DETAILED PROJECT REPORT

Sustainable agriculture development through expansion, enhancement and modelling in the state of Mizoram

Submitted by:
Department of Agriculture
Government of Mizoram

Technical support:
Deutsche GesellschaftfürInternationaleZusammenarbeit (GIZ) GmbH

February, 2016

For
NATIONAL ADAPTATION FUND FOR CLIMATE CHANGE (NAFCC)

Project Summary

Title of Project:

Sustainable agriculture development through expansion, enhancement and modelling in the state of Mizoram

Project Objectives: To augment the livelihood of rural communities through enhancing resilience of agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies

Project Sector: Agriculture

Name of Executing Entity: Department of Agriculture(Crop Husbandry)

Beneficiaries: Rural communities of Mizoram(30% to 50% of the overall beneficiary under the project would be women)

Project Duration: Three years

Start Date: April 2016
End Date: March 2019

Amount of Financing Requested (INR): 10.95 Crores

Project Location
State: Mizoram
District:4 districts namely, Mamit, Aizawl, Kolasib and Serchhip

Contact Details of Nodal Officer of the Executing Entity:
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1.0 PROJECT BACKGROUND

1.1 Project Background and Context:

a) Provide brief information on the problem the proposed project/programme is aiming to solve

Economy of Mizoram (Map of state is at **Fig.1**) is predominantly agrarian, with more than 60% of the total work force engaged either directly or indirectly in agriculture. However, agriculture still remains under- developed and the primitive method of *jhum* (shifting cultivation) predominates. Both production and productivity are relatively low. Majority of the land falls under class-II to class-IV category of land use capability, requiring appropriate soil management practices for intensive crop production *(Mizoram SAPCC 2012-17).*

Figure 1: Map of Mizoram

Mizoram has a varied blend of climatic conditions ranging from tropical, sub-tropical to temperate conditions. State has high mean annual rainfall of 2500 mm and high relative humidity upto 90%. There is plenty of rainfall in a concentrated period of six months, leaving rest of the months relatively dry and water-scarce *(Mizoram SAPCC 2012-17)*. Mizoram has primarily sand-loamy and clay-loamy soil rich in organic carbon and moderately rich in available potash. Due to high rainfall during May to September, soil is acidic ranging from 4.5-5.6 pH.The fertility of soils is affected by the cultivation practices employed by the people, soil erosion, landslides associated with high intensity rainfall and hailstorm. The temperature during summer season varies from 20°C to 34°C and during the winter season varies from 8°C to 17°C. In Mizoram, due to limited availability of irrigation, agriculture is entirely dependent on the rainwater from the driving monsoon downpours. The unfavourable physical conditions do not facilitate irrigated crop production, leading to only 5% of the total area under cultivation and 11% of the total cultivated area under irrigation. The principal crop is Paddy and others are Maize, Cucumber, Beans, Arum, Ginger Mustard sesame, Cotton etc. Paddy continues to remain the chief food crop and the staple food of the Mizos. It occupies almost 50% of the total cropped area and more than 88% of the total area under food grains. In spite of the fact that the rice being the most important crop occupying the largest share in area and production, Mizoram is still not self sufficient in rice production. Moreover there was decline of production in last few years. The traditional method of Paddy cultivation in the hill slopes, commonly known as *Jhuming,* has been practiced from

the time immemorial in Mizoram. The cultivation of jhum paddy is for a period of one year only. After harvest in the month of November- December, the jhum is left uncultivated and shift to another virgin forest area for the next jhum practice. Impact of increased pressure on land, particularly forest land led to shrinkage of 10 years Jhum cycle to 4-5 year cycle lowering productivity and production thus rendering Jhum practice uneconomical and environmentallyunfriendly (Infrastructure pressure on the state is at **Fig.2**). Also pressure on land has made Jhum size small and shrinkage of Jhum cycle cause low productivity, resulting in poor income for the farmers. *Thus the continuous exposure of land due to short jhumming cycle to climate variability's like high intensity rainfall, cyclonic winds lead to massive landslides and erosion leaving the land barren and unfertile overtime, increasing the area under land degradation (Mizoram SAPCC 2012-17).*Mizoram has experienced land degradation at an alarming rate owing to slash-and-burn system of cultivation totaling to 20.64% of the state (Mizoram Remote Sensing Application Centre (MRSAC, 2013)).

Thus, the proposed project on "Sustainable Agriculture Development through Expansion, Enhancement and Modelling" aims to make agriculture more productive, environment friendly and sustainable, remunerative at the same time water and input use-efficient, and climate resilient by promoting location specific integrated/composite farming systems with soil and moisture conservation and management practices. The project also aims to achieve "*Jhum optimisation*" through catchment area protection, soil conservation and management. With mainstreaming of climate resilient and innovative technologies and practices for the state under the project, this initiative is very much in line with the adaptation strategies envisaged under the State Action Plan on Climate (SAPCC) as well as aligned to multiple areas of the National Mission for Sustainable Agriculture and National Water Mission. The project with duration of three-years is proposed to be implemented in 4 districts of the state (highly vulnerable due to agriculture). The proposed budgetary outlay of the project is **INR 10.95 crores**.

Figure 2: Infrastructure pressure on the state

b) Outline the economic, social development and climate change in line with the State Action plan on Climate Change and relevant Missions under National Action Plan on Climate Change

The proposed project activities are in line with the interventions of the National Mission on Sustainable Agriculture (NMSA) under National Action Plan on Climate Change. NMSA aims to make Indian agriculture more resilient to climate change through developing new varieties of thermal resistant crops, new credit and insurance mechanisms and

improving productivity of rain-fed agriculture. The proposed activity is also highlighted under the Agriculture Chapter of the State Action Plan on Climate Change.

The project proposes for sustainable agriculture practices through adoption of practices such as soil and water conservation; water conservation through efficient and assured irrigation practices; developing climate resilient cropping pattern; and knowledge & experience dissemination to wider population.

c) Climate vulnerability analysis

As per Government of India's report titled 'Climate Change and India: A 4x4 Assessment-A Sectoral and Regional Analysis for 2030s', the surface air temperature and precipitation of the north eastern region is projected to rise from 1.8oC to 2.1oC and 0.3 - 3% respectively in the 2030s with respect to the 1970s. Most affected crops of the region are Rice and Maize. Impact on rain-fed rice is likely to be in the range of –35% to 5%, whereas Maize yield is likely to be reduced by about 40%.

Due to its geo-climatic condition, the entire state is one of the most hazard prone states in the country. Cyclonic storms, cloudbursts, hailstorms and landslides annually sweep the state. To make matters worse, the state falls under seismic zone V, and thus liable to be hit by strong earthquakes. Small tremors are felt every now and then in and around the state. The state of Mizoram enjoys a typical climate with variations ranging from sub-tropical to temperate conditions in hilly areas. The quick changes in topography of Mizoram consequences a significant climate changes within a short distance.

Although the State is enjoying abundance of rainfall during monsoon period, the dry spell during non-monsoon period is really hard for the people. Due to the steepness of the hillsides, underground water retention is minimal, causing perennial water sources to dry up during this period*(Ground water information booklet, Mizoram 2013)*. This had been aggravated by the tradition custom of jhum cultivation. The habit of felling trees, foliage of forests and burning them really destroy natural vegetation, thus causing ecological imbalances. Moreover, this usually led to unwanted spread of fire to forests.

Figure 3: Hazard mapping of the state

Pattern of rainfall in Mizoram during the past 20 years i.e., from 1986 to 2005 follows the usual expected trend in which maximum downpour occurred during the monsoon seasons and declines during the rest of the seasons. However, when analyzed on a yearly basis the trend shows a gradual decline and then a sudden increase from 1990 to 1995. In fact, during the span of the 20 years study period, 1995 recorded the highest rainfall of 3185.98 mm whereas 1994 had the lowest rainfall with a measure of 2278.29 mm only. The monthly average rainfall during 1996-2005 when compared to the previous decade of 1986-1995 shows a gradual increase during the month of March, May, September and then a remarkable increase during the month of July, with one-day maximum peaks. Under the action of heavy rain, flash floods may be caused resulting in bank erosion and some local damage (Hazard mapping of the state is at **Fig.3**). The rainfall is projected to increase with some districts expected to experience nearly 25% increase in rainfall. The number of yearly extreme rainfall events is expected to go up significantly (about 26%). In other words, the frequency of floods is expected to increase significantly in the NER. Projections of the (Hadley Centre Coupled Model, version 3)are quite similar to those of other Intergovernmental Panel on Climate Change (IPCC) models which provide some confidence in our projections for the northeast India. However, it is cautioned that the spatial pattern of climate projections could differ for different Global Climate Model (GCM)*(State remote sensing center report, Mizoram).*

The average monthly maximum temperature taken during the period of 1996-2005 shows an increase over the previous decade of 1986- 1995, during the early part (January-February) as well as later part (November-December) of the years. There is increase in the average maximum temperature during 1996-2005 by +0.28°C over the decade of 1986-1995, which denotes a trend in increase in temperature during the last decade. The same increase is also reflected in the average minimum temperature recorded for the decade of 1996-2005 which is +0.30°C, much higher than that recorded for the previous decade of 1986- 1995. The rate of increase is clearly reflected when the overall monthly average temperature recorded for both decades shows an increase of +0.29°C (Chaturvedi et al., 2012). The overall trend in temperature also shows a gradual increase during the 1996-2005 decade. The increase in temperature as per the data indicates that there might be further rise in the heat wave in the years to come.The temperature is projected to go up by about 1.7°C in almost all the districts of northeast. It is projected to go up by more than 2°C in some districts (*State remote sensing center report, Mizoram).*

Humidity is another climatic element that has close relation to temperature and rainfall and also plays a key role in affecting the climate of a region. Average data on humidity for 20 years was collected and analyzed for a period of 5 years each. The results studied for each period clearly indicated that there was a gradual and

progressive increase in humidity during the entire span of 20 years.Records of flood incidents in the State from 2008 to 2011, shows that there has been increasing incident in villages leading to crop damage and erosion of cropland lying in the fluvial flood plains (*DM & R Dept*.)

As evidence from the earlier records, Mizoram state is vulnerable to impact of tropical cyclone, whichdevelops in North Indian Ocean (Bay of Bengal), and the cyclones of the Post Monsoon season (October to December) are more intense than those of Pre-Monsoon season (April & May). Cyclones are associated with strong winds, torrential rains and storm. The impact has often led to loss of properties and even lives. The impact of cyclone has often led to damages to houses, power line cut-off, blockage of road, damages to crops and plantations, loss of live stocks, etc. Generally these winds come from the north western part of the state as the winds originate from the Bay of Bengal. According to the statistical reports on Vulnerability Analysis of Mizoram, out of the fifty two villages/wards, eleven (21.15%) villages/wards are classified under high vulnerable class, eighteen (34.62%) villages/wards under medium vulnerability class and twenty three (44.23%) villages/wards under low vulnerable class (*State Remote Sensing Centre, Mizoram*).

d) Project Location details – villages, block/ mandal, district

Figure 4: Districts for project implementation, Mizoram

The population of Mizoram is 0.89 million according to 2001 census enhanced to 1.091 million as per census, 2011 and is scattered over 8 districts, 26 blocks and 830 villages (2011 census).The project is proposed to be implemented in 4 districts of the state namely, Mamit, Aizawl, Kolasib and Serchhip (**Figure 4**). Districts have been selected based of their vulnerability to climate change. Ravindranath et al (2010) made a district-wise assessment of all districts in NER including those in Mizoram based on their projected increases in temperature (2021-50) and change in their total rainfall (2021-50). According to the assessment Aizawl, Mamit and Kolasib are projected to have an increase in temperature to the tune of 1.7-1.8(ºC) between 2021-50. Similarly Serchhip and Kolasib are projected to be most vulnerable in terms of increase in precipitation due to Climate Change. Selection of Villages and the beneficiary households under the project would be on the basis of the following:

- Jhum area in the village is high
- Low productivity of agriculture.
- Jhum cycle is less than 8 years
- Occurrence of frequent flash floods

- Access to potable water is low
- Access to irrigation is low, less than 30% of the total cropped area
- Food production deficit
- High incidences of pests and diseases in crops reported
- Biodiversity in forests is poor
- Significant population has kutcha roofs on their houses
- Livelihood diversification of the poor households is less than or equal to two

Within the villages, criteria for selecting beneficiary households would be:

- Assessment of household incomes i.e BPL etc
- Source of income
- Food self sufficiency
- Jhuming households

The vulnerable households in a village would be identified in consultation with the Village Councils which are the elected form of village institution in Mizoram comparable to Gram Panchayat. This would be done at the time of execution of Component 1 i.e. "Finalizing household level adaptation interventions: Baseline Households Survey, Finalization and communication of adaptation interventions for each target community and household".

Project also proposed to set up Custom Hiring Centers which will be established in 3 districts. Districts for setting up Custom Hiring Centers would be selected based on criteria such as high vulnerability of the population of selected village, availability of land, acceptance and application of centers of the local population etc.

The selected districtsfor project implementation are predominantly agrarian. More than 70 per cent of the population depends on agriculture for their livelihood.About 95% of current Mizoram population is of diverse tribal origins that settled in the state, mostly from Southeast Asia. This is the highest concentration of tribal people among all states of India. The sex ratio of the state is 976 females per thousand males, higher than the national ratio 940. The density of population is 52 persons per square kilometer (2011 census). Mizoram is a highly literate agrarian economy, but suffers from jhum or shifting cultivation and resultant environmental degradation and poor crop yields. The state's gross state domestic product for 2012 was estimated at INR 6991 crore (US$1.0 billion) (Economic Survey, Mizoram 2012-13). About 20% of Mizoram's population lives below poverty line, with 35% rural poverty. The state is a growing transit point for trade with Myanmar and Bangladesh (Mizoram SAPCC 2012-17). It has been estimated that the project will cover approximately, 13,000 beneficiaries in 4 districts. Details of the beneficiaries are as follows:

Project activities	No of beneficiaries
Tank Renovation & Restoration	700
Construction of Rain Water Harvesting Tank	170
System of Rice Intensification	500
Directed seeded rice cultivation	500

Assistance For Improved cultivation on hill slope	3000
Adoption of Integrated Pest Management for improving crop yields. Preparedness to tackle pests and disease outbreak and capacity building	2600
Farmers' Field School	400
Construction of Hill Slope Terrace for soil and moisture in cultivation of crops	100
On farm development: Land levelling, bundling, reshaping etc.	5000
Total	**12970**

1.2 Project Objective and Activities:

Theoverall objective of the project is to augment the livelihood of rural communities through enhancing resilience of agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies. This includes activities such as:

- To demonstrate site-specific technology packages on farmers' fields for adapting to current climate risks
- Selection of promising crop genotypes with greater tolerance to climatic stress
- Promotion of best practices for climate resilience through demonstrationin three agro climatic zones
- Strengthening of infrastructure at KrishiVigyanKendras (KVKs) for climatic change research activities
- Capacity building & training (Training of staff, field functionaries &farmers)

1.3Details of Project Executing Entity:

a) Name, Registration No. & Date, Registered Address, Project Office Address

Dr. C. Lalzarliana
Director of Agriculture (Crop Husbandry)
Government of Mizoram
Aizawl- 796001
Phone: 0389- 2322437 (O), 0389 – 2322511 (F)
Email: agrimizoram@gmail.com
Mobile: 09436142745
Registration No. and Date: Department of Agriculture was established as a full-fledged entity in 1992.

b) Available technical manpower for the proposed project implementation:

Department of Agriculture (Crop Husbandry), Government of Mizoram

S. No.	Name & Designation	Address	Specialization
i.	Dr. C. Lalzarliana Director (Lead)	Department of Agriculture (Crop Husbandry) Government of Mizoram Aizawl- 796001 Phone : 0389- 2322437 (O), 0389 – 2322511 (F) Email : agrimizoram@gmail.com Mobile: 09436142745	Policy planning, Agricultural extension and Project implementation
ii.	Mr. PradipChhetri, Agricultural Extension Officer	Department of Agriculture (Crop Husbandry) Government of Mizoram Aizawl- 796001 Email: cpradip1962@gmail.com Mob: 9862567891	Natural resource management, project planning and implementation

Department of Agriculture (Research and Education), Government of Mizoram

S. No.	Name & Designation	Address	Specialization
i.	Mr. C.Lalniliana Director	Department of Agriculture (Research and Education) Government of Mizoram Aizawl- 796001	Agriculture Research

Department of Environment and Forest, Government of Mizoram

S. No.	Name & Designation	Address	Specialization
i.	Mr.Tsewang Gyaltson, Nodal Officer for Climate Change	PCCF Office Tuikhuahtlang, Aizawl- 796001	Mathematics, Statistics, Natural Resource assessment

c) Three largest Climate Change Adaptation Projects handled (if already implemented)

Project	Objectives	Amount Sanctioned (crores)	Funding Agency	Geographical Coverage	Implementation Period & Outcome
State is implementing interventions proposed under National Mission	Out scaling of climate adaptation	6.38	MoA	Entire Mizoram	• Climate Resilient agricultural practices • Strategic Irrigation

for Sustainable Agriculture	strategies				• Agro-met advisories dissemination

d) Three largest community based NRM based projects handled by the consortium

Integrated Nutrient Management (INM)

This project aims at promoting INM through judicious use of fertilizers including micro-fertilizers, strengthening soil testing facilities and upgrade skill & knowledge of Soil Testing Laboratory staffs/Extension workers and farmers etc. This project is being implemented in Aizawl, Mamit, Kolasib, Champai, Luglei, Saiha and Lawntlai districts.

Support to State Extension Programmes for Extension Reforms

This programme aims to provide capacity building support in extension management related areas; developing and promoting application of management tools for improving the effectiveness of Agricultural Extension Services. In order to implement the programme, Agricultural Technology Management Agencies (ATMA), autonomous institutions have been set up at districts to ensure delivery of extension services to farmers. This programme during first phase was implemented in 4 districts of Mizoram namely, Aizawl, Champai, Kolasib&Lunglei. This was then extended to other 4 districts namely, Lawngtlai, Mamit, Saiha and Serchhip.

e) Three largest Climate Change Adaptation / NRM projects of State / Central Government

RashtriyaKrishiVikasYojana (RKVY)

This scheme aims to stimulate state for increasing public investment in agriculture and allied sectors, preparation of agricultural maps, reduce the yield map in important crops, enhance production, planning & implementation of agriculture and allied sector schemes and maximize farmer's income. This scheme covers the entire state.

Watershed Development Programme in Shifting Cultivation Area

This programme is a Special Assistance Programme for the benefits of Jhumia families in N.E. States. The activities include treatment of arable, non-arable land, drainage line, creation of water bodies, development of agriculture/horticulture crops etc.

f) Comment of availability of suitable infrastructure for implementation proposed projects (vehicles, computers, required software/ tools, etc.)

Department of Agriculture, Govt. of Mizoram has manpower network of Agricultural Officers (AO) and Agricultural Extension Officers (AEO) with rich experience and capacities to develop and implement adaptation options specific to the study locations.

g) Whether Executing Entity (EE) was blacklisted, barred from implementation of projects, faced any charges / legal cases related to mismanagement of project and funds. (Please list any such incidences and reasons):

No

1.4 Major Project Components and Financing:

No.	Project/Programme Components	Expected Concrete Outputs	Expected Outcomes	Amount (Rs.)
1.	Finalizing household level adaptationinterventions (Baseline HouseholdsSurvey, Finalizationand communication of adaptationinterventions foreach targetcommunity andhousehold)	• Understanding and analysis of Households' perceptions on climate change impacts, existing coping/adaptation strategies and capacities to adapt to different climate change scenarios • Accordingly, farm households would be identified • Identifying concrete adaptation interventions based on area specific vulnerabilities	• Updating climatic vulnerability and scenarios of the targeted regions • Stakeholders aware of the climate change impacts in the farm households identified; • Finalized adaptation strategies suitable to the target locations and farm household typologies	10,00,000
2.	Climate Change Modeling and Networking, Training & Capacity building, Awareness	• Establishment of Automatic Weather Station • Seasonal climate forecast provided for the target villages • On farm interventions like real time pest surveillance, rain water management, demonstration on suitable cropping system, promotion of integrated farming system etc. • Trainings and demonstrations on various aspects of climate change adaptation in agriculture based on research (e.g NICRA, CRIDA etc) findings/experiences. • Research/model/pilot projects for different agro climatic conditions on climate change adaptation and mitigation	• Ensure weather forecast, so that suitable adaptation measures on water and food could be taken up • Farmers adjust their farm planning and operational decisions based on the climate forecast • Pilot projects for planting climate resilient crop varieties in three agro-climatic zones, namely, Humid Mild Tropical Zone, Humid Sub Tropical Hill Zone and Humid Temperate Sub-Alpine Zone • Farmers would be trained on comprehensive field evaluation of new and emerging approaches	71,50,000

			of paddy cultivation like aerobic rice and SRI for their contribution to increase water use efficiency. • Installation of the state-of-the-art equipment like flux towers for measurement of greenhouse gases in large field areas to understand the impact of management practices and contribute data on emissions as national responsibility.	
3.	Soil Conservation for improvement of soil and water regime in the hill area	• Rice area expansion on hill slope • Construction of terraces • Reduction in Jhum areas • Increase in crop productivity by 10% through in-situ moisture conservation farm development	• Weaning away the destructive and unprofitable shifting cultivation practices that hasten land degradation in the wake of rainfall variabilities • Economic and efficient utilization of irrigation water in rice, pulses, cash crops etc. through in situ moisture conservation	3,38,00,000
4.	Water Harvesting and Management	• Restoration/Renovation of small household/ community tanks • Construction of Rain Water Harvesting Tank	• Tanks can fulfil the water demand • Farmers could also apply fish rearing for villagers and provide them additional income	2,75,00,000
5.	Enhancement of Crop Production & Productivity (Mainstreaming innovative agricultural best practices related to climate change adaptation in strategies/policies/projects like SRI, Improved Jhum, Direct Seeded Rice	• Promotion of direct seeded rice cultivation under rain fed condition in upland and lowlands • Increasing rice production through adoption of practices such as System for Rice Intensification • Improved cultivation of	• Innovative best practices for rice plantation would be adopted in the wake of climate change • Establishing a Farmers Field School will lead to the sustainability of	2,77,00,000

	cultivation)	certified crops on hill slope • Establishing farmers' field school through which 5500 farmers would be trained • Preparedness to tackle pests and disease outbreak and capacity building through adopting Integrated Pest Management measures for improving crop yields	the project • Enhance crop productivity resistant to pest and disease	
6.	Farm Mechanization	Custom Hiring Centers (CHC) would be set up so that equipment could be made available to farmers	Improve mechanization in places with low farm power availability, to ensure sustainable crop production	28,50,000
7.	Project management cost of executing entity and Man power			63,50,000
8.	Total Project Cost			10,63,50,000
9.	Project Cycle Management Fee charged by the Implementing Entity(3% of Total Project cost)			31,90,500
10.	**Amount of Financing Requested**			**10,95,40,500**

1.5 Projected Calendar:

Milestones	**Expected Dates**
Start of Project Implementation	April 2016
Mid-term Review (if planned)	October 2018
Terminal Evaluation	January 2019
Project Closing	March 2019

2.0 PROJECT JUSTIFICATION

i. What is the business-as-usual development for the targeted sector?

State has a rich experience in implementing activities related to natural resource management. However, the farming community of state does not haveenough technical capacity to implement climate resilient practices. Further, financial resources are also lacking. The project therefore aims to improve the adaptive capacity of small holder farmers in Mizoram by delivering a combination of climate resilient farming system interventions and enhance their capacity to ensure sustainability of the project. The major activities of the project will enhance the adaptation capacity of agriculture sector.

a) Component-wise details and justification of the project components

Major-activity/ sub-activity	**Justification of the activity**

I.Finalizing householdlevel adaptationinterventions (Baseline HouseholdsSurvey, Finalization and communication of adaptationinterventions foreach targetcommunity andhousehold) a) Understanding and analysis of Households' perceptions on climate change impacts, existing coping/adaptation strategies and capacities to adapt to different climate change scenarios b) Accordingly, farm households would be identified c) Identifying concrete adaptation interventions based on area specific vulnerabilities	This activity would be first and foremost step towards initiation of the project activities. This would help in identifying the vulnerability of the region and accordingly vulnerable households would be selected for implementation of the project. This would also help in prioritization and finalization of adaptation activities targeting location and farm households.
II. Climate Change Modeling and Networking Training &Capacity building, Awareness a) Establishment of Automatic Weather Stations for seasonal climate forecast for the target villages b) Trainings and demonstrations on various aspects of climate change adaptation in agriculture based on research (e.g NICRA, CRIDA etc) findings/experiences. c) Research/model/pilot projects for different agro climatic conditions (a. Humid Mild Tropical Zone, b. Humid Sub Tropical Hill Zone. c. Humid Temperate Sub-Alpine Zone) on climate change adaptation and mitigation	Installation of Automatic Weather Station (AWS) on a cluster basis and dissemination of crop-weather advisory to farmers based on real time data, are the major components proposed. It is proposed to disseminate the advisories through mobile with a tie-up with a suitable Technology Service Provider (TSP). For this purpose, the information generated from the AWS from the project area will be linked to the TSP for agro advisory services. Accordingly, farmers will be able to take suitable decision with regard to input planning and farm management in the wake of changing climate. From climate change adaptation point, it will be one of the inputs to cope with the situation and remain better prepared using the tested technologies for adaptation available on ground. It is also proposed to undertake crop-water budgeting with an objective to utilize the available water in the watershed area most judiciously. Suitable equipments like run-off measurement device, sediment observatory etc. will be installed for this purpose. The project will have a strong knowledge management system which would enable documentation and large scale dissemination of knowledge and lessons learned from the project to different stakeholders, including policy makers

	and planners. Based on the project learning, operational manual, policy briefs, audio visual materials, etc. will be developed for knowledge dissemination. Project will organize seminars, interactive workshops, exposure visits, etc. for cross learning and information dissemination. The operational manual will be developed both in English and local language with illustrations so that it can be used as training instrument to train different stakeholders. Policy brief prepared as part of the knowledge management system will help policy makers to be sensitive to climate change adaptation in rainfed areas on watershed basis and help in mainstreaming such adaptation initiatives in natural resource management projects/programmes. This output will extend over the life time of the project and will highlight the impact of climate change on natural resources and agricultural development.
II. Soil Conservation for improvement of soil and water regime in the hill area a) **Soil and water conservation on hillslope:** One of the primary objectives is to provide sustainable income to farming families by weaning away the destructive and unprofitable shifting cultivation practices. The total Jhum area and the total number of Jhumia families in Mizoram during 2014-15 are 20,064 hectare and 49,198 nos. respectively. **b)** On Farm Development (In Situ Moisture Conservation)	Successful agriculture depends on fertile soil and clean water, which are renewable resources in natural systems and, when managed properly. Most terrestrial life needs a continual source of water for sustenance and soil is an essential medium for plant growth in most terrestrial ecosystems, providing nutrients, water, physical support, and biological interactions with roots. Soil and water are closely linked in nature, impacting each other through the hydrologic, geo-chemical and energy cycles. In most cases, an impact on the soil system has a direct impact on water resources. With increase in the one-day maximum rainfall in terms of intensity and the state being prone to cyclonic storms, slopes are prone to high levels of soil erosion and resultant land degradation. Terraces could considerably reduce soil loss due to water erosion if they are well planned, correctly constructed and properly maintained. There are many examples showing that terraces have to be maintained to prevent processes leading to land degradation such as excessive soil erosion, gully formation and landsliding. There is a large variety

	of terrace types, each adapted to certain landscapes with various slopes gradients, but all terraces can be divided in three groups: bench terraces, contour terraces and parallel terraces. All of these three terrace types could be effective regarding soil and water conservation; there is no such thing as the best terrace type, because it all depends on local conditions. The most important aspect of terracing is that it has to be combined with additional soil conservation practices, of which the most important one is the maintenance of a permanent soil cover. This latter is specially needed on the foot slope of the terrace, because terraces themselves could be easily eroded and they generally require a lot of maintenance and repair. Other disadvantages are the disturbance of the soil strata during construction, considerable decline in soil fertility in the first several years and considerable soil loss during construction. A very important point regarding terraces or any soil and water conservation practice is that most farmers are concerned with production than with conservation. Therefore, the challenge is to develop conservation practices that are also productive is important looking at the increasing climate variability. The ancient farming techniques such as terracing may provide a good basis for that, because far too often attempts have been made to modernize or improve farming practices without looking at existing well established practices first (Mountjoy and Gliessman, 1988). It has been shown by many researchers that terraces could provide a basis for good farming that aims to keep fertile soil resources in place and in a good productive state adapting to rainfall and cyclonic fluxes
III. Water Harvesting and Management a) Restoration/Renovation of small tank **b)** 'Water Harvesting' systems in each of the identified clusters, using the technology developed by the research institutions in the region.	There is a likelihood of more water scarcity and incidence of drought in the coming decades apart from delay in onset of monsoon most of the time (current monsoon of 2014 is the best example). This will significantly reduce crop production and productivity, affect household food security and increase poverty. Lowering of water table and reduction of vegetation cover during climate

	stressed scenario is also observed. The eco-system services will have severe constraints and low or no return on agricultural investment with large scale migration and over exploitation of available resource base, leading to non-recoverable resource depletion stage. Current practice of over-dependence on water intensive crops, methods of rain-fed farming will enhance the vulnerability further. Adaptation to such situation by the farming community, especially small and marginal farmers is essential. In order to improve the climate resilience and better adaptation to the situation, the project looks at improving soil and water regime through various vegetative and mechanical measures. The suggested measures, adhering to the technical specifications, willminimize water stress situation, enhance water availability in the watersheds and make it climate resilient and adaptive to the situation. Activities proposed above will facilitate improvement in soil and water regime, better crop productivity and resultin increase offarmer's income, which is the main outcome envisaged. Activities which envisage harvesting of run-off water like farm pond, earthen embankment, masonry check dam etc., would be beneficial for providing life saving irrigation to crops during critical periods. Small structures like recharge pit, catch pit and well recharge pit would enable recharging of ground water by catching rainwater. Summer/deep ploughing would maintain the soil moisture and prevent excess evaporation.
IV. Enhancement of Crop Production &Productivity:Mainstreaming innovative agricultural best practices related to climate change adaptation in strategies/policies/projects like SRI, Improved Jhum, Direct Seeded Rice cultivation. a) Promotion of Direct seeded rice cultivation b) SRI, System of Rice Intensification c) Assistance for improved cultivation on hill slope	Efficiency is a very important factor of productivity growth, especially in developing agricultural economies, where farmers' resources are meagre. Production efficiency relates outputs with inputs. It can be measured in terms of inputs required to produce a given level of output, or it can be assessed from the total output produced from a given level of input in the backdrop of changing climate. Output is a result not only of the quantity of inputs used but also of the efficiency in the use of these inputs as resources are constrained. A firm producing on a certain

d) Farmers' Field School **e)** Adoption of Integrated Pest Management for improving crop yields.	production function may increase production by improving the efficiency of use of the inputs without increasing the level of inputs; thereby shifting the production function upwards. Climate change induced higher temperatures will increase crops' water requirements. Every 10°C increase in mean temperature, results in 7% decline in the yield of rice crop. Hence, there is a need to develop water saving technologies in rice that consumes more than 50% of the total irrigation water in agriculture. System of Rice Intensification (SRI) and Directed Seeded Rice cultivation are one such water saving rice production technologies. Experiments were conducted at different locations in the state including research farm of Directorate of Rice Research (DRR), Hyderabad, during 2005-10 to assess the potential of SRI in comparison to normal transplanting/Standard Planting (NTP/SP) under flooded condition. SRI recorded higher grain yield (6 to 65% over NTP) at majority of locations. SRI and Directed Seeded Rice cultivation not only results in higher productivity, the available nutrient status in soil also increases marginally at the end of four seasons. There was a reduction in the incidence of pests in SRI and the relative abundance of plant parasitic nematodes was low in SRI and Directed Seeded Rice cultivation. About 31% and 37% saving in irrigation water was observed during Kharif and Rabi seasons, respectively in both methods of SRI and Directed Seeded Rice cultivation. SRI performed well and consistently reduced requirement of inputs such as seed and water in different soil conditions. SRI and Directed Seeded Rice cultivation method, using less water for rice production can help in overcoming water shortage in future and it can also make water available for growing other crops thus promoting crop diversification. In order to produce more, environmentally friendly rice, socially beneficial rice is the main focus of research in recent years. SRI system which facilitates production of more rice with less

	quantity of inputs such as water, seed and chemical fertilizers is one of the promising approaches in this direction. The practice of Jhumming is also still prevalent among many farmers in the state and in spite of the efforts given by the State government to bring more areas under settled cultivation through many interventions, as is evident from the Rice production pattern during 2014-15, more than 50 % of the total Rice production is contributed from Jhum areas. As such, it is proposed to incentivize the farmers through Improved Jhum cultivation wherein subsidy assistance on critical inputs like improved seed, fertilizers, plant protection chemicals, herbicides etc. will be provided.
V. Farm Mechanization **a)** Custom Hiring Centers (CHC)	Timely completion of agricultural operation has shown significant benefits both on research farms and farmers' fields during rainfall variability. It is often seen that the ideal conditions for an agricultural operation such as sowing or intercultural operation exists for a short period of time. Due to increasing climate variability like shifting in the onset of monsoon, change in the intensity and duration of rainfall and cyclones, hailstorms etc. timeliness of operations has significance for increased survival, good crop stand and sustained productivity of crops. Timely harvest and adequate post harvest storage are other aspects that reduce the extent of losses due to variability in timing of rainfall, hail storm etc. during harvest season. This can be done through high capacity energy efficient farm machineryand farming operation with high level of efficiency, which utilizes the reduced time window due to climate variability. Although many efforts have gone in this direction in the past, not much has been made in improving the timeliness of agricultural operations in the wake of climate change. This is mostly because of the unaffordability of many machines by small farmers and difficulties in maintenance and repairs.

	This calls for sharing of the cost of implements by innovative institutional arrangements. In the recent past, custom hiring of agricultural machineries is seen as an appropriate institutional arrangement, which can promote mechanization of agricultural operations on small farms in the most cost efficient manner. This will enable farmers to act on crop husbandry for similar crops at the shortest possible time to avoid uncertainties due to climate variability. Through this project, it is proposed for the first time to set up Custom Hiring Centersin 3 most vulnerable sectors of the state due to agriculture aspects. The focus of the programme is to institutionalize mechanisms at the village level for continued adoption of such practices in sustainable manner.

b) Details on economic, social and environmental benefits project

Activities	**Key Benefits (Direct)**		
	Social	**Economic**	**Environmental**
I-a,b,c	• To give early warning to the farming community (10,000 farmers) about the weather forecast and impact of climate change • Create awareness of 10,000 farmers on the impact of climate change and adaptation	Special attention to the productivity of crops, livestock and fisheries would be given as per the climate change variability.	• Critical assessment of different crops/zones in the state for vulnerability to climatic stresses and extreme events, in particular, intra seasonal variability of rainfall • To conserve natural resources through appropriate soil and moisture conservation measures
II-a,b	At least 30% farmers living in the villages directly benefited from soil and water conservation measures	Farmers get higher production and productivity and cropping intensity is raised to 130%. Encouraging improved agronomic practices for higher farm productivity, improved soil treatment,	High degree of soil erosion control and good interception of run-off water

		increased water holding capacity, judicious use of chemicals/ energy and enhanced soil carbon storage It is estimated that adoption of SRI will increase the rice yield by approximately, 30%, which enhances the economy of farmersby 6 times.	
III-a,b	• To optimize utilization of water resources through efficient water management to expand coverage for achieving *'more crop per drop'*; • Provision of domestic water supply	Drip irrigation will reduce the cost of production as labor for weed control and reduce water consumption	Higher water table positively impacting water quality, decrease soil pollution.
IV-a,b,c,d,e	Reduced agriculture (production) threatens food security in the regioncovering approximately, 60% of the farmers	• To make agriculture more productive, sustainable, remunerative and climate resilient by promoting location specific Integrated/Composite Farming Systems; • Farmers get higher production and productivity	Agro forestry also helps in sequestering atmospheric carbon dioxide and helps in reducing emission and global warming
V-a	To make available various farm machinery / equipment to small and marginal farmers	Offset the adverse economies of scale due to high cost of individual ownership. This will reduce the transport cost and time of agricultural machinery transport.	High degree of soil erosion control and good interception of run-off water

c) Sustainability of intervention

The participatory approach of the project will ensure the ownership of the project by the community, which is expected to ensure the sustainability. The project proposes a livelihood-based approach to adaptation, developing asset / capital base of individual / community in a participatory model. Four types of capital base will be created i.e. human capital, natural capital, physical capital and financial capital. The human capital will be formed through developing adaptive knowledge and skill base of farmers whereas physical capital will be in shape of water harvesting structures, micro irrigation facilities, integrated farming model, home gardens etc. The natural capital will be the scientific basis for drawing up the Village Council wise plan. This will positively impact on the financial capital of the farmer households. All these will lead to improvement in the adaptive capacity, both at household and community level. Combined impact of these components will ensure sustainability of the outcome in the long run.

Environment Sustainability

The project proposes the transfer of sustainable technologies and also the promotion of indigenous varieties of seeds/breeds so that environmental sustainability can be ensured. The improved designs of water harvesting structures, plantation on permanent fallows, will help in soil and water conservation and groundwater recharge sustainably. The increased organic waste in the soil will help to regain the soil health and thereby sustainably increase productivity.

Economic Sustainability

The land and water use master plans prepared on the basis of GIS mapping will give the community a proper scientific basis for planning future interventions. It will also save the community from making wrong investments. Economic gains from effectively planned interventions will give impetus to the community to continue the same activities in future. The crop-weather advisories will help to stabilise the production. The soil and water conservation measures will help to improve the quality of the soil and its moisture retention capacity which will help in making the unutilised lands productive. It will also unleash the scope of alternative income. Introduction of sustainable agriculture practices and integrated farming system will help to reduce the cost of agriculture and increase the total farm production. The extension of growing season will increase the employment opportunity and thereby the income of marginalised farming families. Both seed-grains and fodder banks created as disaster coping mechanism may also be used as community income generation activities. The introduction of appropriate technologies will save the cost for fuel, wastes can be recycled in the farm as organic input and will reduce the cost of manures purchased from the market. The livestock and fisheries will act as resources for generating supplementary income on a sustainable basis.

Social and Institutional Sustainability

Strengthened community based organisations will help in forming linkages with financial institutions, Panchayat and other stakeholders for accessing different schemes and services. The increased awareness among the community will help to choose the better adaptive options for their livelihood. Further ensuring that the capacity building is inclusive for men and women equally will lead to equal distribution of benefits from the project. These factors will impart social and institutional sustainability to the target communities and groups.

d) Analysis of the cost-effectiveness of the proposed project and weighting of the project activities:

Activity	Proposed Alternatives	Benefits
I-a,b,c	Without this project, the business as usual (BAU) scenario continues in farming with uncertainties associated with information generation and dissemination at farmer's level leading to haphazard decision making on farming. BAU scenario will be lack of capacities of the farmers is poor dissemination of information on innovations and technologies among farmers due to poor infrastructure for undertaking effective farm extension activities. This situation will lead to lack of early warning and continued reduction in production and productivity in the wake of climate variability, leading to heavy economic loss to the farmers.	• Project proposes to install AWS on a cluster basis and provide real time data to TSP for analysis, interpretation and dissemination back to the farming community. • Timely advice related to agriculture and other natural resource dependent livelihood will reduce chances of greater cash loss due to adverse weather and disaster. • Special attention to livestock and fishery sectors including aquaculture will also be provided. In particular, the documentation of adaptive traits in indigenous breeds, in the wake of climate change is the most useful step. Thus, cost associated with production loss, this investment will benefit the farmers in the long run.
II-a,b	Under the BAU scenario, reducing cycle of slash and burn with increasing climate variabilities will expose more and more land area to high intensity rainfall and cyclonic rains leading to high levels of soil erosion and increasing area under land degradation. Cultivation in slopes also continues, leading to soil erosion and loss or top-soil and soil fertility. Here the benefits associated with terracing and on-farm development planned under the project will outweigh the investment cost and will	• Farmers get higher production and productivity and cropping intensity is raised to 130%. • Encouraging improved agronomic practices for higher farm productivity, improved soil treatment, increased water holding capacity, judicious use of chemicals/ energy and enhanced soil carbon storage. This conserves soil moisture and fertility and facilitates modern

	substantially reduce the loss that the farmer as well as the land will incur.	cropping operations • The structure helps to reduce run-off or its velocity and to minimize soil erosion.
III-a,b	Under BAU scenario, there will be reduced water availability for critical irrigation during the critical growth stage of the crops. High runoff rates during monsoon will reduce the water storage as well as percolation rates and resultant reduction in the soil fertility, leading to overall reduction in crop productivity from the project areas. BAU might lead to a situation of brining water by irrigation channels or by pipes leading to flood irrigation which will be much more costly than the investments under rain water harvesting, restoration and renovation of existing water harvesting structures. Farm ponds are very effective for water conservation and providing life-saving irrigation (2 to 3 irrigation), tackle the problem of water availability in climate change scenario. The same would also help in reducing the top soil loss from the farmers' field and same can be reapplied in the field. In-situ water conservation measure is effective as compared to ground water harvesting structures (wells and bore-wells) and lined tanks. Farm pond construction is mainly manual one and very cost effective.	• To optimize utilization of water resources through efficient water management to expand coverage for achieving *'more crop per drop'*; • Drip irrigation will reduce the cost of production as labor for weed control and reduce water consumption. • Higher water table positively impacting water quality and decreasing soil pollution.
IV-a,b,c,d,e	Under BAU scenario, there will be increased use of external inputs (chemical fertilizers and pesticides) with very high dependence on natural resources (soil and water) and it's over exploitation. Jhumming for rice cultivation will continue unabated, degrading the land due to massive landslidesand erosion leaving the land barren and unfertile, hence increasing the area under land degradation. BAU scenario will also see steady decline in the production and productivity of major crops like Rice and Maize. Crop intensification for Paddy under SRI and DSR will lead to 30% increase in yield offsetting the input cost as	• Project proposes to demonstrate climate resilient technologies like micro-irrigation, soil fertility improvement, tolerant varieties, seed bank, nutritional security, livelihood diversification etc., as models. • To make agriculture more productive, sustainable, remunerative and climate resilient by promoting location specific Integrated/ Composite Farming Systems

	well as labor requirement per hectare. Improved cultivation packages as well as FFS will make the agri-extension system efficient thus, improving the standards of agriculture extension in the state. Therefore, environmental as well as social returns are much higher than the short term economic returns.	• Farmers get higher production and productivity
V-a	Under the BAU scenario famers will face heavy loss during planting, agronomic practices, harvest and post-harvest operations due to climate variabilities like shift in the onset of the monsoon, rainfall variability, hail storms etc. Farmers will not be able to do timely completion of agricultural operations under BAU scenario and individual farmer will not be in a position to afford adoption of farm mechanisation to save the crops. Thus, comparing to the economic loss associated with crop loss and damages, the investments under the custom hiring centres benefit groups of farmers is justified. Also this could generate income for the farmers groups in the long run by increasing the machinery and develop a revolving fund for maintenance.	• To make available various farm machinery / equipment to small and marginal farmers for timely agronomic practices and harvest and post-harvest operations. This will reduce in a cooperative manner, production and productivity loss associated with climate variabilities like shift in the onset of monsoon, untimely rainfall, hail storms etc. • To provide hiring services for various agricultural machinery/ implements applied for different operations. • To expand mechanized activities during cropping seasons in large areas especially in small and marginal holdings.

e) Weighting of Project Activities

Type of Activities	**List of Activities**	**Funding Requirement in crores**
Capacity Building Activities	Climate Change Modeling and Networking with Awareness and Capacity building	71,50,000
Investment Activities	Finalizing household level adaptation interventions	10,00,000
	Soil Conservation for improvement of soil and water regime in the hill area	3,38,00,000
	Water Harvesting and Management	2,75,00,000
	Enhancement of Crop Production & Productivity	2,77,00,000
	Farm Mechanization	28,50,000
	Man power	16,20,000

Project Management Activities	M&E cost	17,30,000
	Administrative cost of Agri deptt	10,00,000
	Overheads & administrative costs of E&F deptt	20,00,000
	Management fee of NABARD (3% of Project cost)	31,90,500
	Total	**10,95,40,500**

f) Alignment with the National and State Action Plans and other Policies / Programmes :

The project is closely linked to National Mission for Sustainable Agriculture (NMSA) and National Water Mission under NAPCC Mission. The key activities of soil, water conservation and management are well in line with the adaptation strategies suggested in the Mizoram SAPCC for the agriculture sector.Mizoram SAPCC also has kept high priority for development of new crop varieties including hybrid to increase the tolerance and suitability of plants to temperature, moisture and other relevant climatic conditions. Demand side management is also important component for conservation efficient use of inputs for the benefit of agriculture both for adaptation as well as mitigation. SAPCC identified activities in the site-specific adjustment in crop management as a key activity to sustain the production and productivity of Mizo agriculture in the wake of climate variability and change. The SAPCC also highlights "Jhum optimisation" through catchment area protection, soil conservation and management, which is well envisaged within this project. In addition, state also has envisaged high importance in the plan for regional climate modeling to identify future "tilting points" of rice production in a big way. Most of the activities identified havepotential for linkages with other centrally as well as state sponsored schemes of relevance for the state like RashtriyaKrishiVikasYojana (RKVY), NMSA activities, Water shed development programme for shifting cultivation regions, programme on SRIetc.

g) Component wise technical standards:

Activity	Applicable Standard	Application to project
I-a,b,c	Applicable standards prescribed by NMSA guidelines, Government of India	Recommendations of Ministry of Agriculture will be adopted as per NMSA guidelines
II-a,b	Applicable standards prescribed by the State Flagship Programme'New Land usePolicy (NLUP)' guidelines, Government of Mizoram. Cost norms for various treatment measures will be as per Standard Schedule of Rates (SSR) for rural water supply and sanitation	Recommendations of NLUP guidelines, Government of Mizoram. Cost norms for various treatment measures will be as per the SSR

III-a,b	Applicable standards prescribed by NMSA guidelines, Government of India	Recommendations of Ministry of Agriculture Department will be adopted as per NMSA guidelines
IV-a,b,c,d,e	Applicable standards prescribed by National Food Security Mission (NFSM) guidelines, Government of India	Applicable standards prescribed by NFSM guidelines, Government of India
V-a	Applicable standards prescribed by NFSM guidelines, Government of India	Applicable standards prescribed by NFSM guidelines, Government of India

h) Duplication Check

Project	**Objectives**	**Complementarity**	**Geographical Coverage/Agency**
Rain fed Area Development (RAD) under NMSA	To make agriculture more productive, sustainable, remunerative and climate resilient by promoting location specific Integrated/Composite Farming Systems;	Integrated Farming System and Value Addition Special attention to Horticulture, Livestock and Fishery sectors including dairy that have not received enough attention in climate change research in the past. In particular, the documentation of adaptive traits in indigenous breeds is the most useful step.	862 Ha in six districts of the state.

i) Details on Stake-holder consultation:

Sl No	Particulars	Date	Place	Stakeholders participated
1	Consultation with various stakeholders in Aizawl (Proposal was suggested under Agriculture chapter during the consultation when Mizoram SAPCC was being prepared)	20.10.2011	Aijal Club, City Centre, Aizawl, Mizoram	Dept. of Agriculture,Horticulture, Environment &Forest , Sericulture, AH & Veterinary Fishery, Block Administrative Office, Representatives from different banks, NABARD officials, Scientists etc. And individual farmer, group & cluster representatives and other representativesfrom NGOs(Minutes of the consultation is at**Annexure II**)
2	Consultation with stakeholders for the project *"Sustainable Agriculture Development through Expansion, Enhancement and Modelling"*. The meeting apprised the people about the various issues on climate change and its impacts especially in the agriculture sector. Participants deliberated and identified the various measures which can be taken up under climate change adaptation in the villages in Mizoram. The identified measures were agreed to be incorporated as far as possible within the project.	23.09.2015	Directorate of Agriculture, Aizawl Mizoram	Dept. of Agriculture, Dept. of Environment & Forest, Representatives of various Community based NGO's representing Women, Young adults, elders, churches etc, Village council members from the districts.

j) Learning and knowledge management component to capture and disseminate lessons learned for the proposed project.

The project will have a strong knowledge management system which would enable documentation and large scale dissemination of knowledge and lessons learned from the project to different stakeholders, including policy makers and planners. Based on the project learning, operational manual, policy briefs, audio visual materials, etc. will be developed for knowledge dissemination. Project will organize seminars, interactive workshops, exposure visits, etc. for cross learning and dissemination of information. The operational manual will be developed both in English and local language with illustrations so that it can be used as training instrument to train different stakeholders. Policy brief prepared as part of the knowledge management system will help policy makers to be sensitive to climate change adaptation in rainfed areas on watershed basis and help in mainstreaming such adaptation initiatives in natural resource management projects/programmes. This output will extend over the life time of the project and will highlight the impact of climate change on natural resources and agricultural development.

k) Sustainability of the project outcomes has been taken into account when designing the project.

Expected outcomes	**Expected concrete outputs**	**Sustainability mechanism**	**Responsible parties**
Improved climate resilient farming system and increased livelihood security	Farmers willing to adopt climate resilient technologies	**Environmental Sustainability**: Environment of the state will gain from this intervention due to several environmental protection measures for developing resilience and adaptation to climate variability. Soil health will improve through application of organic manure, which is a key input for maintaining plant nutrient. Carbon sequestration through agro-forestry models will have positive impact and sustainable source of eco-system service for the community. Water harvesting structures, percolation tanks, sunken ponds etc. will help not only to arrest run off and minimize water loss, but also will maintain the soil moisture regime and hence	DoA (Crop Husbandry and Research & Education) and DoE&F- Government of Mizoram

		reducing plant morbidity and mortality. Climate forecast data obtained by setting up AWS and crop advisory based on the weather data, will be integrated in the design parameters so that the watershed remains resilient in aggravated climate scenario.	
		Social & Institutional Sustainability: Project aims at building the institutional / organisational capacity to adapt to the climate change situation and ensures their involvement in different stages of implementation. Apart from this, there will be resource generation and management strategies that will help the institutions to grow in the longer run and sustain the process.	-do-
		Economic and Financial Sustainability: To make agriculture more productive, sustainable, remunerative and climate resilient. Farmers get higher production and cropping intensity. Encouraging improved agronomic practices for higher farm productivity, improved soil treatment, increased water holding capacity, enhanced soil carbon storage etc.	-do-

l) Provide an overview of the environmental and social impacts and risks identified as being relevant to the project.

Checklist of environmental and social principles	**Adherence of the Project to Environmental and Social Principles**	**Potential impacts and risks – further assessment and management required for compliance**

Compliance with the Law	The project complies with Environment (Protection) Act, 1986 and Forest Conservation Act, 1980. Further the project complies with state specificLocal governance; and other administrative orders of Sub national Government.	None
Access and Equity	• Project provides fair and equitable access to the project beneficiaries and will not be impeding access to any of the other requirements like health clean water, sanitation, energy, education, housing, safe and decent working conditions and land rights. • Proportion of benefits that will flow to each category of landholder will be determined in consultation with the State Level Committee	None
Marginalized and Vulnerable Groups	• Technical assessment and Baseline and Project Benefit Assessment include identification of impact on marginalized groups. • Project activities are so designed that marginal and landless would also derive benefits from the proposed projects.	None
Human Rights	The project does not foresee any violation of human rights	None
Gender Equity and Women's Empowerment	• Project would ensure participation by women fully and equitably, receive comparable socio-economic benefits. • The beneficiary related activities, e.g. training, exposure visits, will include women so as to enable them to develop their capacities and strengthen their skill base. • Village Level Committees (VLCs) will be formed which will have representation of women	None

	so that they also participate in the project related decision-making process	
Core Labour Rights	Payments to labor under the project will be made as per Government approved norms duly following minimum wage rate and hence ensuring core labor rights.	None
Involuntary Resettlement	The project does not displace any community and hence issue of resettlement does not arise	None
Protection of Natural Habitats	Project does not affect any of the natural habitats.	None
Conservation of Biological Diversity	Project would not cause any impact on bio-diversity values.	None
Climate Change	Project aims at enhancing the adaptive capacity of the rain-fed farming systems and livelihoods against adverse impact of climate change. Project additionally has a co-benefit on reducing the GHG produced through installing rain water harvesting structure, environmental friendly agricultural practices, which will contribute in mitigating the challenges of climate change.	None
Pollution Prevention andResource Efficiency	Project is not expected to create any environmentalpollution and aims for higher resources efficiency for better management of available natural resources like water, soil, plantation species (locally available), etc.	None
Public Health	No adverse impact on public health related issues isenvisaged.	None
Physical and Cultural Heritage	No adverse impact on cultural heritage related issues are identified.	None
Lands and Soil Conservation	Land treatment is envisaged to help in land and soil conservation and will not create any damage to land & soil resources	None

3.0 IMPLEMENTATION ARRANGEMENT

a) Describe the arrangements for project / programme implementation.

i. Who will implement the project and what are their comparative Advantages and capacity compared to other potential implementing institutions?

Project would be implemented on the ground by the Department of Agriculture (DoA), Govt. of Mizoram and coordinated by the Nodal department for Climate Change in the State i.e Department of Environment & Forest (DoE&F). The Nodal department would act as link between DoA and the MoEF&CC, Govt of India for disbursement of funds, Monitoring & Evaluation and submission of progress reports & any other communication.

The State Steering Committee on Climate Change (SCCC) headed by the Chief Secretary, Mizoram formulated during the preparation of SAPCC, would be responsible for regular supervision and monitoring of the project. DoE&F would act as liaison between the SCCC and DoA. SCCC will review the progress of the project through regular meetings conducted half yearly and would give its suggestions and directions, if necessary. Chief Secretary and other senior officials, being the member of the committee, will ensure cooperation from other departments whenever necessary and ensure adequate priority given to the implementation of the project by DoA and DoE&F.

This arrangement takes into account the relative strengths of the institutions involved and leverages those for effective implementation of the project. An agriculture based project is best implemented by the Agriculture department on the ground.

Since this is a Climate Change Adaptation project it is necessary that the coordinating and M&E role be played by the Nodal department for Climate Change (DoE&F), which can also provide its expertise from time to time and as required for steering of the project.

Main beneficiary of the project activities are farming community. Therefore, Village councils will also play a vital role under this project for the economicbetterment of people as well as greatersocial transformation. Village councils will be involved in the selection of beneficiaries for the project. The beneficiaries would be selected by involving the communities through PRA techniques to identify the most vulnerable households. The concurrence of the village councils on the list of identified beneficiary households would be mandatory before being submitted by the district officers to the head of the executing entity. It will also be ensured that women will also participate during the stakeholder consultationsfor planning the project activities.

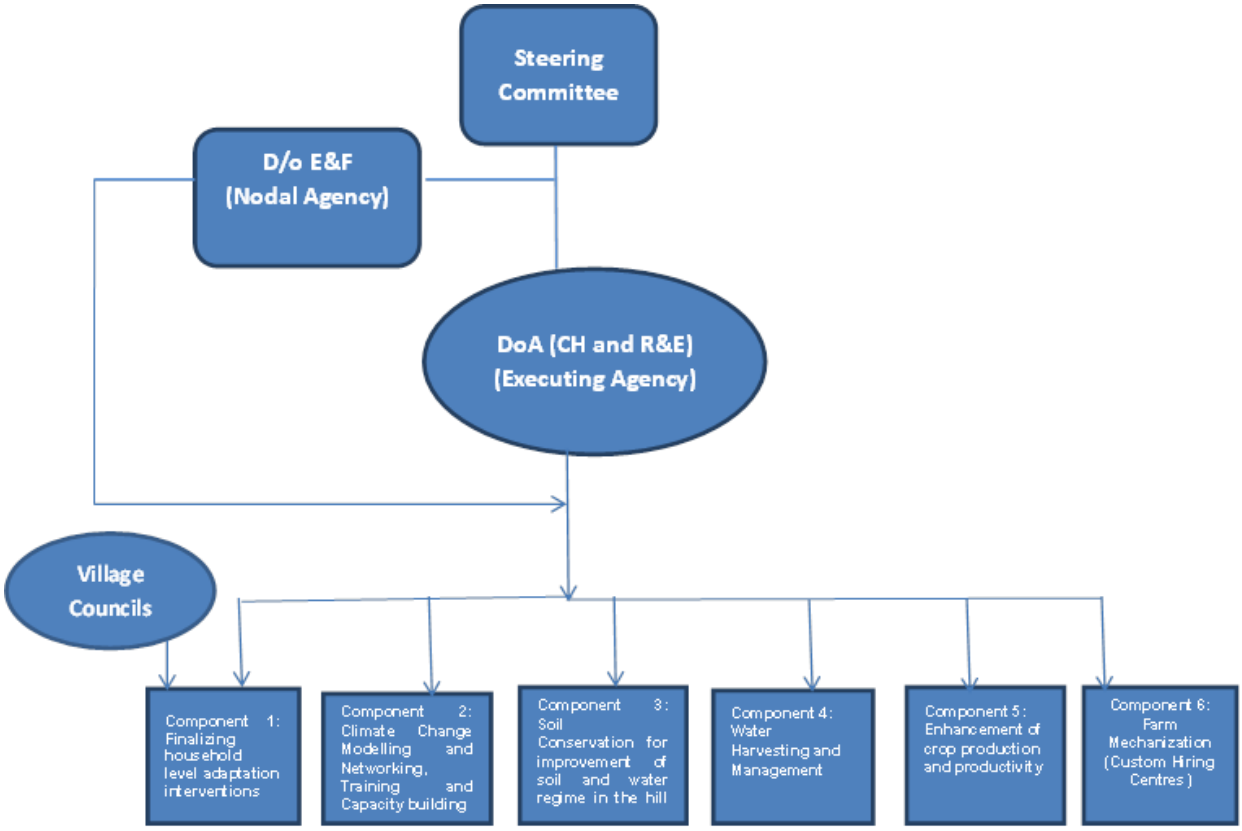

Fig: Implementation Plan

b) Describe the measures for financial and project / programme risk management (also include environmental and social risk, if any).

Risk	**Level (High/Medium/ Low)**	**Mitigation Measures**
Lack of adequate human capital and skills at implementation level	Low	Sensitization and capacity building at various levels of implementation
Adequacy of funding support to the suggested additional measures	Low	Expected funding from NAFCC would meet the requirement.
Unforeseen events that affect the crops like extreme weather that could not be forecasted.	Medium	Risk mapping within the project boundaries using the various climate scenarios to cover all contingencies.
Lack of coordination and consultation among the project partners	Low	Information and Knowledge management and periodic stakeholder interactions and feedback mechanism will ensure synchronization of views of key partners.
Implementation delays	Low	Intensive monitoring mechanism and mid-term evaluation missions are proposed to prevent any unnecessary delay

c) Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan. (Monitoring and evaluation cost need to be included in executing entity management cost).

The progress of activities will be monitored by the team members responsible for Monitoring and Evaluation (M&E) at DoE&F based on the agreed upon outputs, indicators and timelines. DoAwill submit a report to the M&E expert at DoE&F as per following schedule. M&E expert of DoE&Fwill prepare templates for reporting, compile the reports for different project components and submits the comprehensive report to SCCC and eventually to the MoEFCC. In case of any conflict or delay in the conducting the project activities, DoE&F will provide suggestions to DoA.

Monitoring and Evaluation Plan Activity	**Responsible Person**	**Cost (Cost in lakh)**				**Time Frame**
		Year –I	**Year-II**	**Year-III**	**Total**	
Project Inception Workshop	DoA in collaboration with DoE&F	2.00			2.00	3 months
Half-yearly report	DoE&F	.50	.50	.50	1.5	Oct every year
Annual report	DoE&F	2.00	2.00	2.00	6.00	End of year
Project review & monitoring Meeting	DoA	0.40	0.40	0.40	1.20	Quarterly
	SCCC, Mizoram	0.20	0.20	0.20	0.60	Half Yearly
End term evaluation	External Evaluator	--	--	6.00	6.00	End of Project Cycle
Total					**17.30**	

Impact evaluation report based on the indicators developed on the gender differentiated outcomes of the adaptation measures will be published and shared with the policy decision makers. This will also be widely disseminated among science, policy and civil society audiences.

d) Include a results framework for the project proposal, including milestones, targets and indicators with gender disaggregated data.

Result Framework document is at **Annexure-I**

e) Include a detailed budget with budget notes, a budget on the Implementing Entity management fee use and an explanation and a breakdown of the execution costs.
Financial requirement and other details of the project are as follows:

Activity wise budget

Sino.	ACTIVITY/MONTHS	Units	Unit cost (INR)	Total (INR)	Note	Institution responsible
1.	**Finalizing household level adaptation interventions: Baseline Households Survey, Finalization and communication of adaptation interventions for each target community and household**	**Detailed below**	**Detailed below**	**10,00,000**	**Detailed below**	**DoA**
1.1	Baseline Households Survey in Villages	150 nos.	5000	7,50,000	Farm Households in 150 villages will be surveyed	
1.2	Assessing vulnerability using survey data, climate change scenarios and identifying/ prioritizing adaptation	1 no.	2,00,000	2,00,000	Vulnerability analysis will be done for selected districts using all the data	
1.3	Travel and Survey cost	Lump sum figure based on number of field trips		50,000	Travel and other overhead costs	
2.	**Climate Change Modelling and Networking, Training & Capacity building, Awareness**	**Detailed below**	**Detailed below**	**71,50,000**	**Detailed below**	**DoA and DoE&F**
2.1	Developing and implementing the Information System for 'seasonal climate forecast' and 'weather based agro advisories'	4 nos.	9,66,000	38,64,000	4 AWS would be set up and networks would be developed for timely information	
2.2	Piloting the adaptation interventions based on climate change vulnerability and household survey	4 nos.	3,71,500	14,86,000	Adaptation interventions would be prioritized based on household survey	
2.3	Enhancing capacities of stakeholders for developing and	40 nos.	15,000	6,00,000	Capacity would be enhanced through	

Sino.	ACTIVITY/MONTHS	Units	Unit cost (INR)	Total (INR)	Note	Institution responsible
	implementing climate change adaptation strategies				10 workshops/ district	
2.4	Workshops- 1st Year, mid-term and final with partners and experts to review the project outcomes	3 nos.	4,00,000	12,00,000	3 workshops (Inception, mid-term and final)	
3.0	**Soil Conservation for improvement of soil and water regime in the hill area**	**Detailed below**	**Detailed below**	**3,38,00,000**	**Detailed below**	**DoA**
3.1	Construction of Hill Slope Terrace for soil and moisture in cultivation of crops	100 hectare	Rs. 1.38 lakh/hectare	1,38,00,000	Hill Slope Terrace would be constructed covering area of 100 hectare @ Rs. 1.38 lakh/hectare	
3.2	On farm development: Land levelling, bundling, reshaping etc.	5000 hectare	Rs. 4000/hectare	2,00,00,000	Farm development activities would be done at an area of 5000 hectare @ Rs. 4000/hectare	
4.0	**Water Harvesting and Management**	**Detailed below**	**Detailed below**	**2,75,00,000**	**Detailed below**	**DoA**
4.1	Rain water harvesting tank/pond	170 nos.	10000	1,70,00,000	Rain Water Harvesting Tank/Ponds (15X15X1.5mtr) with a capacity of 3.3 lakhs ltr	
4.2	Restoration and renovation of tank	700 nos.	15000	1,05,00,000	Restoration and Renovation of Tanks @ Rs.15,000/No	
5.0	**Enhancement of Crop Production & Productivity : Mainstreaming innovative agricultural best practices related to climate change adaptation in strategies/ policies/ projects**	**Detailed below**	**Detailed below**	**2,77,00,000**	**Detailed below**	**DOA**

Sino.	ACTIVITY/MONTHS	Units	Unit cost (INR)	Total (INR)	Note	Institution responsible
5.1	System of Rice Intensification	500 hectare	7500	37,50,000	System of Rice Intensification @ Rs.7500/ per ha	
5.2	Directed seeded rice cultivation	500 hectare	7500	37,50,000	Directed seeded rice cultivation @ Rs.7500/ per ha	
5.3	Improved cultivation on hill slope	3000 hectare	4000	1,20,00,000	Improved cultivation on hill slope @ Rs 4000/- per ha	
5.4	Farmers' Field School	400hectare	14000	56,00,000	Farmers' Field School@ Rs.14,000/-	
5.5	Adoption of Integrated Pest Management for improving crop yields. Preparedness to tackle pests and disease outbreak and capacity building	2600 hectare	1000	26,00,000	Integrated Pest Management practices would be adopted at cost of Rs. 1000/hectare	
6.0	**Farm Mechanization**	**Detailed below**	**Detailed below**	**28,50,000**	**Detailed below**	**DOA**
6.1	Custom Hiring Centre	3 nos.	9,50,000	28,50,000	Custom Hiring Centre @ Rs.9.50 lakh/station	
7.0	**TOTAL components cost**	**--**	**--**	**10,00,00,000**		
8.0	**Project management cost of executing entity**	--	--	**63,50,000**		**DoA&DoE&F**
8.1	Monitoring & Evaluation	--	--	17,30,000		**DoE&F**
8.2	Administrative costs of **Agriculture Deptt**	--	--	10,00,000	1% of 7.0	**DoA**
8.3	Overheads & Administrative costs of Nodal Deptt	--	--	20,00,000	2% of 7.0	**DoE&F**
8.4	Man power	3 nos.	15000/month	16,20,000	3 Project Assistants @ Rs. 15,000 per person per month	DoA&DoE&F
9.0	**Total Project cost**	**--**	**--**	**10,63,50,000**		
10.0	**Management fee of NABARD**	**--**	**--**	**31,90,500**	**3 % of the total project cost (9.0)**	**NABARD**

Sino.	ACTIVITY/MONTHS	Units	Unit cost (INR)	Total (INR)	Note	Institution responsible
	GRAND TOTAL			**10,95,40,500**		

f) Include a disbursement schedule with time-bound milestones at the component level

S. No.	ACTIVITY	Year 1				Year 2				Year 3			
		3	6	9	12	3	6	9	12	3	6	9	12
1.	Finalizing household level adaptation interventions: Baseline Households Survey, finalization and communication of adaptation interventions for each target community and household												
2.	Climate Change Modelling and Networking, Training & Capacity building, Awareness												
3.	Soil Conservation for improvement of soil and water regime in the hill area												
4	Water Harvesting and Management												
5	Enhancement of Crop Production & Productivity												
6	Farm Mechanization												

Fund release:

i. 50% of the approved projects may be released as 1st Instalment and Release of second and final Instalment will depends upon the fulfilment of the following condition
ii. 100% Utilization of funds of the first instalment released and submission of Utilization Certificate.
iii. Expenditure of 60% funds released in first instalment during the current year.
iv. Submission of performance report in terms of physical and financial achievements as well as outcomes on quarterly basis.

Annexure –I

Result Framework

Output/Outcome	Indicator	Baseline	Target	Source of Verification	Risk and Assumption
Component 1: Finalizing household level adaptation interventions					
Outcome 1: Finalization of adaptation strategies suitable to the target locations and farm household typologies	Climate Change adaptation activities are successfully shortlisted for implementation	M/o Agriculture is implementing climate change adaptation activities under NMSA based on area's vulnerability	4 villages will have list of activities prioritized for implementation	Surveys and interviews Progress report	Assumption: Farmers cooperate during the survey and willing to implement activities in their farms
Component-2: Climate Change Modeling Networking and Capacity building and Awareness					
Outcome 2: Reduced climate change vulnerability with improved risk mitigation measures	10,000 Farmers benefitted from crop weather advisories	Crop weather advisories not available	10,000 nos. of farmers covered with crop-weather advisories	Progress report Surveys and interviews	Assumption: Advisories are disseminated on time Risk: Generation of weather data on real time basis
Output 2.1: Installation of AWS and generation of agro-advisories	• Installation of AWS 4 numbers in four districts (1 AWS per district) • Farmers covered with crop weather advisories	Crop weather advisories on real time basis not available	4 no. of AWS installed 10,000 nos. of farmers covered with crop-weather advisories	Progress report Surveys and interviews	Assumption:AWS are installed, maintained, data generated and disseminated after proper analysis by involving experts

Outcome 2.3: Community and other stakeholders benefitted from training/capacity building/exposure programmes	Number of sensitization/awareness camps/capacity building programmes/exposure visits	No awareness sensitization programmes conducted	40 Sensitationprogrammes/ training/exposure visits conducted for creating better awareness among stakeholders	Progress report Reports/ Documents /Photos	Assumption: Resource persons available locally Risk: Inadequate participation of farmers
Component-3: Soil Conservation for improvement of soil and water regime in the hill area					
Outcome 3: Soil regime improved on account of soil & water conservation measures	Area covered with various soil and water conservation measures	High degree of soil erosion and poor interception of run-off water	At least 30% farmers living in the project villages directly benefited from soil and water conservation measures	Progress Report	Assumption:Department takes active interest in project execution Risk: Availability of the labor during the working season due to competition
Output 3.1: Soil erosion reduced and in-situ moisture conservation improved through construction of field/stone/contour bund	Area covered under field/stone/contour bunds	Soil conservation measures at a small scale being implemented	Terrace= 100 Ha In Situ moisture conservation =5000 ha	Progress Report	Assumption:Department takes active interest in project execution
Component-4: Water Harvesting and Management					

Outcome-4: Water availability increase and crop productivity enhanced	Livelihood vulnerability of farmers reduced through increased water availability	Farmers are vulnerable due to poor water regime and crop productivity.	At least 60% farmers living in the project villages directly benefited from reduced vulnerability to climate change related impacts	• Measurement Book • Micro plans prepared by the VWCs • Progress Report	Assumption: VWC takes active interest in project execution Risk:Non- availability of the labor during the working
Output 4.1: Increased water availability through farm pond, sunken pond and well recharge pit	Number/quantity of farm ponds/sunken pond constructed	Less number of water harvesting structures and poor water availability	170 nos. of farm ponds	Progress report	Assumption: Farm pond and other WHS are constructed as per approved design
Component-5: Enhancement of Crop Production & Productivity: Mainstreaming innovative agricultural best practices related to climate change adaptation in strategies/policies/projects like SRI, Improved Jhum, Direct Seeded Rice cultivation					
Outcome-5: Improved climate resilient farming system and increased livelihood security	Number of farmers adapted climate resilient farming system	Farmers are not following climate resilient farming systems	At least 50% farmers adopt climate resilient farming system	Progress report Surveys and interviews	Assumption: Farmers willing to adopt climate resilient technologies Risk: Lack of capacity and resources for adoption
Output 5.1: Improved resilience through adoption of climate	Introduction of new crop varieties	Introduction of new crop varieties is not practised.	20% increase in crop productivity	Progress report	Assumption: Farmers willing to adopt climate resilient technologies

resilient farming/ livelihood systems					Risk: Lack of capacity and resources for adoption
	Introduction of new cultivation methods	Old cultivation methods	Farmers are practicing new cultivation method	Progress report	Assumption: Farmers willing to adopt climate resilient technologies Risk: Lack of capacity and resources for adoption
	Trainings and skill development	No training and skill development	10,000 farmers would be trained	Progress report	Assumption: Farmers willing to adopt climate resilient technologies Risk: Lack of capacity and resources for adoption
Component – 6: Farm Mechanization (Custom Hiring Centers-CHCs)					
Outcome 6: To make available various farm machinery / equipment to small and marginal farmers **Output 6.1:** To expand mechanized activities during cropping seasons in large areas especially	CHCs are unit comprising a set of farm machinery, implement and equipment meant for custom hiring by farmers. Though certain implement and equipment are crop specific, the traction units like tractors, power tillers etc., and self-propelled machinery like	Agriculture is undergoing a gradual shift from dependence on human power and animal power to mechanical power because increasing cost for upkeep of animal and growing scarcity of human labor.	3 CHCs in 3 districts of Mizoram	• Progress report • Study report/water budget plan	Assumption:Though institutions like Primary Agricultural Credit Societies, Multipurpose Societies, Marketing Societies etc., and line departments have machinery for custom hiring, a vast area still remains uncovered. Informal hiring systems

in small and marginal holdings	combine harvesters etc., are used in common.				are also prevalent in rural areas. However, timely availability is not assured. Therefore there is a need to encourage individuals like progressive farmers, rural unemployed youth, agri graduates etc., and also village level institutions like Water Users Association, Watershed Committee, SHG Federations etc., to set up CHCs.

Annexure II

MINUTES OF STAKEHOLDER CONSULTATION PROGRAMME ON MIZORAM CLIMATE CHANGE ACTION PLAN

Date : 20th October, 2011; Venue : Aijal Club, City Centre, Aizawl, Mizoram, Members Present : 43 Nos.

The meeting started at 10:00 a.m. with a warm welcome address given by Dr.Vanlalzara, Principal Scientific Officer, Directorate of Science & Technology, Mizoram. He then presented a brief overview of the workshop through power point presentation whereby he mentioned that in line with the National Plan on Climate Change released on June 30, 2008, the Mizoram Council of Climate Change was constituted on 17th June 2010 under the Chairmanship of the Hon'ble Chief Minister and that the Executive Council was also created under the chairmanship of the Chief Secretary. He apprised the members that the initiative for preparation of State Action Plan on Climate Change in Mizoram is executed by the Department of Science & Technology with financial support from MoEF-GIZ partnership programme and that CTRAN Consulting, based in Bhubhaneshwar, Orissa is the knowledge partner.

The inaugural address was given by Shri Lalkhama, IAS (Rtd.) and Vice Chairman, State Planning Board. In his speech, he mentioned that the modern day scientists and intellectuals should be more concerned about the influence on climate by humans, and the manner how the land and its resources are used or misused. Under the New Land Use Policy adopted by the State Government, it is intended to keep a large percentage of the state land area under rain forests, and progressively reduce areas under jhum cultivation which is now around 2 lakhs acres annually. He anticipated that the consultation workshop will help in adopting suitable action plan to preserve the natural rhythm of life in the natural environment of cycles of oxygen and other chemical elements in this mysterious universe.

After this, Dr.Vanlalzara extended his appreciation and gratitude to the members attending the workshop who spare their valuable time to share their views and experiences for the success of the workshop. The technical session of the workshop was divided into three main subjects viz.

Technical Session-1 : Agriculture & Allied, Forestry; Technical

Session-2 : Energy, Health;

Technical Session-3 : Strategic Knowledge Mission, Water, Urban.

The Coordinators for each Technical Sessions were:
Technical Session-1 : Mr. T.V. Fambawl, Secretary, Agriculture Department

Technical Session-2 :Er. Dunglena, Engineer-in-Chief (Rtd.)

Technical Session-3 :Er. Valbuanga, Project Director, SIPMIU

The views and feedback shared by the members in the various technical sessions/ subjects are as below:

1) Sector-Sustainable Agriculture :-

i) No data on allocation of human work force in different agriculture & allied activities based on their demand and availability of workforce and also willingness. (Mr. Arulrajan (IFS), E&F Department)

ii) Type and systems of agriculture practices and their compatibility with each other activities. (Mr. Arulrajan, IFS, E&F Department)

iii) Inclusion of more research works in development of traditional indigenous rice varieties e.g. Phulbuh which have been found to acclimatized climate change by retaining beneficial genes and enhancing the yield, if possible. Promotion of fodder for animals through agro-forestry models is also suggested. (Mr. Lalduhthlana, ACF, E&F Department)

iv) Rice genotype (local species) should be propagated and utilized for effective cultivation. (Mr. Vanramliana, Dept. of Zoology, PUC).

v) Concentrate on paddy and orange only (Mr. Vanramliana, Dept. of Zoology, PUC).

vi) Social history claims that after 20 years of NLUP and MIP, people find it difficult to abandon jhum. So, instead of the current 1-2 years cycle, 7-10 years cycle system may be introduced with modified traditional system. (Mr. Vanramliana, Dept. of Zoology, PUC).

vii) No more exotic species. (Mr. Vanramliana, Dept. of Zoology, PUC).

viii) Shifting cultivation/jhuming is the most primitive method of agriculture and therefore should be replaced by sett led agriculture in any forms. While selecting the agriculture/utmost care should be taken: it should be in conformity with agro-climatic conditions, soil and geomorphic characteristics of the area/agricultural land. (Dr. P. Rinawma, Geography & natural Resources Management, Mizoram University) (Also Professor & Dean, School of earth Sciences and Natural resources Management).

ix) Shifting cultivation should not be stopped completely. It has an important place in the culture and way of life of the rural people. (Dr. John ZothanzamaSailo, Environmental Science Department, Mizoram University) (Also, Member, Mizoram Post Graduate Science Society)

x) Research on the alternative plans should be done before implementation in place of jhum cultivation. (Dr. John ZothanzamaSailo, Environmental Science Department, Mizoram University) (Also, Member, Mizoram Post Graduate Science Society)

xi) Quite sufficient, shifting cultivation system may not be abandoned, so instead if this system can be improved and scientific input may be incorporated to a cultivated area as a pilot project. (Dr.Lalnundanga, Dept. of Forestry, Mizoram University).

xii) The proposed strategies of agriculture and allied Departments for Climate Change mitigation and adaptati on need more specific strategies. I feel that area-wise specific technologies/models needs to be identified and adopted for uphill and slope lands which consists of more than 80% of landscape in Mizoram. (Dr. F. Lalnunmawia, Dept. of Forestry, Mizoram University) (Also, Member, Mizoram Post Graduate Science Society)

xiii) If the low-lying areas called plains are well irrigated so as to be able to yield double cropping in a year, sustainable agriculture may be achieved, so as to lessen the slash and burn type of cultivation practice elsewhere in the state. (Er. H. Lalsawmliana, Science & Technology)

xiv) Emphasis may be put on organic farming. (Dr. Ramachandra Laha, Dept. Of Botany, Mizoram University)

xv) Control of shifting cultivation by converting the jhum land for permanent cultivation. Jhum land can be used for fodder cultivation, NWFP cultivation. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)
xvi) Rainfall predictive models should be developed based on the analysis of past climate data in order to adopt alternative agricultural practices for the sustainable development. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

xvii) Agricultural practices should be concentrated along the fertile river valleys and valley plains as the terrain is purely sedimentary and can yield good quantities of water from uplands. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

2) Sector-Sustainable Forestry :-
i) Inter-Departmental co-ordination is needed. (Mr. Arulrajan (IFS), E&F Department)

ii) Awareness on policy and programme of environmental concern should be given to all people and department because people (all) are part of ecosystem. (Mr. Arulrajan (IFS), E&F Department)

iii) De-reservation must be revised. If unavoidable EIA should be done and 1-2 riverine areas may be identified and serve as experiment for at least 10 years. (Mr. Vanramliana, Dept. of Zoology, PUC).

iv) Education and awareness to the public may be conducted with educational institutions. (Mr. Vanramliana, Dept. of Zoology, PUC).

v) The forest policy of Mizoram needs certain amendment in regard to riverine forest, village safety forest etc. The good land i.e. arable land may be given for agricultural activities and the unfavourable land may be devoted for forest cover and for development of recreational centres. (Dr. P. Rinawma, Geography & natural Resources Management, Mizoram University) (Also Professor & Dean, School of earth Sciences and Natural resources Management).

vi) Mitigation measures should be more (Dr. John ZothanzamaSailo, Environmental Science Department, Mizoram University) (Also, Member, Mizoram Post Graduate Science Society)

vii) Agroforestry may be added. (Dr.Lalnundanga, Dept. of Forestry, Mizoram University).

viii) Incentives and support needs to be given for establishment and maintenance of social forestry. (Dr. F. Lalnunmawia, Dept. of Forestry, Mizoram University).

ix) Bamboo and tree based agro-forestry systems needs to be introduced in degraded lands. (Dr. F. Lalnunmawia, Dept. of Forestry, Mizoram University).

x) Environment & Forest Department may co-ordinate with agriculture and allied Departments for introducing agro-forestry system in slope-lands. (Dr. F. Lalnunmawia, Dept. of Forestry, Mizoram University) (Member, MIPOGRASS)

xi) Serious steps should be taken in preventing forest fires and allied destruction. No land in our state is totally or permanently a wasteland, they can be regenerated within 5 years or so. Use of LPG may also be in introduced to preserve the forest. (Er. H. Lalsawmliana, Science & Technology)

xii) The Government of Mizoram may come up with a kind of legislation to improve ‘Greenery’ by making it compulsory for every citizen of the state to ‘plant & nurture’ a tree - in line with Kenya Government. (Dr. U.K. Sahoo, Dept. Of Forestry, Mizoram University).

xiii) Urban Forestry may be promoted & given priority. (Dr. U.K. Sahoo, Dept. Of Forestry, Mizoram University).

xiv) Need for ‘Trees outside forests’ be kept in mind while making developmental projects; quantificati on of TOFs may be undertaken. (Dr. U.K. Sahoo, Dept. Of Forestry, Mizoram University).

xv) Farmers practicing ‘Homegardens’ may be evaluated for ‘carbon credits’ and incentives may be arranged suitably to promote these indigenous home gardens/ agroforestry. (Dr. U.K. Sahoo, Dept. of Forestry, Mizoram University).

xvi) Livelihood improvement activity for forest dependent communities. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

xvii) Riverine forests (reserve) to be protected as it is rich with bamboo. Bamboos are good plant for carbon sequestration. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

xviii) Massive afforestation programmes should be implemented at higher elevations and steeply sloping areas as it checks/prevents soil erosion and also keeps the water-table at higher levels. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

xix) Plantation programmes should be implemented within urbanized areas as they act as carbon sinks. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

3) Sector-Energy:-

i) Non-conventional energy (biomass gasificati on) should be made available to all remote locations where power grids are not possible. (Mr. Arulrajan (IFS), E&F Department)

ii) Instead of efficiency, availability should be ensured. (Mr. Arulrajan (IFS), E&F Department)

iii) Self-reliance is better than feeding from outside. (Mr. Arulrajan (IFS), E&F Department)

iv) Mention is made that about 20 villages are not yet electrified. This has to be taken care of to ensure that all those villages are electrified. (Mr. Lalduhthlana, ACF, E&F Department)

v) The objective to create power plants in all major rivers should be abandoned. Large projects like Kolodyne may be completed first before small projects. (Mr. Vanramliana, Dept. of Zoology, PUC).

vi) If all major rivers are converted to HEP it will affect rainfall, agriculture etc. (Mr. Vanramliana, Dept. of Zoology, PUC).

vii) Distribution and installation of efficient CFL bulbs to BPL families. (Mr. Vanramliana, Dept. of Zoology, PUC).

viii) Hydel power plant may be given priority for power generation. In that, so many small/minor hydel project plant should be minimized, rather one river valley hydel

project plant which can meet the energy requirement of the state may be completed so that environment system as a whole may not be disturb. (Dr. P.
Rinawma, Geography & natural Resources Management, Mizoram University) (Also Professor & Dean, School of earth Sciences and Natural resources Management).

ix) Hydro power and solar energy generation is a must. Mini hydropower plants at many places will have an impact on local ecosystem and many life forms that adds to the rich biodiversity of the state. (Dr. John ZothanzamaSailo, Environmental Science Department, Mizoram University) (Also, Member, Mizoram Post Graduate Science Society)

x) More developmental approach needed. (Dr.Lalnundanga,, Dept. of Forestry, Mizoram University).

xi) Energy sector needs to be touched up. There is no write-up on how the proposal will be affecting the climate change. (Mrs. Lalhmingliani Hmar, EE, P&E Department).

xii) Major stress/thrust towards adopting renewable energy sources like solar energy/ wind energy etc. (Er. N.L. Jaisi, Assistant Engineer-Investigation, PHED)
xiii) There has to be a limitation in setting up/construction of hydro-electricity project in Mizoram. (Dr. F. Lalnunmawia, Dept. of Forestry, Mizoram University) (Also, Member Mizoram Post Graduate Science Society) (Member, MIPOGRASS)

xiv) Production and sell of power energy at the cost of forest biodiversity and the affected communities may not be recommended. (Dr. F. Lalnunmawia, Dept. Of Forestry, Mizoram University) (Also, Member, Mizoram Post Graduate Science Society)

xv) Concerned departments should take utmost interest in producing related energy, whether it is electrical energy, heat energy, so and so forth. Public are still ignorant and lack awareness of our burning topic. They need to be made aware. (Er. H. Lalsawmliana, Science & Technology)

xvi) Southern and eastern rivers of the state to be used for harnessing hydro-potential energy for the entire state. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

xvii) At village level (rural region) solar energy and biogas energy to be encouraged and implemented by the Government. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

xviii) Energy and its management as curriculum to be studied at school and college level. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

xix) Solar water heaters should be produced on subsidized rate in order to save energy. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

xx) Awareness programmes should be conducted to save energy as energy saved is energy produced. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

xxi) As Mizoram is rich in coal reserves to some extent minor thermal power generation stations can be established within the limits of low carbon emissions. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

xxii) Hydel projects should be developed to meet our immediate needs. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

4) Sector-Health:-

i) Climate change increases the risk of malaria and to suppress malaria we are relying on DDT. In developed countries, use of DDT has been banned or restricted due to its adverse impacts on environment. Can we incorporate in our plan to conduct research on impacts of DDT applications on natural environment.(Mr. Lalduhthlana, ACF, E&F Department).

ii) The whole process of malaria control measure must be revised. (Mr. Vanramliana, Dept. of Zoology, PUC).

iii) Rural health management system should be developed. (Mr. Vanramliana, Dept. Of Zoology, PUC).

iv) Biotechnology Research Centre may be established. (Mr. Vanramliana, Dept. Of Zoology, PUC).

v) Regarding health, it is to be noted that Global warming resulted into various diseases like skin cancer, skin diseases and even blindness. Climate change can cause many more and therefore we should take care of all these factors which can add carbon emissions. (Dr. P. Rinawma, Geography & natural Resources Management, Mizoram University) (Also Professor & Dean, School of earth Sciences and Natural resources Management).

vi) Health seems to be irrelevant to be included in the action plan for Climate Change. If at all it is included certain data(s) needs to be changed as pointed out at the discussions relating to malaria. (Mrs. Lalhmingliani Hmar, EE, P&E Department).
vii) Study and documentation of diseases caused by water and insect borne vestors at different regions of the state. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

viii) Poverty, malnutrition due to poverty & extreme climate change. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

ix) Rapid urbanization has great effect on health rather than climate change which is mostly due to pollution. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

5) Sector - Sustainable Habitat :-

i) Recycling plant of paper and rubber/plastic should be proposed. (Mr. Vanramliana, Dept. of Zoology, PUC).

ii) Creation of eco-friendly roads (Plastic waste & tar). (Mr. Vanramliana, Dept. Of Zoology, PUC).

iii) Promotion of solar water heating system and lighting of buildings should be done by having a separate ECBC which should match with the socio-economic status of the state. Inclusion in the building bye-law is not practical seeing the socio-economic status of the population. (Mrs. Lalhmingliani Hmar, EE, P&E Department).

iv) Planning infrastructure like road, drainage, energy, transportation, vehicular pollution, check population rise in all the urban areas, rural areas of the state including the city Aizawl. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

6) Sector – Water :-

i) Water resources availability is very much related to how we use our land resources as well as forest resources. Water management should be incorporated with proper planning. (Dr. P. Rinawma, Geography & natural Resources Management, Mizoram University) (Also Professor & Dean, School of earth Sciences and Natural resources Management).

ii) As our water resources get more and more depleted then our infrastructure itself will not be able to provide adequate water to the public. Hence we have to go in for large water storage projects where conjunctive use of water is possible i.e. power generation, irrigation needs and water supply needs. (Er. N.L. Jaisi, Assistant Engineer-Investigation, PHED)

iii) Meteorological and hydrological data useful for management of water resources of the state. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

iv) Study on the hydrological cycle of different rivers (Dr. Ramachandra Laha, Dept. Of Botany, Mizoram University)

v) Water harvesting system to be developed in urban and rural centres. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

vi) Check dams to be constructed which can be used for domestic, cultivation, fisherry and allied. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)
vii) Proper measures should be taken to explore ground water in addition to utilization of rainwater and river water. Rain water harvesting reservoirs should be made at each locality. (Dr. Ch. UdayaBhaskara Rao, Geography and Resource Management, Mizoram University).

7) Sector – Strategic Knowledge Mission :-

i) It is highly advisable that a definite goal in terms of CO2 emissions, methane emissions, be made in terms of figures/numbers. This would serve as a steering force for the smooth execution of the draft plans. (Dr. John ZothanzamaSailo, Environmental Science Department, Mizoram University) (Member, MIPOGRASS)

ii) Knowledge mission to be used for all people. (Dr. Ramachandra Laha, Dept. Of Botany, Mizoram University)

iii) Inventory of entire profile of GHG of the state to be developed. (Dr. Ramachandra Laha, Dept. of Botany, Mizoram University)

iv) Technological design to meet the local need. (Dr. Ramachandra Laha, Dept. Of Botany, Mizoram University)

After a long day of lively discussion coupled with several presentations from different concerned Departments, the meeting was ended with a brief wrap up from Dr.Vanlalzara, Principal Scientific Officer, Department of Science & Technology. He once again expressed his gratitude to all the members present for their kind presence and contribution, and at the same time invited them for further cooperation in future towards the success of Climate Change Action Plan in Mizoram.

(Dr. VANLALZARA)
Principal Scientific Officer,
Dept. Of Science & Technology

LIST OF MEMBERS PRESENT ON MIZORAM CLIMATE CHANGE ACTION PLAN STAKEHOLDER CONSULTATION WORKSHOP AT AIJAL CLUB, CITY CENTRE, AIZAWL ON 20TH OCT., 2011

1. Arulrajan, IFS, Dept. of Environment & Forest, Govt. of Mizoram
2. Lalduhthlana, ACF (P), Dept. of Dept. of Environment & Forest, Govt. of Mizoram
3. Dr. Ramachandra Laha, Head, Dept. of Botany Mizoram University
4. Dr.UdayaBhaskara Rao, Assistant Professor Dept. of Geography & Resource Management, MZU

5. Dr. P. Rinawma, Dean, School of Earth Sciences & N.R.M., MZU
6. Dr. U.K. Sahoo, Dept. of Forestry Mizoram University
7. Vanramliana, Dept. of Zoology, Pachhunga University College
8. YograjChhetri, Principal Adviser, Planning Department
9. Dr. F. Lalnunmawia, Dept. of Forestry, Mizoram University Member, Mizo Post Graduate Science Society (MIPOGRASS)
10. Lalhmingliani Hmar, EE, P&E Dept., Govt. of Mizoram
11. N.L. Jaisi, AE (I) PHE., Govt. of Mizoram
12. Dunglena, Consultant, Engineer-in-Chief (Rtd.)
13. LalnunsiamaColney, Exe. Committee Member Mizoram Science Society
14. Dr. R.K. Lallianthanga, Project Director, Mizoram Remote Sensing Application Centre (MIRSAC)
15. Edward Lalzuithanga, Scientist, MIRSAC
16. Dr.Ramfangzauva, Joint Director Health & Family Welfare Dept. Mizoram
17. K. Lalrammuana, Exe. Committee Member Mizoram Science Society
18. Samuel Lalmalsawma, Exe. Committee Member Mizoram Science Society
19. K. Guite, Chief Engineer Power Department
20. David C. Zahmuaka, Director, ZEDA
21. T. Thangzagin, S.E. P&E, Govt. of Mizoram
22. Dr.Thangzadinga VD (VE) AH&Vety Department
23. Saihlira, Adviser, Planning Department
24. Dr. H. Saithantluanga, Dy. Director (P) Agriculture Department
25. Lalnunmawii, IPRO, Directorate of Information & Public Relation
26. Dr. David Sailo, Dy. Director AH &Vety
27. C. Lalduhawma, Gen. Secretary, Mizoram Science Society
28. Valbuanga, Project Director SIPMIU
29. Lalnundanga, Dept. of Forestry MZU
30. Dr. A.C. Shukla, Associate Professor Horti culture & MAPs Mizoram University
31. Awadhesh Kumar Research Scholar Mizoram University
32. Dr. John ZothanzamaSailo, Asst. Professor, MZU & Member, Mizo Post Graduate Science Society (MIPOGRASS)
33. T.V. Fambawl, Secretary, Agriculture, Govt. of Mizoram
34. Vanlalremruati, Scientist, MIRSAC
35. Rosy Lalremruati, Scientist, MIRSAC
36. C. Lalzawngliana, Asst. Scientist, MIRSAC
37. F. Lalramchuana, Scientific Officer MIRSAC
38. H. Lalsawmliana, Scientific Officer, Dept. of Science & Technology
39. Lalnuntluangi, Senior H.O.Dept. of Science & Technology
40. LalmuanpuiiSailo, Senior H.O. Dept. of Science & Technology
41. L.H. Lalnunpuia, Scientist MIRSAC
42. F. Lalthenlova, Dept. of Science & Technology
43. Lalrothanga, Director, CCDU PHED.