IC Value 2016 : 61.33| SJIF Impact Factor(2017) : 7.144| ISI Impact Factor (2013): 1.259(Dubai)|UGC J No :47335

Research Paper | Volume - 6, Issue- 2,February 2018|e-ISSN : 2347 - 9671| p- ISSN : 2349 - 0187

EPRA International Journal of Economic and Business Review

IMPACT OF CLIMATE CHANGE ON FARM HOUSEHOLDS IN CUDDALORE DISTRICT TAMIL NADU

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ABSTRACT

The climate change results in extreme weather events in terms of erratic rainfall, delayed rainfall, unseasonal rainfall, over rainfall, deviation from normal rainfall, frequent occurrence of drought and desertification. Climate change alters the cropping pattern and farming practices. Climate change has significant impact on sustainable farming practices. This paper deals with impact of climate change on farm households. It outlines the various indicators on impact of climate change on farm households. This paper identifies various impact of climate change on farm households according to their farm size, education level, family size and gender status. This paper concludes with some interesting findings.

KEYWORDS:
climate change, erratic rainfall, farm households, cropping pattern, food security

INTRODUCTION

According to the 5th IPCC assessment report, on a global level, climate change could affect food security by the mid-21st century and that most of the food insecure would continue to be in South Asia, where there are currently roughly 300 million undernourished people. Many believe agriculture is the most susceptible sector to climate change. This is attributed to the fact that climate change affects the two most important direct agricultural production inputs; precipitation and temperature. Expected long term changes in rainfall patterns and shifting temperature zones are expected to have negative effects on agriculture. Climate change also indirectly affects agriculture by influencing emergence and distribution of crop pests and livestock diseases, exacerbating the frequency and distribution of adverse weather conditions, reducing water supplies and irrigation; and enhancing severity of soil erosion. These climatic hazards are becoming the major forces challenging the livelihood of most farmers. The rural population, for whom agriculture is the primary source of food, direct and/or indirect employment and income, will be most affected due to agriculture's vulnerability to climate changes. It could be noted that over 70% of rural populations 'in India rely on rain fed small holder agriculture for subsistence and livelihood. This dependence makes farmers vulnerable to the adverse impacts of climate change implying that any significant change in climate or weather patterns not only has the potential to impact on farming activities but also threatens to increase poverty in the already vulnerable communities.

REVIEW ON THE SUBJECT

Miguel A. Altieri and Clara I. Nicholls (2017) , reported that the threat of global climate change has caused concern among scientists because crop production could be severely affected by changes in key climatic variables that could compromise food security both globally and locally. Delaporte Isaure and Mathilde Maurel (2016) , reported from their study that climate change is expected to disproportionately affect agriculture; however, there is limited information on smallholder farmers 'overall vulnerability and adaptation needs. Jagadish Thaker and Anthony Leiserowitz (2014) investigated the factors driving shifting Indian discourses of climate change by conducting and analyzing 25 interviews of Indian climate policy elites, including scientists, energy policy experts, leading government officials, journalists, business leaders, and advocates. Naresh Soora, et.al., (2013) carried out a simulation analysis using the InfoCrop-rice model to quantify impacts and adaptation gains, as well as to identify vulnerable regions for irrigated and rain fed rice cultivation in future climates in India

Prabhat Barnwal and Koji Kotani (2013) examined the case of rice yield in Andhra Pradesh, India, an important state producing rice as a main crop but reported to be vulnerable to climate change. S. Naresh Kumar and P.K. Aggarwal (2013) reported that impact of climate change on coconut, a plantation crop, is challenging. However, the development of a simulation model has enabled the process. S. Mahendra Dev (2011) identified climate change related threats and vulnerabilities associated with agriculture as a

sector and agriculture as people's livelihoods exposure, sensitivity, adaptive capacity. K.S. Kavi Kumar (2009) reported that climate change impact studies on agriculture are broadly based on agronomic-economic approach and Ricardian approach. Prasad and Rana, (2006) studied the yield loss between 20% and 60%, depending upon the crop. Sreenivas et al., (2005) conducted field experiment during kharif and rabi seasons to study the effect of weather parameters on grain yield of low land rice. northern States. Sreekanth, P.D., et al., (2004) have observed that crop yield loss varied between 10 and 100% in the case of horticultural and seasonal crops when there was a cold wave from December 2002 to January 2003 in some parts of Jammu, Punjab, Haryana, Himachal Pradesh, Bihar, Uttar Pradesh and north Eastern States. Haldankar et al., (2002) reported that rainy days showed a significant positive correlation with yield. Rainy days explained the yield variability up to 54 per cent.

METHODS AND MATERIALS

This study deals with impact of climate change on farm households in Cuddalore district, Tamil Nadu. In this study 6 blocks in Cuddalore district, Tamil Nadu, India are covered viz., Parangipettai, Cuddalore, Kumaratchi, Keerapalayam, Nallur and Kammapuram. From each block four villages are selected as sample. In total 24 villages are covered in the study. Further from each village 30 farm households are selected as sample. In total 720 farm households are selected as sample under stratified random sampling method. The collected data are classifies tabulated with help of computer programming. Cross tabulation is done by putting independent variables of block, farm size, caste status, educational status, family size and gender status with the dependent variables on impact of climate change on farm households'. The data analysis is done with the help of ANOVA two way analysis, t' test and mean score.

RESULT AND DISCUSSION

Impact of Climate Change on Farm Households'

This section deals with respondents' rating on impact of climate change on farm households'. It can be assessed with the help of 20 factors on a 5 point rating scale. These include loss of household income, shortage of safe drinking water, drying of ponds and wells, reduction in employment, low bio mass production, food shortage, reduction in area under cultivation, loss of soil fertility, decline in livestock yield, decrease of water quality, drought and lower availability of water, decline in crop yield, decline in land productivity, indebtedness, high risk of crop damage from drought, pest pressure, human health problem, farmers depression, decline in soil productivity and increase weed.

Table 1 Block Wise Respondents' Rating on Impact of Climate Change on Farm Households'

Variables	Parangipettai	Cuddalore	Kumaratchi	Keerapalayam	Nallur	Kammapuram	Mean
Decline in crop yield	3.42	3.17	3.03	2.85	2.71	2.46	2.94
Decline in livestock yield	3.81	3.56	3.42	3.24	3.10	2.85	3.33
Food shortage	4.12	3.87	3.73	3.55	3.41	3.16	3.64
Increase weed	2.36	2.11	2.07	1.89	1.75	1.70	1.98
Pest pressure	2.85	2.60	2.46	2.28	2.14	1.89	2.37
Decrease of water quality	3.66	3.41	3.27	3.09	2.95	2.70	3.18
High risk of crop damage from drought	2.91	2.76	2.58	2.42	2.24	2.09	2.50
Decline in soil productivity	2.35	2.30	2.16	1.98	1.84	1.79	2.07
Drying of ponds and wells	4.13	4.08	3.94	3.76	3.62	3.47	3.85
Loss of soil fertility	3.98	3.73	3.59	3.41	3.27	3.02	3.50
Human health problem	2.77	2.52	2.38	2.20	2.06	1.81	2.29
Reduction in employment	4.15	4.00	3.86	3.68	3.54	3.39	3.77
Farmers depression	2.58	2.43	2.25	2.09	1.91	1.76	2.17
Indebtedness	3.12	2.87	2.73	2.55	2.41	2.16	2.64
Drought and lower availability of water	3.41	3.26	3.08	2.92	2.74	2.59	3.00
Shortage of safe drinking water	4.19	4.14	4.05	4.02	3.93	3.73	4.01
Loss of household income	4.20	4.19	4.17	4.15	4.10	3.88	4.12
Decline in land productivity	3.20	2.95	2.81	2.63	2.49	2.24	2.72
Low bio mass production	4.18	3.93	3.79	3.61	3.47	3.22	3.70
Reduction in area under cultivation	4.06	3.81	3.67	3.49	3.35	3.10	3.58
Average	3.47	3.28	3.15	2.99	2.85	2.65	3.07

Source: Computed from primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Variation due to climate change impact of farm households'	54.27128	19	2.856383	523.0874	1.69707
Variation due to blocks	8.894524	5	1.778905	325.7696	2.310225
Error	0.518759	95	0.005461		
Total	63.68456	119			

Data presented in table 1 indicate the block wise respondents' rating on impact of climate change on farm households'. It could be noted that out of the 20 indicators of impact of climate change on farm households', the respondents rate the loss of household income is the first level impact of climate change on farm households' and it is evident from their secured a mean score of 4.12 on a 5 point rating scale. Shortage of safe drinking water is rated at second level impact of climate change on farm households' and it is estimated from the respondents' secured a mean score of 4.01 on a 5 point rating scale. The respondents rate the drying of ponds and wells is the third level impact of climate change on farm households'. It is evident from their secured a mean score of 3.85 on a 5 point rating scale. The respondents rank the fourth level impact of climate change on farm households' by citing the fact that the reduction in employment and it is observed from the respondents' secured a mean score of 3.77 on a 5 point rating scale. Low bio mass production is rated at fifth level impact of climate change on farm households' and it could be known from the respondents' secured a mean score of 3.70 on a 5 point rating scale.

The respondents' rate the food shortage is the sixth level impact of climate change on farm households' and it is revealed from their secured a mean score of 3.64 on a 5 point rating scale. Reduction in area under cultivation is rated at seventh level impact and it observed from the respondents' secured a mean score of 3.58 on a 5 point rating scale. The respondents' rate the loss of soil fertility and it is their eighth level ranking. It is evident from their secured a mean score of 3.50 on a 5 point rating scale. The respondents rank the ninth level impact of climate change on farm households' by citing the fact that decline in livestock yield as per their secured a mean score of 3.33 on a 5 point rating scale. Decrease of water quality is rated at tenth level impact of climate change on farm households' and it is evident from the respondents' secured a mean score of 3.18 on a 5 point rating scale. The respondents' rate the drought and lower availability of water is the eleventh level impact of climate change on farm households' and it could be known from their secured a mean score of 3.00 on a 5 point rating scale. Decline in crop yield is rated at twelfth level impact of climate change on farm households' and it is reflected from the respondents' secured a mean score of 2.94 on a 5 point rating scale. The respondents rank the thirteenth level impact of climate change on farm households' by citing the fact that decline in land productivity. It is evident from their secured a mean score of 2.72 on a 5 point rating scale. The respondents rank the fourteenth level impact of climate change on farm households' by citing the fact that household indebtedness and it is clear from their secured a mean score of 2.64 on a 5 point rating scale. High risk of crop damage from drought is rated at fifteenth level impact of climate change on farm households' as per the respondents' secured a mean score of 2.50 on a 5 point rating scale.

The respondents' rate the pest pressure is the sixteenth level impact of climate change on farm households' and it could be known from their secured a mean score of 2.37 on a 5 point rating scale. Human health problem is rated at seventeenth level impact of climate change and it is reflected from the respondents' secured a mean score of 2.29 on a 5 point rating scale. The respondents' rate the farmers' depression as their observed eighteenth level impact of climate change on farm households' and it is revealed from their secured a mean score of 2.17 on a 5 point rating scale. The respondents' rate the decline in soil productivity is the nineteenth level rated impact of climate change and it could be known from their secured a mean score of 2.07 on a 5 point rating scale. Increase in weed is rated at twentieth level impact of climate change on farm households' and it is reflected from the respondents' secured a mean score of 1.98 on a 5 point rating scale.

The respondents' of Parangipettai block rank the first position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.47 on a 5 point rating scale. The respondents' of Cuddalore block record the second position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.28 on a 5 point rating scale. The respondents' of Kumaratchi block hold the third position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.15 on a 5 point rating scale. The respondents' of Keerapalayam block register the fourth position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.99 on a 5 point rating scale. The Nallur block respondents' occupy the fifth position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.85 on a 5 point rating scale. The Kammapuram block respondents' turn down to the last position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.65 on a 5 point rating scale.

The anova two way model is applied for further discussion. The computed anova value 523.08 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the impacts of climate change on farm households' is statistically identified as significant. In another point, the computed anova value 325.76 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the blocks is statistically identified as significant as per the respondents rated impact of climate change on farm households'.

Table 2 shows data on the farm size wise respondents' rating on impact of climate change on farm households'. The marginal farm size group respondents rank the first position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.42 on a 5 point rating scale. The small farm size group respondents record the second position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.22 on a 5 point rating scale. The medium farm size group respondents hold the third position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.94 on a 5 point rating scale.

Table 2 Farm Size Wise Respondents' Rating on Impact of Climate Change on Farm Households'

Variables	Marginal	Small	Medium	Large	Mean
Decline in crop yield	3.33	3.05	2.83	2.55	2.94
Decline in livestock yield	3.72	3.44	3.22	2.94	3.33
Food shortage	4.03	3.75	3.53	3.25	3.64
Increase weed	2.27	2.15	1.81	1.69	1.98
Pest pressure	2.76	2.54	2.20	1.98	2.37
Decrease of water quality	3.57	3.35	3.01	2.79	3.18
High risk of crop damage from drought	2.90	2.68	2.34	2.12	2.50
Decline in soil productivity	2.36	2.24	1.90	1.78	2.07
Drying of ponds and wells	4.14	4.02	3.68	3.56	3.85
Loss of soil fertility	3.89	3.68	3.53	3.11	3.50
Human health problem	2.68	2.46	2.12	1.90	2.29
Reduction in employment	4.16	3.94	3.60	3.38	3.77
Farmers depression	2.47	2.34	2.00	1.88	2.17
Indebtedness	3.03	2.81	2.47	2.25	2.64
Drought and lower availability of water	3.39	3.11	2.89	2.61	3.00
Shortage of safe drinking water	4.22	4.18	3.94	3.70	4.01
Loss of household income	4.24	4.20	4.19	3.97	4.12
Decline in land productivity	3.11	2.89	2.55	2.33	2.72
Low bio mass production	4.09	3.87	3.53	3.31	3.70
Reduction in area under cultivation	3.97	3.75	3.41	3.19	3.58
Average	3.42	3.22	2.94	2.71	3.07

Source: Computed from primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Variation due to climate change impact of farm households'	36.70985	19	1.932097	390.4541	1.771972
Variation due to farm size	5.744495	3	1.914832	386.965	2.766438
Error	0.282055	57	0.004948		
Total	42.7364	79			

The large farm size group respondents turn down to the last position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.71 on a 5 point rating scale.

The ANOVA two way model is applied for further discussion. The computed anova value 390.45 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the impacts of climate change on farm households' is statistically identified as significant. In another point, the computed anova value 386.96 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the farm size groups is statistically identified as significant as per the respondents rated impact of climate change on farm households'.

Table 3 Education Wise Respondents' Rating on Impact of Climate Change on Farm Households'

Variables	Under Graduate	Higher Secondary	Secondary	Upper primary	Primary	Mean
Decline in crop yield	3.60	3.25	2.80	2.63	2.43	2.94
Decline in livestock yield	3.99	3.64	3.19	3.02	2.82	3.33
Food shortage	4.20	3.95	3.50	3.33	3.23	3.64
Increase weed	2.40	2.29	1.84	1.74	1.64	1.98
Pest pressure	3.03	2.68	2.23	2.06	1.86	2.37
Decrease of water quality	3.84	3.49	3.04	2.87	2.67	3.18
High risk of crop damage from drought	3.17	2.82	2.37	2.20	2.00	2.50
Decline in soil productivity	2.53	2.38	1.93	1.88	1.77	2.07
Drying of ponds and wells	4.21	4.16	3.71	3.65	3.73	3.85
Loss of soil fertility	4.06	3.81	3.37	3.24	3.03	3.50

Human health problem	2.85	2.60	2.15	1.99	1.87	2.29
Reduction in employment	4.13	4.08	3.73	3.55	3.67	3.77
Farmers depression	2.83	2.48	2.03	1.83	1.69	2.17
Indebtedness	3.30	2.95	2.50	2.33	2.13	2.64
Drought and lower availability of water	3.66	3.31	2.86	2.69	2.49	3.00
Shortage of safe drinking water	4.17	4.15	4.10	4.02	3.63	4.01
Loss of household income	4.24	4.20	4.12	4.06	3.97	4.12
Decline in land productivity	3.38	3.03	2.58	2.41	2.21	2.72
Low bio mass production	4.16	4.01	3.66	3.48	3.20	3.70
Reduction in area under cultivation	4.14	3.89	3.45	3.32	3.11	3.58
Average	3.60	3.36	2.96	2.82	2.66	3.07

Source: Computed from primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Variation due to climate change impact of farm households'	45.82757	19	2.411977	154.8001	1.725029
Variation due to educational status	12.11667	4	3.029166	194.4112	2.492049
Error	1.184174	76	0.015581		
Total	59.12841	99			

Table 3 indicates data on the education wise respondents' rating on impact of climate change on farm households'. The under graduate degree level educated respondents rank the first position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.60 on a 5 point rating scale. The higher secondary level educated respondents record the second position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.36 on a 5 point rating scale. The secondary level educated respondents hold the third position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.96 on a 5 point rating scale. The upper primary level educated respondents record the fourth position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.82 on a 5 point rating scale. The primary level educated respondents turn down to the last position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.66 on a 5 point rating scale.

The anova two way model is applied for further discussion. The computed anova value 154.80 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the impacts of climate change on farm households' is statistically identified as significant. In another point, the computed anova value 194.41 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the educational status is statistically identified as significant as per the respondents rated impact of climate change on farm households'.

Table 4 Family Size Wise Respondents' Rating on Impact of Climate Change on Farm Households'

Variables	Small	Medium	Large	Mean
Decline in crop yield	2.47	2.84	3.28	2.94
Decline in livestock yield	2.86	3.23	3.67	3.33
Food shortage	3.27	3.54	3.98	3.64
Increase weed	1.64	1.88	2.32	1.98
Pest pressure	1.90	2.27	2.71	2.37
Decrease of water quality	2.71	3.08	3.52	3.18
High risk of crop damage from drought	2.04	2.41	2.85	2.50
Decline in soil productivity	1.81	1.97	2.41	2.07
Drying of ponds and wells	3.77	3.75	4.19	3.85
Loss of soil fertility	3.07	3.41	3.84	3.50
Human health problem	1.91	2.19	2.63	2.29
Reduction in employment	3.71	3.77	4.11	3.77
Farmers depression	1.73	2.07	2.51	2.17
Indebtedness	2.17	2.54	2.98	2.64
Drought and lower availability of water	2.53	2.90	3.34	3.00
Shortage of safe drinking water	3.67	4.14	4.18	4.01
Loss of household income	4.01	4.16	4.23	4.12
Decline in land productivity	2.25	2.62	3.06	2.72
Low bio mass production	3.24	3.70	4.04	3.70
Reduction in area under cultivation	3.15	3.49	3.92	3.58
Average	2.70	3.00	3.39	3.07

Source: Computed from primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Variation due to climate change impact of farm households'	29.04304	19	1.528581	152.6853	1.867332
Variation due to family size	4.828303	2	2.414152	241.1423	3.244818
Error	0.38043	38	0.010011		
Total	34.25177	59			

Table 4 shows data on the family size wise respondents' rating on impact of climate change on farm households'. The large family size group respondents rank the first position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.39 on a 5 point rating scale. The medium family size group respondents hold the second position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.00 on a 5 point rating scale. The small family size group respondents turn down to the last position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.70 on a 5 point rating scale.

The anova two way model is applied for further discussion. The computed anova value 152.68 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the impacts of climate change on farm households' is statistically identified as significant. In another point, the computed anova value 241.14 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the family size groups is statistically identified as significant as per the respondents rated impact of climate change on farm households'.

Table 5 shows data on the gender wise respondents' rating on impact of climate change on farm households'. The female respondents' ranks the first position in their overall rated impact of climate change on farm households' as per their secured a mean score of 3.23 on a 5 point rating scale. The male respondents' occupy the next position in their overall rated impact of climate change on farm households' as per their secured a mean score of 2.91 on a 5 point rating scale.

Table 5 Gender Wise Respondents' Rating on Impact of Climate Change on Farm Households'

Variables	Male	Female	Mean
Decline in crop yield	2.78	3.10	2.94
Decline in livestock yield	3.17	3.49	3.33
Food shortage	3.48	3.80	3.64
Increase weed	1.82	2.14	1.98
Pest pressure	2.21	2.53	2.37
Decrease of water quality	3.02	3.34	3.18
High risk of crop damage from drought	2.34	2.66	2.50
Decline in soil productivity	1.91	2.23	2.07
Drying of ponds and wells	3.69	4.01	3.85
Loss of soil fertility	3.34	3.66	3.50
Human health problem	2.13	2.45	2.29
Reduction in employment	3.61	3.93	3.77
Farmers depression	2.01	2.33	2.17
Indebtedness	2.48	2.80	2.64
Drought and lower availability of water	2.84	3.16	3.00
Shortage of safe drinking water	3.85	4.17	4.01
Loss of household income	4.00	4.24	4.12
Decline in land productivity	2.56	2.88	2.72
Low bio mass production	3.54	3.86	3.70
Reduction in area under cultivation	3.42	3.74	3.58
Average	2.91	3.23	3.07

Source: Computed from primary data

t statistical vale 19.00, df 19, t critical value 1.72

The t test is applied for further discussion. The computed t value 19.00 is greater than its tabulated value at 5 per cent level significance. Hence, there is a significant difference between male respondents' and female respondents' in their overall rated impact of climate change on farm households'.

CONCLUSION

It could be seen clearly from the above discussion that the respondents' rate the high level impact of climate change on farm households' by citing the indicators that loss of household income, shortage of safe drinking water, drying of ponds and wells, reduction in employment, low bio mass production, food shortage, reduction in area under cultivation and loss of soil fertility as per their secured a mean score above 3.50 on a 5 point rating scale. The respondents' rate the moderate level impact of climate change on farm households' by stating the facts that decline in livestock yield, decrease of water quality, drought and lower availability of water, decline in crop yield, decline in land productivity, indebtedness, high risk of crop damage from drought as per their secured a mean score in the range of 2.50 to 3.50 on a 5 point rating scale. The respondents' rate the low level impact

of climate change on farm households' by indicating the facts that pest pressure, human health problem, farmers depression, decline in soil productivity and increase in population weed as per their secured a mean score below 2.50 on a 5 point rating scale. It could be observed that the respondents belong to the Parangipettai block rank the first position in their overall rated impact of climate change on farm households', respondents belong the Cuddalore block the second, respondents of Kumaratchi block the third, respondents belong the Keerapalayam block the fourth, respondents of Nallur block the fifth and respondents belong the Kammapuram block the last.

The result of farm wise analysis reveals that the marginal farm size group respondents rank the first position in their overall rated impact of climate change on farm households', small farm size group respondents the second, medium farm size group respondents the third and large farm size group respondents the last. It is observed that the under graduate degree level educated respondents rank the first position in their overall rated impact of climate change on farm households', higher secondary level educated respondents the second, secondary level educated respondents the third, upper primary level educated respondents the fourth and primary level educated respondents the last. It is seen from the result of family size analysis that the large family size group respondents rank the first position in their overall rated impact of climate change on farm households', medium size group respondents the second and small family size group respondents turn to the last position. The result of sex wise analysis reveals that the female respondents rank the first position in their overall rated impact of climate change on farm households' and the male respondents hold the next position.

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