

# ANALYSIS OF THE FARMERS' PERCEPTION OF CLIMATE CHANGE AND ADAPTATION IN THE DRY ZONE OF SRI LANKA

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## ABSTRACT

The world agriculture is the most vulnerable sector to the climate change, especially in the developing countries which depend heavily on agriculture. Damage to crops, reduce yields & crop productivity, soil erosion, and land degradation, increase livestock deaths, Salinization of irrigation water are some of the identified impacts towards the agriculture. The General objective of this research is to study the farmers' perceptions of climate change and agricultural adaptation strategies used in dry zone of Sri Lanka. The study was carried out on the major command area in the Mahakanadarawa agro-eco system in the Dry zone of Sri Lanka. Questionnaire method, interviews, field observations were used for the collecting primary data and books and related publications were also used to collect secondary data in this research study. The result of the study shows that the majority of farmers were not very well aware of climatic variations and changes. As a result of that adaptation strategies such as mix cropping (37%), irrigation management systems (37%), diversification of crops and soil conservation, sprinkler irrigation (01%), drip irrigation (0%) used in the study area were very far from satisfactory. Lack of financial facilities (60%), lack of technology (58%), lack of proper agricultural services (48%), shortage of labor (50%), lack of knowledge and information were the major constrains for the adaptation of strategies in the study area.

**Keywords:** Climate Change, Agricultural Adaptation, Adaptation Constrains, Dry Zone, Sri Lanka

## INTRODUCTION

Climate change has been most debated environmental issue in the world in the last two decades and it is considered as the major reason for most of the present environmental problems. The UN appointed Intergovernmental Panel on Climate Change (IPCC) concluded in its assessment reports emphasizing the human activities are responsible for climate change. The change in the atmospheric concentrations of GHGs is the major cause for climate change. The foremost effect of climate change is increase air temperature. With this effect, changes in the atmospheric process, changes in precipitation and sea level rise are happening. Those are directly or indirectly impacted to the system and sectors, regions, and resulting increased ocean acidification and extreme events according to the IPCC 4<sup>th</sup> assessment report. (IPCC, 2007)

Further, the agricultural sector is impacted under the extreme events of climate change effects. Actually agricultural activity is highly sensitive to climate change, largely, because it depends on environmental conditions. Sufficient freshwater supplies, fertile soil, air temperature and average weather conditions all contribute to maintaining agricultural productivity. As agriculture depends directly on environmental conditions, climate change impacts on agriculture are becoming increasingly evident. However Damage to crops, reduce yields & crop productivity, soil erosion, and land degradation, increase livestock deaths, Salinization of irrigation water are some of the identified impacts due to the climate change towards the agriculture according to the IPCC 4<sup>th</sup> assessment report.(IPCC, 2007)

Therefore agricultural sector is most vulnerable to the climate change impacts, especially in the developing countries that are heavily depend on agriculture. For overcome this situation climate change management is essential combining adaptation and mitigation strategies. Some planned adaptation is already occurring on a limited basis and recent studies, according to the 3<sup>rd</sup> Assessment Report finding that adaptation will be vital and beneficial. However, financial, technological,



cognitive, behavioral, political, social, institutional and cultural constraints limit both the implementation and effectiveness of adaptation measures. (IPCC, 2001)

## **MATERIALS AND METHOD**

The General objective of this research is to study the farmers' perceptions of climate change and agricultural adaptation strategies in dry zone of Sri Lanka. The Specific objectives of this research are to identify level of the perception among communities, effects and impacts of climate change on the agricultural sector, the significant climatic variations in Sri Lanka through public perceptions, collection of various suggestions and mitigating measures as used, managed and proposed by the public, the adaptation strategies which already in used in the Dry zone agriculture and the causes for failure of some adaptation strategies.

The study was carried out on the major command area in the Mahakanadarawa agro-eco system in the Dry zone of Sri Lanka. The major command area in Mahakanadarawa agro-eco system is situated in Mihinthale and Rabewa pradesiya Saba area in Anuradhapura district in North central province (NCP). The selected area economy is dominated by the agricultural sector. Therefore paddy cultivation plays a significant role in this area. In addition to that Chena cultivation also contributes to the agricultural economy.

This research falls under the applied research type and follows the approach of the Intergovernmental Panel on Climate Change (IPCC) and it is focus the causes, effects, and management aspects of climate change. This research was conducted using both qualitative and quantitative data. Therefore this research adapts the methodological pluralism. This research was conducted using primary data obtained through the questionnaire survey and secondary data collected from books and other various publications related to study. To collect a primary data, mainly two types of techniques were used. Those are gather information through questionnaire from villagers who are living in long period of time in the selected Mahakanadarawa agro-eco system in Dry zone and the relevant officials. This questionnaire survey

carried out to collect data from the participant residing in the selected area. The sample for questionnaire was designed by using Stratified Random Sampling method. For taking sample from major command area in Mahakanadarawa agro-eco system the researcher selected samples from 6 strata comprising upper, middle, lower sections of the left bank of the canal and right bank of the canal in the major command area in Mahakanadarawa agro-eco system in Dry zone. The researcher completed 60 questionnaire including 10 from each strata to gather information through the whole survey area.

The second type of technique used for collecting data was the relevant officials' interview. An interview was conducted with the officers in the Mahakanadarawa project office. The project manager, Agricultural instructor, Irrigation engineers, Institutional Development Officers were among the officer participated in the interview. In this interview it has also observe the agricultural patterns, perception of effects and impacts of climate changes, the adaptation strategies which already in used, the causes for failure of some of adaptation strategies through the factors of financial, technological, cognitive, behavioral, political, social, institutional and cultural constrain on the agricultural sector in the major command area in Mahakanadarawa agro-eco system in Dry zone. The researcher also conducted in-depth studies in some agricultural farming areas in the specific site. This technique was conducted separately from the above two techniques. The collected data during the questionnaire survey was summarized by using simple statistical methods with the aid of excel and correlation factor analyzing methods.

## **RESULTS AND DISCUSSION**

### **1. Level and source of knowledge**

More respondent were not aware of climate change. Majority of the people who were not aware of climate change and those who aware got the knowledge on climate change through the school, television, radio, newspapers, scientist, and awareness program ( Figure 1). The perception of distribution pattern of knowledge



according to the source of category analysis that more than 24% of respondents were aware of climate change directly through their own experiences. This is the highest percentage in the source of knowledge. It means that majority of farmers had experience to know the changes of climate and its variation. More than 21% of respondents were aware of climate change by the source of television and 17% of respondents by the source of radio. The respondents who are living in the study area have got the knowledge of climate change through the newspaper (14%), scientist and awareness programs (12%), school (7%), other (5%) respectively ( Figure 1).

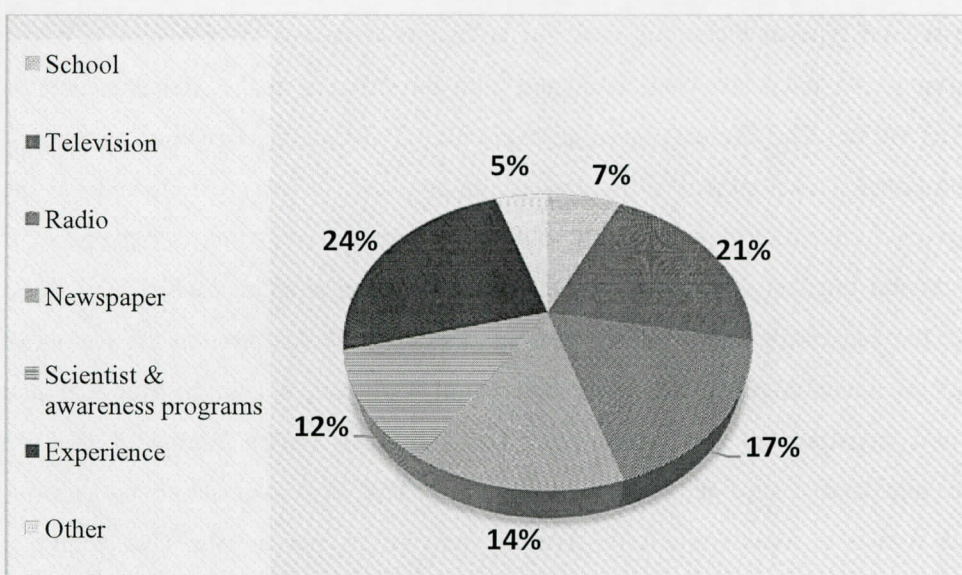


Figure1. Source of Knowledge on Climate Change

(Source: field survey, 2014)

The frequency values of statistical representation on the knowledge source of climate change have discussed below with SPSS statistical tables.

Among the variables considered for measuring source of farmers knowledge 'Experience' had the highest mean value. Meanwhile the lowest Std. Deviation is also recorded by the same variable. This means that among the sample highest score

combine with lowest Std. Deviation shows strongest mean of knowledge which has a low variation among the respondents. Therefore it can be concluded the experience is the dominant source of knowledge in climate changes among the rural people.

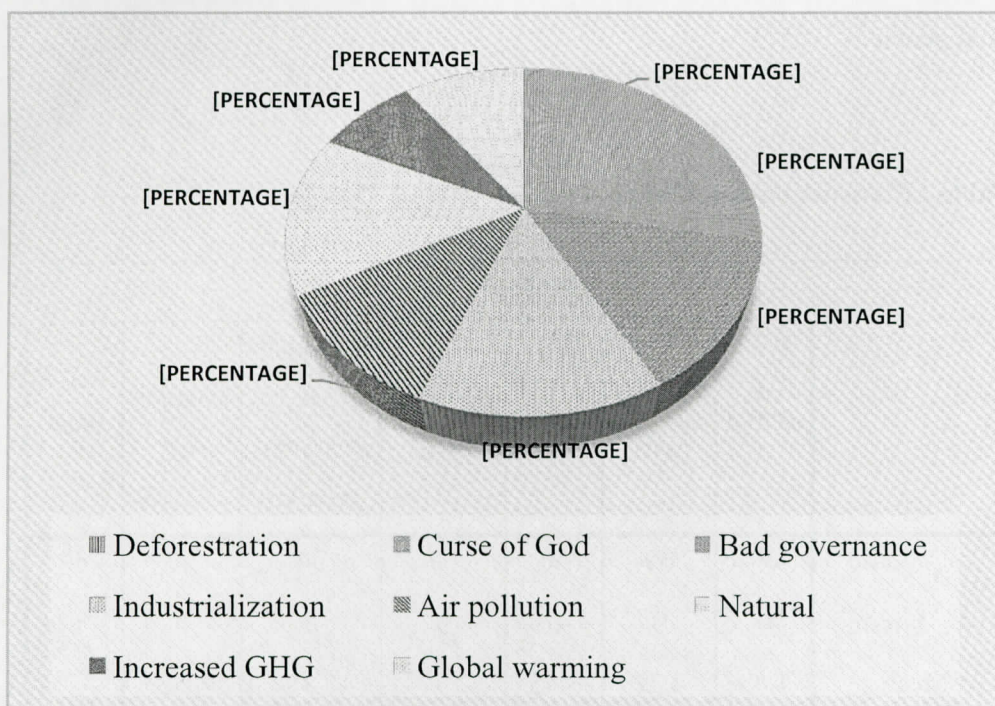
**Table 1. Statistics on Knowledge source of climate change**

		Statistics						
		school	Television	Radio	Newspaper	Scientist & awareness program	experience	other
N	Valid	60	60	60	60	60	60	60
	Missing	0	0	0	0	0	0	0
	Mean	1.48	4.22	3.45	2.77	2.38	4.83	1.12
	Std. Deviation	.892	1.091	1.501	1.533	1.451	.493	.490

## 2. Perception on causes for climate change

The people who are aware of climate change in the study area have identified deforestation as the major cause for climate variations (Figure2). 17% of respondents stated that the Deforestation is the major cause for climate variations. Then the development activities such as use of vehicles, rapid industrialization, urbanization and bad governance are another cause for climate change according to the 14% of respondents. The natural causes and curse of god, Increased GHG are the further causes that have 11% and 10% of respondents confirmed respectively.

However according to the 8% of respondents seated at the air pollution is another cause for climate change(Figure2).

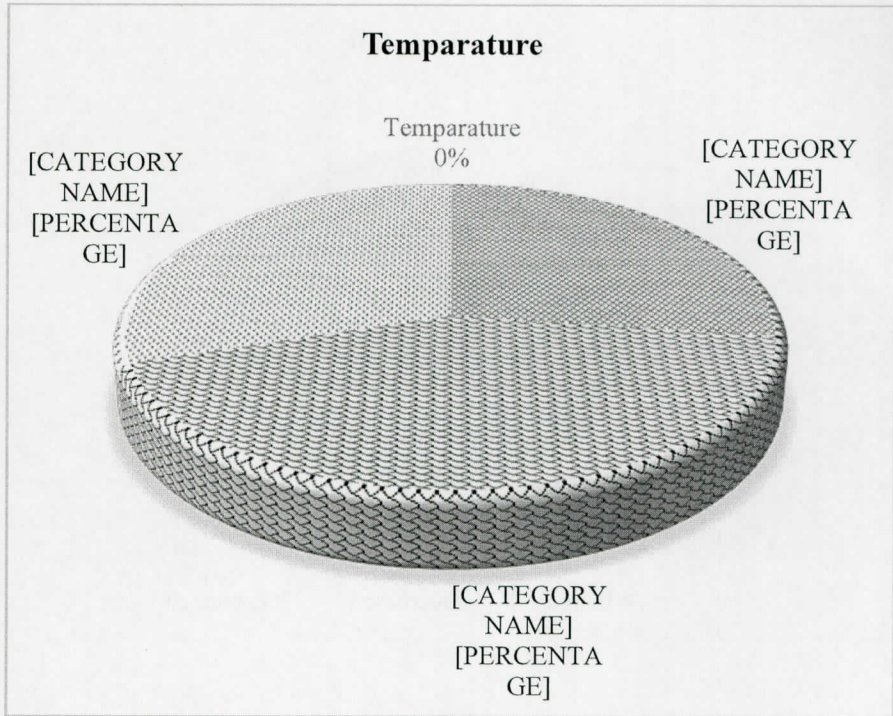


**Figure2. Causes of Climate Change** (Source: field survey, 2014)

### 3. Farmers Perception on changes : Temperature, Rainfall amount, Rainfall intensity, Rainfall pattern, Dryness

The analysis of farmers' perceptions of climate change indicates that most of the farmers in this study area were not aware of the fact variation of climate changes (Figure3, Figure 4, Figure 5, Figure 6 and Figure 7). To get information on their perceptions of climate change, farmers were asked if they have observed any change in temperature or the amount of rainfall over the past years. (To clarify, farmers were also asked whether the number of hot or rainy days had increased, decreased, or stay the same over the past years.)





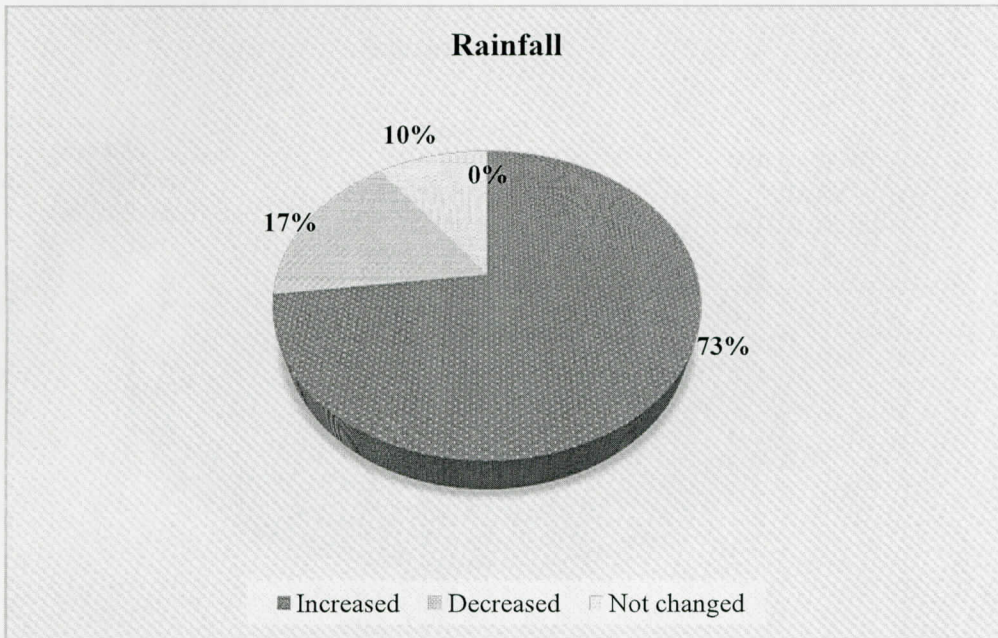
**Figure 3. Profile of Change in air temperature**

(Source: field survey, 2014)

There is a decrease in air temperature and more than 43% respondents clearly stated that the air temperature has decreased in the study area. 30% of respondents said that there is no variation on air temperature and 27% of respondents stated that the air temperature has increased.

The change in rainfall level in the selected study area has increased when compared with the past. More than 73% of the people stated that the rainfall level has increased severely in the recent few decades. 17% of respondent stated that rainfall level has increased and 10% of people said that there has no change in rainfall level and its stay with same.



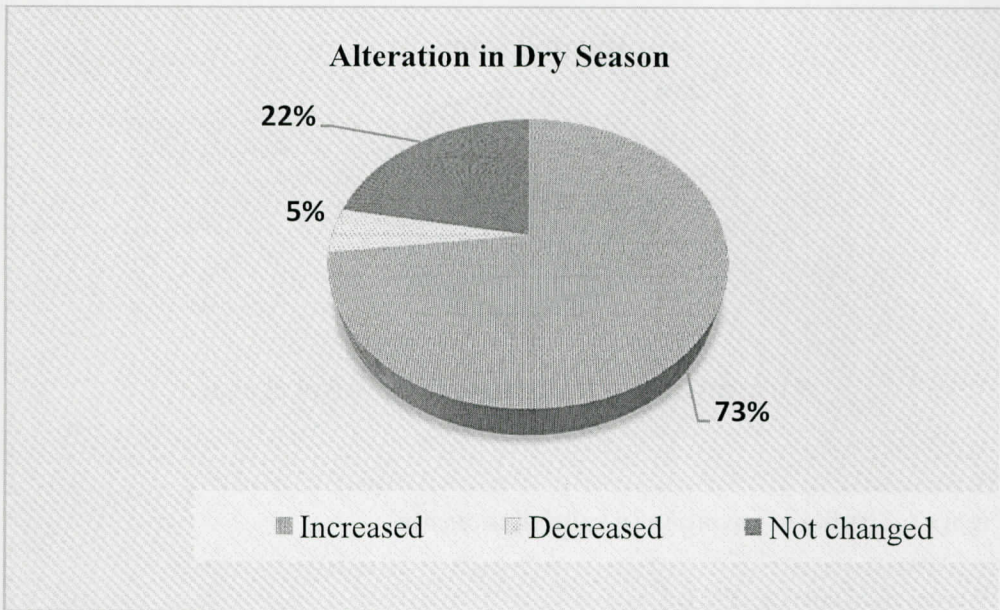


**Figure 4. Profile of change in rainfall level**

(Source: field survey, 2014)

Following is the variation of dry season according to the respondents.

About 64% respondents said that the dry season has stay at same to the previous period and also that there is no distinct dry season as in the past. There are several rains even in the driest month of the dry season. During the past there was a distinct dry and wet period and people have adapted to the lifestyle according to that pattern.

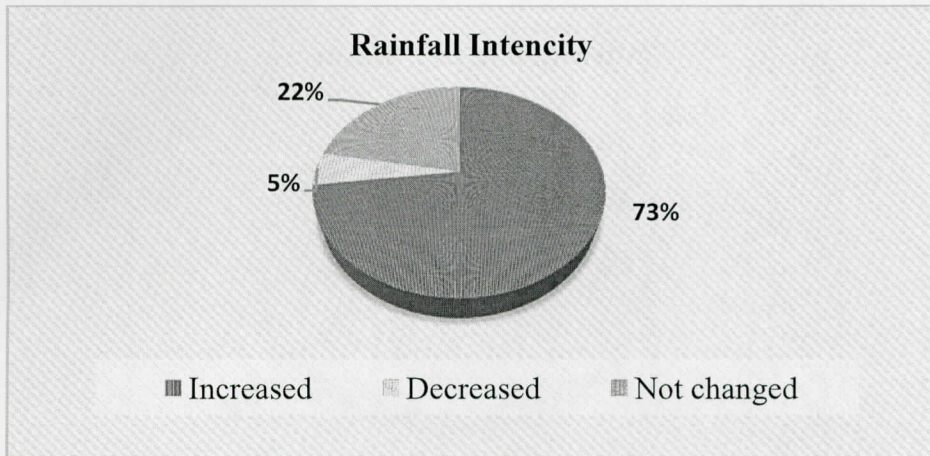


**Figure 5. Alteration in dry season**

(Source: field survey, 2014)

As there is no such distinct pattern the people who depend mainly on the environment related jobs are in a critical condition.

The rainfall intensity of the selected study area has increased when compared with the past. More than 73% of the people stated that the rainfall intensity has increased severely in the recent few decades.

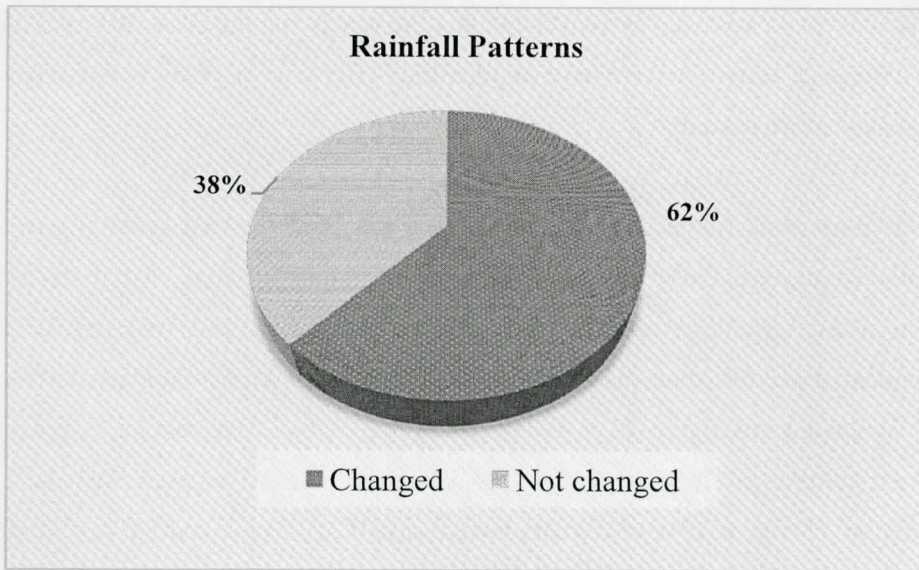


**Figure 6. Profile of variation in rainfall intensity**

(Source: field survey, 2014)

More than 62% of people stated that the rainfall pattern has changed and the on setting of the monsoon has shifted backwards. This phenomenon is similar to the shifting of dry season. As the regular pattern has changed the climatic changes cannot be predicted. In the past the variation of the dry and wet season could be easily predicted and according to it the agricultural practices were carried out. Due to the unbalanced climatic variations the agriculture pattern and its dependent life has become more difficult.





**Figure 7. Profile of variation of rainfall pattern**

(Source: field survey, 2014)

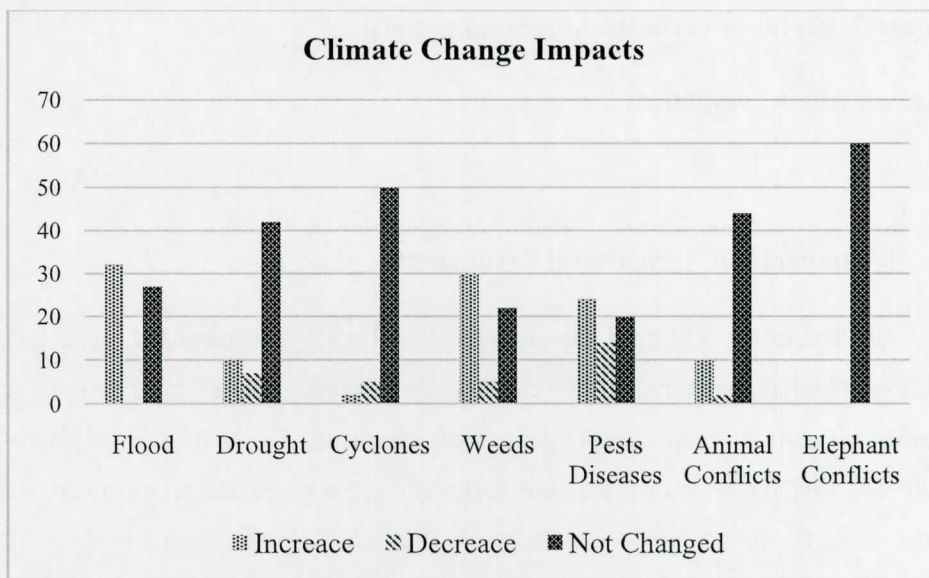
#### **4. Impacts on Agricultural Productivity**

As indicated in the Figure 8 the frequency of floods has increased, especially in selected Mahakanadarawa agro-eco system which leads to decrease crop productivity. As 33 of the respondents have confirmed the frequency of floods has increased this figure shows that the majority of the respondents are aware of the variation of floods.

Natural disasters such as cyclones, droughts, floods, Increases weeds and pest diseases animal conflicts and elephant conflict have increased, decrease and no changed when compared with the frequency of data set. According to the figure majority of respondent seated that floods have increased (33), decreases (0), No change (27). Then the impact of drought has No change (42). Few of respondents (11) said that the drought has increased and other 7 of respondent seated that there has decreases of drought in the selected area. The majority of the farmers from the

Mahakanadarawa agro-eco system stated that the weeds and the pests diseases have been increased. However there have no identified effects on elephant in this selected Mahakanadarawa system.

The environmental related agricultural income has been reduced according to the climatic conditions. Only about 6.7% of the respondents stated that there is no alteration in agriculture due to the climatic variations. But majority of the respondents have lost their production income due to the climate impacts as flood. After analyzing this figure 23 it was revealed that 3.3% of farmers have lost their total agricultural productivity and 11.7% of farmers have lost more than half of production. However 20% of farmers have lost half of income and 58% of farmers have lost their income of 25%.

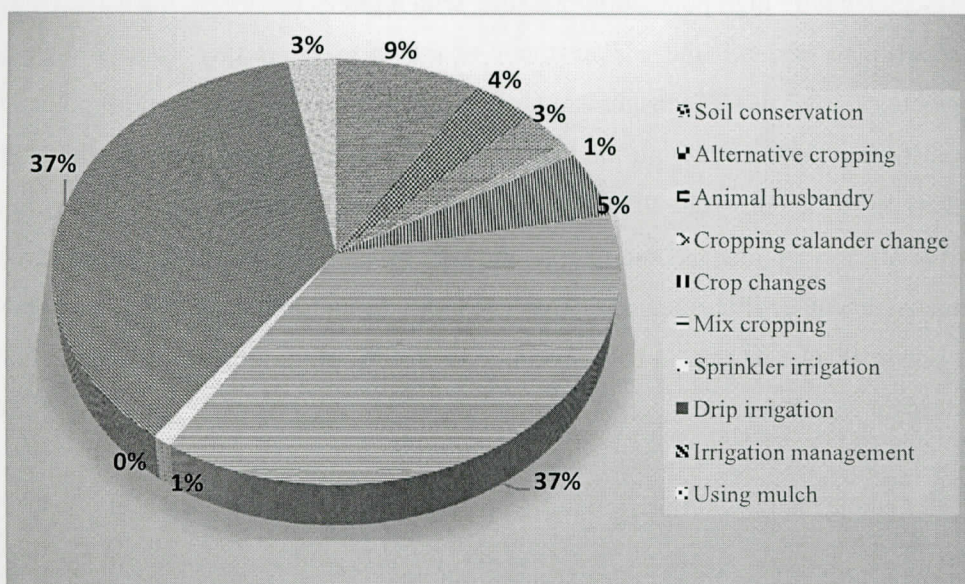


**Figure 8. Perception on Climate Change Impacts**

(Source: field survey, 2014)

## 5. Adaptations, Barriers and Proposed Adaptation Methods

The adaptation methods for this study are based on asking farmers about their perceptions of climate change and the actions they take to counteract the negative impacts of climate change (Figure 9). As indicate in Figure 9, use of mix cropping (37%) and irrigation management (37%) are the most commonly used methods, whereas use of crop changes and soil conservation are the adaptation least practiced among the major adaptation methods identified in the Mahakanadarawa agro-eco system. Greater use of mix cropping and irrigation management as an adaptation method could be associated with the lower expense and ease of access by farmers; however the water management practices as d rip irrigation (0%) and sprinkler irrigation (1%) could not be practice, while the limited use of sprinkler and drip irrigation could be attributed to the need for more capital and low potential for technology. Moreover, the surveyed farmers reported that they have taken those adaptation methods for a small quantity due to the number of reasons, discussed below.



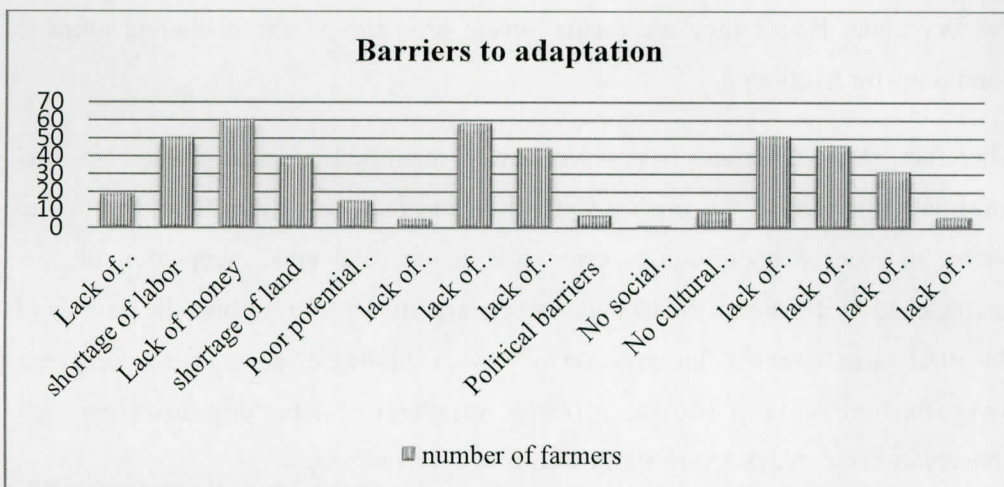
**Figure 9. Percentages of Adaptation Practices**

(Source: field survey, 2014)



## **BARRIERS TO ADAPTATION**

The analysis of barriers to adaptation to climate change in the Mahakanadarawa agro-eco system indicates that there are five major 15 major constraints to adaptation. These are lack of information, lack of money, shortage of labor, shortage of land, poor potential for irrigation, lack of scientific information, lack of technology, lack of knowledge, political barriers, and lack of chances for loans, lack of institutional support, no social background, and no cultural background, lack of agricultural services, lack of positive thinking (Figure 10). Most of these constraints are associated with poverty. For instance, lack of information on appropriate adaptation options could be attributed to the dearth of research on climate change and adaptation options in the area. Lack of money hinders farmers from getting the necessary resources and technologies that facilitate adapting to climate change. Adaptation to climate change is costly and the need for intensive labor use may contribute to this cost. Thus, if farmers do not have sufficient family labor or the financial means to hire labor, they cannot adapt. Shortage of land has been associated with high population pressure, which forces farmers to intensively farm a small plot of land and makes them unable prevent further damage by using practices. Poor water management (such as sprinkler and drip irrigation) potential is most likely associated with the inability of farmers to use the water that is already there in sufficiently, due to technological and financial incapability. Farmers in this area are mostly low income people and cannot afford to invest in irrigation water management practices as sprinkler and drip irrigation technologies to adapt to climate change or sustain their livelihoods during harsh climatic extremes, such as drought and flood.



**Figure 10. Barriers to adaptation**

(Source: field survey, 2014)

## CONCLUSION

Climatic changes have created negative impact on agricultural sector not only in study area of Mahakanadarawa in the Dry Zone but also in all over the county, Sri Lanka. Since other source of income opportunities very limited in rural areas, perception and adaptation strategies plays significant role especially in agricultural sector. According to the research findings utilization of adaptation strategies in the study area were very far from satisfactory due to various reasons. Lack of knowledge and technology in this regards were the main reasons for this situation. The knowledge of rural farmers on climate change and adaptation strategies is not adequate to face these challenges.

The knowledge of rural villagers on climate change and adaptation strategies is very low due to the failure of the present information and education system. As well as low accessibility of agrarian services centers and other agencies also contributed to create this situation in the study area. Information on climatic changes and newly identified adaptation methods do not reach the poor farmers living in rural area of

the Dry zone. Hence they are facing severe problems in the prevailing climatic conditions for livelihood.

Therefore it is essential to provide newly identified adaptation methods and information related to this aspects to rural area satisfactory. Since there is no other source of income opportunities especially in the rural area. Adaptation of new strategies to face the climatic changes is very significant to overcome the poverty of the rural farm families. Introduction of new technologies such as mix cropping diversification of crop pattern, sprinkler irrigation system, drip irrigation, soil conservation etc. plays a very significant role in this regard.

Introduction of new technologies for climatic changes with necessary information along is not sufficient to increase the level of income of rural farm families. Availability of other resources and inputs required for agriculture is very important to improve the yields of crops and other cultivations. Provision of financial facilities with other resources such as fertilizers, seeds and agricultural extension facilities in time are also very much essential the racing of income and living standard of rural farmers and reducing their poverty.

## **RECOMMENDATIONS**

Adaptation of strategies for climatic changes at present is not adequate to obtain substantial income from agricultural sector. Hence new adaptation strategies such as irrigation management, mix cropping cultivation, sprinkler irrigation and drip irrigation systems, crop diversification, soil conservation etc. should have further introduced and strengthened to achieve the expectation of rural farm families in the area.

Provisions of financing facilities, inputs and other extension servicers in time should be ensured to implement plans and other activities related to agriculture without any obstacles or constrains. Financial support with suitable loan scheme or lending program with low interest rate must be introduced with easy access to overcome the prevailing financial difficulties. Awareness programs and training



programs should be conducted to introduce new technologies with demonstration on regular basis. Awareness programs along are not sufficient to change the attitudes of traditional farmers towards the new technologies as we expected. Therefore attention should be given to motivate farmers through the demonstration programs. For example farmers do not well known how to implement and functioning the sprinkler and drip irrigation systems. Hence practical knowledge is essential to make these programs a success. Then farmers should be able to visit and get practical knowledge and experience through already established sprinkler and drip irrigation systems in the Dry Zone under the guidance of Department of Agriculture. Therefore at the end of awareness program field programs should be organized to visit such important places where new technologies implemented in the area. Animal husbandry must be encourage with special emphasis in dairy farming. Positive thinking must be further built up among farm families to motivate them for new adaptation practices.

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