

Farmers in a changing climate

Does gender matter?



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FOOD SECURITY IN ANDHRA PRADESH, INDIA

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EXECUTIVE SUMMARY

This report presents the findings of research undertaken in six villages in two drought-prone districts of Andhra Pradesh, India, Mahbubnagar and Anantapur¹. The study, carried out by an international team led by FAO, used gender, institutional, and climate analyses to document the trends in climate variability men and women farmers are facing and their responses to ensure food security in the context of larger socio-economic and political challenges to their livelihoods and well-being.



**A farmer's village,
Andhra Pradesh**

This work contributes to a growing body of literature on gender and climate change² and draws inspiration from pioneering work in the Indian context³. Gender is one of numerous important socio-cultural dimensions typically included in climate change vulnerability assessments but it is rarely incorporated in adaptation research and planning. A major contribution of this research is the development of an innovative methodological model for studying gender and climate variability for use in the context of climate change. The research uses gender-sensitive qualitative and quantitative methods and gender analysis techniques to capture the voices of both men and women and quantify the degree to which men's and women's responses to climate variability differ. This research tests the hypothesis that due to gender roles (the behaviours, tasks, and responsibilities a society defines as "male" or "female") and due also to differential gendered access to resources, men and women experience climate variability differently and cope in diverse ways with climate variability and changing climate patterns.

The findings confirm that there is a **strong gender dimension** to the way in which climate variability is experienced and expressed by farmers in their coping strategies to ensure their livelihoods and food security. Women's and men's perceptions of and responses to impacts of dry conditions, as well as their access to resources and support, differ in important ways. These findings demonstrate that gender analysis enhances our understanding of what farmers perceive as risks and how they respond to climatic changes. Such findings are essential for informing policy decisions by ensuring that the experiences of both women and men are embedded into policy design. Recommendations are made for future research and for incorporating gender issues into adaptation to long-term climate change.

BACKGROUND

Of the approximately 83 million inhabitants of Andhra Pradesh, around 60-70 percent rely on agriculture as their primary livelihood (Government of Andhra Pradesh, 2008; Acosta-Michlik et al., 2005). Despite advancements in the socio-economic development of Andhra Pradesh overall⁴, such as having one of the lowest levels of poverty in India at around 15 percent, farmers in rainfed agriculture zones of Andhra Pradesh continue to face numerous development and environmental challenges to their livelihoods, food security, and overall wellbeing (Government of Andhra Pradesh, 2008), including limited employment opportunities, low incomes, environmental degradation, and social inequalities.

These challenges are particularly daunting in the study districts: Mahbubnagar (in the Telangana region) and Anantapur (in the Rayalaseema region). According to the 2007 Human Development Report – Andhra Pradesh (Government of Andhra Pradesh, 2008), both districts are among the poorest in the state, and rank near the bottom of the 23 districts of Andhra Pradesh according to the Human Poverty Index⁵. The Human Development Report also found that the districts perform poorly with regard to gender equality and women’s empowerment, with Anantapur ranking near the bottom and Mahabubnagar in last place for both the Gender Development Index⁶ and Gender Empowerment Measure Index⁷ among the districts of Andhra Pradesh⁸.

Both Mahbubnagar and Anantapur have a history of drought with both districts experiencing drought during approximately 20 percent of the forty years between 1960-1999 (Acosta-Michlik et al., 2005) largely linked to low levels of agricultural output (World Bank, 2006)⁹. Farmers rely on the timely and sufficient rainfall of the annual monsoon, and when that is late, as it was in 2008 and 2009, the consequences for the farmers and their families’ food security can be catastrophic. Poor farming households are the most vulnerable and in times of drought, those who are unable to change their farming practices may face starvation, loss of health and loss of life (World Bank, 2006). In order to ensure their food security as well as their overall wellbeing under the difficult conditions of farming in these drought-prone areas, smallholder farmers diversify their livelihoods (Deb et al., 2002). A common strategy to earn additional income in both Mahbubnagar and Anantapur is to work as a day labourer or migrate for labour. Men and women each play key roles in this process of diversifying livelihoods in order to contribute to food security at the household level.

Poor farming households are the most vulnerable

Adding to the challenges of development and drought, global climate change is likely to pose new stressors to agricultural development and farmers' lives in India as a whole, and drought-prone regions of Andhra Pradesh in particular. Despite there being uncertainties in the projections of climate change impacts, it appears that the increasing temperatures associated with climate change, combined with other pressures such as increasing population, a decline in soil fertility, and a decrease in genetic diversity of popular varieties, may lead to a reduction in crop production in India (Mall et al., 2006). Food security could be negatively affected, not just through declines in yield (Ibid.) but also through more complex pathways (see FAO, 2008). Andhra Pradesh is considered vulnerable to climate change due to high environmental sensitivity, including the amount of safe water, percentage of managed land compared to total land, and ratio of fertilizer use to land area (Brenkert and Malone, 2005). Pre-existing socio-economic vulnerabilities to drought, as described above, compound the vulnerability of Andhra Pradesh's smallholder farmers to climate change.

For decades farmers in Andhra Pradesh have relied on coping strategies – short term responses to overcome immediate threats – in order to get through unfavourable weather conditions, particularly drought. With the added pressures of climate change, these coping strategies may no longer be enough in the long term. Adaptation in the

Adaptation in the agricultural sector is crucial



agricultural sector is a crucial response, both for dealing with the impacts of droughts and long-term climate change and for ensuring progress in rural development. Adaptation means¹⁰ “a process by which strategies to moderate, cope with, and take advantage of the consequences of climate events are enhanced, developed and implemented” (Selvaraju et al., 2006). Specific adaptation steps recommended for Andhra Pradesh include water conservation practices and enhancement of existing anti-drought programmes (World Bank, 2006) as well as enhancing the capacity of communities to adapt (Prabhakar and Shaw, 2008).

This report addresses some of the gaps in understanding how men and women farmers cope with climate variability. It explores how coping strategies are shaped by gender dimensions of power relations, access to resources and equity in decision-making. While the coping strategies identified are not equivalent to climate change adaptation, by demonstrating men’s and women’s abilities to react to changes in the climate, the findings can inform our understanding of what is needed for longer-term climate change adaptation.

There were multiple issues that were beyond the scope of this study but are important for understanding how farmers cope with climate variability, particularly in Andhra Pradesh. For example, the impact of globalization through import competition and stagnating prices has been shown to compound the impacts of drought in Anantapur district, making farmers doubly vulnerable (O’Brien et al., 2004). In addition, changing food systems, which affect farmers’ production and marketing choices (Deshingkar et al., 2003) and land rights (Hanstad et al., 2004; Rao, 2006) are relevant to an understanding of farmer decision-making and responses to climate change, but have not been dealt with here.

Finally, despite the challenges discussed above, there are numerous areas of progress, including the overall reduction of poverty in Andhra Pradesh as described previously, and the increased activity of self-help groups linked to the empowerment of women, as documented by local project partner Andhra Pradesh Mahila Samatha Society (APMSS)¹¹. Future work would examine how local, regional and national resources such as self help groups, targeted, institutional support, as well as increased access to education, information and technology and sustainable agricultural development could improve the overall resilience of smallholder farmers and strengthen their efforts to withstand the overall impacts of changes in climate variability and long-term climate change.

● A - Definitions

Gender analysis: The study of the different roles of women and men in order to understand what they do, what resources they have, and what their needs and priorities are (FAO, 2010). This study uses gender analysis to document and interpret how men and women farmers perceive and respond to climate variability to ensure their livelihoods and food security. This report focuses on the gender roles and relations of husbands and wives, the primary decision-makers in the study households, while noting that gender roles are not static and are shaped over time by other differences such as age, class and caste.

Climate variability and climate change: Climate variability refers to variations in the mean state of the climate and variations in other statistics (such as the occurrence of extremes) on all temporal and spatial scales beyond that of individual weather events. The average range of temperature for a location, as indicated by minimum, maximum and average temperature values, is an example of a measure of climate variability. This differs from climate change which refers to a long-term change in the state of the climate and which is identified by changes in the means and/or changes in the variability, or changes in the frequencies or intensities of extreme events. This report describes climate variability at different points in time based on climatic data and also based on farmers' descriptions of "average weather" (what farmers call "average weather" is equivalent to climate variability). Farmers' descriptions are given equal footing to scientific measurements because documenting how farmers' frame the conditions they experience is crucial for understanding their responses to said conditions (Roncoli, 2006; Tschakert, 2007). This report refers to changes in climate variability without necessarily concluding that a permanent change has taken place (a state that would be referred to as climate change).

Coping and adapting: The study distinguishes between farmers' short-term and long-term responses to climate variability and food insecurity. It defines short-term responses to a decline in food availability and income in abnormal years as coping or coping strategies, and defines longer-term or permanent changes in the ways in which food and income are acquired as adapting or adaptation strategies, after the work of Davies (1993). Although this study does not present a detailed analysis of the components of adaptation that are explored in the climate change adaptation literature, such as "adaptive capacity" and "vulnerability" (e.g. Kelly and Adger, 2000; Smit et al., 2000), the findings are fully applicable to the broader climate change adaptation discourse.

Farmers: This is the term used to refer to the participants in the study, although their livelihoods are no longer based solely on farming due to a combination of economic and environmental trends. They are producers but also wage workers when needed. Also, despite the fact that in the study area, women who do not own land are not considered to be “farmers”, here they are referred to as farmers because they engage in many agricultural activities and define themselves as such.

Food security: According to FAO, food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2006). There are four components of food security: availability, access, utilization and stability¹².

● B - Research objectives

1. To characterize the local climate conditions and risks, to identify trends in climate variability over the past four decades (according to recorded data); to compare how recorded data corresponds to men and women farmers’ perceptions.
2. To understand how men and women in farm households perceive and experience climatic shifts and how this is linked to food security.
3. To identify the coping strategies that men and women farmers utilize in order to ensure a measure of food security in response to climate variability; to understand the resources and decision-making processes utilized, and to assess the related outcomes for food security.
4. To identify the institutions that support farmer decision-making with regard to climate, agriculture and food security and to assess the extent to which institutional support is available, accessible and usable by men and women.
5. To develop a replicable methodology for examining the gender dimensions of farmer responses to climatic variability and change.

● C - Description of the study area

Six villages in two drought-prone districts of Andhra Pradesh were chosen to examine men and women farmers’ responses to climate variability, particularly conditions of drought, to secure their livelihoods and food security. The districts of Mahbubnagar and Anantapur were chosen as they are historically drought-prone, and would thus have a long-term record and farmer memory on which to draw (Figure 1). Both districts rely considerably on rainfed agriculture and face development challenges. Mahbubnagar is known for a

high level of drought-induced migrant labour while Anantapur has both drought mitigation and anti-desertification measures.

In each district, three villages were chosen in consultation with the local project partner, Samatha Gender Resource Centre (a unit of Andhra Pradesh Mahila Samatha Society)¹³ which is active in the villages, and local officers of the Department of Agriculture. In each district, two low income villages with limited natural and financial resources, and one receiving more resources and support from government schemes were selected. All of the villages were within 5 to 15 kilometres of the local administrative headquarters. Neither FAO nor other international organisations had had projects there so foreign development interventions do not play a role in the villages, although government interventions are present. The following villages were part of the study: Ankilla, Rampur and Malkapur in Mahbubnagar district and Abbedoddi, Isurallapalli and Jakkalacheruvu in Anantapur district.

Figure 1. Map of India showing approximate location of study districts.



Map source: Google Earth



Mahbubnagar is drought-prone, with single cropping of sorghum, castor and maize

Farmers in drought-prone Anantapur district are dependent on dryland agriculture for their livelihoods. In the past they cultivated a relatively high number of food crops for household consumption (sorghum, pigeon pea, castor, minor millets, horsegram) as mono crops or mixed cropping with more than two crops at a time in the same field. Farmers in the region have adopted new crops and cropping practices over several decades and now groundnut is the major cash crop grown during the monsoon season mainly with the objective of securing income for household expenditure¹⁴. Sowing normally takes place at the earliest opportunity from May to June and so the rainfall during the entire period from May to November is utilized. In addition to groundnut, rainfed farmers in the study villages in Anantapur also grow red gram, green gram and sesame, while farmers with borewells for irrigation water also grow rice, chillies, tomatoes and sunflower. The key farming operations (ploughing, sowing, weeding, harvesting) depend on the rainfall pattern and consequent soil moisture content. Anantapur has a highly variable rainfall pattern and groundnut productivity is often negatively impacted by this variability.

Mahbubnagar district is also drought-prone and agriculture there is mainly rainfed, single cropping of sorghum, castor and maize. Farmers in the study villages in

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Mahbubnagar report growing groundnut, castor, sorghum finger millet, horse gram, red gram, green gram, and sesame, while those with access to irrigation also grow rice. Seasonal rainfall has a significant influence on the yield of the crops. However, technology plays an important role in the yield of sorghum; in the mid and late 1990s, the yield of sorghum exceeded expectations given the amount of rainfall and this was attributed to varietal and technological advancements which facilitated farmers' tasks; the impact of technological improvements needs to be dealt with in a separate discussion as it is outside the scope of this paper.

Borewells were introduced in all of the study villages in the 1980s, along with increased mechanization and a shift toward fertilizer and pesticide use. In recent years the water table has declined significantly so many of the existing borewells are now of little use and even those farmers with a borewell depend on rainfall for irrigation. Women are responsible for collecting water for drinking and other uses, while men are responsible for watering the crops.

● D - Description of the study participants

The results presented here draw on the accounts of over three hundred men and women farmers who participated in this study (201 in the quantitative survey and approximately 100 in the focus group discussions). The participants in the quantitative survey and focus group discussions were drawn from the same portion of the local population according to the following criteria:

Farmers:

- 1) With land holdings below 5 acres**
- 2) Rely primarily on rainfall**
- 3) Age between 40 and 69 years old**
- 4) Live in a household with at least 10 years engagement in farming**

This population was chosen as the focus as it is particularly vulnerable to climate variability and long-term change because with small land holdings there is limited scope for diversifying crops in the face of climate variability and their highly variable water resources expose them to uncertainty in their on-farm production. Such farmers have little margin of error in their high input cost farming systems, and often need to take loans to cover farming costs, to make up for shortfalls in yields, or to be able to purchase food for their families: a potentially precarious financial situation. A broad age range of respondents and a requirement to have at least 10 years in farming were used to ensure that those with longer memories and substantial experience would contribute their experiences to the study.

Male and female heads of household from 95 households each responded to the quantitative survey¹⁵, for a total of 190 individual respondents. Views from members of the same household were collected to control for variability between households and to isolate the gender dimension. In addition, 11 female heads of households took part¹⁶. Almost all of the respondents were from households that owned rainfed land (95 percent), while some respondents, 42 percent, owned some irrigated land in addition to rainfed land. For further details on the participants, see Annex I.

● E - Data sources and analytical methods

Climate analysis: The first step in the research was to conduct an analysis of climate indicators for the key crops in the region to characterize the climate variability and trends of the past four decades (note that the available climate data allowed for an analysis of the past fifty years of climatological trends, but the farmers' descriptions go back forty or thirty years). Climate data for Anantapur and Mahbubnagar was provided by Acharya N.G. Ranga Agricultural University (ANGRAU), Hyderabad, India. Daily rainfall and temperature data for Anantapur and seasonal rainfall totals for Mahbubnagar were used for this analysis.

Focus group discussions: To elicit information on men and women's perceptions of climate variability, the impacts on their livelihoods, and their coping strategies for dealing with food shortages, a series of tools were used in focus group discussions with separate groups of men and women in each of the six villages. See Annex II for a description of the qualitative tools used.

Key informant interviews: In order to map the institutional context in which farmers make their decisions and to cross-reference information provided by farmers, key informant interviews were carried out with representatives of institutions in the two districts and at state level.

Survey of individual farmers: To quantify the trends described in the focus group discussions, an extensive questionnaire was developed. The questionnaire was administered to a representative, but not random, selection of 201 men and women farmers, about 50 from each of four different villages. For more on the survey, including the questionnaire used, see Annex III.



RESEARCH RESULTS

This section presents the key findings/results of the analysis of the data (climate, qualitative and survey). The results are divided into four parts following the design of the research objectives. Part A presents the findings of the climate analysis juxtaposed with the men and women farmers' perceptions of climate variability trends over the past forty years. Part B describes the men and women farmers' perceptions of how these climatic changes have affected their livelihoods and food security. Part C focuses on the more recent past and summarizes the coping strategies used by men and women farmers in response to abnormal amounts of rainfall. Finally, part D highlights the institutional context of the situation the farmers describe. These results are further discussed and interpreted in the final section.

A Men's and women's perceptions of climate variability coincide with the climate record

This section juxtaposes a simple analysis of the climate variability of the study districts based on available data with the farmers' perceptions of climate (note that farmers use the term "weather" to mean both "weather" and "climate"). While climatological terms and farmers' descriptions are not always identical, it was possible to compare them. This comparison is important as it created a multi-perspective description of the climate conditions, which can serve as a foundation for designing participatory responses to climate variability and change.

KEY FINDINGS:

- ① **1. All farmers reported seeing changes in climate variability over the past forty years.**
- ② **2. Farmers' perceptions and the climate record confirmed that Anantapur and Mahbubnagar districts have a history of drought and tend toward worsening drought conditions.**
- ③ **3. Men and women farmers reported similar or identical observations of temperature and rainfall trends over time.**



Anantapur is one of the most drought-prone districts in Andhra Pradesh. The annual average rainfall is 552 mm, of which more than 60 percent is received between June and September during the summer monsoon season. Mahbubnagar receives an average annual rainfall of 850mm, with monthly rainfall showing a dominant uni-modal monsoon season pattern with a maximum rainfall in July. The co-efficient of variation of mean monthly rainfall of Anantapur and Mahbubnagar shows a high level of variability especially during crucial crop growing months. Note that July rainfall is crucial for agriculture as most of the rainfed crops are sown and rice transplanting also takes place during this month. See Figure 2 (next page).

“Nowadays rains are like a sprinkle on a burning coal.” – Female farmer

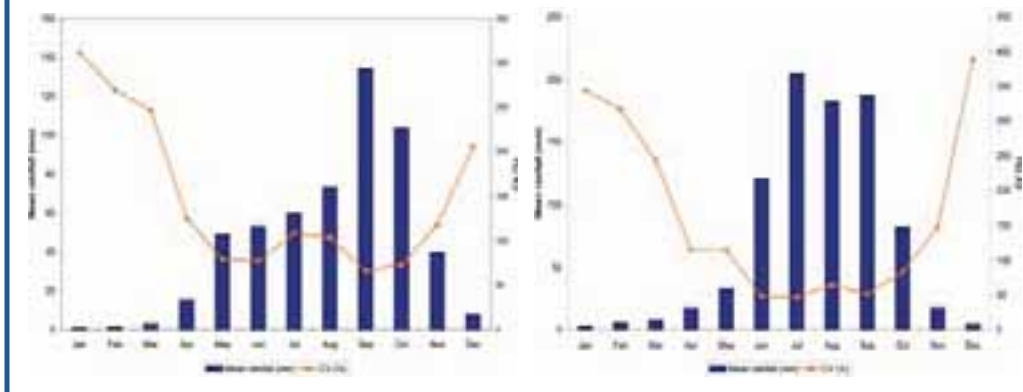
“If it rains during Visaka Karthe* the crop yield will become poisonous, that is what is happening now. We lost the crop!”

– Female farmer
*(seasonal calendar representing winters)

“If rain God opens his eye then everyone will prosper.” – Male farmer

Figure 2. Left: Monthly mean rainfall (mm) and co-efficient of variation (%) in Anantapur district of Andhra Pradesh, India. Right: Monthly mean rainfall (mm) and coefficient of variation (CV) in Mahbubnagar, Andhra Pradesh, India.

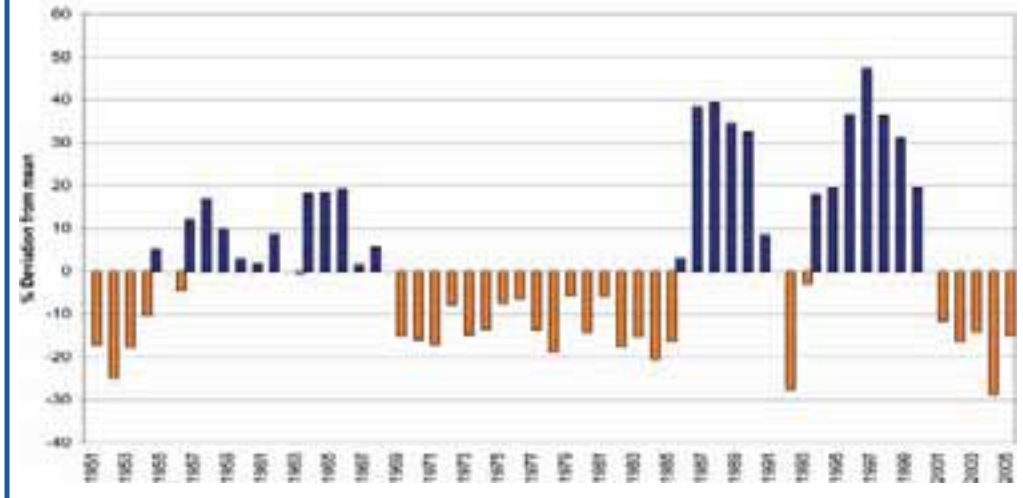
(Data provided by ANGRAU)



An analysis of the monsoon season rainfall over the period 1954 to 2005 for Anantapur¹⁷ indicates a sequence of above and below normal rainfall (Figure 3) with the pattern of distribution within the season varying considerably from year to year. The record shows an extended period of below normal rainfall during the 1970s into the 1980s, followed by years of mostly above normal rainfall.

Figure 3. Percent deviation from average seasonal rainfall (June to September) at Anantapur (5 years moving average); Long-term average rainfall is 332 mm

(Data provided by ANGRAU)



While not directly comparable, Anantapur farmers' perceptions of seasonal rainfall in comparison to what they considered normal amounts of rainfall followed a similar trend as the data displayed in Figure 3. As seen in Table 1, farmers described a "good" amount

of rainfall in the 1960s and drought in the 1970s. The farmers' perceptions did not capture the below normal rainfall in the early 1980s. While we cannot be sure why, it could be that because borewells were introduced around this time, there was enough water for farmers to be able to achieve good harvests despite low rainfall levels, and farmers' memories of the good harvests are attributed to good rainfall. Farmers described the 1990s as having less rain, which differs from the record, however farmers' memories of rainfall amounts may be influenced by the pattern of rainfall, which they described as "scattered" and "unseasonal".

Table 1. Summary of men and women farmers' descriptions of average seasonal rainfall amounts from the 1960s until the present in Anantapur.

DECADE	1960s	1970s	1980s	1990s	2000s
Average amount of rainfall during June-September	Good amount of rain	Drought starting early-mid 1970s	Moderate to good amount of rain	Less rain	Insufficient rain 2000-2005; moderate-to-good rainfall 2006-2008

Table 2. Summary of men and women farmers' descriptions of average seasonal rainfall amounts from the 1960s until the present in Mahbubnagar.

DECADE	1960s	1970s	1980s	1990s	2000s
Average amount of rainfall during June-September	Good to very good rain	Good until onset of drought early to mid 1970s	Moderate rain	good	Insufficient rain

A similar analysis as shown in Figure 2 could not be performed for Mahbubnagar due to lack of data, however an analysis in which an earlier period of thirty years (1963 – 1992) was compared with a recent decade (1993 – 2002), showed that there was a decreasing trend in rainfall in the recent decade for the months of June, July and for the entire monsoon season (Singh et al., 2007). This coincides with Mahbubnagar farmers' observations (see Table 2). They described rainfall amounts from the 1960s to 1993 as good or moderate, and the more recent rainfall as less or insufficient.



The number of days with a maximum temperature greater or equal to 35 °C has increased. Opposite page: women with seeds

The record shows that inter-annual variability has been increasing in recent years in both Anantapur and Mahbubnagar and thus increasing uncertainty of effective rainfall events to support crop growth. Farmer observations supported this; nearly half of the farmers surveyed noted an increase in “unexpected rains”, which can be taken to mean “uncertainty”. In focus group discussions, farmers also agreed that in the last couple of years they had seen unseasonal rains and higher temperatures resulting in changes in all the seasons; summer was longer, winter was warmer. However, only a very small percentage of farmers noted observing an increase in unpredictable weather, which suggests that the changes farmers perceive are within the range of variability with which they are familiar.

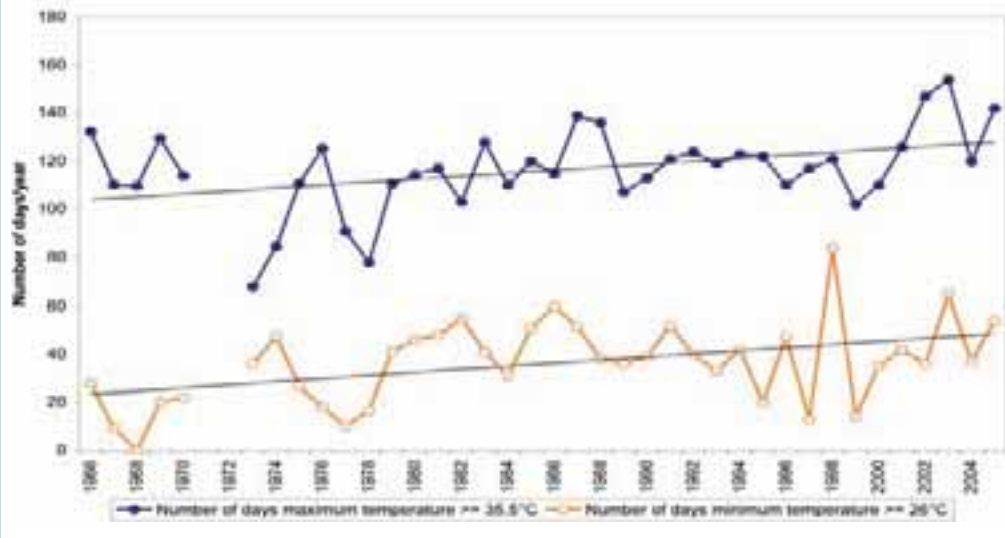
Extreme temperature events could have major impacts on the subsistence farming in drought-prone areas such as Anantapur. In focus group discussions, farmers reported a reduction in the number of cold days and an increase in number of extreme hot days. They described an increase in the minimum temperature as ‘intensity of cold decreasing’ and perceived higher temperatures in summer and winter.

The record shows that the maximum number of consecutive dry days at Anantapur increased over the period from 1965 to 2007. The magnitude of this change was approximately from 80 days in 1960 to around 120 days in 2007. In qualitative focus group discussions farmers reported observing “longer winters” which they described as a lengthening of the period without rainfall. The Anantapur region was particularly vulnerable to changes in climate extremes as a result of its exposure to climate variability, shallow soils and low value crops.

An annual time series of temperature index was computed, without removing the seasonal cycle. This means that changes in a hot day index will tend to be representative of changes in hottest seasons. As seen in Figure 4, the number of days with a maximum temperature greater than or equal to 35 °C¹⁸ has increased and may have an impact on crops in terms of enhanced water requirements and sensitivity to temperature maximum thresholds. Also seen in Figure 4, the number of days with a minimum temperature of greater than or equal to 26 °C is increasing¹⁹.

Figure 4. Number of days with maximum temperature greater than or equal to 35.5 °C and minimum temperature greater than or equal to 26 °C at Anantapur.

(Data provided by ANGRAU)



The recorded data suggests a shift in average climate conditions. Furthermore, all farmers participating in the quantitative survey agreed that the weather had changed over the past thirty years. Seventy eight percent of respondents (81 percent of men and 75 percent of women) agreed that the temperature had increased while 97 percent of respondents (97 percent of men and 97 percent of women) agreed that the amount of rain was less. When asked why these changes were happening, most respondents said they do not know or “only God knows”. While it might not be clear to the farmers why the changes were happening, it is clear from the recorded data and farmers’ perceptions that the conditions with which farmers are familiar were changing and, as the subsequent sections will show, their livelihoods and well-being appeared to be under stress.



E Men and women experience changes in climate variability differently

The farmers in the study area perceived²⁰ that the climate conditions appeared to be changing toward warmer conditions on average and the recorded data supports this. This section discusses what the effects of the changing climate conditions have been and who has been affected according to the farmers. Note that a timeframe of thirty years ago to present (about 1978-2008) was imposed so that all of the respondents could contribute, as opposed to the discussion on general climate trends presented in the previous section.

KEY FINDINGS:

- ◎ **1. Men and women farmers stated clearly that the changes in key aspects of their farming activities over the past thirty years were linked to changes in climate variability.**
- ◎ **2. Men and women farmers described that the changes had led to increased workloads, but in different areas of work according to gender.**



FARMING ACTIVITIES ARE AFFECTED BY CHANGES IN WEATHER²¹

Based on the changes in weather they had observed the participants were asked to describe what those changes meant for their lives. Men and women speaking in separate focus group discussions recognised the centrality of rainfall for their livelihoods and said that “no rains” or “no timely and sufficient rains” were the primary risks facing agricultural production. The survey results also revealed that men and women had similar perceptions of the impacts of the changes in the weather. Ninety percent of men and women surveyed reported that weather changes had led to poorer harvest or reduced crop yields.

Other changes mentioned included bore-wells or ponds dried up (55 percent), decreases in the number of livestock (34 percent), less fodder (38 percent), shortage of drinking water (30 percent) and health affected (23 percent). Men were significantly more likely than women to report there was less fodder and that bore-wells and ponds had dried up. Women were significantly more likely than men to report that health was affected.

These are significant gender findings and indicated that women were more focused on the health of the family while men were more focused on the farming production issues. See Table 3.

Table 3. Perceived impact of changes in weather over the past thirty years on key components of farming activities, by gender

IMPACT OF CHANGES	Percent of male respondents reporting change	Percent of female respondents reporting change	Percent of all respondents reporting change	X ²
Less fodder	45.3	28.3	38.3	6.23**
Use different crops	15.8	15.1	15.4	.019
Borewells/ ponds dry up	53.2	46.8	55.2	3.45*
Decreased livestock	42.1	36.8	39.3	.593
Shortage of drinking water	32.6	26.4	29.4	.934
Poorer harvest/yield	87.4	88.7	88.1	.082
Reduced forest	16.8	18.9	17.9	.140
Health affected	17.9	28.3	23.4	3.02*

* X² significant at 0.10 ** X² significant at 0.01

MEN AND WOMEN ARE AFFECTED BY CHANGES IN WEATHER

Significant gender differences existed in who was perceived as most adversely affected by changes in the weather. Both men and women agreed in similar numbers that the entire family was most affected by the changes. However, women were much more likely than men to report that women were most affected. At the same time, men were more likely to report that men were most affected. See Table 4.

Table 4. Perception of who in the family is most affected by changes in the weather in the past thirty years, by gender

WHO IS AFFECTED	Percent of male respondents	Percent of female respondents	Percent of all respondents
Men	23.2	21.7	22.4
Women	7.4	26.4	17.4
Children	1.1	0.9	1.0
Elderly	0	0.9	0.5
Entire family	67.4	49.1	55.7

Going into more detail about the nature of the effects of changes in climate on their lives, it is clear that men and women's lives were affected in both similar and different ways. The four most popular responses to the question "how are men's lives today different than 30 years ago because of the changes in the weather?" were:

1. Increase in pressure to mobilize loans (reported by 61% of all respondents)
2. Increase in pressure to provide food (reported by 51% of all respondents)
3. Increase in emotional stress/anxiety (reported by 33% of all respondents)
4. Increase in fights/arguments among the family (reported by 22% of all respondents)

Conversely, the four most popular responses to the question "how are women's lives today different than 30 years ago because of the changes in the weather?" were:

1. Increase in pressure to provide food (reported by 61% of all respondents)
2. Increase in workload at home (reported by 55% of all respondents)
3. Increase in health problems (reported by 36% of all respondents)
4. Increase in fights/arguments among the family (reported by 28% of all respondents)

These results show that changes in climate over time have different impacts on men and women and these differences are linked to their gender roles²². The result that an increase

in emotional stress/anxiety was a highly-ranked issue for men more so than women is somewhat surprising as women are typically considered to be the nurturers and caregivers and would thus be expected to be more likely than men to report an increase in emotional stress. The increase in emotional stress among men was likely due to the pressure to mobilize loans, which the respondents report as the top pressure and which has been documented elsewhere as a serious issue, sometimes leading male farmers to commit suicide (Sainath, 2004).

“In earlier days we had a pattern of regular intervals to visit our fields and sometimes we would visit to collect fodder, but nowadays everyday we have to tend our crops. It’s like bringing up an infant. Our workload has increased.”

– Female farmer

MEN AND WOMEN HAVE DIFFERENT PERSPECTIVES ON HOW WEATHER HAS CHANGED EACH OTHER'S LIVES

When a distinction is made between how men and women view the effect of weather changes on men's lives, it became clear that there was a gap between men's and women's perceptions about men's lives (Figure 5a). This difference in men's and women's perspectives was also true when considering changes in women's lives (Figure 5b).

These results demonstrate the importance of documenting men's and women's views of their own lives so that the degree to which certain issues matter more to men or women is clear. In addition, it is important to collect data from men and women separately so that their responses are not biased by the presence of members of the opposite sex (e.g. men may be less likely to report on emotional issues in front of women if cultural definitions of masculinity prohibit displays of emotion).

While the farmers were asked to list changes in their lives due to changes in the weather over thirty years, it appears that some of their responses were not changes due only to weather. The additional household work of women linked to limited water availability as reported by both men and women appears to reflect socio-cultural changes, rather than resulting solely from reduced water resources caused by changes in climate variability. The qualitative exercises revealed that members of the caste traditionally responsible for washing clothes no longer fulfil that function, and it may be the upward mobility among the oppressed castes, among



other social changes, that have led to an increase in household work among the respondents. Thus, while farmers reported these changes in their lives were due to “weather changes”, follow up research is needed to clarify if the result documented here is further evidence of climate change increasing the workload of women (see for example Leduc, et al., 2008; Brody, et al., 2008).

Figure 5a. The four most important changes in men's lives because of weather changes over the last thirty years, perceived by men and women

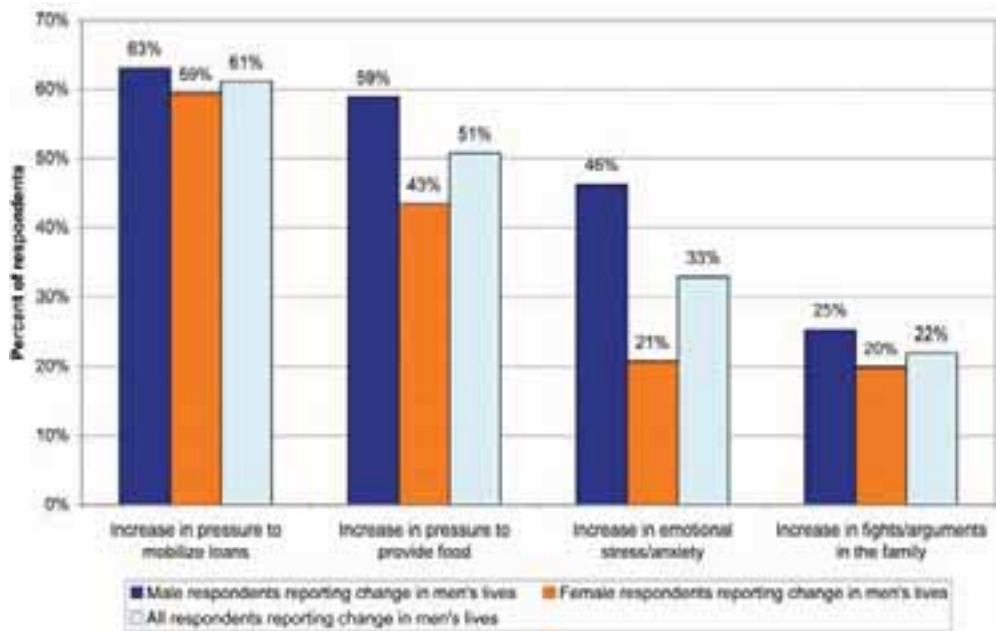
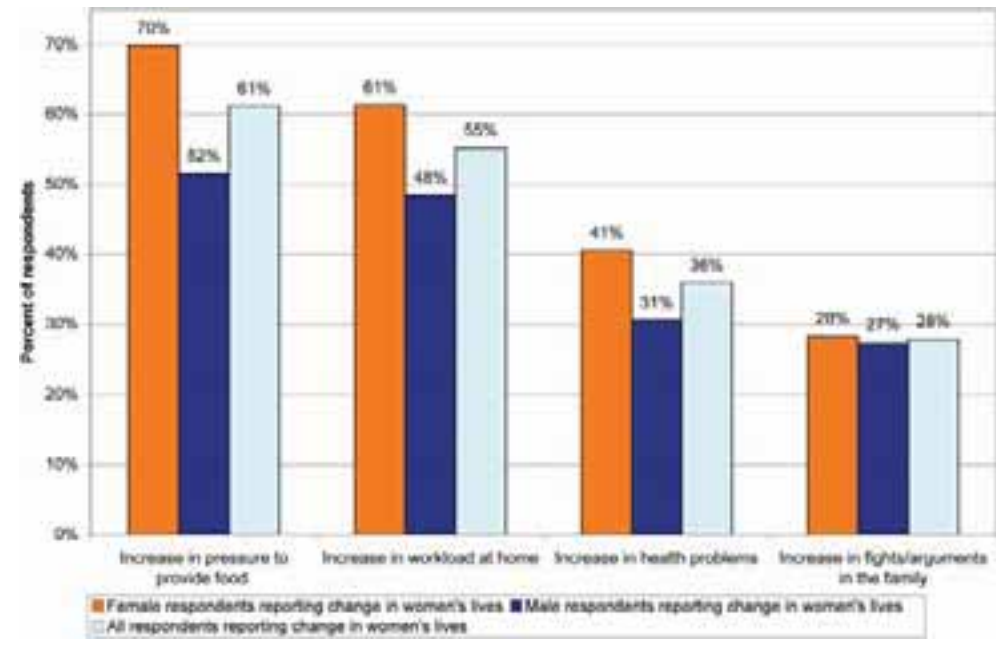
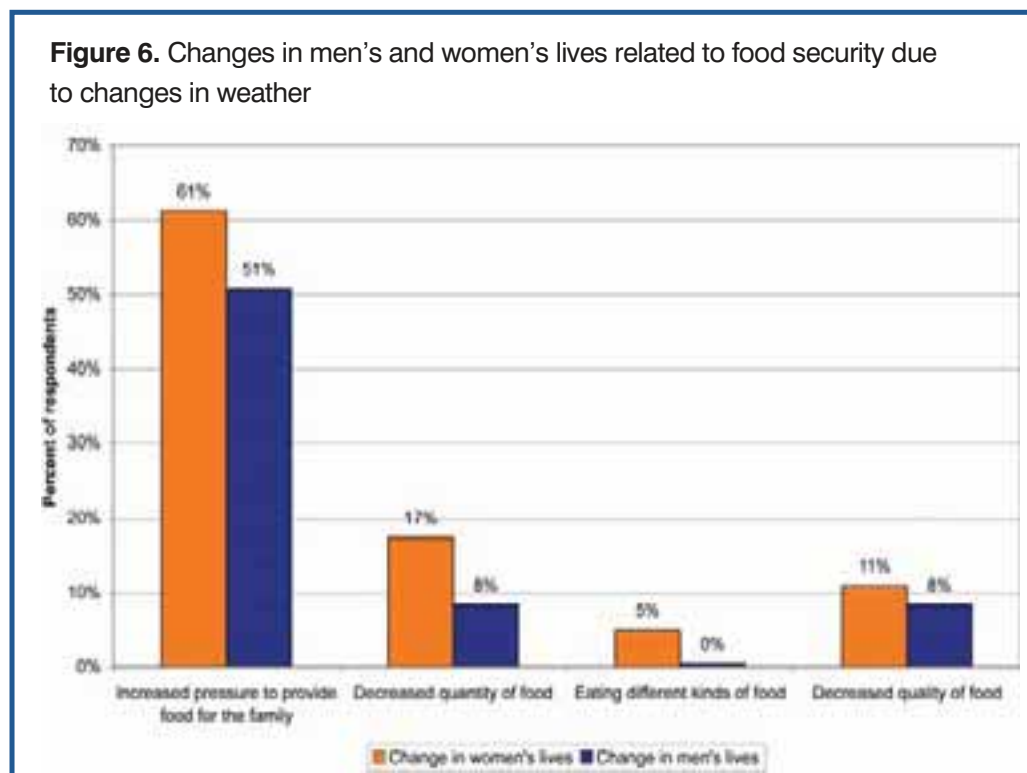


Figure 5b. The four most important changes in women's lives because of weather changes over the last thirty years, perceived by men and women



CHANGES IN FOOD SECURITY DUE TO CHANGES IN WEATHER

Men and women farmers both reported an increase in pressure to provide food to the family as one of the primary changes in their lives due to changes in the weather. Other areas related to food security, however, did not rank as highly. Figure 6 demonstrates that “decreased quantity of food”, “eating different kinds of food”, and “decreased quality of food” were changes for only small percentages of the respondents (results similar for men and women answering separately; not shown here).



In contrast, during qualitative discussions, most farmers did mention a decrease in quality of food over the past thirty years. Based on their responses to the quantitative survey, it appears that farmers may not have associated the decrease in quality with changes in the weather. Instead, they may have perceived the decreasing quality of food as resulting from the shift toward purchasing food (even though this shift is partly related to climatic changes affecting the viability of farming). The issues of availability and sources of food are key components of food security in relation to a changing climate and are discussed in subsequent sections of the report.

Over the course of the last thirty years, many changes have taken place in farming practices, infrastructure and government support which have intersected with changes in climate variability. It is not possible at this level of analysis to attribute changes in farmers’ lives

directly to or solely to changes in climate variability over time. The important outcome here is that men and women farmers perceived changes in their well-being linked to a changing climate and these changes differed for men and women. The following section examines how farmers responded to weather conditions in a given year in the context of climate variability; on this time scale, causal linkages are more clearly defined.

“Earlier when it used to rain, by the time we picked up our sack to protect us, it would get wet and we too would be full of water. Now, most of the time there is hardly a drizzle.”

- Male farmer

“Now we are washer women, sanitary workers, wage labourers and house keepers.”

- Female farmers

■ Men and women’s coping strategies are complementary but different

Examining farmer coping strategies for dealing with different climate conditions over the past thirty years was complicated by the fact that multiple socio-economic changes were also taking place. Thus, instead of looking at average climate conditions over time and responses to them, this section focuses on coping strategies during the growing seasons of the most recent past and hypothetical future scenarios. The discussion focuses on coping strategies for responding to variations in rainfall, as “no rainfall”, “unseasonal rains” and “no rainfall during agricultural season” were ranked as the greatest risks to farming production by men and women in all but one of the study villages²³.

KEY FINDINGS:

- ◎ 1. Men and women reported similar coping strategies to ensure farm productivity in a dry year or wet year.
- ◎ 2. When farm income was not sufficient, women and men had different available options for coping strategies to earn income.
- ◎ 3. Traditional coping strategies for coping with food scarcity had a strong gender component and became exacerbated during dry years.



COPING STRATEGIES IN RESPONSE TO ABNORMAL RAINFALL IN 2008

As shown in Figures 7 and 8, during 2008²⁴ (January-December), Mahbubnagar experienced below normal rainfall during the growing season, while Anantapur experienced above normal rainfall during that time. Farmers’ perceptions confirmed these patterns.

Figure 7. Average seasonal rainfall at Mahbubnagar (average of district stations) in 2008 compared to long-term average of seasonal rainfall

(Data from IMD 2010 a; ANGRAU)

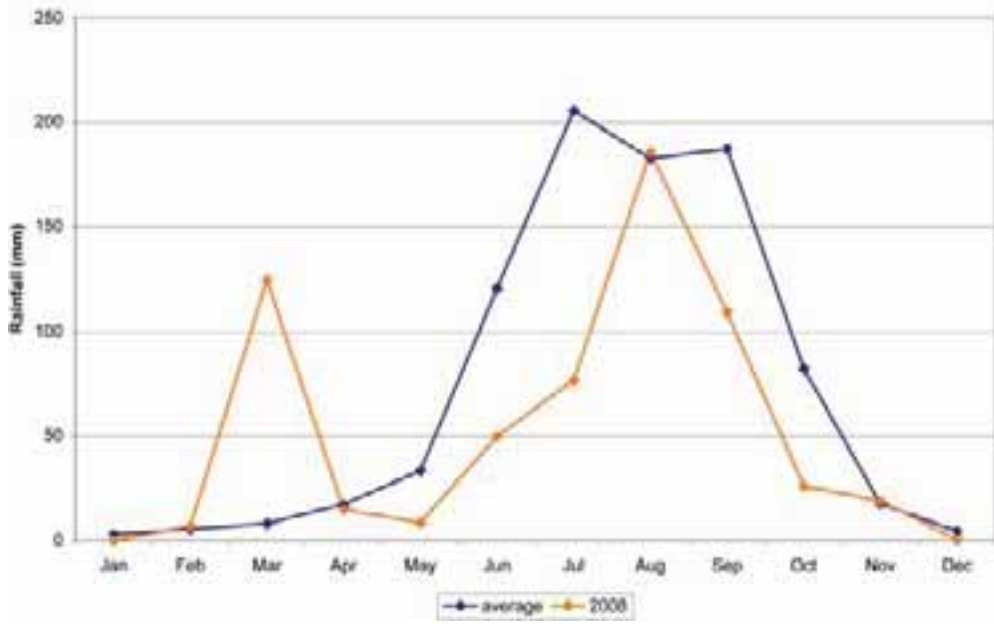
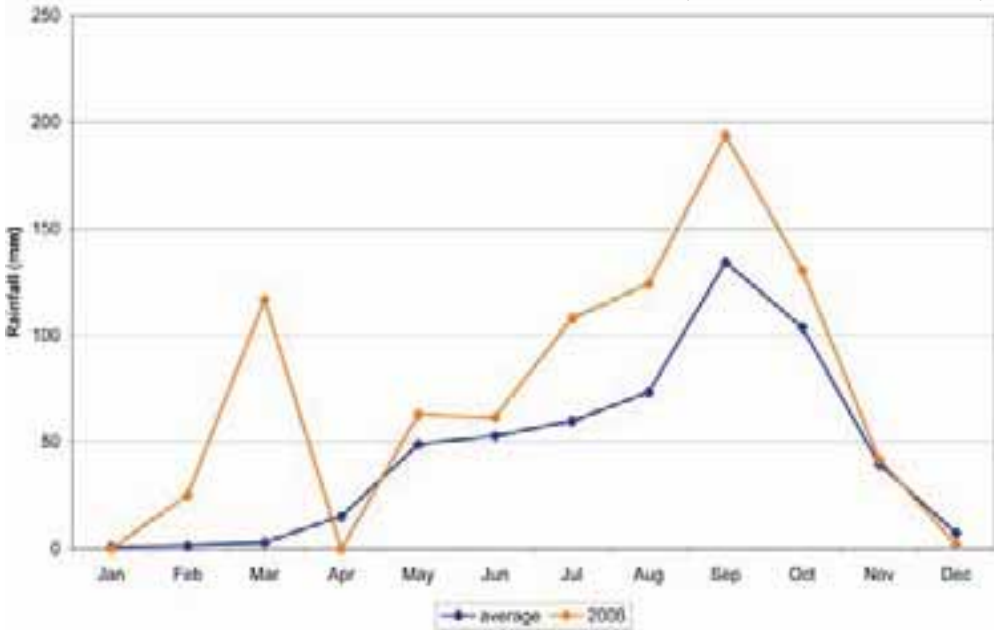


Figure 8. Average seasonal rainfall at Anantapur (average of district stations) in 2008 compared to long-term average of seasonal rainfall

(Data from IMD 2010 b; ANGRAU)



In response to the low and late-arriving rainfall of 2008, the majority of the Mahbubnagar respondents made some sort of change or a combination of changes to their cropping and livestock practices, the most frequent being cultivating crops that used less water (50 percent) and changing to more edible crops (37 percent). Indeed, rainfall was the primary factor among almost all respondents (96 percent) in influencing changes in cropping patterns. In a year in which there was more rain than 2008 (i.e. normal rainfall), farmers in Mahbubnagar would change their cropping pattern (48 percent) and grow more kinds of crops (39 percent). Similar percentages of men and women responded with this preference.

Meanwhile, in Anantapur, in response to an above-normal amount of rainfall, 63 percent of farmers made no change to their cropping and livestock practices while 25

“We will decide as we are the owners and we bear the input costs.”

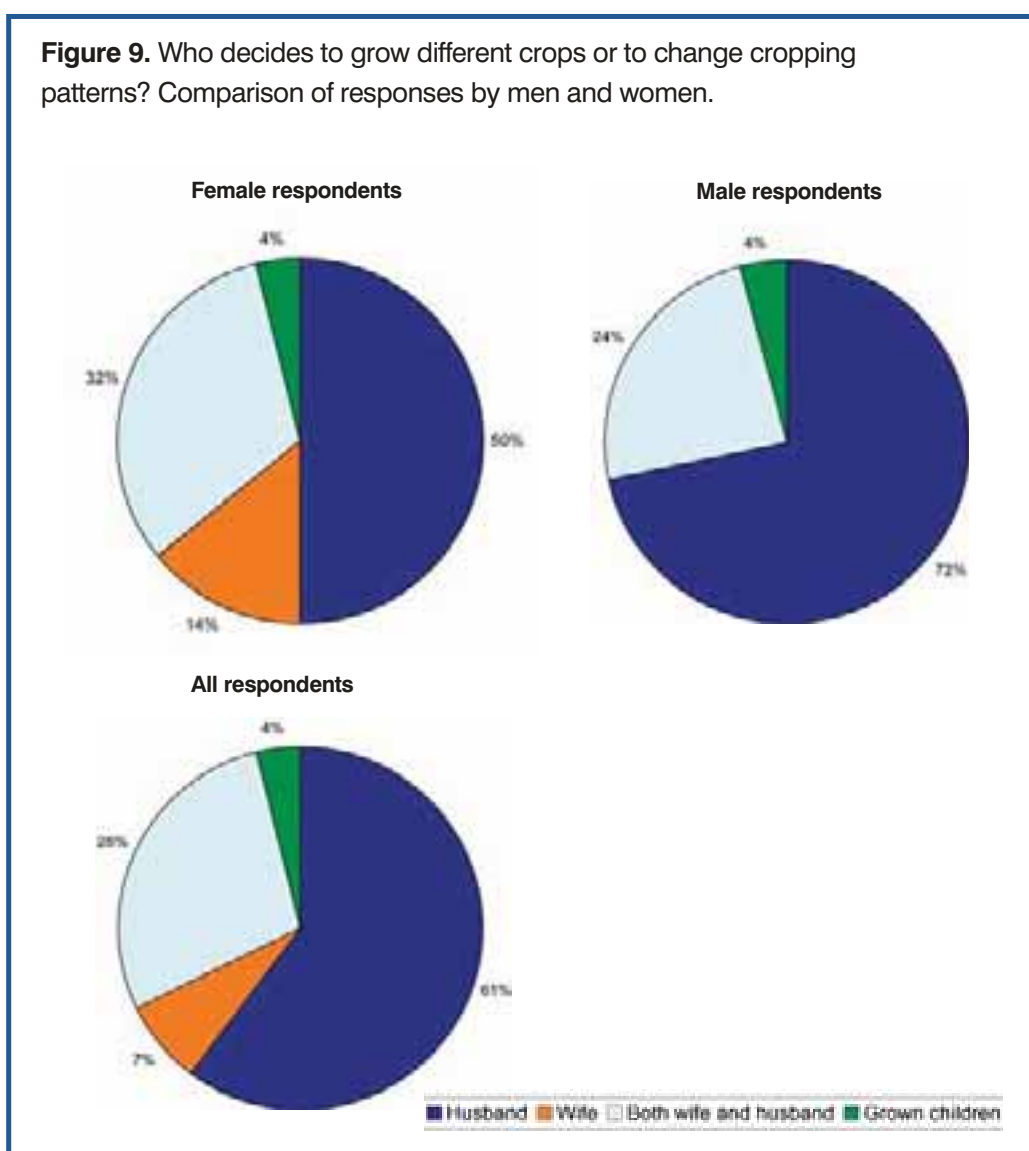
- Male farmer

“Earlier except for red cotton we used to grow all food crops, but now we are only growing crops which we sell.”

- Women farmers

percent did change their cropping pattern. This could be indicative of the respondents not having the resources to make changes, not having the information to anticipate the above-normal rainfall or not believing changes were necessary (institutional support for coping with rainfall fluctuations is discussed in section D). Farmers did seem to feel that they could implement changes if necessary; most farmers in Anantapur said that in a year in which there was less rainfall than 2008, they would cultivate crops that required less water.

There was no discernible difference between men and women with regard to what they reported as changes made in response to abnormal rainfall in Mahbubnagar and Anantapur. However, men and women did have distinct roles in deciding to implement changes and they also had different perspectives on their roles (Figure 9).



COPING STRATEGIES IN RESPONSE TO LOW FARM INCOME DUE TO LOW RAINFALL AND DROUGHT²⁵

In general, when rainfall led to low yields and insufficient income, as it did in 2008 in Mahbubnagar and in other years in Anantapur, farmers employed various coping strategies to supplement their farm income. As shown in Figure 10, the majority of farmers turned to wage labour for income, for example, in construction. More women (70 percent) than men (57 percent) reported that they undertook wage labour as a coping strategy in response to crop loss, which could be indicative of women's roles as "farmers" being less socially determined in terms of roles and expectations than men's. In addition, women of lower castes took on wage labour more readily than men of the same castes; women of lower castes supplementing family income through wage labour has also been shown elsewhere (Deb et al., 2002). Taking loans followed by taking work in neighbouring villages were also mentioned by about one third of participants, in both cases, by a higher percentage of women than men.



In response to the more severe conditions of drought, the majority of respondents, both men and women, cite migration for income (as opposed to migration for survival, see Deshingkar and Start, 2003 and Rao GB, 2001) as the main coping strategy in response to drought. In response to drought, local wage labour and taking loans were also employed as coping strategies. The question of who migrates seemed to be related to the severity of the drought.



Migration in search of wage labour is a major coping strategy of households affected by drought

In focus group discussions, farmers spoke of large numbers of whole families migrating in response to severe droughts in the 1970s and many remaining away permanently, whereas today families migrated to cities for construction work during the non-agricultural season but it was not a permanent migration. In some cases the husband migrated and the rest of the family stayed behind. In the study villages, farmers reported in qualitative exercises that the decision whether to migrate and who migrates were taken jointly by men and women, however the specific decision of where to migrate was taken by men.

Other studies in Andhra Pradesh have shown that migration in search of wage labour is a major coping strategy of households affected by drought (World Bank, 2006; Laxmaiah and Vijayaraghavan in Rao, et al., 2005). Some studies have documented the hazardous conditions that migrants may encounter, including exploitation of labourers from Mahbubnagar district by labour contractors (Olsen and Ramana Murthy, 2000) and the employment of women and children from Anantapur in waste collection in Hyderabad whose living conditions are without basic amenities (CARPED, 2003). This demonstrates that farmers in this region no longer relied only on farming in drought years, and both men and women were likely to seek employment elsewhere.

It has been suggested elsewhere that migration can adversely affect family stability and that the change in demography can lead to the deterioration of natural resources through neglect (Deb et al., 2002). There is anecdotal evidence from the study area that attempts were made to maintain family stability by using new modes of communication; it was reported that men who migrated purchased mobile phones for their wives so that they could call them to check in and to continue to provide inputs to on-farm decision making when they were away from the family. How accessibility to new technology might mitigate the effects of migration on those that remain at home, particularly in light of the expected future agricultural and long term economic pressures of climate change remains to be seen.

COPING STRATEGIES IN RESPONSE TO FOOD INSECURITY

Ninety-eight percent of respondents reported that the amount of income from farm produce, which was their primary source of income, followed by wage labour, varied from year to year and was linked to climate variability. Income from farm produce was impacted in order of importance by the weather, yield, prices, availability of power supply and labour availability. This suggests that farmers' food security varies from year to year along with income.

Income is critical to the food security of the farming households, as food is sourced primarily through purchases rather than only through their own production. In a year with below normal rainfall, farmers obtained their food from multiple sources, including the Public Distribution System (PDS)²⁶ (94 percent), the open market (75 percent), stored produce (53 percent), through earnings of wage labour (48 percent) and wife's original home (3 percent). Less than a third of respondents noted they could not buy sufficient food for the entire family, suggesting that for the majority of respondents, sufficient amounts of food were available, despite the unfavourable climate conditions. While there was availability of food, the utilization component of food security did not appear to be sufficient in a dry year. One quarter of respondents reported that their households had sufficient food but not the types of food they wanted to eat. Most respondents found the food to be somewhat nutritious and a third did not think it was at all nutritious.

For those families that did not have sufficient food during a low rainfall year, the coping strategy for dealing with this shortfall was for all family members to eat less. However, more women than men noted that they themselves would eat less. In fact, men were more likely than women to say that the whole family had sufficient food (56 percent of men vs. 34 percent of women). Also, women were much more likely to say that their husband got sufficient food (24 percent) than men would say their wives got sufficient food (1 percent). As men were not involved in food preparation, they were more likely to be unaware of the actual food distribution. In the qualitative focus group discussions, women described eating two instead of three meals: they distributed food first to men, then to children (boys and girls) and finally to themselves. This gender-based distribution of food is a traditional coping strategy for dealing with food scarcity and takes place usually even without low rainfall (and is based on the 'value' and 'worth' culturally assigned to men and women); however, it appeared to be exacerbated during a dry year. In-household access to food must be considered when examining how climate variability impacts food security.

Finally, the stability of the farmers' food security appeared to vary over the course of the year and was tied to climate variability. The men and women of Malkapur village (Mahabnagar district) described how during the June to October season of 2008 they relied on the Public Distribution System (PDS) for mostly white rice and stored food from

their own crops. According to the women, the amount of food available largely depended on the men's decision on how much to store and how much to sell. Women also noted that while it was the men's responsibility to sell the crop, women, who were responsible for ensuring the family's food supplies and also for cooking and distribution of food, would hide some of the crop without the knowledge of the men for the family's consumption.

In Malkapur, the rains in the June to October season of 2008 were late and yields were low, meaning income was also low. The farmers sought income from other sources in order to pay the loans they had taken for farming activities during June to October and to prepare the fields for the November to February season. The yields during the November to February season were also low, and so by the start of the third season, some of the men of Malkapur migrated and the women collected firewood to sell in order to overcome their severe food shortages. In addition to the low rainfall, the need to guard the land from animal attacks was of serious concern. The experiences in this village show how unfavourable climatic conditions in one season can be compounded over the course of the year and impact the subsequent year.





COPING STRATEGIES: FUTURE SCENARIOS

If confronted with persistent below-normal rainfall or dry conditions in the future, farmers' coping strategies would likely shift from modifications in on-farm activities to other income-generating opportunities. If there were not enough rain for a few years in a row, respondents suggested their preferences would be as follows:

1. taking waged labour (59 percent)
2. going to neighbouring villages for work (35 percent)
3. migrating (27 percent)
4. and taking loans (27 percent).

There was no significant gender differentiation in these responses.

However when asked if the weather was no longer predictable from year to year, i.e. not just persistently dry as above but continually unpredictable, gender differences emerged. Both men and women would seek additional income through wage labour, however women would prefer to do so closer to home whereas men were prepared to go farther away. More male respondents preferred migration in search of wage labour (47 percent) to local wage labour (38 percent) as a coping strategy, whereas more women preferred local wage labour (57 percent) to migration in search of wage labour (18 percent) as a coping strategy. This statistically significant difference along gender lines suggests that if climate becomes unpredictable for the foreseeable future, men and women would prefer wage labour in different locations, with men prepared to face a greater distance from home. There are implications of these different preferences for family structure and their long-term sustainability, and how they will be reconciled with each other.

D Men and women farmers rely on institutional support but have different levels of access

This section describes the broad findings regarding men's and women's access to and use of institutional support (mostly through government and NGO programmes), and also highlights some areas that warrant further investigation.

KEY FINDINGS:

- ◎ **1. Farmers reported a strong reliance on support from government employment schemes and loans.**
- ◎ **2. Men and women farmers made different use of the available institutional support and it appeared that women had limited access to information relevant to farming in comparison to men.**



LIVELIHOOD SUPPORT TO FARMERS

The farmers in the study area found support for farming and food security from numerous sources. The top four programmes were the Public Distribution System (PDS, supply of foodgrains at reasonable prices by the Department of Public Distribution); the National Rural Employment Guarantee Scheme (NREGS, legally guarantees provision of at least 100 days of wage employment to rural households whose adult members are willing to do unskilled manual labour); Arogya Sree (a medical insurance scheme of the Andhra Pradesh State Government); and thrift and credit Self-Help Groups. The large majority of participants also reported receiving assistance from the government bank.

In the study area, government subsidies for inputs, microirrigation, and information on agriculture were accessed, as were employment and food distribution schemes. In general, prior to an extreme event or dry season, institutional support was available in the form of information on cropping patterns; credit; crop insurance and government subsidized seeds. In the event of a dry season or drought, institutional support was mostly in the form of a loan waiver; subsidized food through the Public Distribution System; and wages via the National Rural Employment Guarantee Scheme.

INCOME SUPPORT TO FARMERS

Indebtedness²⁷ among small farmers in Andhra Pradesh has been documented as a major problem with multiple causes, including agricultural stagnation, increased production and marketing risks, an institutional vacuum, a lack of alternative livelihood opportunities, and environmental degradation (Government of India, 2007). The farmers in the sample group were characteristic of farmers in Andhra Pradesh in their use of loans to supplement their livelihoods in order to meet domestic and farm needs, and also apparently in their low capacity to pay back the loans.

In reference to the year 2008, 53 percent of respondents noted they took loans, although this differs significantly by gender with 66 percent of men and 41 percent of women reporting they had taken loans²⁸. The source of loans varied by gender, but the main source was the bank, followed by self-help groups and big farmers or money lenders. The amount of the loans ranged from Rs. 3 000 to Rs. 930 000, with the majority in the range of 10 000 to 59 000. It was not possible to determine the amount of loans received by men and women, because when respondents reported on the amount of loan received they did not differentiate between loans they themselves received or those that a family member received. However, nine of the eleven female-headed households in the study population received loans, ranging from Rs. 4 000 to 40 000 (average Rs. 24 000). In

Borewells dried up due to heavy exploitation



one case, a female-headed household received a loan through the head-of-household's son; in that case, the loan was for Rs. 100 000. These figures suggest that while women have access to loans, they may have access to smaller loans than men.

As sources of credit dried up or became too expensive, and as the dry period extended beyond a period when the hopes of having a good yield would be possible, the households needed to sell some of their assets to compensate for the shortfall in agricultural incomes. Twenty-three percent of respondents reported selling assets during 2008 and these were mostly livestock.

Income from farming did not appear to be enough in order to repay the loans. Loans were repaid by selling crops (68 percent); earning wages (53 percent); taking loans from self-help groups (15 percent) as well as selling some land, getting help from the wife's maternal family which seemed to want to assist their daughter whenever possible even if she lived away from them; as well as selling milk or by receiving support from family members working in the cities and; as a last resort by sending children to work.

**“We know it is fatal,
because rains are
late.”** - Male farmer

**Commenting on the Agricultural
Extension officer's advice to sow
groundnut up to end of August**

**“There is no more
faith that we can live
on our land.”**

- Group of male and female farmers

Working in the National Rural Employment Guarantee Scheme was clearly very important to the livelihoods of the study population. More than half (61 percent) noted that they or a family member did NREGS work during 2008-9. The farmers, especially women, did not have any idea of the allocated budget for their village; they only knew that there was work available the next day in a designated farm. Women were paid lower wages than men for their work in NREGS projects and sometimes were unaware of how much they made as their pay usually went directly to their husbands.

AGRICULTURAL SUPPORT TO THE FARMERS

Much less than one quarter of respondents reported receiving assistance (information, trainings, materials) from the government agricultural department, although this is significantly gendered with 36 percent of men mentioning the agricultural department and only 22 percent of women mentioning it. The type of support received was also gendered: 23 percent of men and 7.5 percent of women reported receiving agricultural information. In qualitative focus groups, farmers reported that the extension networks were poor and considered the advice not to be appropriate.

With regards to receiving information related to on-farm production, 33 percent of respondents said they receive information on cropping patterns/practices, however this was significantly gendered with 47 percent of men and 21 percent of women responding positively. Most agreed that more information was given to farmers with larger land holdings (who happened to always be male); there was a general perception that women farmers did not receive information (this was not necessarily related to the size of land holding but primarily due to gender) although this was not confirmed in the quantitative analysis. The expectations of government assistance also appeared to be gendered; more men than women reported knowing about and receiving timely information on weather and irrigation schedules; whereas women were less aware of the availability of such assistance.

Men and women appeared to have different sources of information about the weather, which has implications for how information on weather and seasonal variability is disseminated to community members. Table 5 outlines these differences and highlights the importance of television and relationships with neighbours in obtaining information related to weather forecasts. In particular, women appeared more likely than men to rely on neighbours for information, whereas men appeared more likely than women to rely on traditional knowledge. These sources of information were important factors in disseminating information to farmers on responding to weather events and seasonal climate conditions.

Table 5. Sources of information on the weather, by gender

SOURCE OF INFORMATION	Percent of female respondents	Percent of male respondents
Radio	5	12
Newspaper	0.9	18
Television	42.5	52
Neighbour	34	23
Family member	17	8
Traditional knowledge	14	33

These results of gender differences in access to institutions and information reflected differences in men’s and women’s education levels and literacy, as well as their culturally-defined roles in decision making and division of labour. For example, cultural practices discouraged women’s interactions with outside men, thus women would not interact with extension agents and as a result would be less likely to report having access to this information. In confirming that gender was a factor in accessing precisely the information and support necessary for responding to climate variability, these results suggest that women are disadvantaged with regards to access to institutional support, which has major implications for building resilience to long-term climate change. However, there are many programmes that extend institutional support specifically to women in India. Nevertheless, there is a greater need to recognize the role of women in agriculture and the impacts on their livelihood of agricultural related decisions. It is important to increase the efficiency of institutional support to ensure that climate related information also reaches them to the degree that it is needed for making good decisions with or without referring to men.

TOPICS FOR FURTHER INVESTIGATION

The research identified a gap between the institutional advice on cropping provided and its uptake by farmers. In focus group discussions, the farmers, especially men, expressed the opinion that the advice provided was not suitable – either it came too late, or, if followed, it would not result in the highest possible profits. Furthermore, the local government practice of disseminating farming practices via a “model farmer” did not appear to be successful, as many farmers, particularly women, could not identify with, or even identify who the model farmer was. In order to better understand the apparent gap between institutional support and farmer actions, a deeper analysis of the institutional structure is needed and a separate analysis for the reasons behind this gap is essential.

As evidenced by the study population's reliance on loans, NREGS and migration, the farmer as a social actor is changing. The formally recognised 'farmer' of the past is becoming increasingly reliant on multiple sources of income other than farming. With women increasingly taking on waged labour, it is possible that gender roles are shifting. However, their entry into off-farm activities is usually centred in low-return easy-entry activities. Unequal access to diversification opportunities often exacerbates inequalities.

These are shifts that have also been documented in other traditional societies in transition: in view of external socio-economic pressures, farmers disengage themselves from entirely agriculturally-based production activities to a more mixed kit of several survival options. It appears that changes in climate variability are also encouraging a shift away from farming. While the government is supplying support to these 'new' farmers, it is not clear whether this support will be sufficient under continued changing climate conditions. Incentives will have to be invented, to encourage the younger generation to stay on the farm and produce food for both rural and urban consumption in the future, especially as the demand from urban areas will increase. In a similar vein, how the 'formal' farmers who are no longer farming are coping both in the short and long-term as well as how they could be supported to remain on the land also warrants further investigation.

THE FUTURE: LESSONS FOR SUPPORT IN TIMES OF DROUGHT

In the summer of 2009, after the conclusion of the field work for this study, the dreaded drought became a reality in both Anantapur and Mahbubnagar district. Not only did the rainfall arrive late, when it finally did arrive just before harvest, it resulted in floods in some areas. On 9 September, 2009, the Government of Andhra Pradesh declared 971 mandals in 21 districts as drought affected, including the two mandals in which the study villages are located (Gooty in Anantapur and Koilkonda in Mahbubnagar) (a mandal is an administrative level within a district) (Government of Andhra Pradesh, 2009).

The field team visited the village of Ankilla in Mahbubnagar district in the aftermath of the drought, for three days at the end of September, 2009, to get a snapshot of what the farmers' and government's responses had been. It appeared that the drought impacts were harsher than what farmers had anticipated prior to the onset. The farmers reported that these drought times were hard on everyone and that it had affected them in many ways.

All of the farmers that the field team met with had experienced crop loss. Sorghum (the June to September season crop) failed for most farmers because of lack of rain. The lucky few who managed to get some yield were wary that the untimely rains would damage that, too. The sorghum crop sown in June was completely destroyed by rains that came



just before the harvest. The few families in the village with cattle were able to endure the drought by selling milk.

Farmers also reported ill health and a rise in food insecurity. Farmers expressed doubts about their resilience, saying they previously thought their coping mechanisms would ensure their food security, but when the situation worsened they could barely appease their hunger. This was especially true for women. “We are eating once a day, and sometimes not eating, too. We eat broken rice now to survive. This was not the case before,” said a woman farmer.

In response to crop losses, farmers turned to wage labour for income. “We need to work as labourers and live, we cannot be farmers” rued a female farmer. Activities through the NREGS provided wage labour for 40-250 persons a day in Ankilla village. Women said that they preferred working in the fields of larger farmers rather than in the construction activities of the NREGS projects because, despite lower wages, field labour was not as heavy or gruelling during the severe summers.

Through the government drought contingency plan, the authorities stepped in to support the farmers. The farmers did not seem to have complete information about the plan and were critical of numerous components, including the following critiques:

- **Farmers hoped for a waiver of crop loans they had taken from the banks and were disappointed that the government prescribed rescheduling of loan repayments.**
- **The farmers were not enthusiastic about the crop insurance scheme because they felt the returns for the premiums were not attractive.**
- **Farmers felt the government advice on alternative crops came too late and the suggested crops were not appropriate.**
- **Farmers found the government-subsidized seeds to be of inferior quality to the ones they had saved, or could borrow or buy.**

These opinions were expressed only a few weeks into the government outreach efforts; a more complete assessment of the programme would be needed to evaluate the eventual impact of the programme in 2009 and identify where improvement may be needed in the future.

Farmers still had hope in farming, but it was unclear how they could be successful in farming if droughts like the one in 2009 were to recur.



DISCUSSION

● A - Summary of research findings

The research results show how men and women farmers perceive and experience climate variability and demonstrate how these experiences lead them to make choices to ensure their food security, choices that may be rational in individual circumstances but ultimately threatening to ongoing food security. The evidence presented here supports the hypothesis that, due to gender roles (the behaviours, tasks and responsibilities a society defines as “male” or “female”) and due also to differential gendered access to resources, men and women experience climate variability differently and have diverse coping strategies. The results reveal that gender is a significant factor in coping with climate variability and ensuring food security as well as overall well-being.

The gender issues of responding to climate variability identified in this research can be summarized in four broad categories. These findings are locally-specific but the hypothesis and methodology would be applicable to other locations and populations.

1. Perceptions of climate variability

An analysis of the climatic record for the study area and the recollections of the men and women farmers reveal that men and women farmers have similar or identical perceptions of temperature and rainfall trends on a decadal basis and over time; these perceptions match well with the climate records which show an increase in drought conditions over the past three decades.

Thus, both men and women’s memories of historical climate trends can be useful resources for understanding the past in particular with regards to extreme events or changes over time. Additional research would be needed to understand if there is a difference in men’s and women’s perceptions of climatic trends on different timescales than those studied here.

2. Experience of climate variability

Men and women farmers in the study area link changes in the climate over the past thirty years to changes in key farming activities; however the changes are perceived in different areas of activity according to gender. In addition, there were differences in gender in the perception of who was affected by changes in climate.

Therefore, it appears that climate variability is experienced through gender roles. Furthermore, it is likely that men's and women's accounts of how climate interacts with livelihood activities would be influenced by gender and thus the involvement of both men and women is needed to fully document perceived impacts of climate variability and change.

3. Coping strategies in response to climate variability

The women and men in the study area perform complementary activities to ensure farm productivity and they elect similar coping strategies to ensure sufficient yields in response to abnormal rainfall. When the farm production and income are low due to low rainfall, men and women share the burden of obtaining additional income, with men tending to feel the burden of loans. Traditional coping strategies for coping with food scarcity have a strong gender component in terms of distribution of food in the household and become exacerbated during dry years. Men and women demonstrate different preferences for longer-term coping strategies. In response to persistently unpredictable weather, more male respondents preferred migration in search of wage labour as a coping strategy, whereas more women preferred local wage labour to migration as a coping strategy. Men play the dominant role in decision-making in the short term, but it appears that in crisis, decisions are more equally shared.

It appears that gender roles in decision-making are in flux, and it is unclear how men's and women's different preferences for coping strategies or adaptation strategies would be negotiated given current gender roles in decision-making. First indications suggest that there is a process of negotiation going on, especially in the younger families as younger women experiment with increased participation in household decisions. Further research is needed to understand how longer-term changes in climate may interact with evolving gender roles, as they may determine shorter-term coping and long-term adaptation strategies. Additionally, further research would be needed to understand if the burdens of responding to climate impacts will fall more heavily on either men or women or if they will be distributed more equitably between them as conditions become exacerbated.

4. Institutional support for coping with climate variability

As farming no longer entirely supports the needs of the farmers' rural families in the study area, the farmers have come to rely largely on support from government employment and food distribution schemes as well as on loans and migration in order to earn additional income. While this support is accessed by all family members, it appears that services related to on-farm activities are available to men more so than women. The research has shown that farmers are getting by with this institutional



support, but they are not thriving. In addition, there appears to be a gap between the advice provided and its uptake by farmers. Informal institutions, including traditional knowledge and neighbours, continue to be important sources of information for the farmers.

Additional research would be needed to understand how institutional support to farmers can meet their needs and be more willingly and meaningfully taken up by them. In addition, further study would be needed to understand how to overcome in policy-making existing gender inequalities that hamper women more so than men from receiving institutional support as households seek to adapt to changing climate conditions to ensure their livelihood. The increased pressure on men to find loans intersecting with women's increased engagement in wage labour may herald new (and perhaps unwelcome) outcomes for inter-household dynamics.

In addition to these findings on gender and climate variability, the study documented other trends that shape the lives of smallholder farmers. Over the past thirty years, farmers switched to cash crops and many came to rely on borewells to meet irrigation needs. Currently, most borewells are no longer a sufficient source of water as the water table has dropped. As borewells and rainfall are less reliable, farming itself becomes a precarious source of income. Farmers have found support through government programs, including guaranteed manual labour opportunities through the NREGS programme and subsidized food through the Public Distribution Scheme (PDS). The

typology of the farmer of today is therefore quite different from the farmer of three decades ago. The future of farming as a productive livelihood choice in these drought-prone districts remains uncertain, if significant investments in increasing agricultural efficiency and sustainability are not made. These investments would imply developing the capacity of farmers to make the best adaptive management decisions in a changing environment to ensure at least the possibility of remaining on the land and continuing to farm in a viable mode.

● B - Future implications

Although the findings presented here relate to climate variability, they are relevant for adaptation to long-term climate change because they illuminate how men and women do and do not cope with changes in their livelihoods and food security induced by climatic factors. Understanding how men and women have responded to climate variability in the past and how they are able to respond now, including what institutional support assists them, is a crucial baseline for designing strategies for long-term adaptation.

Looking to the future of the farmers in the study area, as well as broader implications outside this specific context in other parts of India, it is clear that there are multiple trends - global, national and regional - that threaten food security and rural well-being in the long term. These agricultural regions are increasingly reliant on food being brought in from outside as subsistence production declines, raising the question of how future food security will be ensured. The farmers have come to rely on loans in order to carry out their farming activities, but are often unable to pay these loans and it is unclear how the trap of indebtedness can be resolved. The livelihood choices farmers make are embedded in socio-economic as well as cultural traditions and practices which are also changing at various speeds. Farmer decision-making appears to take place most often on a short and less so on a long-term basis as farmers manage multiple and sometimes contradicting factors. This may call into question their capacity to plan for longer-term shocks to their livelihoods but it may also signal new opportunities for change and social renewal if the right support and capacity building is provided.

Given these trends as well as changes in climate, how will men and women farmers fare? In particular, how will men's and women's roles in decision-making and their access to resources shape the future of food security and livelihood activities? Furthermore, how might gender roles and relations change along with climate change? As women become increasingly responsible for the household income when the husband migrates, will this signal the greater empowerment and

agency of women? It would appear that as their social roles shift, women may gain confidence in dealing with other socio-cultural inequities they face daily. However, research in Australia for example (Alston, 2007) suggests that this would generally occur if external institutions supported and made visible the increased power of women in agriculture through overt processes of consultation and information sharing and through training and development programs addressed specifically to them in a regional or national context. Without external resources for women to become full-fledged farmers, their empowerment remains precarious and open to challenge.

● C - Methodological approaches

The use of multiple methodological approaches (sociological analysis of qualitative and quantitative data as well as climate analysis) helped to triangulate information thus ensuring that the farmers' reporting was substantiated and robust. Establishing direct causal links presented serious methodological challenges. While in some cases it is possible to link climate variability to changes in livelihoods, it is impossible to fully understand these dynamics without an understanding of the broader context, which requires a multi-disciplinary approach. By maintaining the focus on the farmers' perspective throughout all data collection activities, the results present a multi-faceted account of their point of view.

Qualitative focus group discussions presented opportunities for men and women to express their views separately and together, which allowed cross-referencing and verification. The quantitative questionnaire narrowed in all the nuances of perception and understanding. The climate analysis used the data available from weather stations for a period of 40 years and referenced it with the farmers' interpretations. The climate analysis provided the confidence needed to support the farmers' statements.

The perceptions of farmers were expressed in their own terms and within their own conceptual framework. Care was taken not to direct the farmers toward a discussion of climate variability but rather to place the research questions in the broader context of the farmers' lives and livelihoods. Much analytical work had to take place to ensure that the farmers' terminology was appropriately interpreted in the terms of the research framework. Terminology for understanding the approaches needed in dealing with short and long-term climate variability and climate change is diversified and evolving and will increasingly provide more rigorous outcomes.

The gender-sensitive approach employed in this research revealed many dynamics of vulnerability and coping at the household level that are key to overcoming changes in the climate. By speaking with men and women separately, their different perspectives

and perceptions of risk emerged, as did their distinct areas of knowledge. A gender-sensitive approach also served to reveal how changes in climate variability impact dimensions of lives and well-being beyond simple direct impacts on water availability and crop production. Further work along these lines, that also incorporates the important dimensions of caste and class (see Ray-Bennett, 2009), could increase the understanding of how to translate a gender-sensitive research approach into gender-sensitive policies and projects.

● D - Recommendations

The parameters of the study and the analysis that followed had limits, of course. The recommendations that follow are in the context of what was possible to research and what still remains to be researched.

1. Climate, crop and rainfall information dissemination

In dealing with climate variability in the future it will be essential to have a system of information that is accessible to a wider social spectrum and is democratically applied without biases due to gender, property ownership, caste, age or religion. It is of crucial importance that institutional information is received by women as well as men through advice on radio and television in the form and content that is appropriate, and through legitimate community information sources as well as through women's organisations. This information should be tailored to the decision-making needs of farmers and must arrive in a timely fashion.



2. Methodology

Further studies need to be undertaken in other parts of India and elsewhere to test the methodology and whether farmers' perceptions and strategies have a gender component.

More research based on gender analysis that recognises the heterogeneous nature of men and women farmers and the variety of strategies that they develop and employ continuously is needed as it would enhance policy recommendations. Further cross-regional intra-household analysis would illuminate the inequalities of the approaches in use and impacts for different members due to gender, age and access to resources. The methodology employed here, and the data collected for this study in Andhra Pradesh, could be used to explore similar issues in other regions. By signalling that the coping strategies farmers employ may have both a social benefit and/or an individual detriment, policies can provide safety nets as well as encourage innovative solutions. Further research would need to address the ongoing social transformation in Indian social structures, such as the increasing contribution of women and girls to household incomes and the absorption of poorer castes moving from the country side into wage labour in urban areas.

3. Food Security

This study showed that the farmers' own production of food was tied to variations in the climate. Overall however, some food was available to them regardless of climatic variation because of the provisions made by the government food distribution program (PDS). While farmers felt that changes in the weather had put increased pressure on them to provide food, the majority did not report dramatic switches to different kinds of food even though they experienced decreased quality of food. Despite changes in the climate, the food that was mostly available to them seemed to meet their needs which seemed also to have been adjusted to the existing conditions of availability.

Production is very much affected by climate change but the access dimension of food security is also likely to be affected. The men and women farmers in the study population were able to access the food made available by the government mostly because of their socio-economic status as low income, small-scale farmers. Farmers also resorted to wage employment (in different degrees and of different characteristics), because changes in the climate were making farming an unreliable source of income. The income from wage employment enabled them to access food through purchase.

Access to food within the household had a gender dimension. Women's access to food was shaped by their role in the household, their rights to the family's resources, their relationship to their husbands and male children as well as to other women in the family such as mothers or mothers-in-law. Increased climate variability and climate change threatens family resources such as income from farming or wage income used to purchase

food. In this case, women's access to food may become even more tenuous. An unexpected factor (illness, unemployment) affecting the availability of food puts in peril farmers' access to food and therefore undermines food security.

Given the changes in livelihood activities that were taking place in part in response to changes in climate, it appears that future food security will probably be much more determined by the type and location of employment opportunities (which determine access to food), than by the availability of food through on-farm production. As farmers engage in increasing numbers in urban and peri-urban employment for part of the year, greater attention needs to be paid to the changing situation of farming in India to ensure food security in both rural and urban areas on the whole. Leaving farming for government employment programmes or outright migration may assist the household but may change permanently the role agriculture can play in development.

In addition, current coping strategies must be weighed against shorter term adaptation with a view to longer-term sustainability. As one survival or coping strategy, eating less may be helpful in assuring the overall existence of the household but it puts women at great personal risk and vulnerability. Using increasingly scarce resources such as water (from borewells) may assist the households to survive for the moment, but may be destroying forever the un-replenished aquifers of the future. Criteria to evaluate (for sustainability and efficiency) the documented coping strategies on a variety of levels from the personal to the household, community, regional, national and international will need to be applied. Otherwise such short term solutions and strategies might be detrimental to the available natural resources undermining the future capabilities of farmers to cope with crises in the long term.

Finally, it is important to assess the farmers' ability to take on new risks by understanding the existing support infrastructure and gaps. Farmers' risk assessments may be different from official accounts and should be heard. Based on the study findings, it is legitimate to foresee that some people will try to leave agriculture and some of these lands will be abandoned. In view of the need to increase world food production, and promote better food distribution to ensure the food security of a growing population, it would be important to invest in increasing production efficiency, through institutional and technical support such as farmer educational programmes and advisory services addressing both men and women's roles and needs. At the same time, changes in access at the household and individual level due to changes in climate would also need to be addressed.

4. Future resilience

However, not all change should be seen as a threat. As the known patterns of agriculture undergo changes and the farmers seek to adapt, in this 'transitional adaptation phase' there may be emerging new empowerment opportunities. New resilience patterns are emerging both at the institutional and household level as the gradual breakdown of barriers to women's

empowerment is necessarily enhanced through the need to address new climatic emergencies that may result in new creative solutions. It is increasingly impossible to continue 'business-as-usual' in agriculture and the fact that external threats demand new solutions, opportunities emerge for women and men to participate in untried decision-making processes as well as to take on newly defined leadership roles. Gender relationships are also under flux (particularly within younger couples) and this creates new spaces for social change and the emergence of new social patterns and opportunities.

This research shows that opportunities in addressing climate change are being created, and for this reason institutional support and policies should focus on recognising and sustaining these new options. By strengthening emerging social openings for socio-cultural change, new role models may lead to the creation of longer-term sustainability options. The differences documented here by gender in perception of food security show the importance of consulting both men and women when seeking to understand how food security may be related to climate shifts, both short and long-term. What the research reveals is that gender does matter when assessing farmers' responses to climate variability and long-term changes in the climate.

There is a need to continue exploring and defining the socio-economic characteristics of the new Indian farmer. Such research is already taking place in India and already exists in historic reference to agrarian change at key points of modernization. For adaptation to climate change, it will be critical to document this evolution in parallel to the impacts of increased and longer-term climate variability on agriculture in different ecosystems in India and elsewhere.

● E - Questions to continue exploring

- 1) How can farming in resource-poor areas become more efficient? How can existing agricultural practices be adapted so that men and women can produce more and better with less while ensuring long-term food security and sustainable resources?
- 2) How can knowledge and information support male and female farmers to make better management decisions? What type of gender-sensitive information and approaches are needed to ensure farmers make appropriate forward looking decisions?
- 3) Can short-term food security coping strategies be projected in the future to ensure that they work in the long run, or will adaptation to climate change require an entirely new set of strategies differentiated by gender?
- 4) What can traditional support systems (of "compassionate fallback") that help worse-off farmers teach us about strengthening the self sufficiency of villages by addressing the existing social and gender inequalities and overcoming them?

5) What are the decision-making processes of government agencies and other local support institutions for dealing with increased climate variability; and how can better connections be made with male and female farmer decision-making processes to create greater synergy, accounting for the fact that strategies may change from year-to-year?

6) How does climate variability increasingly influence what the farmers (male/female) produce for the market and how does this impact their food security? Who is responsible for the decision-making on how to interpret climate variability and then decide what to produce?

7) How can the gaps between institutional advice and male/female farmer actions be addressed? How can women become more equal partners in the access and use of such support?

8) How can we better understand the causal linkages between climate variability and farmers' actions, in the context of other drivers, including development?

9) How can climate change adaptation become an opportunity for rethinking gender roles and improving gender equality?

● F - Concluding remarks

Planning for adaptation to long-term change must be founded on men and women farmers' specific knowledge and experiences as they make choices in an uncertain climate. In addition, future plans and government policies must consider the reality of farming today, including migration and what the implications will be for longer-term community and family stability and the role of agriculture in development. In pursuing strategies for the future, the needs of women and men farmers need to be incorporated in regional, national and international development plans to ensure an integrated and gender-sensitive approach based on sound knowledge and strategies that build the resilience of the most vulnerable to the impacts of climate change and the enhancing role that agriculture can play in ensuring food security.



ENDNOTES

¹ At the time of writing, the state of Andhra Pradesh was addressing the move for the formation of a separate state for the Telangana region.

² Adger, Agrawala, Mirza et al., 2007; Aguilar, 2009; Alston, 2007; Brody et al., 2008; CAPWIP, 2008; Carr, 2008; Carvajal-Escobar et al., 2008; Chowdhury, n.d.; Dankelman et al., 2008; Lambrou and Piana, 2005; Leduc et al., 2008; Masika, 2002; Mitchell et al., 2007; Röhr, 2004; Segnestam, 2009; Terry, 2009; UNDP, 2009; UNIFEM Australia, 2008; UNISDR, 2008; WEDO, 2007.

³ Ahmed and Fajber, 2009; Mula et al., 2008; Oxfam America, 2007; Parikh, 2007; Ray-Bennett, 2009; Government of India and UNDP, 2008

⁴ For comprehensive overviews of socio-economic development and agriculture in Andhra Pradesh, see, for example, Government of Andhra Pradesh, 2008 and Acosta-Michlik et al., 2005.

⁵ The Human Poverty Index measures the distribution of progress in achieving human development through the level of deprivation. Anantapur receives a score of 0.515 (ranking 20 out of 23 districts) and Mahabubnagar receives a score of 0.592 (ranking 22 out of 23) using 2001 figures.

⁶ The Gender Development Index is composed of the indicators literacy rate, enrolment rate, life expectancy and per capita GNP, and takes into account the inequality in achievement between women and men. The greater the gender disparity in basic human development, the lower is the GDI of a region. Anantapur receives a score of 0.559 (ranking 19 out of 23) and Mahabubnagar receives a score of 0.493 (ranking 23 out of 23) using 2001 figures.

⁷ The Gender Empowerment Measure Index is an indicator of whether women are able to participate actively in economic and political life. Anantapur receives a score of 0.604 (ranking 17 out of 23) and Mahabubnagar receives a score of 0.546 (ranking 23 out of 23) using 2001 figures.

⁸ There is a substantial history of research and action to improve gender equality in India and Andhra Pradesh, however challenges persist, such as in achieving concrete improvements in women's empowerment through outreach programs (Garikipati, 2008).

⁹ Anantapur experienced 8 years of moderate droughts during the period 1960-1999, or 20 percent of that 40-year period, and Mahabubnagar experienced 9 years with moderate droughts and 1 year with severe drought during the same period, or 25 percent of that 40-year period (Acosta-Michlik et al., 2005).

¹⁰ Note that the definition of "adaptation" varies across different disciplines (Smithers and Smit, 1997) and has come to have a distinct definition in the climate change research and policy-making discourse, which is being used here.

¹¹ Andhra Pradesh Mahila Samatha Society. Annual Report 2006-2007

¹² Food availability means sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid). Food access refers to access

by individuals to adequate resources (entitlements) for acquiring appropriate foods for a nutritious diet. Utilization means utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. Stability means having access to adequate food at all times. (FAO, 2006).

¹³ Samatha Gender Resource Centre (SGRC) is the gender mainstreaming unit of the Andhra Pradesh Mahila Samatha Society, a Government of India programme dedicated to education for the empowerment of women through collaborating with village women's collectives, "sanghams". www.apmss.org

¹⁴ The combination of the spread of a market economy and government subsidized grains in the region reduced the need for cultivating food crops for home consumption. In addition, oil mills led to an increase in the price for groundnut and the groundnut based cropping system became profitable for farmers (Gadgil et al., 2002).

¹⁵ The surveys were administered to men and women separately so that they did not influence each other's responses.

¹⁶ While this report focuses on the gender roles and relations of husbands and wives, the primary decision-makers in the study households, it is noted that gender roles are more complex than the binary relationship between husband and wife and are shaped over time by other differences such as age, caste and class. For example, while both are "wives", a woman who is a Mother-in-Law will have a different role in a household than a woman who is a Daughter-In-Law. Where possible, the experiences of female heads-of-household are highlighted to demonstrate the experiences of women outside the husband-wife relationship.

¹⁷ Only a single station analysis could be performed due to lack of data.

¹⁸ A threshold of 35 °C was used in the analysis, a maximum upper limit beyond which the physiological processes related to loss of energy and reduced photosynthetic accumulation are induced.

¹⁹ This may enhance the overall energy loss and reduced accumulation of photosynthates due to enhanced respiration. A trend of increasing minimum temperature under a changing climate may have a negative impact on rainfed crop production.

²⁰ These quotes were extracted from a broader discussion of changes in farmers' lives and reflect farmers' views of changes in climate but not their views of other positive trends that have also occurred in the study area.

²¹ The term "changes in weather" here can be considered to be interchangeable with "changes in climate variability" because the term "weather" is used in this sense to mean what climatologists call "climate".

²² It was not possible within the scope of the study to analyze responses based on age or to analyze in detail the outcomes for different age groups. One-third of farmers reported that their children's education had been disrupted due to the need to put them to work and approximately one-quarter of all respondents reported that their children's health had been affected by changes in the weather. Women were more likely than men to report

that their children were eating less food and that the food was of lesser quality.

²³ While it was beyond the scope of this study, it is critical to understand how coping strategies change over time, and how short-term coping strategies affect long-term options.

²⁴ The year 2008 was chosen as it was the most recent full year, so it is likely that farmers' memories of their actions are accurate.

²⁵ This report discusses the most popular coping strategies mentioned by the farmers but does not touch on all coping strategies (or responses) that have been documented in the region. One response to drought not covered here is that of farmer suicide, which has been discussed in research (e.g. World Bank, 2006) and the popular press. During this research, women farmers of Ankill village of Mahbubnagar district spoke of their concern over the recent suicide deaths of a few farmers in the village. This issue was not brought up in the other study villages, and so it was decided not to pursue it further within this study.

²⁶ According to the Department of Food & Public Distribution (2010), the Public Distribution System (PDS) "evolved as a major instrument of the Government's economic policy for ensuring availability of foodgrains to the public at affordable prices as well as for enhancing the food security for the poor". The PDS is operated jointly through the Central and State Governments. Under the PDS, the commodities of wheat, rice, sugar and kerosene are distributed via Fair Price Shops.

²⁷ For more on indebtedness in Andhra Pradesh, including insights into the link between the debt trap and farmer suicides, see Government of India, 2007.

²⁸ This difference is in line with gender roles in the sphere of financial matters in which men play a dominant role. 51 percent of women noted their husbands had taken loans and 22 percent of men that their wives had taken loans. 8 percent had taken a joint loan. Only 6.5 percent noted they had not taken a loan. Loans were taken mainly for crop and other inputs (80 percent). The main source of the loan is the bank (79 percent).

ANNEX I. ADDITIONAL INFORMATION ON STUDY PARTICIPANTS

Education. Of the 201 farmers (106 females and 95 males in total) who responded to the survey, 70 percent had no formal schooling (women were much more likely than men to have no formal schooling – 87 percent of women versus 51 percent of men surveyed had no formal schooling).

Religion. Ninety eight percent of the respondents were Hindu and 2 percent Muslim. Christians participated in some of the qualitative exercises but were not captured in the quantitative survey.

Caste. A majority of the sample (54 percent) belonged to the caste traditionally composed of artisans and farm labourers (the “Backward Caste”), and the rest were split almost evenly among the “Scheduled Caste” (also known as “Untouchables” or “Dalits”), “Scheduled Tribes” and “Other Caste”. “From bottom to top of the hierarchy, there are four broad caste categories: scheduled caste (SC – so-called untouchables), backward castes (BC) and other Castes (OC), plus the Scheduled Tribes (ST) which are outside the traditional hierarchy but are generally placed below SCs. BCs were mainly artisans and farm labourers in traditional agrarian society. Economic, political and social power is concentrated in the hands of OCs. In Andhra Pradesh the BC are numerically the strongest, followed by the OC, SC and then ST” (Deshingkar et al. 2003).

Farming. The majority of farmers report their land being rainfed only, although some of those farmers also used borewells. While 41 percent of farmers reported having borewells, only 31 percent reported that they had functioning borewells, pointing to the challenges of relying on borewells in the area. The level of mechanization of the farming was low; while 50 percent of respondents had oxen and 38 percent had a power connection for the borewell, only 7 percent had a tractor and 17 percent had sprayers. In addition to growing crops for sale as described in part C of the Methodology section, a small percentage of the farmers owned livestock: 11 percent of households had cows, 14 percent of households owned female buffalos and 23 percent of households owned oxen; a small number of households own goats and sheep. The livestock was used for powering farming activities and for milk for sale.

Land ownership. The majority of respondents reported that land was registered only in the husband’s name (73 percent). Land was jointly registered in both the husband’s and wife’s name for 17 percent of the respondents; land was registered in the wife’s name for 8 percent of respondents, and the remaining 2 percent of respondents had the land registered in the name of another family member. For female-headed households, land ownership was in the female head of household’s name in 10 of 11 cases; in the other case it was registered in a child’s name. Land ownership in the name of the woman does

not necessarily mean that she has authority over how the land is used. In fact, registering a portion of land in the wife's name was a strategy used by some men for obtaining assistance or to benefit from loans that were targeted to women, according to observations made by staff of the Samatha Gender Resource Centre who work in the study villages.

ANNEX II. QUALITATIVE TOOLS USED TO MEET RESEARCH OBJECTIVES

The following tools were used to facilitate focus group discussions with separate groups of men and women. The results were then validated with a group of men and women as well as with key informant interviews. The tools were designed in English and carried out in the local language, Telugu. The research was not presented to the participants as being about climate change. A series of questions about the weather and natural resources were used to establish that farmers have seen changes in the weather and experienced severe droughts. From there the questions shifted to a focus on the impacts of the climatic changes. Note that some tools were used to meet more than one research objective.

Objective 1. To characterize the local climate conditions and risks, to identify trends in climate variability over the past four decades (according to recorded data); to compare how recorded data corresponds to men and women farmers' perceptions.

Seasonal Calendar Past and Present: To describe the farmers' perceptions of seasonal climate parameters such as typical rainfall amounts and timing as well as average seasonal temperatures over the last forty years at regular intervals of 10 years.

Ranking: To document the risks to farm production as perceived by the farmers and to rank them in terms of importance to the farmers.

Time Line & Trend Analysis: To document the farm activities, food security and major livelihood opportunities, including migration, during the same decades as the seasonal calendar in order to overlay the climate conditions onto the livelihood activities.

Water Resources Map Forty Years Ago and Present: To document farmers' perceptions of water resources including drinking water, water bodies, irrigation sources, rivers and drainage, at two points in time in order to document any changes in entitlement, utilization and related problems as well as perceptions of any changes in water resources and linkages to rainfall distribution.

Objective 2. To understand how men and women in farm households perceive and experience climatic shifts and how this is linked to food security.

Time Line & Trend Analysis: To document the farm activities, food security and major livelihood opportunities, including migration, during the same decades as the seasonal calendar in order to overlay the climate conditions onto the livelihood activities (as used for objective 1).

Food Security Annual Calendar: To show the availability, access and distribution of food within the household as well as the community over the course of a reference year and to examine climate-related factors influencing food access, including access to water for agricultural purposes.

Guided Focus Group Discussion: Example guiding questions:

Do you notice any change in the rainfall pattern over these last few decades?

Do these changes affect you, your family, your community? In what ways?

When you have crop losses, how do you ensure food security at household level?

If you migrate, which are the places to which you migrate? Who decides where to migrate to? What happens to the agricultural land?

Objective 3. To identify the coping strategies that men and women farmers utilize in order to ensure a measure of food security in response to climate variability; to understand the resources and decision making processes utilized, and to assess the related outcomes for food security.

Web Exercise on Drought: To capture the farmers' perceptions of cause and effect of a major past drought event, as well as the impacts and responses, particularly with regard to food security.

Food Security Cycle: To show the availability, access and distribution of food within the household as well as the community over the course of a reference year and to document coping strategies at different points in the year including the decision making process and resources used.

Guided Focus Group Discussion: Example guiding questions:

When a family gets some food to eat, how is it distributed and is it sufficient for each person? Does this change during a dry year?

If food was not available, what was the alternative, what do you eat?

Did any family member have information on growing crops that use less water?

Did women try to give their inputs and how did the men react to it?

Was there any change in the crops they cultivated during the drought event?

Objective 4. To identify the institutions that support farmer decision making with regard to climate, agriculture and food security and to assess the extent to which institutional support is available, accessible and usable by men and women.

Venn Diagram: To identify key institutions farmers utilize; the degree to which men and women farmers can access their services and deem them effective; and the relative importance of the institutions in the farmers' lives.

Guided Focus Group Discussion:

Are there programs specifically for women in agriculture or animal or natural resources management? If yes, what organizations are involved?

What sources of information exist on farming practices?

Who provides advice on what to plant? Are your neighbors a good source of information?

ANNEX III. QUANTITATIVE SURVEY

Notes on the survey:

The outputs of the qualitative exercises were used in designing the survey questions and responses. Some aspects are thus specific to the study area but could be modified for use elsewhere.

Additional questions were asked but were not discussed in the report so are not included here.

The surveys were carried out with one man and one woman from the same household separately so that their answers were not influenced by their spouse.

The data from the questionnaires was entered into the Statistical Package for Social Sciences (SPSS). Cross-tabulation analysis was performed to examine gender differences in perceptions of changes in climate and related climate, as well as coping strategies and institutional support. Statistical differences and significances were obtained using chi-square.

QUESTIONNAIRE	
Food and Agriculture Organization of the UN	
CONSENT FORM	
Introduction	
My name is _____, and I am here on behalf of FAO/APMSS. We are conducting a survey of farmers and their family members to understand various issues facing farmers.	
Purpose and Procedure	
This survey will be conducted with farmers in Anantapur and Mahbubnagar Districts of Andhra Pradesh. The findings of this survey will be used as part of a research project that will inform policymakers on issues farmers raise. The interview will take about 45 minutes.	
Your participation in this interview is voluntary. All answers you give will be kept completely confidential and will not be reported individually. We are interested in your ideas and experiences, and so we want your frank and honest opinion on these issues. There are no risks in participating in this survey. If, for any reason, there are any questions that you do not wish to respond to, you are free to skip those questions. Do you agree to be interviewed?	
Respondent agreed to be interviewed	
<input type="checkbox"/> Yes <input type="checkbox"/> No	
Consent has been read to the respondent	Village _____
Signature of interviewer _____	Mandal _____
Date _____	District _____

Section 1. Profile of Respondent		
No.	Question	Response
101	Questionnaire Number	
102	Respondent's Category	<input type="checkbox"/> Rainfed farmer (primarily) <input type="checkbox"/> Borewell farmer (primarily) <input type="checkbox"/> Big farmer (6-25 acres) <input type="checkbox"/> Female-headed farming household
103	Respondent's Age	<input type="checkbox"/> 40-49 <input type="checkbox"/> 50-59 <input type="checkbox"/> 60-69
104	Respondent's Sex	<input type="checkbox"/> Male <input type="checkbox"/> Female
105	Highest level of education achieved	<input type="checkbox"/> No formal schooling <input type="checkbox"/> Primary school <input type="checkbox"/> Secondary school <input type="checkbox"/> Intermediate <input type="checkbox"/> University degree
106	Respondent's Religion	<input type="checkbox"/> Hindu <input type="checkbox"/> Christian <input type="checkbox"/> Muslim <input type="checkbox"/> Other (specify)
107	Respondent's Caste	<input type="checkbox"/> Scheduled Caste <input type="checkbox"/> Scheduled Tribe <input type="checkbox"/> Backward Caste <input type="checkbox"/> Other Caste <input type="checkbox"/> Others (specify)
108	Details of family members: Number of male adults in household _____ Number of female adults in household _____ Number of male children in household _____ Number of female children in household _____ Number of household members who earn income _____	
109	How many acres of the following land are owned by member(s) of your household? Rainfed land _____ Irrigated land _____	<input type="checkbox"/> Do not know <input type="checkbox"/> No response
110	What is the source of water for your irrigated land?	<input type="checkbox"/> Bore well <input type="checkbox"/> Canal <input type="checkbox"/> Tank <input type="checkbox"/> Pond <input type="checkbox"/> Stream <input type="checkbox"/> Well <input type="checkbox"/> Using neighbour's bore well <input type="checkbox"/> Do not know <input type="checkbox"/> No response
110a	If responded "bore well" to 110, please answer the following: How many bore wells total do you have? _____ How many bore wells function? _____	<input type="checkbox"/> Do not know <input type="checkbox"/> No response
111	How many acres of land are registered under the following names? Husband's name _____ Wife's name _____	

	Wife's and husband's names _____ Son's name _____ Daughter's name _____ Joint property _____ Other (specify) _____	<input type="checkbox"/> Do not know <input type="checkbox"/> No response
112	Which crops does your household grow during the following seasons? (List all answers) Rabi season (season 1) Rainfed crops _____ Irrigated crops _____ Kharif season (season 2) Rainfed crops _____ Irrigated crops _____ Summer (season 3) Rainfed crops _____ Irrigated crops _____	
113	How many of the following types of livestock does your household own? Cows _____ Female Buffaloes _____ Bullocks _____ Male Buffaloes _____ Goats _____ Sheep _____ Pigs _____ Other (specify) _____	<input type="checkbox"/> Do not know <input type="checkbox"/> No response

Section 2. Climate Variability and Seasonal Climate Conditions		
No.	Question	Response
201	Have you noticed any change in the weather from year to year in the past 30 years?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know <input type="checkbox"/> No response
202	What is the change? (Multiple responses possible. Record all responses given.)	<input type="checkbox"/> Increased temperature <input type="checkbox"/> Severe winter <input type="checkbox"/> Mild winter <input type="checkbox"/> Increased unpredictability of weather <input type="checkbox"/> Reduced length of winter season <input type="checkbox"/> Increased length of summer season <input type="checkbox"/> Reduced amount of rainfall <input type="checkbox"/> Rains don't fall at expected time <input type="checkbox"/> Rains arrive late <input type="checkbox"/> Rains arrive early

		<input type="checkbox"/> More floods <input type="checkbox"/> Other (specify) <input type="checkbox"/> Do not know <input type="checkbox"/> No response
203	<p>What are the reasons for the changes that you have seen? {Do NOT read the responses.}</p>	<input type="checkbox"/> Deforestation <input type="checkbox"/> God's curse <input type="checkbox"/> God knows <input type="checkbox"/> Others (specify) <input type="checkbox"/> Do not know <input type="checkbox"/> No response
204	<p>Which of the following changes do you see now compared to thirty years ago because of the changes in the weather? {Read list of responses and record all affirmative responses given.}</p>	<input type="checkbox"/> Poorer yield <input type="checkbox"/> Using different crops <input type="checkbox"/> Reduced size of forest <input type="checkbox"/> Lower amount of fodder <input type="checkbox"/> Decrease in amount of livestock <input type="checkbox"/> Shortage of drinking water <input type="checkbox"/> Wells and ponds drying up <input type="checkbox"/> Health is affected <input type="checkbox"/> Household garden losses <input type="checkbox"/> Crops are drier <input type="checkbox"/> Shortage and scarcity of food due to low yield <input type="checkbox"/> Others (specify) <input type="checkbox"/> Do not know <input type="checkbox"/> No response
205	<p>Who would you say has been most affected by the change in weather between now and 30 years ago?</p>	<input type="checkbox"/> Men <input type="checkbox"/> Women <input type="checkbox"/> Children <input type="checkbox"/> Elderly <input type="checkbox"/> Entire family affected the same <input type="checkbox"/> Do not know <input type="checkbox"/> No response
205a	<p>How are women's lives today different than 30 years ago because of the changes in the weather?</p>	<input type="checkbox"/> Increased violence <input type="checkbox"/> Increased pressure to provide food for the family <input type="checkbox"/> Increased health problems <input type="checkbox"/> Increase in fights/arguments among the family members <input type="checkbox"/> Decreased quantity of food <input type="checkbox"/> Eating different kinds of food <input type="checkbox"/> Decreased quality of the food <input type="checkbox"/> Increased emotional stress/anxiety <input type="checkbox"/> Pressure to mobilize loans <input type="checkbox"/> Pressure to get labour and machines <input type="checkbox"/> Other (specify) <input type="checkbox"/> Do not know <input type="checkbox"/> No response
205b	<p>How are men's lives today different than 30 years ago because of the changes in the weather?</p>	<input type="checkbox"/> Increased violence <input type="checkbox"/> Increased pressure to provide food for the family <input type="checkbox"/> Increased health problems <input type="checkbox"/> Increase in fights/arguments among the family members <input type="checkbox"/> Decreased quantity of food <input type="checkbox"/> Eating different kinds of food <input type="checkbox"/> Decreased quality of the food

		<input type="checkbox"/> Increased emotional stress/anxiety <input type="checkbox"/> Pressure to mobilize loans <input type="checkbox"/> Pressure to get labour and machines <input type="checkbox"/> Other (specify) <input type="checkbox"/> Do not know <input type="checkbox"/> No response
205c	How are children's lives today different than 30 years ago because of the changes in the weather?	<input type="checkbox"/> Disruption in education to seek work <input type="checkbox"/> Marriages get delayed <input type="checkbox"/> Increased health problems <input type="checkbox"/> Decreased quantity of food <input type="checkbox"/> Eating different kinds of food <input type="checkbox"/> Decreased quality of food <input type="checkbox"/> Others (specify) <input type="checkbox"/> Do not know <input type="checkbox"/> No response
206	When did rainfall begin in the year 2008?	<input type="checkbox"/> Rains started early <input type="checkbox"/> Rains started late <input type="checkbox"/> Rains started at normal time <input type="checkbox"/> Other (specify) <input type="checkbox"/> Do not know <input type="checkbox"/> No response
207	What was the amount of rainfall like in 2008?	<input type="checkbox"/> More rains than usual <input type="checkbox"/> Less rains than usual <input type="checkbox"/> Normal, good amount of rain <input type="checkbox"/> Drought <input type="checkbox"/> Other (specify) <input type="checkbox"/> Do not know <input type="checkbox"/> No response
208	Did you do any of the following activities in response to rainfall in 2008?	<input type="checkbox"/> Change cropping pattern <input type="checkbox"/> Shift from crops to livestock <input type="checkbox"/> Change to more cash crops <input type="checkbox"/> Change to more crops we will eat <input type="checkbox"/> Grow more kinds of crops <input type="checkbox"/> Reduce amount of livestock <input type="checkbox"/> Grow low input crops <input type="checkbox"/> Grow crops which require less water <input type="checkbox"/> Cultivate some parts of land and leave rest fallow <input type="checkbox"/> Grow dry fodder crops <input type="checkbox"/> Leave all land fallow <input type="checkbox"/> No change, continued the same crops <input type="checkbox"/> Other (specify) <input type="checkbox"/> Do not know <input type="checkbox"/> No response
209	In a year with less rainfall than you had in 2008, do you make any of the following changes to your farming activities? {Read responses.}	<input type="checkbox"/> Change cropping pattern <input type="checkbox"/> Shift from crops to livestock <input type="checkbox"/> Change to more cash crops <input type="checkbox"/> Change to more crops we will eat <input type="checkbox"/> Grow more kinds of crops <input type="checkbox"/> Reduce amount of livestock <input type="checkbox"/> Grow low input crops <input type="checkbox"/> Grow crops which require less water

		<input type="checkbox"/> Cultivate some parts of land and leave rest fallow <input type="checkbox"/> Grow dry fodder crops <input type="checkbox"/> Leave all land fallow <input type="checkbox"/> Do not know <input type="checkbox"/> No response
210	In a year with more rainfall than you had in 2008, do you make any of the following changes to your farming activities? {Read responses.}	<input type="checkbox"/> Change cropping pattern <input type="checkbox"/> Shift from crops to livestock <input type="checkbox"/> Change to more cash crops <input type="checkbox"/> Change to more crops we will eat <input type="checkbox"/> Grow more kinds of crops <input type="checkbox"/> Reduce amount of livestock <input type="checkbox"/> Grow low input crops <input type="checkbox"/> Grow crops which require less water <input type="checkbox"/> Cultivate some parts of land and leave rest fallow <input type="checkbox"/> Grow dry fodder crops <input type="checkbox"/> Left all land fallow <input type="checkbox"/> Do not know <input type="checkbox"/> No response
211	Who decides to grow different crops or to change cropping patterns?	<input type="checkbox"/> Husband <input type="checkbox"/> Wife <input type="checkbox"/> Husband and Wife <input type="checkbox"/> Grown up children <input type="checkbox"/> Elders in house <input type="checkbox"/> As per government advice <input type="checkbox"/> Others specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
212	What factors influence the decision to grow different crops or to change cropping patterns?	<input type="checkbox"/> Rainfall <input type="checkbox"/> Investments <input type="checkbox"/> Water availability <input type="checkbox"/> Land fertility <input type="checkbox"/> Market demand <input type="checkbox"/> Availability and access to seeds and fertilizers <input type="checkbox"/> Suitability of crops which give high yields <input type="checkbox"/> Suggestions from agriculture department <input type="checkbox"/> On time supply of power <input type="checkbox"/> Others specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
213	If there is not enough rain for a few years in a row, do you have to make different decisions than if it lasts for one year?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know <input type="checkbox"/> No response
213a	If yes to 213, what types of decisions do you make?	<input type="checkbox"/> We migrate <input type="checkbox"/> Go for wage labour work <input type="checkbox"/> Go to neighboring villages for labour work <input type="checkbox"/> Do other kinds of work <input type="checkbox"/> Take loans <input type="checkbox"/> Do not know <input type="checkbox"/> No response
214	If the weather is not predictable from year	<input type="checkbox"/> We migrate

	to year, what do you do?	<input type="checkbox"/> Go for wage labour work <input type="checkbox"/> Go to neighbouring villages for labour work <input type="checkbox"/> Do other kinds of work <input type="checkbox"/> Take loans <input type="checkbox"/> Others specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
215	Even with making changes in your agricultural activities, do low rainfall levels result in impacts on your livelihood and food security?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know <input type="checkbox"/> No response
215a	If yes to 215, what are typical impacts on your agriculture activities in a year with a low amount of rainfall	<input type="checkbox"/> Crop loss <input type="checkbox"/> Low yields <input type="checkbox"/> Food shortage <input type="checkbox"/> Debts increase <input type="checkbox"/> Unable to repay loans <input type="checkbox"/> Others specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
216	If you suffer from crop loss, what do you do?	<input type="checkbox"/> Migrate <input type="checkbox"/> Go for wage labour work <input type="checkbox"/> Go to neighbouring villages for labour work <input type="checkbox"/> Do other kinds of work <input type="checkbox"/> Take loans <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
217	If there were a drought, what would you do?	<input type="checkbox"/> We migrate <input type="checkbox"/> Go for wage labour work <input type="checkbox"/> Go to neighbouring villages for labour work <input type="checkbox"/> Do other kinds of work <input type="checkbox"/> Take loans <input type="checkbox"/> Take support from relatives / other family members <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response

Section 3. Food Security

No.	Question	Response
301	What are your sources of food?	<input type="checkbox"/> Production <input type="checkbox"/> Livestock <input type="checkbox"/> Purchase from open market <input type="checkbox"/> Ration supplied thru PDS <input type="checkbox"/> Wild food <input type="checkbox"/> Food aid <input type="checkbox"/> Other, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
302	Was the year 2008 an average year in terms of the amount of food <i>you</i> had to eat?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know <input type="checkbox"/> No response
303	How would you describe the amount of food <i>your family as a whole</i> had to eat during the year of 2008? {Read responses.}	<input type="checkbox"/> Often not enough to eat <input type="checkbox"/> Sometimes not enough to eat <input type="checkbox"/> Enough but not always the kinds of food we want to eat <input type="checkbox"/> Enough of the food we want to eat <input type="checkbox"/> Was not enough to store due to crop loss <input type="checkbox"/> Do not know <input type="checkbox"/> No response
304	How nutritious do you think the food you and your family consumed this past year was?	<input type="checkbox"/> Very nutritious <input type="checkbox"/> Somewhat nutritious <input type="checkbox"/> Not at all nutritious <input type="checkbox"/> Do not know <input type="checkbox"/> No response
305	Whom do you think gets sufficient food in the family {Do NOT read the responses.} {Multiple responses possible. Record all responses given.}	<input type="checkbox"/> Husband <input type="checkbox"/> Wife <input type="checkbox"/> Both wife and husband <input type="checkbox"/> Grown children <input type="checkbox"/> Elders in family <input type="checkbox"/> All the family members <input type="checkbox"/> Any other, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
306	What are the different means through which you acquire food during a year with very little rainfall for year long consumption? {Do NOT read the responses.} {Multiple responses possible. Record all responses given.}	<input type="checkbox"/> Stored produce <input type="checkbox"/> Public distribution system (PDS) <input type="checkbox"/> Buy from open market <input type="checkbox"/> From wife's maternal house <input type="checkbox"/> Wage labour <input type="checkbox"/> Any other (specify) _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
307	Are you able to buy sufficient and desired food for the entire family?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know <input type="checkbox"/> No response
308	If there is not sufficient food, how is the food divided among the family members?	<input type="checkbox"/> We all eat less <input type="checkbox"/> The women eat less <input type="checkbox"/> The elders get priority <input type="checkbox"/> Children get priority <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response

Section 4. Income and Loans

No.	Question	Response
401	What are the household's main sources of income?	<input type="checkbox"/> Selling products from farm <input type="checkbox"/> Wage labour <input type="checkbox"/> Labour in city <input type="checkbox"/> Selling of milk <input type="checkbox"/> Supported by children / family <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
402	Does the amount of income from selling what you produce on your farm vary from year to year?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know <input type="checkbox"/> No response
402a	If yes to 402, what effects income?	<input type="checkbox"/> Prices <input type="checkbox"/> Weather <input type="checkbox"/> Labour availability
		<input type="checkbox"/> Yield <input type="checkbox"/> Availability of power supply <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
403	Did you or a member of your family take a loan in 2008? {Multiple responses possible. Record all responses given.}	<input type="checkbox"/> Yes, I did <input type="checkbox"/> Yes, my spouse did <input type="checkbox"/> Yes, I took a joint loan with my spouse <input type="checkbox"/> No, we did not take loans <input type="checkbox"/> Other, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
403a	If yes to 403a, please provide the following details about the loan(s) taken in 2008. Purpose _____ Source (e.g. bank) _____ Amount _____	<input type="checkbox"/> Do not know <input type="checkbox"/> No response
404	How do you repay the loans?	<input type="checkbox"/> By selling land <input type="checkbox"/> By selling crop <input type="checkbox"/> By selling valuables <input type="checkbox"/> With help from wife's maternal family <input type="checkbox"/> By sending children to work <input type="checkbox"/> By selling the milk <input type="checkbox"/> With the income generated from the wages <input type="checkbox"/> With the support from children earning wages in cities or towns <input type="checkbox"/> By taking loans from SHGs <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
405	Did you sell any assets during the year 2008?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know <input type="checkbox"/> No response

405a	If yes to 405, please provide the following details about the sale of assets. Type of asset _____ Why sold _____	_____ _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
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Section 5. Institutional Support		
No.	Question	Response
501	What are the benefits you are getting from the government and other agencies?	<input type="checkbox"/> PDS ration card <input type="checkbox"/> Housing <input type="checkbox"/> Old age pension <input type="checkbox"/> Widow pension <input type="checkbox"/> Disabled pension <input type="checkbox"/> NREG Card <input type="checkbox"/> Thrift and credit through Self-help groups <input type="checkbox"/> Rythu mitra (farmers group) <input type="checkbox"/> Arogya Sree (medical insurance) <input type="checkbox"/> Support from NGOs, specify _____ <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
502	Which are the government departments from which you get support for farming activities?	<input type="checkbox"/> Agricultural department <input type="checkbox"/> Bank <input type="checkbox"/> Cooperative bank <input type="checkbox"/> Mandal /Block office <input type="checkbox"/> Meteorological department <input type="checkbox"/> Irrigation department <input type="checkbox"/> Fisheries department <input type="checkbox"/> Horticulture department <input type="checkbox"/> DRDA <input type="checkbox"/> District water management agency (DWMA) <input type="checkbox"/> Ground water department <input type="checkbox"/> NREGA <input type="checkbox"/> Animal Husbandry <input type="checkbox"/> Health department <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
503	What is the support you get from these departments?	<input type="checkbox"/> Information and suggestions regarding agricultural practices <input type="checkbox"/> Subsidy for fertilizers, seeds and other farming inputs <input type="checkbox"/> Crop loans from bank <input type="checkbox"/> Cattle loans from bank <input type="checkbox"/> Agriculture implements loans from banks <input type="checkbox"/> Crop loans from cooperative society <input type="checkbox"/> Cattle loans from cooperative society <input type="checkbox"/> Agriculture implements loans from cooperative society <input type="checkbox"/> Purchase of our farm produce

504	Did you or a family member go for NREG work during the year 2008?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know <input type="checkbox"/> No response
505	As a farmer what kind of support do you want or expect from government?	<input type="checkbox"/> Timely (on time) information and suggestions regarding agricultural practices <input type="checkbox"/> Timely subsidy for fertilizers, seeds and other farming inputs <input type="checkbox"/> Timely loans commercial banks and cooperative society <input type="checkbox"/> Timely purchase of our farm produce through market yards with minimum support price <input type="checkbox"/> Timely compensation for crop damage <input type="checkbox"/> Subsidized sprinklers and drip irrigation equipment <input type="checkbox"/> Strengthening and repair of ponds/tanks <input type="checkbox"/> Permanent source of irrigation <input type="checkbox"/> Financial assistance for bore wells <input type="checkbox"/> Lift irrigation schemes <input type="checkbox"/> Sufficient 9 hours power supply <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
506	As a farmer do you get any information on cropping patterns/agronomic practices?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Do not know <input type="checkbox"/> No response
506a	If yes to 506, who has access to information on cropping patterns/agronomic practices?	<input type="checkbox"/> Big farmers <input type="checkbox"/> Marginal farmers <input type="checkbox"/> Small farmers <input type="checkbox"/> Women farmers <input type="checkbox"/> All of the above <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response
507	Where do you learn about what the weather will be like?	<input type="checkbox"/> Radio <input type="checkbox"/> Newspaper <input type="checkbox"/> Television <input type="checkbox"/> Neighbor <input type="checkbox"/> Family member <input type="checkbox"/> Don't pay attention to the weather predictions <input type="checkbox"/> Based on traditional knowledge <input type="checkbox"/> Through agriculture department <input type="checkbox"/> Others, specify _____ <input type="checkbox"/> Do not know <input type="checkbox"/> No response

LITERATURE CITED

Acosta-Michlik, L., Galli, F., Klein, R.J.T., Campe, S., Kumar, K., Eierdanz, F., Alcamo, J., Kromker, D., Carius, A. & Tanzler, D. 2005. *How vulnerable is India to climatic stress? Measuring vulnerability to drought using the Security Diagram concept*. In Human Security and Climate Change – An International Workshop. Oslo, GECHS, UNEP, IHDP, CICERO, CSCW.

Adger, W.N., Agrawala, S., Mirza, M.M.Q., Conde, C., O'Brien, K., Pulhin, J., Pulwarty, R., Smit, B. & Takahashi, K. 2007. *Assessment of adaptation practices, options, constraints and capacity*. In Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J. & C.E. Hanson, eds. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, 717-743. Cambridge, Cambridge University Press.

Aguilar, L. 2009. Women and Climate Change: Vulnerabilities and Adaptive Capacities. In The Worldwatch Institute. *State of the World 2009: Into a Warming World*. New York, W. W. Norton & Company.

Ahmed, S. & Fajber, E. 2009. Engendering adaptation to climate variability in Gujarat, India. *Gender & Development*, 17(1): 33-50.

Alston, Margaret. 2007. Gender and Climate Change: Variable Adaptations of Women and Men. *Just Policy: A Journal of Australian Social Policy*, 46: 29-35.

Andhra Pradesh Mahila Samatha Society. 2007. *Annual Report 2006-2007*. Hyderabad.

Brenkert, A.L. & Malone, E.L. 2005. Modeling Vulnerability and Resilience to Climate Change: A Case Study of India and Indian States. *Climatic Change*, 72(1-2): 57-102.

Brody, A., Demetriades, J. & Esplen, E. 2008. *Gender and climate change: mapping the linkages*. Brighton, BRIDGE, Institute of Development Studies.

CAPWIP. 2008. Proceedings of The Third Global Congress of Women in Politics and Governance: *Gender in Climate Change Adaptation and Disaster Risk Reduction*. Manila, 19-22 October 19-22. (available at www.capwip.org/genderandddrr.html).

Centre for Action Research and People's Development (CARPED). 2003. District Profiles of Andhra Pradesh. Hyderabad.

- Carr, E.R. 2008. Between structure and agency: Livelihoods and adaptation in Ghana's Central Region. *Global Environmental Change*, 18(4): 689-699.
- Carvajal-Escobar, Y., Quintero-Angel, M. & Garcia-Vargas, M. 2008. Women's role in adapting to climate change and variability. *Advances in Geosciences*, 14: 277-280.
- Chowdhury, N.A. no year. *Men, Women and the Environment: Gender Issues in Climate Change*. Dhaka, Unnayan Onneshan.
- Dankelman, I., Alam, K., Ahmed, W.B., Gueye, Y.D., Fatema, N. & Mensah-Kutin, R. 2008. *Gender, Climate Change and Human Security: Lessons from Bangladesh, Ghana and Senegal*. New York, WEDO, ABANTU for Development, ActionAid & ENDA.
- Davies, S. 1993. *Are Coping Strategies a Cop Out?* IDS Bulletin. 24(4): 60-72.
- Deb, U.K., Rao, G.D., Rao, Y.M. & Slater, R. 2002. *Diversification and Livelihood Options: A Study of Two Villages in Andhra Pradesh, India 1975–2001*. London, Overseas Development Institute.
- Department of Food and Public Distribution. 2010. Department website. (available at fcamin.nic.in/dfpd_html/index.asp).
- Deshingkar, P. & Start, D. 2003. *Seasonal Migration for Livelihoods in India: Coping, Accumulation and Exclusion*. Working Paper 220. London, Overseas Development Institute.
- Deshingkar, P., Kulkarni, U., Rao, L. & Rao, S. 2003. Changing Food Systems in India: Resource-sharing and Marketing Arrangements for Vegetable Production in Andhra Pradesh. *Development Policy Review*, 21(5-6): 627-639.
- FAO. 2010. Gender website. (available at www.fao.org/gender/gender-home/gender-why/why-gender/en/).
- FAO. 2008. *Climate Change and Food Security: A Framework Document*. Rome.
- FAO. 2006. *Food Security* (Policy Brief, Issue 2). Rome.
- Gadgil, S., Rao, P.S. & Rao, K.N. 2002. Use of climate information for farm-level decision-making: rainfed groundnut in southern India. *Agricultural Systems*, 74(3): 431-457.

Garikipati, S. 2008. The Impact of Lending to Women on Household Vulnerability and Women's Empowerment: Evidence from India. *World Development*, 36(12): 2620-2642.

Government of Andhra Pradesh. 2009. Adverse Seasonal Conditions 2009-10 – Drought Declaration of Certain Mandals as Drought Affected in the State. (available at disastermanagement.ap.gov.in/website/G_O_Ms_No_20.pdf).

Government of Andhra Pradesh. 2008. *Human Development Report 2007 – Andhra Pradesh*. Hyderabad, Centre for Economic and Social Studies and Government of Andhra Pradesh.

Government of India and UNDP. 2008. Women as equal partners: Gender Dimensions of Disaster Risk Management Programme, Compilation of Good Practices. no city.

Government of India. 2007. *Report of the Expert Group on Agricultural Indebtedness*. Ministry of Finance, Government of India. no city.

Hanstad, T., Nielsen, R. & Brown, J. 2004. *Land and livelihoods: Making land rights real for India's rural poor*. Rome, FAO.

India Meteorological Department. 2010a. District Rainfall (mm) for Last Five Years. District: Mahbubnagar. (available at imd.gov.in/section/hydro/distrainfall/webrain/andhra/mahbubnagar.txt).

India Meteorological Department. 2010b. District Rainfall (mm) for Last Five Years. District: Anantapur. (available at imd.gov.in/section/hydro/distrainfall/webrain/andhra/anantapur.txt).

Kelly, P.M. & Adger, W.N. 2000. Theory and Practice in Assessing Vulnerability to Climate Change and Facilitating Adaptation. *Climatic Change*, 47: 325-352.

Lambrou, Y. & Piana, G. 2005. *Gender: The Missing Component in the Response to Climate Change*. Rome, FAO.

Leduc, B., Shrestha, A. & Bhattarai, B. 2008. *Case Study: Gender and Climate Change in the Hindu Kush Himalayas of Nepal*. New York, WEDO.

Mall, R.K., Singh, R., Gupta, A., Srinivasan, G. & Rathore, L.S. 2006. Impact of Climate Change on Indian Agriculture: A Review. *Climatic Change*, 78: 445-478.

Masika, R. 2002. *Gender, Development and Climate Change*. Londn, Oxfam Publishing.
Mitchell, T., Tanner, T. & Lussier, K. 2007. *We know what we need: South Asian women speak out on climate change adaptation*. London, ActionAid.

Mula, R.P., Ashok Kumar, A., Gowda, C.L.L., Bantilan, C. & Dar Willian, D. 2008. *Women's coping with mother nature: ICRISAT's response to climate change in the semi-arid tropics*. Published in a CD provided by CAPWIP at The Third Global Congress of Women in Politics and Governance: Gender in Climate Change Aaptation and Disaster Risk Reduction, 19-22 October. Manila, Philippines.

O'Brien, K., Leichenko, R., Kelkar, U., Venema, H., Aandahl, G., Tompkins, H., Javed, A., Bhadwal, S., Barg, S., Nygaard, L. & West, J. 2004. Mapping vulnerability to multiple stressors: climate change and globalization in India. *Global Environmental Change*, 14:303-313.

Olsen, W.K. & Ramana Murthy, R.V. 2000. Contract Labour and Bondage in Andhra Pradesh (India). *Journal of Social and Political Thought*, 1:2.

Oxfam America & Anawin Trust. 2007. *Understanding gender differential impacts of tsunami & gender mainstreaming strategies in tsunami response in Tamil Nadu, India*. no city.

Parikh, J. 2007. *Gender and Climate Change: Framework for Analysis, Policy & Action*. IRADe and UNDP India. no city.

Prabhakar, S.V. & Shaw, R. 2008. Climate change adaptation implications for drought risk mitigation: a perspective for India. *Climatic Change*, 88(2): 113-130.

Rao, G.B. 2001. *Household Coping/Survival Strategies in Drought-prone Regions: A Case Study of Anantapur District, Andhra Pradesh, India*. Hyderabad, SPWD-Hyderabad Centre.

Rao, KPC., Bantilan, MCS., Singh, K., Subrahmanyam, S., Deshingkar, P., Rao, PP. & Shiferew, B. 2005. *Overcoming Poverty in Rural India: Focus on Rainfed Semi-Arid Tropics*. Patancheru, International Crops Research Institute for the Semi-Arid Tropics.

Rao, N. 2006. Land rights, gender equality and household food security: Exploring the conceptual links in the case of India. *Food Policy*, 31(2): 180-193.

Ray-Bennett, N.S. 2009. *The influence of caste, class and gender in surviving multiple disasters: A case study from Orissa, India*. *Environmental Hazards*. 8(1): 5.

Röhr, U. 2004. *Gender relations in international climate change negotiations*. Berlin, Genanet.

Roncoli, C. 2006. Ethnographic and participatory approaches to research on farmers' responses to climate predictions. *Climate Research*, 33: 81-99.

Sainath, P. 2004. *Farmers' suicides in Andhra*. Series published in India Together. (available at www.indiatogether.org/opinions/psainath/suiseries.htm).

Segnestam, L. 2009. Division of Capitals—What Role Does It Play for Gender-Differentiated Vulnerability to Drought in Nicaragua? *Community Development*, 40(2): 154-176.

Selvaraju, R., Subbiah, A., Baas, S. & Juergens, I. 2006. Livelihood adaptation to climate variability and change in drought-prone areas of Bangladesh: *Developing institutions and options*. Rome, FAO.

Singh, K.K., Reddy, D.R., Kaushik, S. Rathore, L.S. Hansen, J. & Srinivasan, G. 2007. Application of seasonal climate forecasts in Telengana subdivision of Andhra Pradesh, India, In Sivakumar, M.V.K. & Hansen, J., eds. *Climate Prediction and Agriculture: Advances and Challenges*, pp. 111-117. New York, Springer.

Smit, B., Burton, I., Klein, R.J. & Wandel, J. 2000. An Anatomy of Adaptation to Climate Change and Variability. *Climatic Change*, 45: 223-251.

Smithers, J. & Smit, B. 1997. Human adaptation to climatic variability and change. *Global Environmental Change*, 7(2):129-146.

Terry, G., ed. 2009. *Climate Change and Gender Justice*. Bourton on Dunsmore, Practical Action and Oxfam GB.

Tschakert, P. 2007. Views from the vulnerable: Understanding climatic and other stressors in the Sahel. *Global Environmental Change*, 17(3-4): 381-396.

UNDP. 2009. *Resource Guide on Gender and Climate Change*. New York.

UNIFEM Australia Inc. 2008. *Gender and Climate Change in the Pacific*. Mawson.

UNISDR. 2008. *Gender Perspectives: Integrating Disaster Risk Reduction into Climate Change Adaptation*. Geneva.

WEDO. 2007. *Changing the Climate: Why Women's Perspectives Matter*. New York.

World Bank. 2006. *Overcoming Drought: Adaptation Strategies for Andhra Pradesh, India*. Washington, DC.

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