

## **DETAILED PROJECT REPORT**

# **Resilient Agricultural Households through Adaptation to Climate Change in Mahbubnagar district, Telangana**

Submitted by:  
Environment Protection Training and Research Institute (EPTRI)  
Government of Telangana

Technical support:  
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For

**NATIONAL ADAPTATION FUND FOR CLIMATE CHANGE (NAFCC)**

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## PROJECT SUMMARY

Title of Project/Programme:	Resilient Agricultural Households through Adaptation to Climate Change in Mahbubnagar district, Telangana
Project/Programme Objective/s:	To enhance the livelihoods (income and nutrition) of the farming community in targeted villages of Mahbubnagar district, Telangana through implementing climate resilient agricultural interventions
Project/ Programme Sector:	Agriculture
Name of Executing Entity/ies/Department:	Environment Protection Training and Research Institute (EPTRI), Government of Telangana, Gachibowli, Hyderabad
Beneficiaries:	Farming community of Mahbubnagar district, Telangana state (30% to 50% of the overall beneficiary under the project would be <b>women</b> )
Project Duration: Start Date: End Date:	4 years 1 <sup>st</sup> March, 2016 (tentative) 29 <sup>th</sup> February, 2020 (tentative)
Amount of Financing Requested (Rs.):	<b>24,99,12,474</b>
<u>Project Location</u> State: District:	Telangana Mahbubnagar
Contact Details of Nodal Officer of the Executing Entity/ies/ Email: Mobile:	Shri B. Kalyan Chakravarthy, IAS, Director General, Environment Protection Training & Research Institute, Government of Telangana, 91/4, Gachibowli, Hyderabad - 500 032 Tel (O) +91 40 23180104 Fax (O): +91 40 23180135 Mobile: +91 9133331456 Email: dgeptri@gmail.com

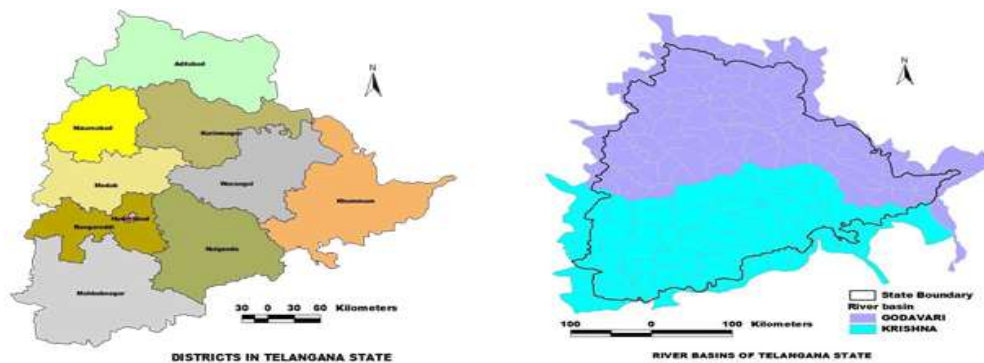
## 1. PROJECT BACKGROUND

### 1.1 Project/ Programme Background and Context:

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

Climate variability has been, and continues to be the principal source of fluctuations in global food production in the arid and semi-arid tropical countries of the developing world. Favourable weather is essential for good harvests. Weather abnormalities like cyclones, droughts, hailstorms, frost, high winds, extreme temperature and insufficient photosynthetic radiation etc., may generally lead to very low or even no yields. Hence, characterization of agro climates is a pre-requisite to know the potential of a region, especially under dryland conditions for improving and stabilizing the productivity<sup>1</sup>. As per the India's Second National Communication<sup>2</sup>, extremes of heat and cold, droughts and floods, and various forms of violent weather have caused havoc on the agricultural systems. The rain dependent Indian agriculture is known to be closely linked to the performance of the south west monsoon (June-Sept.), which contributes to 60 to 80% of the annual rainfall in most parts of the country. In the absence of adequate irrigation facilities, rainfall is the most critical element dictating the productivity in rain-fed farming system<sup>1</sup>.

Telangana, a newly created southern state of India, which lies between 15° 46' and 19° 47' N latitude and 77° 16' and 81° 43' E longitude, is bordered by the states of Maharashtra in the north and north-west, Karnataka in the west, Chhattisgarh in the north-east and Andhra Pradesh in the south and east. Administratively, the state is divided into 10 districts, 459 mandals and around 10,434 villages (Administrative structure of the state is at **Fig 1**). Telangana has a geographical land area of 114,840 Sq.km and population of 3, 51, 93,97833. The average annual rainfall is about 906 mm, 80% of which is received from the South-west monsoon. The climate is predominately hot and dry. Nearly 73.5% of the State's territory is covered by the basins of two major rivers – Godavari and Krishna (River basin map of the state is at **Fig 1**). The river Godavari is flowing on the North and the river Krishna is flowing on the South in Telangana region. Apart from the major rivers, there are other small rivers such as Bhima, Dindi, Kinnerasani, Manjeera, Manair, Penganga, Praanahita, and Peddavagu and Taliperu<sup>4</sup>. The catchment area of the Godavari lying in the State is 79% and that of the Krishna is 68.5%.



**Fig 1: Administrative structure and river basin of the Telangana state**

<sup>1</sup> Rao et al. (1999). Resource characterization of Drylands : Climate. In Fifty years of Dryland Agricultural Research in India (Eds. Singh, H.P. et al.) CRIDA, Hyderabad, Pp.21-40.

<sup>2</sup> India's Second National Communication (Report) to UNFCCC (2012). Ministry of Environment and Forests, GOI.

<sup>3</sup> Population census, 2011

<sup>4</sup> "Administrative and Geographical Profile" (PDF). Telangana State Portal. Retrieved 14 July 2014.

The districts of the state are divided into 3 agro-climatic zones (Details of the Agro-Climatic zone is at **Table 1 and Fig 2**). Telangana is an agriculturally-prosperous State and has districts rich in mineral resources, with a gross irrigated area of over 62.88 lakh hectare. The State receives rainfall from South-West (June–September) and North–East (October–November) monsoons; however, there is large variation in the distribution of rainfall<sup>5</sup>. Telangana generally receives modest rainfall. The average annual rainfall in the state is about 906 mm, 80 percent of which is received from the South-West monsoon (June-September). The south west monsoon rainfall is the main source of water for the kharif crops grown over an extensive area. The year to year variations in South-West monsoon rainfall are directly affecting the production and productivity of rain-fed crops in Telangana<sup>5</sup>. Moisture stress due to prolonged dry spells or thermal stress due to heat wave conditions also significantly affect the crop productivity when they occur in critical life stages of the crop.

Telangana is a semi-arid zone and has a predominantly hot and dry climate. The areas covered by the Deccan Plateau are characterized by hot summers with relatively mild winters. The mean maximum temperature varies between 40°C and 43°C in May and the mean minimum temperature is 13° C to 17° C in December and January. The minimum temperature falls rapidly after October, and less than 10°C has also been recorded on certain days. The State experiences tropical climate with slight variations depending on the elevation and maritime influence and varies according to the rainfall, type of soils and cropping pattern.

**Table - 1: Agro-climatic zone wise division of the State**

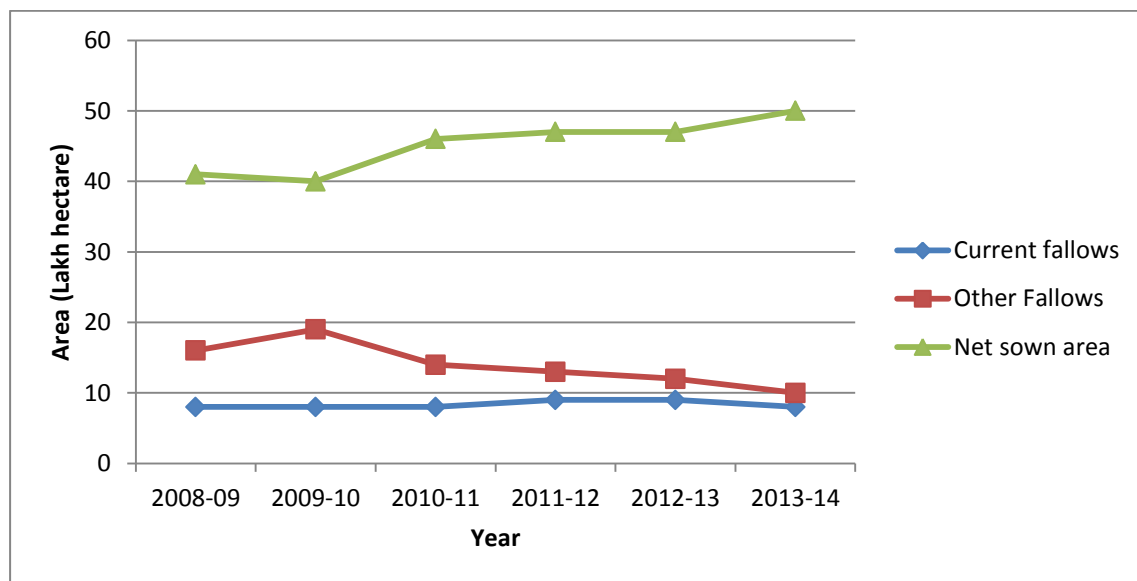
S. No.	Name of the Zone	Districts	Geographical area(lakh ha)	No. of Mandals
1.	Northern Telangana Zone	Karimnagar, Nizamabad, Adilabad	35.5	140
2.	Central Telangana Zone	Warangal, Khammam, Medak	30.6	132
3.	Southern Telangana Zone	Mahabubnagar, Ranga Reddy, Nalgonda, Hyderabad	39.3	164



**Fig 2: Agro climatic zones of Telangana state**

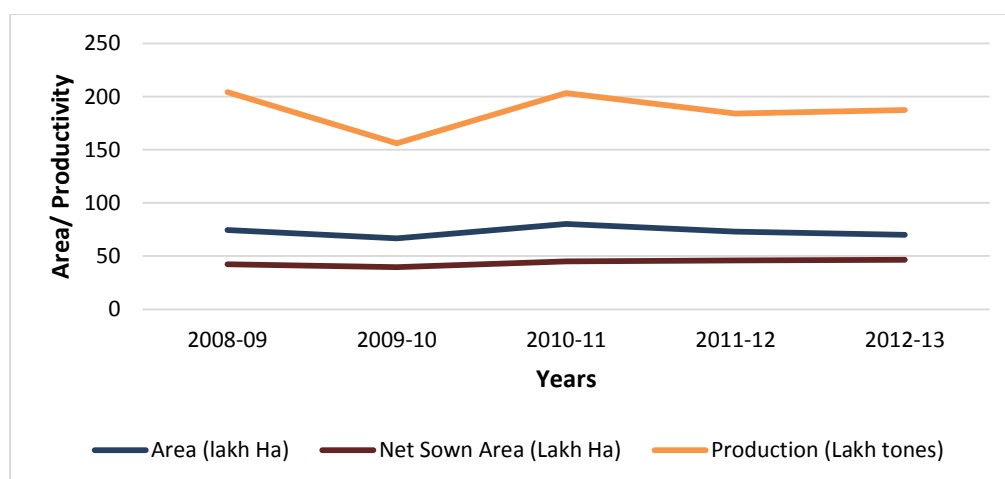
<sup>5</sup> Statistical Year Book of Telangana (2015). Directorate of Economics and Statistics, Government of Telangana, Hyderabad.

About 55.49% of the State's population is dependent on some form or the other on farm activity for livelihoods. Agriculture is one of the critical areas vulnerable to Climate Change. In view of this, there will be greater impacts from climate change on livelihoods. As per the GSDP of 2014-15, agriculture sector expected negative growth of -10.3% recorded in agriculture and allied sectors, attributed mainly to the adverse seasonal conditions. Agriculture per season was badly hit due to climatic conditions and recorded negative growth of -21.3%, which was partially compensated by the positive growth trends in Livestock (6.5%), Forestry & Water logging (2.7%) and fisheries (11.4%)<sup>5</sup>. Consequently, the contribution of Agricultural sector declined to 12.8% from 15.1% in the previous year.



**Fig 3: State's geographical area under agriculture during the years 2008-09 to 2013-14**

As indicated in **Fig 3**, net sown area has been increased by approximately, 10 lakh hectares from the year 2008-09 to 2013-14. Despite this increase in net sown area, agriculture production experienced a decelerating trend in the State in recent years. **Fig 4** depicts the reduction of land put to productive use which is decreasing from the year 2008-09 to 2013-14. This is mainly due to less water availability for irrigating the crops.



**Fig 4: Land distribution of State during the years 2008-09 to 2012-13**

*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*

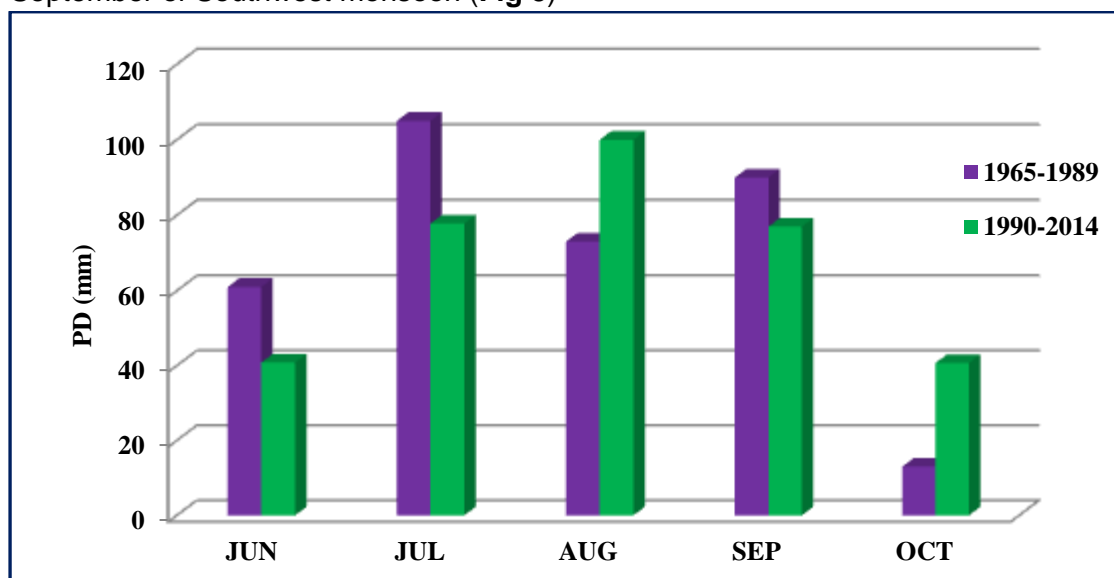
The proposed project activities are in line with the interventions of the National Mission on Sustainable Agriculture (NMSA) under National Action Plan on Climate Change. NMS aims to make Indian agriculture more resilient to climate change through developing new varieties of thermal resistant crops, 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 activities such as soil and water conservation; water conservation through efficient and assured irrigation practices; developing climate resilient cropping pattern; developing forecasting model and knowledge & experience dissemination to wider population.

*c) Include climate analysis and vulnerability analysis*

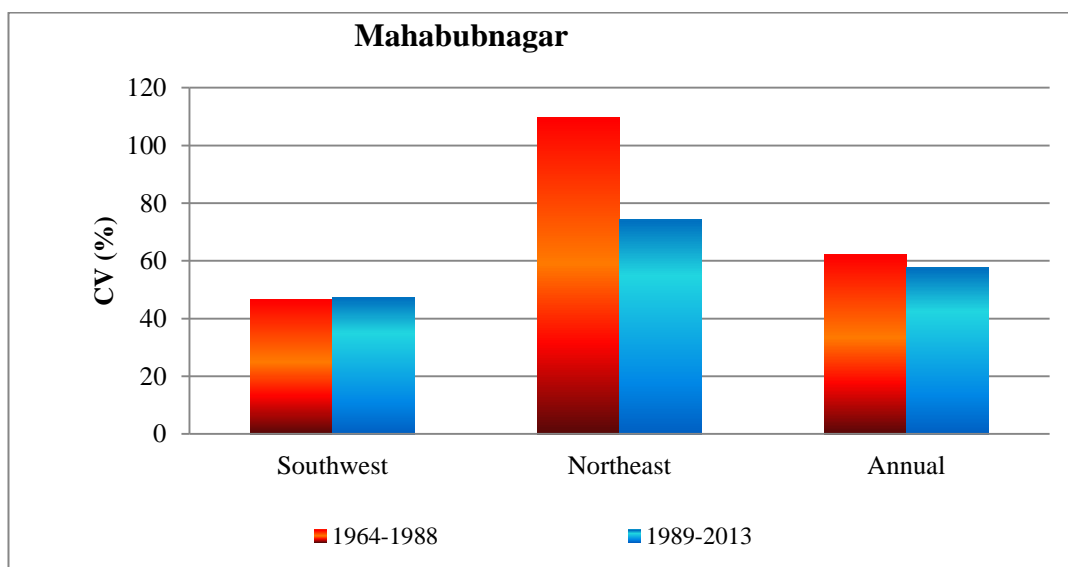
The project district Mahabubnagar is bounded by Ranga Reddy district in the North, Nalgonda and Guntur districts in the East, the rivers Krishna/Tungabhadra in the South, Raichur and Gulbarga districts of Karnataka state in the west. The district is located between 15°55' and 17° 20' North Latitude and 77° 15' and 79° 15' East Longitude.

The district is one of the most drought prone areas in Telangana and classified as rain shadow district. The average rainfall of Mahabubnagar district is 651 mm, most of it received during south west monsoon period (June – September). The rainfall is hardly 69% of the state average (940 mm). The year-to-year variation in the actual rainfall ranges between -32% (in 2004-05) and + 61% (in 2005-06) resulting in more of dry spells during the cropping season. The maximum temperature of the district range between 28 - 34°C and minimum temperature ranges from 22-23°C during southwest monsoon season. Analysis of historical (50 years) rainfall data indicated that the dependable rainfall decreased during months of June, July and September of Southwest monsoon (**Fig 5**)



**Fig 5. Dependable rainfall (mm) in recent twenty five years (1990-2014) over past twenty five years (1965-1989) in Mahabubnagar district.**

Unfavourable weather conditions such as delayed monsoon, intermitted dry spells, erratic rainfall and prolonged droughts etc., are the major concern to the farmers in the district. The rainfall is on decreasing trend from 1990 onwards. The coefficient of variation (CV) has reported to be high in this district indicating uncertainty of rainfall of Mahabubnagar and involves more risk in cultivation of rainfed crops (**Fig 6**). The CV increased during the months of June and July which are most critical months to take up sowing of rainfed crops like sorghum, cotton, maize, redgram, greengram etc. Any delay in sowing of rainfed crop will have greater impact on growth, development and yield of crops, since the crop is terminated under drought conditions



**Fig 6: Coefficient of variation for the rainfall at Mahabubnagar**

Due to limited availability of rainfall, farmers rely on ground water. As per Census data, 2011, approximately ten lakh small/ marginal farmers and labourers have migrated due to drought in search of survival. Indiscriminate grounding of bore wells, open wells resulted in depletion of groundwater resources<sup>6</sup>. **Table 2** shows the depletion in groundwater level over a span of 35 years (from 1975 to 2010):

**Table 2: Groundwater level over a span of 35 years (from 1975 to 2010) of Mahabubnagar district**

S. No.	Year	Depth to water level (mbgl)	Depletion in water level over 1975 (m)
1.	1975	2.34	0.00
2.	1980	4.58	-2.24
3.	1985	5.67	-3.33
4.	1990	6.25	-3.91
5.	1995	7.80	-5.46
6.	2000	12.04	-9.70
7.	2005	8.82	-6.48

<sup>6</sup> Rama Mohan R. V. Social Regulation of Groundwater and its Relevance in Existing Regulatory Framework in Andhra Pradesh, India. <http://www.cwsy.org/>

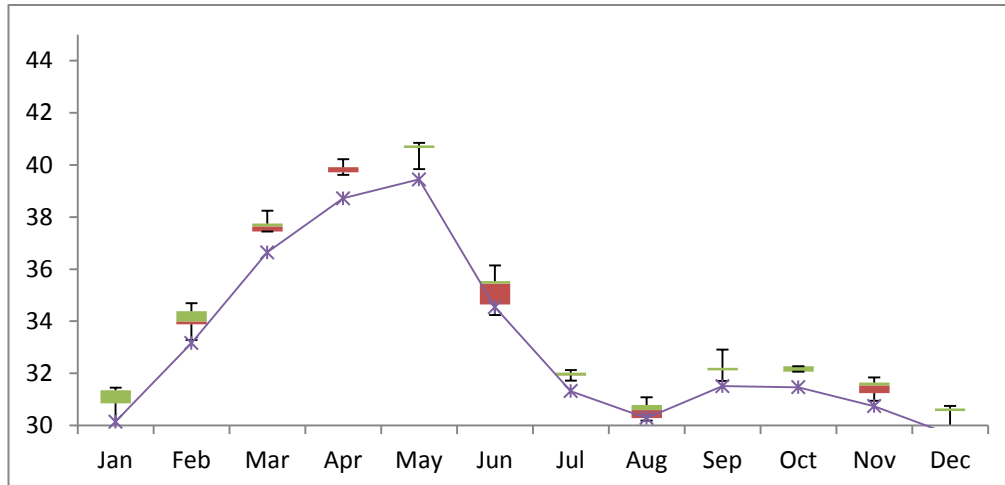


8.	2010	9.90	-7.56
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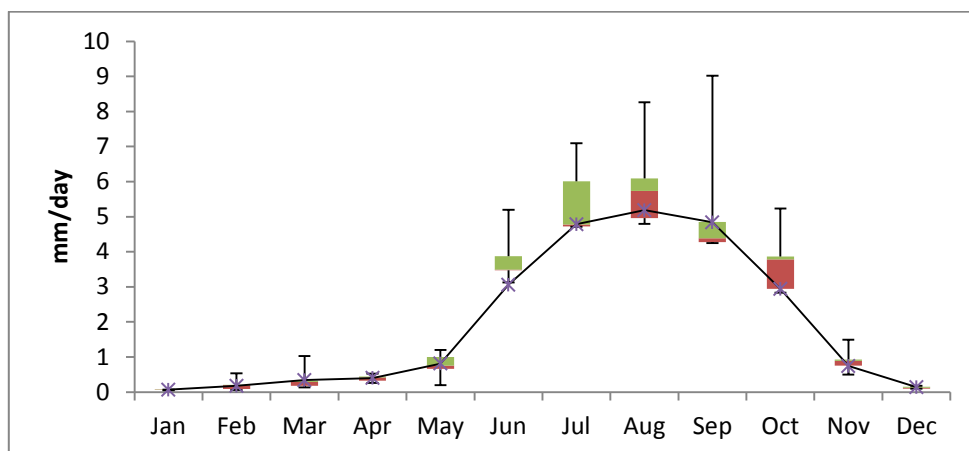
### Climate projections

Projections of future climate were obtained by using the fifth Coupled Model Inter-comparison Project (CMIP5) and the Representative Concentration Pathways for carbon emissions currently in use by the IPCC Fifth Assessment Report. Future climate projections were created by utilizing a “delta” approach, in which the mean monthly changes in important agro-climatic variables were calculated by taking the difference between the RCP8.5 climate scenario and baseline conditions. Scenarios were generated for the Near-Term-2010-2030 (centered around 2030). These monthly mean agro-climatic changes, or deltas, were then applied to the daily baseline weather series for each respective month

Projections by five CMIP5 GCMs indicate, and agree upon, a warming in Mahabubnagar (**Fig 7**), which also extends to both the maximum and minimum temperatures (not shown). The GCMs display more uncertainty in rainfall, particularly during the southwest monsoon season (June-September), indicated by the larger spread shown for the five GCMs (**Fig 8**). However, most of the models generally show increases in rainfall during the monsoon season. **Fig 7** shows all five GCMs from CMIP5 project warmer conditions from the baseline, and all of these temperature increases are significant. Barring any increases in extreme events or higher intra-seasonal variability, increased rainfall that is evenly distributed over the planting/growing season may have a positive impact on crop yields, particularly as the district is frequently prone to droughts.



**Fig 7. Projected changes in monthly mean maximum temperatures for RCP 8.5 near term (2010-2029) in Mahabubnagar. Black lines and stars indicate the baseline climate and the box-whisker plots show the spread in projections amongst the five GCMs taken from CMIP5**



**Fig 8. Projected changes in monthly mean rainfall for RCP 8.5 near term (2010-2029) in Mahabubnagar. Black lines and stars indicate the baseline climate and the box-whisker plots show the spread in projections amongst the five GCMs taken from CMIP5.**

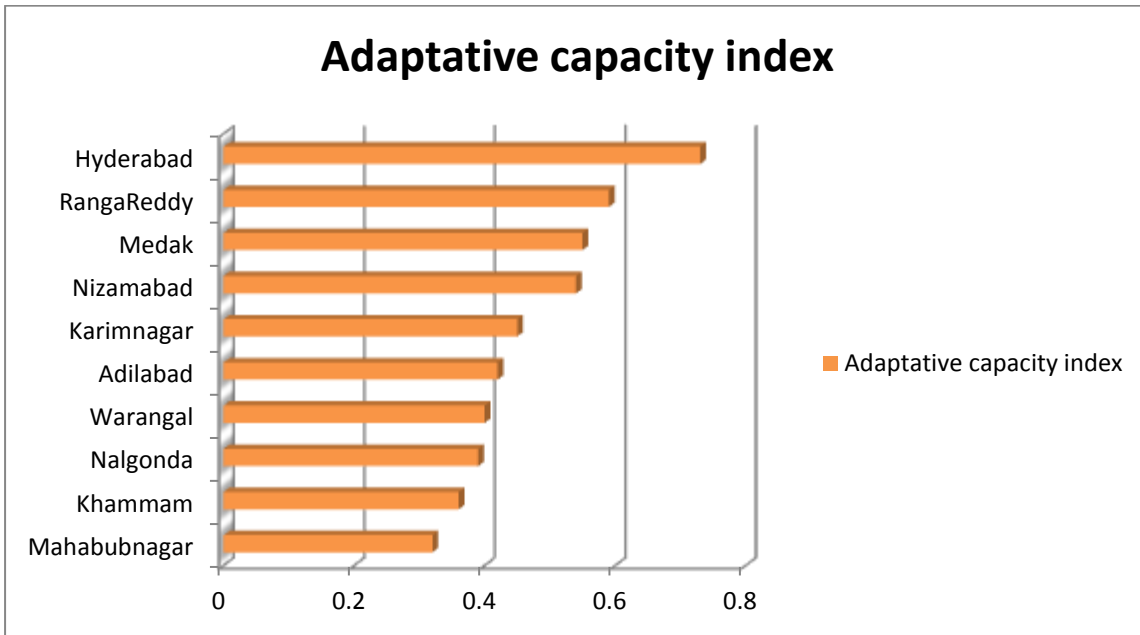
The major reasons of reduction of agricultural productivity in Mahabubnagar district are:

- Large variation in the onset dates of south-west monsoon.
- Variations in total seasonal rainfall received.
- Prolonged dry spells within the rainy season, Poor shallow chalka soils with low water retention capacity (80%).

The project titled ‘Climate Resilient Agricultural Households in Mahabubnagar district, Telangana’ aims to develop strategies to adapt to variable climatic conditions for reducing the negative impact on rain-fed agriculture production systems and bridging the gap between national scale climate change vulnerability and impact assessments, and adaptation interventions at the household and community levels. Hence, early warnings based on seasonal rainfall forecasts along with pest and disease forecast can help farmers to adapt crop management strategies to reduce impacts of malevolent climate and maximize benefits of benevolent climate. Implementation of project interventions will be carried out in Mahabubnagar district which is the largest district in Telangana State covering area of 18,432 sq. km and located between 16<sup>0</sup> and 17<sup>0</sup> N, latitudes and 77<sup>0</sup> and 79<sup>0</sup> E, longitudes.

Government of Telangana has conducted an adaptive capacity<sup>7</sup> analysis of the state. The bar chart (**Fig 9**) indicates that Hyderabad and Ranga Reddy have high adaptive capacities whereas Mahabubnagar district has the least. It is influenced by a number of parameters. It is envisaged that with hard (i.e. infrastructure) and soft (i.e. social, educational, health related) interventions from the Government, there could be significant change in the adaptive capacity of the district.

<sup>7</sup>It is the measure of the capability of a particular region/State/district to cope with climate change.



**Fig 9. Adaptive capacity index of districts in Telangana**

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

The project is to be implemented in Mahabubnagar district, Telangana. It is bounded on the north by Ranga Reddy and Nalgonda districts of Telangana, on the east by Nalgonda district of Telangana State and Guntur districts of Andhra Pradesh State, on the south by the rivers Krishna and Tungabhadra and on the west by Raichur and Gulbarga districts of Karnataka State. The total population and total number of household (Census 2011) of the district is 40, 53,028 and 8, 69,451 respectively. There are 5 revenue (viz., Mahabubnagar, Nagarkurnool, Gadwal, Narayanpet, Wanaparthy) and 51 mandals divisions in the district (**Fig 10**). The district has 1544 villages including 1475 inhabited and 69 uninhabited. Most of the Population is centered at rural areas which made Mahabubnagar to have the highest rural population (89%) in the Telangana State<sup>8</sup>.



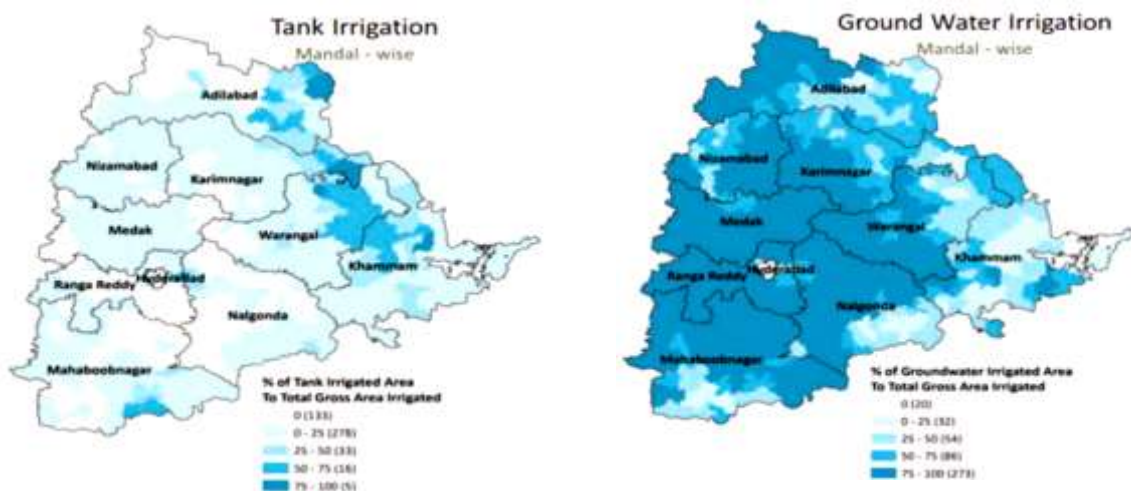
**Fig 10. Project location mandals in Mahabubnagar**

<sup>8</sup> Mahabubnagar district portal. <http://mahabubnagar.nic.in/>

Agriculture is the main occupation in the district, with Paddy, Jowar, Ragi, Bajra, Vegetables, Pulse (Redgram, Greengram) and Millets as major crops. Groundnut, Castor and Sugarcane are the major commercial crops, whereas various horticulture crops include Mango, Sweet orange, Acid lime, Guava, Sapota and Papaya also grown in considerable area.

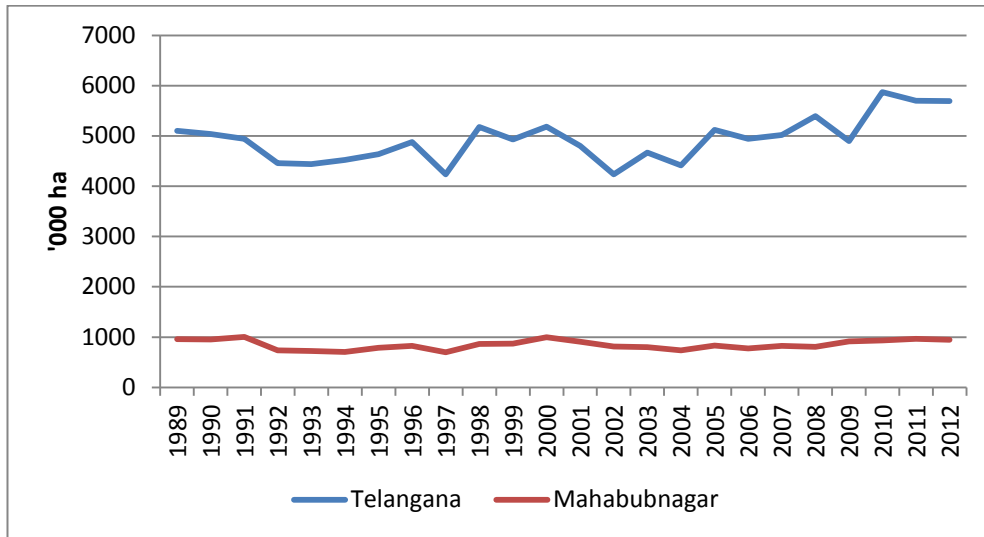
The cropping intensity (the ratio of gross cropped area to net cropped area) is one of the indicators for assessing efficiency of agriculture sector. The cropping intensity of Mahabubnagar district for the year 2013-14 is amongst the lowest (1.11) in Telangana after Adilabad district (1.09).

Major source of irrigation are canals, tube wells, tanks and wells. Mandal-wise distribution of area under tank irrigation and ground water irrigation is shown in **Fig 11**. Since 1990, well irrigation in the State has increased substantially while there is a steady decline in tank irrigation, causing serious concern on source sustainability and energy demand for pumping groundwater. A comprehensive programme for restoration of tanks and revitalization of irrigation potential is critical for developing an integrated approach towards surface and groundwater management, and filling the prevailing 63% gap in realizing the potential of tank irrigation in the state benefiting about 11.5 lakh farmers in the nine drought prone districts of Telangana state including Mahabubnagar<sup>9</sup>. Net area irrigated for both Telangana and Mahabubnagar from the year 1989-2011 is at **Fig 12**. Irrigation facilities in Mahabubnagar are very poor as compared to many other districts of the state and improvement in irrigation facility during the last two and half decade is almost insignificant (**Fig 13**). There are total 150775 dug/bore well in the district. The use of bore well has increased from almost nil (during 1977-78) to 97 per cent in 2009 (**Fig 14**). Intense competition among users viz., agriculture, industry and domestic sectors is in demand for ground water resulting driving the ground water table lower.

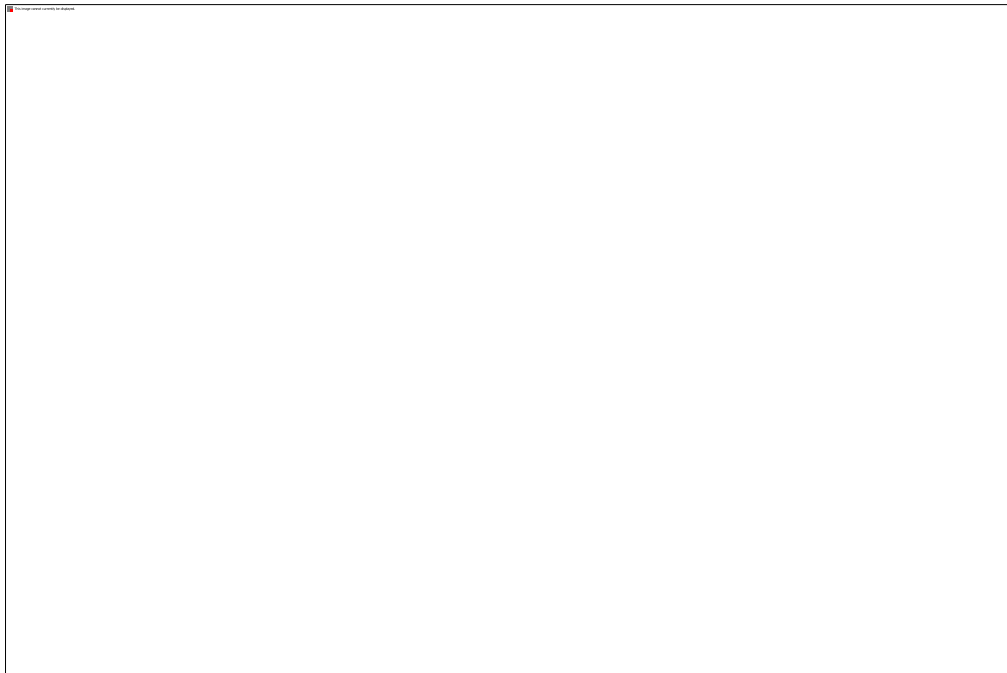


**Fig 11. Mandal-wise distribution of area under tank irrigation and ground water irrigation (Socio-economic outlook (2015), Telangana).**

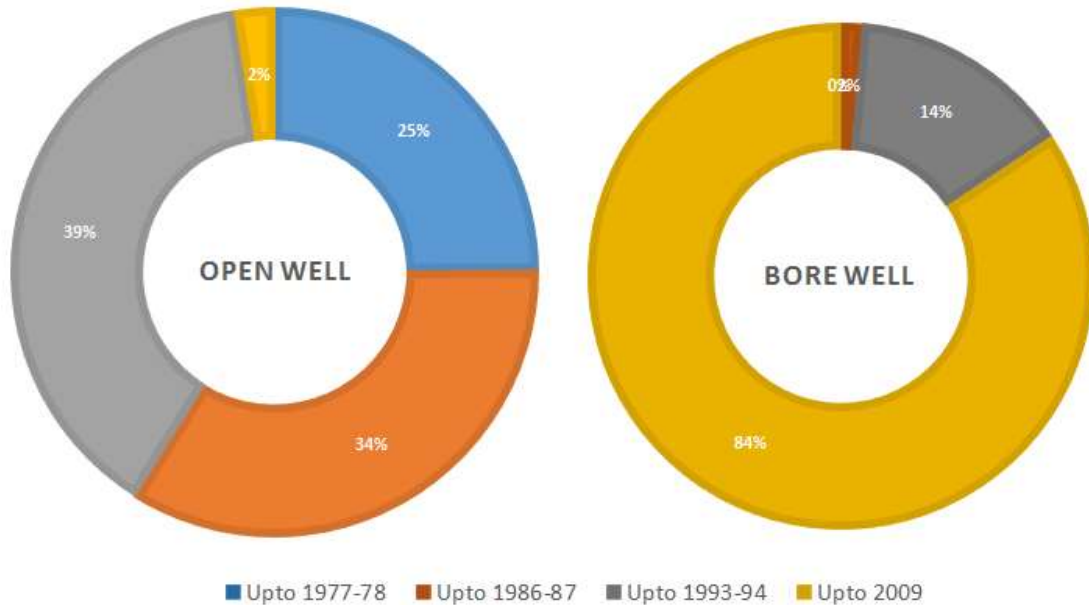
<sup>9</sup> Socio-economic outlook 2014, Telangana.



**Fig 12: Trends in Net Irrigated Area (Source: VDSA database)**



**Fig 13: Area irrigated in different mandals of Mahabubnagar district (Source: WTC, PJTSAU)**



**Fig 14. Shifting in irrigation type (from 1977 to 2009) from open well to bore well in farmers of Mahabubnagar district.**

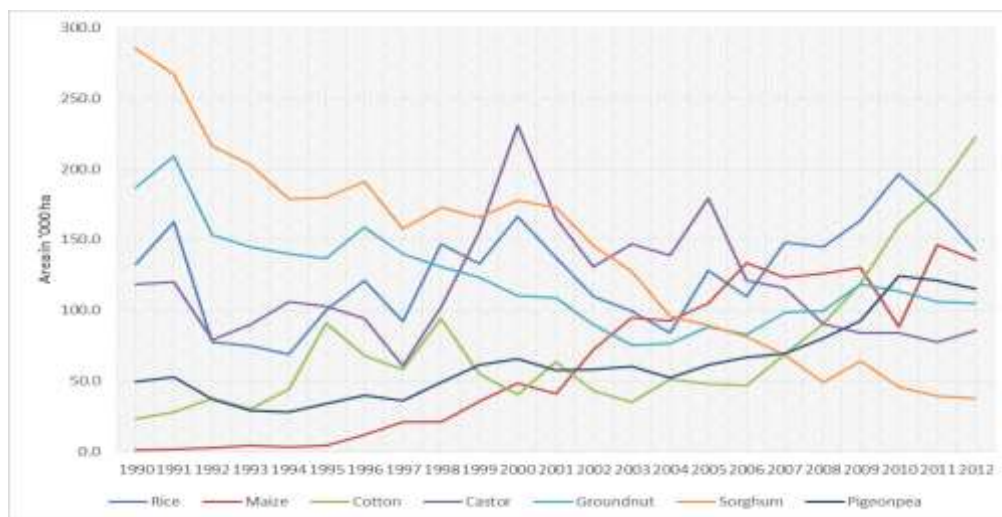
Two important rivers, viz. Krishna and Tungabhadra flow through the district. Other small rivers flowing through the district are Vendi, Peddavaagu and Chinnavaagu. Major river projects in the district are PriyadarshiniJurala, KoilSagar, SarlaSagar, Dindi Reservoir. Despite having many river systems in the district, drought is a persistent problem.

The project is proposed to be implemented in 3 clusters of the district, which would cover 15 villages (5 villages per cluster). The details of the clusters and villages are as follows:

S. No.	Name of the Mandal/ Cluster	Villages under clusters
1.	Jadcherla	<ul style="list-style-type: none"> <li>• Konded</li> <li>• Goplapur</li> <li>• Kodgal</li> <li>• Pedda Adirala</li> <li>• Chinna Adirala</li> </ul>
2.	Bijinapalli	<ul style="list-style-type: none"> <li>• Vattem</li> <li>• Vasanthapur</li> <li>• Waddeman</li> <li>• Salkarpet</li> <li>• Lattupalli</li> </ul>
3.	Ghanpur	<ul style="list-style-type: none"> <li>• Agaram</li> <li>• Anthaipally</li> <li>• Allamaipally</li> <li>• Md. Hussainpally</li> <li>• Venkatampally</li> </ul>

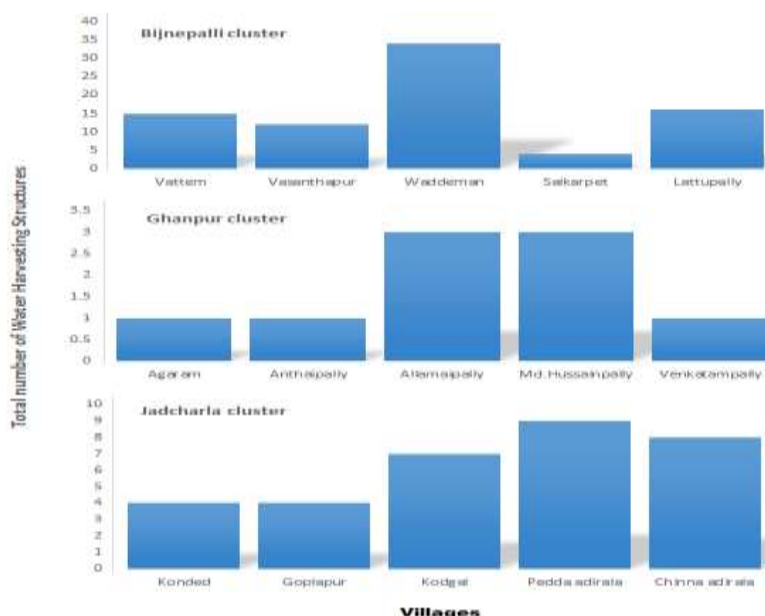
Clusters have been selected based on their high vulnerability to climate change. All the identified clusters have predominantly rain-fed agriculture and about 90% of the households are dependent on agriculture for their livelihoods. Bijinapalli and Ghanpur cluster has less than 5000ha of agricultural land under irrigation while in Jadcherla cluster 500-7500ha of total

agricultural land are under irrigation (**Fig 13**). Therefore, due to recurring droughts, agriculture is majorly suffering in the area. Area occupied by various major crops in Mahbubnagar district during the year 1990 to 2012 is at **Fig 15**.



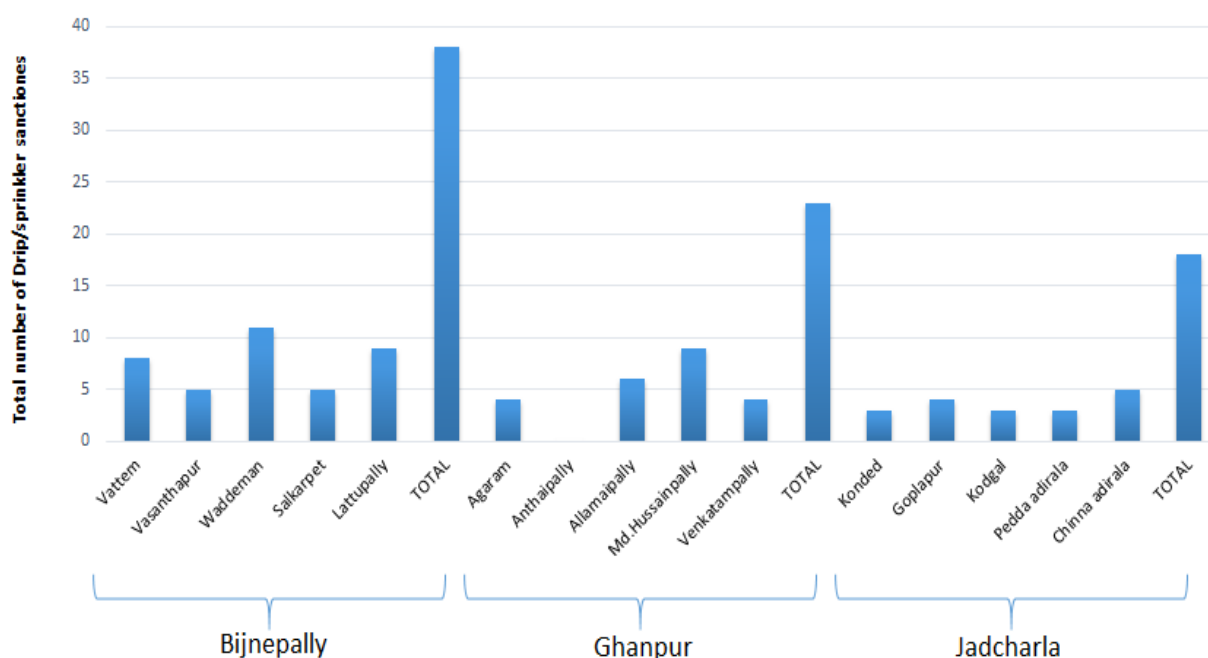
**Fig 15. Trends in area ('000 ha) of major crops in Mahbubnagar district (Source: VDSA Meso level database)**

The selected village clusters are not well equipped with water harvesting/ water storage structures for agriculture resulting in low crop productivity and replacement of native climate adaptive crops (sorghum and groundnut) with commercial crops like (cotton and maize). More than 65 per cent of the total water storage structures in the selected village cluster of Bijnepalli Mandal is check dam (**Fig 16**). In Ghanpur Mandal, community level water storage structure lacking and household level water storage structure is also rare. The only available water storage structures in this Mandal are water tanks. Similarly in Jadcharla Mandal, water tank is the major water storage structure (79 per cent). Only 1-2 per cent households in the selected Mandals of the district have farm ponds.



**Fig 16. Water storage/ harvesting structures available in the selected clusters of Mahabubnagar district.**

Further, farmers are also relying on ground water for fulfilling their water demand, leading to the reduction in ground water levels. Due to crop failure and inadequate water supply in the district, there is widespread distress migration of farmers from Mahbubnagar district to other districts and states. In order to conserve water and to support more crop per drop of water, the state government has distributed a few drip irrigation and sprinklers irrigation system to the farmers in the selected village clusters (**Fig 17**). Less than 5 per cent households are getting benefits of this scheme. A large number of households and agricultural lands are deprived of technical and financial support by state government on agricultural intervention.



**Fig 17. Drip/ sprinkler unit sanctioned in the Mandals**

The dominant soil types of the selected cluster is sandy and loamy sand which has poor water retention capacity. Moreover, farmers of these clusters have large number of small ruminants and cattle. Dependency on small ruminants like sheep and goat is very high. For many farmers livestock is an important assets to sell off to cope with drought, therefore is an important resource against vulnerability. Due to failure of monsoon in the last couple of years, fodder shortage is notices and shepherds are migrating with their sheep to nearby areas.

This project has a unique feature for addressing the issues of small and marginal farmers at both household and community levels. Adaptation interventions will be selected and implemented based on farmer's needs. The details of preliminary agriculture adaptation interventions proposed depending on the need of farmers are provided in **section 2**.

### 1.2 Project Objectives:

The overall objective of the project is to enhance the livelihoods (income and nutrition) of farming community in targeted villages of Mahbubnagar district, Telangana through implementing climate resilient agricultural interventions. This objective is proposed to be achieved through following activities:

- Promoting and implementing *science based suitable climate smart adaptation strategies* such as developing farm ponds, promoting drought and heat tolerant crop varieties



micro-irrigation, inter-cropping etc. for resilience of agricultural households to climate variability and change

- Developing and implementing an *information system* for providing *seasonal climate forecast* and *weather based agro advisories* for farmers
- *Enhancing the capacities of stakeholders* for implementing and sustaining the climate change adaptation strategies
- Improving the alternate livelihoods options such as livestock rearing, vermicomposting and value chain integration (e.g. decentralized dal mill, millet processing unit),etc
- Mainstreaming adaptation strategies into policies and programmes through better Knowledge Management and Sharing

### 1.3 Details of Project/ Programme Executing Entity:

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

Name and address (Registered and Project office):

Shri B. Kalyan Chakravarthy, IAS,  
 Director General,  
 Environment Protection Training & Research Institute, Government of Telangana,  
 91/4, Gachibowli,  
 Hyderabad - 500 032  
 Tel (O) +91 40 23180104  
 Fax (O): +91 40 23180135  
 Mobile: +91 9133331456  
 Email: [dgeptri@gmail.com](mailto:dgeptri@gmail.com)

Registration No. and Date: Registration No. 496 of 1992

b) Available technical manpower for the proposed project implementation:

<b>S. No.</b>	<b>Name &amp; Designation</b>	<b>Address</b>	<b>Specialization</b>
i.	<i>Dr. DandRaji Reddy, Director of Research (Nodal Officer)</i>	<i>Administrative office, PJTSAU, Rajendranagar, Hyderabad</i>	<i>Agrometeorology, Crop simulation modelling, Climate Analysis and Scenario Analysis</i>
ii.	<i>Dr. Gade Sreenivas, Director (Lead)</i>	<i>Agro Climate Research, Centre, ARI, PJTSAU, Rajendranagar, Hyderabad</i>	<i>Agrometeorology, Crop Simulation Modelling, Climate analysis and Scenario Analysis</i>
iii.	<i>Dr. V. Ramulu, Principal Scientist(Lead)</i>	<i>Water Technology Centre, Rajendranagar</i>	<i>Irrigation and Water Management</i>
iv.	<i>Dr. A. Srinivas, Associate Director of Research</i>	<i>Regional Agricultural Research Station, Palem, Mahabubnagar.</i>	<i>Water management and Micro Irrigation</i>

v.	Dr. M. V. Ramana, Principal Scientist	Chief Agronomist, AICRP on IFS, Rajendranagar, Hyderabad- 30	Cropping systems research
vi.	Dr. G. P. Sunandini, Principal Scientist (Research)	Directorate of Research, Administrative Office, PJTSAU, Rajendranagar, Hyderabad.	Value Chain Management
vii.	Dr. R. VijayaKumari, Associate Professor	Department of Agricultural Economics, C.A., Rajendranagar	Market Intelligence
viii.	Dr. T.V. Hymavathi, Professor (Food & Nutrition)	PGRC, Rajendranagar	Processing and Value Addition
ix.	Dr. A.V Ramanjaneyulu, Scientist (Agron.)	Regional Agricultural Research Station, Palem, Mahabubnagar	Farm pond technology, Micro irrigation, Dryland farming and Organic farming
x.	Dr. M. Jagan Mohan Reddy	Programme Coordinator, KVK , Mahabubnagar	Capacity building of farmers and demonstrations of the technologies
xi.	Dr. A. Ramakrishna Babu	Coordinator, DAATTC, Mahabubnagar	Capacity building of farmers and demonstrations of the technologies

## **2. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad**

<b>S. No.</b>	<b>Name &amp; Designation</b>	<b>Address</b>	<b>Specialization</b>
i.	<i>Dr. K.M. Dakshina Murthy Senior Scientist –Systems Modelling (Lead)</i>	<i>RP-MIP, ICRISAT, Hyderabad</i>	<i>Agrometeorology, Crop Simulation Modelling, Climate analysis</i>
ii.	Dr. S. Srinivasa Reddy, Scientist	-do-	Natural resource economics
iii.	<i>Dr. S. Nedumaran Scientist</i>	-do-	<i>Climate change impacts assessment, economic modelling for technology and policy evaluation</i>

## **3. Department of Agriculture, Government of Telangana, Hyderabad**

<b>S. No.</b>	<b>Name &amp; Designation</b>	<b>Address</b>	<b>Specialization</b>
i.	<i>Mr. N. Yashwant Rao, Assistant Director (Lead)</i>	<i>O/o JDA, Mahbubnagar</i>	<i>Agricultural extension, Project implementation</i>
ii.	Mr A. Jhansi Laxmi	c/o Commissioner of Agriculture, Dept. of Agriculture	Agricultural extension, Project implementation

Note: Other concerned Agricultural officers / Agricultural Extension officers of respective study village mandals

#### **4. Environment Protection Training and Research Institute (EPTRI), Hyderabad**

<b>S. No.</b>	<b>Name &amp; Designation</b>	<b>Address</b>	<b>Specialization</b>
i.	Shri B. Kalyan Chakravarthy, IAS, Director General, (Lead)	EPTRI	Project implementation / strategic decision making
ii.	Shri J. Sessa Srinivas, Senior Scientist	-do-	Climate change impacts and knowledge management
iii.	<i>Ms. S. Kavita</i>	-do-	<i>Project Management and administration</i>

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

<b>Project</b>	<b>Objectives</b>	<b>Amount Sanctioned (lakhs)</b>	<b>Funding Agency</b>	<b>Geographical Coverage</b>	<b>Implementation Period &amp; Outcome</b>
Developing multi- scale climate change adaptation strategies for farming communities in Cambodia, Laos, Bangladesh and India	Out scaling of climate adaptation strategies	80.00	ACIAR, Australia	Three villages one in each district of Telangana	<ul style="list-style-type: none"> <li>• Sowing Rule</li> <li>• Rainfall Visualizer</li> <li>• Farmers Climate information centre</li> <li>• Strategic Irrigation</li> <li>• Agro-met advisories dissemination</li> </ul>
Integrated Assessment of Climate Change Impacts on Principal Crops and Farm Household Incomes in Southern India(AgMIP)	Development of climate scenarios and mitigation strategies	35.10	USDA and UK	Three villages in Mahbubnagar district	<ul style="list-style-type: none"> <li>• Future climate Scenarios</li> <li>• Risk management in Maize</li> </ul>
Can seasonal climate forecasts improve food security in Indian Ocean Rim Countries in a variable and changing climate?	Seasonal climate forecast for adaptation strategies across the food chain	32.20	AusAID- Australia	Two Villages in Nalgonda	Tools like Decision analysis tree and Wonder bean developed for communication of seasonal climate forecast Hind cast data were used to assess the risk associated with seasonal climate forecast and developed adaptation strategies to minimize risk in Agriculture

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

#### **National Project on Management of Soil Health & Fertility**

This project aims at facilitating and promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers, including secondary and micro nutrients, in conjunction with organic manures and bio-fertilizers for improving soil health and productivity. Strengthen soil testing facilities and provide soil test based recommendations to farmers for improving soil fertility and economic returns to farmers. Provide soil health through green manuring. Facilitate and promote use of soil amendments for reclamation of acidic/ alkaline soils for improving fertility and crop productivity .Promote use of micro nutrients for improving efficiency of fertilizer use. Upgrade the skill and knowledge of the staff at soil testing laboratories (STL)/ agricultural extension and farmers and developing their capacities through training and demonstration on farmers' fields regarding benefits of balanced use of fertilizers. Ensure quality control of fertilizers through strengthening of fertilizer quality control facility including training to enforcement officers of State Governments for effective implementation of "Fertilizer Control Order". Provide financial assistance for upgrading and setting up of STLs/ Fertilizer Testing Laboratories and various activities for promoting balanced use of fertilizers

#### **National Watershed Development Project for Rain-fed Areas (NWDPR)**

This project works with the objectives of conservation of natural resources and integrated development of natural resources, in-situ soil moisture conservation, sustainable farming systems, emphasize production enhancement activities for land owners and livelihood support for landless families and creation of sustained employment opportunities for the rural community including the landless.

#### **Andhra Pradesh Water Sector Improvement Project (APWSIP) (2010-2016)**

The project aims to provide assured supply of water with equitable distribution through strengthening of Water Users Associations (WUAs) and also to provide farmers with the necessary tools to maximize the production of water resources.

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

#### **National Food Security Mission**

Government of India launched flagship programmes titled 'National Food Security Mission (NFSM)' which aims at increasing production of rice and pulses through area expansion and productivity enhancement in a sustainable manner in the identified districts in the State. The major activities of the mission include enhancing farm level economy i.e. farm profits to restore confidence amongst farmers; restoring soil fertility and productivity at the individual farm level and creation of employment opportunities. The plantation of rice is implemented in 11 districts, whereas pulses are being planted in 22 districts in erstwhile Andhra Pradesh state.

## **Mission project to boost productivity in rain-fed areas of Andhra Pradesh**

The main objectives of this project were, to adopt soil test based recommendations along with good management practices (soils, crop & water management) including improved varieties to enhance productivity of the selected crops by 20-25% over a period of four years, to undertake representative soil sampling to identify micro and macro nutrient deficiencies of the soils, to adopt this mission mode through different schemes of the department in selected clusters to reduce the gap in dissemination of knowledge, To obtain the maximum yield from the area under cultivation also by safeguarding farmers' interest to obtain profitable yields, to strengthen the institutional mechanisms such as inputs supply, farm extension through farm facilitators for all categories of farmers in the state through capacity development, convergence, collective action and to promote organic matter building practices which support the long term sustainability and enhance productivity.

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

EPTRI has the requisite set up for conducting trainings, workshops, seminars & coordination meetings at regular intervals and publishing information dissemination products. Department of Agriculture, Govt. of Telangana has manpower network of Agricultural Officers (AO) in each mandal and Agricultural Extension Officers (AEO) for a cluster of villages to implement the identified adaptation options. The PJTSAU has District Agricultural Advisory and Transfer of Technology Centres (DAATTCs), Krishi Vikas Kendras (KVKs) and other research centres to cater the technical needs for the project. ICRISAT an international organization has rich capacity in generating data base, information on climate change scenarios and developing 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 Project / Programme Components and Financing:

Fill in the table presenting the relationships among project components, activities, expected concrete outputs, and the corresponding budgets.

No.	Project/Programme Components	Expected Concrete Outputs	Expected Outcomes	Amount (Rs.)
1.	Finalizing household level adaptation interventions (Baseline Households Survey, Finalization and communication of adaptation interventions for each target community and household)	<ul style="list-style-type: none"> <li>Understanding and analysis of Households' perceptions on climate change impacts, existing coping/adaptation strategies and capacities to adapt to different climate change scenarios</li> <li>Vulnerability assessment of households to identify target beneficiaries households</li> <li>Identifying concrete adaptation interventions based on area specific vulnerabilities</li> </ul>	<ul style="list-style-type: none"> <li>Updating climatic vulnerability and scenarios of the targeted region</li> <li>Stakeholders aware of the climate change impacts in the farm households identified;</li> <li>Finalized adaptation strategies suitable to the target locations and farm household typologies</li> </ul>	80,00,000
2.	Developing and implementing Information System for 'seasonal climate forecast' and 'weather based agro advisories'	<ul style="list-style-type: none"> <li>Seasonal climate forecast provided for the target villages</li> <li>Improved Weather based agro advisories through ICT</li> </ul>	<ul style="list-style-type: none"> <li>Farmers adjust their farm planning and operational decisions based on the climate forecast</li> <li>Take preventive measures for saving the crops and minimizing the cost of production and reduce risk of crop failure and income loss</li> </ul>	21,36,000
3.	Enhancing capacities of stakeholders for developing and implementing climate change adaptation strategies	<ul style="list-style-type: none"> <li>Training and capacity building modules/ manuals for agronomic, NRM and economic adaptation measures developed and piloted</li> <li>Capacity building workshops for 1500 stakeholders conducted</li> </ul>	State government officials and farmers will be trained to implement climate change adaptation measures	66,00,000
4.	Implementation of the suitable portfolio of adaptation strategies to climate change in the target villages and farm households	Adoption/Implementation of following Agronomic, water conservation practices at both farmer and community levels such as: <ul style="list-style-type: none"> <li>Micro irrigation in high value crops</li> </ul>	<ul style="list-style-type: none"> <li>Agriculture adaptation measures implemented by the beneficiary households in the target locations will provide both social</li> </ul>	19,55,62,500

		<ul style="list-style-type: none"> <li>• Farm ponds</li> <li>• Alternate furrow /strategic irrigation</li> <li>• Bore-well recharge structures</li> <li>• Popularisation of pulses /oil seeds cultivation</li> <li>• Integrated farming systems approach for increasing economic resilience</li> <li>• Adoption of practices such as Backyard poultry</li> <li>• Small ruminants</li> <li>• inclusion of fodder crops in the system/ fodder trees on bunds plantation, silage</li> <li>• Vermicomposting</li> <li>• Tank silt application etc.</li> <li>• Designing of weather based crop insurance product</li> </ul>	<p>and economic benefits</p> <ul style="list-style-type: none"> <li>• Improvement of resilience of farm households to the projected climate change impacts such as drought, heat waves etc.</li> <li>• Demonstration of weather based crop insurance product and based on its success the product could be sustained for long term</li> </ul>	
5.	Knowledge management and mainstreaming of adaptation strategies	Central knowledge repository on climate change adaptation to enable evidence based policy and program formulation in agriculture	<ul style="list-style-type: none"> <li>• Convergence of policies in programs that influence adaptation behaviour of farmers</li> <li>• Open access to knowledge-sharing platforms (portals, repository)</li> </ul>	19,50,000
6	Project monitoring and evaluation cost			20,00,000
6	Project Miscellaneous cost			43,24,970
7	Project executing cost			2,20,60,000
8	Implementing Entity including NIE fee of 3%			72,79,004
	<b>Amount of Financing Requested</b>			<b>24,99,12,474</b>

### 1.5 Projected Calendar:

Indicate the dates of the following milestones for the proposed project/programme (projects which have four or more than four years of implementation period would require to have mid-term review after two years of implementation).

Milestones	Expected Dates
Start of Project/Programme Implementation	1 <sup>st</sup> March, 2016
Mid-term Review	1 <sup>st</sup> September, 2018
Project/Programme Closing	31 <sup>st</sup> March, 2020
Terminal Evaluation	31 <sup>st</sup> November, 2019

## 2.0 PROJECT / PROGRAMME DESCRIPTION AND JUSTIFICATION

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

Farming communities of the State does not have enough financial resources and technical capacity to implement climate resilient practices. The project therefore aims to improve the adaptive capacity of small holder farmers in Telangana 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.

Adapting to climate change often requires responses which range from adoption of concrete agricultural technologies, soil and water management practices at farm and landscape levels, economic and social safety nets which enable the poor farmers to cope with the vagaries of climate extremes. Individual and collective responses to the changing climate impinge on the perception of the problem, traditional knowledge and practices to deal with it. However, with increased change in the climate as a result of centuries of industrialization, the mental models of impacts of this change in communities do not correspond to the projected impacts of climate change based on the new assessment reports. As a result, responses to climate change include adoption of new technologies and practices in addition to the traditional adaptation strategies, which often require collective action. 'Social engineering' is as important an intervention focusing on technologies. Therefore, the project constitutes components which focus on improved understanding of the most vulnerable regions and farm household to climate change impacts; develop capacities of farmers and departmental staff in responding adequately to climate change impacts; and designing and implementing a portfolio of adaptation measures at farming and community level in Mahbubnagar district, most vulnerable district of Telangana.

### *ii. What are the specific adaptation activities to be implemented to reduce the climate change vulnerability compared to the business-as-usual situation?*

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

Component 1: Finalizing household level adaptation interventions: (Baseline Households Survey, Finalization and communication of adaptation interventions for each target community and household)

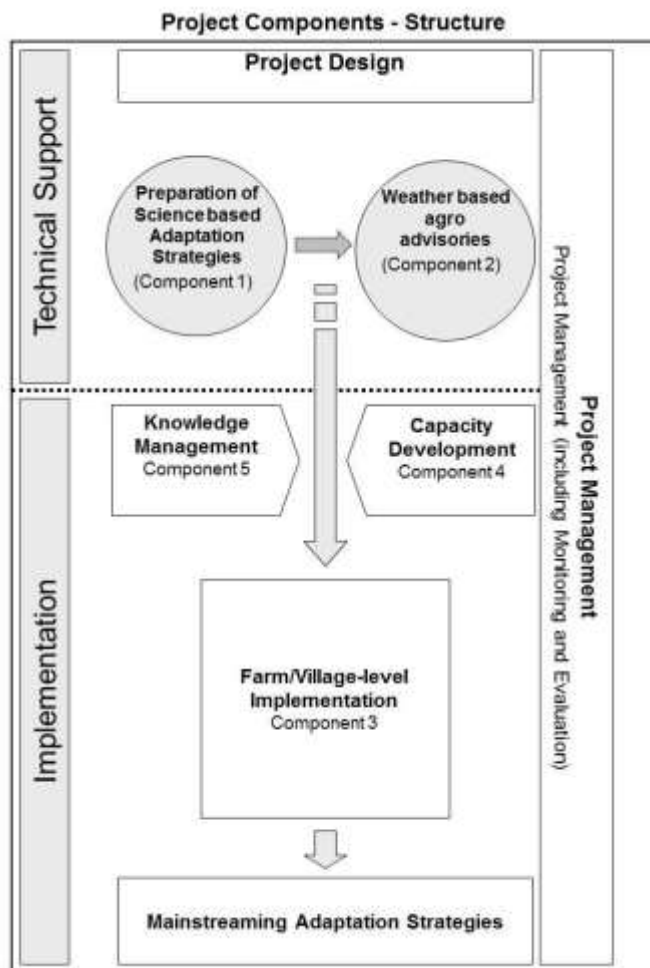
Outcomes 1: Stakeholders aware of the climate change impacts in the target region and accordingly adaptation interventions will be implemented

Finalized adaptation strategies suitable to the target locations and farm household typologies. Formulation of concrete adaptation strategies and their successful implementation in particular region requires thorough understanding of vulnerability which is based on three aspects: (i) exposure to climate variability and change under different scenarios; (ii) sensitivity of the sector to these changes and (ii) adaptive capacity of the households engaged in the sector (Singh et al. 2015). This component aimed at improving the understanding of the stakeholders in order to identify specific vulnerabilities and implement adaptation interventions. Therefore, this component is expected to generate convincing evidences to achieve the stated component outcome. Baseline survey of farm households (n=8000) will be conducted in the villages in the selected three clusters which are identified as most vulnerable to the impacts of climate change. Farm households will be selected based on the outcomes of baseline survey village and only



one hectare land of each landholding farmer will be considered for implementation of interventions. Further, baseline survey of 500 non-project areas would also be covered to compare the results. The survey covers household's socio-economic characteristics, climate change perceptions, and traditional coping and adaptation strategies, current adaptation mechanisms to climate variability and change. The results of the activities of this component will be discussed in a workshop with all stakeholders and validated.

Based on the household survey results and community consultations, suitable agronomic, soil & water management, horticultural and economic interventions for improving the climate resilience in the target villages and households will be implemented. Several years of research by different agricultural universities and research centres have resulted in technological and institutional solutions which will improve the resilience of the farming system to the climatic stress conditions. The analysis of the baseline farm household level data will be conducted to categorize the farm household into typologies based on their adaptive capacities and socio-economic characteristics. The adaptation measures will be selected and bundled for implementation based on their suitability to different farm household typologies and mutual compatibility of the measures. Technical and operational guidelines for implementation of adaptation measures published and disseminated to the relevant nodal agencies at the block and village levels. Project components and structure is at **Fig 18**.



**Fig 18: Project components and structure**

**Component 2: Developing and implementing the Information System for 'seasonal climate forecast' and 'weather based agro advisories'**

*Outcome 2: Finalized adaptation strategies suitable to the target locations and farm household typologies*

An information system for 'weather based agro advisories' will provide regular weather based agro advisories based on the medium range weather forecast received from India Meteorological Department (IMD) to plan their day to day weather dependent operations.

Seasonal climate forecasts (SCF) of climate 3–6 months ahead of time can potentially allow farmers and others in agriculture to make decisions to reduce unwanted impacts or take advantage of expected favourable climate. In the project SCF information will be provided to farmers to help in deciding the best cropping systems in the study village

Further, it is also planned to establish village based weather stations. Weather stations with manual operated rain gauge will be set up in each target study village. The regular display of the observed rainfall in the village will help the farmers to take up critical operations like sowing, application of fertilizers or pesticides or provide irrigation to their crops.

**Component 3: Enhancing capacities of stakeholders for developing and implementing climate change adaptation strategies**

*Outcome 3: Staff of line departments and farmers in Telangana capacitated to implement climate adaptation measures*

Capacity development interventions are an integral part of the project occurring at various levels through the entire period of the project implementation. For the selected bundles of adaptation measures to be implemented technical institutional capacities of participant departments and communities need to be developed. Technical capacities of the department staff are required to train and supervise the farmers' adoption of adaptation measures. Prior to the actual implementation of adaptation measures in each of the target villages, communities will be mobilized through raising awareness on climate change impacts and possible solutions. Collective action at the community level is vital for the success of the measures which are a combination of agronomic, natural resource management and value chain interventions. The project will build on the existing base of local level institutions like village Panchayat and other community based organizations through sensitizing them about the new issues and seeking their support and advice in the implementation of the adaptation measures. Finally, capacity building and training manuals will be revised and disseminated for wider adoption for scaling up of adaptation strategies in other regions within and beyond the state of Telangana.

**Component 4: Implementation of the suitable portfolio of adaptation strategies to climate change in the target villages and farm households**

*Outcome 4: Climate change adaptation measures adopted by the beneficiary households in the target locations*

The staffs of the Department of Agriculture, Telangana in the target villages are capacitated to train and implement the adaptation measures. The selected measures are planned to be implemented in a phased manner. The total beneficiary households in the one district during the entire project period will be 2050.

Efforts will be made to institutionalize beneficiary contributions to the cost of adaptation at least to the tune of 30 percent in order to create ownership and the practices sustained. Besides, farm-based interventions, community level interventions targeting natural resource management in common property resource; value addition to the commodities of the climate resilient crops and better integration of small holder farmers in value chains will be made. Female-headed and socially disadvantaged households will be given a priority for inclusion in the project. Tentative preliminary list of adaptation interventions in agriculture sector proposed to be implemented for different types of farmers are given in **Table 3**.

**Table 3: Tentative adaptation interventions in agriculture sector proposed to be implemented for different types of farmers**

<b>Farmer type</b>	<b>Adaptation interventions</b>
Marginal farmers with irrigation facilities	Micro irrigation for cash and food crops Alternate furrow /strategic irrigation Bore-well recharge structures Pulses /oil seeds Backyard poultry' Small ruminants Fodder crops/ fodder tress bunds plantation Vermicomposting
Marginal farmers with no irrigation facilities	Farm pond with micro irrigation for life saving irrigation Pulses and millets/minor millets (short to early) Tank silt application Backyard poultry' Small ruminants Check-basin/dead furrow/ridge and furrow Intercropping with pulses/castor Boundary plantation Vermicomposting
Small farmers with irrigation facilities	Micro irrigation for cash and food crops Alternate furrow /strategic irrigation Pulses / maize/cotton/oil seeds Backyard poultry' Dairy/Small ruminants Fodder crops/ fodder tress bunds plantation Bore-well recharge structures Vermicomposting
Small farmers with no irrigation facilities	Farm pond with micro irrigation Pulses and millets/minor millets (short to early) Tank silt application Backyard poultry' Small ruminants Check-basin/dead furrow/ridge and furrow Intercropping with pulses/castor Boundary plantation Vermicomposting

In addition to above farmers will be encouraged to take-up multipurpose forest tress on field bunds and on bunds of farm ponds with the support of forest department

## Component 5: Knowledge management and mainstreaming of adaptation strategies

### *Outcome 5: Knowledge based advisory system for integrating climate change adaptation strategies at various levels*

The knowledge generated from different components of the project namely, vulnerability assessment to climate change and adaptation strategies (development and implementation) suitable to the region as well as relevant knowledge from other initiatives and sources need a management strategy. The purposes of such a strategy and dedicated tools to achieve this are manifold. One internal purpose is that knowledge generation occurs in tandem across different components which need continuous exchange and updating. Therefore, a web-based system for internal exchange of information and knowledge will be put in place. Concepts, plans, progress and results of activities under different components are integrated into the platform and continuously updated. The proven concepts, guidelines for implementation, capacity building manuals and tools will be made openly accessible so that a large set of stakeholders can benefit directly through and beyond the project.

A systematic analysis and dissemination of results through popular media is vital in shaping the policy discourses and mainstreaming of adaptation strategies in agricultural as well as relevant non-agricultural sectors like, energy and water.

Knowledge management strategy of the project will also cater to the village and farm levels through establishment of climate based agricultural advisory systems. This system will collect and assimilate climate related information relevant for agriculture that originates from project and external sources and disseminates location specific information to farmers using the advanced ICTs.

## **b) Details on Economic, social and environmental benefits of the project**

### *Scientific knowledge*

- The project will improve the scientific knowledge of the various stakeholders, which will have a greater impact on future research. The new concepts of scenario analysis using biophysical models and testing of these models across study locations will improve the modelling capabilities of scientific community.

### *Capacity building*

- The project will build capacity in addressing climate change and possible mitigation & adaptation responses within collaborating extension agencies such as KVKs, NGOs etc.

### *Economic impact*

- Improved cropping strategies and adoption of best management practices such as critical irrigation concept and optimum nutrient use will increase net household income through increased farm returns i.e. yields and/or a reduction in production costs
- Due to better adoption of improved policies will not only benefit the farming community but also improve the government mechanisms for better planning of scarce water and other resources

### *Social impacts*

- Sustainable rural livelihoods are the major objective of this project. The improved capabilities on risk will help marginal and small farmers in adopting the strategies to mitigate climate change impacts, which will enhance their income levels and improve their livelihood.

### *Environmental impacts*

- The development of best management practices suitable and adaptable to each location will reduce the stress on natural resources. Better matching of cropping systems to seasonal rainfall variations is likely to increase water & nutrient use efficiencies, reduce the environmental impacts and improve watershed performance.

### **c) Sustainability of intervention**

i. How will the project assure that the benefits achieved through its investments are sustained beyond the lifetime of the project?

The project follows a **demand driven approach** to developing adaptive capacities of stakeholders to climate change. Design of the various components is a result of the continuous collaborative engagement of the project partners in farmer-participatory climate adaptation research in the region. The adaptation strategies will be developed based on the thorough analysis of social, economic, agricultural and ecological dimensions of the problem of vulnerability to climate change conducted by the departments. The involvement of all the stakeholders in the design of the project supports the demand driven nature of the project promoting ownership and acceptance of the promoted solutions. A stakeholder consultation involving farmers, state, district and block level staff of agricultural and other line departments as well as researchers from various disciplines of partner institutions was conducted to validate the relevance of the project components (See **Annex I**). In the consultations, it was decided that 70% of cost towards adaptation interventions will be borne by the project and rest by the farmers. Once the project is over, farmers will be provided requisite capacity for successfully implementing adaptation interventions in agriculture sector and will be well versed with the success rate of activities. This would therefore help farmers in comfortably applying and investing in these activities.

Implementation of the adaptation measures most suitable to different farm household typologies is carried out by the farmers themselves which is facilitated by trained staff of the involved line departments (mainly DoA). The structured capacity development trainings for the staff through tools and manuals developed under the project provide ample scope for scaling up of capacity development of the entire staff of the department and farmers beyond the target district. The knowledge management strategy of the project ensures that the tools, manuals and other documents highlighting the key success factors and processes are available freely (open source) for utilization of stakeholders to sustain the adaptation beyond the project period and locations. These findings will help in ensuring sustainability.

### **d) Analysis of the cost-effectiveness of the proposed project / programme:**

i. Cost effectiveness will compare alternative options available and how the proposed components/ intervention are best for given climatic conditions. It will also how the community has preferred the selected interventions and their views / concerns are addressed while designing the project/ programme.

The proposal should compare to other possible interventions that could have taken place to help adapt and build resilience in the same sector, geographic region, and/or community. A comparison of the chosen option vis-a-vis alternative options may be provided as per the **Table 4**.

**Table 4: Chosen options vis-a-vis alternative options**

<b>Activity</b>	<b>Proposed Alternatives</b>	<b>Benefits</b>
Improved resilience through adoption of climate resilient farming/livelihood system	Construction of canals and providing assured irrigation through lift irrigation is another option to improve the crop productivity	<ul style="list-style-type: none"> <li>• Micro- irrigation and designing farm ponds are relatively cheaper and requires less resources than lift irrigation. Moreover, lift irrigation is energy consuming resulting in increased emissions.</li> <li>• The activities proposed in this project intend to enhance skills and knowledge of farmers so that they will be able to adopt their production system according to climatic situation.</li> </ul>
Developing and implementing the Information System for 'seasonal climate forecast' and 'weather based agro advisories	Automatic Weather stations could be established for climate forecast	<ul style="list-style-type: none"> <li>• The project will set up manual weather stations, so that farmers could measure climatic parameters themselves to ensure farm planning decisions</li> <li>• Timely advice also helps farmers in taking preventing measures for reducing possible losses related to agriculture and other natural resource dependent livelihoods.</li> </ul>

**ii. Weighting of project activities:**

How much funding will be allocated to 'investment activities', 'capacity building activities' and 'project management activities' respectively?

<b>Type of Activity</b>	<b>List of Activities</b>	<b>Funding required (Rs.)</b>
Investment activities	<ul style="list-style-type: none"> <li>• Finalizing household level adaptation interventions</li> <li>• Developing and implementing Information System for 'seasonal climate forecast' and 'weather based agro advisories'</li> <li>• Implementation of the suitable portfolio of adaptation strategies to climate change in the</li> </ul>	21,00,23,470



	target villages and farm households	
Capacity building activities	<ul style="list-style-type: none"> <li>• Enhancing capacities of stakeholders for developing and implementing climate change adaptation strategies</li> <li>• Knowledge management and mainstreaming of adaptation strategies</li> </ul>	85,50,000
Project management activities	<ul style="list-style-type: none"> <li>• Monitoring and Evaluation cost</li> <li>• Coordination, human resource and cost escalation costs</li> </ul>	2,40,60,000

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

- The proposed project aligns with the national and state strategies to strengthen adaptive capacities of stakeholders to impacts of the changing climate. The Indian government has responded with the launching of its National Action Plan on Climate Change<sup>10</sup>. A key priority is for adaptation to focus on dryland agriculture with possible adaptation strategies ranging from provision of better matched crop varieties, weather insurance to help farmers cope with crop losses against extreme weather events and interventions to increase water productivity. Similarly, within the framework of NAPCC, states have been encouraged to prepare and implement State Action Plans on Climate Change (SAPCC). Agriculture, especially in the rain-fed drylands has been identified as the most vulnerable sector with a majority of rural poor dependent on it for their livelihoods.
- On 2 June 2014, Telangana was separated Andhra Pradesh and became the 29<sup>th</sup> State of India with Hyderabad as its capital. Several programs on nature resource management were launched at erstwhile Andhra Pradesh, which has its linkage with the project. Some of the ongoing and planned projects relevant to this proposal are given below:
  - Andhra Pradesh Drought Adaptation Initiative (APDAI): The overall objective of the APDAI is to enhance drought adaptation capacity of affected communities and reducing their vulnerability to drought in the long-term. The APDAI pilot project is being implemented in two phases due to different modes of financing. Phase I of the pilot program (June 2006–April 2007), financed by a World Bank-executed trust fund, initiated activities in 6 villages in three Mandals of Mahbubnagar District. Phase II of the pilot implementation started in November 2007 and expanded the project into an additional 9 villages in Mahbubnagar and initiated activities in 10 new villages in Anantapur District.
  - Andhra Pradesh Farmer Managed Groundwater Systems Project (APFAMGS): APFAMGS aims at managing groundwater systems in about 650 villages in seven drought-prone districts of Andhra Pradesh. The project is also been implemented in Mahabubnagar district.
  - Integrated Watershed Management Program (IWMP), Telangana: IWMP programme was launched by Gol in 2009-10, which is recently being implemented in Telangana. The programme aims to restore the ecological balance by harnessing, conserving and developing degraded natural resources such as soil, vegetative cover and water. The outcomes are prevention of soil erosion, regeneration of natural vegetation, rain water harvesting and recharging of the ground water table. This enables multi-cropping and the introduction of diverse agro-based activities, which help to provide sustainable

<sup>10</sup> National Action Plan on Climate Change (2008). Government of India.

livelihoods to the people residing in the watershed area. In the selected village clusters, IWMP has not being implemented till date.

f) *Component wise technical standards:*

*(Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, standards related to pollution control, etc. The details need to be provided for each of the interventions proposed)*

The overall objective of the project is in line with the National Mission on Sustainable Agriculture and highlighted under the SAPCC. The project will be governed as per the policy and preference of State Governments in adherence to all the specific local criteria. Apart from that the project would also adhere to the national scientific criteria with regard to adaption such as economic, social and environmental benefit etc. The involvement of the key stakeholders in the project formulation and the Project Management/ Implementation Mechanisms ensures compliance with the policy of participatory implementation of the project.

<b>Activity</b>	<b>Applicable Standard</b>	<b>Application to project</b>
Component 1: Finalizing household level adaptation interventions	Standard guidelines provided by DoA and PJTSAU on sustainable agriculture practices	Enhance the food security, nutrition level and income of small and marginal farmers
Component 2: Developing and implementing the Information System for 'seasonal climate forecast' and 'weather based agro advisories'	Standard guidelines provided by PJTSAU and ICRISAT	Forecast uncertain events such as drought, extreme events etc. which would help farmers to plan for the future course of activities
Component 3: Enhancing capacities of stakeholders for developing and implementing climate change adaptation strategies	Standard guidelines and procedures of EPTRI	Enhance the capacities of farmers and state government officials for implementing climate change adaptation activities
Component 4: Implementation of the suitable portfolio of adaptation strategies to climate change in the target villages and farm households	Standard guidelines provided by DoA, PJTSAU and ICRISAT  MGNREGA guidelines and designs for construction	Implementation of sustainable agriculture practices
Component 5: Knowledge management and mainstreaming of adaptation strategies	Standard guidelines and procedures of EPTRI	Mainstreaming of adaptation activities

g) Duplication Check:

(Describe if there is duplication of project / programme with other funding sources, if any)

<b>Project</b>	<b>Objectives</b>	<b>Complementarity</b>	<b>Geographical Coverage/Agency</b>
Andhra Pradesh Farmer Managed Groundwater Systems Project	Managing groundwater systems in drought prone areas of the state	Groundwater restoration	650 villages in seven drought-prone districts including Mahabubnagar

Andhra Pradesh Drought Adaptation Initiative	Enhance drought adaptation capacity of affected communities and reducing their vulnerability to drought in the long-term	Findings of the success of implementation of drought reduction activities can be helpful for this project	Phase I of the pilot program (June 2006–April 2007), was implemented in 6 villages in three Mandals of Mahbubnagar District. Phase II of the pilot implementation started in November 2007 and expanded the project into an additional 9 villages in Mahbubnagar and initiated activities in 10 new villages in Anantapur District.
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h) Details on Stakeholder consultation:

(Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations).

Consultation	Date/ Place	Participation	Objective	Outcome
1 <sup>st</sup> meeting of project partners	Date: 16 <sup>th</sup> August, 2015 Place: PJTSAU	Project partners	To develop objectives and framework for the project	Project objective were agreed upon
2 <sup>nd</sup> meeting of project partners	Date: 21 <sup>st</sup> August, 2015 Place: PJTSAU	Project partners	To finalize roles and responsibilities	Project concept, components and roles of partners were defined
Farmers meeting	Date: 10 <sup>th</sup> & 11 <sup>th</sup> September, 2015 Place: Gorita, Nimmani	PJTSAU scientists and progressive farmers	To discuss earlier CSIRO project outcomes and other expectations	Discussed with farmers and extension Specialists about project outcomes and new target Areas
2-day write shop “Proposal Developing”	Date: 24 <sup>th</sup> & 25 <sup>th</sup> August, 2015 Place: ACRC, Rajendranagar	Project partners (ICRISAT, PJTSAU, Department of Agri., EPTRI)	Proposal development	Initial draft proposal was Developed

Stakeholder workshop	Date: 28 <sup>th</sup> October, 2015  Place: ACRC, Rajendranagar	Staff from PJTSAU, Departments of Agriculture, Horticulture, Animal Husbandry, ICRISAT, EPTRI. Farmers from Mahbubnagar & Nalgonda	To meet with primary stakeholders to understand climate related problems and their views	Detailed Report enclosed in <b>Annexure I</b>
Farmers meeting	Date: 23 <sup>rd</sup> December 2015 Place: Mahabubnagar	Staff from DoA, ICRISAT, EPTRI, PJTSAU and progressive farmers	To identify major agricultural practices, agriculture production, interventions adopted impact of climate change on agriculture and also to find out major scientific interventions anticipated to develop climate resilient agricultural practices.	Detailed report enclosed in <b>Annexure II</b>

Few photographs of field interaction with Research scientists & farming community of the selected cluster of villages in Telangana is shown in Photo 1-8.



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8

**Photo: Interaction with Research scientists & farmers of Mahabubnagar district. (Vattem, Nandi Vaddeman, Kistagiri, Nagasala)**

- i) Learning and knowledge management component to capture and disseminate lessons learned from the proposed project.

Component 5 of the project dealing with knowledge management and mainstreaming of adaptation strategies, describes both the cross-cutting and specific knowledge management functions that will be undertaken in this project. The transfer of knowledge generated through the project is crucial since this will be the first of climate change adaptation project targeting the agricultural sector comprehensively in the newly formed state of Telangana which takes into account current as well as future climate change scenarios. The project is expected to generate crucial learnings in terms building climate resilient agricultural options. The knowledge will include adaptation techniques at the farm level, best practices, benefits of early warning information, sustainable agricultural practices that improve adaptation ability and resilience; institutional capacity to sustain community based efforts to adapt to climate change and other policy recommendations and technical guidelines produced by the project.

- j) Sustainability of the project outcomes has been taken into account when designing the project

<b>Expected outcomes</b>	<b>Expected concrete Outputs</b>	<b>Sustainability mechanism</b>	<b>Responsible parties</b>
Finalisation and implementation of climate resilient agricultural practices	Prioritization and implementation of adaptation strategies suitable to the target locations and farm household Typologies	<p>These practices will be included in package of practices of PJTSAU and will be regularly discussed &amp; popularized in Zonal Research Extension Advisory Council (ZREAC) meetings.</p> <p>During the project duration, it has been decided that 70% of cost towards implementation of adaptation interventions will be borne by the project and rest by the farmers. Once the project is over, farmers will be provided requisite capacity for successfully implementing adaptation interventions in agriculture sector and will be well versed with the success rate of activities. This would therefore help farmers in comfortably applying and investing in these activities.</p>	DoA, PJTSUA and ICRISAT
Enhancing capacities of stakeholders	Capacity building modules for agronomic, NRM and economic adaptation measures	These modules will be regularly updated and out scaled to other location for wider reach	EPTRI in-consultation with DoA, PJTSAU and ICRISAT

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

<b>Checklist of environmental and social principles</b>	<b>No further assessment required for compliance</b>	<b>Potential impacts and risks – further assessment and management required for compliance</b>
Compliance with the Law	<p>The project activities are in line with the priorities on climate change as predicted by scientific community and policy makers of Government of India. The activities find convergence with National documents such as Second National Communications to the UNFCCC, NAPCC and SAPCC.</p> <p>The activities will not impede access to any of the other requirements like health, clean water, sanitation, energy, education, housing, safe and decent working conditions and land rights. Therefore, the project activities are in convergence with the Environment Protection Act, 1986; Air (prevention and control of pollution) Act, 1981 and Water Pollution Control Act, 1984.</p>	No risk
Access and Equity	<p>The project provides fair and equitable access to the project beneficiaries and is based on clear vulnerability aspects linked to livestock productivity.</p> <p>During the project implementation and community level interventions, special focus will be given to women and disadvantaged groups in building their capacities and enabling their access to community level assets (knowledge and natural resources)</p>	<p><u>Risk:</u> Despite the best efforts to promote equity in the benefits of the project by selecting beneficiaries, in some cases, there may be a risk of diluting the principles of beneficiary selection.</p> <p><u>Mitigation option:</u> Due care will be given so that the selected beneficiaries are proportionately selected from different household typologies and represent their</p>

		actual proportion in the Population
Marginalized and Vulnerable Groups	<p>The beneficiaries of the project will be small and marginalised farmers at both household and community levels.</p> <p>Marginalized and vulnerable households will be identified through the household survey data analysis and are included as beneficiaries in the project.</p>	<p>Adaptation and capacity building measures are designed based on their adaptive capacities.</p> <p>Therefore, there is no risk for the community.</p>
Human Rights	The project does not foresee any violation of human rights	No risk
Gender Equity and Women's Empowerment	<p>Project would ensure participation by women fully and equitably, receive comparable socio-economic benefits and that they do not suffer adverse effect. It is proposed that amongst the total beneficiary, 30-50% would be women.</p> <p>Women would be provided training for managing and conservation natural resources. Subsequently, they would be involved in activities such as agricultural, water management, alternative livelihood practices etc. proposed under the project. Upon the successful completion of the project, women would be equally benefited by availability of water resources and ensuring food security hence maintaining their nutrition level.</p>	<p><u>Risk:</u> As per climate change studies, women are more prone to climate change compared to male population.</p> <p><u>Mitigation:</u> During the project implementation, gender differentiated impacts of climate change will be assessed and technologies and capacity development measures targeted at empowering women will be designed and Implemented</p>
Core Labour Rights	Payments to labour under the project will be made as per Government approved norms duly following minimum wage rate and hence ensuring core labour rights.	No risk
Indigenous Peoples	Not applicable to this project	No risk
Involuntary Resettlement	Not applicable to this project	No risk
Protection of Natural Habitats	Project does not affect any of the natural habitats	No risk
Conservation of Biological Diversity	The project would not cause any impact on biodiversity values.	No risk
Climate Change	The project aims at enhancing the livelihoods (income and nutrition) of farming community	No risk



	through implementing climate resilient agricultural interventions for enhancing the adaptive capacity of the small and marginal farmers against adverse impact of climate change. Project additionally has a co-benefit on reducing the GHG produced through installing rain water harvesting structure, pumps powered by solar pumps, which will contribute in mitigating the challenges of climate change	
Pollution Prevention and Resource Efficiency	Project activities are in convergence with the Air (prevention and control of pollution) Act, 1981 and Water Pollution Control Act, 1984 and Noise Pollution (Regulation and Control) Rules, 2000	No risk
Public Health	No adverse impact on public health related issues is envisaged.	No risk
Physical and Cultural Heritage	No adverse impact on cultural heritage related issues is identified.	No risk
Lands and Soil Conservation	The project envisages conserving the soil water, effectively utilising water, plantation of high yielding drought varieties etc. which will help in conserving the land resources.	No risk

### 3.0 IMPLEMENTATION ARRANGEMENTS

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?

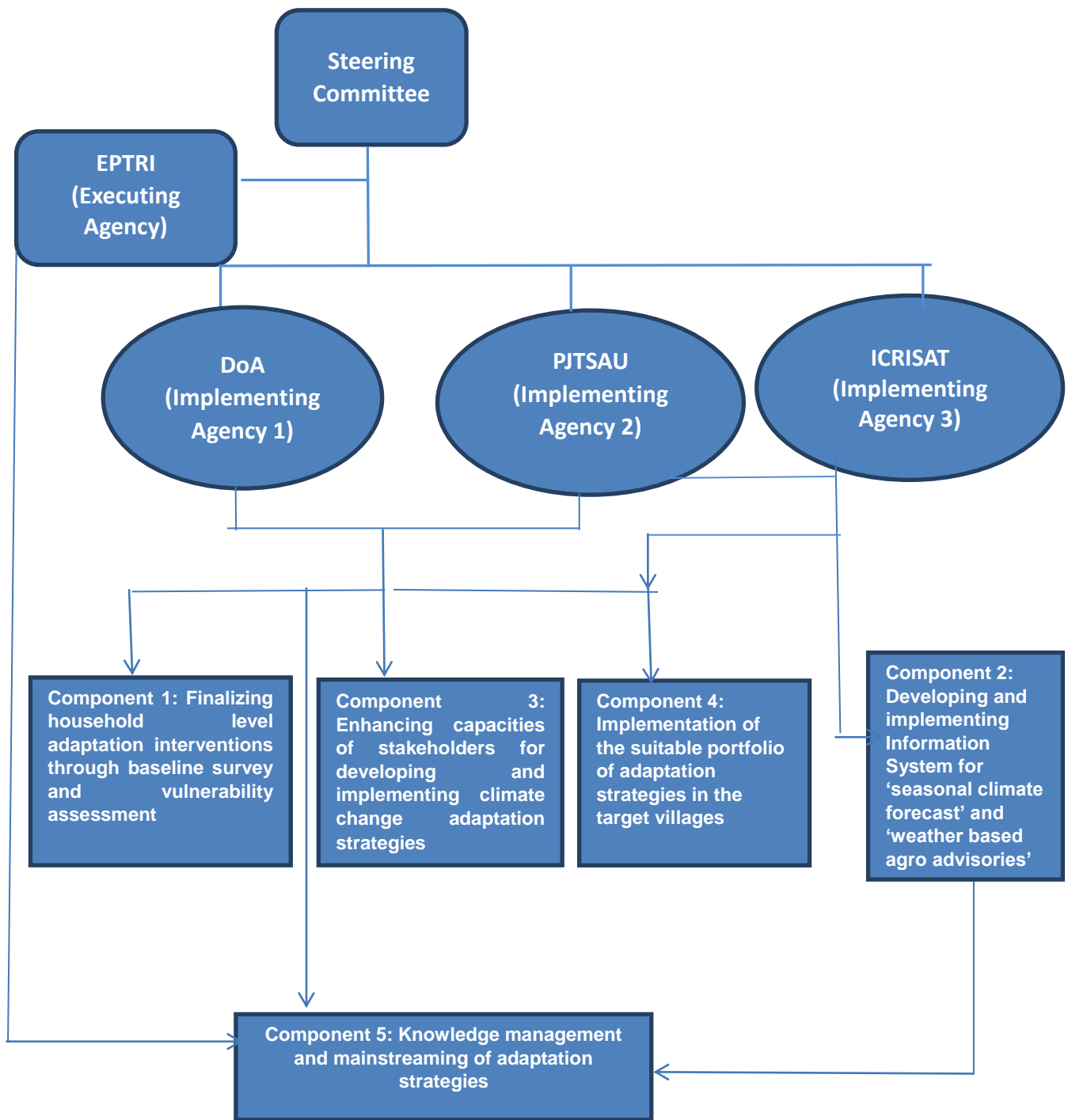
The implementation of the project will be through a multi-department coordination with the overall responsibility led by Environment Protection Training and Research Institute, Government of Telangana. Following are the responsibilities of the various implementing agencies:

Agency/committee	Responsibility
State Steering Committee	Project Steering Committee headed by the Chief Secretary will advise the project in financial and technical implementation, ensuring full implementation of project actions and review progress of the project against the agreed time lines.
Technical Advisory committee	Technical Advisory Committee comprises of representatives from ICRISAT, PJTSAU, EPTRI and DOA. TAC will be responsible for: <ul style="list-style-type: none"> <li>• Preparing the implementation plan</li> <li>• Reviewing the progress of the implementation of the project</li> <li>• Overseeing execution of project activities, fund administration of the project and procurement of goods and services.</li> </ul>
Environment Protection Training and Research Institute (EPTRI)	EPTRI will be responsible for the following tasks: <ul style="list-style-type: none"> <li>○ Oversee the project and main link from MoEFCC for receiving the funds</li> <li>○ Prepare contractual documents/Memorandum of Understanding with each implementing agencies in coordination with DoA, PJTSAU and ICRISAT</li> <li>○ Fund flow management and reviewing the progress of the activity</li> <li>○ Conducting stakeholder workshops and consultations at the state, district and community levels on appraising climate change impacts</li> <li>○ Preparing progress report of the project with the help of project partners for the steering committee meetings that will happen annually</li> <li>○ Preparing and submitting report and Utilisation Certificates to the MoEFCC in coordination with DoA, PJTSAU and ICRISAT</li> <li>○ Development of knowledge products with DoA, PJTSAU and ICRISAT</li> </ul>
Department of Agriculture (DoA)	<ul style="list-style-type: none"> <li>○ Implementing the agronomic adaptation measures, field demonstrations in the selected study villages in consultation with farming community, as per expert committee recommendations</li> <li>○ Implementation of Climate change Adaptation measures in the beneficiary households in the target locations in</li> </ul>

Agency/committee	Responsibility
	<ul style="list-style-type: none"> <li>○ consultation with PJTSAU and ICRISAT</li> <li>○ Development of APPS to gather farmers database and pushing regular agro advisories in consultation with PJTSAU, ICRISAT and EPTRI</li> <li>○ Development a web portal to house the Central knowledge repository on climate change adaptation to enable evidence based policy and program formulation in consultation with PJTSAU, ICRISAT and EPTRI</li> <li>○ Facilitate in arranging tabs for the field staff and cloud storage charges in consultation with PJTSAU and ICRISAT</li> <li>○ Assisting in development of web portal by providing the information available with the department as and when required</li> </ul>
PJTSAU	<ul style="list-style-type: none"> <li>○ Setting up manual Weather stations in consultation with DoA</li> <li>○ Enhancing capacities of stakeholders for developing and Implementing climate change adaptation strategies</li> <li>○ Providing training to the community for implementing adaptation interventions in consultation with EPTRI and DoA</li> <li>○ Providing training to line departments on agronomic, NRM and economic adaptation measures in consultation with EPTRI and DoA</li> <li>○ Arranging exposure visits to target villages/farms where adaptation measures are implemented in consultation with DoA</li> <li>○ Regular provision of weather based agro advisories for planning agricultural operations in consultation with ICRISAT.</li> <li>○</li> </ul>
ICRISAT	<ul style="list-style-type: none"> <li>○ Conducting baseline households survey</li> <li>○ Updating climate scenarios</li> <li>○ Assessing vulnerability using survey data and climate change scenarios and identifying target farm households</li> <li>○ Scenarios analysis using simulation models to provide cropping strategies in in consultation with PJTSAU.</li> <li>○ Providing Seasonal climate forecast for farm planning decisions in consultation with PJTSAU</li> <li>○ Monitoring the project outcomes and outputs</li> </ul>

i. How will the project be coordinated with (and/or mainstreamed into) Related development activities of the targeted sector?

EPTRI being the nodal agency for climate change in Telangana state will be responsible for the overall coordination of implementing agencies. The project will have a Steering Committee and Project implementing team, for supervising the project activities; monitoring its implementation and taking policy decisions. Implementation plan of the project is as follows (Fig 19).



**Fig 19. Implementation plan for the project**

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

<b>Risk</b>	<b>Rating (High / Medium / Low, etc.)</b>	<b>Mitigation Measure</b>
The farmers might not agree to do all the different management approaches.	High	Targeted capacity building along with exposure visits will build the consensus
Bureaucratic hassles may delay in initiating the project activities and sanctioning of funds	High	Bureaucrats dealing with the concerned subject will be special invitees for the State Steering Committee on Climate Change. This would enable the policy makers to be well versed with the progress of the project activities and thus ease in sanctioning of funds.  Preliminary activities of the project will be initiated on time like preparation of tender docs for buying Weather stations, baseline survey, capacity building of the community etc. and the information of initiation of project activities may be informed to the central ministry for ease in sanctioning of fund.
Extreme events such as cyclones, earthquakes may hassles the project activities	High	Weather forecasting stations will be established which will guide the farmers in planning for the future activities and hence precautions could be taken.
Timely execution	Low	Better coordination with implementing entities involved. The project will have advisory panel who will guide the teams regularly with regards allotment of budget, workload etc.
Social issues (selection of beneficiaries)	Medium	The project partners has developed this proposal based considering all the limitation for selecting the beneficiaries and accordingly, a common criteria has been agreed upon in selecting farming community for execution of adaptation strategies
All activities suggested may not come to fruition as planned	Low	Since each activity is headed by exclusive entities with high level of competence and experience, outcome of all activities will be ensured.  Continuous monitoring will be done to ensure the same.

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 M&E at ICRISAT based on the agreed upon outputs, indicators and timelines. A **Technical Advisory Committee** will be constituted at the beginning of the project constituting five members namely,

- i. Director of Research, PJTSAU
- ii. Commissioner of Agriculture, Telangana
- iii. Director General of EPTRI
- iv. AGM of NABARD, Hyderabad
- v. Scientist from ICRISAT

Monitoring will be a continuous process where each component (partner in-charge) will submit a report to the M&E expert at ICRISAT as per following. The M&E expert will prepare templates for reporting compile the reports from different components and submits the comprehensive report to the PSC.

Monitoring and evaluation plan	Responsibility	Year				Total	Time frame
		2016- 17	2017-18	2018-19	2019-20		
Monitoring of outputs	ICRISAT	2	2	2	2	8	2016-2020
Mid-term Evaluation	ICRISAT			1		1	May, 2018
Final Evaluation	ICRISAT				1	1	December, 2019

Evaluation of the project with respect to the outputs and outcomes will be conducted twice during the entire project period. The first/mid-term evaluation will be conducted after the first phase implementation of adaptation strategies in 500 farm households. The second/final evaluation will be conducted towards the end of the final year of the project after the second phase of implementation. The final impact evaluation will be based on a farm household survey/ exit survey (n=2050).

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 (as per the format in annexure1).*

### Results Framework of the Project

Outcome/Output	Indicator	Baseline	Target	Source of Verification	Risks and Assumptions
<b>Component 1: Finalizing household level adaptation interventions: Baseline Households Survey, Finalization and communication of adaptation interventions for each target community and household</b>					
<u>Outcome 1.1:</u> Stakeholders aware of the climate change impacts in the target region and vulnerable districts and farm households identified;	Percentage of members in stakeholder organizations (line departments and target communities) understand and agree to the predicted magnitude of climate change impacts and vulnerable locations/groups	No evidence of understanding and agreement on climate change impacts and vulnerable locations/groups. Currently, about 5% stakeholders have a clear understanding of potential climate change impacts	25% of the District level staff of the line departments and at least 50% of the farmers in 10 target villages understand and agree to the predicted climate change impacts on agriculture	Baseline surveys; stakeholder workshop proceedings	<u>Assumptions:</u> Farmers are already facing the impacts of climate variability and change but lack understanding of magnitude of future consequences and available options, willingness to learn  <u>Risks:</u> Uncertainty of Global Circulation Models (GCMs) and downscaling issues in predicting localized future climate
<u>Output 1.1.1:</u> Households' perceptions on climate change impacts, existing coping/adaptation strategies and capacities to adapt to climate change analysed and understood	Researchers and line department staff understand farmers' knowledge on climate change and their existing coping and adaptation practices Knowledge of farm household typologies based on adaptive capacities integrated into development of adaptation strategies by researchers and line department staff	Majority of researchers and line department staff (~70%) lack knowledge on farmers' perceptions, strategies and capacities for climate change adaptation in the target region	60% of the researchers and line departments enhance their knowledge on farm household typologies based on adaptive Capacities integrated into development of Adaptation Strategies	Survey reports; Interviews with key stakeholders	<u>Assumptions:</u> Stakeholders willing to learn and update their skills

<p><u>Output 1.1.2:</u> Updated climate scenarios for testate of Telangana using the recent Assessment Report (AR 5) of the IPCC</p>	<p>Number of members of line departments government research institutions and local NGOs trained on updating climate scenarios</p>	<p>10% stakeholders understand the recent AR5 climate scenarios and its impacts on Telangana</p>	<p>At least 20% members of Stakeholder organizations update their knowledge on recent climate scenarios and Impacts</p>	<p>Report on climate change scenarios published and shared</p> <p>Policy brief and info graphics on impacts of climate change under different scenarios in Telangana</p>	<p><u>Assumptions:</u> Stakeholders willing to learn and update their skills</p>
<p><u>Output 1.1.3:</u> Vulnerable regions and groups identified</p>	<p>Identified group of households that are most vulnerable to be included for implementing adaptation strategies</p>	<p>Very limited information on the regions and groups in Telangana that are most vulnerable to climate change</p>	<p>2000 households that are most vulnerable in the study regions Identified for implementation of adaptation strategies</p>	<p>Reports and list of villages and beneficiary households for implementation</p>	
<p><u>Outcome 1.2:</u> Finalized adaptation strategies suitable to the target locations and farm household typologies</p>	<p>A suit of best management practices to adapt climate change impacts based on farm house hold typologies developed and communicated</p>	<p>No knowledge and information on the coherence and suitability of a mix of adaptation strategies available with farmers and line department officials</p>	<p>6-8 typology based package of practices manuals which include adaptation packages specific to study locations.</p>	<p>Technical and operational package of practices documents</p>	<p><u>Assumptions:</u> All stakeholders will participate and contribute in the preparation of package of practices</p>
<p><u>Output 1.2.1:</u> Agronomic adaptation measures</p>	<p>Number of households adopting - a. Secure sowing</p>	<p>Farmers are going for traditional high water intensive climate vulnerable</p>	<p>10% yield increase through adaptation of climate resilient</p>	<p>Report on successful agronomic adaptation measure</p>	<p><u>Assumptions:</u> Farmers are willing to learn &amp; adapt the recommended climate smart package of practices</p>



	<ul style="list-style-type: none"> <li>b. Drought tolerant varieties</li> <li>c. Direct Seeded rice/aerobic</li> <li>d. Short-duration legumes for rice fallows</li> <li>e. Intercrop of maize with legumes</li> </ul>	<p>crops results in 20-30% yield losses at the times of drought</p>	<p>cropping system in 15 villages with 2000 Households</p>	<p>reports including visuals</p>	
<p><u>Output 1.2.2: Soil and water management</u></p>	<p>Number of households investing and drawing benefits from -</p> <ul style="list-style-type: none"> <li>a. Farm ponds</li> <li>b. Farm bunds with green manure trees</li> <li>c. Bore well Recharge structures</li> <li>e. increasing water use efficiency through crop water budgeting for beneficiary farmers</li> </ul>	<p>Poor soils management practices coupled with indiscriminate use of fertilizers and pesticides resulting increased cost of cultivation</p>	<p>15% increased yields through adaptation of soil test based fertilizer application, 20% increase crop yields through adaption of critical irrigation concept using the water collected in farm ponds in 15 target villages in about 400 ha area</p>	<p>Field visits, Visuals, field demonstration of best soil and water management practices in farmers' fields. Monitoring the farm ponds for water collection regularly, survey on crop fields where critical irrigation was applied</p>	<p><u>Assumption:</u> Existing management practices are not resource efficient</p>
<p><u>Output 1.2.3: Integrated farming System interventions (crop-livestock integration)</u></p>	<p>Number of households adopting</p> <ul style="list-style-type: none"> <li>a. Fodder crops</li> <li>b. Sheep and Goat</li> <li>c. Poultry</li> <li>d. Milch cattle</li> </ul>	<p>No income resilience of farm households to crop failures under drought Fodder scarcity Very low livestock heads in the village and per household</p>	<p>At least 10 percent increase in the share of livestock income to the total household income 10 percent increase in the  Livestock headcount per capita in the</p>	<p>Impact/Exit Survey Project Reports</p>	<p><u>Assumption:</u> Availability of sufficient family or hired labour for livestock rearing</p>

			Beneficiary Households		
<u>Output 1.2.4:</u> Economic measures for adaptation	Weather based crop insurance schemes designed  Assessment of existing value chains for their suitability with the adaptation strategies.  Value chain interventions	Insurance schemes exist but do not consider intra-regional variability Existing value chains are not catering to the climate resilient crops Smallholder farmers not integrated enough into the value chains	Insurance schemes that consider the variability within the region and Household typology are Designed Identification of strategies to Improve smallholder and climate resilient crops into the value chains	Reports and strategy papers on weather based insurance and climate smart value chains	
<b>Component 2: Developing and implementing the Information System for ‘seasonal climate forecast’ and ‘weather based agro advisories’</b>					
<u>Outcome 2:</u> Farmers adjust their farm planning and operational decisions based on the climate forecast and also take preventive measures for saving the crops and minimizing the costs of production	Losses prevented due to cropping system adjustments based on climate forecast and weather based agro advisories Increased crop income of farmers following the climate forecasts and advisories as compared to control group	Farmers lack access to or do not utilize the seasonal climate forecasts and weather based agro advisories	30-50% farmers in the target communities utilize the seasonal climate forecasts and weather based agro advisories; 10% increase in profitability due to reduced losses for farmers utilizing climate and weather forecasts	Survey reports  Focus group discussions	<u>Assumptions:</u> Farmers trust the long-term climate forecasts  <u>Risks:</u> Some farmers sow the seeds and apply fertilizers in the hope of securing the minimum grain for own consumption without waiting for the forecasts
<u>Output 2.1:</u> Seasonal climate	Number of farmers utilizing the seasonal climate	0-1% farmers utilize the seasonal	At least 30% of the	Survey reports	<u>Assumptions:</u> Farmers trust the

forecast	forecast for farm planning decisions  Losses prevented due to cropping system adjustments based on climate forecast	climate forecast for farm planning	farmers in the Selected communities utilize seasonal climate forecasts for farming decisions	Focus group discussions	long-term climate forecasts
<u>Output 2.2:</u> Weather based agro advisories	ICT based information system set up for weather based agro advisory system  Number of farmers utilizing the weather based agro advisories provided	10% farmers utilize the weather based agro advisory system	40-50% of the farmers in the Selected communities utilize the weather based agro advisory Services	Survey reports  Focus group discussions  Number of subscribers	<u>Assumption:</u> Farmers capacity and interest to follow the advisories
<b>Component 3: Develop capacity in research and extension processes that support the building of adaptive capacity to climate change</b>					
<u>Outcome 3:</u> Staff of line departments and farmers in Telangana capacitated to implement climate adaptation measures	Number of men, line departments and farmers in Telangana capacitated to implement climate adaptation measures women and young farmers trained on potential climate change impacts and developing adaptation strategies  Number of members of local self-government and line departments trained on climate change impacts and developing adaptation strategies	10% trained community members on identification of climate change adaptation strategies specific to farm typologies  15% of the stakeholder groups know on how to develop climate change adaptation practices and implementation	At least 50% marginalized and vulnerable farmers of the study villages are trained on  Operational guidelines and know-how on the 'new portfolio' of adaptation measure  At least 30% members of Stakeholder Organizations	Capacity building and training documents including visuals and reports	<u>Assumptions:</u> Departmental staff acknowledge the weaknesses and appreciate and actively participate in the trainings  <u>Risks:</u> Too much burden on the departmental staff and transfers of the nodal office

			working in the study region trained		
<u>Output 3.1:</u> Training and capacity building for line departments on agronomic, NRM and economic adaptation measures (100)	Number of training programme organized for staff of line departments  Number of trainees (men and women)	~ 5% staff of line department have capacities for implementing vulnerability based adaptation measures	100 men and women staff of line departments are trained in implementing vulnerability based adaptation measures	Training reports and visuals;  Training manuals	<u>Assumptions:</u> Staff are not overburdened and have time and interest for the trainings
<u>Output 3.2:</u> Capacity building workshops for farmers conducted (1000)	Number of training programmes organized  Number of men, women farmers Trained	Zero farmers have capacities to adapt farm level climate smart agricultural practices	1000 men and women farmers trained in climate smart agricultural Practices	Training reports and visuals; Training manuals	<u>Assumptions:</u> Farmers show interest in the trainings Women have time and are allowed to participate
<u>Output 3.3:</u> Exposure visits to target villages/ farms where adaptation measures are implemented (8 visits)	Number of field visits organized  Number of men and women farmers Participated	No exclusive field visits to expose farmers to climate smart practices are available	8 field visits will be organized for Farmers	Field visit reports, visuals, videos	<u>Assumption:</u> Availability of enough comparable and successful adaptation sites
<b>Component 4: Implementation of adaptation options suitable for study regions to prepare households for climate change</b>					
<u>Outcome 4:</u> Climate change Adaptation measures implemented by the beneficiary households in the	Improved resilience of farm households through stabilized crops and livestock yields, incomes and nutrition to climate change impacts	Zero households practicing climate smart agriculture	2000 households to practice climate smart agriculture in the study villages covering an approximate	Impact evaluation  Monitoring reports  Remote sensing & GIS time series	<u>Assumptions:</u> Farmers are committed and willing to adopt the adaptation measures and are willing to contribute to the investment

target locations	compared to households not practicing climate smart agriculture		area of 400 ha.	studies on cropping changes	
<u>Output 4.1:</u> Agronomic adaptation measures	Yield stabilization under drought and water stress conditions	Presently 10-60% yield loss in severe drought situations in study regions	Yield stabilization even under drought conditions 15% higher yields compared to control households	Field demonstrations,  Field data Monitoring and impact evaluation reports	<u>Assumptions:</u> Comparable rainfall years for assessments  <u>Risks:</u> Complete drought resulting in failures
<u>Output 4.2:</u> Soil and water conservation and management	Invest in in-situ and ex-situ conservation of soil and water by beneficiary farm households	Farmers' reluctance for continued investments to maintain the soil and water efficient structures/practices	70% of Farmers maintain soil and water conservation infrastructure on farm through various in-situ and ex-situ measures  Conservation through investment by community	Field data on investments in soil and water conservation M&E reports.  Remote sensing imagery	<u>Assumptions:</u> Farmers are ready to make additional investments in maintaining the conservation structures
<u>Output 4.3:</u> Weather based insurance schemes implemented (2 villages)	Economic resilience of the household to cope with the losses due to extreme weather instances	Insurance schemes exist but do not consider intra-regional variability	2 villages will be piloted using crop simulation models instead of block level crop cutting experiments	Impact assessment report of pilot project	<u>Assumptions:</u> Farmers are willing to join the new insurance scheme  <u>Risks:</u> Moral hazard and false reporting of crop losses
<u>Output 4.4:</u> Value chain integration of climate smart farm households	Farmers better integrated into the value chain. Value addition to climate smart crops	Presently producer receives only 25-30% share in consumer price	Implementation of strategies to improve smallholder	M&E Reports	<u>Assumptions:</u> Smallholder farmer swilling to aggregate in order to access value chains

	Better producer share in consumer price for the farm produce of beneficiary households	Existing value chains are not catering to the climate resilient crops.  Smallholder farmers not integrated enough into the value chains	and climate resilient crops into the value chains will results in 25% increase in existing producer share in consumer price		<u>Risks:</u> Dependence of the smallholder farmer son the middlemen and commission agents
<u>Output 4.5:</u> Sustainable alternative livelihood practices such as rearing of small ruminants, vermi-compositing	Set up of climate resilient infrastructure (water recharging facilities, common shelters etc.) at community level	Practices are being adopted at the household level which are not sustainable	At least, 3 infrastructure facilities located at the community level	Monitoring and Evaluation reports  Stakeholder consultations	<u>Assumption:</u> Farmers cooperate jointly agree to take up alternative livelihood practices  <u>Risks:</u> Reluctance of stakeholders to converge
<b>Component 5: Knowledge management and mainstreaming of adaptation strategies</b>					
<u>Outcome 5:</u> Knowledge based advisory system for integrating climate change adaptation strategies into different sectoral policies	Convergence of policies in programs that influence adaptation behaviour of farmers	Lack of understanding on the trade-offs and complementarities of different policies and programs	Understanding of the incoherence and possible Complementarities that can be achieved  Through convergence by the relevant stakeholders in different sectors	Three Policy workshops at district and state level workshop reports	<u>Assumption:</u> Perception of climate change threat by stakeholders to their policies and programs  <u>Risks:</u> Reluctance of stakeholders to converge
Output 5.1: Central Knowledge repository on	Number of stakeholders accessed and used	No repository, knowledge sharing platforms for	A dedicated web portal on evidences	Project website and internal platform	<u>Assumptions:</u> All the stakeholders are familiar with web based portals and

climate change adaptation to enable evidence based policy and program formulation in agriculture established	Knowledge-sharing platforms (portals, open access repository) to understand climate related information	sharing climate related information available	of projects activities will be made available 80% of the stakeholder in study region will use the knowledge sharing platforms for climate risk management		internet usage
<u>Output 5.2:</u> Real time climate based farm advisory	Number of Farmers receive and us climate related information for their decision making	Only 10% farmers receive weather based agro-advisory services	90% farmers receive and utilize weather based agro-advisories for farm planning and operations	Data on farmer subscriptions M&E Reports Exit survey	<u>Assumptions:</u> Farmers find the information and knowledge relevant  <u>Risks:</u> Other constraints driving farm decision making than the scientific climate based information.

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:

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	80,00000	Detailed below	PJSTAU (Lead)
1.1.	Identification of the climate change impacts in the target region and vulnerable districts and identification of farm households					
1.1.1	Baseline Households Survey and vulnerability assessment of households to select the target beneficiaries	8000 households in the selected clusters	500	40,00,000	All the farm households in the cluster villages will be survey to select beneficiary farmers. The cost includes enumerators, supervisors, travel, data entry, baseline reports, stationery and printing (Annexure-IX)	ICRISAT
1.1.2	Updating climate scenarios using downscaled climate data for Telangana state and also for the project location	1	30,00,000	30,00,000	Using cluster computing facilities grid wise analysis will done for whole Telangana and in particular Mahabubnagar district. The cost includes data purchase, crop types maps generation using RS&GIS, climate maps generation	ICRISAT
1.2.	Finalized adaptation strategies suitable to the target locations and farm household typologies					
1.2.1	Identification of portfolio of adaptation strategies based on the baseline survey results and	1	10,00,000	10,00,000	Cost for brainstorming sessions with scientist from PJTSAU and Department of Agriculture and	PJTSAU



Sino.	ACTIVITY/MONTHS	Units	Unit cost (INR)	Total (INR)	Note	Institution responsible
	vulnerability assessment. Scientist interaction and develop household wise, village wise adaptation strategies as a part of climate smart agricultural practices				ICRISAT to develop suitable adaptation measures to be implemented in the villages	
2.	Developing and implementing the Information System for 'seasonal climate forecast' and 'weather based agro advisories	Detailed below	Detailed below	21,36,000	Detailed below	ICRISAT (Lead)
2.2	Regular provision of seasonal and weather based agro advisories for planning agricultural operations	7680	200	15,36,000	Two bulletins (Ten Typologies) in a week for 48 months for fine tuning management strategies for effective implementation of adaptation interventions (10 typologies, 48 months 16 villages 48 X 16 X10 X200 =1536000	PJTSAU
2.4	Setting up manual raingauge stations	15	12,000	1,80,000	15 rain gaues in each in one village will be installed	PJTSAU
2.5	Training the field assistants, Agricultural extension officers on maintaining the weather station and interpreting the agro advisories for the benefit of farming community	10	42000	4,20,000	10 trainings for line department extension officers. Each training with 50 participants	PJTSAU/ICRISAT
3.	Enhancing capacities of stakeholders for developing and Implementing climate change adaptation strategies	Detailed below	Detailed below	66,00,000	Detailed below	PJTSAU (Lead)
3.1	Providing training to the community for implementing	8		40,00,000	Total 8 trainings for total three clusters. This activity is very	PJTSAU/EPTRI

Sino.	ACTIVITY/MONTHS	Units	Unit cost (INR)	Total (INR)	Note	Institution responsible
	adaptation interventions		500000		important keep in view the importance of capacity building and making the farmers more aware about the climate change impacts and climate smart agricultural practices to make the households more resilient to climate change	
3.2	Workshops -inception, two annual and final with partners and experts to review the project outcomes	4	4,00,000	16,00,000	Four annual workshops one in each year	EPTRI
3.3	Exposure visits to experimental stations demonstration fields where adaptation measures are implemented	20	50,000	10,00,000	Total 20 exposure visits to Regional Research stations, Climate smart pilot villages, ICRIASAT, PJTSAU and KVKs	PJTSAU
4.0	Implementation of the suitable portfolio of adaptation strategies to climate change in the target villages and farm households	Detailed below	Detailed below	19,87,26,000	Detailed below	
4.1	Implementation of Climate change Adaptation measures in the beneficiary households in the target locations					DoA (Lead)
4.1.1	Marginal farmers with irrigation facility	300	87500 (70% of total cost for non-SC/ST households)	2,84,25,000	Includes Dairy/ back yard poultry/ providing bore well recharge structures / Micro irrigation vermi-composting pits and farm ponds and allocation of some	DOA

Sino.	ACTIVITY/MONTHS	Units	Unit cost (INR)	Total (INR)	Note	Institution responsible
			112,500 (90% of total cost for SC/ST HH)		land for fodder, inclusion of oil seeds and pulses- Household contribution 30% for non-SC/ST and 10% for SC/ST. 25% of beneficiaries should be from SC/ST HH	
4.1.2	Marginal farmers with no irrigation facility	725	80500 (70% of total cost for non-SC/ST households) 103,500 (90% of total cost for SC/ST)	6,25,31,250	Includes small ruminants/ back yard poultry/ providing bore well recharge structures / Micro irrigation vermi-composting pits and farm ponds and allocation of some land for fodder/ inclusion of oil seeds and pulses	
4.1.3.	Small farmers with irrigation facility	300	87500 (70% of total cost for non-SC/ST households) 112,500 (90% of total cost for SC/ST HH)	2,84,25,000	Includes Dairy/ back yard poultry/ providing bore well recharge structures / Micro irrigation vermi-composting pits and farm ponds* and allocation of some land for fodder, inclusion of oil seeds and pulses- Household contribution 30% for non-SC/ST and 10% for SC/ST. 25% of beneficiaries should be from SC/ST HH	
4.1.4	Small farmers with no irrigation facility	725	80500 (70% of total cost for non-SC/ST households) 103,500 (90% of total cost)	6,25,31,250	Includes small ruminants/ back yard poultry/ providing bore well recharge structures / Micro irrigation vermi-composting pits and farm ponds and allocation of some land for fodder/ inclusion of oil seeds and pulses	

Sino.	ACTIVITY/MONTHS	Units	Unit cost (INR) for SC/ST	Total (INR)	Note	Institution responsible
4.1.5	Setting up of community post harvesting facilities for value chain integration					
4.1.5.a	Millet processing unit	3	18,00,000	54,00,000	One unit for each cluster of five villages. Details in Annexure-IV	
4.1.5.b	Custom hiring centres for farm implements, chaff cutters etc.,	15	3,00,000	45,00,000	For providing implements/ chaff cutters etc., on hiring basis with nominal contribution (Annexure-V)	
4.1.5.c	Climate information centres	15	150,000	22,50,000	Details in Annexure-VI	
4.1.5.d	Mini Dal mills	15	100,000	15,00,000	Each village one dal mill maintained by village self-help groups	
5.	Knowledge management and mainstreaming of adaptation strategies	Detailed below	Detailed below	19,50,000		EPTRI
5.1	Development a web portal to maintain the Central knowledge repository on climate change adaptation to enable evidence based policy and program formulation		15,00,000	15,00,000	Developing and maintenance of web portal for the project and Developing and maintenance of platform for project internal and external communication	EPTRI
5.2	Tabs for the field staff	15	30,000	4,50,000	Tabs for field staff for real time data collection at field	EPTRI, PJTSUA, DoA, ICRISAT
6.0	Project monitoring and evaluation cost	10	200000	20,00000	Early two evaluations (mid-term, annual) total 8 evaluations will be conducted. One impact evaluation after the project	ICRISAT

Sino.	ACTIVITY/MONTHS	Units	Unit cost (INR)	Total (INR)	Note	Institution responsible
					completion (refer page no 47). The cost includes field visits, survey expenditure of the monitoring & evaluation team)	
7.0	Miscellaneous cost for petty expenses and cost escalations		2% of project cost	43,24,970	Amount to meet cost escalations	EPTRI/ICRISAT/PJTSAU
	Total project activity cost			<b>22,18,11,240</b>		
8.0	Project execution cost			<b>2,20,60,000</b>	Cost includes project implementation costs, project management costs, manpower, travel etc.,	
9.1	Total cost			<b>24,26,33,470</b>		
10.0	NIE fee	-		<b>72,79,004</b>	3 % of the Total cost	
	GRAND TOTAL			<b>24,99,12,474</b>		

**\*Criteria for selection of adaptation strategies for farm households**

The adaptation strategies will be designed for each farm households after selection of beneficiary farm households, baseline survey and physical verification of farm lands of the beneficiaries. As per the initial discussions with farmers and various stakeholders a set of adaptation straggles were developed for both marginal farmers, small farmers with and without irrigation and presented in the project DPR (refer Table 3.). Each household will receive a set of need based adaptation strategies without exceeding the total outlay of Rs. 87500/- (for non-SC/ST farmers) and 112500/- (for SC/ST farmers) for marginal & small farmers with irrigation and Rs. 80500/- (for non-SC/ST farmers) and 103500/- (for SC/ST farmers) for marginal & small farmers without irrigation. The criteria for selecting farmers to adopt farm ponds will depend upon the physical topography of the farmer's field which include catchment area, slope etc., (Unit cost of each pond with dimensions was given in Annexure-VII)

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

Project has been proposed for the duration of 4 years involving mainly four components namely, Finalizing household level adaptation interventions; Developing and implementing Information System for 'seasonal climate forecast' and 'weather based agro advisories'; Enhancing capacities of stakeholders for developing and implementing climate change adaptation strategies; Implementation of the suitable portfolio of adaptation strategies to climate change in the target villages and farm households; Knowledge management and mainstreaming of adaptation strategies and Project Miscellaneous and Management cost. Based on the success and demand of the product, it will be replicated to other villages of the districts. The timeline for each activity are as follows:

S. No.	ACTIVITY	Year 1				Year 2				Year 3				Year 4			
		3	6	9	12	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																
1.1.	Identification of the climate change impacts in the target region and vulnerable districts and identification of farm households																
1.2.	Finalized adaptation strategies suitable to the target locations and farm household typologies																
2.	Developing and implementing the Information System for 'seasonal climate forecast' and 'weather based agro advisories																
2.1.	Providing Seasonal climate forecast for farm planning decisions																
2.2.	Regular provision of weather based agro advisories for planning agricultural operations																
2.3.	Scenarios analysis using simulation models to provide cropping strategies																
3.	Enhancing capacities of stakeholders for developing and implementing climate change adaptation strategies																
3.1.	Create awareness amongst farming communities through regular trainings																
3.2.	Providing training to the community for implementing adaptation interventions																
3.3.	Training and capacity building for line departments on agronomic, NRM and economic adaptation measures																
3.4.	Workshops- Inception, mid-term and final with partners and experts to review the project outcomes																
3.5.	Exposure visits to target villages/farms where adaptation measures are implemented																
4.0	Implementation of the suitable portfolio of adaptation strategies to climate change in the target villages and farm households																

S. No.	ACTIVITY	Year 1				Year 2				Year 3				Year 4			
		3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12
5.	Knowledge management and mainstreaming of adaptation strategies																
5.1	Development a web portal to house the Central knowledge repository on climate change adaptation to enable evidence based policy and program formulation																



## Annexure-I

### Resilient Agricultural Households through Adaptation to Climate change in Telangana

#### *Stakeholder Meeting on 28 October 2015 at Agro Climate Research Centre, PJTSAU, Rajendranagar*

Participants: Farmers from Mahabubnagar and Nalgonda Districts, Department of Agriculture, PJTSAU, ICRISAT

Meeting started at 10:00 with the arrival of participants (researchers, farmers and staff from line departments, agriculture, animal husbandry and horticulture)

Welcome by Dr. G. Srinivas, Director, ACRC, PJTSAU

#### **PART 1**

Dr. G. Srinivas: Introduction and background for the meeting.

Researchers have been conducting research and farmers have been producing crops for several years. But, agriculture has changed over time, with demands, climatic and other changes. For the next two hours we will discuss how we can we better conduct research to help adapt farming to changing climatic conditions.

Dr. Kadiyala Dakshina Murthy: providing the background and the objectives of the workshop. Main information required from the meeting is to understand how farmers, agricultural department officials and researchers perceive climate change, their capacities to adapt to climate change, their existing adaptation and coping strategies.

Dr. D Raji Reddy (DRR): We know the importance of the changing environment for farming. We have conducted some research to identify strategies to mitigate drought which is recurring and become more frequent in recent years. We have conducted farmer participatory research in the past and found out that such participatory research is very successful. So, in the event of extreme climate events like droughts or hailstorm, how can we face and minimize the risk is the main objective of the project which is jointly conceived by PJTSAU and ICRISAT and implemented over the period of 4 years by the Department of Agriculture and farming communities.

We have a lot of expertise from different fields of agricultural sciences which contributed their inputs into the proposal. But, we need the inputs from farmers based on which the important components of the project will be refined or redefined. Farmers' suicides are so rampant and mostly among farmers who are debt ridden, tenant farmers, and those who invested in tube wells.

Earlier, farming was aimed at both own consumption and market. Now, it has changed. Entire production is for the market. Even the paddy is sold and entirely and rice is bought from the market. There is a need to integrate old and new approaches to farming. Therefore, your experiences are very critical in shaping the strategies for the project.

## PART II

Facilitation by Dr. Kadiyala Dakshina Murthy

(DM): Language: Telugu

Perceptions on Climate Change and existing mechanisms to cope and adapt to climate change impacts

Guiding questions:

- What are the important climatic factors you considered for farm planning and operation
  - How have these factors changed over time, what are their effects (positive/negative)
    - Short term
    - Long term
  - What are your climate risk management strategies and coping mechanisms to deal with unexpected climate shocks?
- Mallesh Goud (Farmer): how far has it rained, tilth of the soil and based on which crops and varieties
  - Deenaiah (Farmer): Percentage of rainfall is known, nobody knows. I got the forecast and given the information to 10 others. But, nobody cared and planted as usual.
  - Mallesh Goud (Farmer): reduced area of cultivation based on the rain forecast.
  - Rami Reddy (Farmer): May-June is the time for paddy nursery. Only then we can produce rice. Are there any varieties which are suitable for late sowing and transplanting? RohiniKarte
  - Farmer: Swarna is what we cultivate. We don't wait for rain forecast as we at least get  
  
10-15 bags for own consumption. BPT 1504 is not suitable for TS. We need short duration varieties.
  - DM: Rainfall and water availability seems to be the most critical.
  - DRR: Light soils of MBNR is not suitable for cotton and maize. There is a need to change the cropping based on the climate related information. How are some farmers adopting the adaptation strategies able to cope with the changing climate?
  - DM: just as you have mentioned that you need short duration varieties, we will

learn from the researchers and agricultural departments how they

- Farmer: wild boars, birds are also problems besides rainfall
- Rami Reddy: Untimely rains are resulting in new diseases and pests.
  
- Example: Due to changing weather patterns and resulting new pests and diseases, even in BT cotton, we are facing a decline in yield (70-80 pods to 20-40 pods).
  
- ADA Bhongir: We all know that rainfall is important. There were some good rains early in the season which led to lot of sowing. Then there was a long dry spell. Water is the main constraint.
  
- DoA prepares some contingency plans in the event of monsoon failure. For example, Aru thadi crops – 33% subsidy is increased to 50%. Seeds are made available.
  
- Farmer 3: Yes, but they are not distributed in time and subsidy is still only 33%
  
- Goverdhan, Integrated Farming Systems Researcher: (cites an) example of farmer who adopted drip irrigation for the cotton crop. He is not cultivating paddy anymore and cultivating vegetables like gourds to use available water efficiently.
  
- In Miryalguda, there is another farmer (Mohan Reddy), who, based on the rainfall prediction, has changed his cropping pattern and practicing Pigeon pea and Rice inter crop.
  
- Rearing Kamju (Quails) and other poultry birds is also another alternative adaptation strategy
  
- Rami Reddy: we are also ready, but there is no investment.
  
- Ramudu, Water Technology Centre: Pandal systems for horticultural crops are subsidized. There is a lot of subsidy with the horticultural department.
  
- Farmer 3: there is a lot of upfront cost even to avail the subsidy.
  
- DRR: Subsidies, delay in supply of seeds are general and persisting but important issues. But, the objective of today's meeting is to understand what your perception and adaptation strategies for climate change
  
- Bikshapati, ADA - Shadnagar: We are spreading the information about the elfin effect and the resulting deficit monsoon. Based on this activity, maize has been replaced by cotton. We have also recommended to go for cotton in black soils. Farmers also acknowledge and share the way they adjusted their cropping decisions based on this advisory.
  
- Increase the number of rain gauges as the rainfall is not uniform across all the villages in a mandal. Therefore we need at least 4-5 RGs in a mandal.

- Subsidy of groundnut seeds to farmers who have lost kharif crop.
- DRR: Contingency is not for rabi. If there is no soil moisture in rabi season, what will he do with it?
- ADA Bhongir: Farmers are also not accepting the seeds if they think it is not relevant or useful for them.
- ADA-Shadnagar: Intercropping is also being practiced. Pigeon pea+Maize/Sorghum is being practiced to minimize risk of crop failure of one crop.
- DM: Now, we will hear from the researchers on what they are doing to adjust their research programs to climate change.
- Ram Gopal Varma, Rice researcher: Short duration fine varieties are released. Telangana Sona (RNR 15048): 125 days duration, finer than BPT is suitable for both Kharif and Rabi, Glycemic index is low (suitable for diabetic patients), blast resistant. Interested farmers can come and visit the farm. They can also get the seed from other farmers who are producing the seeds. (eg: in Pochampally).
- Not to sow in June (RohiniKarthi). Then it will be long duration and it will grow tall. It has to be sown around July 10.
- There are also other varieties with larger grain short duration rice varieties. JGL???
- Hailstorm resistant varieties are also released. Padhyumna
- Temperature: High temperature and low rainfall (dry spells) leads to new pests. Aakunalli etc. are also considered for research. We have started to develop heat tolerant varieties
- Jagadeeshwar, Rice researcher: RythuSadbhavanaYatra – farming has become equivalent to cotton. Minimum of 70-80mm of rainfall is required to sow cotton. BT is more sensitive to sowing times. This has to be carefully considered. Earlier cotton varieties were not so sensitive.
- BT is also more susceptible to foliar diseases which is exacerbated by climate change impacts. Use of pesticides is more for cotton. There is too much affection towards cotton which is reflected in the amount of chemicals applied.
- ADA-Bhongir: BT's resistance is reduced. Earlier spraying was only for sucking pest, but now it is also done for boll worm.
- Entomologist-ACRC: Spodoptera can be migratory from other non-BT plants
- Ramudu, WTC: We carried out research on water management to mitigate climate risk. Aerobic rice cultivation, DSR is also found to be very useful practice. What still needs to be done in research is to identify or develop suitable varieties for aerobic (aru-thadi) and DSR cultivation.

- Alternate wet and dry is also resulting in same yield as the flooding irrigation method.
- In monsoon, maize, pigeonpea, cotton are largely cultivated. Farm ponds are another solution to give critical irrigations in aru-thadi crops. Drip is another solution.
- Mulching is another adaptation strategy to save moisture during dry spells with high temperatures like we are facing currently. This also reduces weed infestation.
- Water conservation and efficient management is the key focus of our research
- PJTSAU: common concern among the farmers is that despite their awareness of the alternatives, they still go for the same old practices. The reason they gave was that, new implements and technical inputs are required. Secondly, market is a problem for the new crops. For new crops, markets are very important. Thirdly, insurance is another important mechanism to improve adoption of new technologies.
- VijayaKumari, Ag Dev (Market): how are climate and market linked? What do you think: if there is a good monsoon, will there be a good price or not? We should consider this into consideration while planning crops. We have a project called market intelligence which will project market prices for different crops ex ante based on the climate and demand factors.
- This information should be utilized in decisions of crop choice, harvesting and marketing. If you can spread the selling of produce for a longer period of time, it will be useful and lead to greater returns.
- Rami Reddy: there is a lot of pressure from the moneylenders, labour..and the purchase centres are not opened yet. What shall we do?
- DRR: a lot of information which are coming out of research is not reaching the farmers. 2011/12 case of turmeric.
- Farmer 3: What about the tomatoes price. It is the most fluctuating with large differences.
- Suresh, IFS, PJTSAU: we are conducting research on integrated
- Black gram, green gram, soybean as intercrop with cotton.
- Agriculture is not only crops. Based on your capacity and interests, improved dairy animals, goats and sheep and even poultry birds minimize the risk of CC. loans may not be available for everything and everyone. So, based on the individual capacity and interest, farmers can adopt these crop-livestock integration technologies.
- Pigeon pea value addition: dal mill (1 lakh/unit)
- Fodder Scientist, PJTSAU: fodder storage techniques are also important
- Mahadevappa, ACRC, PJTSAU: we provide a 5 day forecast bulletin which can be useful for minimize unnecessary costs by planning operations based on the forecast.
- Deenaiah: Livestock – milk animals is the adaptation strategy

### **PART III**

#### Access and use of existing climate related information and future needs

##### Guiding questions:

- What weather or climate information do you have access to and from which sources?
  - Which of these sources do you trust the most? And why?
  - How do you receive this information and are these dissemination mechanisms effective?
  - How this information is currently shared within your organization?
  - How do you use the weather or climate related information for your own operations?
  - What are the additional capacities (information, technologies, finance) required for better adaptation to climate change?
- 
- Narasimhulu, Rayapalle: We are getting the information on the weather forecast which is very helpful
  - This is important for every village.
  - Farmer 2: Government should provide remunerative prices to crops. Technologies/crops for water saving/efficient production
  - Farmer 3, Deenaiah: farm ponds (percolation tanks) are a very good solutions to improve water availability
  - Rami Reddy: for black and green gram, drip may not be suitable. Therefore, sprinkler irrigation should be promoted.
  - I had livestock for a long time. But now I am old and cannot keep livestock.
  - Farmer 4: Cotton pest (pindinalli) is becoming very big problem due to the changes in climatic conditions and resulting water stress.
  - Farmer 5: Weather information is good. But it is not uniform even within the village. Insurance considers village as a unit and a farmer is a unit.
  - DRR: will you cooperate as a community for implementing the insurance scheme properly. Will you prevent the farmers not facing the losses from availing the insurance benefits? If you can do that we will implement?
  - Farmer 5: This is not possible sir, people are selfish. But insurance should be designed so that such false reporting does not occur and only genuine cases of crop

losses get compensation.

- DRR: How many people are watching the kisan channels? We have made regulations that all cable operators have to telecast them. But nobody cares to watch this information. There is so much of knowledge being shared for the betterment of farmers.
- Farmer: Each mandal should be adopted by a seed company to study and improve farming by providing appropriate technologies
- Narsimhulu, Pedakaparthi: No rain, pest attack
- Farmer, Chityal Mandal: every farmer should have 2 buffaloes, practice mixed farming and multi-cropping system to minimize risk and increase incomes.
- Sailaja, ADA, Commissionerate: we have been planning action plans and also contingency plans in a phased manner based on the predictions.
- Management practices: we have the network to reach out to maximum farmers. But, still the capacities are very limited. Mandal jurisdiction is too big. Therefore, capacity strengthening is very crucial.
- Second is seed availability. We have seen that farmers are looking at us for seed, subsidy, time and availability. There is a need to improve availability of quality seeds of climate resilient crops.
- Third, attitudinal change is important also from farmers' side. Example, problems in implementing relief programs for suicide victim's families
- Jhansi Lakshmi, Ag Dept.: Farmers are always following the farmers next to them and not listen to the researchers or extension agents. Soil tests are so important and being promoted. But, how many are actually going for the testing without any financial support.
- Importance of bringing attitudinal change in farmers towards government programs
- Nirmala, ADA Jadcherla: maize and cotton growers are facing losses due to delayed monsoon. Labour problem and technologies and strategies should consider this. Farm ponds are labour intensive.
- Insurance – Mandal is a unit is not really suitable as the cost is being deducted but the farmers say they are not getting compensated for the losses.
- Revisit the unit of assessment of crop failure for insurance schemes
- Srinivas, EPTRI: A lot of programs like Mission Kakatiya and Haritha Haram are being initiated by the government. But, the communities/people should take the responsibility to sustain them. The climate forecast for the next decades is projected in the reports which should be useful for making long term strategies.

- ADA, Alair: Integrated farming systems is proven to be an important adaptation strategy. Therefore, this has to be encouraged. Post-harvest losses should be minimized through improving storage facilities. Similarly, capacities for value addition of crop and livestock produce need to be developed.

## CONCLUSION

- G Srinivas: we have discussed a number of issues viz. short duration varieties, integrated farming systems, markets, water management etc. All these issues will be integrated into the project proposal. I thank all the farmers, department officials and mainly our Director of Research for participating and contributing your views to be integrated into the project proposal.
- The meeting was followed by lunch organized by the ACRC, PJTSAU.

## **Key Messages from the Stakeholders' Workshop**

Downscaling of weather forecast to village level

Water saving crops/technologies

On-farm water conservation and storage structures

Study and design effective control measures for new and old pests and diseases under changed climatic conditions

Mixed farming, intercropping, crop rotations and strengthened crop-livestock interactions as adaptation measures

Strengthening the capacities of department staff to implement climate change adaptation interventions

Improving availability of quality seeds of climate resilient crops

Importance of bringing attitudinal change in farmers towards government programs

Revisit the unit of assessment of crop failure for insurance schemes



## Annexure-II

A field visit was conducted on 6 villages namely, Palem, Vattem, Nandi vaddeman, Kistagiri, Peddaguda thanda and Nagasala of Mahabubnagar district on December 23, 2015. Representatives from DoA, PJTSAU, ICRISAT, EPTRI and IORA participated in the field visit wherein an interaction from farming community was done to understand their problems for prioritization their activities. Based on the discussion, following issues of farming community were noted and accordingly, preliminary activities have been prioritized:

<b>Constraints noticed</b>	<b>Suggestions offered</b>
<ul style="list-style-type: none"> <li>• Deficit rainfall, drought is common feature</li> <li>• Shallow light chalka soils</li> <li>• No irrigation water supply from projects</li> <li>• Input subsidy not in time</li> <li>• Wild boar menace</li> <li>• Lack of go down facility</li> <li>• Excessive use of pesticides</li> <li>• Falling ground water levels</li> <li>• Low crop productivity</li> <li>• Replacement drought tolerant native crops/var. with commercial crops (cotton, maize, groundnut etc.,)</li> <li>• Technical gap in farm technology among farmers</li> <li>• Nonpayment MSP to produce in markets</li> <li>• Migration to urban areas</li> <li>• Livelihood through employment generation programmes(Govt) in drought years</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated farming with dairy component</li> <li>• Fodder supply</li> <li>• Veterinary facilities(artificial insemination etc.,)</li> <li>• Loan facilities for animal purchase</li> <li>• Seed supply of drought tolerant short duration crops/var.</li> <li>• Farm ponds</li> <li>• Micro-irrigation</li> <li>• Small scale farm implements</li> <li>• Lift irrigation from Jurala canal</li> <li>• Excavation of tanks</li> <li>• Ready to part their own land if needed in tank construction</li> <li>• Rehabilitation village tank</li> <li>• Tank silt application</li> </ul>

the proposed project will be covered in separate and varied clusters of the district.

### Annexure-III

#### Unit Price of a Weather Station

S.No.	Description	Quantity	Amount (Rs.)
1	Rainguage	1 No.	12000
	<b>Total Cost (Rs.)</b>		<b>82000</b>

### Annexure-IV

#### Millet processing unit

Sno	Item	Cost (lakhs)	Cost ( 3 units)( ( In lakhs)
1	Destoner cum grader cum aspirator	0.9	2.55
2	Dehuller(MAJOR MILLETS)	0.55	1.65
3	Dehuller( minor millets)	0.55	1.65
4	Pulvarizer( flour)	0.54	1.62
5	Flour sifter	0.75	2.25
6	Packaging machine	0.11	0.33
7	Flaking machine	1.50	4.50
8	Packaging material	1.00	3.00
9	silos	1.40	4.20
10	Electric connections, permissions& wiring	1.00	3.00
11	Small equipment like tubs, winnowers, sieves ,aprons, gloves, laminated grain storage bags etc	0.75	2.25
12	Maintenance of the equipment during the project period( repairs etc)	1.00	3.00
	<b>Total</b>	<b>10.00</b>	<b>30.00</b>

Cost of construction shed – 800000/-

## Annexure V

**A.P.S.AGRO INDUSTRIES DEVELOPMENT CORPORATION LIMITED,  
Hyderabad**  
**List of approved manufacturers for supply Tractor drawn agricultural implements  
for the year 2015-16**

1	9 Tyne rigid cultivator (Light duty) $\geq 240$ kg	20000
2	11 Tyne rigid cultivator(Light duty) $\geq 270$ kg	24800
3	9 Tyne spring loaded cultivator(Light duty) $\geq 230$ kg	22700
4	2 Bottom disc plough with Tubular frame (HD) >_210kg	29700
5	2 Furrow M.B plough (Heavy duty) $\geq 260$ kg	28600
6	3 Furrow MB Plough (Heavy duty) $\geq 325$ kg	33300
7	12 offset disc harrow(Heavy duty) $\geq 335$ kg	38200
8	Guntuka blade (Uplands)(Heavy duty) off set pipe frame(Heavy duty) pipe frame-Fixed frame $\geq 140$ kg	12600
9	Guntuka blade (Uplands)(Heavy duty)off set pipe frame adjustable frame $\geq 180$ kg	15700
10	10 ft. spike tooth harrow(Heavy duty) $\geq 110$ kg	10400
11	5 Bottom plough(ATP type) $\geq 225$ kg	26500
12	7 Bottom plough 2.1 (ATP type) $\geq 280$ kg	27400
13	5 tyne boot type cultivator(ADB type) $\geq 225$ kg	26500
14	9 Tyne spring loaded cultivator, 340 kgs.	28500
15	Tractor drawn Bund former, 350 kg.	29000

## Annexure-VI

### Unit price of a Climate Information Centre (for each cluster of village)

S.No.	Description	Quantity	Amount (Rs.)
1	Desktop Computer	1 No.	65000
2	LED TV	1 No.	40000
3	UPS of 1 KVA	1 No.	22500
4	Furniture (Computer Table & Chair)	1 No.	8000
5	Public Address System(Audio System)	1 No.	12000
6	Data Card	1 No.	2500
	<b>Total Cost (Rs.)</b>		<b>150000</b>

### Annexure-VII

S.no	Work component	Square model
1	Dimensions of the pond a) Top dimensions (mx m) b) Bottom dimensions (mx m)	17 x 17 8 x 8
2	Depth of pond , m	3
3	Side slopes, Z:1	1.5 : 1
4	capacity of the pond, m <sup>3</sup>	489
5	Cost for excavation of soil	15000
6	Surface area for lining (m <sup>2</sup> )	334
7	Required dimensions of the plastic sheet (m x m)	21 X 21
8	Lining with 500 micron plastic sheet (Rs 97 per m <sup>2</sup> )	42,777
9	construction cost of inlet requirement and spillway (Rs)	10,000
10	Labour cost for anchoring the lining plastic sheets including trenching	8,900
11	Total cost Rs.	76677

Source : Reddy et al., 2012 (Technical Bulletin : 3/2012)

### Annexure-VIII

#### Approximate cost of adaptation strategies

S.no	Work component	Cost
1	Micro irrigation (per acre)	
	a) Drip	60,000
	b) Sprinkler	25,000
2	Bore well recharge structures	25,000
3	Backyard poultry	4000
4	Small ruminants	25000
5	Vermi composting	10000
6	Dairy cattle	60000

### Annexure –IX

#### Number of households in project villages

Mandal	Villages	No of Households
Jadcherla	Jadcherla	207
	Gopalpur	236
	Kodgal	1130
	Peddadirala	780
	Chinnadirala	423
Bijinapalli	Vattem	1043
	Vasanthapur	279
	Waddeman	1581
	Salkarpet	490
	Lattupalli	1659
Ghanpur	Agaram	214
	Anthaipally	85
	Allampally	206
	Md. Hussainapally	412
	Venkatampally	367
<b>Total HH</b>		<b>9112</b>