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An Assessment of Perceptions and Autonomous Adaptation among the Farmers of North East Tamil Nadu, under the Purview of Climate Change

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ABSTRACT

This study tries to explore the perceptions of local farming community on the changes in climate and to evaluate their existing coping strategies in the Chengalpet areas of Tamil Nadu, a semi arid coastal region of South India. For this purpose, Rapid Rural Appraisals, Focal Group Discussions and in depth surveys have been carried out during the month of June 2013. This research observed that majority of the farmers have perceived climate variability and especially increasing temperature, prolonged dry spells, erratic rainfall pattern etc based on their personnel and farming experiences. This study observed that climate change has already started to affect the marginal and subsistence farmers to a great extent. The farmers are practicing autonomous adaptation strategies like changing the timing of farm operations, varying planting dates, shifting traditional crops to heat tolerant crops and varieties and shifting from traditional rice paddy cultivation to other cash crops which are less water intensive etc. This study recommends that in order to cope up with the future challenges and to attain sustainable crop production and livelihood security, site specific planned adaptations strategies also should be implemented.

Keywords; *Autonomous adaptations, Perceptions, Climate variability, Adaptation Matrix.*

JEL Classification: N55, Q54

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Palanivelu K, Centre for Climate Change and Adaptation Research, College of Engineering, Guindy Campus, Anna University Sardar Patel Road, Chennai – 600 025, and can be contacted at kvelu@annauniv.edu This works falls under the CIFRE¹ convention of the Office of Economic Cooperation for Mediterranean and Middle East (OCEMO)²

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² OCEMO is a cluster in Marseille-Valmer that brings together several key players in the field of economic cooperation in the MENA region, including the World Bank-CMI, the European Investment Bank, the AFD, the CDC (Deposits and Consignments Fund), FEMISE (Euro-Mediterranean network of economic analysis institutes), the ANIMA investment network (network of Euro-Mediterranean Agencies promoting FDI), and the IMPGT of Aix-Marseille University.



Introduction

Climate change cause a severe threat to crop production systems, thereby negatively affecting the food security of a country. A highly populated developing country like India is especially vulnerable to its impact (IPCC,2014).The productivity of agricultural eco systems depend critically on the temporal and spatial distribution of weather conditions in terms of temperature, precipitation and evaporation etc (IPCC, 2013).Crop Productions in marginal areas with respect to water would face increased climatic vulnerability and risk under climate change due to factors that include, for instance, degradation of land resources through soil erosion and saline water intrusion and over-extraction of groundwater and associated salinisation, and desiccating of arid and semi arid region (FAO, 2003).

Water plays a crucial role in crop production regionally and worldwide. More than 80% of global agricultural land is rain-fed in these regions, crop productivity depends solely on sufficient precipitation to meet evaporative demand and associated soil moisture distribution (Lobell et al., 2009). Changes in water demand and availability under climate change will significantly affect agricultural activities and food security in the 21st century. Regions where agriculture is currently a marginal enterprise, largely due to a combination of poor soil, water scarcity and rural poverty, may suffer increasingly as a result of climate change impacts on water (Arora,2002).

The latest CMIP5 ensemble mean future projections of RCP6 and RCP 8.5 emission pathways indicate rise in warming of about 3.3 to 4.8 °C by 2080 is relative to pre-industrial times (Chaturvedi et al.2012).There is consensus across both global- and national-scale studies that water stress could increase in India with climate change. A number of recent studies support conclusions from the IPCC,(2007) AR4 that India is highly vulnerable to the impacts of sea level rise (SLR). The findings from the research papers have already portrayed the eastern coast of India, to be more vulnerable than the western coast (Patnaik and Narayanan,2005).

Higher temperatures eventually reduce yields of desirable crops while encouraging weed and pest proliferation, (Lobell et al 2009). Changes in precipitation pattern (timing and amount) increase the likelihood of short-run crop failures and long-run production declines, posing a serious threat to food security. Although there will be gain for some crops

in some regions, the overall impacts of climate change on agriculture is expected to be negative and need to be much better understood (Challinor et al.2007a).

1.1. Impacts of Climate Change for Tamil Nadu.

Along the eastern coast of India, Tamil Nadu has been hit by about 32 cyclonic storms between 1891 to 2006 of which 30 were severe cyclonic storms. The total number of cyclonic storms hitting the Tamil Nadu coast has increased by 37.5 percent between 2006 and 2011,SAPCC-TN(2013).. The mean sea level rise trend of the Chennai coast, which lies in the midst of Kancheepuram and Thiruvallur coast is 0.32 mm/year, based on monthly mean sea level data for the period 1916to 2008 .(<http://tidesandcurrents.noaa.gov/sltrends/>). The increase in sea level in 2100 with respect to current levels is likely to range from 0.19 m to a maximum of 0.83 m across various IPCC -SRES emission scenarios (<https://www.ipcc.ch/pdf/special-reports/spm/sres-en.pdf>). Agriculture still continues to be a dominant sector and provides livelihood to nearly 45 percent of the people. But its share has eroded to 8.0 percent of GSDP in 2011-12 from 13.0 percent in 2002-03.Drought occurrence in Tamil Nadu is reported to have a return period frequency of 2.5 years.(Nathan et al.1998).

Projections of maximum annual temperature over Kancheepuram district for the time period 2010-2040, 2040-2070, 2070-2100 with reference to the base line year (1970-2000) indicated an average increase of 1.2 °C,2.4 °C, and 3.3 °C, respectively. The projections of the annual minimum temperature showed an average increase of 1 °C, for 2010-2040, 2.2 °C for 2040-70, and 3.3 °C for the period 2070-2100. Projections on the annual precipitation also showed a decreasing trend,(Dhanya et al.2013).To substantiate this findings, a glimpse of another study report published by the State action plan on climate change, Tamil Nadu for the study area is also been provided here.(Table.1)

Based on its intent, autonomous adaptation is an adjustment that does not constitute a conscious response to climatic stimuli, but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. It is also referred to as spontaneous adaptation (IPCC,2001).This research involves an assessment of climate change perceptions and autonomous adaptations prevailing among the farmers of

Kancheepuram and Thiruvallur district, erstwhile Chengalpet district.

2. Data and Methodology

2.1. Understanding the perceptions and existing autonomous adaptations.

This research was carried out using both qualitative and quantitative research designs. The rapid rural appraisals, focal group discussions and in depth surveys were employed. This survey was conducted in June 2013. Interactive focal group discussion was also conducted with different stake holders including researchers from the Centre for Climate Change and Adaptation research, Anna university, officials from the Department of Agro and social-forestry, local farming communities. Focal Group Discussions (FGD) were conducted using open ended questions. This aimed at generating first hand information regarding the perceptions of farmers on the trends of climate and evaluates their existing coping strategies through face to face interactions. The data collection is mainly primary. Fieldwork consisted of focus group meetings and semi structured interviews. Focus group Discussions lasted between 120 minutes while individual conversations lasted generally between 20 and 60 minutes.

In depth surveys helped to get familiar with the surroundings and local conditions of the farming communities. Semi structured interview style is the methodology used in this questionnaire survey. This was conducted calling representative farmers from Chengalpet areas. Information regarding the existing cropping pattern, crop productivity, perceptions about the observed changes in the climate and their current coping strategies have been collected through the survey. Questionnaires contained both open ended and close ended questionnaires. The open ended questionnaires helped to have better freedom of expressions and were related to their existing farming operations, coping strategies. Questionnaires were prepared both in English and in the local language i.e. in 'Tamil'.

2.2. Identifying and Prioritizing Adaptation Options

The farmers' preferences among various adaptations were identified using Focus Group discussions. All the stakeholders were invited and formed an Expert committee including agriculture officers, farming communities, climate change research group working in Anna University s were part of the discussion. This discussion was aimed to guarantee

heterogeneity in perspectives and to have a broader scrutiny towards coming to agreement with respect to adaptation. The pair wise ranking method is adopted to prioritize the recommended adaptation options following the participatory learning and action methodology of Pretty (1995). Pairwise (or preference) ranking is often used by many scientists. In the field of climate change adaptation, the application of pair wise ranking is still rare. Ranking the preferred adaptation options facilitated a clear understanding on the most commonly adopted strategies by the farmers to cope up with the existing challenges.

3. Results and Discussion

3.1. General socio economic background of the respondents farmers of Chengalpet areas.

Most of the interviewed farmers (50.6%) were small and marginal farmers had only less than 1 acres of crop land for cultivation. Many had taken it for lease or rent. Only 4.4% of the farmers had crop land more than 5 Acres. Around 31.9% of the interviewed farmers had farming experience more than 20 years as majority of them were in the age group of 50 years and above. The survey revealed that percent of the young farmers were very less (7.9%) which shows that the young generation is reluctant to follow their parent's footsteps and were interested/engaged in other livelihood options other than farming.(Table.2).

3.2. Perceptions of farmers' on the observed climate and related events

Focal Group discussions with the respondent's farmers exposed many valuable facts. The way in which the climate change was perceived by them was through the feeling of scorching heat during the farm operations. Battisti & Naylor (2009) have already stated in their research article that rise in temperature during the sensitive growth stages of the plants may adversely affect the crop productivity, income of the farming community and food security of a place. The survey revealed that there is a notable rise in the temperature(96.78%).(Fig.2) A study reported by (A.K.Srivastava et al2007),Chennai, the nearest metropolitan city near the present study area shows an increasing trend of 1.5 C/2 C/1C in the mea, maximum, and minimum temperatures respectively. They also reported that while rainfall has become highly erratic. More than 80% of the farmers responded that number of rainy days have reduced and the long dry spells during the crop growth season has become the major challenge in crop production

combined with the non availability of irrigation. These situations are really alarming to the fertility of the soil. Majority of the farmers (87.13%) had an opinion that drought and heat stress are hampering their crop and affecting their livelihood in a negative way. Farmers have pointed out that the heat during the farming operations has become unbearable and the cold during the night time has reduced. Fig.1 shows the percentage of farmers who have expressed their general perceptions related to climate change. Majority of them were having a uniform opinion about increasing temperature, prolonged dry spells, increasing heat stress on the standing crops. They reported that they were very much concerned about the long dry spells especially for rice paddy cultivation.

For cropping systems, there are many potential ways to alter management to deal with projected climatic and atmospheric changes (Easterling et al., 2003; Howden et al., 2003; Howden and Jones, 2004; Wheeler et al (2000), Challinor et al., 2007). These adaptations include altering inputs such as varieties and/or species and altering the timing or location of cropping activities to those with more appropriate thermal time and vernalisation requirements and/or with increased resistance to heat shock and drought, altering fertiliser rates to maintain grain or fruit quality consistent with the climate and altering amounts and the timing of irrigation and other water management practices, Nyong and Thomas (2007)..

3.3. Change in crop preferences.

This paper discusses about the farmers' preferences of crops for cultivation. It was clear from the survey that farmers are shifting from their traditional crops to more diversified crop varieties due to extreme climatic events like droughts and cyclonic storms especially during the last one decade.

3.4. Adaptation matrix- a pair wise ranking approach

Interacting with all the stake holders facilitated identification of the most effective adaptation strategies that were popular at present enable them to cope up better with local climate changes. For this purpose, the primary stakeholders like farmers and the secondary stakeholders like climate change research groups officers working in the agricultural, agro and social forestry and water sector were consulted and adaptation options were prioritized. This exercise helped to identify and ensure the best suitable autonomous adaptation options that are conducive for sustaining the livelihood and security

of the people. Changes in the farming operations and crop varieties was chosen as the best and popular adaptation options in order to reduce the risks from climate change. Improving water efficiency is prioritized as the next best option as it would help the farmers to cope up with climate variability and water stress during the dry spells to a great extent. None of the farmers were seem to be aware of or availing the crop weather insurances. (Table 4).

Conclusions

It's very essential to create primary information about farmers' views and responses regarding climate variability and change and the ways in which they cope with the change challenge. As most of them understood the change especially in the temperature and rainfall pattern with a rising trend this has already necessitated adjustments to the present practices. With respect to the farmers priority in adaptation, changes in the timing of farming options and crop varieties have got the prime rankings. This was found to increase their resilience to climate vagaries. A combination of autonomous planning makes the farmers less vulnerable to climate variability and can be seen as a response to a changing situation, both climatologically and economically. Both autonomous/traditional adaptation and planned adaptation have to co-exist to manage the climate change risks in more productive ways.

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Appendix

Table.1
Projected future change in the climate for the study area with reference to the baseline period 1970-2000,as per IPCC SRES-A1Bscenario.

District	Change in Maximum Temperature(^o C)			Change in Minimum Temperature (^o C)			Changes in Precipitation(%)		
	2010-2040	2040-2070	2070-2100	2010-2040	2040-2070	2070-2100	2010-2040	2040-2070	2070-2100
Kancheepuram	1.1	1.8	3	1	2.2	3.3	-8	-12	-3
Thiruvallur	1.1	1.6	2.8	1.1	2.2	3.3	-6	-13	-5

Source: SAPCC-TN(2013).

Table.2: The socio economic background of the respondents farmers in Chengalpet areas

Socio Economic Charecteristics of Respondant farmers in Kancheepuram district	
Variable	percentage
Gender	
male	55.8
female	44.2
Total	100.0
Age Groups	
20-30	9.6
30-40	16.4
40-50	28.7
50 and above	45.3
Total	100.0
Level of education	
No formal Education	10.8
primary	56.4

secondary	28.1
college and above	4.7
Total	100.0
Farming Experience	
1 to 5	7.9
6 to 10	17.8
11 to 15	19.3
16to 20	23.1
20 and above	31.9
total	100.0
Farm holdings Size	
below 1	50.6
1 to 2	22.8
2 to 3	12.0
3 to 4	7.9
4 to 5	2.3
5 and above	4.4

Table.3: Ranking of the preferred crops cultivated before and at present.

<i>Ranking of six main crops preferred for cultivation -traditionally and at present(as responded by the farmers).</i>		
	<i>A</i>	<i>B</i>
<i>ranking</i>	<i>traditional practice</i>	<i>current status</i>
<i>1</i>	<i>Rice</i>	<i>jasmine flower</i>
<i>2</i>	<i>Sugarcane</i>	<i>groundnuts</i>
<i>3</i>	<i>Maize</i>	<i>cluster beans</i>
<i>4</i>	<i>Millets</i>	<i>sesame</i>
<i>5</i>	<i>Pulses</i>	<i>sorghum</i>
<i>6</i>	<i>Other legumes</i>	<i>millets</i>

Table. 4. Climate change Adaptation matrix for Agriculture sector for the study area.

Adaptation Options(Agriculture)	Change in Farming practices	Changes in the Crop Varieties	Efficient Water Management	Dependence on Weather forecast	Crop Insurances	Score(no .of Times Preferred)	Rank
Change in Farming practices	x	Changes in crop varieties	Change in Farming practices	Change in Farming practices	Change in Farming practices	7	1
Changes in the Crop Varieties	Change in Farming practices	x	Changes in the Crop Varieties	Changes in the Crop Varieties	Changes in the Crop Varieties	7	1
Efficient Water Management	Change in Farming practices	Changes in crop varieties	x	Efficient Water Management	Efficient Water Management	4	2
Dependence on Weather forecast	Change in Farming practices	Changes in crop varieties	Efficient Water Management	x	Dependence on Weather forecast	2	3
Crop Insurances	Change in Farming practices	Changes in crop varieties	Efficient Water Management	Dependence on Weather forecast	x	0	

Fig.1: General perceptions of farmers' on the observed climate change in Chengalpet Area, Tamil Nadu, India.

