FINAL TECHNICAL REPORT

Period from (30-09-2019) to (31-03-2023)

(REVISED)

For the Project

"Identification of Vulnerability and Potential Risk Factor Zone at District and Village Level in Manipur"

Under

National Mission on Himalayan Studies (NMHS)

G.B. Pant National Institute of Himalayan Environment (GBPNIHE)

Kosi-Katarmal, Almora-263643, Uttarakhand, India

Submitted by

Government of Manipur

Directorate of Environment and Climate Change

Porompat, Imphal-05

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Template/Pro forma for Submission

REVISED

NMHS-Himalayan Institutional Project Grant

NMHS-FINAL TECHNICAL REPORT (FTR)

Demand-Driven Action Research and Demonstrations

NMHS Grant Ref. No.:	**GBPNI/NMHS-2019-20/MG**	**Date of Submission:**	2 **d**	6 **d**	0 **m**	2 **m**	2 **y**	0 **y**	2 **y**	4 **y**

PROJECT TITLE:

"**IDENTIFICATION OF VULNERABILITY AND POTENTIAL RISK FACTOR ZONE AT DISTRICT AND VILLAGE LEVEL IN MANIPUR"**

Project Duration: *from* **(30-09-2019)** *to* **(31-03-2023).**

***Submitted to*:**

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DSL: Date of Sanction Letter

3	0	0	9	2	0	1	9
d	d	m	m	y	y	y	y

DPC: Date of Project Completion

3	1	0	3	2	0	2	3
d	d	m	m	y	y	y	y

Part A: PROJECT SUMMARY REPORT

1. Project Description

i.	Project Grant Ref. No.:	GBPNI/NMHS-2019-20/MG					
ii.	Project Category:	Small Grant		Medium Grant	√	Large Grant	
iii.	Project Title:	**Identification of vulnerability and potential risk factor zone at district and village level in Manipur**					
iv.	Project Sites (IHR States/ UTs covered) (*Location Maps attached*):	Shirui and Hungpung Village of Ukhrul District, Manipur Khekman and Tentha of Thoubal District, Manipur					

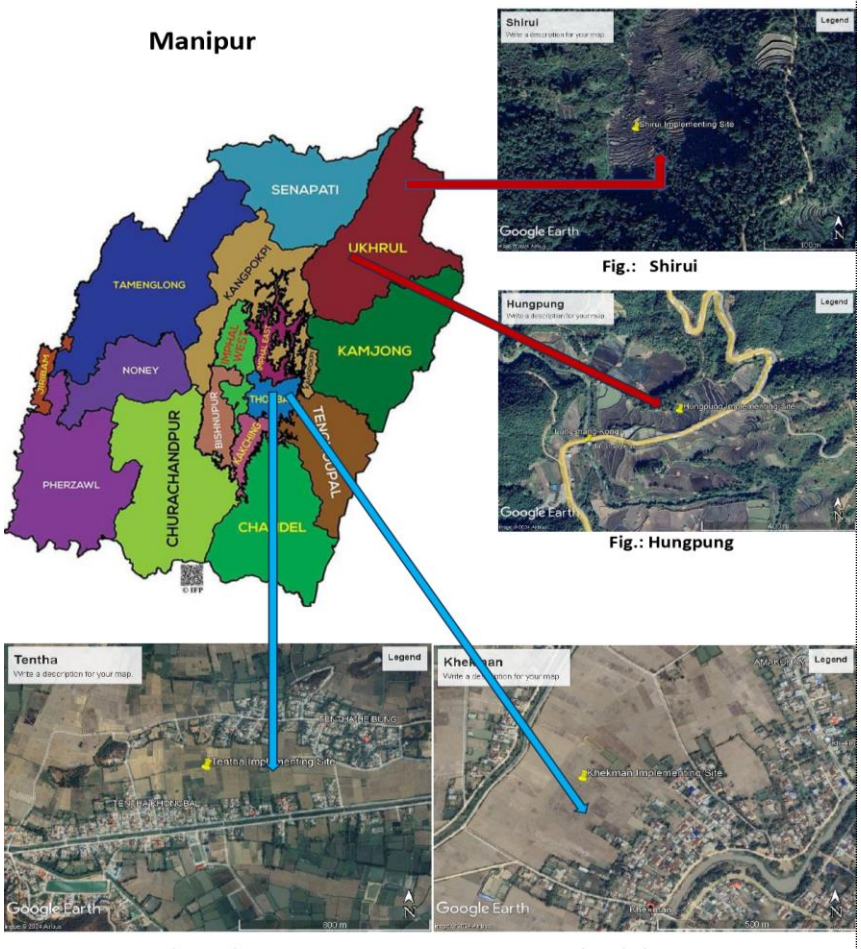

Fig.: Shirui

Fig.: Hungpung

Fig.:Tentha

Fig.: Khekman

v.	Scale of Project Operation:	Local	√	Regional		Pan-Himalayan	
vi.	Total Budget:	Rs. 69,95,760.00					
vii.	Lead Agency:	Directorate of Environment and Climate Change, Govt. of Manipur.					
	Lead PI/ Proponent:	Dr. N. Sanamacha Meetei, Development Officer Directorate of Environment and Climate Change, Porompat, Imphal-795005, Manipur					
	Co-PI/ Proponent:	Dr. Mohd. Habibullah Khan, Programme Officer Directorate of Environment and Climate Change, Porompat, Imphal-795005, Manipur					
viii.	Implementing Partners:	1. ICAR, Manipur 2. Department of Agriculture, Manipur 3. National Institute of Technology (NIT), Manipur 4. Manipur University					
	Key Persons (Contact Details, Ph. No., E-mail):	1. Dr. I. Meghachandra Singh Principal Scientist, ICAR, Manipur 0385-2414654 2. L. Sanatomba Singh Soil Chemist, Agriculture Dept., Manipur 9612721533 3. Kh. Nimaichand Singh AAO, Agriculture Deptt., Manipur 9402882971 4. Dr. Ng. Romeji Singh Asst. Professor, Civil, NIT, Manipur 0385-2058566 E-mail: romeji@nitmanipur.ac.in 5. Prof. N. Rajmuhon Singh Chemistry Deptt., Manipur University 0385-2435276					

2. Project Outcomes

2.1. Abstract/ Summary

Background:

Manipur state, being a part of the Himalayan Region, the hills and valleys has a variety of natural resources and is also known for its unique ecosystem and rich biodiversity. But, the state is also experiencing climate variability due to its different topographical locations, terrain diversity, altitudinal variation and river system. All these variations also influencing on socio-economic status, demographic profile, sustainable development, etc. In order to secure the future environment, action is needed soon to build resilience and prepare for adapting these changing scenarios of climate. Under this project, work has been carried out in two districts as sample vulnerable districts amongst the 16 (sixteen) districts of Manipur to assess the socio-economic vulnerability profile to current climate variability in which agricultural sector has been focused as it is the main source of livelihoods for majority of the population.

Objective/Aim:

The objective of this project is “to develop a scientific based policy document and pilots for appropriate actions / strategies and right planning of climate change activities in the state based on sector and regional specific vulnerability & risk assessment”.

It is also aimed to build capacity of the communities to cop the varied climate events by introducing climate resilient adaptive measures such as blending of traditional agriculture practices with modern knowledge through selection of climate resilient cropping practices as well as model pilots for replication in the state.

Methodology/Approach:

House to House survey with developed questionnaires was adopted for collection of Primary and Secondary data. Subsequently, after assessment of indicators, agriculture sector has been identified as the most vulnerable sector for improvement of socio-economy and livelihood activity in the project sites. Selection of climate resilient interventions, construction of climate resilient / flood resilient low-cost model for housing, model for community shelter home for landslide and flood exposed people, installation of automated rainfall recorder at the project sites, enhancement of village knowledge centre with scientific inputs, natural resource management, etc. were the main activity of this project

Result /Outcome:

In order to improve the vulnerable sector, several programmes like training cum capacity building, orientation, awareness, interaction with the experts, field exposure visit, etc. has been conducted successfully. Focus has been given towards mass organic/natural farming practices with

the objective for production of homemade organic inputs and construction of 40 (forty) numbers of vermi-compost to reduce dependency on artificial fertilizers by the farmers. Besides, water harvesting ponds at two villages i.e. Hungpung and Shirui of Ukhrul (Hill District) has been constructed to preserve forest resource management and conservation of water. Adaptive measures taken up were integration of traditional agricultural practices with modern knowledge such as introduction of SRI, modified SRI, ICM, DSP and selection climate resilient crop varieties. Construction of Climate resilient / flood resilient low-cost model for housing, model for community shelter home for landslide and flood exposed people has been completed as a part of mitigation activity. Human resource has been enhanced by installation of automated rainfall recorder at the project sites and creation of village knowledge centre with scientific inputs. Natural forest resource management and water conservation were also implemented.

Conclusion:

Peoples are, now, aware about the impacts of climate change, build-up capacity building and become self-confidence to adapt the impact of climate change through different programs and interventions conducted during the project mainly on improvement of livelihood activity and socio-economic conditions with scientific approach.

Recommendations/ Way Forward with Exit Strategy:

Nevertheless, the project is a model reference for all scientific communities, planners, decision makers and development agencies to develop climate change adaptation interventions especially in ecologically fragile and environmentally degrade zones subject to socio-economic pressures. Taking into consideration with the activities implemented, the project model could be replicated at other vulnerable districts and villages in the context of climate change adaptation strategies to create self-confidence for improvement of livelihood activity and socio-economic conditions with scientific approach by enhancing capacity building and understanding of climate change impacts

2.2. Objective-wise Major Achievements

Sl.No	Objectives	Major achievements
1	To develop a scientific based policy document and pilots for appropriate actions / strategies and right planning of climate change activities in the state based on sector and regional specific vulnerability & risk assessment.	• Primary baseline data based on demographic and socio-economic profile of the 4(four) project sites has been developed. • Identified Agriculture is one of the venerable sectors for improvement • Implemented climate change adaptation and disaster risk reduction programmes with state line departments • Promoted climate resilient agricultural practices at both hill and valley • Developed scientific based village knowledge centre at 4(four) villages • Established institutional linkage with the villagers • Capacity building has been developed for improvement of socio-economic activities • Set up 4(four) Climate resilient/ flood resilient low-cost model for housing pilot models • Model community shelter home for landslide and flood exposed peoples (02 Nos.; one each of the two districts) has been constructed • Constructed 40(forty) units of vermi-composting and liquid manure models in two districts • Installed 8 (eight) nos. of Automated Rainfall Recorder • Published 2(two) scientific papers and 1(one) is to be published shortly

2.3. Outputs in terms of Quantifiable Deliverables*

Sl.No	Quantifiable Deliverables*	Monitoring Indicators*	Quantified Output/ Outcome achieved	Deviations, if any, & Remarks thereof:
1	Development of vulnerability profile and drivers of vulnerability-socio-economic and agriculture (04 Villages).	Socio-economic and vulnerability profiles 4 (four) sample villages.	• Vulnerability profile for 4 (four) Villages have been developed. - Hungpung and Shirui in Ukhrul District - Khekman and Tentha in Thoubal District	
2	Introduction of climate resilient agriculture practices/ SRI at valley i.e. Tentha and Khekman of Thoubal District (100 Ha).	Climate resilient agriculture practices introduced in Tentha and Khekman of Thoubal District.	• Introduced climate resilient agriculture practices at valley i.e. Tentha and Khekman (100 Ha)	
3	Enhancement of traditional terrace cropping practices with modern technology at the hill village i.e. Shirui and Hungpung of Ukhrul District (100 Ha).	Practices of traditional terrace cropping with modern technology introduced in 2 (two) hill villages.	• Traditional terrace cropping practices with modern technology like ICM and modified SRI at Shirui and Hungpung of Ukhrul District (100 Ha) have been implemented	
4	Climate resilient/ flood resilient low-cost model for housing (4 nos.; One each of the 4 villages).	Construction of Climate resilient / flood resilient low cost model for housing at 4 (four) villages.	• 4 (four) numbers of Climate resilient / flood resilient low cost model for housing has been constructed at Khekman & Tentha of Thoubal District and Hungpung & Shirui of Ukhrul District	

5	Model for community shelter home for landslide and flood exposed peoples (02 Nos.; one each of the two districts).	Construction of community shelter home for land slide and flood exposed peoples at 2 (two) districts.	• 2 (two) numbers Model for community shelter home for land slide and flood exposed peoples has been constructed and handed over to the villagers of at Tentha, Thoubal District and Hungpung, Ukhrul District.	
6	Trainings / capacity Building programme to the farmers (>100 Nos. including ST communities).	Training/Awareness/ capacity building Programme conducted at village level with SHGs/FIGs including ST community.	• Conducted 13(thirteen) nos. of training cum capacity building programme • Conducted 18 (eighteen) nos. of awareness cum outreach programme • More than 100 nos. farmers including ST Communities have been participated in two districts.	
7	Formation and trainings to the Self Help Groups (40 SHG; two districts) and Promotion of vermin composting and liquid manure model (40 units; two district)	Number of SHGs formed during the project period along with construction of vermi-compost units at 4 (four) villages.	• Trainings conducted to 47 nos. of SHG in four villages of two Districts (33 nos. in two valley village and 14 nos. in hill village (ST community). • Constructed 40 nos. of vermi- composting and liquid manure model (10 nos. each in the four villages)	

8	Conservation Models for forest resources and water conservation (2 community forest of 2 hill villages)	Model developed for forest resources and water conservation at 2 (two) hill villages.	• Developed 2 (two) Conservation model for sustainable forest resources and water conservation at Shirui and Hungpung village of Ukhrul District.	
9	Development of 03 (three) knowledge products: 01 Policy, 01 manual document and publications in well reputed journal	Publication of Research articles	• Published one research paper in HSOA Journal of Environmental Science; Current Research during 2021 • Published one research paper in International Journal of Recent Scientific Research during 2022 • One more research paper has been accepted for publication in Journal of Diversity Studies • Outcome of this project will be incorporated in SAPCC Ver-II as model for development of policy document	

*As stated in the Sanction Letter issued by the NMHS-PMU.

2.4. Strategic Steps with respect to Outcomes (in bullets)

Sl.No	Particulars	Number/ Brief Details	Remarks/ Attachment
1.	New Methodology/ Technology developed, *if any*:	• Preparation of indigenous home-made EM-1 and organic inputs • Development of economic paddy nursery raising	Attached manual in Appendix - 5
2.	New Ground Models/ Process/ Strategy developed, *if any*:	• Constructed 40 nos. of vermi-compost and liquid manure units • Constructed 4 (four) Climate resilient / flood resilient low-cost model for housing • Constructed 2 (two) Model shelter home for flood exposed peoples	Attach on appendix-7(i).
3.	New Species identified, *if any*:	NA	
4.	New Database established, *if any:*	• Established Demographic and Socio-economic profile of four villages.	
5.	New Patent, *if any*:		
	Filed (Indian/ International)	NA	
	Technology Transfer, *if any*:	NA	
6.	Others, *if any*	NA	

3. New Data Generated over the Baseline Data

Sl.No	New Data Details	Status of Existing Baseline	Addition and Utilisation New data
1	Demographic and Socio-economic profile of four villages, viz shirui & Hungpung of Ukhrul District; Khekman and Tentha of Thoubal District	A landmark document for assessment of socio-economic profile	Review and assessment are to be made for further utilization of data

4. Demonstrative Skill Development and Capacity Building/ Manpower Trained

Sl. No.	Type of Activities	Details with number	Activity intended for	Participants Trained			
				SC	ST	Women	Total
1.	Workshop/ Awareness	18	i) Consultative meeting and dissemination of awareness on impact of climate change on day-to-day life. ii) Selection appropriate climate resilient livelihood activity iii) Improvement of adaptive capacity and socio-economy in the event of climate change iv) Impact of Climate change on agricultural activity and its measures v) Enhancement of traditional agricultural practice with modern technology vi) Extension programme on Climate resilient activities vii) Integrated paddy cum fish farming viii) Enhancement of knowledge on pest and disease management ix) Use of timely use of organic inputs x) Preservation of community forest resources and conservation of water		**56**	**87**	**143**
2.	On-Field Training	13	i) Preparation of Vermi-compost and liquid manuring		50	60	110

			ii) Preparation of kitchen waste into compost iii) Preparation of organic inputs like EM-1 liquid and past /powder iv) Promotion of sustainable organic agriculture v) Methods/Techniques on implementation of SRI/Modified SRI vi) Sustainable management of paddy nursery/ seedling raising vii) Exposure visits and implementation of Direct Seed Paddy (DSP) method viii) Integrated crop management practice ix) Sustainable rabi crops and natural farming practices				
3.	Skill Development	3	i) Training on "Waste to Compost" to Women SHG ii) preparation of homemade EM-1 (liquid and paste) iii) Forest resources and water conservation at hill station		**18**	**50**	**68**
4.	Academic Supports	**4**	**State line departments**				
	Others (if any)						

5. Linkages with Regional & National Priorities (SDGs, INDC, etc.)/ Collaborations

Sl.No	Linkages /collaborations	Detail of activities (No. of Events Held) *	No. of Beneficiaries
1.	Sustainable Development Goals (SDGs)/ Climate Change/INDC targets addressed	NA	NA
2.	Any other:		

6. Project Stakeholders/ Beneficiaries and Impacts

Sl.No	Stakeholders	Support Activities	Impacts in terms of income generated/green skills built
1.	Line Agencies/ Gram Panchayats:	Co-ordination of villagers specially farmers groups during organization of workshop/capacity building/training	Good impact on socio-economy
2.	Govt. Departments (Agriculture/ Forest/ Water):	As expert during organization of workshop/capacity building/training	Enhanced skill/capacity building
3.	Villagers/ Farmers:	On field implementation of various programmes	Developed self capability for climate resilient activity and improvement of socio-economy
4.	SC Community:	NA	NA
5.	ST Community:	Implementation of intercropping and natural farming activities; community forest resource and conservation of water in hill stations	Developed self capability for climate resilient activity and improvement of socio-economy
6.	Women Group:	Primary role for improvement of socio-economy	Developed self capability for climate resilient activity and improvement of socio-economy
	Others, *if any*:		

7. Financial Summary (Cumulative)

Sl. No.	Budget Head	Total Grant	Funds Received	Expenditure/ Utilized	% of total cost
A: Recurring					
1.	Salary	2232000.00	2157600.00	2157600.00	96.67%
2.	Travel (Domestic)	120000.00	116000.00	116000.00	96.67%
3.	Consumable	0.00	0.00	0.00	NA
4.	Contingency	120000.00	118000.00	112897.00	94.08%
5.	Activities and Other Project Cost	3960000.00	3883827.00	3882098.00	98.03%
6.	Institutional Charge/ Overhead	203760.00	196968.00	196968.00	96.67%
B: Non-Recurring					
1.	Equipment (Automated Rainfall Recorder- 8 nos. & GPS- 4 nos.)	360000.00	360000.00	360000.00	100%
	Grand Total	**6995760.00**	**6832395.00**	**6825563.00**	**97.57%**

* Attached the consolidated and audited Utilization Certificate (UC) and Year-wise Statement of Expenditure (SE) separately at **Annexure I.**

8. Major Equipment/ Peripherals Procured under the Project** (*if any*)

Sl.No	Name of Equipment	Quantity	Cost (INR)	Utilisation of the Equipment after project
1.	Automatic Rainfall Recorder	8	30,000.00 (18% GST Extra)	To be transferred to the Department
2.	GPS	4	16,300.00 (18% GST Extra)	To be transferred to the Department

Details are provided at (Annexure III &IV).**

9. Quantification of Overall Project Progress

Sl. No.	Parameters	Total (Numeric)	Remarks/ Attachments/ Soft copies of documents
1.	IHR States/ UTs covered:	*1 (one)*	*Manipur*
2.	Project Sites/ Field Stations Developed:	*4*	*Attach in appendix-7(i).*
3.	Scientific Manpower Developed (Ph.D/M.Sc./JRF/SRF/ RA):	*3 M. Sc. Student have been trained*	
4.	Livelihood Options promoted	-	
5.	Technical/ Training Manuals prepared	*2*	*Enclosed at Appendix-5*
6.	Processing Units established, if any	-	
7.	No. of Species Collected, if any	-	
8.	No. of New Species identified, if any	-	
9.	New Database generated (Types):	*1*	*Socio-economic profile*
	Others (if any)	-	

10. Knowledge Products and Publications:

Sl.No	Publication/ Knowledge Products	*Number*		*Total Impact Factor*	*Remarks/* Enclosures
		National	International		
1.	Journal – Research Articles/ Special Issue:		2	A good reference for climate researchers	Enclosed copies as Appendix 2
2.	Book – Chapter(s)/ Monograph/ Contributed:	-	-	-	-
3.	Technical Reports:	-	-	-	-
4.	Training Manual (Skill Development/ Capacity Building):	-	-		
5.	Papers presented in Conferences/Seminars:	-	-	-	-
6.	Policy Drafts/Papers:	-	-	-	-
7.	Others, if any:	-	-	-	-

11. Recommendation on Utility of Project Findings, Replicability and Exit Strategy

Particulars	Recommendations
Utility of the Project Findings:	Being the project is research oriented, the achievements during three years has been published in two reputed International Journal and one is accepted for publication highlighting the impacts of climate change on different aspects. It will be benefited to all the grooming climate researchers for finding new interventions and mainstreaming for successful climate change adaptation to enhance self-sustain mechanism towards climate resilient activities. Enhancement of networking system among the policy maker, researchers and implementing agencies are to be bought into a common framework so that any finding /achievement could be translated directly to common people for better human dignity.
Replicability of Project/ Way Forward:	The findings from the study will be able to identify the key drivers of vulnerability risk zone along with the bio-physical parameter for adaptation in various climate change impacts. The project itself has been completed with a grand success benefiting to the local community specially the low-income agricultural farmers by providing new ideas and knowledge through different programmes conducted during the project tenure. The project activities taken up will be highlighted to planners and decision makers for developing, disseminating and adopting such mechanism as viable for sustaining and replicable to climate change vulnerable areas in the state. The achievement of the project is trying to upload in the official web portal DARPAN as showcase for replication.

Exit Strategy:	As the directorate of Environment and Climate Change is State Nodal Agency for formulation and preparation of State Action Plan on Climate Change, the outcomes from this project will be inculcated as adaptive pilot model which could be replicated/applied in coming future in the event of climate change. Communities in the project area have been trained and developed self sustenance capacity for future course of action even after the project is completed. Moreover, the Directorate will take care of the activities implemented during the project so that the communities may get in touch for their livelihood and socio-economic support.

(PROJECT PROPONENT/ COORDINATOR)

(Signed and Stamped)

DEVELOPMENT OFFICER
Directorate of Environment & Climate Change
Government of Manipur

(HEAD OF THE INSTITUTION)

(Signed and Stamped)

DIRECTOR
Directorate of Environment & Climate Change
Government of Manipur.

Place: Imphal

Date: 26/02/2024

PART B: DETAILED PROJECT REPORT

1 EXECUTIVE SUMMARY

Manipur, one of the states situated in the North Eastern Region of India, is an isolated hill-girt state stretching between 92°58'23.422" East to 94°43'35.553" East Longitudes and 23°49'45.530" North to 25°42'1.456" North Latitudes encircled by nine layers mountains of Himalayan extending towards south. The state, being a part of the Himalayan Ecosystem, the hills in the state has a variety of natural resources and is also well known for its unique ecosystem and rich biodiversity. Geo-climatically, the state is clubbed into 2 (two) regions such as the hill and the valley. The valley region is very small with an area of 2,238 sq.kms which is 10% of the total area, but the region is one of the most thickly populated regions of the state. The hill constitutes 20,089 sq.kms i.e. 90% of the total state area and therefore, it is approximately 9 (nine) times the size of the valley area. The density of population per sq. km. in the hill is 61 as against 730 in the valley. The economy of hill is very low with respect to its low density as against high density population of the valley. However, all the important resources are belonged to the hill areas. The mark potential economy of the valley is due to main agricultural and allied activities products. The means of livelihood in the hill is mainly on forest resources, terrace and jhum-cultivation.

The state is endowed with diverse climate variability especially in terms of ecosystem, biodiversity and livelihood, agriculture & its allied, water resources, forest, health, etc because of different topographical locations, terrain diversity, altitudinal variation and river system. These variations made changes on state's economic development, population growth, sustainable development and resource management. Today, the need of the time is to get attention on climate disasters and other geo physical parameters like rising temperature, erratic rainfall or sudden flash floods, drought like situation, etc.

The economy of Manipur is fully depended on agriculture and allied sectors. It contributes a major share to state domestic products. About 52.81% of the workers in Manipur are engages as cultivators and agricultural labours. However, the performance of agriculture in the state mainly depends on timely rainfall and weather conditions. Permanent cultivation is generally practiced in the valley districts while terrace cultivation is practiced in some pockets of the hills where jhuming or shifting cultivation is widely adopted in most part of the hills. Rice is the main staple food and is grown in hill and plain areas.

Manipur is, now, witnessing the serious repercussions of climate change impacts. Certain evidence like higher temperatures, extreme weather, deficit in rainfall and changing rainfall pattern have already been observed in the state. The decrease in rainfall during the monsoon season has brought unprecedented loss in the economy of the state. Even though the state getting actual annual quantity of rain, the shifting of rainfall pattern has directly affected on agricultural and livelihoods

activities thereby raising issues of socio-economic status, food security, water supply, health, etc. Therefore, in order to sustain socio-economic and livelihood activities, action is needed soon to build resilience and prepare for adaptation planning and strategies/ interventions for a better and secure human environment.

Under this project, two districts namely Thoubal (valley district) and Ukhrul (hill district) has been identified as sample vulnerable districts amongst the 16 (sixteen) districts of Manipur to assess the socio-economic vulnerability profile to the current climate variability at village level. The main objective is to build adaptive capacity of the communities in varied and unprecedented climate events. Village level house to house surveys with developed questionnaires were adopted for collection of Primary and Secondary data. Subsequently, after assessment of data, agriculture sector has been identified as the most vulnerable sector for improvement of socio-economy and livelihood activity in the project sites. Some of the adaptive measures taken up are blending of traditional agriculture practices with modern knowledge such as introduction of SRI, modified SRI, ICM and selection climate resilient crop varieties. Construction of Climate resilient / flood resilient low-cost model for housing, model for community shelter home for landslide and flood exposed people, installation of automated rainfall recorder at the project sites, enhancement of village knowledge centre with scientific inputs, natural resource management, etc. are also implemented. Besides, several programmes like training cum capacity building, orientation, awareness, interaction with the experts, field exposure visit, etc. has been conducted successfully as a part of the project.

. Even though the state belongs to naturally fertile zone, farmers are habituated with extensive use of chemical inputs/fertilizers hoping for more production of crops which in turn degrades the quality of soil as well as affects the economy of the farmers. In order to improve the soil quality and farmers economy, focus has been given towards mass natural farming practices with self production and utilization of homemade organic inputs. 40 (forty) numbers of vermi-composting and liquid manuring unit have been constructed at 4(four) villages to reduce dependency on chemical fertilizers by the farmers. Two water harvesting ponds at two villages i.e. Hungpung and Shirui of Ukhrul (Hill District) have also been constructed with the aim atleast to preserve forest resources and conservation of water.

Now, peoples are aware about the impacts of climate change and become self-confidence to cope up climate events through different programs conducted during the project mainly on improvement of livelihood activity and socio-economic conditions with scientific approach. The Directorate of Environment, Manipur as Nodal Agency for State Climate Change has also formulated the State Action Plan on Climate Change, where rainfall pattern is one of the major indicators to have state climate policy and planning. In this project, 8 (eight) nos. of automated rainfall recorder have been installed at four villages to facilitate assessment in variation of rainfall which can be integrated in making climate change vulnerability index, profile and ranking with reference to other village / districts

in the context of climate risk zone. Therefore, the outcomes from this project could generate significant inputs in compilation of State Action Plan on Climate Change, Manipur and as a model which could be replicated at district and village in the context of climate change adaptation strategies.

2 INTRODUCTION

2.1 Background

Being a part of the Himalayan Region, Manipur state has a unique ecosystem and rich biodiversity. Due to its different topographical locations, terrain diversity, altitudinal variation and river system, the state also experiences diverse climate variability which influences livelihood activities, socio-economic development and resource management. During the last few decades, there has been great changes in terms of annual temperature, rainfall and precipitation, occurrence of natural calamities like, forest fire, flood, drought, outbreak out of many insect and pest diseases etc. which ultimately increases rate of biodiversity loss and decrease the availability of water resources, health related issues, and decrease in production of agricultural crops.

The state as a whole experiences changes in its normal rainfall pattern with extended rainy period which links to the climate change. The Manipur State Action Plan on Climate Change (SAPCC) Ver-I has already focused about shifting of rainfall pattern as one of the major indicators. Today, climate change is one of the environmental challenges affecting the basic elements of human lives all over the world. The strategic knowledge on climate change is to assimilate and upgrade the information to determine the variability and vulnerability of livelihood for a particular region. However, the impact of the climate variation depends on the coping capacity of the people and intensity of the condition arising out of anthropogenic and natural changes which are likely to influence the determinants of climate. It proposes a coordinated mechanism and process with new ideas for further enhancement existing intra and extra mural knowledge generating system. Hence, data sharing among various data sources is necessary for building up strategic action based knowledge paths for developing, disseminating and adopting climate resilient technologies.

Now, it is high time is to get attention on climate disasters and other geo- and bio-physical parameters like climate events, rising temperature, erratic rainfall, frequent floods, landslides, drying up of stream heads, loss of biodiversity, etc. Such variability in regional climate brought unprecedented loss in the economy of the state. In order to secure future environment, action is needed soon to build resilience and prepare for adaptation with changing scenarios of climate and weather extremes based on the vulnerability assessment.

In view of the above facts, the project was proposed to carry out and prioritize in two sample vulnerable districts amongst the 16 (sixteen) districts of Manipur to assess the inherent socio economic vulnerability to current climate variability which is not only considered socio economic indicator, but also includes agricultural parameters as it is the main source of livelihoods for majority of the population towards adaptive capacity approach. The proposed project focused on district level

approach of Tier I i.e. base on the available secondary information, Tier II. approach i.e based on combination of secondary and primary data and finally followed by the Tier III i.e. approach which was based on the actual field level data. Literature review and expert consultation had also been taken into consideration.

2.2 Overview of the major issues addressed

Climate change and socio-economic condition of the people, especially those whose economics mainly depend on agricultural sectors, are closely interconnected. While extreme climate events can have a profound impact on the overall economic production and the health of the environment. Poverty of the people can have profound effects, not only on environment but also on the economic growth of the state due to excessive dependent on natural resources by the people and less capacity to adapt. The fall out of such variability will have greater impact on a state like Manipur where most of the economy are depended on natural resources and climatic conditions.

Due to rapid urbanization, the state urban population is about 0.8 million in 2011 as compared to 0.5 million in 2001 and decadal growth of 43%. Urbanization is known to have negative impact on local climate and enhances unsustainable resource demand and congestion as well as pollution. With the ratio of increasing population and decreasing land productivity, relatively higher dependence on natural resources (e.g. forests) are also major constraints for Manipur's environmental sustainability. The bulk of population in Manipur are predominantly in rural areas and they constitute about two third of the total state population. Most of the people in the state are engaged in agricultural sector for their livelihood. Agriculture & its allied sectors are considered to be the main occupation of the people of Manipur. 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. Agriculture in the valley accounts for 58.22% of the total crop area in the state. The pressure on land in the valley is thus quite conspicuous.

The Manipur State Action Plan on Climate Change (SAPCC) has also reported that water and agriculture is the most vulnerable sector in the state followed by forest and health sector. Some of the important issues of the said sectors in respect to the climate change are water, agriculture & allied, forest resource and health. A high degree of vulnerability to the water and climate induced disasters has increasingly made the state environmentally insecure for the future. Therefore, a set of holistic policy and programme/interventions that integrate developmental goals with disaster risk management for the region as a whole is the need of the hour.

Moreover, some of the prevailing issues in respect to the climate change specially the identified villages viz. Tentha, Khekman, Hungpung and Shirui may be highlighted as:

- Part of vulnerable Himalayan Ecosystem due to climate change
- Rich in bio-resources and traditional knowledge for conservation

- Frequent flood and landslides due to erratic rainfall with high intensity
- Failure of agriculture specially paddy cultivation, rain-fed agriculture with mono crops, shifting of livelihood, outmigration of youths, etc.
- Depletion of water table, drying up of spring heads, limiting of water source

2.3 Baseline Data and Project Scope

Sustaining the Himalayan Ecosystem will largely depend on the sustenance of livelihood in the region. With a large number of the population depending on forest as their sole source of livelihood, an eye for alternative source is necessary along with adaptive measures to the constantly changing climate variability. A sustainable livelihood will help protect the Himalayan Ecosystem and a way towards adaptation.

Base on the vulnerability assessment report in four villages of two districts of Manipur namely Shirui and Hungpung in Ukhrul district and Tentha and Khekman in Thoubal district, adaptive capacity approach has been carried out pertaining to the major sectors such as water, agriculture and allied activities, forests resources. The study aimed to develop a model with the combine approach of different tiers starting from Tier I approach based on available secondary data, Tier II approach based on combination of secondary and primary data and finally followed by the Tier III approach which will be based on the actual field level data. The study will be highly beneficial for developing a model in terms of climate change adaptation and mitigation programme in the proposed vulnerable districts and villages in Manipur State in the context of current climate change issues.

The identified villages are exposed in flood and landslide very often and even occurs drought like situation at the valley that affects agriculture and its allied sectors which are the main source of income and economy of the state. As such the state is highly susceptible and vulnerable to various impact of climate change and directly impact on livelihood and socio-economic factors. Therefore, an assessment of the vulnerability on natural ecosystem, bio-physical and socio-economic systems of the state at village level could be an importance source for regional climate change vulnerability index. The assessment has to be given priority at village level for adaptation planning, in particular for ecologically fragile and environmentally degraded zones, subject to socio-economic pressures.

The scope of this project is to contribute review and stock taking of the targeted activities under previous SAPCC Ver-I in of 4 (four) dimensions with 3 (three) principles i.e. State circumstances, progress and state contribution to INDC, climate change action plan & strategies and State Climate Policy by aligning strategies under NDC and SDG with a target for 2030.

2.4 Project Objectives and Target Deliverables

The objective of this project is “to develop a scientific based policy document and pilots for appropriate actions / strategies and right planning of climate change activities in the state based on sector and regional specific vulnerability & risk assessment”.

The target deliverables are:

1. Development of vulnerability profile and drivers of vulnerability-socio-economic and agriculture (04 Villages)
2. Introduction of climate resilient agriculture practices/ SRI at valley i.e. Tentha and Khekman of Thoubal District (100 Ha)
3. Enhancement of traditional terrace cropping practices with modern technology at the hill village i.e. Shirui and Hungpung of Ukhrul District (100 Ha)
4. Climate resilient/ flood resilient low cost model for housing (4 nos.; One each of the 4 villages)
5. Model for community shelter home for landslide and flood exposed peoples (02 Nos.; one each of the two districts)
6. Trainings / Capacity Building Programme to the farmers (>100 Nos. including ST communities)
7. Formation and trainings to the Self Help Groups (40 SHG; two districts) and Promotion of vermin composting and liquid manure model (40 units; two district)
8. Conservation Models for forest resources and water conservation (2 community forest of 2 hill villages)
9. Develop the 03 knowledge products: 01 Policy, 01 manual document and publications in well reputed journal

3 METHODOLOGIES/STARTEGY/ APPROACH

3.1 Methodologies used:

The proposed project has been carried out in two vulnerable districts as sample vulnerable districts amongst the 16 (sixteen) districts of Manipur to assess the inherent socio-economic vulnerability to current climate variability which not only considered socio economic indicator, but also includes agricultural parameters as it is the main source of livelihoods for majority of the population for adaptive capacity approach. The proposed project focused on village level approach of Tier I i.e. base on the available secondary information, Tier II approach i.e. based on combination of secondary and primary data and finally followed by the Tier III approach which was based on the actual field level data. Literature review and expert consultation had been used for selection of the indicators. Indicators had been identified based on readily available relevant secondary data to represent the

socio economic and agricultural vulnerability of the 16 (sixteen) districts of Manipur. Vulnerability profile of the four villages was based on the common framework of IPCC-2014.

The strategy/ approach for development of data at village level inherent socio-economic vulnerability to current climate variability are-

- Collection of secondary information from concerned departments (climate sensitive indicators)
- Collection of random household survey at the identified districts and villages through questionnaires
- Assessment on sector specific climate change vulnerability like socio-economy, agriculture, etc. at for villages namely Tenth, Khekman, Hungpung and Shirui with developed questionnaires.
- Data verification Validation of secondary information / data through focused group consultation workshop with different stakeholders, authorities, etc.
- Identified for introduction of climate resilient pilots based on in general vulnerability & risk assessment
- Development of pilot model for Climate Resilient / Adaptation Practices to demonstrate the peoples affected due to climate events like flood and draught.
- Blending of traditional agriculture and the modern climate resilient techniques and introduction of Climate resilient agricultural practices
- Construction of low-cost climate resilient or flood mitigation housing

3.2 Data collected and Equipments utilized:

Sets of questionnaires has been developed to conduct house to house survey for the 4 (four) villages (Tentha & Khekman of Thoubal District and Shirui & Hungpung of Ukhrul District) during January to March, 2020. The main objective for the survey is to develop the socio-economic profile and to identify the vulnerable section of the people inhabited in the four villages. Collection of data at village level started with the approach of Tier I i.e. base on the available secondary information, Tier II approach i.e. based on combination of secondary and primary data and finally followed by the Tier III approach which was based on the actual field level data. Literature review and expert consultation had also been conducted for selection of the indicators to identify the vulnerable sector. Minimum eight indicators have been identified based on readily available relevant secondary data to represent the socio economic and agricultural vulnerability from the 16 (sixteen) districts of the state of Manipur. The indicators are non-irrigated land, total area of agricultural land, agricultural laborer, crop yield, crop insurance, MGNREGS, marginal land holding, livestock population, etc. The common framework of IPCC-2014 was used to integrate and determine the vulnerability in the four villages. The identification of vulnerable sector was based only by utilizing secondary and primary data sources.

Demographic profile with graphical representation of four project sites:

Population and Percentage of Householder:

Table- 1: Thoubal district (Khekman & Tentha village).

Population/Village	1.Khekman	Percentage of Khekman village population.	2. Tentha	Percentage of Tentha village population.
Total population	8957		10659	
Nos. of Male	4578	51.11	5543	52.00
Nos. of Female	4379	48.89	5116	48.00
Nos. <1 yrs	108	1.21	62	0.58
Nos. 1 – 10 yrs	1056	11.79	2719	25.51
Nos. 11 – 18 yrs	1812	20.23	1595	14.96
Nos. 19 – 30 yrs	1742	19.45	2045	19.19
Nos. >30 yrs	4239	47.33	4238	39.76

Table – 2: Ukhrul district (Shirui & Hungpung village).

Population/Village	3. Shirui	Percentage of Shirui village population	4. Hungpung (Lower)	Percentage of Hungpung village population
Total population	1095		11752	
Nos. of Male	572	52.24	6061	51.57
Nos. of Female	523	47.76	5691	48.43
Nos. <1 yrs	4	0.37	167	1.42
Nos. 1 – 10 yrs	156	14.25	1791	15.24
Nos. 11 – 18 yrs	174	15.89	2110	17.95
Nos. 19 – 30 yrs	278	25.39	2604	22.16
Nos. >30 yrs	483	44.11	5080	43.23

Fig-1: Percentage of Male and Female Population:

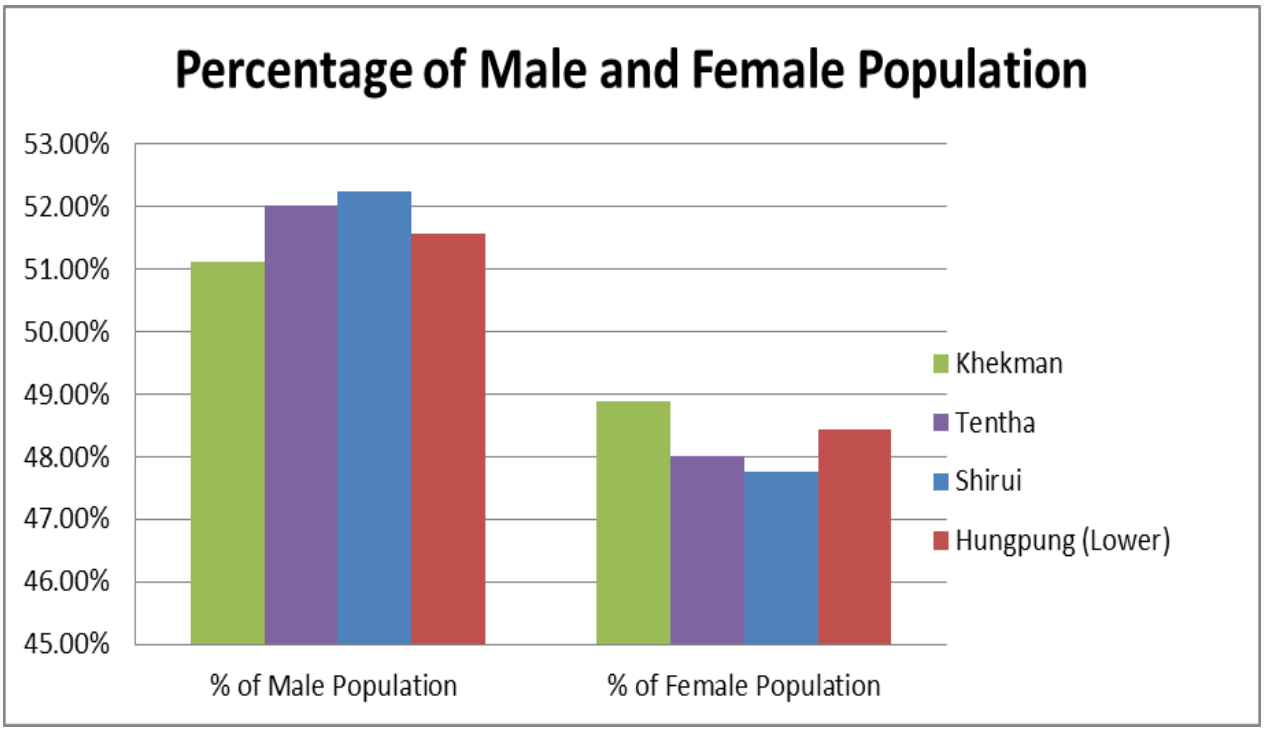

Fig-2: Percentage of Age Group:

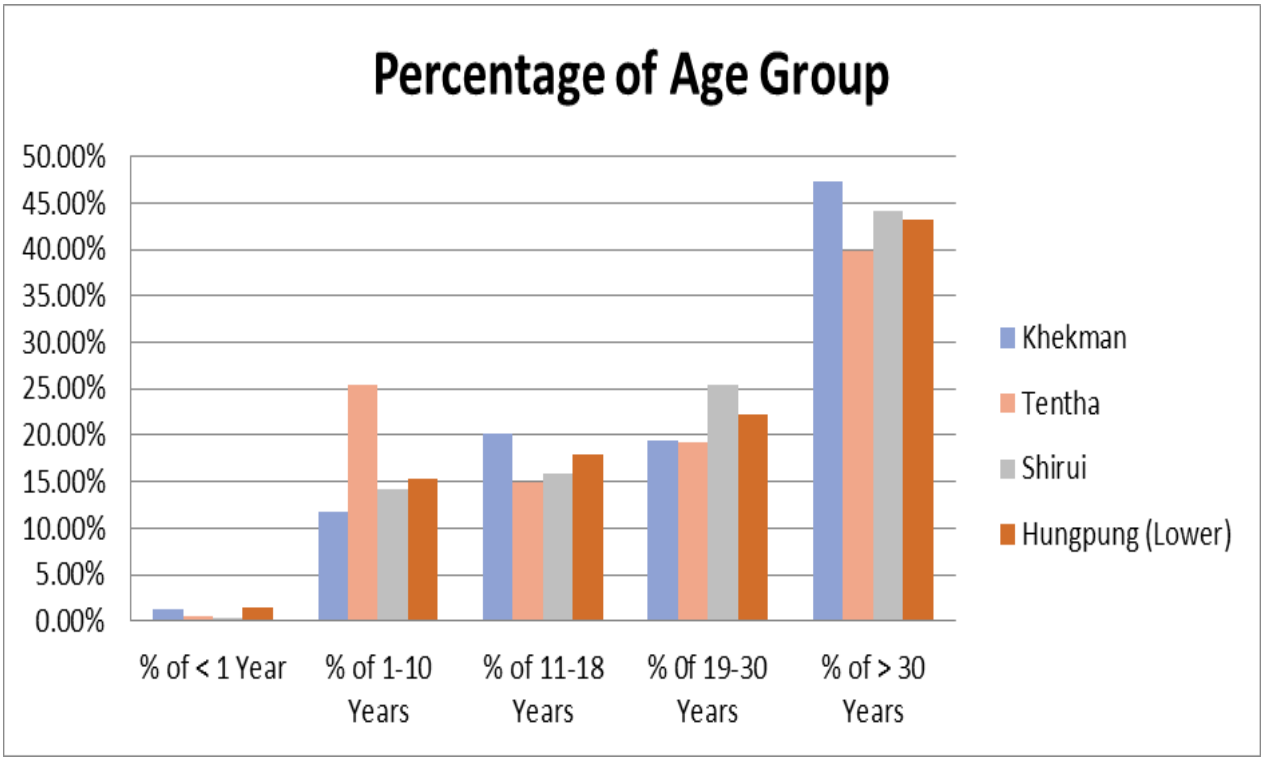

Table no. 3: Thoubal district (Khekman and Tentha district)

Population/Village	1.Khekman	Percentage of Khekman village occupation	2. Tentha	Percentage of Tentha village occupation
Nos. of Household	1513		1890	
Total population	**8957**		**10659**	
Nos. of Farmer	3654	40.79	4531	42.51
Nos. of govt. Employee	156	1.74	162	1.52
Nos. of Students	3294	36.78	2980	27.96
Nos. under Private service	30	0.33	210	1.97
Nos. of Business	109	1.22	45	0.42
Nos. of Unemployed/ Daily wages	1525	17.03	1769	16.60

Table no. 4: Ukhrul district (Shirui and Hungpung village)

Population/Village	3. Shirui	Percentage of shirui village occupation	4. Hungpung (Lower)	Percentage of Hungpung (Lower) village occupation.
Nos. of Household	228		2609	
Total population	**1095**		**11752**	
Nos. of Farmer	430	39.27	4667	39.71
Nos. of govt. Employee	36	3.29	396	3.37
Nos. of Students	247	22.56	2548	21.68
Nos. under Private service	112	10.23	1112	9.46
Nos. of Business	46	4.20	637	5.42
Nos. of Unemployed/ Daily wages	210	19.18	2225	18.93

Fig-3. Percentage of Occupation:

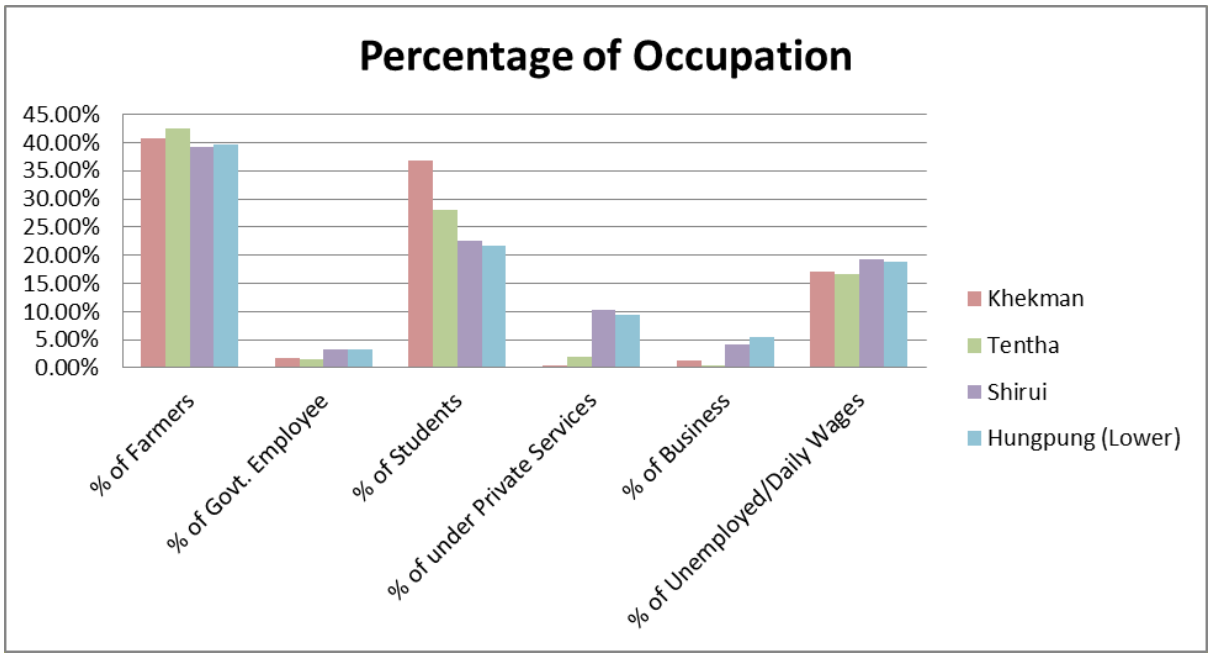

Table no.5 : Agricultural Vulnerability Index values and corresponding ranks of district in the state.

DISTRICT	Vulnerability index values	RANKING
Ukhrul	0.74	1
Churachandpur	0.72	2
Tamenglong	0.69	3
Senapati	0.62	4
Imphal East	0.53	5
Imphal West	0.51	6
Chandel	0.49	7
Thoubal	0.44	8
Bishnupur	0.37	9

Table no.6: The result of the Integrated Assessment with the Vulnerability Index (VI) and Ranking of the villages

VILLAGE	Literacy rate	% of Female Workforce	% of Agricultural labourer	% of Marginal Workers Population	% of Non-workers population	VI	Ranking
Hungpung	75.13	11.37	0.84	18.35	56.26	1.016	1
Shirui	82.06	22.92	0.08	3.95	48.22	0.000	2

VILLAGE	Literacy rate	% of Female Workforce	% of Agricultural labourer	% of Marginal Workers Population	% of Non-workers population	VI	Ranking
Khekman	54.94	9.40	2.29	11.23	59.91	0.800	1
Tentha	59.18	12.58	1.25	25.74	41.93	0.201	2

Under this project 8 (eight) nos. of automated tipping bucket type rainfall recorder have been procured. Two set each of the rainfall recorder have been installed at four villages to get the information of quantity and pattern of the rainfall prevailing in the respective villages. 4 (four) nos. of GPS (Garmin eTrax-10) have also been procured. It is utilized during field survey to check the location of implemented intervention of the project.

3.3 Details of Field Survey conducted, if any:

The identified villages are located at different geo-topographical locations. Hungpung and Shirui are hill villages of Ukhrul District whereas Tentha and Khkman are valley villages of Thoubal District of Manipur. Since the locations are different, the micro climatic condition influences the mode of livelihood activities. As such the overall agricultural activities that support the economy of the people and agricultural productivity are also different. As per the timeline given in the project, village level demographic and socio-economic profile as been developed in the first quarter during 2020-21. Data collection started at village level with the approach of Tier I i.e. based on the available secondary information, Tier II approach i.e. based on combination of secondary and primary data and finally followed by the Tier III approach which was based on the actual field level data. After computing the data, the actual field survey for identification vulnerable sector and appropriate intervention to be applied at the village level have been conducted. Focus has been given to agriculture and lied activities in the four villages as it is concerned the prime vulnerable sector due to climate change. Besides, it is the main livelihood activity which contributes socio-economy of the people and the state as well.

Feasible locations where the interventions are to be taken up were identified with village Headman at the hill village and Pradhan at the valley village. Co-ordination with the experts had also been made to select suitable interventions. Farmers group/ Self Help Groups (SHGs) in the respective villages were formed to implement the assigned works. Series of workshop, training/capacity building, meeting, exposure visit were conducted to the farmers. Selective leader specially for monitoring and survey of implemented works within the existing community farmer groups has been formed under the supervision of different customary local institutes like Loumi Marup, Singlup (local institute), Panchayat, etc. They supervised the different project supported activities during implementation, survey and collection of data. Time to time monitoring and survey with the expert on implementation of climate resilient agriculture activity, selection climate resilient crops, agriculture with home-made organic inputs (vermi-composting and liquid manuring), preventive measures and timely control of diseases and pests, etc. has also been conducted.

As rice is the main staple food, more than 10 (ten) varieties of high yielding rice crops have been introduced to meet adequate supply and demand in the state by various institution. As evident from household surveys, it was observed that most farmers prefer high -yielding rice varieties in comparison to traditional local varieties due to the changing weather pattern which affects the crop yield. During the project, some high yielding varieties had been introduced and thorough survey was conducted during planting season with the experts. After the survey, it was observed a medium to high productivity according to their field size. by 322 kg per ha. Besides, survey on other interventions like production of organic inputs, climate resilient agriculture practice/SRI/Modified SRI, intercropping for terrace farming, promotion of vermi-composting and liquid manuring, etc. were also conducted from time to time.

3.4 Strategic Planning for each activity with time frame:

Broadly 4 (four) target components have been classified in order to achieve the target activities according to time frame. The target components are 1) Identification of potential impacts of climate change sectors and development plans for adaptation options 2) Mainstreaming for successful climate change adaptation and disaster risk reduction by using ecological building and construction technology 3) Self-sustain mechanism for managing climate related disaster and enhancing ecological services and 4) Improvement of community base institution empowered with better human resources and knowledge centre for better human dignity.

Under target No.1, the planned activity is to develop vulnerability profile and drivers of vulnerability-socio-economic and agriculture at four village namely Shirui & Hungpung at Ukhrul District and Tentha & Khekman at Thoubal District. The timeline is 1st & 2nd quarter of the project period.

Under target No.2, the planned activities are -

a) Introduction of climate resilient agriculture practices/ SRI at valley i.e. Tentha and Khekman of Thoubal District at 100 Ha with the timeline 3rd to 12th quarter

b) Enhancement of traditional terrace cropping practices with modern technology at the hill village i.e. Shirui and Hungpung of Ukhrul District at 100 Ha with the timeline 3rd to 12th quarter

c) Construction of 4(four) nos. of Climate resilient / flood resilient low cost model for housing at four villages during 1st and 2nd year

d) Construction of 2 (two) nos. of Model for community shelter home for landslide and flood exposed peoples at Ukhrul and Thoubal District during 1st and 2nd year

Under target No.3, the planned activities are –

a) Organization of Trainings / capacity Building to the farmers (100 farmers in two district) during 3rd to 4th quarter

b) Formation and trainings to the Self Help Groups (40 nos in two district) during 2nd to 4th quarter

c) Construction of composting pits for promotion of vermin composting and liquid manure (40 units in two district) during 3rd to 6th quarter

d) Development of conservation models for forest resources and water conservation at two village Shirui and Hungpung of Ukhrul District during 3rd and 4th quarter

Under target No.4, the planned activities are –

a) Infrastructure development at village level to disseminate climate information by installing 8 (eight) nos. of automated rainfall recorder at four villages (2 each of the villages) during 2nd and 3rd quarter

b) Preparation of policy & programme, Report and Publication 4th to 12th quarter

4 KEY FINDINGS AND RESULTS:

4.1 Major Activities/ Findings:

Under this project, four villages has been identified as sample village (shirui & Hungpung in Ukhrul District and Tentha & Khekman in Thoubal District) to assess the socio-economic vulnerability profile to the current climate variability at village level with the objective to build adaptive capacity of the communities and action for appropriate intervention in varied and unprecedented events due to climate change.

To develop vulnerability profile, drivers of vulnerability of socio-economy and agriculture, village level house to house surveys with developed questionnaires were adopted for collection of Primary and Secondary data during first quarter, 2020-21. Data collection started at village level with the approach of Tier I i.e. base on the available secondary information, Tier II approach i.e. based on

combination of secondary and primary data and finally followed by the Tier III approach which was based on the actual field level data. After computing the data, the actual field survey for identification vulnerable sector and appropriate intervention to be applied have been conducted. Subsequently, after assessment, agriculture sector has been identified as the most vulnerable sector for improvement of socio-economy and livelihood activity in the project sites.

After identification of vulnerable sector, adaptive interventions have been started to improve socio-economy of the villagers. Interventions like SRI /modified SRI, DSP, ICM, etc.as climate resilient agricultural practices have been introduced at valley i.e. Tentha and Khekman of Thoubal District at 100 Ha. The same has also been implemented at the hill villages also. After the intervention, it was found that a medium to high productivity rate by 322 kg per ha. Moreover, traditional cropping practice at the hill villages has been improved with the integration of scientific approach. It reduces occurrence of many plants disease thereby increases the production which implies to improvement of socio-economy. Distribution farm equipments and seasonal crop seeds to the farmers and SHG were also part of the income support activities. Programmes like awareness, training cum capacity building, orientation, interaction with the experts and field exposure visit has been organized among the farmers including Self Help Groups (SHG) in the four villages to promote natural farming practices and self-production organic inputs for better sustenance. For production of compost and liquid manure 40 (forty) nos. of vermin-composting units (10 unit each in the four villages) has been constructed and replaced the use of chemical fertilizer. The use of compost has a great impact to the farmers. As per finding of the survey, dependencies on use of chemical fertilizers are found minimized and also reduced prevalence of plant diseases to a great extent.

In order to reduce disaster risk 4(four) nos. of Climate resilient / flood resilient low-cost model for housing at four villages has been constructed and 2 (two) nos. of model for community shelter home for landslide and flood exposed peoples are significantly handed over to the people of Ukhrul and Thoubal Districts under this project. Two water harvesting ponds at two villages i.e. Hungpung and Shirui of Ukhrul (Hill District) have also been successfully implemented with the aim to preserve forest resources and conservation of water. To enhance village knowledge centre and disseminate climate information 8 (eight) nos. of automated rainfall recorder at four villages (2 each of the villages) has been installed.

4.2 Key Results:

With due importance on regional climate change vulnerability, an assessment of the vulnerability on natural ecosystem, bio-physical and socio-economic systems of the state of Manipur at village level is thus ubiquitous. Therefore, such type of assessment has to be given priority at village level for adaptation planning, in particular for ecologically fragile and environmentally degraded zones, subject to socio-economic pressures.

The finding from this project will have the opportunity to review and stock taking of the targeted activities under State Action Plan on Climate Change (SAPCC Ver.-I) which could be aligned the strategies under NDC and SDG with a target for 2030. It could be considered in 4 (four) dimensions with 3 (three) principles i.e. state circumstances, progress and state contribution to INDC, climate change action plan & strategies and State Climate Policy.

The present project has come up with the following key results-

- Understanding Impact of climate change on water resources, forest and dominant agriculture crops
- Development of vulnerability profile and drivers of vulnerability on socio-economic and agriculture in 4(four) villages
- Identification of potential impacts of climate change sectors and development plans, as well as possible adaptation options
- Mainstreaming for successful adaptation planning to the geographic conditions such as ecological building and construction technology
- Enhancement of traditional knowledge and blending to the network on climate science
- Development of self-sustain mechanism for managing adaptation to climate related disaster and enhancing ecological services
- Development of models for forest resources and water conservation management.
- Improvement of community base institution empowered with better human resources and knowledge centre for better human dignity

4.3 Conclusion of the study:

The project has been undertaken with the objective “to develop a scientific based policy document and pilots for appropriate actions / strategies and right planning of climate change activities in the state based on sector and regional specific vulnerability & risk assessment”. Due to the different topographical locations, terrain diversity, altitudinal variation and diverse climate variability with different livelihood activities in terms of socio-economic development and resource management, four villages in the two districts i.e. Shirui & Hungpung in the hill district Ukhrul; and Khekman & Tentha in the valley district Thoubal have been selected to develop socio-economic vulnerability profile to the current climate variability at village level and build adaptive capacity of the communities for improvement of sustainable economic growth in the events of unprecedented climate change impacts.

Adaptive measures taken up were integration of traditional agricultural practices with modern knowledge such as introduction of SRI, modified SRI, ICM, DSP and selection climate resilient crop varieties. Construction of Climate resilient / flood resilient low-cost model for housing, model for community shelter home for landslide and flood exposed people has been completed as a part of mitigation activity. Human resource has been enhanced by installation of automated rainfall recorder

at the project sites and creation of village knowledge centre with scientific inputs. Natural forest resource management and water conservation were also implemented. Several programmes like training cum capacity building, orientation, awareness, interaction with the experts, field exposure visit, etc. has been conducted successfully as a part of the project. Focus has also been given towards mass natural farming practices by constructing 40 (forty) numbers of vermi-composting and liquid manuring unit at 4(four) villages with self production and utilization of homemade organic inputs to reduce dependency on chemical fertilizers by the farmers.

Taking into consideration with the activities implemented during the project period, it can be concluded with the following points that-

- It will contribute important parameters in reviewing and stock taking of the targeted activities under previous Manipur State Action Plan on Climate Change (SAPCC Ver-) and State Climate Policy by aligning strategies under NDC and SDG with a target for 2030.
- It will create self-confidence for improvement of livelihood activity and socio-economic conditions with scientific approach.
- This model could be replicated at district and village in the context of climate change adaptation strategies.
- The findings will open a new dimension to the policy makers, researchers, and planners about the various drivers of vulnerability to the changing climate at the local grassroots level.
- The community of the project site will have the ability of post project caring activities for self-sustenance.
- The project will develop current climate information for the 4 (four) project sites
- The project will promote organic farming through vermin-composting and liquid manure
- Model pilot developed for Climate resilient / flood resilient low-cost model for housing and community shelter home for landslide and flood exposed peoples were the significant models which could be replicated to some more vulnerable areas in the state.
- The study will enhance capacity building and understanding of climate change impacts
- It will further facilitate assessment of Climate Change vulnerabilities & risk on bio-physical and socio-economy in terms of water, agriculture and forest.

Lastly, the findings and scientific research publication base on the appropriate intervention taken up will be helpful in the scientific communities, planners, decision-makers and development agencies for their references. The project will also surely contribute an important document in terms of adaptation interventions in the Indian Himalayan State's climate action, planning and strategies.

5 OVERALL ACHIEVEMENTS:

5.1 Achievement on Project Objectives/ Target Deliverables:

Based on the Objectives and Target Deliverables, the following works have been achieved through this project.

In order to develop vulnerability profile and drivers of vulnerability of socio-economy and agriculture, village level house to house surveys with developed questionnaires were conducted for collection of Primary and Secondary data during first quarter, 2020-21. Data collection started at village level with Tier I approach on the available secondary information, Tier II approach on combination of secondary and primary data and it was followed by the Tier III approach on the actual field level data. After assessment of data, agriculture sector has been identified as the most vulnerable sector for improvement of socio-economy and livelihood activity in the four villages.

Introduction of SRI, modified SRI, ICM, DSP and selection climate resilient crop varieties at two valley with an area of about 100 Ha were taken up as adaptive measures. Enhancement of traditional terrace cropping practices with the integration modern technology at two hill village i.e. Shirui and Hungpung of Ukhrul District with about 100 Ha has also been taken up.

Climate resilient / flood resilient low-cost model for housing, model for community shelter home for landslide and flood exposed people has been constructed as a show case pilot model (4 nos.; One each of the 4 villages). And also two Models for community shelter home for landslide and flood exposed peoples (02 Nos.; one each of the two districts) were handed over successfully for the people in the two districts. Apart from this, human resource was being enhanced by creation of village knowledge centre with scientific inputs and installation of automated rainfall recorder at the project sites to know the current rainfall pattern.

. More than 100 farmers including ST communities were participated in training cum capacity building, orientation, awareness programmes conducted during the project. Time to time interaction programmes with the experts and field exposure visits were also organized to enhance knowledge sharing among each other. Training has been given to more than 40 nos. of SHG in the two districts for self-production and utilization of homemade organic inputs to reduce dependency on chemical fertilizers. Besides, 40 (forty) units of of vermi-composting and liquid manure model has been constructed at the 4(four) villages. To preserve community forest resources and conservation of water, two models for water harvesting ponds has also been setup at two hill villages i.e. Hungpung and Shirui of Ukhrul District. So far two research papers have been published in HSOA Journal of Environmental Science and International Journal of Recent Scientific Research during 2022. One more research paper is being accepted for publication in Journal of Diversity Studies. The interventions/outcomes from this project will be integrated as one of the parameters in reviewing the targeted activities of previous Manipur State Action Plan on Climate Change (SAPCC Ver-) and State Climate Policy by aligning strategies under NDC and SDG with a target for 2030.

5.2 Interventions:

After identification of agriculture as an important vulnerable sector for improvement of socio-economy and livelihood activity in the four project sites, appropriate interventions within the scope of this project have been undertaken. With respect to the global climate scenario and state's climate related issues, adaptive measures were mainly focused to improve capacity building of the villagers especially the farmers whose source of income are mainly from agriculture and allied activities.

Identification of proposed sites in the four villages was conducted through consultative meeting with the Village Gram Panchayat at the valley and Village Chief/Chairman at the hill and thereafter, continued the selection of target farmers to start further implementation of work programmes. Works has been started with dissemination of workshop among the target farmers. Experts from different fields have been engaged for deliberation of scientific views and sharing knowledge challenging the climate change impact. Programmes on capacity building, orientation, awareness, hands on training, field cum exposure visits were conducted from time to time to the targeted farmers. More than 100 farmers including ST communities were participated in the different programmes conducted during the project.

Climate resilient agricultural activities like promotion SRI/modified SRI has been implemented at about 100 Ha in valley village of Tentha and Kheman. DSP type of seed broadcasting also introduced to minimize cost of labour and expenditures. Introduction of new high yielding variety (HYV) were also part of the programme for selection and identification of climate resilient crop varieties as adaptive measures. Traditional terrace cropping practices with the integration modern technology like ICM has introduced to reduce prevalence of plant diseases at two hill village i.e. Shirui and Hungpung of Ukhrul District in an area of about 100 Ha.

All together 40 (forty) nos. of SHG in the two districts has been formed and they were being trained for self-production and utilization of homemade organic inputs. They have been provided seasonal crop seed and minimum farm equipments to support their socio-economy. Besides, 10 (ten) nos. each of vermi-composting and liquid manure units has been constructed at the 4(four) villages to produce compost for enhancing organic/ natural farming practices. Two models for preservation of community forest resources and conservation of water at two hill villages i.e. Hungpung and Shirui of Ukhrul District has also been developed. Four nos. of Climate resilient / flood resilient low-cost model for housing at four villages and, two model for community shelter home for landslide and flood exposed people in the two districts have been constructed as a show case pilot model. Eight nos. of automated rainfall recorder at the four project sites have been installed to check rainfall pattern in the area as well as enhancement of village knowledge centre.

5.3 On-field Demonstration and Value-addition of Products, if any:

In this project, emphasis has been given mainly on the agriculture and allied activities as it is identified the most vulnerable sector which needs to draw attention for improvement of socio-economy of the people in the four sample villages. It is also considered that Agriculture & its allied sectors are the main occupation of the people of Manipur and most of the people are engaged in agricultural sector for their livelihood. Therefore, climate smart agricultural practices like introduction of SRI/Modified SRI, ICM, DSP, etc. has been successfully implemented.

Preparation of economic paddy nursery raising for implementation of SRI/Modified SRI has been demonstrated among the farmers. In two dialects, manual for preparation of paddy nursery raising were developed for easy practical application during the process. To make soil fertile and free from plant diseases, soil treatment process with homemade natural ingredient as value addition product was applied successfully. Direct Seeding Plant (DSP) model of seed broadcasting in row by using dispenser pipe prepared manually was also taken up as on field demonstration so as to reduce labour and quantity of seeds thereby improving the socio-economy of the people.

Demonstration on preparation of vermi-compost and liquid manuring has been given to the Farmer Interest Group (FIG) for which 40 (forty) nos. of vermi-composting units has been constructed. Generation of Vermi-compost has been started and its application in the field instead of using chemical fertilizers in the field has becoming farmer's choice as it doesn't harm the environment and their health. In the meantime, training cum demonstration on preparation of homemade EM-1 (liquid and paste) was conducted to FIGs and SHGs. Even farmers do get earned from selling both the products in the locality.

. Two new high yielding variety (HYV) i.e. RCM, Tampha were introduced so as to demonstrate as selection of climate resilient crop varieties which have more productivity and resistant to plant diseases. Good positive responses among the farmers have been observed for choosing the HYV varieties due to its unique resilient properties. Integrated methods of terrace cropping practices such as mix cropping system have been demonstrated to reduce prevalence of plant diseases. Paddy cum pisciculture at two hill village i.e. Shirui and Hungpung of Ukhrul District has also been introduced.

5.4 Green Skills developed in State/ UT:

The State Government has already setup different programmes for development of green skill especially for the youths having technical knowledge for generation self-employment in order to get the committed figures of the Intended Nationally Determined Contributions (INDCs) and Sustainable Development Goals (SDCs). The State Planning Department has initiated a programme "Startup Manipur" since 2017 to give soft loan to the green skilled youths so as to discharge their ability in different fields in terms of new innovations, skill development, employment generation and state specific contribution to NDC.

The Directorate of Environment and Climate Change, being the State Nodal Department, has implementing “ENVIS HUB Manipur” for providing information on various states’ related environmental issues. The first GSDP course run by this centre was on Para Taxonomy (including Peoples Biodiversity Register (PBR) emphasizing to develop green skilled workers for getting employment opportunity gainfully in different sectors. Altogether 40 trainees were selected for the 4 months skill development programme. This centre has also worked on promotion of ecotourism in Manipur and organized Training Programme of Certificate Courses on “Nature Conservation & Livelihood: Ecotourism”.

In this project, training on “Waste to Compost” has been organized specially to the Women Self Help Groups for management kitchen waste products as a part of Green Skill Development. More than 60 (sixty) nos. of women were participated in the programme. Required materials were supplied to the SHGs and demonstrated how to prepare compost from the products of kitchen waste. Also, conducted training on sustainable utilization of natural resources and development of skill in making organic inputs like preparation of homemade EM-1 (liquid and paste) as well as utilization of on farm products as compost to FIGs and SHGs for sustaining economic activity of the people.

5.5 Addressing Cross-cutting Issues:

About 80% of the state population depends on agriculture and allied activities and plays an important role in the social and economic life of the people. However, agriculture in Manipur is facing the consequences of climate change and it is also identified as one of the most vulnerable sectors in the State Action Plan on Climate Change (SAPCC). From the primary survey in the four villages, it was also observed to be the most vulnerable sector for which required intervention were taken up during the project. The state is also projected to experience more of extreme rainfall and reduction in crop yields. As subsistence level farming is coupled with prevalent shifting cultivation, the small and marginal farmers will be most affected due to climate change. Agricultural production system is mostly rainfed, mono-cropped and at subsistence level. Use of local varieties, low moisture retention capacity of upland soil and lack of irrigation facilities along with traditional management practices have resulted in low crop productivity and low cropping intensity. Hence, there is an urgent need for devising climate proof plan and climate ready policy for climate compatible agricultural development in Manipur. Location-specific climate smart technology need to be introduced and should be demonstrated through participatory approach for ensuring a climate resilient production system and a climate resilient ecosystem.

The introduction of climate resilient varieties and contingent crop planning with major emphasis on horticultural crops are two important issues for adapting climate resilient agriculture in Manipur. The urgent need is the seamless blending of traditional knowledge with modern scientific technologies to devise locally suitable adaptive strategies in the climate action programme. Targeted and dedicated

efforts with co-ordination from various departments, developmental agencies and government policies are to be strengthened. Therefore, multidisciplinary collaborative approaches need to be prioritized for achieving durable climate resilience agricultural practices. In addition, 'public–private–civil society partnership (PPCP)' approach should be promoted.

Moreover, secondary income generation agricultural activities like community-based value addition programme, integrated beekeeping and honey processing unit, mushroom production, primary processing of horticultural crops, value added or enriched vermicomposting, etc. are to be popularized as climate resilient livelihood support systems.

6 PROJECT'S IMPACTS IN IHR:

6.1 Socio-Economic impact:

The state, being a part of the Himalayan Ecosystem, has unique ecosystem because of different topographical locations, terrain diversity and altitudinal variation. These variations made changes in terms of biodiversity, forest, water resources, agriculture & allied activity, livelihood and socio-economic challenges. The state is divided into 2 (two) regions such as the hill and the valley. The valley region is very small which is only 10% of the total geographical area, but the region is one of the most thickly populated regions of the state. The hill region extends 90% of the total state area with low density population of 61 per sq. km. as against 730 in the valley. The economy of hill is very low with respect to valley. However, all the important resources are belonged to the hill areas. The mark potential economy of the valley is due to main agricultural and allied activities products. Permanent cultivation is generally practiced in the valley districts while terrace cultivation, jhuming or shifting cultivation is widely adopted in most part of the hills.

The main socio-economy in the hill is mainly due to natural forest resources, terrace and jhum-cultivation. The village council that represents the village community is the owner of the community land that comprises all open and forestland of the village where from the villagers freely collect timber, firewood, thatching grass, bamboo, fruits, vegetables and herbs both for domestic and commercial purposes. Cultivation food grains i.e. rice, maize, pulses, ginger, oilseeds and other cash crops are the primary source of income whereas forest-products are the secondary source of economy. Transport and communication infrastructures are also at a bare minimum. Hence, only small industries are found here. However, due to unchecked management of forest resources like selling of fire wood, making black charcoal, timbers and other forest products, the area of forest coverage has reduced to a great extent. Jhuming or shifting cultivation is the biggest cause of the destruction of the natural forest, loss of biodiversity, land slide, soil erosion, etc. Now, many of the streams are becoming drying up and most of the areas are facing the acute problem of water scarcity.

Majority of the villager in the valley are directly or indirectly dependent in agricultural and allied activities. Cultivation of cash crop and vegetable includes sugarcane, oilseeds, maize, potatoes,

pulses, chilies, cabbages, cauliflower, different kinds of peas, gourds, pumpkins, etc. are important activities which impart the socio-economy of the people. Another important sector of socio- economy is animal husbandry; important livestock found in the village are cattle, buffaloes, goats, horses, ponies, pigs, dogs, poultry etc. In the valley pisciculture is famous which contributes to the economy providing an important occupation for a large number of people.

In this project, emphasis has been given mainly on improvement of socio-economy of the people both at the hill and valley. As agriculture and allied activities are the main occupation for the livelihood and source of economy, appropriate interventions were taken up from time to time for the welfare of the people. Interventions like climate resilient agriculture SRI/Modified SRI, Integrated Crop Management System (ICM), Direct Seeded Plant (DSP) and selection climate resilient crops has been successfully implemented. Traditional system of cultivation has been improved with modern knowledge at both hill and valley. A landmark improvement has been observed in terms of achievement and production, knowledge sharing and promotion, livelihood and socio-economy, etc. In addition, different variety of seasonal crop seeds were also distributed to the women SHGs and FIGs for generation of their income. Paddy cum Pisciculture practices has also been introduced by providing linger fishes to the SHGs especially at the hill for better development of economy. Moreover, training and capacity building on preparation of natural organic inputs such as preparation of vermin-compost and liquid manure, production of liquid and solid EM-1 were organized for promotion sustainable natural farming practices. Therefore, looking forward with the minimum support provided, it was observed that socio-economic condition in the four villages has been improved to some extent and the interventions taken up are appropriate in the context of climate change adaptation approach.

6.2 Impact on Natural Resources/ Environment:

The state, both hills and valleys have a variety of natural resources due to its different topographical locations, terrain diversity, altitudinal variation and climatic conditions. Due to its unique ecosystem and rich biodiversity, the state is also known as biological hotspot area in the Indian Himalayan Region. The hills and the mountains provide the precious resources for the people. The villagers use to collect wild vegetables, wood for building houses and fuels, honey, fruits, medicinal plants, etc. to the meet needs of the local people and livelihood security as a whole. However, with rapid growth of population and economic development in Manipur, there are threats to the natural resources and environment through expansion and intensification of agriculture, uncontrolled growth of urbanization, destruction of natural habitats, imperatives of industrialization etc. The well-known impact on natural resources is due to unsustainable production and consumption such as mass cutting of timbers, cutting trees for fire wood, over exploitation of forest products, shifting cultivation or jhuming cultivation, etc. which lead to extinction of various flora and fauna.

The conservative method of agricultural practices and uncontrolled use of chemical fertilizers, insecticides and pesticides is one of the factors which surged pressure on the environment and natural ecosystem in Manipur. Adoption of sustainable way of agricultural practice by the farmers is very also low despite the effort of different government agencies. Peoples are using mass weedicides for removal of unwanted weed and grasses during agricultural processes and practicing jhuming cultivation especially in the hill which totally clears all the shrubs and trees. The burning of the remnants again causes the mass destruction of all the flora and fauna.

During the project, promotion of organic/natural farming practices has given priority to the farmers and SHGs. Use of chemical fertilizers, insecticides and pesticides were totally out of the activity during agricultural practices. Terrace cultivation was given emphasis at the hill whereas interventions like climate resilient agriculture SRI/Modified SRI, Direct Seeded Plant (DSP)were implemented at the valley. These types of agricultural practices with use of natural organic inputs have significant role in saving environmental degradation. Two models for preservation of community forest resources and conservation of water which were developed at two hill villages i.e. Hungpung and Shirui of Ukhrul District had a great impact on natural resource management. This has benefited the people in both the way in terms of conserving the natural resources and water for domestic use. Besides, 10 (ten) nos. each of vermi-composting and liquid manure units has been constructed at the 4(four) villages to promote production of compost from on farm products in order to reduce firing of byproducts after cultivation to save environment.

However, for conservation and sustainable use of natural resources, it is now need of the hour to make a strong and dynamic network among conservationists, local representatives, state and central government functionaries and other stakeholders for social or community mobilization on natural resource management and its linkages to the livelihood of local communities.

6.3 Conservation of Biodiversity/ Land Rehabilitation in IHR:

The State has its own setting within the Eastern Himalayan region representing many angiospermic and medicinal plants, different kinds of edible fungi, orchids, bamboo, fishes, wild animals, migratory birds, a multitude of low and high altitude butterflies, etc. Apart from other endangered species, the Sangai, Shiroi Lily, Dzuko Lily, Hoolock Gibbon, Scrow, Slow Loris, Golden Cat, Leopard Cat, Malayan Sun Bear, Spotted Linsang, Mrs Hume Pheasant and Hornbills add to the beauty of faunal and floral diversity in the state. It is home for an important and official symbols of the state flower namely ShiruiLily(*Lilium mackliniae* Sealy), State bird Nongin (*Syrmaticus humie humie*) and state tree Uningthou (*Phoebe hainesiana* Brandis). However, many species are on the verge of extinction due to the extensive process of anthropogenic activities, forest fragmentation and climate change. Severe practices of shifting cultivation leading to forest fire both in hill and valley are responsible for the biodiversity loss and land degradation. Lack of alternative sources of livelihood and collection of non-timber forest products to support the lifeline are also accountable for it. The

situation is again made worse by the shifting climate change such as scanty rainfall and rise in temperature which is leading to fast extinction of species, posing a major threat to biodiversity conservation.

During the project, efforts have also been made to disseminate awareness among the local people about the importance of biodiversity conservation and their cohesive role in making ecological balance and environment sustainability. Practicing terrace cultivation at the hill and climate resilient agricultural methods at the valley, as intervention of the project, were the important activities for conservation of biodiversity and land rehabilitation. The ill effects of burning of on farm and off farm products are well aware and no such activities were taken by the locality during the project. Capacities building for preparation of compost from on farm products have been emphasized to save environment. Plantation of locally available seed varieties with scientific approach were also encouraged as conservation approach of indigenous plant diversity. People are also practicing traditional way conservation of seed varieties in both the hill and valley. Developing two models for preservation of community forest resources and conservation of water contributes the conservation and management approach of natural resources. Even though, the project does not go directly into the action of conservation of biodiversity, the approaches/interventions so far taken up are more relevant and have meaningful impact on biodiversity conservation and land regeneration in the state. Therefore, biodiversity conservation interventions need to be focused more with wide spread of proper awareness to the people on their conservation. It is a collective responsibility for all the stakeholders. However, vague on legal status of the forest and lack of adequate legal and institutional structure for managing the forest and land, has become one of the big challenges in conserving the biodiversity in the state.

6.4 Developing Mountain Infrastructures:

Manipur being a hilly terrain, it requires such an adequate and efficient infrastructural set up which will provide physical accessibility, social and economic development in the state. The state is economically backward even though there are plenty of natural resources and the performance for development of infrastructure sector is dismal. In fact, it is limited as existence of poor investment from outside Manipur is very poor. The expansion of basic infrastructure like transportation, communication, health, power and internet service connectivity are considered to be extremely vital for the region as a whole. On the other hand, educational, agricultural and eco- tourism infrastructures are the main concerned infrastructure for improvement of socio-economy both in hill and valley.

Due to poor connectivity, the hill districts are lagging behind the valley districts in terms of aggregate infrastructure development. Even at the disaggregate level it is found that the hill districts are way behind the valley districts. In spite of the vastness of the region and the scenic beauties, the infrastructure in the hill region is still very poor and needs to be developed. Besides, the infrastructure bottleneck, there are also critical areas that need to be looked into such as lack of awareness about

the potentials of tourism industry, lack of accommodation, roads and bridges, road and transport supplier, side amenities such as eateries or dhabas, trained manpower such as tour managers or guides etc. The most important thing is that the mindsets of the youths have to start their own enterprises in tourism infrastructure development as lucrative business venture in the hilly areas of Manipur.

During the project, one community shelter home has been developed at Lungshangkhong, Hungpung of Ukhrul district. This shelter home has benefited to all the people of Ukhrul District and become a rest house of travellers as it stands in the half way between Imphal to Ukhrul road. It is also one of the attractive sites for the local tourist where the famous Mouwa Cave is located and many visitors are used to take rest on their trip. Some basic amenities have also been provided from the department side to support socio-economy of the local people and generation of income by taking minimum fee from the visitors. Now, it is worthy to say that construction of such a shelter home in Ukhrul District is landmark achievements of this project in terms of add on infrastructure development for state especially in hill region.

6.5 Strengthening Networking in State/ UT:

Institutional setup and co-ordination with different line departments has been made to achieve the deliverables of the project through identification of the vulnerable sectors which are very much linked to the current climate change scenario in the state. Networking and strengthening of knowledge sharing among the institutions was the key role to build up capacity building of the people especially in area of identified four sample villages. This has also increased the institutional capacity for more studies in the region expecting new network on Climate Change programme with respect to Himalayan eco-system. Considerable progress has also been made to build capacity building, skilled development and strengthening knowledge sharing among the farmers through different programmes conducted in collaboration with Agriculture Department, ICAR, Manipur University, KVKs and other renown experts for climate resilient agriculture like selection climate resilient crops, agriculture using less agro-chemicals, rain water harvesting at their fields, preventive measures and timely control of diseases and pests, etc. A good network with the Farmer Progressive Organization (FPOs), specially for marketing network, existing community level farmer groups and village development committee under the supervision of different customary local institutes like Loumi Marup, Singlup (local institute), Self Help Groups (SHG), Panchayati Raj, etc. were formed to enhance continuous efforts towards building of infrastructural and human capacity.

Besides, the Directorate of Environment and Climate Change, as Nodal Agency for State Climate Change, has also formulated the State Action Plan on Climate Change with the co-ordination of 22 state line departments supported by Sectoral Working Groups and a Technical Support Groups.

Therefore, this Directorate has a good network with different line departments and facilitated various climate related information among each other for making climate policy and planning in the state.

7 EXIT STRATEGY AND SUSTAINABILITY:

7.1 Utility of project findings:

The project undertaken is a new research model pilot for the policy makers, researchers, and planners about the interventions that could be taken up to the changing climate at the local grassroots level. Now, a more effective policy/ programme could be formulated to solve the woes of the common people on a larger scale as the actual factors affecting their socio-economy due to climate change impact has been identified during the project.

The outcome of the project will be helping in aligning the state plan activities towards effective climate action and compilation of State's climate vulnerability information in the context of Indian Himalayan States' climate change vulnerability profile. It will also help in creating and dissemination of awareness about climate resilient activities as well as meaningful utilization of resources for sustainable development.

The utility of the project can be summarized as;

(i) The project outcome may be utilized in the State Actions and Strategies on climate change impact.

(ii) The project report/published paper based on the project activities would be a good document for policy-makers as well as the researchers.

(iii) The identified activities taken up during the project could be addressed for better adaptation planning and action.

(iv) The community of the project site involved during the project is being trained for post caring and self-sustenance.

(v) The project has developed current climate information for the 4 (four) project sites.

(vi) The project has promoted organic farming through vermin-composting and liquid manuring.

(vii) The model so far developed like community shelter home for landslide and flood affected peoples, climate resilient low-cost housings, introduction of traditional climate resilient agriculture, blending of modern agriculture practices and traditional practices, etc. are the milestone achievement not only for the 4 (four) villages but also for the whole state.

(viii) The project has enhanced capacity building and understanding of climate change knowledge.

(ix) The socio-economic data collected during the project will be a meaningful data for further assessment of Climate Change vulnerabilities & risk on bio-physical and socio-economy at district and village level.

7.2 Other Gap Areas:

The project has been implemented with the co-ordination of institutions like Manipur University, Agriculture Department, National Institute of Technology (NIT), Manipur and Indian Council of Agricultural Research (ICAR), Manipur. Strong support from the Village Chief at the hill district and Pradhan of Gram Panchayat at the valley district were the key functional local institution to achieve the target deliverables of the project. Other members/development committee and Self-Help Groups (SHG) also extended continuous support and participated in all the programmes/activities associated with their specific role during implementation.

The gap areas which could be highlighted during implementation of the project are-

a) Most of the people in the four project sites are low income and marginalized farmers and are less likely to adopt adaptation activities because of pre-occupied mind set.

b) Limited financial support to robust adaptation mechanisms/activities sustainably in wider scale.

a) Lack of sufficient data on socio-economy due to impact of climate change is a common priority gap in both the district.

b) Lack of access to existing technologies, traditional and indigenous knowledge.

c) Lack of actionable knowledge on agro-ecological sensitivity zones for appropriate climate risk management and climate-smart agriculture.

d) Lack of technological knowledge transfer, poor capacity building and lack of institutional bridging with the farmer are the main observed gap to be filled up in the wake of climate change at grass root level.

7.3 Major Recommendations/ Way Forward:

The project undertaken is a model to identify the adaptation strategies/ interventions in the global climate change scenario for better improvement of socio-economy sustainably in a poor state like Manipur. The project has enlightened the knowledge of the people in the area especially in the two districts by understanding the current climate science and methodologies to be adopted for more resilient livelihood activity and enhancing their adaptive or coping capacity.

The major recommendation/way forward envisaged are-

1. Improvement of economic sustainability of the economically challenged people through diversification of livelihood strategies by integrating institutional support, capacity building, training and access to resources.

2. Strengthening of institutional networking system through organizing meetings, workshops, presentations along with co-ordinations and sharing of regional specific interventions for better services in terms of sustainably management and planning.

3. Improvement of community base institution empowered with better human resources, self-sustain mechanism and livelihood for managing climate related disaster in the Indian Himalayan Region.

7.4 Replication/ Upscaling/ Post-Project Sustainability of Interventions:

Climate change in general have a significant impact on all natural ecosystems thereby affects the normal livelihood activities of the people. However, the impacts will be far greater on the already-stressed ecosystems of the Eastern Himalayas. The state of Manipur as part of this ecosystem is highly vulnerable both due to geological reasons and on account of the stress caused by increased pressure of population, exploitation of natural resources and other related challenges. The rapid urbanization is causing decline in agricultural productivity and lost in forest cover resulting in food insecurity and social unrest. Therefore, it is essential to understand the socio-economic profile of the state in order to assess the impact of the climate change on ecosystem and therefore on the livelihood issues.

The main objective of the project is “to develop a scientific based policy document and pilots for appropriate actions / strategies and right planning of climate change activities in the state based on sector and regional specific vulnerability & risk assessment”. The site selection of the project was based on the different topographical locations, altitudinal variation and diverse climate variability with different livelihood activities in terms of socio-economic development and resource management with the aim to develop socio-economic vulnerability profile at village level and build adaptive capacity of the communities for improvement of sustainable economic growth in the events of unprecedented climate change impacts.

In order to achieve the target deliverables, adaptive measures taken up were integration of traditional agricultural practices with modern knowledge such as introduction of SRI, modified SRI, ICM, DSP and selection climate resilient crop varieties. These are the important climate resilient intervention which could be scaling up at most part of state. Now, the farmers in the project site are continuing these activities as post-project sustainability interventions and have the ability of post project caring activities for self-sustenance. Construction of Climate resilient / flood resilient low-cost model for housing, model for community shelter home for landslide and flood exposed people has become at successful model in the two district on which community in the area are appreciated with high enthusiasm and could be replicated as a climate change mitigation approach at other districts. Installation of automated rainfall recorder at the project sites has improved knowledge about weather information which enhanced village knowledge centre with scientific inputs could be up-scaling. Natural forest resource management and water conservation so implemented could also be scaling up. The programmes like training cum capacity building, orientation, awareness, interaction with the experts, field exposure visit, etc. has been successful one which enlighten the knowledge about the impact of climate change and appropriate interventions in order to have self-sustainable and climate resilient community. To promote organic farming practices 40 (forty) numbers of vermi-composting and liquid manuring units have been constructed at 4(four) villages with self-production and utilization of homemade organic inputs to reduce

dependency on chemical fertilizers by the farmers. This could also be replicated at other area as to promote organic and natural farming practice in the state.

Taking into consideration with the activities implemented, the project model could be replicated at other vulnerable districts and villages in the context of climate change adaptation strategies to create self-confidence for improvement of livelihood activity and socio-economic conditions with scientific approach by enhancing capacity building and understanding of climate change impacts.

8 REFERENCES/BIBLIOGRAPHY: NA

9 ACKNOWLEDGEMENTS

Principal Investigator is very much thankful to the Director and Nodal Officer, National Mission on Himalayan Studies, PMU, GB Pant National Institute of Himalayan Environment (GBPNIHE), Kosi-Katarmal (Almora) for granting the project and funding support to execute this action-oriented research project. We are also thankful to all officers and staff of GBPNIHE for supporting us time to time. We are also wish to express our sense of gratitude and thankful to the Director, Directorate of Environment and Climate Change, Government of Manipur for his time-to-time valuable support and cooperation during implementation of the research project. The help and support rendered by the community representatives, line department officials and other stakeholders are also duly acknowledged.

APPENDICES

Appendix 1 – Details of Technical Activities -

- (As enclosed)

Appendix 2 – Copies of Publications duly Acknowledging the Grant/ Fund Support of NMHS

-**2 (two) copies of publication enclosed**

Appendix 3 – List of Trainings/ Workshops/ Seminars with details of trained resources and dissemination material and Proceedings

- (As enclosed)

Appendix 4 – List of New Products (utilizing the local resources like NTFPs, wild edibles, bamboo, etc.)

- Nil

Appendix 5 – Copies of the Supporting Materials like Manual of Standard Operating Procedures (SOPs) developed under the project

- **Preparation of organic inputs like EM-1 liquid and past /powder**
- **Sustainable management of paddy nursery/ seedling raising**

Appendix 6 – Details of Technology Developed/ Patents filled, if any

- Nil

Appendix 7 – Any other

i. **New Ground Models/ Process/ Strategy developed,**
   - Construction of 40 nos. of Vermicomposting and liquid manure unit
   - Construction of 4 (four) Climate resilient / flood resilient low-cost model for housing
   - Construction of 2 (two) Model shelter home for flood exposed peoples.

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Annexure-I

Consolidated and Audited
Utilization Certificate (UC) and Statement of Expenditure (SE)

For the Period: 01.01.2020 to 31-03.2023

1.	Title of the project/Scheme/Programme:	**"Identification of vulnerability and potential risk factor zone at district and village level in Manipur"**
2.	Name of the Principal Investigator & Organization:	Dr. N. Sanamacha Meetei, Directorate of Environment and Climate Change, Porompat, Imphal-795005, Manipur
3.	NMHS-PMU, G.B. Pant National Institute of Himalayan Environment, Kosi-Katarmal, Almora, Uttarakhand Letter No. and Sanction Date of the Project:	GBPNI/NMHS-2019-20/MG,. Dtd. 30-09-2019
4.	Amount received from NMHS-PMU, G.B. Pant National Institute of Himalayan Environment, Kosi-Katarmal, Almora, Uttarakhand during the project period (Please give number and dates of Sanction Letter showing the amount paid):	**i) Rs. 3101920.00** GBPNI/NMHS-2019-20/MG, dtd. 30-09-2019 **ii) Rs. 2281920.00** GBPNI/NMHS-2019-20/MG/301/107/363, dtd. 26-03-2021 **iii) Rs. 1448555.00** GBPNI/NMHS-2019-20/MG/301/107/363/61, dtd. 15-06-2022
5.	Total amount that was available for expenditure (Including commitments) incurred during the project period:	**Rs. 6995760.00**
6.	Actual expenditure (excluding commitments) incurred during the project period:	**Rs. 6825563.00**
7.	Unspent Balance amount refunded, if any (Please give details of Cheque no. etc.):	**Nil**

8.	Balance amount available at the end of the project:	**Rs. 6832**
9.	Balance Amount:	**Rs. 6832**
10.	Accrued bank Interest:	**1,17,649.00**

Certified that the expenditure of **Rs. 68,25,563.00 (Rupees sixty eight lakhs twenty five thousand five hundred sixty three) only** mentioned against Sr. No. 6 was actually incurred on the project/ scheme for the purpose it was sanctioned.

Date: 26-02-2024

(Signature of Principal Investigator)

DEVELOPMENT OFFICER
Directorate of Environment & Climate Change
Government of Manipur

(Signature of Registrar/ Finance Officer)

JUNIOR ACCOUNTANT
Directorate of Environment & Climate Change
Government of Manipur

(Signature of Head of the Institution)

DIRECTOR
Directorate of Environment & Climate Change
Government of Manipur.

OUR REF. No.

ACCEPTED AND COUNTERSIGNED

Date:

COMPETENT AUTHORITY
NATIONAL MISSION ON HIMALAYAN STUDIES (GBP NIHE)

Statement of Consolidated Expenditure

[Directorate of Environment and Climate Change, Porompat, Imphal-795005, Manipur]

Statement showing the expenditure of the period from

Sanction No. and Date : GBPNI/NMHS-2019-20/MG, dtd. 30-09-2019

1. Total outlay of the project : Rs. 6995760.00

2. Date of Start of the Project : 01-01-2020

3. Duration : 3 years

4. Date of Completion : 31-03-2023

a) Amount received during the project period : Rs. 6832395.00

b) Total amount available for Expenditure : Rs. 6832395.00

S. No.	Budget head	Amount received	Expenditure	Amount Balance/ excess expenditure
1	Salaries	21,57,600.00	21,57,600.00	Nil
2	Permanent Equipment Purchased (Item-wise)			
	a) Automatic Rainfall Recorder (8 nos.)	3,00,000.00	3,00,000.00	Nil
	b) GPS (4 nos.)	60,000.00	60,000.00	Nil
3	Travel	1,16,000.00	1,16,000.00	Nil
4	Contingencies	1,18,000.00	1,12,897.00	5,103.00
5	Expendables & Consumables	0.00	0.00	0.00
6	Activities & Other Project cost	37,66,178.00	37,64,449.00	1,729.00
7	Institutional charges	1,96,968.00	1,96,968.00	Nil

8	Accrued bank Interest	1,17,649.00 (+)497 (as on 31st September,22)	1,17,649.00	497.00
9	**Total**	**68,32,395.00**	**68,25,563.00**	**7,329.00**

Certified that the expenditure of **Rs. 68,25,563.00 (Rupees sixty eight lakhs twenty five thousand five hundred sixty three)** mentioned against Sr. No. 9 was actually incurred on the project/ scheme for the purpose it was sanctioned.

Date: 26-02-2024

(Signature of Principal Investigator)

DEVELOPMENT OFFICER
Directorate of Environment & Climate Change
Government of Manipur

(Signature of Registrar/ Finance Officer)

JUNIOR ACCOUNTANT
Directorate of Environment & Climate Change
Government of Manipur

(Signature of Head of the Institution)

DIRECTOR
Directorate of Environment & Climate Change
Government of Manipur.

OUR REF. No.

ACCEPTED AND COUNTERSIGNED

Date:

COMPETENT AUTHORITY
NATIONAL MISSION ON HIMALYAN STUDIES (GBP NIHE)

Annexure-II

Government of Manipur
Directorate of Environment and Climate Change
Porompat, Imphal-05

Consolidated Interest Earned Certificate

This is hereby certified that the under mentioned interest has been earned during three years period of the project 'Identification of Vulnerability and Potential Risk Factor Zone at District and Village Level in Manipur".

Sl. No.	Year	Interest Earned (Rs.)
1.	2019-20	27,484.00
2.	2020-21	59,257.00
3.	2021-22	30,908.00
4.	2022-23	497.00
	Total	**1,18,146.00**

Total interest earned = Rs. 1,18,146.00 (Rupees one lakh eighteen thousand one hundred forty six) only

.(Signature of Principal Investigator)

DEVELOPMENT OFFICER
Directorate of Environment & Climate Change
Government of Manipur

(Signature of Registrar/ Finance Officer)

JUNIOR ACCOUNTANT
Directorate of Environment & Climate Change
Government of Manipur

(Signature of Head of the Institution)

DIRECTOR
Directorate of Environment & Climate Change
Government of Manipur.

Annexure-III

Consolidated Assets Certificate

Assets Acquired Wholly/ Substantially out of Government Grants

(Register to be maintained by Grantee Institution)

Name of the Sanctioning Authority: National Mission on Himalayan Studies, G. B. Pant National Institute of Himalayan Environment (GBPNIHE)

1. Sl. No. _____
2. Name of Grantee Institution: Directorate of Environment and Climate change, Govt. of Manipur
3. No. & Date of sanction order: GBPNI/NMHS-2019-20/MG, Dtd. 30-09-2019
4. Amount of the Sanctioned Grant: **Rs. 21,00,000.00**
5. Brief Purpose of the Grant: Purchase of Automatic Rainfall Recorder & GPS, Construction of Vermi-compost Unit, Climate resilient/Flood resilient low-cost model for housing and Model community shelter home for land slide and flood exposed peoples.
6. Whether any condition regarding the right of ownership of Govt. in the property or other assets acquired out of the grant was incorporated in the grant-in-aid Sanction Order: **NA**
7. Particulars of assets actually credited - **details in Annexure-IV**
8. Value of the assets as on **31st March, 2023 is Rs. 21,00,000.00**
9. Purpose for which utilized at present- As mentioned in Sl. No. 5.
10. Encumbered or not _____NA_____
11. Reasons, if encumbered_____ NA_____
12. Disposed of or not _____ NA_____
13. Reasons and authority, if any, for disposal_____ NA_____
14. Amount realised on disposal_____ NA_____

Any Other Remarks: _____

_____

(PROJECT INVESTIGATOR)

(Signed and Stamped)

DEVELOPMENT OFFICER
Directorate of Environment & Climate Change
Government of Manipur

(FINANCE OFFICER)

(Signed and Stamped)

JUNIOR ACCOUNTANT
Directorate of Environment & Climate Change
Government of Manipur

(HEAD OF THE INSTITUTION)

(Signed and Stamped)

DIRECTOR
Directorate of Environment & Climate Change
Government of Manipur.

Annexure-IV

List or Inventory of Assets/ Equipment/ Peripherals

S. No.	Name of Equipment/Asset	Quantity	Sanctioned Cost	Actual Purchased Cost	Purchase Details
1	Automatic Rainfall Recorder	8	3,60,000.00	3,58,720.00	Tipping Bucket type Rain Gauge @ 30,500.00 (18% GST Extra)
2	GPS	4			Garmin STrax-10 @15,000.00 (18% GST Extra)
3.	Construction Vermi-compost Unit	40 Units	3,20,000.00	3,20,000.00	@ Rs. 8,000/- per Unit
4.	Climate resilient/Flood resilient low cost model for housing	4 nos.	4,20,000.00	4,20,000.00	@ Rs. 1,05,000/- per unit
5.	Model community shelter home for land slide and flood exposed peoples	2 nos.	10,00,000.00	10,00,000.00	@ Rs. 5,00,000/- per unit

(PROJECT INVESTIGATOR)

(Signed and Stamped)

DEVELOPMENT OFFICER
Directorate of Environment & Climate Change
Government of Manipur

(FINANCE OFFICER)

(Signed and Stamped)

JUNIOR ACCOUNTANT
Directorate of Environment & Climate Change
Government of Manipur

(HEAD OF THE INSTITUTION)

(Signed and Stamped)

DIRECTOR
Directorate of Environment & Climate Change
Government of Manipur.

Annexure-V

Government of Manipur
Directorate of Environment and Climate Change
Porompat, Imphal-05

To,

The Convener, Mountain Division
Ministry of Environment, Forest & Climate Change (MoEF&CC)
Indira Paryavaran Bhawan
Jor Bagh, New Delhi-110003

Sub.: Transfer of Permanent Equipment purchased under Research Project titled "Identification of Vulnerability and Potential Risk Factor Zone at District and Village Level in Manipur" funded under the NMHS Scheme of MoEF&CC – reg.

Sir/ Madam,

This is hereby certified that the following permanent equipment purchased under the aforesaid project have been transferred to the Implementing Organization/ Nodal Institute after completion of the project:

1. 8 (eight) nos. of Automatic Rainfall Recorder
2. 4 (four) nos. of GPS

(Dr. T. Brajakumar Singh)
Director,
Directorate of Environment and Climate Change

Date: 26-02-2024

Stamp/ Seal: DIRECTOR Directorate of Environment & Climate Change Government of Manipur.

Copy to:

1. The Nodal Officer, NMHS-PMU, National Mission on Himalayan Studies (NMHS), G.B. Pant National Institute of Himalayan Environment (NIHE), Kosi-Katarmal, Almora, Uttarakhand-263643

Annexure-VI

Government of Manipur
Directorate of Environment and Climate Change
Porompat, Imphal-05

DECLARATION

This is hereby declared that a sum of Rs. 5,103.00 (Rupees five thousand one hundred three) has been laying as unspent balance in the CZBA Account No. 110058875348 of Canara Bank, Imphal and lapsed at the end of 31st March, 2023. There was no any refund of unspent balance.

(Dr. T. Brajakumar Singh)
Director,
Directorate of Environment and Climate Change

Date: 26-02-2024

Stamp/ Seal: DIRECTOR Directorate of Environment & Climate Change Government of Manipur.

APPENDIX-1

Details of Technical Activities

1. Village level consultative meeting:

The actual work of the project had been started through consultative meeting at four selected project sites (villages) with co-ordination of respective Village Chief/Pradhan, Gram Panchayat members along with Subject Experts concerned at different time interval. During the

meeting, the scope and relevant project activities were highlighted and discussed elaborately. Participants also shared their issues and problems faced due to impact of climate change at the local context. Identification and development of village level vulnerability profile with developed questionnaires were considered to be carried out in four villages during first quarter of the project through house-to-house survey. By the time, formation of Self-Help Groups (SHGs) & Farmer Interested Groups (FIGs) comprising not less than 15 members in each group had also been started to enable successful implementation of the project activities. Emphasis had been given to adopt climate resilient activities and selection of climate resilient crops for which necessary training cum capacity building were conducted with experts and concerned line departments.

2. Identification of farmers group and location:

Selection of farmers for implementation of the component activities of the project was held with the co-ordination of Gram Panchayat and Village Chief/Chairman at valley and hill. Interested Farmers were being invited in the scheduled meeting and allowed them to express their opinions on the interventions which were being acknowledged to be taken up. Different opinions from the farmers were observed and discussed one by one to bring into a common framework on which the activity components of the project could be covered.

The locations where the project interventions to be taken up were identified with village Headman at the hill village and Pradhan at the valley village. Co-ordination with Farmers and the experts had also been made to select suitable interventions. Farmers were advised to form

Farmers group/ Self Help Groups (SHG) in the respective villages for implementation of the assigned works. Workshop, Training/Capacity building, Meeting, Exposure visit were being planned according to the Activity Chart of the project. Selective leader specially for monitoring and survey of implemented works within the existing community farmer groups had been formed under the supervision of different customary local institutes like Loumi Marup, Singlup (local institute), Panchayat, etc. They were being authorized to supervise the different project supported activities during implementation such as survey, collection of data, time to time monitoring and co-ordination with the farmers.

3. Household socio-economic profile survey:

To identify and analyse vulnerable sector in the village, door to door collection and survey of socio-economic information from every household of four villages viz. Tentha & Khekman of Thoubal District and Shirui & Hungpung of Ukhrul District had been started with questionnaires developed especially for this project. The survey was completed during first quarter of 2020-21. Based on the information/data collected, agriculture and its allied activities were observed to be the most vulnerable sector and need to be improved as the majority population depend on it for their livelihood.

4. Workshop on selection of climate resilient activities:

Workshops with the respective Village Gram Panchayat at the valley and Village Chief/Chairman at the hill were conducted for selection of target farmers to implement the actual work components of the project. In order to develop vulnerability profile and drivers of vulnerability of socio-economy and agriculture, village level house to house surveys with developed questionnaires were conducted for collection of Primary and Secondary data during first quarter, 2020-21. Dissemination of mass awareness on impacts of climate change, changing scenario of surrounding environment & climate, livelihood condition, socio-economy and others related issues were the main topics to address and achieve the objectives of the project. Appropriate interventions within the scope of this project had been undertaken with respect to the global climate scenario and state's climate related issues.

Adaptive measures were mainly focused to improve capacity building of the villagers especially the farmers whose source of income is mainly from agriculture and allied activities. Selection of locally specific climate resilient activities was given as a focal group discussion and deliberation among the participants. After elaborating all the aspects of the project activities, it had been unanimously agreed for adoption and implementation of sustainable way of agricultural activities with the incorporation of new scientific method to enhance the livelihood activity and socio-economic condition in the four sample villages. Works had been started with dissemination of workshop among the target farmers. Implementation of climate resilient agricultural activities like promotion SRI/modified SRI had been taken up in valley village of Tentha and Kheman. Traditional terrace cropping practices with the integration modern technology like ICM was opted for implemention at two hill villages i.e. Shirui and Hungpung of Ukhrul District.

5. Awareness programme for the Self-Help Groups (SHGs) & Farmer Interested Groups (FIGs):

During the Covid-19 Pandemic period, with the guidelines of Indian Council of Medical Research (ICMR), awareness cum capacity building development programme of women Self Help Groups (SHGs) & Farmer Interested Groups (FIGs) were conducted in coordination with Village Headman/Pradhan

Newly formed Self-Help Groups (SHGs) &

Farmer Interested Groups (FIGs) from the villages were enlightened by the Experts with the objective to build capacity building for adaptation in various climate events by incorporating traditional practice with modern knowledge to achieve the targeted interventions of the project.

6. Training cum capacity building on Waste Management:

Local Women Committee or Women Self Help Groups (SHG) was taking the active role during implementation of component activities of the project. They were invited in all the programmes like capacity building, orientation, awareness, hands on training, field cum exposure

visits which were conducted from time to time. Training programmes especially for the woman SHGs on preparation of EM-1 (liquid and Paste) and management of kitchen waste into compost were also arranged to support and enhance the sustainable climate resilient activities.

It is well known that improper management of kitchen waste affect our environment by releasing GHGs. To become aware and care about the quality of environment, training cum

capacity building on Kitchen waste management or household waste management into compost had been conducted as a model by providing modified waste bins to the women SHGs. In fact, kitchen waste management is a crucial aspect of household waste management.

As it is estimated that a large portion of household waste comes from the kitchen. If not managed properly, kitchen waste can cause environmental problems, attract pests and create unpleasant odors. Moreover, it can also lead to blockages in drainage systems and ultimately harm the environment. This way of activity, in addition to the project objective and deliverables, may help in an eco-friendly way to dispose of kitchen waste and it is also a cost-effective alternative to buying fertilizer.

7. Distribution of farm equipment to FIGs and SHGs:

Agricultural mechanization plays a significant role in agriculture sector as it contributes in improving the efficiency and effectivity of the inputs used in the crop production thereby increasing the productivity of crops. To assist the Climate Resilient Agriculture Practices, distribution programme of various farm/agricultural equipment were done from time to time during the project period. Creating awareness by demonstrating the operation of the machines to the FIGs & SHGs were also a major

component of the project. The distributed equipment was directed to maintain, share and utilize properly among the participants.

8. Installation programme of Automated Rainfall Recorder (ARR):

To enhance village knowledge centre of the villagers, Automated Rainfall Recorder (ARR) were installed at each project sites in the presence of Project staffs, Project PI, Experts, villagers. Project PI, highlighted on the importance of ARR by explaining its ability to predict and quantify the quantum of rainwater

received at the project sites which will be very helpful for the farmers for planning of crops. During project period, 8(eight) ARR had been installed in the selected villages. Project staffs visited regularly at the respective sample villages for collection of rainfall data.

9. Construction and Inauguration of Climate Resilient Model Housing and Model Shelter Home:

With a mission to reduce mass havoc to vulnerable communities as a results of global climate calamities like flood, drought, storms and high peak daily temperature events, 4(four) climate resilient /flood resilient low-cost model housing had been constructed at the sample villages**.** Besides, 2(two) community shelter home for landslide and flood exposed peoples

were also constructed and handed over to the villagers during the project period. Construction of Climate resilient model housing provided helpful information to vulnerable communities while making decision in order to plan and develop strategies from the impacts of climate change.

10. Training on Vermi-composting and liquid manuring:

One of the major problems in the village is injudicious use of chemical and inorganic fertilizers load in the soil. In order to combat and transform into organic/natural farming, training cum capacity building on vermi-composting and liquid manuring programme had been conducted in the village so that the use of chemical substrates in the soil may be reduced and in turn promote the health of the soil in the farms. Also, maximum utilization of farm waste is realized from this intervention.

During the programme, it was taught that vermi-compost along with bio-fertilizers had the ability for fixation of the nitrogen, although the process is slow in fields which had already been using urea. Once this was successful, it would become self-sustainable and condition of the surrounding environment will also improve.

Thus, farmers could replace their need for urea with vermi-compost and bio-fertilizers, thereby helping in increasing the fertility of the soil and production of pesticide-free goods. During

the project, forty units were constructed in the four sample villages for demonstration purpose. On seeing the outcome of the technology, other neighboring farmers had also adopted it. The production of vermicompost per unit of size 1m x 4m x 0.8m was about 2.5 quintals per harvest.

11. Training on Sustainable management of paddy nursery raising for practicing SRI and Modified SRI:

Among crops, rice is strongly dependent on labor. Preparing the nursery and growing rice seedlings are among the labor-intensive and time-consuming rice production processes. Additionally, incorrect management of rice seedling production and consequently, the production of weak seedlings cause paddy farmers to incur huge losses every year.

Therefore, paddy nursery raising and correct transplantation are very important to harvest a good rice crop. A Paddy nursery raising technique is more fruitful when it ensures healthy seedlings for transplantation. Transplanting technique also ensures the optimum plant population in the field.

In this respect, sustainable management of paddy nursery/ seedling raising hands on training programme had been undertaken in the two valley villages i.e. Tentha and Khekman of Thoubal District for sustainably production of rice. The aim of the programme is to reduce

costs, facilitate the seedling nursery process, and contribute to producing healthy and rigorous rice seedlings that are appropriate to be climate resilient agricultural practice such as SRI.

A simplified methodology for economic and sustainable management of paddy nursery preparation had been developed as training manual in both local dialect and English medium. After the programme, the adoption of the technique and SRI method of rice cultivation by farmers had been increased as compared to the conventional method of rice cultivation. On the other hand, the cost of cultivation of paddy was observed to be declined. Hence, the method so introduce in this project has increased the productivity of rice with optimum utilization of inputs like labour, seeds, fertilizers/nutrients, water, etc.

12. Training Liquid Organic Manure:

Training programme on preparation of liquid organic manuring was conducted in order to promote sustainable climate resilient and organic agriculture. The technique for preparation of liquid organic manure had been developed for easy hands-on application at the field. The main objective of this training is to overcome temporary nutrient shortages and provide a way for reducing the indiscriminate use of chemical fertilizers and help to maintain the soil health with a positive impact on organic matter recycling.

During the programme, experts highlighted the importance of liquid organic manures which help in rapid availability of macronutrients, micronutrients, growth regulators and other beneficial substances to the plants. They also increase the beneficial micro-flora of the soil and

their activity to a large extent upon soil application and thereby increase the availability of soil nutrients.

Besides, these liquid organic manures are low cost in production as they can be easily prepared from naturally and locally available materials by the farmers, thereby they also offer eco-friendly nature. Thus, use of liquid organic manures help to avoid the dependency of farmers on chemical fertilizers and provide a way for sustaining the soil fertility and crop productivity in agriculture.

13. Training on Preparation of EM-1 (Liquid and Paste):

One of the objectives of this project is to develop self-sustain mechanism for sustaining the socio-economic activity of the farmers by utilizing eco-friendly their own resources. In this project, training on “Waste to Compost” had been organized specially to the Women Self

Help Groups for management of kitchen waste products. Also, conducted training on sustainable utilization of natural resources and development of skill in making organic inputs like preparation of homemade EM-1 (liquid and paste) as well as utilization of on farm products as compost to FIGs and SHGs for sustaining

economic activity of the people. More than 60 (sixty) nos. of women were participated in the programme. Required materials were supplied to the SHGs and demonstrated how to prepare homemade EM-1 (liquid and paste). Even farmers do get earning from selling both the products in the locality.

Another purpose for organizing preparation of homemade EM-1 (liquid and paste) is to promote natural farming practice because using of EM technology is an added dimension for

optimizing the soil condition, soil fertility, promotes growth, crop yields and improve crop quality as well as accelerating the breakdown of organic matter from crop residues and biological control of pests. The population of beneficial micro- organisms in the soil is also increased helping to control soil diseases through competitive exclusion. The manual for preparation of homemade EM-1 (liquid and paste) had been developed for easy hands-on preparation at home.

14. Training cum capacity building of SHGs and FIGs on sustainable Rabi crops and natural farming:

Training cum capacity building on natural farming was organized to mark the address of Hon'ble Prime Minister India Shri Narendra Modi during the valedictory session of the National Conclave on Natural Farming on 16th December 2021 at 11 AM in Anand, Gujarat via video conferencing as well as the launching of National Mission on Natural Farming (NMNF) as a separate and independent scheme from 2023-24.

A good number of participants from Women SHGS and FIGs were taking part in the programme. They have been motivated to adopt chemical free natural farming through minimizing the dependence of farmers on purchased inputs, and reduce the cost of agriculture by relying on traditional field-based technologies which lead to improved soil health.

In fact, natural farming is a way of chemical free farming based on desi cow and locally available resources, with no chemical fertilizers and pesticides and promotes traditional indigenous practices which give freedom to farmers from externally purchased inputs. This is largely based on on-farm biomass recycling with major stress on biomass mulching, use of on-farm desi cow dung-urine formulation; exclusion of all synthetic chemical inputs and given emphasis on improving natural nutrient cycling and organic matter in the soil, which can help with climate change resilience and carbon sequestration in soils.

Parallel training programmes on making of natural organic liquid manure and EM-1 (Liquid and Paste) had also been conducted to promote natural farming practices. Organising such programmes may transform the farmer's agricultural activity and increase their income by reducing dependencies in chemical inputs, sustainability of the system, cost reduction and better value realization.

15. Promotion of Paddy Cum Pisciculture Practice at Hill Station:

Fish culture in paddy fields is an ancient farming practice found in several rice-growing areas in the hill region of Manipur. It is the one of the examples of vertical growth in food grain

production without endangering ecological assets. Therefore, in order to promote integrated paddy cum pisciculture practices at hill station, fish spawn had been distributed and released at the terrace paddy fields. This practice in another way may provide both food and livelihood security to rural farmers and work force on an economically sustainable basis.

16. Development of Forest Resource and Water Conservation:

The state had been witnessing degradations of forest and scarcity of water due to some ascertains anthropogenic activity like mass deforestation for Jhuming in the River Basins as well as some portion of the valley. The entire basin area of the state gets disturbed due to injudiciously cutting of valuable trees in the upstream. As a result,

there is occurrence of scarcity of water for agriculture, drinking and other domestic purposes in the river basin. Therefore, in order to recuperate, two model for conservation of forest resource and water in the hill area have been undertaken where group of communities could preserve forest and manage water for ensuring conservation and optimum utilization of water resources sustainably.

13. Farmers Meet Cum Orientation Programme:

Time to time interaction programme with the SHGs and FIGs as Farmers meet Cum Orientation Programme had been conducted to highlight the issues and challenges faced during implementation of the project interventions. It was an open

discussion forum and let the participants to share the challenges and experiences individually with the experts for better understanding and future perspectives.

Feedbacks and suggestions were also obtained from all the participants involved in the programme and success stories were also shared by the different members of the SHGs and FIGs.

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DOI: 10.24966/ESCR-5020/100027

HSOA Journal of Environmental Science: Current Research

Research Article

Socio Economic Impact Due to Climate Variability on Selected Villages of Ukhrul and Thoubal Districts, Manipur

Sanamacha Meetei*, Mohd Habibullah Khan, Ashem Rahul Singh, SW Yuingamla, Zahir Shah and Onil Laishram

Department of Environment and Climate Change, Porompat, Imphal East, Manipur, India

Abstract

As global climate change continues, many of the villages are likely to become vulnerable at present. The altering of spring shed cycles, rainfall pattern, evaporation, precipitation and temperature are all subjected to climate variability and change. The present paper defined to study the socio-economic impacts due to climate variability on certain villages of Ukhrul and Thoubal districts, Manipur. Tentha and Khekman village are selected from Thoubal district where as Shirui and Hungpung village are selected from the Ukhrul district based on their vulnerable status. Socio economic and livelihoods status were conducted with the structured questionnaire interview and informal discussions. Questionnaire system was used to get responses in a standardized and cost-effective way. The one-way forward option is to reduce the socio-economic vulnerability and improve the ecological systems and services.

Keywords: Climate; Manipur; Socio economic; Selected; Villages; Vulnerable

Introduction

Directly or indirectly, global climate change is associated with the socio-economic and environmental impacts. Houghton [1], well-defined the impact of climate change on human society as well. More studies reveal that the impact of climate change depend on certain factors like demography, occupations, earnings, literacy, poverty incidence and dependency on government funds. In such cases, rural communities tend to be more vulnerable in comparison to urban counterparts. Therefore, the need of time is to delineate climate change impacts across rural and urban communities, and to develop appropriate policies to mitigate or adapt the impacts. Public awareness and capacity building will enhance more on understanding the present scenario of climate change. Moreover, facilitate assessment of climate change vulnerabilities and risk on bio-physical and socio-economy in terms of water, agriculture, forest and health sectors geared towards reducing climatic vulnerability is warranted. According to Hewitt [2], social vulnerability is the susceptibility of a given population to be harmed from exposure to a hazard, directly affecting its ability to prepare for, respond to, and recover. Furthermore, Houghton [1], calculated the temperature increase in the last hundred years and the last three decades have been successively warmer at the Earth's surface than any preceding decade since 1850 IPCC [3]**,** Moreover, climate change impacts on human health could occur through both direct (e.g., thermal stress) and indirect (e.g., disease vectors and infectious agents) pathways. Karl [4], suggested that direct impacts could result from increased exposure to temperature (heat waves, winter cold) and other extreme weather events (floods, cyclones, storm-surges, droughts) and increased production of air pollutants and aeroallergens such as spores and molds.

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Materials and Methods

Both valley and hills formed the State, Manipur. According to the Forest Survey of India FSI [5], report, the state lies between Latitude of 23°83'N-25°68'N and a Longitude of 93°03'E -94°78'E. The total area covered by the State is 22,327 sq. kms. Due to its different topographical location, terrain diversity, altitudinal variation and river system, the state experiences diverse climate variability especially in terms of ecosystem, biodiversity and livelihood, agriculture & its allied, water resources, forest, health, etc. It is therefore necessary to pay attention to climate disaster and other geo physical parameters in order to secure the future environment and also to help state build resilience for these dramatic climate and weather extremes.

Authors prepared structured type questionnaire for defining the village socio economic profile. Interview and informal discussions were conducted to overcome the poor response rates of a normal questionnaire survey. Moreover, personal interview of local youth, women's and leaders of the village community of varying ages, sexes and economic background to ensure clarity and effectiveness of the questions before use. Respondents were selected from different sex, age group, educational, social and economic classes. Secondary data were obtained from the office file, research works and published article etc (Table 1).

Study area

Thoubal district (*Khekman and Tentha*): The villages *(Khekman and Tentha)* experienced three-times floods during last year

inundating many of the agricultural fields losing different varieties of crop species. The local describe drought like situation after the floods. The worse condition is the reduction of rice production in the defined villages after post floods (Table 2).

Ukhrul district (*Hungpung* and *Shirui*): The villages *(Shirui* and *Hungpung)* reflect floods and landslides on regular interval of time. At recent times, the villages receive heavy rainfall during the pre-monsoon season causing landslides. Moreover, the destruction and degradation of surrounding forests led to the problem of water scarcity during lean season of the year. In most cases, spring is near to threatened due to the felling of trees for Livelihood purposes. Moreover, erratic rainfall, no rainfall and even heavy rainfall disturbs the agriculture and agricultural practices. The introduction of new insect species is another notable achievement in the selected villages. (Table 3)

Sample village	Khekman	Tentha	Shirui	Hungpung
Total population	8957	10659	1085	11752
Total household	1513	1890	228	2609
No. of male	4578	5543	572	6061
No. of female	4379	5116	523	5691
Sex ratio	956.53	922.96	914.33	938.95
Literacy rate	36.77	27.95	22.76	21.68

Table 1: Demographic profile of the selected villages, Census [6].

SL NO	Name of the village	Total population (2011 census)	Number of house hold (2011 census)
1	Khekman	**7157**	**1369**
2	Tentha	9087	1766
3	Hundung	10785	2036
4	Shirui	1265	284

Table 2: Population profile of the selected villages.

Villages	WATER	FOREST	AGRICULTURE	HEALTH
Khekman	Frequent flood due to erratic rainfall with high intensity. Shifting of rainfall pattern, deficit during monsoon & high intensity. Off and on of water source Decreasing of underground water recharge Mainly depend on river water. Drying up of wetlands and reservoirs.	Degradation of forest cover, urbanization	Mono crops cultivation practising there by damaging varieties of field crops due to impact of erratic rainfall. Shifting of livelihood, outmigration of youths, etc. Failure of rainfed agriculture, variability of yield. Limited adaptive capacity of farmers to new varieties of crop. New disease and pests.	Nutrient deficiency. Respiratory problems. Cardiac problem, diabetes, BP strokes problems etc. Water borne diseases.
Tentha	Frequent flood due to erratic rainfall with high intensity. Shifting of rainfall pattern, deficit during monsoon & high intensity. Off and on of water source. Decreasing of underground water recharge Mainly depend on river water. Drying up of wetlands and reservoirs.	Degradation of forest cover, urbanization	Mono crops cultivation practising there by damaging varieties of field crops due to impact of erratic rainfall. Shifting of livelihood, outmigration of youths, etc. Failure of rainfed agriculture, variability of yield. Limited adaptive capacity of farmers to new varieties of crop. New disease and pests.	Nutrient deficiency. Respiratory problems. Cardiac problem, diabetes, BP strokes problems etc. Water borne diseases.
Hundung	Very often Landslides due to erratic rainfall with high intensity. Depletion of water table. Drying up of spring heads. Limiting of water source. Shifting of rainfall pattern, deficit during monsoon & high intensity. Drying up of wetlands and reservoirs.	Decreasing/ diminishing of forest resources. Vulnerable due to fragmentation, Degradation, conservation etc.	Rich in bio-resources and traditional knowledge for conservation Limited adaptive capacity of farmers to new varieties of crop.	Nutrient deficiency. Respiratory problems. Cardiac problem, diabetes, BP strokes problems etc. Water borne diseases.
Shirui	Very often Landslides due to erratic rainfall with high intensity. Depletion of water table. Drying up of spring heads. Limiting of water source. Drying up of wetlands and reservoirs. Shifting of rainfall pattern, deficit during monsoon & high intensity.	Decreasing of forest resources. Vulnerable due to fragmentation, degradation, conservation etc.	Rich in bio-resources and traditional knowledge for conservation Limited adaptive capacity of farmers to new varieties of crop.	Nutrient deficiency. Respiratory problems. Cardiac problem, diabetes, BP strokes problems etc. Water borne diseases.

Table 3: Vulnerable sectors.

Results and Discussion

During the study period from January 2020 to December, 2020, it was difficult time for the authors as the pandemic covid-19 disturbs the whole state of Manipur. It was observed that the authors found that most people in the selected villages *(Tentha and Khekman)* of Thoubal districts depend on agriculture and agricultural practices for sustaining their livelihood. Irrigation supported horticulture and rearing of small and large livestock are other option for the secondary income. Sometimes, pisci culture works well during peak hour of the year. Out of the 7157 population in *Khekman,* numbers of farmers identified are 2654, number of governments employed reached to 156, 12 people woks on private sectors, 101 people are living with business and 1382 are unemployed as recorded in the census book, 2011 whereas number of farmers in Tentha village are 1176, 148 people works on government department, 2535 are students, 190 peoples are working under private sectors, 37 are business and 2256 are unemployed. Unfortunately, the scenario of climate variability and change are likely to exaggerate the problems of future food security by exerting pressure on agriculture. The total agricultural land calculated in Khekman is 556 Sangam while 872 Sangam is recorded in Tentha village. More importantly, Ravindranath [7], suggest that agricultural yields are more unstable in rain-fed areas than irrigated ones due to unpredictable climate changes. An estimated 3.5-million-hectare land which has under rain-fed cultivation, accounts for about 30% of the total area under cultivation. During natural calamities and hazards, the people of Khekman village faced problem like floods and droughts. Over 1368 families are frequently affected by flood and 248 families are rarely affected by drought. The same problem is faced by the Tentha village. Over 1232 families are frequently affected by flood, 150 families on occasional seasons and 137 families are rarely affected by flood. The worst case is post flood, like spreading of disease, non-availability of essential commodities and medicines and loss of dwellings etc. Besides, the villages do not face the problem of drought frequently, but over 264 families of the village faced occasionally and 230 families faced rarely.Health facilities are few and thinly in both the villages. The women in particular bear the burden of looking after the sick that fail to get modern medical attention.

While in Ukhrul *(Hundung and Shirui),* shifting cultivation is practicing in the villages for their livelihood. In addition, the villages rear livestock for supplement of household economy. Some of the important livestock are cow, chicken, boar, buffalo etc. Out of the 1265 population in *Shirui* village, 51 people are engaged in government department, 128 people on agriculture and 13 on agricultural activities, 32 as self-employed and number of students stand at 363. Whereas, out of the 10785 population in Hundung village, 80% have their own family agricultural land as many of the villagers depend on agriculture for their socio-economic livelihoods. Moreover, women play a vital role in income generating activities. They sell vegetables, fruits, fire-wood and other products Non Wood Forest Products (NWFP) found in the forest. At present, all come to a halt to the changing scenario of rainfall patterns, as little rainfall, no rainfall and heavy rainfall etc in the hills. More often, people spend little time in agricultural activities than the earlier. The reason is identified as low productivity of paddy cultivation. Many of the springs are dried up during the summer and winter months of the year leading to water scarcity in both the hill villages. According to Pimentel [8], maintaining biological diversity is essential for productive agriculture, and ecologically sustainable agriculture. Butt [9], suggests that it will be good to change to other crops that maintain forest cover and diversity, diversify the agricultural areas implementing more crops, or change the cropping pattern in warm regions shifting toward patterns used in hotter regions. Therefore, Reilly and Schimmelpfennig [10], recommend adaptation as an important component in any policy response to climate change. Furthermore Challinor [11], mentioned that farmers and producers need to have physical, agricultural, economic, and social resources to moderate, or adapt to, the impacts of climate variability. Parry and Carter and Met Office [12,13] defined, for those people depends on agriculture and cultural practices, food security is an issue of major concern, because climate change will affect crop yields and agriculture. On the other, farmers and producers need to identify the way of crop infection and the way forward option to reduce the way of infection (Table 4).

Conclusion

The study brings out suggestion in order to understand the scenario of climate variability and change in the selected villages. **Firstly,** the selected villages need to connect with various stakeholders such as farmers, line department officials, scientists, policy makers etc. to understand the present situation in terms of temperature rise, erratic rainfall, etc. **Secondly,** people depend on agriculture and agricultural practices needs to be trained with the help of the concerned department. **Thirdly,** awareness, workshop and capacity building to understand the various aspects of coping with climate variability. **Fourthly,** modern application and communication tools related to climate variability and change must utilized appropriately, for timely and proper dissemination of climate related information.

Sample village	Khekman	Tentha	Shirui	Hungpung
Agriculture & Allied sector	Rice, Pulses, Seasonal Vegetables, Maize etc.	Rice, Pulses, Seasonal Vegetables, Maize etc.	Rice, Pulses, Seasonal Vegetables, Fruits, maize, Spices etc.	Rice, Pulses, Seasonal Vegetables, Maize, Fruits, Spices etc.
Livestock	Chicken, Cow, Duck, Pisciculture, Piggery	Heifer, Cow, Poultry, Duckery, Pisciculture, Piggery	Buffalo, Cow, Chicken, Fishery, Pisciculture, Piggery	Bull, Cow, Poultry, Pisciculture, Piggery
Health	Khekman Primary Health Sub-Centre	Tentha Primary Health Sub Centre	Primary Health Sub Centre, ASHA	Primary Health Sub Centre, ASHA, District Hospital
Drinking water source	Thoubal Turel (River)	Tentha Pukhri Achouba (Ponds) Wangjing River	Shinguira Kong,Kokthi Kong, Yangui Kong (River)	Kazora, Mayora, Kaphungra, Kongrara, Kazora (Ponds)
Forest	Non-Wood Forest Products	Non-Wood Forest Products	Non-Wood Forest Products	Non-Wood Forest Products

Table 4: Questionnaire methods.

Fifthly, policies need to be framed, keeping importance on challenges posed by the changing climate. **Lastly**, the above suggestions will help in formulating positive strategies for coping up climate variability, especially in socio economic, livestock, forests, spring shed, which contributes to more than 60% of livelihoods (rural population) in the State of Manipur.

Some of the programme organised during the study

1. Development of capacity building toward self-generation of agricultural organic inputs and its management practices:

1.1 Preparation of vermin-compost to improve economic condition.

1.2 Management of kitchen waste for better environment.

2. Started methods of ICM (Integrated Crop Management) as pilot for convergence.

2.1 Farmers Interest Group (FIG) has been formed and started ICM method on their own at 4 (four) selected villages of the project site.

2.2 Sharing of knowledge among farmers.

3. Encouragement of crop rotation to increase soil health for better sustainable agricultural practices.

3.1 Preparation for analysis of soil health

3.2 Rabi crop cultivation started to improve soil quality.

4. Enhancement of Knowledge for safe and better livelihood.

4.1 Organised extension programme on capacity building development in the neighboring villages.

4.2 Construction of climate resilient model housing and community shelter home.

5. Paddy cum fish culture has been practising in Nungsangkhong, Hungpung village, Ukhrul District.

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References

1. Houghton J, Ding Y, Griggs D, Noguer M, van der Linden (2001) Climate change. Cambridge University Press, The scientific basis Cambridge, UK.
2. Hewitt K (1997) Regions of risk: A geographical introduction to disasters. London: Addison Wesley Longman, US.
3. Inter-governmental Panel for Climate Change (2014) Climate change 2014: impacts, adaptation, and vulnerability – IPCC WGII AR5 summary for policymakers. In: Field CB, Barros VR, Dokken DJ, Mach KJ, Mastrandrea MD, et al. (eds.). Inter-governmental Panel for Climate Change (1st edn.). Contribution of working group II to the fifth assessment report of the intergovernmental panel on climate change, Cambridge University Press, Cambridge and New York, UK. Pg no: 113.
4. Karl TR, Melillo JM, Peterson TC (2009) Global climate change impacts in the United States. (1st edn). Cambridge University Press, Cambridge.
5. Forest survey of India report (2019)
6. Manipur Census (2011)
7. Ravindranath NH, Rao S, Sharma N, Nair M, Gopalakrishnan R, et al. (2011) Climate change vulnerability profiles for North East India. Current Science 101 : 354-361.
8. Pimentel D, Stachow U, Takacs DA, Brubaker DW (1992) Conserving biological diversity in agricultural/forestry systems. Bio-Science 42: 354-362
9. Butt TA, McCarl BA, Kergna AO (2006) Policies for reducing agricultural sector vulnerability to climate change in Mali. Climate Policy 5: 583-598
10. Reilly J, Schimmelpfennig D (1999) Agricultural impact assessment vulnerability, and the scope for adaptation. Climatic Change 43: 745-788
11. Challinor A, Wheeler T, Garforth C, Craufurd P, Kassam A (2007) Assessing the vulnerability of food crop systems in Africa to climate change. Climatic Change 83: 381-399
12. Parry M, Carter TR (1998) Climate impact assessment and adaptation assessment. Earthscan, London, UK
13. Met Office (2011) Climate Observations, projections and impacts, Mexico. Exeter, Met Office, United Kingdom.

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Research Article

CLIMATE CHANGE AND CHALLENGES OF WOMEN'S IN THOUBAL AND UKHRUL DISTRICTS OF MANIPUR

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ABSTRACT

Manipur State, being a fragile mountain ecosystem in the Himalayan region, is experiencing the adverse impact on ecosystem, agricultural productivity, water resources, socio-economy and sustainability. Peoples, irrespective of valley and hill, are trying to adjust their socio-economic and livelihood activities in the present hardship scenario of climate change. The rising temperature, sudden and erratic rainfall are main concerned climate factors in both the regions. The study defined the livelihood status and role of women in the social dimensions of economic development and productivity as compared to men and also to focus the issues and problems faced by the women community admit impact of climate change in two districts with different topography. More focus is given on women activities like agriculture and allied, water sources, health problems etc. The need of time is to take up necessary adaptive measures and practices to reduce the challenges faced by women in the context of climate change.

INTRODUCTION

Climate change is a major threat for social development factors like poverty, infrastructure, security, and economics. In most of the impoverished communities, the co-relation between climate change and social vulnerability and inequality is particularly an evident of often resulting in reduced food security, access to safe drinking water, and health issues. It is stated that the impact of climate change will be borne differently by different people, based on geographies, generations, age classes, income groups, occupations and genders (IPCC 2007).

With the changing climate, peoples are more focusing on mitigation and adaptation plans. Planting trees and use of renewable energies are the major actions taken up as a mitigation plan whereas adaptation actions play important role to improve livelihood and economic sustainability. According to the NDC implemented post 2020, climate change adaptation is one of the major goals in India at present. As a result, many of the states are in the process of revising their SAPCCs for strengthening their climate adaptation strategies in view of the evolving climate realities and recent advancement in understanding of climate science, impacts and vulnerabilities. Moreover, the Swiss Agency for Development and Cooperation (SDC), through its project, Indian Himalayas Climate Adaptation Programme (IHCAP), is working towards strengthening the resilience of vulnerable communities in the Himalayas and towards enhancing the knowledge and capacities of research institutions, communities and decision-makers **[1]**. The National Mission for Sustaining the Himalayan Ecosystem (NMSHE) seeks to facilitate formulation of appropriate policy measures and time-bound action programmes to sustain ecological resilience and ensure the continued provisions of key ecosystem services in the Himalayas. The State, Manipur is on the process of revising its SAPCC version 2.0 to address the existing as well as future challenges of climate change and take actions to reduce the associated risks and vulnerabilities. Looking forward, this paper focuses on the climatic change (temperature and rainfall) and challenges of women in selected district of Thoubal and Ukhrul of Manipur. The valley district, Thoubal show sign of climatic change during the last decade. Temperature rises, sudden and erratic rainfall is becoming a common sequence in the district. In the year 2015, flood of Tentha village is one good example of erratic rainfall in Thoubal district. After the flood, there has been hue and cry of the people due outbreak common water borne diseases like diarrhea, typhoid, malaria and other skin related diseases. The arrival of new insects and pest led to the destruction of agricultural crops and other home

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orchard. While in the hills, the district Ukhrul is slowly or rapidly showing signs of disturbance on agriculture, forests and water resources. More clearance is observed in those areas where land use patterns are changing more sharply due to intense summer temperature, erratic rainfall or colder winter temperature. Sometimes, induced hazards like floods, landslides, and droughts are imposing significant stresses on the livelihoods of the district population and downstream populations. Changes in annual temperature, rainfall and precipitation of a particular region increase the occurrence of natural calamities like, forest fire, flood, drought, outbreaks of many diseases and pest etc. which ultimately increase rate of biodiversity loss and decrease the availability of water resources, fuel, fodder and production of agricultural crops. As defined in INCCA Report (2010) **[3]**, the minimum temperature is observed to be increasing in most parts of the Western Himalayan region (J&K, Himachal Pradesh and Uttarakhand) and in certain parts of the North-Eastern region from 1901 to 2007. The warming is mainly contributed by winter and post-monsoon temperatures. For maximum temperature, an increasing trend is observed for the IHR in the long term (1901-2007) while in the last three decades (1971-2007), a warming trend is observed in the Western Himalayas and a mix trend of cooling and warming is indicated in the North-Eastern RegionProjection (NERP). Over the past decades (1981-2007), increased monsoon precipitation (intensity) has been observed over the high mountain belt of the Himalayas, particularly in the east. The greatest decrease in monsoon rainfall has been observed in the south in the Ganges basin. While the number of extreme rainfall events is indicated to be decreasing, the intensity of each event (amount of rainfall) appears to be increasing (ICIMOD, 2015) **[2**]. In addition, according to the Intergovernmental Panel on Climate Change (IPCC) 2014 report **[4]**, changes and variability in temperature and rainfall trends are already affecting both the biophysical and socio-economic systems. Under the future climate change scenarios, impacts of climate change are projected to exacerbate, thereby, increasing the vulnerability of biophysical and socio-economic systems.

MATERIALS AND METHODS

Materials collection

1. Collection of review literature, published journal and unpublished reports
2. Random household survey and oral interview related to temperature and rainfall in the study area, particularly to women's folk
3. Studies on weather reports of study areacollected from the Directorate of Environment and Climate change
4. Defining vulnerability, sensitivity and adaptation knowledge to the study areas

Study area

Thoubal (Valley district); Ukhrul (Hill district)

Selection of district

The selection of districts (one valley, one hill) is done based on the vulnerability status. The valley district, Thoubal experienced three-times floods during last year inundating many of the agricultural fields losing different varieties of crop species. The local describe drought like situation after the floods. The worse condition is the reduction of rice production in the defined villages after post floods. Most women's face different kinds of unsuitable situation during the time. While in Ukhrul district, it reflects floods and landslides on regular interval of time. At recent times, the villages receive heavy rainfall during the pre-monsoon season causing landslides. Moreover, the destruction and degradation of surrounding forests led to the problem of water scarcity during lean season of the year. In most cases, spring is near to threatened due to the felling of trees for unreasonable purposes. Moreover, erratic rainfall, no rainfall and even heavy rainfall disturbs the agriculture and agricultural activities. Both in the cases, women play an important role starting from agricultural operations to household chores either in the valley or the hills. They faced the same challenges of climate variability and change at this era. Solving the issue and problems on one hand whereas introduction of adaptation plans or following the mitigation programme organised by many public and private organizations would clearly help the womenfolks in some way or the other from the scenario of climate change.

RESULT AND DISCUSSION

According to the 4th session of the United Nations Environment Assembly in Nairobi in March 2019, attended by all 193 UN Member states, offers hope for greater engagement of women in climate action planning and monitoring of their impact**[5].** A resolution adopted at this Assembly not only acknowledged the disproportionate burden of climate change on women and girls but also emphasized the "power of their knowledge and collective action", the need to encourage women's participation and leadership in environmental-decision making--from the local to the international levels-and "to support training and capacity building efforts on gender mainstreaming and to ensure meaningful participation in global processes"**[5]**To fight the change, women are often in the frontline in respect to the impacts of a changing climate **[6].**Unfortunately, women are incapable of raising up their voice toward the concern government agencies or department regarding the challenges facing by them due to continuously changing climate.Besides, the alarming worldwide situation is identified by numerous/multiple environmental problems that are worsening due to climate change and its related disaster (IPCC, 2012) **[7].**On the other, women empowerment plays as a significant role for economic development of a society **[8]**(Duflo, 2012). Small State like Manipur depends on agriculture and agricultural activities for their socio-economic livelihoods. On this, womenare known as the backbone of agriculture and agricultural activitiesin the State. They involved in all aspects of agriculture operations, from crop selection to land preparation, to seed selection, planting, weeding, pest control, harvesting, crop storage, handling, marketing, and processing. Besides, they are more responsible to all household maintenance. Likewise, from caring and brought up of children, they are also engaged in preparation of daily meals, preparation of home garden, and assisting in crop and animal production. In fact, as a whole, women are moral responsible to all maintenance of a household in both the valley and hills of the State. In contrast to the men's folk, women's play a major work role in the socio-economic conditions of the village. They play major part in agricultural development and their vital contribution in the field of livestock farming and fodder

collection from the forests. On the hills, most of the agricultural fields are located on upper hill terraces and near the river bed; modern agricultural tools cannot be used and considered as time-consuming methods. At present, the rising temperature and erratic and sudden rainfall led to the women, a challengeto face for their survival. The increase in temperature and erratic rainfall disturbs the forest and forest non timber products (NTFP) leading the women to walk long distance for collection of fuelwood and other forest products, including NTFPs. About 15.49% of total female population in hill areas are involved in the forest-based livelihoods system **[9].**While in the valley, the temperature rises lower the water level of rivers leading to water scarcity. The issue of water scarcity become a problem mostly during the winter and pre monsoon season of the year. Most women wake up early in the morning in search of water in the nearby rivers or ponds or have to walk long in order to get couple of water. The encroachment of wetlands and ponds in urban areas is another factor for the scarcity of water in the valley areas like Thoubal. It is believed that climate variability and change is introducing new insects both in the valley and hills districts of Manipur. The insects are killing the tree species like Sahi (*Quercus dealbata)* and Kuhi (*Quercus pachyphylla)* mostly used for the production of charcoal during the winter (November till March) and monsoon months (May to August) of the year. The process of charcoal production is mainly done by women parts so it become a big challenge for them to collect the tree species for their socio-economic livelihoods. Likewise, the scenario of temperature rises and erratic rainfall tends to shift the income generation activities like manual labor, construction activities, sand quarrying, street vendor etc. There are other certain fundamental causes influencing the women community due to the climate variability and change. The following **(Fig 1)** defined the temperature (highest and lowest) and rainfall (highest and lowest) at the study area in order to calculated the months of challenges faced by women. The figure identified that most women face challenges during the pre-monsoon, monsoon and post monsoon season of the year. Out of this, monsoon season is considered asthe easiest victims of women health disorders. Water -borne diseases, malnutrition, anxiety, mental disorders, depression, are the major impact over women at this time. Sometimes, pre monsoon and post monsoon can affect women's health through a range of mechanisms. These include relatively direct effects of hazards such as heat waves, drought, floods and storms, and more infectious disease patterns, disruptions of agricultural and other supportive ecosystems etc.

Fig 1 Identifying the Temperature and rainfall (PrM, M, PoM, W) scenario in the study areas

THOUBAL				
Year	Temperature (°C)		Rainfall (mm)	
	Highest (Month)	Lowest (Month)	Highest (Month)	Lowest (Month)
2017	June, 36.26 (M)	July, 5.61 (M)	July, 326.4 (M)	July, 1 (M)
2018	August, 34.83 (M)	July, 4.52 (M)	June, 200 (M)	June, 0.2 (M)
2019	July, 35.16 (M)	July, 4.7 (M)	September, 150 (M)	September, 0.8 (M)
2020	August, 36.15 (M)	July, 5.66 (M)	July, 191.4 (M)	July, 0 (M)
2021	May, 35.67 (PM)	August, 5.84 (M)	June, 195 (M)	June, 1.2 (M)

UKHRUL				
Year	Temperature (°C)		Rainfall (mm)	
	Highest (Month)	Lowest (Month)	Highest (Month)	Lowest (Month)
2017	October, 29.29 (PoM)	August, 3.9 (M)	July, 1371 (M)	July, 2.8 (M)
2018	April, 32.37 (PrM)	July, 2.55 (M)	August, 493.6 (M)	August, 2.8 (M)
2019	July, 29.24 (M)	July, 3.3 (M)	September, 430.4 (M)	September, 0.8 (M)
2020	August, 27.98 (M)	September, 1.7 (M)	July, 276.2 (M)	July, 0 (M)
2021	April, 27.75 (PrM)	September, 2.03 (M)	August, 132.8 (M)	August, 4.4 (M)

According to the census report of 2011, the women population stand at 49.81% as a whole in Manipur. Out of this, the women population in the study areas of Thoubal and Ukhrul district are 50.06% and 48.52% respectively. The percentage of female workers found in Thoubal and Ukhrul are 44% and 47.08% respectively, higher in the hills than to the valley districts. In comparison to the rural men and urban women (Thoubal), the condition of hills women (Ukhrul) employed in the agriculture sector is worse. They experience poverty, exclusion and the effects of climate change. In similar version with the old woman, a middle-aged woman shares her view on the environmental conditions of one of the Ukhrul village. In comparison to the last decade, the scenario of climate is changes from colder to semi colder ones in our area. At one time, the village was frightened by a nightmare drought. During church hour and village meeting, most villagers complained of shift in the intensity and distribution of rainfall. The rains are so scattered that at times it rains in the village, but the fields remain dry. The rainfall pattern was not like these 10-15 years ago. Such changing pattern affects the production of agricultural yields in recent times. It also increased in pest-related problems, especially during the flowering season. Many, like her, are facing similar problems: erratic rainfall pattern affecting yield, pests and related diseases on the rise; and losses staring them in the face.In short, women face the brunt of risks associated with climate change since they are primary managers of energy, water, food and essential services. In fact, women faced triple burden as they go to nearby town or on the high way road for selling the vegetables. They carried the vegetables by local taxi or by walk in the early morning. Some of the common vegetables or cash crop available in the village are like cauliflowers, cabbages, peas, onions, garlic, turmeric, potatoes with different kinds of local species found in the State. Besides, some fruits are available in the village like banana, peach, plum, wild apple, goose berry, wild nut, lemon etc. Moreover, women are the home-makers, worker, mother and elderly citizens. For the better living of the family, women work hard in compatible with the counter partners. Women do not neglect their responsibility of managing the household chores. The money is mostly spending for children's education, food, clothing, medicine and festival, which means saving is very low. An interview with an old woman describes the changing scenario of climate change in the last fifty years. According to her, the changes is mainly associated with the globalization, diversification of rural livelihoods, increased labor mobility and food insecurity, as well as other global trends, has brought both gains and challenges for both men and women in the village. Women's Organizations and Youth departments at village level are aware on the perception of waste management take up their action plan in the preservation and protection of environment by planning their own way of managing their household waste and by organizing social work in their own community where the whole community comes forward and takes step in the protection of their own environment

CONCLUSION

The need of time is to spread awareness especially to women community and childrenabout the present scenario of climate in Manipur. Rising temperature and sudden and erratic rainfall nowbecome a common scene at present. As a result, vulnerability has become a serious impact over the valley and hills women that makes difficulty in finding employment opportunities in the private and public sectors where they are underpaid and less access towards the resources. In fact, the social conditions of women community to face various social problems within the family, society as a whole, which disintegrates the social process where women are not able to adopt the social change. Therefore, encouraging the women community to adopt various adaptive measures is one method to fight against climate change. Appropriate information is necessary for the people, as well as planners and decision makers for developing, disseminating and adopting climate resilient technologies. More importantly, mitigation, adaptation and resilience of climate change depend upon the conditions of living standard particularly in the hills district of Manipur **[6].** The degree of exposure and dependency upon weather patterns for livelihoods and food security, to varying capacities in adaptation, are influenced by gender, social status, economic and poverty. Comprising the majority of agricultural laborer's, women have been putting in labor not only in terms of physical output but also in terms of quality and efficiency. Methods like Jhum cultivation, degradation and deforestation of forests are some human activities responsible for the increasing carbon dioxide level in the hilly parts of Manipur. The State of Manipur is characterised with low socio-economic status which is a risk factor for climate change, including the Thoubal and Ukhrul districts.

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References

1. Climate Vulnerability Assessment for the Indian Himalayan Region Using a Common Framework
2. ICIMOD (2015), the Himalaya Climate and Water Atlas; Impact of Climate Change on water Resources in Five of Asia's Major River Basins. ICIMOD GRID-Arenal and CICERO.
3. INCCA (2010) Climate change and India: A 4x4 assessment – A sectoral and regional analysis for 2030s. New Delhi, India: Indian Network for Climate Change Assessment, Ministry of Environment and Forests, Government of India
4. IPCC, Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (2014). Climate Change 2014: Synthesis Report. IPCC, Geneva, Switzerland: Cambridge University Press
5. Innovative solutions for environmental challenges and sustainable consumption and production, 4th sessions of the UN environment assembly
6. Women at the frontline of climate change, Gender risks and hopes, ICIMOD
7. IPCC, 2012 – Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (Eds.) Available from Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 8RU ENGLAND, 582 pp. Available from June 2012.
8. Esther Duflo, Journal of Economic Literature, vol. 50, no. 4, December 2012 (pp. 1051-79)
9. Women's Role in Agriculture and Allied Fields in Manipur, Indian Journal of Hill Farming

Appendix -3

List of Trainings/ Workshops/ Seminars with details of trained resources and dissemination material and Proceedings

Sl. No.	Name of Trainings/ Workshops/ Seminars	Details	Key Resources
1	Workshop on impact of Climate Change	i) Consultative meeting and dissemination of awareness on impact of climate change on day-to-day life. ii) Selection appropriate climate resilient livelihood activity	Dr. Mohd. Habibullah Khan, Ch. Nimaichand Singh (AAO), Gram Pradhan, Village Chairman
2	Awareness cum Capacity Building Programme	i) Impact of Climate change on agricultural activity and its measures ii) Enhancement of traditional agricultural practice with modern technology iii) Extension programme on Climate resilient activities iv) Installation and dissemination weather information such as automatic rainfall recorder v) Implementation of climate resilient practices like SRI/modified SRI vi) Integrated paddy cum fish farming vii) Enhancement of knowledge on pest and disease management viii) Use of timely use of organic inputs ix) Preservation of community forest resources and conservation of water	Ch. Basantakumar Roy (AAO) and A. Sanatomba Singh (DAO), Expert from Agriculture Department

3	Training cum Orientation programme	i) Preparation of Vermi-compost and liquid manuring ii) Preparation of kitchen waste into compost iii) Preparation of organic inputs like EM-1 liquid and past /powder iv) Promotion of sustainable organic agriculture v) Methods/Techniques on implementation of SRI/Modified SRI vi) Sustainable management of paddy nursery/ seedling raising vii) Exposure visit and implementation of Direct Seed Paddy (DSP) method viii) Integrated crop management practice ix) Sustainable rabi crops and natural farming practices	T. Nandababu Singh, Organic Expert, Ch. Basantakumar Roy (AAO) and A. Sanatomba Singh (DAO), Expert from Agriculture Department

Appendix 5

PROCESS FOR MAKING OF EM- 1

Requirement:

1. A full cup of sticky rice
2. Two cups of water (not chlorinated)
3. Fresh cow milk 1 litre
4. Molasses 1 litre
5. 2 litre size plastic container
6. Measuring cup and a clean cloth

How to prepare:

1) Mix thoroughly 1(one) cup of sticky rice with 2(two) cups of water. After mixing thoroughly take the rice wash for use.
2) Keep rice wash in a bottle and cover with clean cloth.
3) Keep the bottle in dark and cool place for 5-7 days for fermentation.
4) By taking clear middle portion of fermented Rice wash (100ml), mix with 1 (one) litre of fresh milk in a bottle and covered it. Keep in dark and cool place for another 7 days.
5) After 7 days, it has become culture of Lactic bacteria solution and take supernatant solution. This solution is also called LABORATORY SOLUTION. Keep the laboratory solution in refrigerator and can be use for 3(three) years.
6) Mix the solution with molasses in the ratio 1:1 i.e one litre of laboratory solution with one litre molasses. This mixture is called EFFECTIVE MICRO-ORGANISM(EM-1) or NATURAL MANURE or STOCK SOLUTION. This solution can be used for 6 months to one year.

Multiplication or Activation of EM 1:

For activation of EM-1/ Natural Manure/ Stock Solution, take 1 litre solution and mix with 19 litres of non-chlorinated water. Keep for 7 days in dark and cool place for activation.

Doses for Use:

After 7 days, take 100 ml of activation solution and mixed with 1000 ml (1 litre) of non-chlorinated water for spraying on standing crops. Do spray at least 2 time in a week. It can control all pest and diseases for all crops. It can also be use as de-odorize in cow, dog, pig and poultry shed. This can also be used in fishery pond purify the water.

Government of Manipur
Directorate of Environment and Climate Change
Porompat, Imphal

NATIONAL MISSION ON HIMALAYAN STUDIES (NMHS)
G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD)

PANCHAGAVYA

(A method to enrich soil fertility)

Panchagavya or panchakavyam is a mixture used in traditional Hindu rituals that is prepared by mixing five ingredients. The three direct constituents are cow dung, urine, and milk; the two derived products are curd and ghee. These are mixed in proper ratio and then allowed to ferment.

Requirement:

1) Cow dung-5kg 2) Cow urine-5litres, 3) Sour milk (Curd)-2litres,4) Ghee- 250gm,
5) Jaggery-1kg, 6) Banana- 10-12 number, 7) Water- 5litres

Method of Preparation:

1. Fresh cow dung(5kg) and cow ghee(250gm) may be mixed together and kept in a plastic bucket for four days.
2. This may be mixed daily once and then amended after four days with 5 litres of cow urine + 2 litres of Sour curd + 2 litres of milk + 1kg of jiggery (Chini Angangba) + 12 ripe banana and 5 litre of water.
3. After mixing thoroughly the container was covered with wire mesh and kept under shade for fermentation.
4. The mixture should be stirred thoroughly twice a day upto 15 days.
5. It should be stirred more often for more aeration as a result more micro organisms are multiplied in the solution.
6. This material can be kept for six months.

NOTE: Use it by stirring the mixture thoroughly. If the solutions become very thick then add sufficient water to loose enough.

More number of days the panchagavya is stirred the more potent it becomes. It contains all nutrients, microorganisms and plant growth nutrients in large quantity. This acts as 75% manure and 25% pest controller.

How to Apply: Dilute 1 litre of mother solution in 10 litre of water (10%strength) and use as a foliar spray or 5-10 litres per acre in irrigated water.

Supported by: National Mission on Himalayan Studies (NMHS),
G.B. Pant National Institute of Himalayan Environment and Sustainable Development(GBPNIHESD)
Under the Project: "Identification of Vulnerability and PotentialRisk Factor Zone at District and Village Level inManipur".

Appendix 7

1. Model for vermi-compost and liquid manure:

The aim for construction of vermi-composting and liquid manuring unit during the project is to provide compost to the target farmers as to show case for substitution of chemical fertilizers and promotion sustainable organic agricultural practice. Vermi-compost is also known as “farmers' friend” as well as ‘world's best fertilizer” due to its production of nutrients and hormones required for plant growth. It is one of the easiest methods to recycle agricultural wastes and to produce quality compost.

Size: The size of the unit is 7.4 X 4.2 X 2.3 ft. Outside the wall there is a drain around in which the liquid waste could collect through the holes provided for getting out.

Composting material:

Decomposable organic wastes such as animal excreta, kitchen waste, farm residues and forest litter are commonly used as composting materials. Mostly cow dung and dried chopped crop residues are the key raw materials.

Earthworm used:

Red earthworm (*Eisenia foetida*) was used because of its high multiplication rate. They convert the organic matter into vermi-compost within 45-50 days. Since it is a surface feeder it converts organic materials into vermi-compost from top.

Process of vermi-compost preparation:

• Composting is done in pit method and maintained a cool, moist and shady site. Cow dung and chopped dried leafy materials like straw are mixed in the proportion of 3: 1 and are kept for partial decomposition for 15 – 20 days.

• A layer of 15-20cm of chopped materials is kept as bedding material at the bottom of the bed.

• Different layers of chopped material with slurries of cow dung sprayed and increased as per raw material availability and requirement.

• Red earthworm (*Eisenia foetida*) about 1500-2000 numbers were released at each layers

• Sprinkled water to make the material moist daily and also covered with polythene.

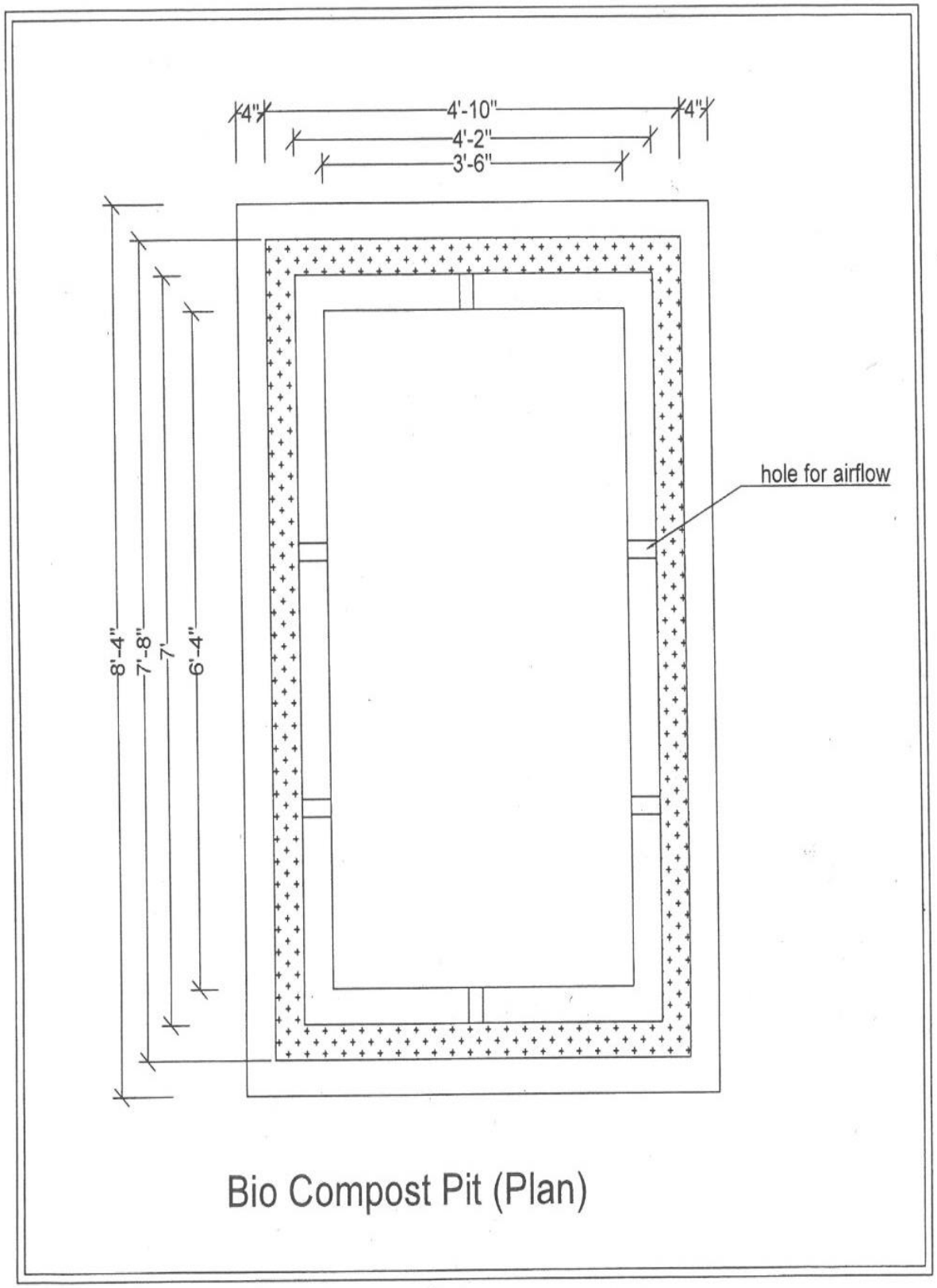
• Compost is ready in 45-50 days.

Harvesting:

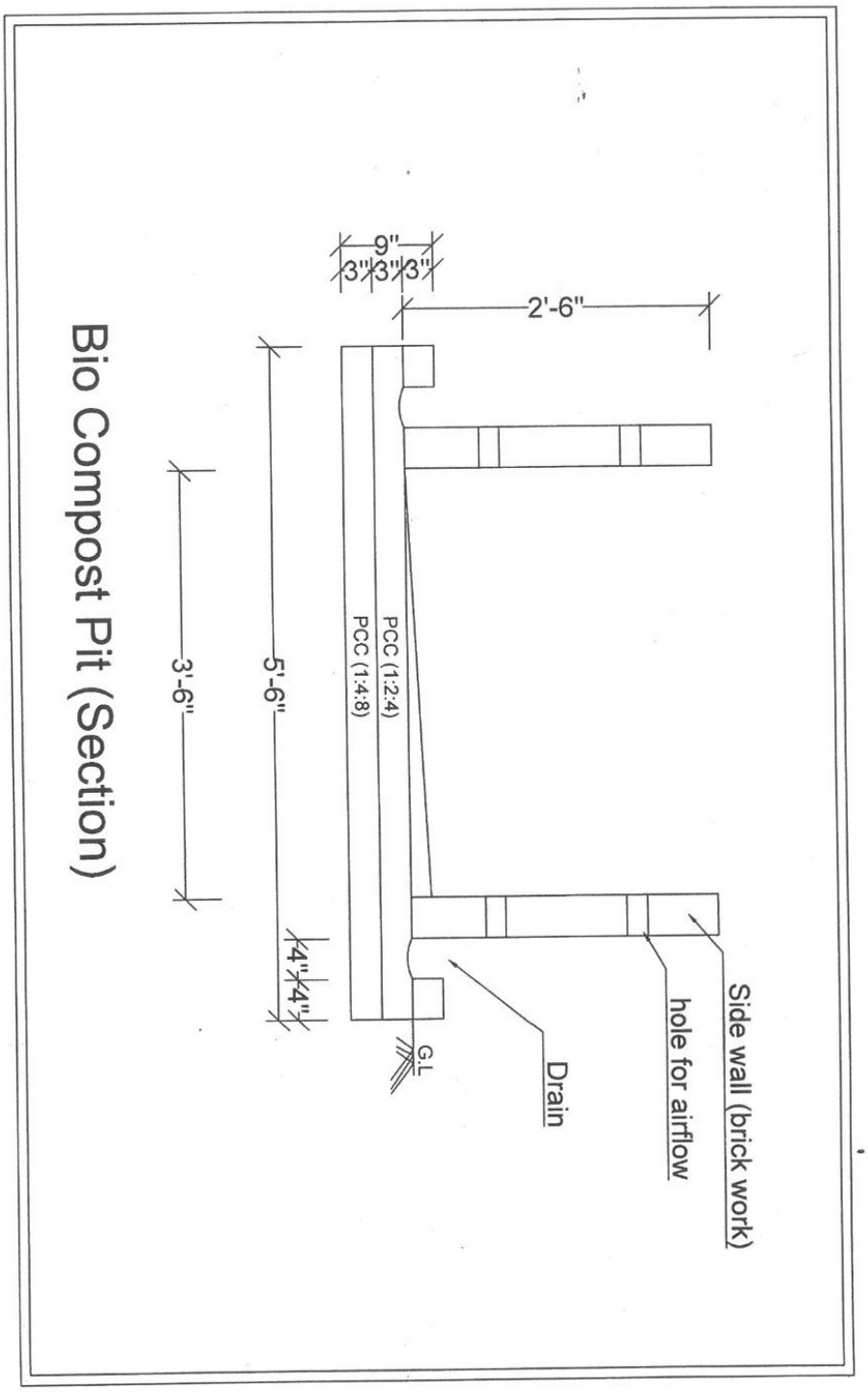
When raw material is completely decomposed it appears black and granular. The compost should be kept over a heap of partially decomposed cow dung so that earthworms could migrate to cow dung from compost. After two days compost can be separated and sieved for

use. On the other side, the liquid waste generated in the drain was collected in a container for use as liquid fertilizer or liquid biocides.

Vermi-Compost and Liqui manure Unit



Model Composting Drawing Plan (Top View)



Model Composting Drawing Plan (Section View)

2. Climate resilient/ flood resilient low-cost model for housing:

The general objective for construction of climate resilient/ flood resilient low-cost model house is to develop a model house that can respond to the impact of climate change disaster. It is also aimed to develop conceptualized characteristics of resilience and sustainability in the context of climate change in different topographical location in the state, especially in Himalayan region. Four numbers of the model were constructed at the villages i.e.Hungpung and Shirui of Ukhrul District and Khekman and Tentha of Thoubal District.

Size:

The model is hexagonal shaped with 6ft distance between each pillars and 12ft diagonally. Height of the base is 3ft from ground level and 3ft inside the ground. Total height upto the eave is 10ft.

Material used:

The model house had been constructed with common material like wood, plank, cement concrete, still bar and rods with aluminium sheets, etc.

Design:

The design was developed in consultation with the other implementing partners of this project. The hexagonal shaped model was specially designed accordingly to the reality of capability for holding during earth quake and flood. It was also provided free passage of air and incorporation of cross-ventilation which promotes thermal comfort during summer. Provision for use of renewable energy through solar lighting system is also being incorporated. The design has addressed the integral concepts of adaptation or mitigation solution to climate Change. Therefore, the perspective of resilience and sustainability may be applied in this model through all shocks and stresses such as floods, strong winds, landslides and other extreme weather events.

Utility:

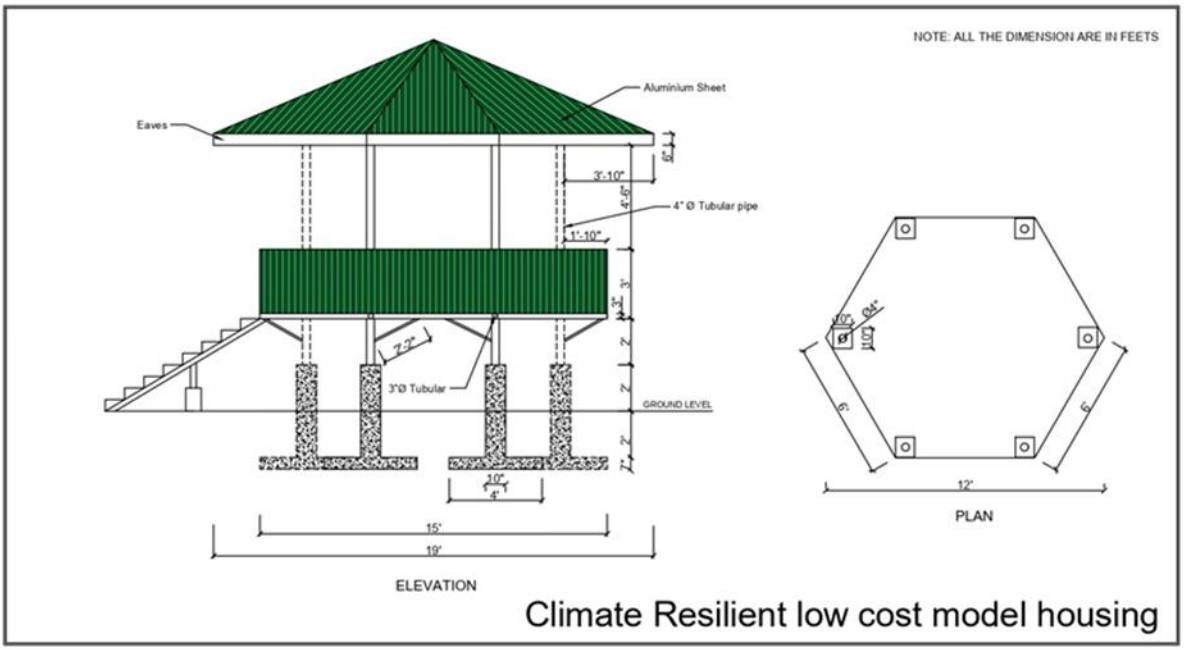
The project itself has established the expectation of quality life, security and development of efficient measures towards adaptation and mitigation to climate change. Considering climate change and its impact, especially the model housing, the current project has given the opportunity to the local villagers as show case model to identify resilient and sustainable models housing with minimum affordable resources. The model will also serve as inspiration for climate researchers who would like to follow up with complementary research in fields such as social, economic and/or political sciences.

Climate Resilient Model Housing at Khekman Village (Valley)

Climate Resilient Model Housing at TenthaVillage (Valley)

Climate Resilient Model Housing at Shirui Village (Hill)

Climate Resilient Model Housing at Hungpung Village (Hill)



Fig;Model Drawing Plan of Climate Resilient Low Cost Model Housing

3. Model for community shelter home for **landslide and flood exposed peoples.**

The model community shelter home was constructed with aim to provide facilities for shelter to a group of people who were severely affected due to climate disaster like flood and landslide. The model was developed with community-based initiatives where the community provided area of land for construction. Most of the community also participated during construction. Two models were constructed at Hungpung village of Ukhrul District and Tentha village of Thoubal District.

Size:

The model is rectangular in shape with an area of 40 X 20ft. with an attached kitchen area of 20 X 10 ft. and a toilet with two rooms. Height of the home from ground level is 16.6ft and portion of extension in the front is 14.6ft.

Material used:

The shelter home had been constructed with common available materials like wood, plank, cement concrete, still bar and rods with aluminium sheets, etc.

Design:

The design of the shelter home was developed in consultation with the other implementing partners of this project. This model was also specially designed to provided free passage of air and incorporation of cross-ventilation which promotes thermal comfort

during summer. Provision for use of renewable energy through solar lighting system was also being incorporated. The design had also addressed the integral concepts of adaptation or mitigation solution to climate Change such as floods, strong winds, landslides and other extreme weather events. Special features also included in shelter home for hill slopes to control erosion and earth slips.

Utility:

Construction of such a model shelter home created lot of interest and enthusiasm among the people in the area specially in Ukhrul and Thoubal District. The model stands out magnificently at the two sites as a demonstrative model that could provide shelter for the people inhabiting in hazard prone areas. The model also intended to carry out suitable landscaping to enlighten the visual impact. In the time to come, they would become talking points for the surrounding communities and probably become folklore in the area of how a team of people came into the site to extend support and resources in building two model shelter home. The value in awareness creation was immeasurable and hopefully would make a significant contribution to a paradigm shift towards safe building in the area.

Community Shelter housing model for Land Slide and Flood Exposed People at Tentha Village (Valley)

Community Shelter Home model for Land Slide and Flood Exposed People at Hungpung Village (Hill)

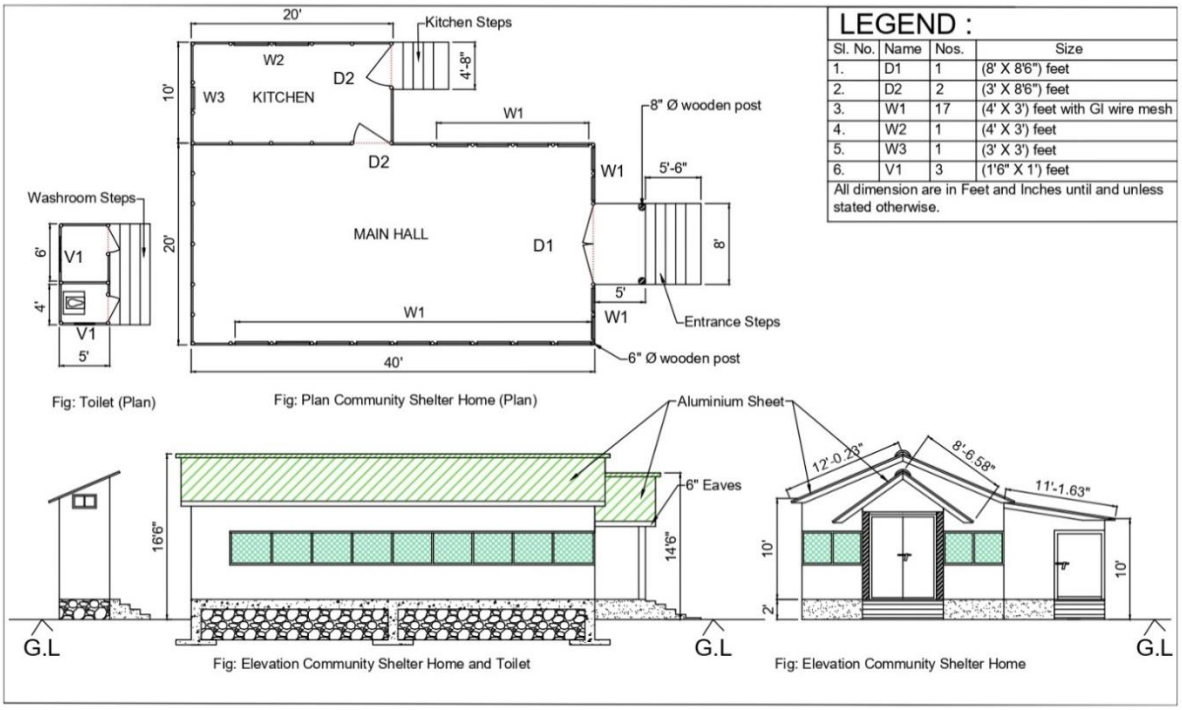


Fig. Model Drawing Plan Community Shelter Home

Project Site's Photographs

Shirui Village (Hill)

Hungpung Village (Hill)

Khekman Village (Valley)

Tentha Village (Valley)