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Farmers' perception on climate change

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Abstract: This study focused on identifies temporal rainfall and temperature variability in Anuradhapura district from 1941 to 2010 and determine farmers' perception on climate change. This study was conducted in Thantirimale and Mahavilachchiya GN of Mahavilachchiya Divisional Secretariat in Anuradhapura District. Questionnaires and focus group discussions were used to gather primary data. Five years moving average and descriptive statistical tools such as the coefficient of variation and percentages were adopted in the analysis process. Result from descriptive analysis of meteorological data (rainfall and temperature) revealed that the temperature has increased and rainfall has decreased. The majority of the farmers' perceptions from both areas are parallel with statistical record of meteorological data. Though they have already identified that climate is changing and they knew how to face these changes but they need more awareness about how to adapt to climate change.

Keywords: climate change, perception, paddy farmers

Introduction

Weather and climate play a main role in human life. At the same time, scientists have determined that human activities have become a dominant force, and are responsible for most of the weather change phenomena. Weather and climate vary from each other. The difference between weather and climate is a measure of time. Weather is the conditions of the atmosphere over a short period of time, and climate is how the atmosphere "behaves" over relatively long periods of time. Climate change and weather are intertwined. Observations can show that there have been changes in weather, and it is the statistics of changes in weather over time that identifies climate change (IPCC, 2010). Farmers perceive climate change as a change in rainfall and temperature patterns and variability as well as extreme weather events.

Weather and climate change have become a major concern to human society because of their potentially deleterious impacts, worldwide. It poses especially significant threats to sustainable development in developing countries, which have fewer resources and are more vulnerable (Munasinghe, 2010). Changing climate has been observed in many parts of the world. The Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report observed that, warming of climate system is now unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global sea level" (Kumar & Balasubramanian, 2010). Sri Lanka's climate has also been changing for a couple of decades. As a result, the expected rainfall may not come at the expected time with correct amount and intensity, whereas more rainfall may be received when it is not really necessary and annual mean air temperature anomalies have also shown significant increasing trends during the recent few decades in Sri Lanka (Punyawardena, 2009).

When we compare the impacts with other sectors, agriculture is one of the most vulnerable sectors to climate change. There are positive and negative impacts on agriculture due to climate change. Many countries, especially developing countries face negative impacts of climate change such as, long-term water and other resource shortage, worsening soil conditions, drought and desertification, disease and pest outbreaks on crops and livestock, rising sea-levels, and so on. Even so, some countries have experienced beneficial effect from climate change particular in temperate regions. The lengthening of growing seasons, carbon fertilization effects, and improved conditions for crop growth are forecast to stimulate

gain in agricultural productivity in high-latitude regions such as, northern China and many parts of Northern America and Europe (Kurukulasuriya& Rosenthal, 2003).

A better understanding of farmer perceptions regarding climate change, current strategies for managing climate change and their determinants will be important to form policy and planning for the future successful adaptation of the agricultural sector. So, this study has focused on identify temporal rainfall and temperature variability in the Anuradhapura district from 1941 to 2010 and determine farmers' perception on climate change.

Study Area

This study focused on the Thantirimale and Mahavilachchiya GN from Mahavilachchiya Divisional Secretariat in Anuradhapura District of the North Central Province in Sri Lanka. Fig 1 indicates the study area.

Both Thanthrimale and Mahavilachchiya climate are characterized by the dry zone, which receive less than 1800mm of rainfall per year during both the south western (smaller *Yala*) and the north eastern (*Maha* season) monsoon periods and mean annual temperature of 30^0 C, although maximum temperature may even exceed 37^0 C occasionally. Thanthrimale's paddy farmers depend on rain-fed system (Being dependant on local rainfall without access to any substantial sources of supplementary water) but Mahavilachchiya'spaddy farmers depend on irrigation system (using the water supplied from large irrigation reservoirs on a year round basis).

*(**Source:** Divisional Secretariat Mahawilachchiya)*

Figure 1:
A sketch showing the location of the study area

Materials and Methods

This study was conducted with the active farmers who are involved in paddy farming activities for more than thirty years and above fifty in age. Among them forty percent (40%) of paddy farmers were selected as a sample for this study. The random sampling technique was applied to draw the samples and selecting the samples was based on electoral lists by using random table.

Table 1: Details of the sample size

Name of the study area	Population (above fifty in age + 30 years' experience in farming)	Sample (40%)
Mahawilachchiya	87	40/100 * 87 = 35
Thanthrimale	82	40/100*81= 33
Total	**169**	**68**

Data on the selected indicators was collected through both primary and secondary sources in the study and the following methods were used.

- Questionnaire was used with 40 percentage of the sample from paddy farmers (age above 50 + 30 years' experience in farming) in the area.
- Focus Group Discussions (FGDs) were conducted with farmer groups of 5-10 in size, from the selected GN areas. Discussions were held in a semi-structured,

yet flexible focus guide. The discussions were inquired about the physical profile of the resources in the villages, about the farming systems, local water management, formal and informal institutional arrangements, experience in climate change.

- Secondary data was collected from a number of key institutes. The major types of secondary data collected include: information on water sources; agricultural base data; rainfall, temperature and other meteorological data; physiographic information of resources; and studies on socio-economic and institutional aspects.

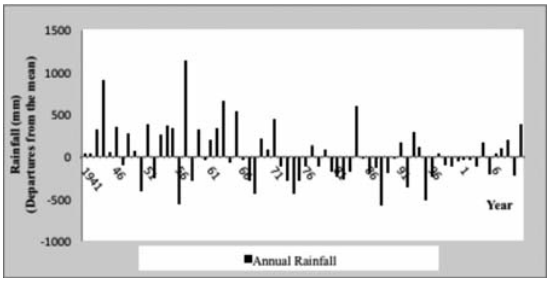
Five Years Moving Average of Time series Analysis and descriptive statistical tools such as and coefficient of variation (CV) and percentages were used to recognize the patterns of temperature and rainfall variability in the Anuradhapura district from 1941 -2010 and farmers' perception on climate change.

Results and Discussion

Temporal rainfall and temperature variability in the Anuradhapura district from 1941 to 2010

Rainfall is one of the important factors that determine the development or drop down of agriculture and plant distribution. It is important to have sufficient rainfall from land preparation for harvesting to get maximum production. Land preparation starts from low rainfall conditions and after transplanting the maximum amount of water, is supplied at the highest growth rate stage and with low rainfall at the flowering stage to get a better harvest. Temperature is also an important factor that effect on crop production. Germination, Physiological activities, flowering and Photosynthesis depend on temperature. Rainfall and temperature variability cause a negative effect on crop production.

Climate is changing world-wide, and the science community in Sri Lanka has come up with ample evidence to suggest that the country's climate has already changed. During 1961-1990 the country's mean air temperature increased by 0.016 0C per year, and the mean annual rainfall decreased by 144 mm (7 percent) compared to the period 1931-1960 (Eriyagama & Smakhtin, n.d.). Fig 2 presents a graphical display of the rainfall total as deviations above or below the mean of 1115mm for the district. The data shows that there were dry years with rainfall below the long term mean of 1115mm and wet years with rainfall above the same long term mean. Generally most of the wet years were observed from 1942 to 1965 and the wettest year in 1957. The district experienced most of the dry years after 1965 especially in 1988 and 1995.

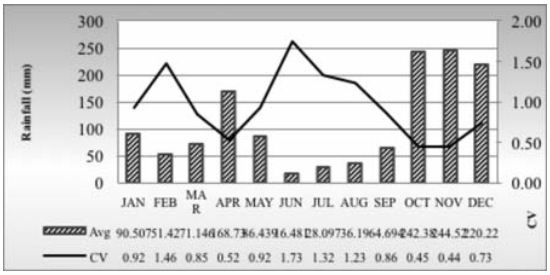


Source: *meteorological department, Colombo. 2012*

Figure 2: Rainfall anomalies of Anuradhpura District during past 70 years

Rainfall in Anuradhapura could be divided mainly as the *Maha*and *Yala*seasons. Rainfall of the *Yala*season is received the first-inter monsoon and south west monsoon from March to August in this season. The *Yala*season will be restricted from mid-March to mid-May due to less effect on the south west monsoon for the dry and intermediate zone. Rainfall of the *Maha season* is received by the second-inter monsoon and North east monsoon. That period will be effective from September to February. Hence, high rainfall will be received from October to November throughout the island. A presence of these two patterns of rainfall is known as the bi-model rainfall pattern, but this pattern can be observed well in the Dry zone and very less in wet zone (Pushpakumara, 2011).

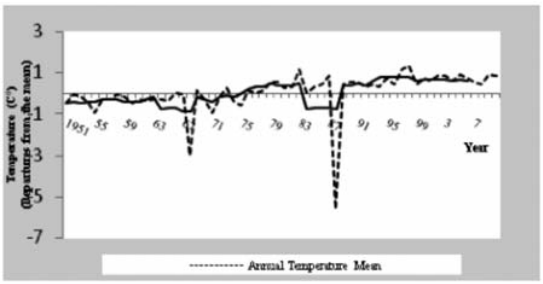
Fig 3 theco-efficient of variation (CV) of months. It shows that the co-efficient of variation remains low during the four months from October-January indicating that the variability of rainfall during these months is quite low. In contrast, the variability of rainfall during the eight months from February - September is relatively high as indicated by the high values of co-efficient of variation during these months. Therefore, the bi-model pattern indicated by monthly averages seems somewhat illusionary since chances for a minor peak around April are low. Compared to these data variations of the *Yala*season is higher than the *Maha*seasons. Therefore, farmers face a water shortage during the *Yala*season.



Source: *Meteorological Department, Colombo. 2012*

Figure 3: Intra annual variation of average rainfall

Annual mean air temperature anomalies have shown significant increasing trends during the recent few decades in Sri Lanka (Basnayake, 2011). Fig4 shows the temperature anomalies of the Anuradhapura district in the past sixty years. It is noted that the temperature has increased gradually after 1987 but the temperature was below the annual mean before 1972.



Source: *Meteorological Department, Colombo. 2012*

Figure 3: Temperature anomalies of Anuradhpura District past 60 years

Further, the graph reveals that the temperature fluctuates from 1972 to 1987. There was an increased trend in 1976 and a conversely decreased trend in 1986.

An increasing trend in temperature can affect the paddy yield in the future. Therefore it is expected that the farmers should adopt some strategies to overcome this problem.

Farmers' perceptions of climate change

Farmers perceive climate change as a change in rainfall and temperature patterns and variability as well as extreme weather events. This is perceived differently at different levels of conceptualization. Through the questionnaire survey and focus group discussion it is understood that weather is continuously changing and it is getting worse over time. The majority of the farmers acknowledge an increase in temperature and a decrease in rainfall.

Among the experienced farmers aged 40 years and above, more than 97 percent from Thanthrimale and 63 percent from Mahavilachchiya have perceived that the weather is worse when comparing with past (10 – 20 years before) (Tab 2). The result further shows that 82 percent of the farmers from the both GN division noted that the weather conditions were favorable for paddy cultivation 10 – 20 years before. But it is unfavorable now

Table 2:
Perception of the weather condition

Weather	GN Name	
	Thanthrimale (%)	Mahawilachchiy (%)
worse	97	63
better	0	6
not change	0	23
no idea	3	9

Source: *Field survey (2012)*

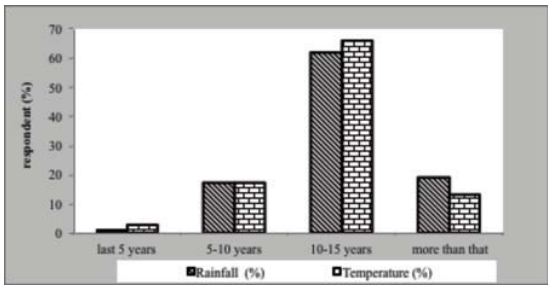
About 82 percent and 77 percent farmers from Thanthrimale and Mahavilachchiya noted a decreasing trend in rainfall respectively. At the same time, approximately 90 percent of the farmers from both GN divisions indicated that the increase in temperature is significant (Tab 3).

Tab 3:
Farmers' perceptions on trends of temperature by GN

GN Name	Farmers' perceptions on trends of temperature by GN			
	increase (%)	Decrease (%)	not change (%)	no idea (%)
Thanthrimale	91	3	6	0
Mahavilachchiya	89	6	3	3

Source: *Field survey (2012)*

And more than 80 percent of the farmers noted a declining trend in rainfall and an increasing trend in temperature during the last 10 – 15 years (Fig 5).



Source: *Field survey (2012)*

Figure 5: Rainfall and Temperature Changes

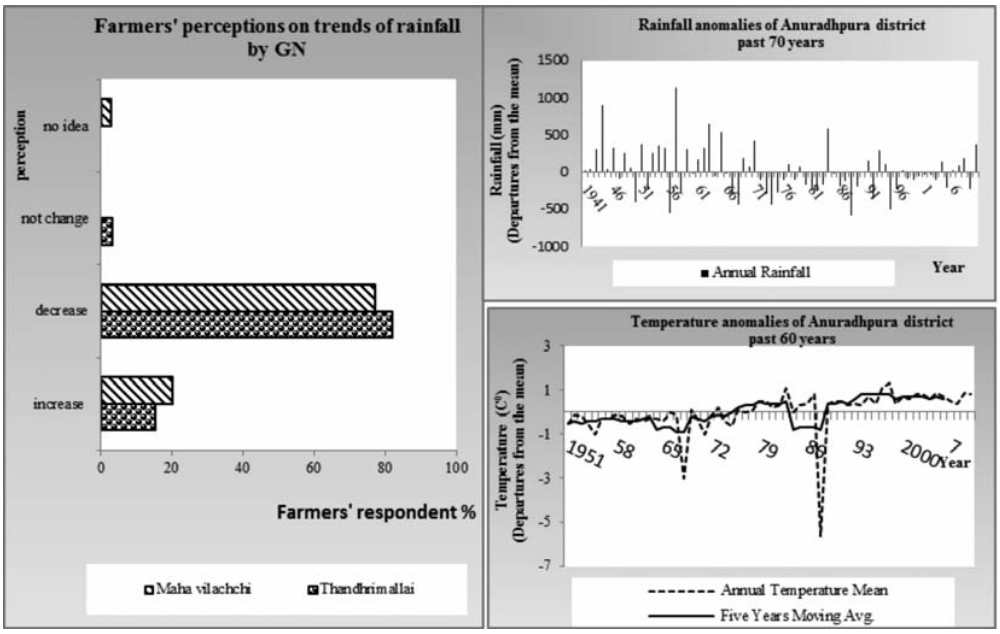
This perception is matched to the statistical records (Fig 6), which showed a temperature increase and a significant decrease in rainfall occurring consistently over the years.

Climatic factors of rainfall and temperature variability could affect the paddy yield. The study by Ann Laker (1984) has shown that climatic factors seem to significantly affect yield variations of rice in the Anuradhapura district in the dry zone, particularly under rain-fed conditions. Other analyses have shown that a temperature increase of 0.5 deg. C will reduce the rice output by 5.91% (Fernando, 2003).

Conclusion and Recommendation

This study assesses paddy farmers' perception on climate change in Mahavilachchiya and Thanthrimale. Specifically, this study investigated rainfall and temperature trend in Anuradhapura district, and farmers' perception on climate change. Result from descriptive analysis of meteorological data (rainfall and temperature) revealed that the temperature has increased and rainfall has decreased. The majority of the farmers' perception is parallel with statistical record of meteorological data. They perceived that the weather has become hotter and the rain less predictable and shorter in duration.

Generally, both areas' farmers are vulnerable to changing weather but comparatively, farmers who cultivate rain-fed rice as a primary source of food and income are particularly vulnerable. Weather variation such as prolonged dry spells during the growing season and flooding at the end of the season prior to harvesting, are events that are common in the current weather. Farmers can cope with climatic risk with their experience and indigenous knowledge. But lack of information (weather forecasting) has limited their coping ability. Hence, necessary steps should be taken to enhance climate risk forecasting like future scenarios of drought and flood and information must reached the farmers on time.



Source: *Field survey (2012)*

Source: *Meteorological Department, Colombo. 2012*

Figure 6: Comparison between farmers' perceptions and the actual records

References

Ann Leaker, 1984. *An Investigating of the factors affecting paddy yields from two districts. National science council of Sri Lanka,12 (1).*[Online] Available at: <http://dl.nsf.ac.lk/bitstream/1/6337/1/JNSF12_1_71.pdf>[Accessed: 29 April 2011].

Basnayake, B.R.S.B., 2011. *Climate Change in Sri Lanka*. [Online] Available at: <http://www.meteo.gov.lk/index.php?option=com_content&view=article&id=73&Itemid=82&lang=en>[Accessed 17 March 2012].

Eriyagama, N., and *Smakhtin, V.,* n.d .*Observed and Projected Climatic Changes, Their Impacts and Adaptation Options for Sri Lanka: A Review.* Colombo: International Water Management Institute. [pdf] Available at: <http://publications.iwmi.org/pdf/H042863.pdf> [Accessed: 30 May 2011].

Fernando, T.K., 2003. *Key vulnerabilities, information needs and capacity needs: presentation on the Sri Lankan situation*. [Online] Available at: <www.aiaccproject.org/meetings/Bangkok.../Panel1_TKFernando.doc>[Accessed: 29 July 2011].

Intergovernmental Panel on Climate Change(IPPC), 2010.The IPPC explains... Climate Change & Weather. [Online] Available at:<http://co2now.org/Know-the-Changing-Climate/Climate-System/ipcc-faq-climate-change-weather.html> [Accessed 1 May 2012].

Kumar, K.S., and Balasubramanian, I., 2010. *Climate Variability and Agricultural Productivity: Case study of rice yields in Northern India*. Madras: School of Economics.

Kurukulasuriya, P., and Rosenthal, S., 2003. Climate Change and Agriculture: A Review of Impacts and Adaptation. [pdf] Available at: <http://unfccc.int/files/national_reports/nonannex_i_natcom/meetings/application/pdf/agriculture.pdf>[Accessed: 1 May 2011].

Munasinghe, M. 2010. *Making Development more sustainable: Sustainomic Framework and practical Application*. Colombo: MIND press, Sri Lanka.

Punyawardena, B.V.R., 2009. A Brief Glimpse at climate change, In: Gunarathne, L.H.P. et al., 2009. *Role of Community in Adaptation to the Climate Change Crisis*.Stockholm: Swedish Cooperative Centre.

Pushpakumara, D.K.N.G., 2011. Identification of climatic potential.[Online]Available at: <http://www.navagoviya.org/index.php?option=com_content&view=article&id=7&Itemid=&lang=en> [Accessed 28 June 2012].