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# Does climate change aggravate gender inequalities?

## Empirical assessment from South India

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*Sammendrag:*  
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*Summary:*

The effects of climate change are unequally distributed between female and male gender in agrarian communities, particularly in developing countries. The agrarian regions of South India offer some representative examples where extreme events such as drought and floods influence gender inequalities. The current study assesses the potential effects of climate change as reflected through weather extremes to gender in agricultural communities of Andhra Pradesh state in South India.

The findings signify that no major existent inequalities could be found in the study areas. There is though some uncertainty on the income contribution of males and females in a household and the economic independency of female gender. All the more, a different attitude between men and women was confirmed towards the concerns and initiatives to be undertaken mainly against droughts events. This differentiation could be the cause for the creation of future inequalities because the unilateral decisions seem to provoke unequal access to natural, social and economic resources.

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## Contents

1. Summary .....	4
2. Introduction .....	5
3. Materials and Methods .....	6
3.1 Mapping inequalities .....	6
3.2 Qualitative Assessment .....	7
3.3 Quantitative Assessment and Comparative Evaluation .....	8
4. Study area .....	10
5. Results.....	15
5.1 Exploring existent inequalities .....	15
5.2 Aggravation of current gender inequalities between men and women ..	17
5.3 Overcoming inequalities .....	19
5.4 Attribute Agreement Analysis.....	21
6. Discussion .....	24
6.1 Exploring Results .....	24
6.2 National and State initiatives for balancing gender in development .....	25
6.3 ClimaAdapt and proposed initiatives .....	27
7. Concluding remarks .....	28
8. REFERENCES .....	29

## Tables

Table 1. Coordinates of the selected villages .....	13
Table 2. Village features.....	14
Table 3. Statements of current gender inequalities analyzed from FGDs .....	17
Table 4. Statements of gender inequalities as an effect of climate change .....	18
Table 5. Statements for mitigation of gender inequalities .....	21
Table 6. Proposed Training and Information Sessions .....	27

## Figures

Figure 1. Nalgonda and Guntur districts in Andhra Pradesh .....	11
Figure 2. Canal Network of Nagarjuna Dam and 15 FGD locations .....	12
Figure 3. Attribute Agreement Analysis .....	22
Figure 4. Gender-bases response on the individual statements .....	23

# 1. Summary

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The effects of climate change are unequally distributed between female and male gender in agrarian communities, particularly in developing countries. The agrarian regions of South India offer some representative examples where extreme events such as drought and floods influence gender inequalities. The current study assesses the potential effects of climate change as reflected through weather extremes to gender in agricultural communities of Andhra Pradesh state in South India. It also attempts to explore the potential initiatives to improve mainstreaming gender in adaptation. The sample selection for this study was based on the exposure to weather extremes and other socio-economic features. In particular, respondents from 15 villages impacted by drought and flood occurrences were selected in Nalgonda and Guntur districts of Andhra Pradesh in India.

In all, 15 Focus Group Discussions (FGDs) were conducted, covering all the villages selected. In addition, a questionnaire survey was also conducted to the same Focus Groups' participants for a better clarification on issues related to gender and climate change. The data and information from both sources enabled to realize a qualitative and quantitative analysis. Gender differences mainly in the areas of land ownership, decision making and access to information services were analyzed. Also, a comparative evaluation between the results of each FGD was accomplished for the identification of potential similarities and differences within the selected villages. Further, the similarities and discrepancies in the perceptions of male and female participants in all FGDs were clarified.

The findings signify that no major existent inequalities could be found in the study areas. There is though some uncertainty on the income contribution of males and females in a household and the economic independency of female gender. All the more, a different attitude between men and women was confirmed towards the concerns and initiatives to be undertaken mainly against droughts events. This differentiation could be the cause for the creation of future inequalities because the unilateral decisions seem to provoke unequal access to natural, social and economic resources.

The communities seem rather unaware of what climate change concept is and how it is associated with weather extremes. The poor information that communities have on climate change may further restrain males and females from undertaking common initiatives to confront weather extremes by exacerbating future inequalities.

Finally, each village seems to react quite differently on weather extremes. This differentiation should be well considered when planning climate change policies on a regional level.

## 2. Introduction

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The effects of climate change on gender constitute a major component in the international agenda that mostly focuses on less developed regions of the world (FAO, 2009; UNDP, 2009; EC- UNECA, 2009; Gender CC, 2011; IUCN, 2011). A multitude of global aspects pertaining to climate change and gender inequalities has been addressed in the relevant literature.

Indicatively, the World Health Organization (WHO, 2011) has reported the potential inequalities emerging from climate change to women's health, while the International Labor Office (ILO, 2012) has investigated the deterioration of labor conditions. The insecure employment and low income predictions have been scrutinized by related organizations (World Bank, 2009) while the Food Agricultural Organization has conducted a series of studies on climate change, gender nutrition and food access (FAO, 2010). Other studies attempted to look at the multiple effects of climate change on gender by introducing socio-demographic and economic parameters like population, educational status and economic growth (World Bank, 2009; Gender CC, 2011).

There are numerous in-depth and country-specific studies pertaining to the above field areas which are often clustered in well elaborated web platforms (Eldis, 2013) and on-line data bases (OECD, 2013; World Bank, 2013).

Many of the global and regional studies suggest that the agrarian communities within less developed parts of south Asia offer some representative examples of existent gender inequalities (Lambrou and Nelson 2010; Øvstegård et al, 2010; Suman et al, 2011). In India, studies show that men and women are impacted differently by climate change, not only at the household, but also at the community level (Rao, 2001; Acosta-Michlik et al, 2005; Brenkert and Malone, 2005; Ahmed and Fajber, 2009).

However, most studies are based only on qualitative analysis without offering some measurable elements and practical policy recommendations. In the present study, fifteen Focus Group Discussions (FGDs) were conducted, equally covering 15 selected villages in the two districts of Nalgonda and Guntur of Andhra Pradesh state in south India. The FGDs findings were interpreted in qualitative and quantitative terms while rigorous policy recommendations were suggested that can be useful to the local and state authorities.

In section 2, the methods and materials are introduced while in section 3 an overview of the study areas is given. In section 4, the results are depicted while in Section 5 the discussion points are noted. Finally, in Section 6 the concluding remarks are presented.

## 3. Materials and Methods

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### 3.1 Mapping inequalities

The study attempted to identify whether significant inequalities between men and women already existed due to climate change. Also, some suggestions to reduce the impact from climate change and to improve mainstreaming gender in adaptation were explored.

Relevant literature review was conducted to identify the most significant areas that may host gender inequalities. The most noticeable areas in which gender inequalities may underlie were considered to be the land use and ownership, labor markets, financial services, decision making aspects, education and access to technology (Revelo, (Ed), 2009; World Bank, 2009; FAO 2012).

Expert views on gender differences were also analyzed in the study, in particular the access to information, professional agencies and vocational training. Information gathered during field visits, meetings with local administration and agricultural extension officers, male and female farmers was compared with the patterns observed in the literature review.

The participation of women in Self-Help Groups (SHGS) was widely prevalent in the study area and it provided an important institutional arrangement for women at the village level to network with others and also to earn some income.

#### Box 1: The Self Help Groups (SGHs)

The SHG is a village-based institutional scheme established by national government in early 2006 which aims at generating knowledge and information, imparting capacities and providing peer support for women. There is a widespread expansion of SHGs all over India nowadays with a considerable success in improving the financial status, skills and access to information mainly of disadvantaged female farmers. SHGs can provide an important platform for women to express their interests and influence community level or village decision making. They can also be used to mainstream gender in climate adaptation, especially through agriculture sector.

For more information:

International Fund for Agricultural Development (IFAD)  
[http://www.ifad.org/evaluation/public\\_html/eksyst/doc/insight/pi/india-13.htm](http://www.ifad.org/evaluation/public_html/eksyst/doc/insight/pi/india-13.htm)



Literature review, experts views and data from the field study identified existent gender inequalities using the following variables that were most relevant to the study area:

- Land ownership
- Cash income source
- Decisions on household financial matters
- Labor access
- Decisions on crop preferences
- Membership in formal and informal village level institutions (SHGs, Water user associations)

Further on, the potential increase of existent gender inequalities as an effect of climate change was explored. Both literature review and expert views showed that the training and economic support for women was the most needed option to help them get connected to entrepreneurial activities. Also, the field visits and meetings with farmers further clarified the need of training on various skills and adaptation technologies for both genders. It was confirmed that the training for self-employment initiatives was demanded mostly by women while the training in new cultivating methods and livestock management were opted by both genders.

### **3.2 Qualitative Assessment**

A qualitative assessment was first conducted with the introduction of Focus Group Discussions (FGDs). A Focus Group Discussion (FGD) is a qualitative research tool where selected group of people (8-15), participate in a discussion focused on a particular issue or topic of common interest to the group (Dawson et al, 1993; Schönherr et al, 2010). Normally a FGD is coordinated by a facilitator familiar with the topic. The facilitator should ensure the active involvement of all the participants in the discussion. For a better coordination of the groups, the facilitator often prepares a guideline with key issues pertaining to the topic of the discussion.

In our case, the focus was on mapping the impacts of climate change on gender and how the gender differences influence the adaptation. Also, suggestions for the mitigation of these potential discrepancies were inferred. A Focus Group Discussion (FGD) was held in each of the fifteen villages in the two selected study areas. The groups comprised of approximately 15 participants from both genders. Most of the male participants were members of Water Users Associations (WUAs) whereas women were linked to Self-Help Groups, where only females were involved. Care was taken to ensure a balanced representation of male and female participants so as to avoid biased responses due to unequal gender representation. A pilot FGD was conducted in Feb 2012 in one of the study area to test the level of participation and the appropriateness of the discussion issues. Necessary improvements were made based on the experience from the first FGD. The actual FGDs were conducted between 18<sup>th</sup> March to 12<sup>nd</sup> April with the support of field coordinators from IWMI and WALAMTARI institutes and local facilitators.

### 3.3 Quantitative Assessment and Comparative Evaluation

A quantitative assessment of the FGDs results was conducted by using a binary-wise questionnaire. In particular, the FGDs findings of all the fifteen groups were initially summarized and the results were converted to affirmative statements (e.g. Women contribute up to about half of the cash income in the households). Based on these results, a questionnaire was developed where a respondent was asked to agree or object on the relevant statements (Yes/No). The same individuals taking part in the FGDs were surveyed a month after the FGD, so as to cross check their views. The total amount of the agreeable responses in each FGD was calculated as below:

$$FG_r = 100 \times \sum_{i=1}^{15} (X_i / r_t) \dots (\text{Eq.1}) \text{ where}$$

$FG_r$  = The aggregated agreeable rate of responses of all (15) individuals in each Focus Group (FG)

$X_i$  = The agreeable responses of each individual

$r_t$  = The amount of statements in each questionnaire

For example, let us assume that 15 individuals ( $X_1, X_2 \dots X_{15}$ ) who belong to the same FG, agree to the following extent in 18 statements presented in each questionnaire:

$$FG_r = 100 \times \frac{10+12+9+9+10+11+9+14+10+12+14+11+14+15+7}{15 \times 18} = 100 \times \frac{167}{270} =$$

*61% rate of agreement of one village for all statements*

In turn, an aggregation of the agreeable responses of each gender in each statement from all the FGs was conducted as below:

$$FGS_{m,f} = 100 \times \sum_{i=1}^n (X_{im,if} / r_{im,if}) \dots (\text{Eq.2}) \text{ where}$$

$FGS_{m,f}$  = The aggregated agreeable rate of responses of the males/females in all FGs

$X_i$  = The agreeable responses of each male/female

$r_{im,if}$  = The amount of male/female responses in each questionnaire

In another example, let us assume that in each FG, 8 out of the 15 individuals are women and agree to the following extent for the first statement:

$$FG_f = 100 \times \frac{6 + 7 + 8 + 4 + 6 + 7 + 5 + 6 + 7 + 5 + 6 + 8 + 8 + 7 + 6}{8 \times 14} = 100 \times \frac{96}{112}$$

*= 85% rate of agreement of all females in the first statement*

A comparative evaluation between the rates of agreement of each village (Eq.1) and gender (Eq.2) was conducted through the introduction of Attribute Agreement Analysis. The Attribute Agreement Analysis is customarily a measurement system analysis that assesses the accuracy of one or more people against some reference values (Minitab, 2013). The analysis is conducted by comparing the reference values against the values proposed by one or more people through a quantitative approach.

In our case, the reference values were represented by the affirmative statements inferred through the FGDs events. The individuals were replaced by the aggregated agreeable responses of each FG as presented in Eq.1 for the identification of potential differences between each village. Similarly, the aggregated agreeable responses of each gender as presented in Eq.2 indicated the potential differences between males and females in the proposed statements. For a better clarification of the potential agreements or discrepancies between the villages and genders some indicators of statistical agreement were given.

## 4. Study area

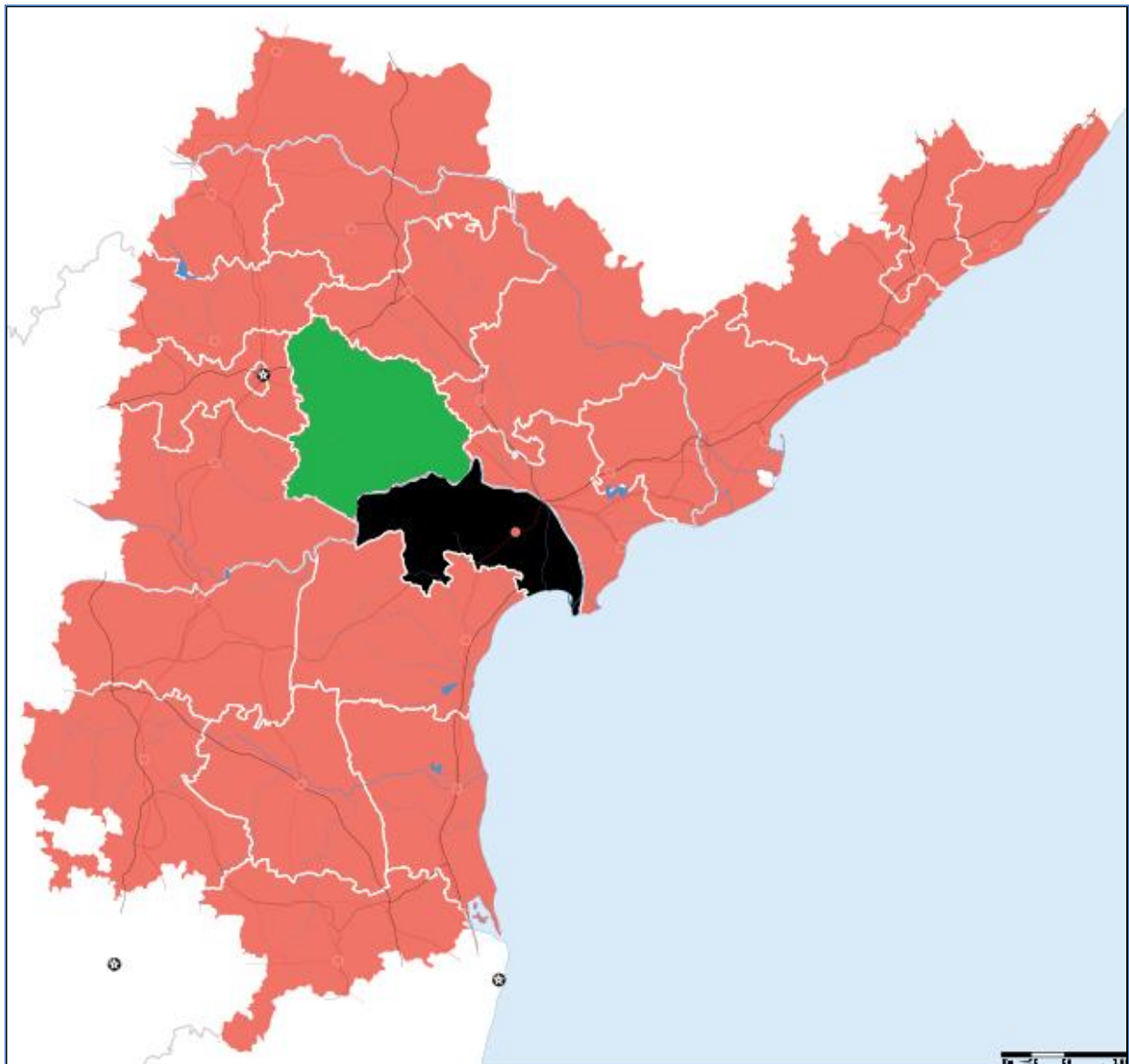
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The state of Andhra Pradesh is experiencing rapid development and economic growth mostly based on sectors such as information technology and biotechnology (AP State Portal, 2013). However, the agricultural sector and particularly the rice production still comprise the backbone of the rural economy in the state and sustain a large amount of subsistence farmers (GoAP Agricultural Dpt., 2013). The state is rather vulnerable to extreme weather events which frequently entail human losses, damages to house properties and severe impacts on agricultural production (GoAP Disaster Dpt., 2013). According to the Disaster Management Department of Andhra Pradesh government, about 44 percent of the state is vulnerable to floods resulting from tropical cyclones. However, the same districts and the northern parts of Andhra Pradesh also suffer from severe droughts thus becoming the third most drought prone states in India (GoAP Disaster Dpt., 2013). The recent impacts primarily from drought and secondarily from flood events have dramatically affected the livelihoods of the agrarian communities.

To this end, the area selection was mainly based on the exposure of the agrarian communities to weather extremes and to other technical and socio-economic constraints including:

- rainfall patterns
- impact type and magnitude of natural disasters
- irrigation methods (surface and groundwater)
- agricultural practices (dry land and wetland crops)
- socio-economics (land size, wealth, education)

Six villages from Nalgonda and nine from Guntur districts were selected as presented below:



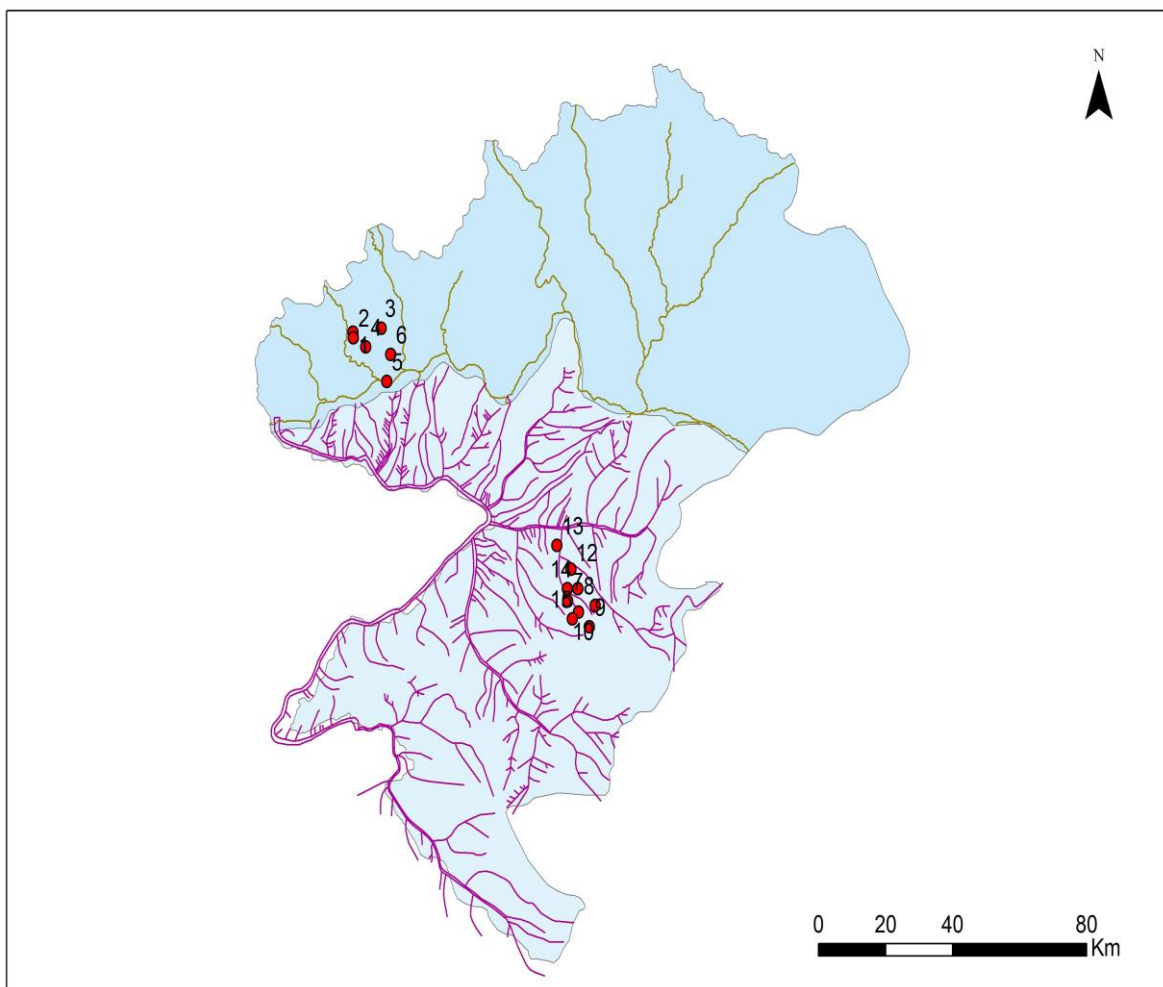
**Figure 1. Nalgonda and Guntur districts in Andhra Pradesh**

In both districts, the major portion of the rainfall is received during the south west monsoon between June and September, which contributes to about 70% of the annual rainfall. The other 30% is received during the northeast monsoon (October to December) period. However, there is a distinctive variation in the precipitation volume between the districts which indicates the exposure to weather extremes, the selection of cropping patterns and irrigation sources.

In particular, the villages in Nalgonda district have faced an averagely low annual precipitation (670mm, +/- 163mm) for the years 2007-2012 which has entailed consecutive droughts. This high water scarcity has caused major impacts to agricultural output and resulted in economic crisis for many small and marginal farmers (Handbook of statistics, 2013).

The villages of Guntur district were endowed with a relatively higher mean precipitation rate (701mm, +/- 242mm) over the period 2007-2012 but also a higher deviation (Table 1). The deviation of the mean annual rainfall depicts an erratic rainfall volume which has resulted in higher exposure to flood but also drought events.

The water supply and variations in rainfall considerably impacts the irrigation conditions and consequently the socio-economic conditions in the rural areas. In principle, both the districts are supplied by irrigation canals stemming from the Nagarjuna Sagar Project (NSP). The NSP project was completed in 1967 and recognized as one of the earliest multi-purpose projects in India serving irrigation, hydro-electric and flood control objectives (GoAP Agricultural Dpt., 2013). However, the irrigation outlets and drainage ditches in the extensive network as presented in Figure 2 are not sufficiently maintained thus aggravating the impacts of floods and droughts.



**Figure 2. Canal Network of Nagarjuna Dam and 15 FGD locations**

**Table 1. Coordinates of the selected villages**

Districts	Village	Longitude	Latitude	Areas	FGDs
West Godavari	Borraipalem	16° 46'36.92"N	79° 32'8.72"E	DC 4	1
Nalgonda	Appalammagudem	16° 45'53.43"N	79° 32'11.12"E	DC 4	2
Nalgonda	Kondrapole	16° 47'10.80"N	79° 36'40.24"E	DC 4	3
Nalgonda	Kallepalli	16° 44'40.43"N	79° 34'9.66"E	DC 4	4
West Godavari	Irkigudem	16° 40'5.10"N	79° 37'32.51"E	DC 4	5
Nalgonda	Damaracherla	16° 43'40.81"N	79° 38'13.26"E	DC 4	6
Guntur	Irlapadu	16° 10'54.00"N	80° 6'43.00"E	DC21	7
Guntur	Nadendla	16° 10'18.97"N	80° 11'8.28"E	DC21	8
Guntur	Ganapavaram	16° 7'27.65"N	80° 10'11.87"E	DC21	9
Guntur	Appapuram	16° 9'25.77"N	80° 8'26.11"E	DC21	10
Prakasam	Rajugaripalem	16° 12'32"N	80° 8'20"E	DC21	11
Guntur	Sathuluru	16° 15'6.09"N	80° 7'11.95"E	DC21	12
Guntur	Gollapadu	16° 18'16.40"N	80° 4'56.59"E	DC21	13
Guntur	Kanaparru	16° 12'31.40"N	80° 6'38.30"E	DC21	14
Guntur	Kavuru	16° 8'32.40"N	80° 7'24.73"E	DC21	15

The low rainfall volume and the unreliability of canal water forces farmers in Nalgonda villages to rely on groundwater (65%) as the major irrigation source. The groundwater use is comparatively less in Guntur villages (34%) where irrigation from canal water is predominant.

In both districts, the semi-aquatic (paddy) rice is mostly preferred mainly as a staple crop to sustain marginal and small farmers. Cotton crop has been introduced in Nalgonda (14%) and Guntur (36%) as a more profitable alternative. Although cotton demands almost an equal amount (700-1300mm) of water to paddy when management practices apply (900-1400mm) it is however a commercial crop with higher profits (FAO, 2007).

The socioeconomic features of Nalgonda district depict that the highest percentage of households (49%) are medium-size landholders with land ranging from 2.5 to 5 acres (Table 1). A considerably lower percentage (35%) of medium-sized farmers was observed in the case of Nalgonda district. Guntur shows higher percentage (22% of small and marginal of farmers (>2.5 acres) than in Nalgonda (14%). More than ninety percent of the households in both districts have access to electricity.

The farmers from both districts appear to have good access to various agricultural equipment which may substantially help them to increase production. In effect, about 60% either own or rent a power-tiller for seeding and harvesting purposes. Also, one in every two farmers owns ploughs, spraying and fodder cutting machinery. The good access to farming equipment and the relatively high percentage of medium-sized landholders seems to go hand in hand with the high literacy status in both districts. Indicatively, more than 85% of both genders have graduated from primary school and one in every three has continued to secondary school studies. The features of the selected areas are summarized in Table 1.



**Table 2. Village features**

Districts	Village	Vill. Code	Technical Features	Socio-Economic Features	Impacts		FGDs /Part .
					Flood	Drought	
Nalgonda (Left Bank canal)	Borraipalem	C1I	670mm, +/- 163mm SF:35%, GW:65% Rice:81%, Cotton:14%	Medium LH (49%)	Mode rate	Severe	6 (15*6) 90
	Irkigudem	C1II		Small-Marginal LH (14%)			
	Appalammagudem	C1III		90% Electricity Access 70% Farming Machinery 85% Literacy Status (Primary) 33% Literacy Status (Secondary)			
	Kondrapole	C1IV					
	Kallepalli	C1V					
	Damaracherla	C1VI					
Southwest Guntur (Right Bank Canal)	Irlapadu	C2I	701mm, +/- 242mm SF:66%, GW:34% Rice:48%, Cotton:36%	Medium LH (35%)	Intense	Severe	9 (15*9) 135
	Nadendla	C2II					
	Ganapavaram	C2III					
	Appapuram	C2IV					
	Rajugaripalem	C2V		Small-Marginal LH (22%)			
	Sathuluru	C2VI					
	Gollapadu	C2VII					
	Kanaparru	C2VII I					
Kavuru	C2IX						

Note: Vill. Code= Village Code; SF=Surface Water; GW=Groundwater, LH=Landholders, Part.= Participants

Since the FGDs participants have already agreed to further contribute to the binary-wise questionnaire there were no incomplete or no responding cases in the interviewing process.



## 5. Results

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### 5.1 Exploring existent inequalities

The outcome of all the fifteen FGDs events is synopsised in regard to the areas of gender inequalities as mentioned in Section 2.1 Women in most of the fifteen FGDs reported that they owned almost equal farm and household properties as men. They also claimed to have same earnings with men by working as farm labor and other revenue-raising activities (Table 3).

Women also stated that the household's duties they carry out should also be considered as indirect savings from the annual household expenditure. Although the male participants did not share the same views with regard to women's household duties, they however admitted that the women earn almost an equal income. It was also commonly accepted that the decision making about critical issues and major financial matters within the household is equally taken by both men and women. Also both genders agreed that in cases where the females decide on financial matters in the household, it is mostly young women (less than 30 years old).

Male farmers who owned land complained about the recent labor shortages for agricultural work. They mentioned that the country wide "Mahatma Gandhi National Rural Employment Guarantee Act" (MGNREGA) hassled to labor scarcity in farming sector, and mainly shortage of female workers. Women felt that MGNREGA has enabled them to become economically independent to a certain extent. Some of the projects in MGNREGA include the rain harvesting storage for the drought periods and the revitalization of drainage ditches for flood protection.

The selection of the type of crop to be grown was another issue that both genders were interested in. As noted by some female respondents, although the cropping decisions are usually taken by both sexes, there are instances where elder men requested their sons to take the responsibility, as they are often more knowledgeable and updated in agricultural matters.

In the case of information services, most of the female respondents mentioned that they were also involved in the Self-Help Groups (SHGs) which have greatly helped them in revenue-raising activities and in obtaining substantial information related to various professional and social aspects.

## Box 2: The MGNREGA scheme

The MGNREGA aims at the enhancement of livelihood security of farmers in rural areas through the provision of at least 100 days guaranteed wage employment.

This act was initially introduced at 2005 as “National Rural Employment Guarantee Act (NREGA)” with the aim to improve the purchasing power of unskilled rural people of India, irrespective of whether or not they fell below the poverty line. In 2009 the program was renamed to “Mahatma Gandhi National Rural Employment Guarantee Act” (MGNREGA).

The participants are employed in agricultural and conservation related works like water conservation, drought proofing and afforestation projects. The NREGA ensures that at least one-third of beneficiaries should be women by providing them wages almost equal to male workers.

Although high criticism stands on the corruption, the labor scarcity and the poor infrastructure developed with MGNREGA, program adherents denote that great success has been achieved in improving rural livelihoods.

For more information:

The Mahatma Gandhi National Rural Employment Guarantee Act

<http://nrega.nic.in/netnrega/home.aspx>

It was also unanimously mentioned by both men and women that the membership in a SHG or an agricultural association has greatly helped the family to take better decisions on cropping pattern issues.

Female participants expressed their dissatisfaction about their unequal representation in decision making processes taken at the community level. In particular, they alleged that although they are economically independent still their participation in community decisions is rather limited and is given least importance. It was however underlined that the inequality has declined due to some national programs which encouraged the inclusion of women in local administration (Unicef, 2006).

The perceptions on current gender inequalities could be synopsized in the following statements:

**Table 3. Statements of current gender inequalities analyzed from FGDs**

Code	Statements
1A	The house and farmland is jointly owned by the wife and husband in almost 1 out of 2 cases
2A	The house and farmland is owned by the wife in almost 1 out of 4 cases
3A	Women contribute up to about half of the cash income in the household earnings directly (e.g. labor in farm or other professional activities) and indirectly (e.g. housing works etc.)
4A	Decisions on regular financial matters are taken almost equally by the wife and the husband
5A	It is frequent to notice that when the women decide on financial matters, they are usually young women (younger than 30 years old)
6A	In 1 out of 2 cases wife and husband together decide on what crops to be grown on the farm
7A	In 1 out of 3 cases male children decide on what crops to be grown on the farm
8A	Almost 1 in every 2 women belong to a Self-Help Group or a relevant association in the area
9A	It is frequent to notice that when the cropping pattern decision is jointly taken by the husband and wife, one of the two (husband or wife) usually belongs to a group or association (e.g. Self-Help group, agricultural association etc.)

## 5.2 Aggravation of current gender inequalities between men and women

The potential aggravation of the existent gender inequalities due to climate change effects was further raised by the facilitators. Each facilitator initially queried participants about their awareness on climate change concept and the potential linkage with agriculture and their livelihoods. A serious lack of knowledge was seen in almost half of the participants irrespective of gender. Occasionally did they receive some information from agricultural extension officers. The facilitators explained how the recent drought and floods could be linked to climate change.

When the reactions to weather extremes were queried the insufficient and unreliable water supply in drought periods was mostly mentioned by both genders. The canal dependent farmers who comprised the majority of the FGDs' participants underlined that the reasons for less water flows through canal irrigation within the last years was due to the repeated droughts and the consecutive decreased water level in Nagarjuna Sagar dam. However, the leakages and the illegal water abstractions all along the canal systems were also blamed as major causes of poor water supply. The tubewell owners also claimed major problems emerging from the over-abstraction due to extensive demands along the extensive drought periods. Moreover, the electric pump owners noted additional hardships due to the frequent power cuts which have dramatically obstructed groundwater pumping.

Both the canal and tubewell dependent farmers indicated that the water scarcity of the last years has resulted in crop failure and severe economic losses. The male farmers and especially the small and marginal ones were mainly worried about the employment insecurity and the deterioration of the loaning payback conditions (for those have borrowed capital). In the case of the female participants, the food security for the family members was the major concern to be considered along extreme weather events (Table 3).

Various initiatives and reactions against weather extremes were spontaneously indicated by each gender. In the case of male farmers, there was a high admittance that a new loan or a re-loaning is the most likely solution for confronting adverse weather conditions.

The support from the extensive family members was also deemed as handy options for female participants. Both genders also noted that in case of extensive drought periods, they opt to livestock farming which requests some financial support but can ensure a minimum income (Table 3).

Further, some women mentioned instances of increased violence exerted by the husband when extreme weather conditions damage the harvest. They particularly mentioned that when the men become depressed because of the devastating economic losses they can react violently to the spouses and sometimes to other household members.

By summarizing the concerns and initiative commonly indicated in the all FGDs, the following statements are drawn as below:

#### **Table 4. Statements of gender inequalities as an effect of climate change**

Code	Statements
1B	During weather extremes (e.g. droughts) men are more concerned about labor security and pay back the loans
2B	During weather extremes (e.g. droughts) women are more concerned about household food security
3B	During weather extremes (e.g. droughts) there is an increased violence on women
4B	Most frequent solution for men to confront adverse weather conditions is to get loans from official or unofficial sources
5B	Most frequent solution for women to confront adverse weather conditions is the support from the extensive family
6B	In case of deficient rainfall years, the majority of farmers change cropping patterns to water resistant crops or shift to livestock activities

### 5.3 Overcoming inequalities

In turn, the facilitator queried the options to overcome potential gender inequalities that may have exacerbated by weather extremes. Both genders denoted the improvements noticed in rice production after the attendance of trainings in “Alternate Wetting and Drying Irrigation”-AWD approach.

The female farmers highly encouraged the launching of such initiatives which could provide them higher profits and more economic independence. The “Alternate Wetting and Drying Irrigation”-AWD has been recently introduced in the area as a promising technique for rice farming. Both female and male farmers mentioned that although the AWD demanded almost the same resources as the traditional cultivating systems, however a significant harvest increase has been observed.

#### Box 3: Alternate Wetting and Drying (AWD)

As the International Rice Research Institute stipulates “Alternate Wetting and Drying (AWD) is a water-saving technology that lowland (paddy) rice farmers can apply to reduce their water use in irrigated fields. In AWD, irrigation water is applied to flood the field a certain number of days after the disappearance of ponded water.

Hence, the field is alternately flooded and non - flooded. The number of days of non-flooded soil in AWD between irrigations can vary from 1 day to more than 10 days.

For more information:

International Rice Research Institute - Rice Knowledge Bank  
[http://www.knowledgebank.irri.org/factsheetsPDFs/watermanagement\\_FSAWD3.pdf](http://www.knowledgebank.irri.org/factsheetsPDFs/watermanagement_FSAWD3.pdf)

Other training needs were also suggested by both genders in some of the FGDs as below:

- training on azolla fertilizer cultivation and application
- training on dry land agricultural techniques
- training on the cultivation of new cotton varieties
- training on micro-irrigation techniques

There was however a complaint from female participants that the training programs on AWD are frequently limited to male farmers on purpose because they are considered more knowledgeable on agricultural matters.

#### Box 4: Blue Green Algae, Azolla and Phosphobacteria Bio-fertilizers

Some field trials on Blue Green Algae, Azolla and Phosphobacteria have been conducted along ClimaRice II project ([www.climarice.com](http://www.climarice.com)) for the minimization of climate change impacts in rice cultivations. As the technical brief of RiceClima II on Biofertilizers notes, the results have shown that microbial inoculants (biofertilizers) such as Blue Green Algae, Azolla and Phosphobacteria could minimize the impacts of climate change in rice cultivation.

The cyanobacteria (Blue green algae) is a highly promising biofertilizer for rice in supplementing nitrogen. Azolla is a floating water fern that also fixes atmospheric nitrogen. Azolla and Cyanobacteria have been identified as eco-friendly natural nitrogen fixers in the rice field ecosystem. A judicious use of these blue green algae could provide entire rice acreage of India as much nitrogen as obtained from 15-17 lakh tonnes of urea.

In total, the bio-fertilizers could help to minimize the over dependence of chemicals in rice farming and also enhance the use efficiency of nitrogen by releasing ammonia to the rice crop.

For more information:

ClimaRice II - Biofertilizers in minimizing climate change impacts in rice farming  
<http://www.bioforsk.no/ikbViewer/Content/99141/Technical%20Brief-%209.pdf>

The training in livestock management was another suggestion by both genders and mostly female participants. Particularly, the women mentioned that the cattle and poultry farming can be a more profitable activity than rice cultivation if managed effectively. Both men and women expressed interest in getting to own buffalos as these dairy products can have a high demand. Additionally, the training on forage grass was seen as an essential prerequisite for attaining high forage supply.

The training and economic support for self-employment initiatives was a suggestion mostly supported by the females who underlined the importance of SHGs to these initiatives. As mentioned, the SHGs have already implemented some training sessions on dairy products which have greatly helped in the startup of small enterprises. Similarly, they proposed SHGs to initiate trainings on the following subjects:

- sewing and tailoring
- growing of silk worms
- candle-making development

Based on the above results the following three statements commonly heard and established by all FGDs are presented:

**Table 5. Statements for mitigation of gender inequalities**

Code	Statements
1C	Training on new cultivating approaches
2C	Training on livestock management
3C	Training on self-employment initiatives (only by women)

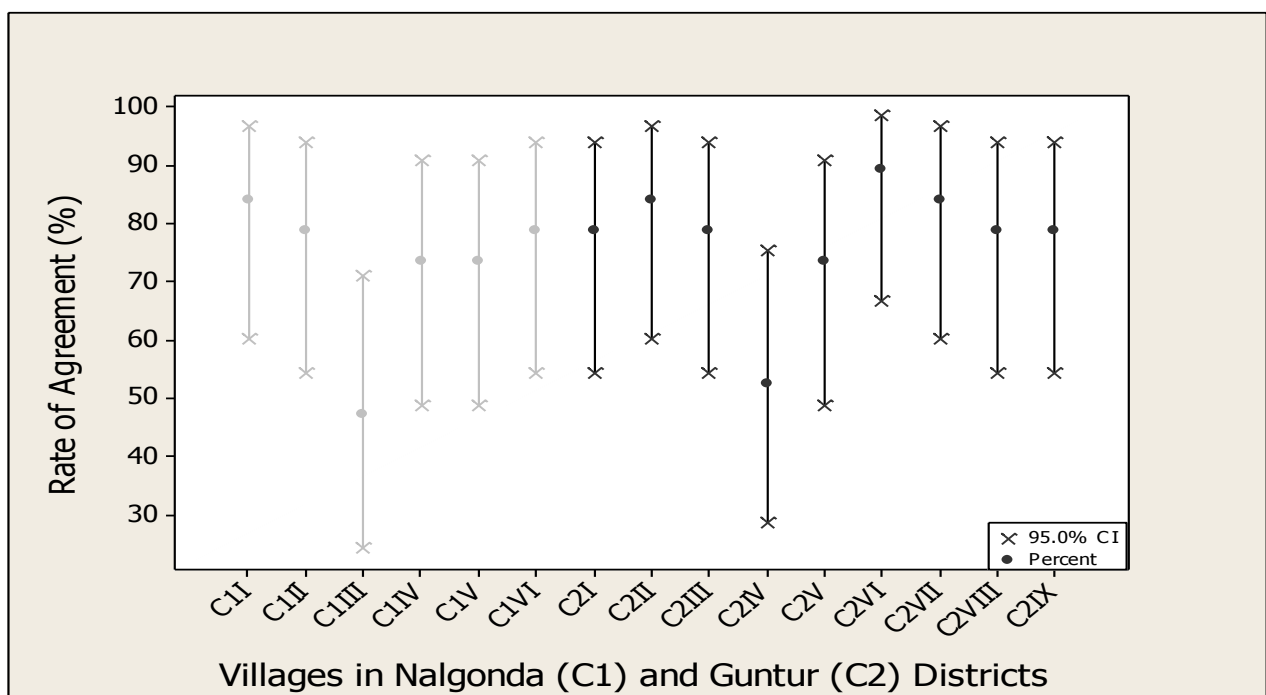
## 5.4 Attribute Agreement Analysis

The results of the Attribute Agreement Analysis initially reveal how differently each village may respond to all the statements. As presented in Figure 3, the agreeable rate of response of the Nalgonda (C1) and Guntur (C2) villages in regard to all the statements is initially presented. The rate of agreement with the statements lies on the vertical axis while on the horizontal axis the agreement of each FG (village) towards the statements is depicted.

The villages from the Nalgonda cluster (C1I-C1VI) present on an average a high rate of agreement (73%, CI<sup>1</sup> [48.56, 89.56]) while a higher convergence (78%, CI [53.68, 92.68]) is noticed in the case of the Guntur villages (C2I-C2IX).

However, the responses between the Nalgonda and Guntur villages present some considerable discrepancy. As it can be visually noticed in Figure 3 at the dotted points of the vertical lines which represent the mean rate of agreement of each village, there are noticeable deviations between them.

In particular, it is only in 6 out of 18 statements in which the responses between villages match each other. The low agreement rate between the respondents suggests that each village may perform rather uniquely in a survey process with small but distinctive differentiations.



**Figure 3. Attribute Agreement Analysis**

The rate of agreement of each gender towards the statements of gender inequalities, weather extremes and mitigation options are presented in Figure 4. An overall high rate of agreement is noticed for each statement but for three specific cases.

In the first case, the equal contribution of women to income seems to be agreed only by about half of the respondents (3A). The initial common feeling in FGDs of women bringing the same household earnings seems to fade out when both genders are asked on an individual level. In the second case, a lower rate of agreement is noticed in the case of children deciding on crop cultivations (7A). Third, a

<sup>1</sup> The confidence intervals (CI) provide the likely range of a sample proportion or sample mean from the true proportion/mean found in the population (The Scottish Government, 2013).



remarkably lower rate of agreement is presented for the assumption of household violence increase as a burst of the extreme weather impacts (3B).

A high convergence between the female and males respondents is generally noticed except for some small deviations. In particular, the women portray a higher rate of agreement in the case of common decision-making for crop selections (6A). Likely, the women are also more agreeable in the adoption by both genders of water resistant crops or livestock activities in case of deficient rainfall years (6B). Reversely, the men seem to be more keen on attending training courses about new cultivating techniques (1C). It is mentioned that for the training on self-employment statement (3C) it was only women to be queried since a unilateral interest was noted along the FGDs events.

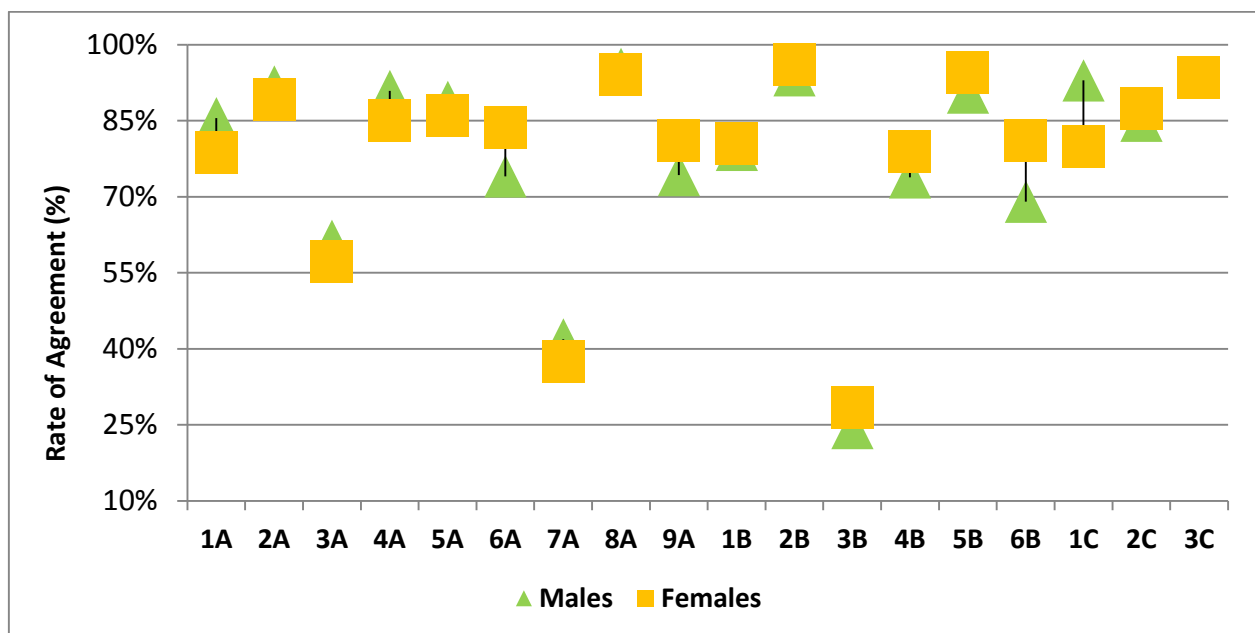


Figure 4. Gender-bases response on the individual statements

## 6. Discussion

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### 6.1 Exploring Results

The study has shown that gender inequalities in variables such as land ownership, income, household decision making and access to information was not very significant. Women strive for more involvement in profit-making occupations and a better say in financial decisions, an indication that is important to consider these issues while planning for future.

The qualitative assessment was validated from the quantitative survey analysis except for the sharing of income contribution and the crop decision issues. These discrepancies could be sometimes explained by the slightly different objectives pursued by Focus Groups and individual survey. As mentioned in Section 2.1, the Focus Group aims at the inference of the collective views of the participants while a questionnaire targets on the preferences of each single individual (Schönherr et al, 2010). A potential discordance may reveal how the individual's behavior could change when acting as a single person rather than when participating in a group scheme. Nevertheless, the discordance appeared in the household income contribution should be further explored in future research since other also similar studies in the region have signified the noticeable income differences between genders (Lambrou and Nelson, 2010; Rao, 2011).

The qualitative results also signified the unawareness of both genders to the climate change concept. The poor information may have prevented households from applying common efforts against weather extremes. Currently, each gender appears to act individually against adverse weather conditions.

In particular, the recent droughts have forced many farmers, especially male household members to take loans from unofficial sources /money lenders at exorbitant interest rates. It is estimated that in about 71% of households in Nalgonda and 45% of households in Guntur have taken loans (ClimaAdapt, 2013). In most cases, money lenders confiscate household and farm assets mortgaged as compensation, as farmers fail to repay. This can impact gender relations in a household. The recent noticeable amount of suicides in Andhra Pradesh mainly of small and marginal male farmers due to their exposure to irrevocable debts is a strong evidence of this situation (GoAP Disaster Dpt., 2013).

On the other hand, the inclination of females to seek for support from the extended family members (e.g. cousins, uncles) brings more people into decision making of financial matters. This individual attitude of each gender may in the future aggravate gender inequalities.

However it is believed that the introduction of agricultural innovations will bring higher profits and reduce the dependence of male farmers on loaning as well the interference of non-household members.

## 6.2 National and State initiatives for balancing gender in development

The state authorities of Andhra Pradesh and the national authorities of India have also adopted significant policies and measures to mitigate gender inequalities mainly in the field of local administration, education, health and socio-demographics.

The local administration has gained significant powers since the 73rd Amendment conducted in 1993 where the local infrastructure, the permission for drinking water schemes, the funding for welfare programs and the grants for administrative expenses were to be coordinated by local administration bodies on a village level known as “Gram Panchayat” (GP) (AP Online, 2013).

All the more, the Amendment has required that one-third of the GP councilor positions were to be reserved for women. A study related to the effectiveness of the GP institutions all over India concluded that in the case where women chair the administration, the females have better access to public goods and education while the infrastructure projects are well implemented (Unicef, 2006).

### Box 6: Local Administration rights (Gram Panchayat)

The 73rd amendment to the Constitution of India in 1993 established the framework of a three-tiered local government system, in District, Block and Village level (Gram Panchayat - GP), with regular elections every five years, throughout India.

The 1993 act gave the GP primary responsibility in implementing development programs, as well as in identifying beneficiaries for federal poverty programs. GP size, both in terms of number of people and villages, varies across states.

For more information:

Indian Panchayat Raj, <http://www.panchayats.in/>

Similar attempts to involve females in public administration have been noticed at a state level in the Forest Department of Andhra Pradesh. At a workshop organized on Gender Mainstreaming of Forest Frontline Staff in the year 2008 (AP Forest Dpt., 2008) the state authorities confirmed the multiple benefits raised by the recruitment of females as a frontline staff as well as in a higher administrative level. As stated, the female participation has greatly helped Forest Department to improve transparency in the management activities and to get closer with the local communities.

In the area of education, simultaneous national and state policies strive to increase the school attendance of females by giving higher attention to rural areas. By acknowledging that there is a significant gender gap in enrolment at the elementary level with a ratio of 1 girl to 3 boys, a National program has been established to provide access and facilitate retention for female students (AP Online, 2013). The national education policy is further empowered by Andhra Pradesh through the introduction of 8 different capacity building schemes targeting on the education of females in agrarian communities (Centre for Good Governance, 2013).

The joint efforts of both national and state authorities to improve gender inequalities can be noticed in the health sector. Different projects aim at forging a partnership between the Central, State and the Local governments for the improvement of maternal Health Care Service and a better access to primary health care programs (AP Online, 2013). The high infant mortality rate is expected to get significantly decreased upon the improvement of the maternal health programs. However, there are also many cases of purposive abortions when female fetuses are diagnosed. To this end, there has been a coordinated policy on national and state level to financially promote the family on a birth of girl child. Indicatively, the Andhra Pradesh has passed a law in 2013 where each family will receive assistant of Rs 2,500 upon a female birth. Also, each family would get a total of Rs 55,000 till the girl's 21st birthday and upon completion of intermediate school an additional Rs 50,000 would be offered as an incentive (First Post, 2013).

The aforementioned results are implemented on a horizontal manner by giving higher attention to deprived households and backward rural areas. Notwithstanding the crucial attempts of national and regional authorities to curb gender inequalities, our study results suggest that high cautiousness should be given on the horizontal application of different measures. As indicated in Figure 3, a very small rate of agreement was noticed between villages in the Attribute Agreement Analysis. These peculiarities among villages may entail poor performance of a gender policy although the policy framework could be well designed. It is thus suggested that the gender policies should be customized to the local needs and after a thorough consultation with local governments which could better sense the peoples' preferences.

### 6.3 ClimaAdapt and proposed initiatives

The ClimaAdapt project has already developed tailor-made gender initiatives to the selected study area of Tamil Nadu and Andhra Pradesh states. Knowledge Village Centres (KVCs) have been established in designated villages where training sessions on agricultural innovations are already taught by paying attention to female participation. The current study results could provide some further ideas for the material to be taught and/or in cooperation with the local administration as presented below:

**Table 6. Proposed Training and Information Sessions**

<b>Climate Change Preparedness</b>	<b>Land Cultivation training</b>	<b>Livestock Farming training</b>	<b>Other trainings</b>
Information on climate change and weather extremes	Alternate Wetting and Drying	Poultry breeding	Small agricultural enterprises
Common (gender) approaches against drought and flood events	Irrigation and drainage techniques	Cattle breeding and dairy products	Small craftsmen enterprises
Early warning systems for weather extremes	Groundwater abstraction	Buffalo breeding and dairy products	Growing of silk worms

## 7. Concluding remarks

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The study results suggest that no major gender inequalities were found in the current ownership patterns of property including house and land in the study areas. However, it became apparent that each gender takes different initiatives against climate change and this may trigger forthcoming inequalities. Lack of awareness about climate variability and the linkage to weather extremes may also impact as to how men and women respond to such extreme weather conditions. The findings are in full accordance with similar studies which also acknowledge the fear of gender inequality when each gender takes different initiatives against weather extremes (Lambrou et al., 2006; Skinner, 2011; Vogt et al, 2009).

The particular behavior of each village and gender indicates the need to pay attention on the introduction of scaling up gender policies without prior adequate analysis in a local level.

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