"Challenges of Global Warming in Sustainable Agriculture''

Dr. N. Sukumaran, Assistant Professor, Department of Sociology, Rani Anna Government College for Women, Tirunelveli-8.

Abstract

Over the last 200 years this change in climate has speeded up due to human interference, leading to a considerable disruption of natural balance. The massive of the monsoon on Indian economy participated livelihood opportunities of farmers is indeed very apparent. For the last two decades the farming communities are experiencing the violent behavior of weather on their livelihood. The risks of global warming are real, palpable; the effects are accumulating daily, and the cost of correcting the trend rise with each days delay. The global heating caused by the green house gases effect will be more at poles and in winter months resulting in progressive shift in the global climate. Warmer climate will promote evaporation of water and increase conditions and rainfall. The present research has made an attempt to analyze the Challenges of global warming in sustainable agriculture of farming communities in Cuddalore district.

Key words: Climate change, Eco-system, Rural livelihood, Organic farming, Sustainable environment

Introduction

The earth and its systems have shifted between alternative status through long term processes over its geological history. Now it appears some critical thresholds. The delicate equilibrium of the natural environmental system has to do with process that amplify or damage warning. Climate change would irrevocably disrupt ecosystem and societies and there would be runaway climate change, taking us to a hothouse earth. There are several alarming predictions about its impact. The UN Sustainable Goals Report, 2018 notes that climate change is among the key factors in rising hunger and human displacement.

Credentials of Global Warming and GHGs Effect:

For the past two centuries, at an accelerating rate, the basic composition of the Earth's atmosphere has been maternally altered by the fossil fuel effluvia of machine culture. Human-induced warming of the Earth's climate is emerging as one of the major scientific, social and economic issues of the twenty first century, as the effect of climate change become evident in everyday life in locations as varied as small island nations of the Pacific Ocean and the shares of

Arctic Ocean. The risks of global warming are real, palpable; the effects are accumulating daily, and the cost of correcting the trend rise with each days delay (Bruce E. Johansen – 2006). The global heating caused by the green house gases effect will be more at poles and in winter months resulting in progressive shift in the global climate. Warmer climate will promote evaporation of water and increase conditions and rainfall. Tropical cyclones will become more intensive and their ferocity will increase.

Change in Agricultural Production*:*

Result of the process stimulation models of IARI shows that a $1^{O}C$ increase in temperature may reduce the yield of wheat, soya bean, mustard, groundnut and potato by 3-7 percent (Agarwal 2004). Climate change is likely to have both positive and negative effects on agricultural production systems. Climate change can be expected to increase production risks and require changes in the way farmers and growers select and manage their enterprises in the future some of the major risks include:

Loss of productivity, loss of income and associated social stresses,Transitional costs of shifting from one land use activity to another more suited to a new climate, Increased frequency of extreme weather events leading to business disruption and infrastructure damage, Increased pressure on water resources ,Increased pest and disease problems due to increased activity of organisms already present and the increased risk of any new species entering the country being able to survive and reproduce .

Problem Setting

The present research paper has been made an attempt to understand the farming communities' perception on the potential risks of climate variability's and their interest of preparedness for cope up and face such vulnerable eventualities in the select villages of Cuddalore district, Tamilnadu. It is one of the vulnerable districts in Tamilnadu which consecutively experiences the occurrence of flood or drought or cyclone frequently and exacerbates tension and triggers conflict among farming communities.

Methods of the Study

It may be perceived that though the share of agriculture in the total green house gas emissions of India is relatively low, the climate change brings the adverse consequences on agricultural production and damages rural livelihood system.

Objectives of the Study:

1. To study the socio-economic and cultural background of the respondents,
2. To find out the respondents level of perceptions on climate, climate changes and sustainable life style,
3. To assess the effects of governmental measures to overcome the implications of climate change and to sustain agriculture and rural livelihoods.

Hypotheses:

The following hypotheses are formulated for the purpose of present study:

1. Farmers differ in their social hierarchy (caste) with respect to their knowledge on sustainable life style.

2. The farmer's educational attainment has significant association with their knowledge n sustainable environment

3. There is a significant association between form wise and consequence upon challenges of sustainable agriculture. .

Selection of the Study Area: The four villages Karikadu, Virupatchi, Agaram and Kerapalayam are selected from Cuddalore district for this study.

Sampling: Thus all the selected villages have 1471 farm household and out of them 365 form households are selected as sample, under stratified random sampling method with a view to give relative importance to the farmers of different type of land holding, constituting 25 percent of the universe.

Tools of Enquiry: The interview schedule, the tool of the research was prepared all the questions necessary to focus the enquiry on the objectives of the present study.

Techniques of Analysis: The farm households' analysis includes farmers' perception on long term temperature and precipitation changes, farmers perceived temperature adaptation to climatic change impact on agriculture (livelihood) and ecological wealth.

Findings of the Study

1. Socio - Economic Profile:

The respondent's personal characters play a significant play any sociological investigation. It order there to understand the dada on their socio, economic and other personal life style details were collected.

Table No-1Socio-Economic Status of Respondents

(N=365)

S.No.	Socio-Economic Status	Sub Samples	Number of Respondents	Percentage
1.	Age Group	Below 30	140	38.36
		31-40	110	30.14
		41-50	59	16.16
		51and above	56	15.34
2.	Caste	FC	46	12.60
		BC	48	13.15
		MBC	96	26.30
		SC	172	47.12
3.	Land holding	Small farmers	176	48.22
		Medium farmers	122	33.42
		Large farmers	67	18.36
4.	Educational Status	Primary Level	131	35.89
		Middle school level	52	14.25
		Higher secondary level	135	36.98
		College level	47	12.88
5.	Monthly Income	Below 5,000	62	16.99
		5,001-10,001	162	44.38
		10,001-15,000	92	25.20
		15,001 & above	49	12.43

In this study, 12.6 percent of the respondents belong to the Forward Caste group, 13.15 percent of the respondents belong to Backward Caste group. 47.12 percent of the respondents are belonging to the most backward caste group. Moreover 27.13 percent of the respondents belong to the Scheduled Caste group. Out of the total 365 respondents 48.22 percent are belong to the small farmers (up to 2.5 acres of land), 33.42 percent of them are medium farmers (2.6-5 acres of

land), and 18.36 percent of them are large farmers (5.1 acres of land or more). All are educated. The study have been undertaken to ascertain the respondents level of perception on climate change and to identify their coping strategies and adoption practices for meeting and tackling the vulnerablelities of climate variability in the study region.

Building a Sustainable Society

Climate change/ global warming is the defining challenge of our time. The way in which this predicament is resolved will determine how all other environmental, social and economic challenges play out. Climate will decide the winners and losers of the future. It is the ultimate issue of sustainability (Bob Doppelt 2009). Humanity can-and will-make the shift in thinking and behavior needed to resolve global warming and adapt a path towards sustainability. The present investigation tried to gauge the extent of knowledge and adoption behavior of respondents regarding the environmentally and socially positive practices in order to understand the level of knowledge and adaptation of climate protection and sustainable practices and materials of respondents, the researcher collected the data under the following aspects:

(a) Sustainable life style (b) Sustainable environment (c) Challenges of sustainability

a) Sustainable Life Style

It can be assessed with the help of 15 factors on a 5 point rating scale. These include production and consumption of organic fruits and vegetables which encourage the use of bio-inputs in production of foods and services, cheaper bio-energy production, degradable waste generation, production of cobber gas through organic method, avoiding drinking synthetic soft drinks, sustainable life style mitigation through organic farming, proper disposable of solid wastes, reduction in consumption of fossil fuel, consuming coconut and palm products, low input use in high value output in food production, production and consumption of organic food, cultivation of green manure crops, utilization of recycling production, and using eco-friendly products.

Table 2 Caste wise Respondents and Knowledge on Sustainable Life Style

Variables	Forward Caste	Backward Caste	Most Backward Caste	Scheduled Caste	Mean
Production and consumption of organic fruits and vegetables	3.82	3.67	3.58	3.52	3.42
Production and consumption of organic food	3.58	3.45	3.36	3.25	3.31
Sustainable life style mitigation through organic farming	3.71	3.55	3.02	2.46	3.14
Reduction in consumption of fossil fuel	3.59	3.32	3.12	2.36	3.05
Utilization of recycling production	3.82	3.73	3.54	2.86	3.04
Degradable waste generation	3.43	3.14	3.29	2.27	3.03
Cheaper bio-energy production	3.71	3.62	3.69	2.47	2.95
Cultivation of green manure crops	3.21	2.88	2.2	2.18	2.94
Low in put use in high value output in food production	3.84	3.73	3.51	3.31	2.87
Proper disposable of solid wastes	3.58	3.12	3.08	2.86	2.74
Avoiding drinking synthetic soft drinks	3.5	3.41	3.16	2.94	2.69
Consuming coconut and palm products	3.24	3.05	2.17	2.34	2.67
Using eco-friendly products	3.36	3.27	2.39	2.54	2.6
Encourage use of bio inputs in production of foods and services	3.69	3.78	3.46	3.22	2.47
Production of cober gas through organic method	3.52	3.41	3.24	3.01	2.46
Average	**3.59**	**3.44**	**3.11**	**2.76**	3.42

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Rows	5.443743	14	0.388839	7.618066	1.935009
Columns	5.556125	3	1.852042	36.2849	2.827049
Error	2.14375	42	0.051042		
Total	13.14362	59			

Table 2 presents data on the caste wise respondents' knowledge on sustainable life style. It could be noted that the forward caste respondents rank the first position in reporting the overall attributed ways of sustainable life style as per their secured mean score of 3.59 on a 5 point rating scale. The backward caste respondents take the second position in their rating the attributed ways of sustainable life style as per their secured mean score of 3.44

on a 5 point rating scale. The most backward caste respondents occupy the third position in their rating the attributed ways of sustainable life style as per their secured mean score of 3.11 on a 5 point rating scale. The scheduled caste respondents slip down to the last position in rating the overall attributed ways of sustainable life style as per their secured mean score of 2.76 on a 5 point rating scale.

The ANOVA two-way model was applied for further discussion. The computed ANOVA value 7.61 is greater than its tabulated value at 5 percent level of significance. Hence, the variation among the overall attributed ways of sustainable life style is statistically significant. In another point, the computed ANOVA value 36.28 is greater than its tabulated value at 5 percent level of significance. Hence, the variation among the caste groups is statistically significant as per the respondents' overall attributed ways of sustainable life style.

(b) Sustainable Environment:

This part deals with farmers' knowledge on sustainable environment. It can be assessed with the help of 18 factors on a 5 point rating scale. These include pollution free production of goods and services, bio inputs in production of goods and services, discouraging the use of pesticides, production of recyclicable products, discouraging deforestation, use of renewable energy, ecosystem health depends on waste reduction, discouraging the use of chemical fertilizers, greening the environment, environmental sanitation, sustainable environment depends on less waste production, use of bio pesticides, green consumerism, survival of humanity depends on stabilizing and restoring physical environment, social wellbeing depends on healthy climate and natural environment, scientific advancement degrades the environment, natural environment promotes life support system, and agricultural ecosystem interaction with soil plant and animal.

Table 3 Education wise Respondents Knowledge on Sustainable Environment

Variables	Primary	Middle school	High school	Higher secondary	College and professional	Mean
In agricultural ecosystem interaction of soil plant and animal	2.15	2.90	3.45	3.28	3.81	2.57
Scientific advancement degrades the environment	2.35	3.55	3.85	3.90	3.90	2.70
Survival of humanity depends on stabilizing and restoring physical environment	2.39	2.62	3.26	3.85	3.45	2.89
Sustainable environment depends on less waste production	2.51	2.47	3.56	3.75	3.77	3.02
Social wellbeing depends on healthy climate and natural environment	2.37	2.85	3.35	3.80	3.92	2.82
Discouraging deforestation	2.77	2.51	3.61	3.85	3.89	3.14
Use of renewable energy	2.59	3.05	3.69	3.80	3.79	3.13
Green consumerism	2.34	2.67	2.95	3.52	3.70	2.97
Ecosystem health depends on waste reduction	2.15	3.21	3.41	3.76	3.77	3.10
Natural environment promotes life support system	2.25	2.42	3.35	3.85	3.81	2.63
Pollution free production of goods and services	2.71	2.67	3.66	3.90	3.99	3.8
Production of recyclicable products	2.01	2.25	3.68	3.77	3.95	3.19
Bio inputs in production of goods and services	3.03	3.10	3.33	3.65	3.92	3.34
Discouraging the use of pesticides	2.95	3.12	3.44	3.75	3.90	3.33
Discouraging the use of chemical fertilizers	2.16	3.13	2.95	3.38	3.88	3.05
Use of bio pesticides	2.26	2.85	3.12	3.90	3.95	2.99
Greening the environment	2.32	2.97	3.26	3.65	3. 97	3.04
Environmental sanitation	2.18	2.66	3.27	3.65	3.89	3.03
Mean	2.43	2.85	3.43	3.74	3.89	2.99

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	3.310831	11	0.300985	2.496437	0.03261	2.258518
Columns	1.228356	2	0.614178	5.094135	0.015205	3.443357
Error	2.652444	22	0.120566			
Total	7.191631	35				

The high school level educated respondents take the third order in reporting the overall knowledge on sustainable environment as per their secured mean score of 3.43 on a 5 point rating scale. The middle school level educated respondents take the fourth order in rating the overall knowledge on sustainable environment as per their secured mean score of 2.85 on a 5 point rating scale. The primary level educated respondents slip down to the last position in starting the overall knowledge on sustainable environment as per their secured mean score of 2.43 on a 5 point rating scale.

The ANOVA two-way model was applied for further discussion. The computed ANOVA value 2.49 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall knowledge on sustainable environment is statistically significant. At another point, the computed ANOVA value 5.09 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the education groups is statistically significant as per the respondents' rating on overall knowledge on sustainable environment.

It could be seen clearly from the above discussion that the college and professional level educated farmers rank the first position in their overall knowledge on sustainable environment, higher secondary level educated farmers the second, high school level educated farmers the third, middle school level educated farmers the fourth and primary level educated farmers the last.

(C) Challenges of Sustainability

This part deals the challenges of sustainability to understand the sensitivity of agricultural communities on endurance of natural resources and its present nature and trends of public and administrators interest to restore and recover the resources.

Table 4 Farm wise Households' Challenges on Sustainability

Farm	Encroachment of water bodies		Conversion of common property resources		Displacement of native plants		Total
	Yes	No	Yes	No	Yes	No	
Small	99 (56.25)	77 (43.75)	76 (43.18)	100 (56.82)	45 (25.57)	131 (74.43)	176 (100)
Medium	69 (56.56)	53 (43.44)	55 (45.08)	67 (54.92)	26 (21.31)	96 (78.69)	122 (100)
Large	22 (32.84)	45 (67.16)	39 (58.21)	28 (41.79)	8 (11.94)	59 (88.06)	67 (100)
Total	190 (52.05)	175 (47.95)	170 (46.58)	195 (53.42)	79 (21.64)	286 (78.36)	365 (100)
Farm	Habitats degradation		Arrival of exotic species		Disruption of food web		Total
	Yes	No	Yes	No	Yes	No	
Small	80 (45.45)	96 (54.55)	17 (9.66)	159 (90.34)	90 (51.14)	86 (48.86)	176 (100)
Medium	78 (63.93)	44 (36.07)	52 (42.62)	70 (57.38)	79 (64.75)	43 (35.25)	122 (100)
Large	48 (71.64)	19 (28.36)	35 (52.24)	32 (47.76)	52 (77.61)	15 (22.39)	67 (100)
Total	206 (56.44)	159 (43.56)	104 (28.49)	261 (71.51)	221 (60.55)	144 (39.45)	365 (100)

Chi-Square Summary

Variables	Chi-Square calculated value	Degrees of freedom	Chi-Square table value at 5%
Encroachment of water bodies	12.15	2	5.99
Conversion of common property resources	4.568	2	5.99
Displacement of native plants	5.326	2	5.99
Habitats degradation	17.2	2	5.99
Arrival of exotic species	61.14	2	5.99
Disruption of food web	15.60	2	5.99

It could be seen clearly from the above discussion that respondents report about the first order challenge on sustainability disruption of food web, habitats degradation the second, encroachment of water bodies the third, conversion of common property resources the fourth, arrival of exotic species the fifth, and displacement of native plants the last.

Table 4 presents data on the farm wise responders' challenges on sustainability. It could be noted that the majority of the small farmers (56.25%) and medium farmers (56.56%) note that encroachment of water bodies leads to challenges to sustainability. Majority of the large farmers (58.21%) observe the conversion of common property resources in to private property results in challenges to sustainability. Majority of the farmers of all groups deny the views on displacement of native plants results in challenges to sustainability. Majority of the medium farmers (61.91%) and large farmers (71.64%) report that habitats degradation results in challenges to sustainability. A more than half of the large farmers (52.24%) reports challenges of sustainability in terms of arrival of exotic species. A more than two third of the large farmers (77.61%) and majority of the medium farmers (64.75%) and small farmers observe the disruption of food web consequent upon challenges to sustainability.

The Chi-Square test was applied for further discussion. The computed Chi-Square value 12.15 is greater than its tabulated value at 5 percent level of significance. Hence, there is a significant difference between respondents of different farm groups and their views on challenges on sustainability in terms of encroachment of water bodies. A similar result has been observed with respect to respondents' views on habitats degradation, arrival of exotic species, and disruption of food web. The computed Chi-Square value 4.56 is less than its tabulated value at 5 percent level of significance. Hence, there is no significant difference between respondents of different farm groups and their views on challenges on sustainability in terms of conversion of common property resources in to private property. A similar result has been observed with respect to respondents' views on displacement of native plants.

Conclusion:

The findings of respondents' knowledge on sustainable environment reveal the following facts. It could be seen clearly from the above discussion that the respondents have high level knowledge on sustainable environment with reference to pollution free production of goods and

services, bio inputs in production of goods and services, discouraging the use of pesticides, production of recyclicable products, discouraging deforestation, use of renewable energy, and ecosystem health depends on waste reduction. The findings of respondents' views on challenges to sustainability indicate the following facts. The respondents report about the first order challenge on sustainability disruption of food web, habitats degradation the second, encroachment of water bodies the third, conversion of common property resources the fourth, arrival of exotic species the fifth, and displacement of native plants the last.

It is concluded from the study that despite the vulnerabilities and catastrophe of climate risks posed to people and their livelihoods especially that of agricultural community towards social distress, economic loss and damages of natural capital and ecological wealth, they adopt certain coping mechanisms in ameliorating and stabilizing the climate variability. The farmers have agreed that the risks of climate change are high and warrant action. They also convinced about the coping strategies needed to reduce these risks which are socially sustainable, politically feasible and economically affordable. It is observed that democratic and integrated approaches to climate risk reduction would be not only product but also profitable for agriculture community. Such approaches with a foresight towards bio-remedial methods and clean developmental mechanisms ensure sustainable environment with smart climate.

Suggestions:

1. In the study area, conventional water bodies have been destroyed; hence the government should renovate the degraded water bodies and restore the water table in the study area.
2. The farmers need accurate weather forecasting and agro advisory services to take vital decision regarding farming practices.
3. There is a need of financial support for the promotion of sustainable land use practices.

References:

1. Ramesh Chand and S.S. Raju (2009). Dealing with Effects of Monsoon Failures. Economic and Political Weakly. Oct. XLIV(41).
2. The Hindu (2013). September 28.
3. Sustainable Ground Water Management (2004). Lesson from Practice. The World Bank. Global Water Partnership Programme.
4. K.R. Ashok and C. Sasikala (2012). Farmers vulnerability to Rainfall Variability and Technology adoption in rain-fed talk irrigated agriculture. Agricultural Economics Research Review, 25(2). 267-278.

5. Dr. Harender Raj Gauthan and Dr. H.C. Sharm (2012). Environmental Degradation. Climate Change on Agriculture. Kurukshetra. 60(8). June. 3-5.
6. K. P. Agrawal (2008). Climate Change and its Impact on Agriculture and Food Security. LEISA Indian. December.
7. Krishnan,N.R,(2007),"Global warming and India", The Hindu, April 13.
8. Mary Kensa V.(2011)."Impact of Climate Change on Agriculture Ecology", Environmental Conservation,17(2).
9. Prabu, M.J.(2009)."Climate Change Science Complex, Effects Clear", The Hindu, December,10.
10. Selvaraj and Philip (2015) Climate Change on Paddy Farming in Erode and Tiruchirapalli District of TamilNadu, Journal of Extension Education, Vol.27, No.4.
11. Mohanraj, K and Karthikeyan, C. (2014), Perception of Tank Irrigated Farmers Towards Climate Change, Journal of Education Education, Vol. 26, No.3.