



# **Vulnerability to Climate Change:** A Comparative Study of Perceptions and Adaptive Capacities of Aurepalle and Shirapur Villages

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## Abstract

The threats related to climate change are apparent across the globe. This paper attempts to understand the perceptions of the farmers on climate change, the adaptation strategies and behavior that they are demonstrating based on their perceptions through a study done in the villages named Aurepalle and Shirapur, both of which belong to the semi-arid regions of India. The study shows that climate change/variability is becoming a major concern for the farming and non-farming community. As a result of their perceptions, they have been adapting and have developed coping strategies to shield themselves against climate uncertainties. Diversification into short duration crops and commercial crops along with experimenting with vegetable growing, local methods of soil conservation, the involvement of women in farm activities, and caste-based professions have emerged as effective strategies that have come to be accepted socially and culturally at the local level. At the institutional and the community levels, there are serious constraints towards adapting to what may be a more challenging future resulting from climate change; the lack of collective feeling and action, poor governance, financial inclusion and inadequate information access being the main concerns. The current study is an attempt to represent the understanding of the farming community to climate change and therefore the starting point for sensitising policy makers to work towards aiming to enhance capabilities on adaptation measures of farmers in the semi-arid regions of India and mainstreaming of successful adaptation strategies in the agricultural development agenda.

**Key Words:** Perception, Capabilities and Entitlements, Adaptation Behavior, Constraints

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**International Crops Research Institute  
for the Semi-Arid Tropics**

This work has  
been undertaken  
as part of the





## Contents

List of Abbreviations .....	iv
1. Introduction.....	1
2. Study Area Description .....	2
2.1 Materials and Methods .....	4
3. Findings .....	5
3.1 Community Perceptions on Climate Change and Perceived Impacts .....	5
Climate Change or Climate Variability.....	5
Water stress .....	5
Pests and diseases .....	6
Second Order Impacts.....	6
3.2 Adaptive Capacity and Behavior.....	8
Technological .....	8
Institutional support .....	9
Socio-economic.....	13
3.3 Constraints to Adaptation and Vulnerability .....	13
Financial .....	15
Governance.....	15
Infrastructure .....	16
Information Access .....	17
4. Summary and Discussion.....	18
5. The Way Forward.....	21
6. Annexures 1, 2 and 3 .....	22
References.....	26

## List of Tables

Table 1. Socio-economic profile of Shirapur and Aurepalle as of 2009 .....	3
Table 2. Landholding size (ha) of the study villages.....	4
Table 3. Farmers' perception on climate change and variability. ....	7
Table 4. Recovery period of various groups w.r.t climate shock/bad year. ....	8
Table 5. Changing sources of water for irrigation.....	9
Table 6: Adaptation Behavior across groups .....	14
Table 7. Constraints to adaptation .....	18
Table 8. Perception on the importance of institutions to aid adaptive capacities in Aurepalle Village.....	22
Table 9. Perception on the importance of institutions to aid adaptive capacities in Shirapur Village.....	23
Table 10. Important ongoing Government Programs.....	24

## List of Figures

Figure 1. Analysis process based on Grounded Theory. ....	5
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## List of Abbreviations

BPL	Below Poverty Line
SAT	Semi-Arid Tropics
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
KVK	Krishi Vigyan Kendra
PDS	Public Distribution System
NREGS	National Rural Employment Guarantee Scheme
SHG	Self Help Groups

# 1. Introduction

It has been accepted that the worst to be hit by climate change in the future are going to be the agricultural community. Therefore, there is a need for micro-level studies to understand community perceptions and actions as a guide in devising viable adaptation strategies.

Adaptation has come to be considered as an important response option worthy of research and assessment, not simply in order to guide the selection of the best mitigation policies, but rather to reduce the vulnerability of groups of people to the impacts of climate change (Grothmann, Patt 2005). This has partly stemmed from the realization that a society can take steps to minimize certain losses caused by a certain amount of climate change based on their capabilities and capacity to adapt. Entitlements generate capabilities, which are both a policy end and the means of enlarging individual choice and participation in society. People select functioning that yield personal well-being and meet any external objectives. The final end is improved quality of life, including well-being and other relevant goals (Jackson et al. 2005).

It is frequently assumed that if climate change is gradual, it will be a small factor that the farmers will have to deal with. However, Smith (1996) argues that agricultural systems do not evolve in response to changes in average conditions, but to changes in variable and largely unpredictable conditions, including extreme weather events, thus making coping with these events a part of the current and ongoing adaptation to climate variability. Earlier studies in Africa have shown that the perceptions of change according to the farmer are observed through increased variability and uncertainty in specific climatic parameters (Thomas, Twyman, Osbahr and Hewitson 2007; Mertz, Mbow, Reenberg and Diouf 2008). Some of these perceptions include late onset of rains, shorter wet monsoons characterized by little but intense rainfall, strong winds with excessive rains, more intense summer heat and unpredictability in the patterns of seasons. In addition, through a pilot study conducted in two villages of Uttarakhand state in India, it was found that almost all the households interviewed felt that the rainfall had declined in quantity and timely onset of monsoons could no longer be relied on. Respondents noted a decrease in scattered light rainfall, useful for percolation, and an increase in intense rainfall, which destroyed crops and increased run-off rates as well as soil erosion. They observed decline in groundwater with increase in heat intensities (Kelkar, Narula, Sharma and Chanda 2008).

Perceptions, subsequent adaptation strategies and resilience of a community to climatic shocks are determined by the practices and choices that can be institutional, technological and socio-economic in nature. Characteristics of adaptation are a product of the role and influence of these practices and choices from within, in determining environmental and social outcomes. This study therefore aims to understand the context of vulnerability and adaptation to climatic shocks from the technological, institutional and socio-economic view. In doing so, the paper draws attention to certain constraints that the communities in these villages are facing and the implications on their capabilities and capacity to adapt.

The study is based on a survey conducted in two villages, Shirapur village in Maharashtra state and Aurepalle village in Andhra Pradesh state, in the semi-arid tropics of India. Community perceptions and actions in response to climate change and variability were elicited using a

combination of focus group discussions and semi-structured interviews. Special attention was paid to constraints to adaptation and institutional mechanisms that farming households are employing to manage the shocks.

The qualitative nature of the study was based on the premise that not many studies had been conducted in India based on the perceptions of the farmers, especially with reference to climate change. The basic questions that were consequently deliberated upon before going to the field were:

- Are farmers responding to climate change or climate variability and how do they perceive it?
- What kind of adaptive capacities and behavior do they exhibit that will help them build resilience assuming situations get worse?
- What are the constraints to adaptation that are faced, which make certain individuals or groups vulnerable ?

The study area was carefully deliberated upon and chosen with the intention of carrying out a year-long ground-level study in 2009, of the farming and non-farming groups as they have been at the primary receiving end of the effects of climate change. It was felt that it was significant and valuable to understand the farmers' perceptions on climate change, their definition of vulnerability, the adaptation practices based on their perceptions, the factors that affect their adaptive capacities and behavior. In order to do so, a total of six villages were selected; 4 in Maharashtra and 2 in Andhra Pradesh. These villages were the sites of the Village Level Studies of ICRISAT, which were selected largely because they were representative of SAT India.

## 2. Study Area Description

For the purpose of this paper, the villages under study are Aurepalle, located in the Mahabubnagar district of Andhra Pradesh, and Shirapur, located in the Sholapur district of Maharashtra. Both these villages have not had to go through too many unfavorable years until recently, barring a few major climatic shocks in the past. In addition, factors such as industrialization and recent infrastructure development around the villages have been acting as agents that could influence the adaptive capacity of the communities of the two villages. A brief socio-economic profile of the study villages is provided below (Table 1).



**Table 1. Socio-economic profile of Shirapur and Aurepalle as of 2009.**

Characteristics	Shirapur	Aurepalle
Cultivable land (ha)	1069	1300
Total number of households	571	766
Average family size	5.4	5
Literacy rate (2001-04)	70%	50%
% Below poverty line	40%	20%
Average annual rainfall	545 mm (2005-07)	790 mm (2006-08)
Soil type	Deep black	Red sandy
Sources of irrigation	Canals, wells, river, borewells	Borewells
Major crops grown	Sugarcane, sorghum, wheat	Cotton, pigeonpea, sorghum, millet, groundnut

Source: VK Chopde and Y Mohan Rao

With regard to education, the villagers since 1955 in Aurepalle, and 1848 in Shirapur, have had access to a primary school offering up to a fourth grade education. Infrastructure wise, though none of the villages are located on a paved road, the main road is only a few kilometres away. All the villages have access to electricity, but relatively few of the households in each village receive it, especially in Maharashtra. The electricity received is primarily used to pump water for agricultural purposes. One fair-price shop, also popularly called the PDS shop selling subsidized kerosene, sugar, rice, or wheat is located in each village. One cannot walk very far in any of the villages without encountering a small private shop retailing a few inexpensive consumer goods. In terms of market linkages, marketing inputs, especially seed and fertilizer, leave much more to be desired (Walker and Ryan 1990).

Agroecologically, these areas are representative of the SAT region as mentioned; Mahabubnagar is dominated by red-soils whereas rich thick black-soils dominate Sholapur. Rainfall is scantier and erratic in Aurepalle and Shirapur, most years being unusually dry. More than 90% of area cultivated is planted during the *kharif* (rainy) season in Mahabubnagar. Erratic rainfall coupled with deep clay soils in the Sholapur village makes it more profitable for farmers to store precipitation in their deeper soils during the rainy season and cultivate crops under a regime of residual soil moisture during the *rabi* (postrainy) season. The onset of the monsoons in the regions of study is usually in the first week of June continuing on to end of September (Walker and Ryan 1990).

The topography of each of the study villages being different, dissimilar land holding has been used to determine the different categories of farmers. A short summary of the landholding sizes is given in Table 2.

**Table 2. Landholding size (ha) of the study villages.**

Category	Shirapur	Aurepalle
Small	0.2-2.0	0.2-1.2
Medium	2.0-5.3	1.2-3.2
Large	>5.3	>3.2

Source: Walker and Ryan 1990

## 2.1 Materials and Methods

As the nature of the study was qualitative, and based on information received from the field, the method of analysis used was based on Grounded Theory. Grounded theory is a well-established qualitative method for developing theories and conceptual frameworks in a way that is both inductive and deductive based on long-term fieldwork (Strauss and Corbin 1998). For this particular study, where the objective was to understand and identify the perceptions of the farmers to climate change and adaptation strategies based on the same, it was significant to begin the research with an explorative and iterative approach to data collection. The gaps that appeared in the theoretical representation from initial interviews, documents and observations, were filled up with follow-up visits and interviews. Adopting this approach gave the flexibility and methodological rigor needed to adjust the theoretical framework guiding the research to fit the data collected in the field. The study began with capability and entitlements based conceptualization focused largely on the range of choice of individual decision-making (according to the perceptions to climate change) to adaptation mechanisms of the farming and the non-farming community. However, through the process of analysis, there were insights on the constraints of adaptation that emerged as important factors leading to vulnerability of different groups, thus working as a deterrent on the adaptive potential and capacities.

The coding process was the most important part of the analysis as it formed the basis of the findings that emerged related to perceptions, vulnerability, adaptations to climate change and the layers of resilience for the same (Figure 1). The analysis process helped to tap the diverse perspectives of different groups and provide insights and develop an in-depth understanding of the issue by probing, clarifying, and listening to stakeholders talk about the topic in their own words. The process was iterative where attempts were made to keep clarifying the understanding of climate change among the respondents. It gave the freedom to the respondents to give their own interpretation of “why” and “how” the phenomenon was happening and ‘what’ were they doing based on their understanding. This process hence helped generate explanations regarding the impact and the adaptations, the role of institutions, technology, participation and collective action that were grounded in the context of climate change.

The sampling method used was purposive sampling to understand and identify the perceptions of farmers to climate change and subsequent adaptation practices. The sample was separated into large, medium, and small farmers, landless laborers and women.

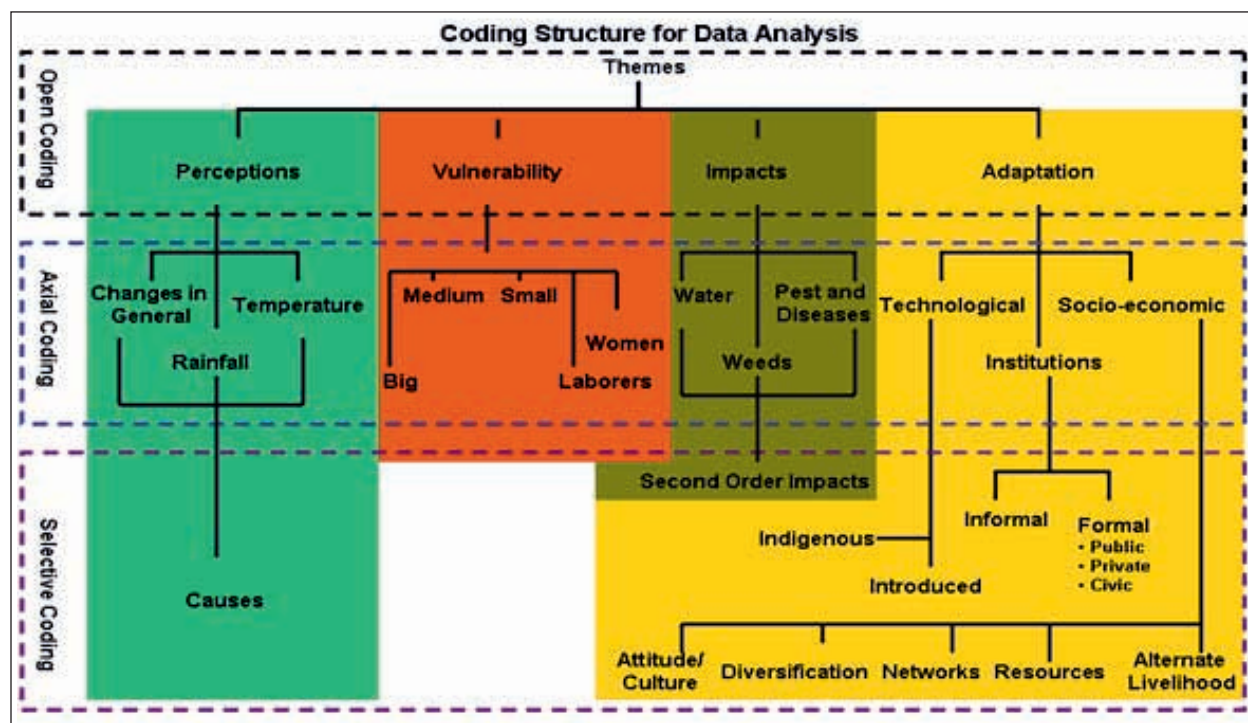


Figure 1. Analysis process based on Grounded Theory.  
Source: Self

### 3. Findings

#### 3.1 Community Perceptions on Climate Change and Perceived Impacts

##### Climate Change or Climate Variability

It was observed that in both Shirapur and Aurepalle, there was a concern with regard to the variability of the climate though respondents could not pinpoint on climate change. The variability was noticed through reduction in the rainfall intensity and the duration of the rainfall in the last 20 years along with the erratic nature in the distribution of the same (Table 3). The respondents felt that there had been an increase in temperatures, indicators of which were in the form of warmer nights during winters and intense summers. In Aurepalle, the respondents felt that most of the rains were coming during the harvesting time of the crops, whereas in Shirapur, the farmers had been experiencing continuous unfavorable conditions for two years. The interesting observation in the case of the villages was that the respondents, other than the stated reasons of increasing pollution and cutting of jungles, attributed the variability of climate to the Supreme Being, being unhappy because of the human carelessness shown towards the natural environment.

##### Water stress

In the case of both Aurepalle and Shirapur, the respondents across groups observed that there had been a sharp decline in water tables in the last 20 years, with most of the open wells completely dry and 75% of the borewells failing in the former and about 50% of them failing in case of the latter.

The respondents, citing examples, recalled that 10-12 years ago (around 1999-2000) the water from the borewells was available at 100 feet as compared to the present where they had to be dug for atleast 400 feet. In Shirapur, it was claimed that in 2002-03 there was a situation with no water in the canals.

The respondents of both villages felt that the resulting water stress was because of decreasing rainfall and inadequate percolation. However they could not rule out the possibility of the same due to increasing population pressure.

## **Pests and diseases**

The increase in pest attacks was attributed to the delay in the monsoons, increase in temperature and subsequent delay in sowing. In addition to the late rains and late sowing, they felt that the increase in pest attacks had taken place since they had started growing cotton about 5-6 years ago, as the variety that they were using (BT cotton) was susceptible to pest attacks. They felt that it was essential that there was timely rainfall as deviation from it encouraged the attack from pests and increase in plant diseases.

## **Second Order Impacts**

The farmers across groups informed that since the past two years there was a constant cycle of resowing the seeds because of the uneven distribution of rainfall, delay in the onset of rains followed by dry spells. Citing the example of cereal production in Aurepalle, the farmers stated that for a good harvest, it was imperative that the cereal crops were planted at the right time and if delayed the yield would be affected. The smallholder farmers shared that most of the crops had dried up as the majority of them were unable to irrigate their lands. Some of the farmers who were involved in toddy tapping informed that the untimely rains had affected the extraction and that it was particularly severe in 2009.

In Shirapur, the farmers gave an example of 2008 where most of them were not able to sow the *kharif* crops. In 2009, the rains being late by two months had delayed the sowing and the harvesting time had come early, which had affected the quality of the pigeonpea and drumstick crops. There was no flowering with the standing crops not being more than 1 or 2 inches long. The first generation farmers<sup>1</sup> reflected that since the rains were becoming more erratic and less than what it should be, it was getting difficult for crops such as sorghum to survive. In the last 10 years, it was claimed that the area under cereal crop production had decreased from 20% to 5%. Though it was claimed to be as a direct consequence to the uncertainty of rainfall, it cannot be ruled out that it could be also as a result of market influence of cash crops over food crops.

The high intensity and out of season rains had affected horticulture crops such as bananas and grapes as most of the orchards would get destroyed because of the strong winds that accompanied the rains.

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<sup>1</sup> The first generation farmers are defined as the ones who are at least 65-70 years old.

**Table 3. Farmers' perception on climate change and variability.**

Changes in Climatic Characteristics	Aurepalle					Shirapur		
	Old Farmers	Young Farmers	Women	Reasons	Old Farmers	Young Farmers	Women	Reasons
Quantum of rainfall	Substantially reduced than what it was in the past	Decreased rainfall Less soil moisture	Rains reducing with each passing year		Visible decline in amount of rainfall	Reduction by almost 35%	Reduction by almost 35%	Cutting down of trees
Number of rainy days	Less than 45 days and in breaks	Less than 45 days	Less than 45 days	Cutting down of trees	Less than 45 days	Less than 45 days	Less than 45 days	Jungles are being cut and animals like goats are eating them
Rainfall outside the rainy season	Rains coming when not required	Rains during the harvest season when not required	Rains in November which is an unlikely time	Jungles are being cut and animals like goats are eating them	Rains come when crops ready for harvesting	Come in May and disappear and then come again end of August	Rains come when crops ready for harvesting	Increase in area taken up for growing crops Pollution from vehicles
Onset of rainfall	Rains coming one month after the expected time	Continuous late rains particularly in the past 5-6 years	No Rohini rains and Aarudra rains late by a month	Wrath of God for destroying the environment	Have been later than 7 June since 5-6 years	Have been later than 7 June since 5-6 years	Have been later than 7 June since 5-6 years	Wrath of God for destroying the environment
Temperature	Increase in heat conditions and warmer winters	People are sleeping outside even during the winter seasons	Summer months intolerable		Increase in heat conditions and warmer winters	10 years ago temperatures were lower than what they are presently	Summer months intolerable	

Source: Farmer FGDs Aurepalle and Shirapur 2009

### 3.2 Adaptive Capacity and Behavior

The fairness of the rules by which these decisions are made is fundamentally determined by the underlying distribution of power within the institutions that manage resources and often create vulnerabilities (Adger et al. 2005). For a strategy to be successful to its maximum effect, it is important that it has the required heterogeneity, which is in the capacity of different stakeholders to adapt to across the different groups. These capacities are often determined by technological, institutional support and socio-economic choices.

Taking these factors into consideration, the respondents of both the villages thought that a farming community took a minimum of two years to recover from a climatic shock or bad year (Table 4).

**Table 4. Recovery period of various groups w.r.t climate shock/bad year.**

Category of respondents	Time span to recover	
	Aurepalle	Shirapur
Big Farmer	1-2 years	1-2 years
Medium Farmer	2-3 years	3-4 years
Small Farmer	2-3 years	3-4 years
Laborers	2-3 years	3-4 years*
Women	Dependent on household	Dependent on household

Note: This is assuming that the following year is a normal year or a favorable year

\*Though the farmers thought that with the kind of government aid and livelihood options available to them this group could recover in a year's time

Source: Farmer FGDs Aurepalle and Shirapur 2009.

### Technological

It was claimed by the respondents of both the villages that with the increasing water stress, the methods of irrigation had changed from mainly being wells and tanks to presently borewells with depths of atleast 300 feet. Respondents across all groups stated that in the last 10 years there were only tube wells that had been used as sources of irrigation (Table 5). It was informed that Aurepalle did not have a dam or a river as a water source; however, the drinking water had been taken care of by the government through an overhead tank, which was built in the village about 5-6 years ago. In Shirapur, the water in the wells was attributed to the availability of water from the canal, which was introduced to the village in 1991 through the dam. The water from the dam was released depending on the requirement of the water in the fields.



**Table 5. Changing sources of water for irrigation.**

Total number in the villages								
Source	Aurepalle				Shirapur			
	2009	2000	1990	1980	2009	2000	1990	1980
Wells	0	50	>100	>100	60	50	46	46
Bore wells	400	80	0	0	>300	>40	10	0
Tanks	0	0	1	1	1	1	1	0
River	0	0	0	0	1	1	1	1

Source: Focus Group Discussion with Farmers: Aurepalle and Shirapur, 2009.

In spite of the high costs of cultivation, the respondents stated that almost every one of them used tractors to plough their lands as it was less time consuming and also solved the problem of getting labor to a large extent. It was claimed that almost 70% of the farming was mechanized though the respondents didn't deny the use of bullocks from time to time for ploughing. In Shirapur most of the farmers were using tractors to plough their fields except for the ones who were completely dependent on the rains for their farming and who had land close to the canal.

In Shirapur, the presence of irrigation from the canal had reduced the impacts of climate change on agriculture, though efficiency of water usage needed to be improved. The majority of the farmers have diversified into growing sugarcane since atleast 8-10 years as they claimed that it was not easily affected by the variability in climate. Among the food crops, pigeonpea and sorghum were grown as subsistence. There were about 3–4% of the farming community who had diversified into horticultural produce, though the production of grapes had drastically reduced as it was claimed to be the most susceptible to the erratic nature of the climatic conditions.

In Aurepalle, the farmers had shifted to short duration paddy seeds along with sunflower and maize; they were continuing to grow groundnut and BT cotton. The government, by providing subsidies on drip irrigation to grow groundnut had encouraged the farmers to get back into groundnut growing even though it was water intensive. Since BT cotton was found to be the most commercially viable crop, most of them had shifted to allocating certain parts of their farms to growing cotton. This shift was claimed to have taken place during the last three years.

In both the villages, the respondents claimed that the ones who have grown and diversified into different varieties of crops have experimented on their own and were adjusting and experimenting in terms of what worked and what did not across seeds, pesticides, fertilizers and so on. It was stated that the objective of the experimentation was to ensure that not only was it climatically favorable but it was also profitable enough as profitability was seen as an issue with regard to dryland agriculture.

### **Institutional support**

External interventions can reinforce livelihoods, practices and local rural institutions by supplying four types of supports: informational, technological, financial and leadership that

reduces the costs of collective action (Agrawal 2008). These categories of support were considered in the context of the study villages to establish how different kinds of institutions may emphasize certain adaptation practices.

## **Financial**

Crop insurance was acknowledged by the respondents as a good mechanism for safety against the increasingly erratic and uncertain weather conditions. However, the farmers still lacked proper understanding of the implementation process. The uptake of crop insurance was more in Aurepalle than in Shirapur.

Women were observed to be highly dependent on self-help groups (SHGs) for not only financial assistance but as a platform to mediate access to technology along with credit especially in Aurepalle. In the case of Shirapur, it was mainly for purposes of acquiring credit for non-farming activities such as meeting household expenses and starting petty business. This reliance on SHGs seemed important despite the fact that they were not run as efficiently as they should have been, compared to the ones seen in Aurepalle.

It was interesting to note that only Aurepalle had the presence of a microfinance institution (MFI) called SKS Microfinance<sup>2</sup>. The MFI gave loans, which ranged from ₹ 10,000 to ₹ 40,000 with a weekly collection of ₹ 225 over a maximum of 50 weeks. Though the loans were given for farming activities, most of the respondents used them for non-farming activities like meeting household expenses.

Money lenders continued to be quite popular in both the villages among the laborers and smallholder farmers since they did not ask for collateral. Even though the interest rate was as high as 36% per month, almost 50% of the village community obtained loans from them.

Generally, immediate financial assistance in case of a climatic shock was sought mainly from family and friends, rich farmers and moneylenders as the respondents claimed that the government programs took time to implement. Co-operatives also played a vital role in financial assistance for the farming community, especially for the medium-sized farmers in the two study villages.

## **Leadership**

The Indian Government operates several social protection programs to reduce risks such as food insecurity faced by vulnerable groups and assist them to graduate out of poverty. Like many rural development programs, they are prone to governance challenges such as leakages especially in procurement, human resource management issues and biased targeting (Raabe et al. 2010). Effective implementation of these programs requires good leadership and transparency from the Central Government, state governments and the local level. The government programs in Aurepalle were perceived by laborers and smallholder farmers to be running more efficiently compared to the ones in Sholapur.

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<sup>2</sup> Started as an NGO in 1998, SKS is a for-profit NBFC (Non-banking financial corporation) regulated by the RBI. SKS uses the group lending model where poor women guarantee each other's loans.



The laborers and the smallholder farmers stated that besides the normal or favorable years, during the time of climatic shocks, they relied on government schemes like The Mahatma Gandhi National Rural Employment Guarantee Act<sup>3</sup> (NREGA) for work and the Public Distribution System (PDS<sup>4</sup>) for supply of food grains. For laborers, the PDS, locally known as the “control shop” was regarded as quite important as they had Below Poverty Line (BPL) cards that gave access to essential food grains at below market prices. During a bad year or an extreme event, essential food grains were sometimes even provided free to this group, depending on severity of the event. NREGA seemed quite significant among not only the laborers but also the farming community and the women.

It was worth noting that though the laborers and the smallholder farmers completely relied on the NREGA and the PDS, the medium farmers in Aurepalle were also using and benefiting from the same. It could be assumed to be a concentrated intervention of the government given the background of the frequent occurrence of drought conditions in the district. Another likelihood is that the community themselves, irrespective of socio-economic status, have acquired the use of government programs as a long term adaptation strategy.

The women perceived that besides their SHGs, the school and the PDS, the Anganwadi<sup>5</sup> centre was very important to them as they were not only a source of education for their children, but also provided meals both during favorable and unfavorable times.

The government has also taken initiatives on natural resource management. For instance, there have been some restrictions on the felling of trees, along with promotion of tree planting from time to time. The scheme ‘*Pani Aarwah aani Paani Jhirwa*’ (Stop Water Conserve Water) in Shirapur, was believed to be helpful in increasing the water table, as it promoted bunding and field ponds.

The respondents pointed out that during a climatic shock, the Gram Panchayat mainly served as an agent of the Zila Parishad<sup>6</sup> for distribution of food and subsidies provided by the government.

## Technological

The increased use of sprinklers and drips in the recent years was attributed to government subsidies and promotion of horticulture. However, the uptake of drip and sprinklers was still restricted to only some of the farmers who were using it on an individual basis. The government was also providing loans at cheap or subsidized rates as the case might be to a farmer having a landholding of 2 acres to dig a well or deepen the existing one.

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<sup>3</sup> Aims at enhancing the livelihood security of people in rural areas by guaranteeing hundred days of wage-employment in a financial year to a rural household whose adult members volunteer to do unskilled manual work.

<sup>4</sup> An Indian food security system that distributes subsidized food and non-food items to India’s poor through a network of public distribution shops (PDS) established in several states across the country.

<sup>5</sup> Anganwadis are defined as play schools for children from 2-5 years.

<sup>6</sup> Zilla Parishad is a local government body at the district level in India. It looks after the administration of the rural area of the district and its office is located at the district headquarters. The Hindi word Parishad means Council and Zilla Parishad translates to District Council.

Dairy farming was emerging as a potential source of livelihood in the study villages. In the case of Shirapur, an entrepreneur in the village who had established a milk dairy for collective marketing was offering loans to the smallholder farmers, which were paid back through delivery of milk.

For farmers of Shirapur, the water distribution system from the canal was seen to be critical as a means of supplying water to their fields. The farmers explained that they got the water from the canal by paying for it, which was fixed depending on the crop by acre. Though the water supply was primarily meant for farming purposes, it was also used for industrial purposes and drinking water needs. During an unfavorable year, water was released into the canal under emergency grounds to ensure certain minimum water availability for farming activities. This however depended on the levels of water available in the dam.

The suggestion of pricing of water to ensure optimal use of the same was evidence enough that there was a strong sense of awareness among the farmers regarding the conservation of water and the need for water harvesting to raise depleting water tables.

The construction of the airport near Aurepalle and the presence of industries such as the sugar factory and the MIDC (Maharashtra Industrial Development Corporation) in Shirapur, has led to traditional coping strategies being integrated with diversification into alternative occupations.

### **Informational**

In the context of getting information, the second generation farmers<sup>7</sup> in Aurepalle went to the market themselves and acquired information from traders on an individual basis or at the most groups of two. The first generation farmers along with the rest of the farming groups asserted that they relied more on the Agriculture Department than the private companies for information regarding agricultural inputs and market conditions.

Where Shirapur was concerned, most respondents got their information and purchased inputs from the private seed companies. Their source of information regarding prevailing market conditions was the shopkeepers that sold them seeds, the middlemen and sometimes the television. 80% of the farmers got agriculture-related information from private agencies. The marketing of produce was done on an individual basis by the farmers through middlemen. However, there was no mention of seeking any form of assistance from the KVKs in either of the two villages.

The only visible form of collective action was seen in Shirapur, and this was in the form of canal maintenance. It had become mandatory to work in a group as the farmers were getting the water from that one line and collective non-maintenance would lead to disruption of supply of water to their fields.

Through the interviews, it was established in the two villages that social networks was an important factor when it came to the adaptive capacity of a group or individual as i) it was a means of accessing alternative livelihoods through migration to the cities and other places

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<sup>7</sup> Second generation farmers are defined as farmers who have been farming for about 15-20 years.

outside the villages ii) when there was a bad year or a climatic shock, the first reaction had always been to approach the most trusted people who could be friends, relatives, parents and even local moneylenders. (See Annexure 1).

### **Socio-economic**

In the case of Aurepalle, it was claimed that labor participation contributed about 30% of the income, caste occupations such as Todi tapping and selling, goat and sheep rearing comprised about 20%, livestock rearing 20%, out migration 20%, while agriculture contributed to only 10% of the income. In the case of Shirapur, some of the respondents had government jobs with fixed salaries, though both the villages displayed the trend of starting small businesses through petty shops and accessories either in the villages themselves in the case of the women, and on the outskirts of the villages in the form of small roadside hotels in the case of the men.

The respondents in both the villages were of the opinion that there had been a radical shift from food crops to cash crops in the last four-five years, in addition to some orchard based crops like oranges, bananas and pomegranate, though the shift to horticulture was by a relatively small number of farmers. The food crops that were being grown were mainly for subsistence. The reasons cited were increase in price of cereal crops, labor problems and uncertainty of rainfall. Most farmers moved to cash crops as they perceived it to be more viable than food crops both in terms of production as well as profitability.

Across groups, it was felt that diversification in livelihood was useful especially as the weather and climate was becoming more erratic with each year. It was justified on the grounds that with the diversification to non-agricultural activities, even if there was a 90% crop failure, a household irrespective of the size was still in a position to cope in spite of setbacks.

One such example was that of Shirapur where the respondents informed that 80% of the people were sugarcane growers. The sugarcane was sold to the nearby sugar factory at ₹ 1,800 per ton as the farmers informed that the prices of cane had gone up in the past two years with further anticipation of price hikes in the future (Table 6).

### **3.3 Constraints to Adaptation and Vulnerability**

Opportunities in the form of financial and information access, technology and leadership and their adequate utilization depends to a large extent on the implementation will and efficiency of the local administration along with the conditioning socio-cultural factors. The adaptive capacities of individuals or groups are thus influenced by these factors, which can also be reasons of constraints to their capabilities to adapt, this making them vulnerable. Four categories of such constraints emerged; financial, governance, infrastructure and information access (Table 7).

Table 6: Adaptation Behavior across groups.

Shirapur					Aarepalle				
Ex - Ante					Ex - Ante				
Big Farmer	Medium Farmer	Small Farmer	Women	Laborer	Big Farmer	Medium Farmer	Small Farmer	Women	Laborer
Loans from banks and co-operatives for agricultural inputs  Crop Insurance	Loans from banks and co-operatives for agricultural inputs  Crop Insurance	Aid from Government schemes and PDS  Pull migration in transport companies for additional income	Loans and savings with SHGs	Government Programs - NREGS (digging wells, building bunds, roads)  Pull migration to nearby industries, towns and cities	Loans from banks and co-operatives for agricultural inputs  Crop Insurance	Intensification on small portions of their land  Loans from banks and co-operatives for agricultural inputs  Crop Insurance	Pull Migration  Loans for input purchase  Aid from Govt schemes and PDS	Loans and savings with SHGs, MIFs and chit funds	Pull Migration  Government Programs - NREGS
Ex - Post					Ex - Post				
Big Farmer	Medium Farmer	Small Farmer	Women	Laborer	Big Farmer	Medium Farmer	Small Farmer	Women	Laborer
Continue working in the fields and reduce	Loans from banks and co-operatives, other sources	Loans from sources available	Work as laborers	Push migration to nearby industries and cities	Savings of previous years	Loans from banks and co-operatives	Push migration	Work as farm laborers	Push migration
Less of produce sold more of subsistence	Increased participation of family members	Leave their own fields and look for work in other fields	Loans from SHGs	Loans from sources available	Recovery of loans	Increased participation of family members	Loans from sources available	Migrate depending on the severity of the situation	Depend on NREGS for work
Savings and stocks from previous years	Most of the produce used as subsistence	Migrate depending on the severity of the situation	Migrate depending on the severity of the situation	Selling of assets depending on the severity of the situation	Leaving land fallow	Limited or no use of hired human resources	Selling of assets depending on the severity of the situation	Loans from SHGs	Selling of assets depending on the severity of the situation
	Postpone all major investments	All produce used as subsistence	Reduction in consumption of food and expenses	Aid from Govt schemes, e.g. NREGS and PDS		Non farm employment	Aid from Govt schemes and PDS	Reduction in consumption of food and expenses	Aid from Govt schemes and PDS
	Limited or no use of hired human resources	Aid from Govt schemes, e.g. NREGS							

Source: FGD with family and non family community Aarepalle and Shirapur

## **Financial**

With regard to access to formal sources of finance, only Aurepalle had microfinance institutions or private bank establishments. In addition, the need for a collateral and negative attitude of the bank and co-operative officials towards the smallholder farmers, laborers and women, emerged as deterrents towards approaching these formal institutions for credit.

The lack of access to formal financial sources and inadequate information about the schemes and benefits available made the laborers and the smallholder farmers dependent on middlemen and the moneylenders who most often than not were misleading them into farming and non-farming practices that were detrimental to their livelihoods, making them susceptible to future climatic shocks. One of the reasons for lack of collective action by the farmers was claimed to be that most of the farmers were not very rich and that there was a continuous requirement of money to repay debts to moneylenders and banks.

The women and laborers relied on their Self Help Groups (SHG) since there was no need of collateral. The assets of the household were mostly in the name of the husband making it difficult for women to gain access to formal sources of credit. The interest rate charged at the SHGs was 3% per month for both farming and non-farming activities, the latter being activities like setting up of small businesses. It was, however, observed that the SHGs were being managed better in Aurepalle than in Shirapur.

The need for better financial inclusion and access to more formal systems of finance especially for women is pertinent not only to increase their capabilities but also the overall adaptive capacity of the household, as the woman plays a major role in the household management especially during crisis situations or climatic shock.

With regard to dairy farming, there was a clear disparity that was seen in Aurepalle as it was mainly the big and the medium farmers who were indulging in dairy farming whereas the smallholder farmers and the landless were more into caste based occupations.

## **Governance**

The human development approach recognizes that valuable capabilities can be expanded through institutions, though they can be responsible for constraining the achievements of these capabilities as well, especially where social norms discriminate between people. (Johnson 2009). The issue of poor governance emerged considerably in both Aurepalle and Shirapur with respect to the functioning of the Gram Panchayat, as it was considered to be of not much service when it came to agriculture, especially during climatic shocks. It was pointed out that the probable reason was the limited resource base that the Gram Panchayat had access to, which did not allow them to aid the farmers adequately. The laborers accused the Gram Panchayat of being inefficient regarding the implementation of the National Rural Employment Guarantee Scheme (NREGS).

The medium group of farmers, in Shirapur and Aurepalle, felt that lopsided preferences of the government was an impediment in working towards means to be better prepared to meet the challenge of the increasing climatic variability.

In Andhra Pradesh, the schemes promised by the former Chief Minister (YS Rajasekhara Reddy) were not implemented after his sudden death even though he belonged to the current ruling party. The community attributed these failures in assistance to the lack of political will and prevalent corruption in the existing system.

Even though Shirapur seemed to have the most advanced sources of irrigation, there were complaints of malpractices and mismanagement of the water distribution. In spite of representation at the local level in the Water User's Association, the respondents felt that the influence of the central authorities was most often conflicting with the needs of the locals, determining the allocation of water from the dam to the canal and diversion for industrial use. There was a feeling among the respondents that because of the politics of water distribution, there could be an adverse effect in the near future on the production of sugarcane, which was the major crop in Shirapur.

The issue of poor governance was apparent as a key concern, with political connections and influence acting as major factors that determine whether community members will derive benefits from existing opportunities and entitlements. Although inherent capabilities exist, external factors like lack of accountability and politics of distribution become major impediments to develop a community's adaptive capacity. This is exemplified by the contrast between the Maharashtra and the Andhra Pradesh villages in terms of implementation of government schemes, the latter being much more effective as perceived by the respondents. The capabilities are understood as both mutually supportive and all of central relevance to social justice.

Governance and allocation of resources is a concern especially in a country like India, where political connections and influence act as major factors in determining the development of an area. This becomes particularly important when certain groups are dependent mostly on provisions made by the government and look up to it to safeguard their adaptive capacities against uncertainties such as increasing climate variability.

## **Infrastructure**

In Aurepalle, of the 400 borewells, 30% had dried up. The issue of irregularity in availability of electricity in Shirapur had led farmers to being discouraged to use drips though they were aware that it was less water intensive. The demand exceeding the supply of the same had aggravated the level of power cuts from 8 hours to 16 hours, which was affecting the crop production, especially of the ones whose fields were away from the water sources that were being used for irrigation in the village.

Another key factor that emerged as a constraint to adaptation was the lack of institutional arrangements for providing access to input and output markets. It was mentioned that each farmer independently sells their produce, according to the prevailing market price, to the trader. The reasons they cited were i) due to the lack of storage facilities in the village and the need for finances, they had to sell their produce soon after harvest ii) they did not have a co-operative of their own with the help of which they could negotiate better prices for themselves. In addition, the sugar factory in Shirapur had a monopoly in the area because of which there was hardly any



room for negotiation of prices for the farmers and they accepted the price that they were being offered.

The reason for the absence of the co-operative and storage facilities was attributed to the lack of a collective feeling to create one. This is a typical problem in situations where multiple individuals would all benefit from a certain action; there is no incentive for individuals to incur the associated cost especially when there will be free-riders. There was a noticeable practice of dairy farming in Aurepalle. Some form of collective action was observed among the farmers in Shirapur for the maintenance of the irrigation canals; otherwise it would hamper water supply to the fields. Barriers to collective action in the villages were cited as mutual distrust and the fear of either exclusion of the most vulnerable or elite capture and dominance of particular groups.

In Shirapur, the viability of agriculture as a profitable livelihood option was reported to be going down. At the same time, the lack of collective feeling and action hindered bargaining for better market prices and the development of alternate livelihood options.

The PDS had emerged as one of the most important institutions contributing to adaptive capacity in all the villages through subsidized food especially during times of climatic shock. However the point of concern on certain occasions was the quality of the food grains that were made available in the shop. Since there were limited or practically no choice on getting subsidized food, the community was accepting what was on offer. However, this might also be a strategy of the government so that the beneficiaries self-select as the well-off households may not want to acquire the poor quality grains.

## **Information Access**

Wealth or resources alone cannot act as a good indicator for judging an individual's capacity to adapt, rather it depends a lot on actual opportunities that a person has than the means (Sen 2009). It was seen in Aurepalle that the respondents felt that there was a dearth in the formal information sources and the guidance in terms of the kind of seeds available, shorter varieties which were both drought resistant yet profitable. There was a need expressed as the respondents believed that because of the lack of government's initiatives in this regard, most people were ignorant and were continuing farming practices without being aware of what they were using. Similarly, in Shirapur, one of the reasons cited for using excess of chemical fertilizers and pesticides was because there was lack of guidance from formal sources on the appropriate time and the quantity of application. The practice was thus harming the crops and soil more than being useful.

**Table 7. Constraints to adaptation.**

Constraints	Aurepalle	Shirapur
Financial	Inability to access the formal financial services cited as the requirement for collateral	Lack of access to formal financial services because of need of collateral
Governance	Grains provided in the PDS shops are of questionable quality and sometimes non-consumable Benefits received by those with influence and contacts over real beneficiaries	Grains provided in the PDS shops are of questionable quality and sometimes non-consumable Lack of resources by the Gram Panchayat makes it ineffective during a climatic shock NREGS mainly working on principle than actual
Infrastructure	No storage facilities for crops and produce No fodder depot in the village	No storage facilities for crops and produce No fodder depot in the village Availability of electricity only for 8 hours from 16 hours
Information	Lack of information and formal guidance on short duration variety of seeds Lack of government's initiatives in providing information on the above	Lack of information and formal guidance on use of fertilizers and pesticides No other organization available to give information other than ICRISAT

Source: FGD with farming and non – farming communities in Aurepalle and Shirapur 2009

## 4. Summary and Discussion

In order to understand and identify the perceptions of the farmers on climate change and adaptation strategies based on the same, it was significant to begin the research with an explorative and iterative approach to data collection. Adopting an analytical approach based on grounded theory gave the flexibility and methodological rigor needed to adjust the theoretical framework guiding the research to fit the data collected in the field. The study began by conceptualizing vulnerability, and associated individual or group decision-making, using an approach based on theories of capability and entitlements. The findings identified key drivers of adaptation and several important constraints that worked as a deterrent on adaptive potential and capacities.

The study of the two villages, namely Aurepalle in Mahabubnagar, Andhra Pradesh; Shirapur in Sholapur, Maharashtra, showed that climate variability is a major concern for the farming community. Farmers are and have been perceiving variability in climate for at least 20 years, with this becoming more obvious in the past five-six years. Village level historical timelines indicate that there is correspondence between these perceptions and recorded weather data. It cannot be ignored that it is not so in isolation as factors like soil degradation, decreasing livestock, reducing jungle cover are changes that have happened over a given span of time, not



related to climate variability directly, but do have the capacity to accentuate the impacts of climate variability.

The farmers see the climatic shocks that they have experienced over these years, in the form of extreme events like prolonged dry spells or unprecedented floods, late onset of rains, shorter wet monsoons characterized by little but intense rainfall, strong winds with excessive rains, as evidence of variability; similar to the studies of the perceptions of farmers in Africa (Thomas et al. 2007, Mbow et al. 2008). As a result of these perceptions, the farmers in the SAT have developed coping strategies that evolve as long-term adaptation mechanisms to shield themselves against climate uncertainties. Some of the attempts are reflected through farmers building furrows in between the sugarcane plants to regulate the flow of water. Yet others are constructing mounds around the fields and growing trees on them to prevent soil erosion and collect the excess water, which could be seen as local practices carried out through generations, still thought effective as an adaptation strategy.

Practices like diversification to short duration crops and commercial crops like sugarcane and experimenting with indigenous methods of soil conservation along with involvement of women in farm activities and cast based professions, which they were not part of earlier, is a representation of options that have emerged locally. They are clearly effective and have come to be accepted socially and culturally at the local level, indicating that individuals and communities faced with both rapid change and increased uncertainty are challenged to respond to climate changes in new ways to protect their social, environmental and human rights, thus empowering them to come up with ways of adaptation and mitigation (Human Development Report 2007/2008).

The emphasis on water conservation practices is evidence enough to suggest that farmers are ready and obliging to work towards it, assuming they have definite guidelines and capacities. The shift from food crops to cash crops because of the climate as well as commercial viability does raise some concerns regarding food security.

When a climatic shock is felt by the agricultural or the agricultural labor community, one of the resorts sought is migration. However, over a period of time, this short term measure begins to emerge as a potential adaptation strategy in the form of short term migration. This is where the role of social networks plays a significant role. Migration by the youth to the city of Hyderabad in the case of Aurepalle and cities like Mumbai, Pune and Sholapur in the case of Shirapur based on existing networks was an example of this phenomenon.

At the institutional and the community levels, there are serious constraints towards adapting to what may be a more challenging future resulting from climate change. The lack of collective feeling and action, particularly in the villages of Maharashtra, has hindered bargaining for better market prices and the development of alternate livelihood options. At the same time, the viability of agriculture as a profitable livelihood option was reported to be going down; notwithstanding the fact that for the older generation of farmers it was still the preferred livelihood option. The minimal impact of information and communication technologies (ICT) as a knowledge dissemination tool in today's digital age was a source of concern to the farmers, and so was the lack of options such as toll-free numbers for the farming community.

The issue of poor governance was apparent as a key concern, with political connections and influence acting as major factors that determine whether community members will derive benefits from existing opportunities and entitlements. This is particularly important in a country like India, when certain groups are dependent mostly on provisions made by the government and look up to it to safeguard their adaptive capacities against uncertainties such as climate variability.

The contrast between Shirapur and Aurepalle in terms of implementation of government's schemes demonstrates that although inherent capabilities exist, external factors like lack of accountability and politics of distribution are major impediments to develop a community's adaptive capacity. This becomes important as the capabilities are understood as both mutually supportive and all of central relevance to social justice, which is determined by the availability of resources and crucially by the entitlement of the individuals and groups to call on these resources (Adger and Kelly 1999).

The concerns of the medium group of farmers in Shirapur and Aurepalle regarding the lopsided preferences of the government could be seen as a reflection of distributive justice, which looks at welfare maximization with the notion that the most able adapt, though the most vulnerable are the ones who are prioritized (Nozik 1974).

Growth in industry and other sectors of the economy was seen to have significant effects on the rural agricultural community. For instance, the presence of a sugar factory in Shirapur and the international airport near Aurepalle have stabilized the livelihood options of most farmers along with non-farmers. Nevertheless, this stability could be threatened if government policies such as pricing of sugar look unfavorable. All the same, efforts towards better, accurate and formalized information dissemination have to be looked at if adaptive capacities of the farming community have to be improved.

Social resilience is observed by examining positive and negative aspects of social exclusion, marginalization and social capital (Hayami and Ruttan 1985; Stern 1995). It needs to be reiterated that there is an urgent need for better financial inclusion and access to more formal systems of finance not only to increase the capabilities of the women, smallholder farmers and the laborers but also the overall adaptive capacity of the household. Women especially play a major role in the household management particularly during crisis situations or climatic shocks and often are the ones who are affected the most as they become the first targets of food insecurity thus making them more vulnerable than any other groups.

The cultural context of institutional adaptation and the differing conceptions of human–environment interactions within different knowledge systems are central to the resilience of institutions (Gadgil et al. 1993, Blaikie et al. 1997 and Brown 1997). Access to instrumental freedoms, namely political freedom, economic facilities, social opportunities, transparency guarantees, and protective security is necessary to gain a better quality of life and acquire the capabilities they need to build better resilience to climatic shocks. Therefore, it would be worthwhile to develop an understanding of how much of the freedoms mentioned, are accessible to certain groups, if they differ depending on the socio-economic-cultural background and how they determine and influence the coping mechanisms and adaptive capacities.

## 5. The Way Forward

Through this study it has been established that the farming community is reacting to climate variability and stands to be vulnerable in the future because of increase in the same. With the findings in the field it has also been established that agricultural development is fundamentally a social process in which people construct solutions to their problems. It goes beyond technology and economic principles as it is determined within social, political and cultural realms, ie, every process is determined simultaneously by every other process in society (Yapa 1993).

It needs to be acknowledged that i) farmers have developed coping strategies to shield against the climate uncertainties ii) a better understanding of the farmers' needs, current and past adaptation measures and constraints is required for a sustainable system. This will entail further studies and documentation of innovations being carried out both at the technology and institutional levels in the given social system towards better agricultural practices. The stability of the systems in themselves is usually a contributing factor to induce innovation and technology development, which is an important factor in determining adaptation capacity (Hayami and Ruttan 1985; Stern 1995). In policy terms these are also useful since both ecological stability and resilience are perceived as desirable social goals for many issues, from nature conservation to climate change as there is a profound relationship between ecological and social resilience.

## 6. Annexures 1, 2 and 3

### Annexure 1: Perception on the Importance of Institutions to aid Adaptive Capacities

**Table 8. Perception on the importance of institutions to aid adaptive capacities in Aurepalle Village.**

Formal														Informal																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
Govt. Progs NREGS/ Indira Aawas														Private Institutions-Seed companies				Co-operatives		Banks		MFIs		Fodder Depot		KVK /Agri Dept		Gram Panchayat		Chit Funds		Money Lender		Family/ Relatives																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Groups	PDS	Yojana	SHGs	Indira	Aawas	Seed companies	operatives	H	H	L	M	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	Fodder	Schools	Depot	F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**Table 9. Perception on the importance of institutions to aid adaptive capacities in Shirapur Village.**

Groups	Formal										Informal				
	PDS	Govt. Progs NREGS/ IAY	SHG	Private Institutions- Seed companies	Co-operative	Bank	ICRISAT	Water Dist System	Fodder Depot	School	KVK /Agri Dept	Gram Panchayat	Sugar Factory	Money Lender/ Village Dairy Farm	Family/ Relatives
Big Farmer	L	L	M	H	H	H	H	H	M	H	L	L	H	L	H
Medium Farmer	L	L	M	H	H	H	H	H	M	H	L	L	H	L	H
Small Farmer	H	H	M	H	L	L	M	H	L	H	L	L	H	H	H
Women	H	H	H	L	L	L	L	L	L	H	L	L	H	M	H
Laborers	H	H	H	L	L	L	L	L	L	H	L	L	H	H	H
H = High M = Medium L= Low															
Source: FGD across groups: Shirapur 2009															

Where importance of an institution was defined as high (H) if the particular group thought it was extremely important and relied on it for assistance. The ones that the respondents defined as being medium (M) in importance were those from which they either had got help from in the past, were getting some benefits in the present and were likely to continue getting certain benefits in the future. The ones that were termed as being low (L) in importance were those organizations that the respondents perceived as having inefficiencies and constraints to enhancement of their adaptive capacities.

## Annexure 2

**Table 10. Important ongoing Government Programs**

Shirapur		Aurepalle	
Program	Purpose	Program	Purpose
Self Help Group (SHG)	Each group consists of 11 members; where savings are collected from the women each month on a fixed amount.	Self-Help Groups (SHGs)	Each group consists of 15 members; where savings are collected from the women each month on a decided amount.
National Rural Employment Guarantee Scheme (NREGS)	Guarantees employment as wage labor; helps in arresting migration	National Rural Employment Guarantee Scheme (NREGS)	Guarantees employment as wage labor; helps in arresting migration
Public Distribution System (PDS)	Subsidized wheat, rice, kerosene and sugar mainly to the BPL card holders	Public Distribution System (PDS)	Subsidized rice, kerosene and sugar mainly to the BPL card holders
Prime Minister's Package	Provision of seeds for the required crop by the Government at 50% subsidy	Anganwadi centers	To improve nutrition and health of infants, young children, pregnant women and lactating mothers who are below poverty line
Pension Scheme	Old people, widows and physically handicapped (200 rupees per month)	Pension Scheme	Old people, widows and physically handicapped (200 rupees per month)
Employment Guarantee Scheme	Providing work for agricultural labor during lean period in agriculture	Jathiya Prasuthi Sahaya Padhakam	Supply of nutritious food before and after delivery

*Continued*

**Table 10. Important ongoing Government Programs** *continued.*

Shirapur		Aurepalle	
Program	Purpose	Program	Purpose
Indira Aawas Yojana	Housing scheme; subsidies are given for constructing houses with basic amenities	Indiramma Gruha Nirmanam	Housing scheme; subsidies are given for constructing houses
Mid Day Meal Scheme	Lunch to school children from classes 1-7 on every working school day	Mid-day meal scheme	Lunch to school children from classes 1-7 on every working school day
Pradhanmantri Sadak Yojana	Construction work of roads inside the village to avoid outward migration	Construction of toilets	Toilets for those who do not have their own toilets
Pani Aadwa Paani Jidwa (Stop Water Preserve Water)	Water conservation schemes to build bunds and check dams	Protected drinking water	Supply of protected drinking water to all households in the village and school children in schools

Source: VK Chopde, C Bantilan Source: Y Mohan Rao, Kamanda JO (Aurepalle Village Profile forthcoming)

## Annexure 3

### Definitions as interpreted by the Community

- Dushkaar: As the year of climatic shocks or a bad year.
- Climatic Shocks: Extreme events such as a drought or a flood.
- Bad Year: A year where the rains are not up to the expectations of the farmers in terms of onset, quantum and distribution, when crop production is lower than their expectations, where there is water shortage either for agriculture, drinking, or both, and laborers find it hard to get work inside the village with the farmers.
- Normal Year: When the rains come on time, with regular distribution and quantum, the crop production is according to the expectations of the farmers, there is enough water available for the fields as well as the village, and the labor find work in the fields
- Good Year: According to the farming community, a year of rainfall that gives them a bumper harvest and wells and tanks are filled and overflowing, ensuring provision for the coming two to three years.

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## International Crops Research Institute for the Semi-Arid Tropics

The **International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)** is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. Covering 6.5 million square kilometers of land in 55 countries, the semi-arid tropics have over 2 billion people, of whom 644 million are the poorest of the poor. ICRISAT innovations help the dryland poor move from poverty to prosperity by harnessing markets while managing risks – a strategy called Inclusive Market-Oriented Development (IMOD).

ICRISAT is headquartered in Patancheru, Telangana, India, with two regional hubs and six country offices in sub-Saharan Africa. It is a member of the CGIAR Consortium. CGIAR is a global research partnership for a food secure future.

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