

## Farmers Coping Mechanism and Suggestions to Mitigate the III-Effects of Climate Change in North Karnataka, India

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### ABSTRACT

Climate change is one of the severe challenge the world is facing today. The problem of climate change induced by humans came first into force and drew the attention of the scientists and policy makers when Inter Governmental Panel on Climate Change (IPCC) was established. For achieving the objectives of the study primary data was used. To analyse the factors influenced the adoption of adaptation strategies Binary Logit Model and Garrett's ranking technique was used. Relevancy Rating Technique was employed to ascertain the suggestions made by sample farmers to mitigate the ill effects of climate change. The study reveals that the farmers have initiated different adaptation measures (10 farm and 8 income management strategies) to mitigate the effects of climate change and initiated subsidiary enterprises and also the farmers have felt that providing early warning signals and creating awareness on appropriate adaptation technologies are more relevant and important than creating awareness on organic farming technologies and providing incentives on green manuring. This is a good trend and it has to be supported by organizing training programmes by development departments. In order to retain the farmers in their occupation a fixed source of income need to be provided.

**Key words:** Climate change, Ill effects, Management strategies and Socio-economic factors

### INTRODUCTION

Climate change is one of the severe challenge the world is facing today next to population growth. The problem of climate change induced by humans came first into force and drew the attention of the scientists and policy makers when Inter Governmental Panel on Climate Change (IPCC) was established. The effects of climate change are various and there is a need to create awareness about its impact on various sectors of economies.

### Agriculture and Climate Change

Indian economy is mainly dependent on agriculture, as agriculture is one of the main sources of livelihood of about 58 per cent of the population in the country. In 2017, agriculture sector alone contribute 13.6 per cent of India's Gross National Product (GNP), plays a very crucial role in the country's development and shall continue to occupy an important place in the economy.

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It sustains the livelihood of about 70 per cent of the population, employs about 51 per cent of the work-force and contributes 10 per cent to export earnings.

Climate and agriculture are mutually linked together. Climate change affects agriculture in many ways, including changes in average temperatures, rainfall, climate extremes, changes in pests and diseases; changes in atmospheric carbon dioxide and ground-level ozone concentrations etc. Climate change is mostly affecting agriculture, with unevenly distributed effects across the world. In future, climate change will likely have negative effect on crop production in low latitude countries, while effects in higher latitude countries may be positive or negative. Climate change may probably increase the risk of food insecurity in the vulnerable groups or underdeveloped countries. It's obvious that any major change in climate on a global scale will impact local agriculture, and therefore affect the world's food supply. Considerable studies have been carried out to investigate how agriculture is affecting in the different regions. Many climatologists predicted a significant global warning in the coming decades will occur due to rising atmospheric carbon dioxide and other green-house gas emission. Climate change also have an economic impact on agriculture, including variations in farm profitability, prices, supply, demand and trade. The magnitude and geographical distribution of such climate changes may affect the ability to increase the food production, area as required to feed the burgeoning population. Agriculture sector is very sensitive to short-term changes in weather and to seasonal, annual and longer-term variations in climate. In the long-term changes, agriculture is able to tolerate moderate variations in the climatic condition. Changes beyond these limits of tolerance may require shifts in crops and cultivars, new technologies and infrastructure or conversion to different land uses.

#### MATERIAL AND METHODS

For achieving the objectives of the study primary data was used. Realizing the

importance of study on climate variability related to agriculture, the study was conducted in Dharwad and Bagalkot districts of North Karnataka by interviewing over 240 selected sample farmers. The primary data were collected through multi stage random sampling technique. To analyse the factors influenced the adoption of adaptation strategies Binary Logit Model and Garrett's ranking technique was used. Relevancy Rating Technique was employed to ascertain the suggestions made by sample farmers to mitigate the ill effects of climate change.

#### RESULTS AND DISCUSSION

##### Farmers coping mechanism and suggestions made by sample farmers to mitigate the adverse effects of climate change

Traditionally farmers practice various adaptation strategies to secure their occupation as well as income from the adversities caused by climate variability. Various coping mechanisms or strategies followed by sample farmers are categorized under two groups *viz.*, farm and income management strategies which are discussed under below.

##### Factors influenced the adoption of adaptation strategies

The various socio-economic characteristics of sample respondents influence the adoption of different adaptation strategies by farmers (Table-1). The important factors like age of the farmers, his education level, his farming experience, social participation, his farm holding size, livestock possessions, his access to irrigation and access to institutional credit significantly influence the adoption of strategies to overcome the ill-effects of changing climate in the study area. Deressa *et al.*<sup>4</sup> reported that different socio-economic and environmental factors influence the coping with climate extremities. The elderly farmers who have more experience in farming adopt more and furthermore, availability of irrigation facility gives the farmers leverage to try various strategies like inter / mixed cropping, contingent cropping, intensive cropping and repeated sowing *etc.* to sustain their occupation in order to maintain their

livelihood. On the other hand, livestock possession gives the farmers option to skip crop production during a distress agricultural season. In addition, education level of farmers, farm holding size, institutional credit availed and social participation also significantly influences the adoption, further off-farm occupation positively influence adoption while family size was negatively influence the adoption, though both factors do not significantly influence adoption. These findings were in line with the results obtained from Varadhan and Kumar<sup>12</sup>.

#### **Farm management strategies followed by sample farmers**

Adaptation to climate change requires that farmers should first notice that the climate is changing and then identify the necessary adaptation measures and implement them<sup>6</sup>. Furthermore, adaptation to climate change refers to any adjustment that occurs naturally within ecosystem or in human system in response to the changing climate that either exploits beneficial opportunities in response to actual or expected climate changes. Some of the important adaptation options in the agricultural sector includes crop diversification, mixed crop, livestock farming systems, changing planting and harvesting dates, using different crop varieties, drought-resistant varieties and high-yield water sensitive crops<sup>1</sup>.

Various farm management strategies followed by sample farmers were listed in the Table -2. It may be noted that the crop diversification (e.g. Agro – Horti - Vegetables) was the foremost strategy practiced by most of the respondents in study district (Dharwad) which was followed by inter/mixed cropping (e.g. redgram + pearl millet, redgram + maize + sorghum, redgram + groundnut). Cooper *et al.*<sup>3</sup> identified that diversification is identified as coping strategy that has evolved to deal with both expected rainfall uncertainty and evolved within season fluctuations in rainfall. Some section of farmers also follow the alternate cropping system with short duration crops or vegetables besides growing commercial crops (eg. cotton and sugarcane).

Among sample farmers surveyed in Dharwad district, agriculture was the main occupation and food crops are predominant which was followed by vegetables. The farmers in the region forged to crop diversification as well as mixed farming in order to reduce the risk associated with changing climate. In Bagalkot district, the principal farm management strategy practiced by majority of sample farmers was mixed /inter cropping (jowar + redgram, groundnut + jowar, chickpea + jowar) which was followed by manipulating the sowing date in accordance with the arrival of monsoon rains. In both study districts majority of sample farmers reported that crop diversification and mixed cropping was major strategies followed to reduce the negative impact of climate changes. Mixed cropping systems are better and able to cope with changes in climatic condition<sup>7</sup>. The similar findings were also observed by Rimi *et al.*,<sup>11</sup> and reported that majority of the farmers in the coastal region adopted Inter cropping, integrated farming, homestead gardening, moved to non-farm activities and zero tillage *etc.* to cope with climate variability. Varadhan and Kumar<sup>12</sup> reported that majority of the farmers in Varudhnagar and Villupuram districts of Tamil Nadu practiced the farm management strategies to reduce the adverse impact of climate change like intercropping/mixed cropping, alternate cropping with short duration vegetables, crop diversification and manipulating sowing date were.

#### **Income management strategies followed by sample farmers**

Various income management strategies are followed by sample farmers to maintain their livelihood especially during climate adversities (Table-3). Looking towards non-farm employment opportunities was the predominant strategy followed by majority of sample farmers in the study area since it safeguards the farmers especially during adversities and forms the major source of buffer to the sample farmers which was followed by borrowing loans from money lenders, friends and relatives. Portion of farmers also followed distress migration in

search of life sustaining employment opportunities is a feature of dryland tract. Depending on government relief measures after any natural disaster was another strategy followed by the sample farmers. Government relief measures play critical role in protecting farmers against natural calamities. It acts as buffer to most of the farmers during crop failure and economic distress caused due to climate shock condition. Since most of the farmers in study taluks depends on agriculture and in turn depends on monsoon rains for their agricultural practices. Due to adversities caused by climate change and frequent failure of monsoon in the recent years farmers in the study area opted for non-farm employment strategy to reduce the ill-effects of climate variability. Though not in big way farmers in both study districts (Dharwad and Bagalkot) purchases crop insurance policies when they availed crop loan. These findings were in line with the results inferred by Varadan and Kumar<sup>12</sup>

#### Suggestions made by sample farmers to overcome the constraints

It was observed from the analysis that the sample farmers were facing too many constraints in initiating the adaptation

measures in response to the adverse effects of climate variability so to overcome these constraints the farmers have expressed their suggestions (Table-4). The data revealed that the foremost suggestion made by respondents was providing early warning signals about the environmental changes (rank I) followed by creating awareness about appropriate adaptation measures against climate change (rank II), ensuring supply of production inputs at appropriate time (rank III) etc. Creating awareness on organic farming technologies (rank IX) and giving incentives/ support for increasing the green manuring (last rank) were the less important suggestions quoted by the respondents. It may be because that the farmers might have felt that providing early warning signals and creating awareness on appropriate adaptation technologies are more relevant and important than creating awareness on organic farming technologies and providing incentives on green manuring. Above findings are in line with the results of Pande and Akermann<sup>9</sup> and Pettengell<sup>10</sup>. Therefore, the hypothesis that the sample farmers have various coping mechanism to reduce the ill-effects of climate change was accepted.

**Table 1: Factors influencing adoption of adaptation strategies**

(n=240)

SI. No.	Variable	Co-efficient	Standard error	p-value
1.	Constant	2.857	3.231	0.859
2.	Age	0.081	0.019	0.003***
3.	Education	1.304	0.482	0.042**
4.	Family size	-0.439	0.540	0.147
5.	Farming experience	0.100	0.145	0.008***
6.	Social participation	1.823	0.367	0.009***
7.	Farm holding size	-0.042	0.035	0.001***
8.	Live stock	-0.720	0.013	0.092*
9.	Irrigation	1.388	0.032	0.002***
10.	Institution credit	-3.588	1.013	0.001***
11.	Off farm occupation	1.353	0.555	0.756
	Chi-square value	125.059***		

Note: \*, \*\* and \*\*\* denote significance at 10 %, 5 % and 1 %, respectively

**Table 2: Farm management strategies followed by sample farmers**

(n=240)

Sl. No.	Strategies/coping mechanism	Mean Garrett Score	Rank
1.	Crop diversification	95.45	I
2.	Inter/ mixed cropping	77.42	II
3.	Alternate cropping	64.09	III
4.	Drought tolerant varieties	60.91	IV
5.	Water conservation practices	56.52	V
6.	Reducing fertilizer application	47.58	VI
7.	Dry sowing	34.09	VII
8.	Manipulating sowing date	32.42	VIII
9.	Contigent cropping	11.97	IX
10.	Widening irrigation interval	11.14	X

**Table 3: Income management strategies followed by sample farmers**

(n=240)

Sl. No.	Strategies/coping mechanism	Mean Garrett Score	Rank
1.	Non-farm employment	70.35	I
2.	Borrowing from money lenders	69.50	II
3.	Borrowing from friends and relatives	57.70	III
4.	Migration	55.24	IV
5.	Government relief funds	45.36	V
6.	Sale of livestock	38.67	VI
7.	Crop Insurance policy	34.40	VII
8.	Jewel loan from banks	30.05	VIII

**Table 4: Suggestions to mitigate the ill effects of climate change**

(n=240)

Sl. No.	Farmers suggestions	Relevancy rates	Rankings
1.	Early warning has to be given to the farmers about environmental changes	1.00	1
2.	Creating awareness to the farmers about appropriate adaptation measures against climate change	0.97	2
3.	Development department should ensure supplying of production inputs at appropriate time in the villages	0.97	3
4.	Subsidies/compensation has to be given for the crops to make up the cost of cultivation due to weather aberrations	0.89	4
5.	Green coverage has to be increased	0.85	5
6.	Insurance has to be extended to all crops	0.83	6
7.	Support price has to be given to all the crop produce based on cost of cultivation	0.76	7
8.	Providing financial support for soil nutrient enrichment	0.75	8
9.	Creating awareness/ Support for adoption of organic farming technologies	0.69	9
10.	Incentives/support for increasing the green manuring	0.57	10

### CONCLUSION

The study reveals that the farmers have initiated different adaptation measures (10 farm and 8 income management strategies) to mitigate the effects of climate change and initiated subsidiary enterprises and also the farmers have felt that providing early warning signals and creating awareness on appropriate adaptation technologies are more relevant and important than creating awareness on organic farming technologies and providing incentives on green manuring. This is a good trend and it has to be supported by organizing training programmes by development departments. In order to retain the farmers in their occupation a fixed source of income need to be provided. Agriculture is certainly becoming an increasingly risky business because of adverse climatic situations. Hence, Government along with an insurance agency need to make the scheme more attractive and popularize apart from maintaining accountability of schemes in order to ensure greater participation and benefits of the scheme.

### REFERENCES

1. Bradshaw, B., Dolan, H. and Smit, B., Farm-level adaptation to climatic variability and change: Crop diversification in the Canadian prairies. *Climatic Change*, **67**: 119 -141(2004).
2. Bryan, E., Ringler, C., Okoba, B., Roncoli, C., Silvestri, S. and Herrero, M., Adapting agriculture to climate change in Kenya: Household and community strategies and determinants, *ILRI report to the World Bank for the project "Adaptation to climate change of smallholder agriculture in Kenya"*. Nairobi, Kenya, p. 30 (2011).
3. Cooper, P. J. M., Dimes, J., Rao, K. P. C., Shapiro, B., Shiferaw, B. and Twomlow, S., Coping better with current climatic variability in the rain-fed farming systems of sub-Saharan Africa: An essential first step in adapting to future climate change. *Agric. Ecosystems Environment*, **126(1-2)**: 24-35. URL: <https://vpn.uia.no>. (2008).
4. Deressa, T. T., Ringler, C. and Hassan, R., The factors affecting the choices of coping strategies for climate extremes: The case of farmers in the Nile basin of Ethiopia. *IFPRI Discussion paper No.1032*, International Food Policy Research Institute (IFPRI), Washington, DC, USA, p. 35 (2010).
5. Ishaya, S. and Abaje, I. B., Indigenous people's perception on climate change and adaptation strategies in Jema'a local government area of Kaduna state, Nigeria. *J. Geo. Reg. Planning*, **1(8)**: 138-143 (2008).
6. Maddison, D., The perception and adaptation to climate change in Africa. *Policy Research Working Paper 4303*, World Bank Development Research Group, Sustainable Rural and Urban Development Team, South Africa, p. 53 (2007).
7. Nhemachena, C. and Hassan, R., Micro-level analysis of farmers' adaptation to climate change in Southern Africa, *IFPRI Discussion Paper No. 00714*, Washington, DC, USA, p. 32 (2007).
8. Nzeadibe, T. C., Egbule, C. L., Chukwuone, N. A. and Agu, V. C., Climate change awareness and adaptation in the Niger Delta Region of Nigeria. *African Technology Policy Studies Network (ATPS) Working Paper Series*, Nairobi: ATPS, p. 22(2011).
9. Pande, P. and Akermann, K., Adaptation of small scale farmers to climatic risks in India. *Sustainet India*, B-4 GK II, New Delhi, India. p.16(2010).
10. Pettengell, C., Climate change adaptation: Enabling people living in poverty to adapt. *Policy research working paper 4342*, World Bank, Washington, DC. **6(2)**: 1-48 (2010).
11. Rimi, R. H., Rahman, S. H., Karmakar, S., Hussain, S. G., 2009, Trend analysis of climate change and investigation on its probable impacts on rice production at Sathkhira, Bangladesh. *J. Meteorol.*, **6**:37-50.
12. Varadan, R. J. and Kumar, P., Indigenous knowledge about climate change: Validating the perception of dryland farmers in Tamil Nadu. *Indian J. Trad. Know.*, **13(2)**: 390-397 (2014).