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Climate Change Awareness, Environmental Education and Gender Role Burdens among Rural Farmers of Northern Cross River State, Nigeria.

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ABSTRACT

This paper examined climate change awareness level among rural farmers of Northern Cross River State, Nigeria, the strategies adopted for mitigating, prevention and adaptation, gender role burden between men and women due to the effects of climate change and the roles Environmental Education can play in privation, mitigation and adaptation of farmers to climate change effects in Northern Cross River State, Nigeria. Five questions guided the study. Two sets of instruments were used for data collection, a sample of 1258 respondents were selected for the study. Result analyzed using simple percentage and independent t-test revealed that rural farmers have some level of climate change awareness, 6 out of 9 strategies listed were being used by the rural farmers, women have increased workload burden than men, while Environmental Education can play very significant role in climate change prevention, mitigation and adaptation among rural farmers in Northern Cross River. Environmental Education should be carried to the rural setting to create the needed awareness, knowledge and skills to combat climate change effects.

KEYWORDS

Climate change awareness, Gender roles burden, Environmental Education, Prevention, Mitigation and adaptation to climate change.

INTRODUCTION

Environmental Education is an education process designed to create the needed awareness, knowledge, skills and information about human activities and their impacts on the ever-changing environment. Environmental Education has also been variously defined as the education process that is aimed at creating the needed awareness, skills, knowledge, attitude and values toward environmental problems, and creating in the learner the skills and willingness to work individually and collectively towards solving environmental problems and working to avoid the creation of new ones. From all perspectives, the cardinal duty of Environmental Education is to create awareness about already existing environmental problems and how to prevent the occurrence of new ones. Environmental Education (EE) can be defined as an organized effort to teach about how natural environment function and particularly, how human beings can manage their behavior in the ecosystems in order to live sustainably (Bhattarai, Beilin& Ford, 2015; Eneji, et al., 2017).

The term Environmental Education is often used to imply education within the school system, from primary to post primary, this is narrowing the scope of the course, however it is sometimes used more broadly to include all effort to educate the public and other audience including print materials, websites, media campaigns etc. Environmental Education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions. Environmental Education is a learning process that increases people's knowledge and awareness about the environment and associated challenges, and foster attitude, motivations and commitments to make informed decisions and take responsible action (Ford Foundation, 2005, cited in Eneji, et al., 2017). It also refers to organized efforts to teach about how natural environment function and particularly, how human beings can manage their behavior and ecosystems in order to live sustainably(Gruenewald, 2004; Bangay & Blum, 2010;Benavot, et al.,2019).The term is uniquely and slightly different from Environmental Science and Environmental Studies, while the former is concerned with identification, designing, collecting, analyzing and interpreting empirical data, the latter is concerned with using the analyzed and interpreted data to create the needed awareness as obtained by the former (Carr, 2013; Eneji, et al, 2017).

The key components of Environmental Education include:

Awareness and sensitivity to the environment and environmental challenges.

Knowledge and understanding of the environment and the emotional challenges.

Attitude of concern for the environment and the motivation to improve or maintain environmental quality and standards.

Skills to identify and help in resolving environmental challenges.

Based on these components, Environmental Education seeks to pursue increased public awareness and knowledge about environmental issues, teach individuals and groups critical thinking to identify environmental issues, their causes, the effects they have on the environment and humans, their mitigation

strategies or what can be done to solve the identified problem, it enhances individual's problem solving and decision making skills. Hence, Environmental Education is wholistic in nature, because it does not advocate any particular viewpoint about nature (Chaudhury, et al., 2012; Bentley, Petcovic & Cassidy, 2019).

Gender roles and the daily routine of most rural households are influenced by the kind of livelihood activities engaged by these rural populaces. The burden of food production from rural agrarian activities as carried out by women has become even more pronounced in recent times, as their statutory roles are care givers and mothers of the household. From prehistoric times, the women folks have been seen as mothers who are solely saddled with the duty of providing for the households, these roles are beginning to become compounded daily, because of the increased burden inflicted on the them by the changing climatic conditions under which they carry out their daily livelihoods activities in their agrarian rural societies (Binswanger-Mkhizer & D'Souza, 2012; Carr& Thompson, 2014).

Scholars have posited that both male and female are engaged in agricultural production process at one point or the other, the men clear the thick forest land or bushland and also proceed to till the mounds for planting of food crops, their activities end here, while the women take over from weeding the farms, tending the crops till the crops are mature for harvesting. During the harvesting process, the men do the actual harvesting for some crops, while the women carry the harvested crops home, prepare them for storage and do the actual storage themselves. Their duties do not stop here. They do the harvesting of fuelwood including the cooking of food for the family, washing and doing of the used dishes, fetching of water, bathing the younger ones etc. These are all activities which are the daily routine of most rural women (FAO, 2011; Partoev, 2012; Panda & Singh, 2016; Pandey, Kumar, Archie, Gupta, Joshi, Valente & Petrosillo, 2018).

Climate change is the effect which changing climatic condition has brought on the environment and its resources, to the extent that these effects have influenced so many human activities negatively. The causes of global climate change include: incomplete combustion of fossil fuel and gasoline from industrial chimneys and exhaust pipes, resulting in the release of carbon dioxide and carbon monoxides, methane emission from animal dungs, agricultural chemicals and pesticides and waste garbage, artic sea beds and paddy rice field, deforestation especially from tropical wood for agriculture, pulp and farmlands; increased use of agricultural chemicals especially pesticides and other agrochemicals, bush burning among others(Padmanabhan, 2011).

Climatic conditions are measured in terms of what is call climate or weather elements; these include temperature, air pressure, wind direction and strength, humidity and the amount of precipitation (rainfall). These elements are further influenced by the factors of latitude, altitude, continentality or continental effects, mountain range orientation towards prevailing winds and ocean current among others (Carr& Thompson, 2014; Opiyo, Wasonga, Nyangito, Mureithi, Obando & Munang, 2015).

Climate change awareness on the other hand, has to do with all the knowledge, skills, value, attitude and belief about the causes, effects and mitigation strategies among the rural populace about climate change. Climate change awareness imbues in the learner or possessor the needed information about the concept

of climate change, some human activities that cause climate change, their effects and some level of knowledge about the mitigation of climate change effects.

The burden of climate change effects on the environment cannot be over emphasized. These effects have variously been listed to include salinization of fresh water, salt water intrusion, rise in seas level as a result of the melting of ice at the polar regions, flooding, low or excess rainfall, drought and desert encroachment, increased ambient temperatures, greenhouse gases, global crop failures and food insecurities. Studies have shown that one of the major causes of crop failure and food insecurity is the shortage in the amount of precipitation resulting to a widespread desertification with its attendant effects (Mcdowell & Hess, 2012; Berger, Gerum & Moon, 2015).Most studies further opined that climate change is expected to have a very severe impact on water supplies and food productivities. These shortages would most likely threaten food production and availability, reduce sanitation and hinder economic development and damage to the ecosystems, causing swings between floods and droughts (Carr& Thompson, 2014; Opiyo, et al., 2015).

Some studies suggested that the rising of temperatures might lead to the extinction of more than a million species; this is worrisome, because man's existence on the planet is tied to the presence of the diverse species and population of plants and animals in the ecosystems. A significant number of species have gone extinct already or are under threat as a result of the global climate change occasioned by rising temperatures and dwindling rainfalls (Manandhar, et al., 2011; McDowell, et al., 2013; Berger, et al., 2015).

Studies have shown that in most rural communities, gender role analysis shows a negatively skewed gender role towards the womenfolk (Wilk, Andersson & Warburton, 2013; Macchi, Gurung &Hoermann, 2015). According to Abott (1978) cited in Eneji, et al, (2017), the womenfolk are usually likened to the ever giving mother earth, who is always giving in terms of giving lives to children, feeding the family, providing water for the family, fetching the firewood, cooking the meals, washing the dishes, weeding the farm and tending the crops to produce food, washing the family clothes, even late in the nights after a tedious days work in the farms, she works late into the night in preparation for the following day. Even when the children and the husbands are not feeling too well, they are the ones who take care of their health, boil the herbs and administer them to the sick person, they still stay with the sick person in the herbal homes or hospital. Due to drought and the late arrival of rains, the women still mulch the mounds to avoid high temperatures from burning the yams seedlings in the mounds (Busch & Roman, 2017; Bieler, et al., 2018).

The men on the other hand, only clear the farms, till them, may be plant only yams and stake them, thereafter; their jobs are over until harvest time. Only in rare cases would they go back to add artificial manure to the farm. They may stay at home all day, but the women would be expected by custom to come back from the farms late and cook the family meal, including fetching of fuelwood and water for the family use (Djoudi& Brockhaus, 2011; Dominelli, 2013; Pandey, Cockfield &Maraseni, 2016).

Climate change awareness is an education process aimed at helping people to understand and address the global, regional and local impacts of global warming with its attendant effects, increasing climate change literacy among young and adult population, encourage changes in their attitudes and behavior and also helping the populace to adapt to climate change related problems.

A lot of studies have shown that there is urgent need to sensitize or create the needed awareness among the populace about the devastating effects of climate change (Akerlof, et al. 2010; Pandve, et al., 2011; Bhardwaj & Yadav, 2015; Ravera, et al., 2016). The approaches and strategies to be adopted for this awareness creation and sensitization is dependent on the perceived susceptibility to threats and the extent of the climate change impacts on the people (Below, Mutabazi, Kirschke, Franke, Sieber, Siebert &Tscherning 2012). This is so much so that people's adaptability has become a function of the knowledge and information at their disposal, hence the need for climate change awareness for the rural populace. Looking at these studies, there is a life wire running across all their postulations and research outcomes, the urgent need to address issues of climate change awareness, adaptation, vulnerability and developing coping strategies among the rural farmers like their urban counterpart must be made paramount, (Bellon, Hodson &Hellin. 2011; Busch, et al., 2019).Most often, the problems of climate change impacts are mostly perceived and felt in the rural communities, where their livelihoods are mostly dependent on the environment.

Taking a closer look at the institutional and social perspectives of the extent of vulnerability and the perceived adaptation strategies people adopt to climate change, there has been the increasing need for scholars to address these issues (Behrman, Bryan & Goh, 2014), especially when it comes to understanding the issue of social differentiations in terms of gender based factors like gender equality, equity and gender based power models (Barnett & O'Neill, 2010). There is however, some complexities of factors that determines and shapes the divergent contexts under which vulnerability and adaptability, especially the capacity to adapt and pose different response to mitigation strategies to these climate change effect, most of these adaptive strategies are yet to be fully explored and exploited (Badola, Ogra & Barthwal. 2014). Most scholars have understood and recognize that such determining factors are gender biased, orchestrated by socio-cultural, traditional, institutional and economic based structures and processes which are always detrimental to the women folks (Sujakhu, Ranjitkar, Niraula, Pokharel, Schmidt-Vogt & Xu, 2016; Tembo & Tadesse, 2018). It is worthy to state that a large amount of scholars and their literature on gender based issues on climate change are perceived differently between men and women (Lorenzoni & Pidgeon, 2006; Akerlof, Berry, Leiserowitz, Roser-Renouf, Clarke, Rogaeva, et al. 2010;Rishi, Ompraksah & Mudaliar, 2011; Ravera, Martin-Lopez, Pascual & Druker,2016), their experiences and their perception of climate change are seen from the prism of gender based perspective, (Pandve, Chawla, Fernandez, Singru, Khismatrao & Pawar, 2011), even at this, the women folks have been found to be most vulnerable to the effects of climate change in our agrarian societies. This is because they are most dependent on the natural environment and their resources, in this sense, any harm to the environment, are felt mostly by the women.

In a cross-sectional study to assess the level of awareness regarding climate change in urban communities in the urban field practice area of Pune city, Maharastra state of India, Pandve, Chawla, Fernandez, Singru, Khismatrao and Pawar, (2011), with the purpose to assess their climate change awareness, major causes of climate change are from human activities , their sources of climate change awareness, their knowledge of United Nations Frameworks on Climate Change (UNFCC), Kyoto Protocol and Intergovernmental Panel on Climate Change (IPCC), water related issues and physical hazards related to human health from climate change among others. Data collected and analyzed show that global climate change is majorly due to

human activities, these are based on personal experiences of the respondents. The respondents observed that the easiest source of information was the television.

It was also found that there is a poor level of awareness about the purpose of the UNFCC, IPCC and the Kyoto Protocol; most respondents observed that one of the major causes of global climate change is deforestation for whatever reason. Respondents observed that they have observed water related issues due to climate change, other respondents posited that there are other physical hazards directly felt from extreme weather events which have very potential health impacts on both humans and the environment as a result of climate change. These respondents further posited that life style changes can be a significant way of addressing the climate change trend. When climate change occurs, the burden and volume of work done in the rural communities are increased to protect crops, household livelihoods and to assuage harsh environmental conditions. During these periods, whose daily chores burden increases most, and how have these rural populaces mitigated these harsh environmental trends?

Granted that climate change have serious impacts on the rural agricultural activities, does it add additional burden to these rural farmers? Which group of people do these impacts affect most? What role can their extent of climate change awareness play in identifying their local strength and methodology for cushioning their vulnerability and adaptability to climate change effects? What roles can Environmental Education play in their decision making to enhance the adoption of environmentally friendly strategies to cushion the impacts of climate change to enhance bounty productivity? It is on this premise that this study sought to dissect the tripod relationship between climate change awareness, Environmental Education and gender role analysis burden on the agrarian society of Northern Cross River State, Nigeria.

The following research questions were posed to guide the study:

a) What extent of climate change awareness do the rural farmers of Northern Cross River state have?

b) What is the gender role analyses of some daily routine activities carried out by these rural farmers?

c) What is the difference in the workload burden of the impacts of climate change between men and women?

d) What are the strategies adopted by these rural farmers to mitigate the effects of climate change in their agricultural activities?

e) What roles can Environmental Education play in helping the rural farmers to design and adopt sustainable adaptation and mitigation strategies to reduce or completely eradicate their vulnerability to climate change effects?

Materials and Design (Methodology)

Using a cross -sectional survey method, a sample of 0.1% of the entire population of the study area was selected from a combined population of one million, two hundred and fifty eight thousand, nine hundred and sixty six (1,258, 966) persons, who are predominantly farmers, civil servants, Environmental Educators, Agricultural Science teachers, civil servants, Environmental Health workers, staffs of conservation organizations and students from the 5 local government areas of Bekwarra, Ogoja, Yala, Obudu and Obanliku., all in Cross River State. Using the multi-stage sampling technique, a sample of one thousand, two hundred and fifty-eight respondents (1258), comprising both female and female was selected. The selection process is such that husbands and wives were selected from each compound, in households where male or female are found as widows or widowers, they are paired for the study. In all, a gender disaggregated sample of 629 pairs was selected for the study. Data was generated for the study using two sets of instruments: a structured questionnaire titled extent of climate change awareness and the roles of Environmental Education in climate change prevention, mitigation and adaptation questionnaire; the second instrument is the Gender roles analysis and schedule activity burden checklist. The instruments were personally administered by the researchers in the five LGAs and same collected, seven respondents did not complete their instrument properly, so there were rejected, only 1251 instruments were coded and analyzed for the study. Simple percentage, independent t-test, pie charts, line graphs and tables were used to analyze and present results from the analysis.

Results and Discussion

Question 1: What extent of climate change awareness do the rural farmers of Northern Cross River state have?

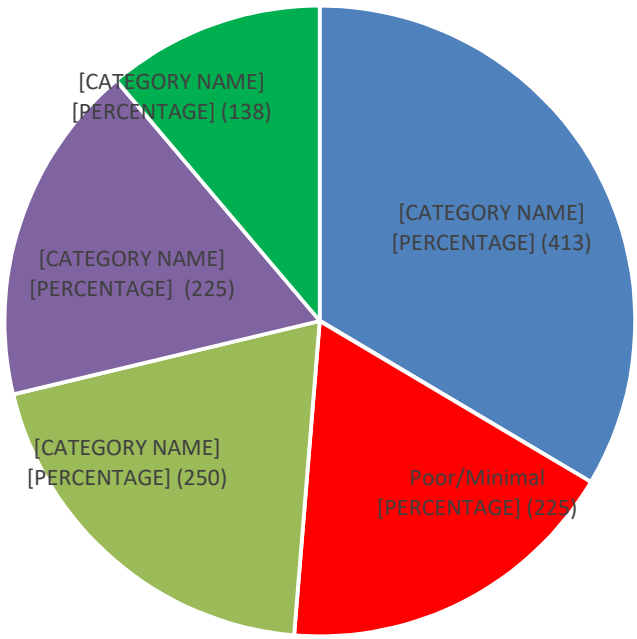

Figure 1: Extent of Climate change awareness among local farmers in the Northern Cross River State

From the result of the data analyzed, one hundred and thirty -six (136) respondents representing 11%, have very much awareness about climate change, 225 respondents representing 18%, have high awareness about climate change, causes and effects, 250 respondents (20%) ticked that they have average awareness about climate change, 225 respondents, representing 18% said they have very minimal level of climate change awareness, while 413 respondents (33%) said they have no awareness or knowledge about climate change. Based on these results, it is found that a substantial number of respondents have some extent of climate change awareness among the rural farmers in the Northern Cross River State.

Arising from the result on the pie chart on figure 1 above, it is pertinent to inform that most of the rural farmers have little to high level of climate change awareness. A substantial number of these farmers too do not have any formal awareness about climate change. Concerned about their sources of the climate change awareness among these rural farmers, it was discovered that some got their awareness through radio, television, hand bills and information bulletins, others read through newspapers and news magazines, while some got their information through public awareness created by some non-governmental organizations.

This result is a confirmation of Pandve, et al., (2011) who in their study found that in most rural communities, the level of climate change awareness like every other environmental awareness is dependent on the people's exposure to all programs or activities geared towards creating the awareness. Most studies found a significant relationship between climate change awareness and the processes through which they use to acquire such knowledge. Most authors still observed that the extent of climate change awareness most farmers have in the rural communities are through experiential knowledge, where weather elements change in terms of fluctuation trends (Akerlof, et al., 2010; Rishi, et al., 2011; Opiyo, et al., 2015).

The climate change awareness level of older farmers was gained through observation of weather elements: shortage of rainfall or excess of precipitation, prolonged drought regime, increased temperature, excess river water overflow (flooding), crop failure due to changing environmental conditions. The finding of this study is in line with those of Badola, et al., (2014); Behrman, et al., (2014); Ravera, et al., (2016) who found that most rural farmers are not ignorant of the presence of climate change in their communities, crop failures, shortage in rainfall, increased temperature, erosion, crop pest and other heat related conditions are all pointers to climate change situations. These farmers have observed the present weather conditions to be different from what they use to see when they were younger.

While most farmers claimed to have these awareness through experience, others became aware of climate change through mass media, public enlightenment campaigns, posters, bill boards, through townhall meetings, age grade meetings and through the activities of some non-governmental organizations (Tambo & Abdoulaye, 2013; Tamang, et al., 2014; Eneji, et al., 2017). This result has revealed that most of the rural farmers studied have very reasonable level of climate change awareness, while some about 50% of the farmers lack the basic knowledge of what causes climate change, most of these farmers do not know that negative and unsustainable farming activities and practices influenced the acceleration of global climate change.

Question 2: What is the gender role analyses of some daily routine activities carried out by these rural farmers?

Figure 2 shows the gender role analysis of farmers in Northern Cross River State where the study is carried out. The respondent's opinion suggests that from the 23 items listed on figure 2, the women do more of the activities than men. From Figure 2, the scores of the gender that performs each of the activities listed are also attached on the figure depicting whose duty it is to perform that activity. Table 1 also brought out the respondent's raw scores and the percentage of the activities performed by each group of people between men and women. Four hundred and fifty-four (454) respondents, representing 36.3% said that men perform most of the duties, while 797 respondents, representing 63.7% ticked that women perform most of the daily activities in the community than men. From the result, it is evident that most of the daily activities including household chores are done by women in the study area.

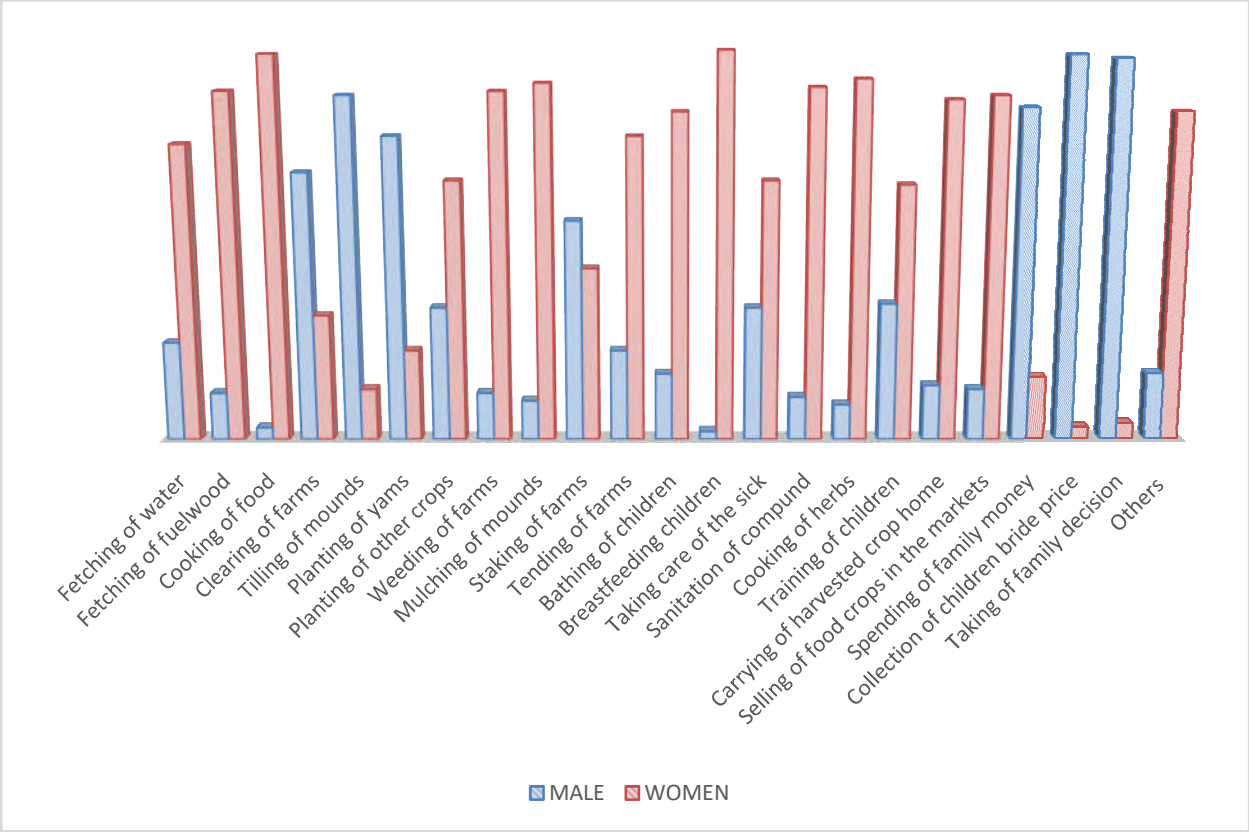

Figure 2: Community daily household activity schedule based on Gender role analyses in Bekwarra LGA

Looking at the result of the community activity and gender disaggregated roles survey as presented on figure 2, it shows that out of the 23 items listed, men scored highest in clearing of farmlands (850, 68%), tilling of mounds (1087, 87%), planting of yams (963,77%), staking of farms (700, 56%), spending of incomes generated from the sales of farms produce (1050, 84%) , collection of bride price for daughters married (1213, 97%) and taking of family decisions (1200, 96%). While the women on the other hand scored highest on fetching of water for family use (938, 75%), fetching of fuelwood (1100, 88%), cooking of family meal (1213, 97%), planting of other crops (825,66%), weeding of farms (1100, 88%), mulching of mounds (1125, 90%), tending of farms (963, 77%), bathing of children (1225, 98%), breast feeding of children (1225, 98%), taking care of the sick (825, 66%), compound sanitation (1113, 89%), cooking of herbs for the sick, (1138, 91%), training of children (813, 65%), carrying of harvested crops home from the farms (1075, 86%), selling of crops in the markets (1075, 86%) and other chores like watering farm crops etc (1038, 83%).

Table 1: Community daily household activities schedule based on gender role analysis in Northern Cross River State (N=5001)

S/No	Respondent's opinion on gender roles Community Activities	Male Respondents		Women Respondents	
		Score	%	Score	%
1	Fetching of water	313	25	938	75
2	Fetching of fuelwood	150	12	1100	88
3	Cooking of food	38	3	1213	97
4	Clearing of farms	850	68	400	32
5	Tilling of mounds	1088	87	163	13
6	Planting of yams	963	77	288	23
7	Planting of other crops	425	34	825	66
8	Weeding of farms	150	12	1100	88
9	Mulching of mounds	125	10	1125	90
10	Staking of farms	700	56	550	44
11	Tending of farms	288	23	963	77
12	Bathing of children	213	17	1038	83
13	Breastfeeding children	25	2	1225	98
14	Taking care of the sick	425	34	825	66
15	Compound Sanitation	138	11	1113	89
16	Cooking of herbs	113	9	1138	91
17	Training of children	438	35	813	65
18	Carrying of harvested crop home	175	14	1075	86
19	Selling of food crops in the markets	163	13	1088	87
20	Spending of family money	1050	84	200	16
21	Collection of children bride price	1213	97	38	3
22	Taking of family decision	1200	96	50	4
23	Others	213	17	1038	83
Total	**28762**	**455 (10456)**	**36.3**	**796(18306)**	**63.7**

Out of the 23 activities listed as daily routine chores in the community, men perform 7 out of the 23, while women perform 16 out of the 23 activities listed. From this preliminary data, women are mostly saddled with duties regarding their household daily activities than their male counterparts.

The result of this study is a confirmation of the earlier findings of Bellon, et al., (2011); Badola, et al., (2014); Behrman, et al., (2014) whose results found that using gender lens scope, women perform more activities in the agrarian communities than men. These authors further found that women are likened to the ever-giving earth, so they are over stressed beyond limit to do almost all the agricultural activities. This overloaded or overburdened activity is premised on the conviction traditionally; women are married

by men and should be made to do all the household chores. This traditional conviction has always been assessed by gender scholars as gender inequity and gender-based stereotype, where men are generally seen to be the head of the house and the womenfolk as slaves or at best laborers. This result is a confirmation of the finding of Panta & Thapa, (2018) who found that in gender based roles analyses, women have been found to be the major drivers of every agricultural enterprises, after the clearing, preparing, tilling of mounds and planting of crops like yam, the staking are occasionally done by men, but after tilling the mounds or beds for other crops, women are responsible for planting of the crops, they do the mulching and weeding, where drought exists, they water the crops through either local irrigation or the use of sprinklers where small generators can be connected to water or irrigate crops. They engage in harvesting, processing, storage and probably sales of the farm produce, but when it comes to spending proceeds from the sales of farm crops, the men handle this aspect.

This same position has been canvassed by Padmanabhan, (2011) that traditionally, women are assigned the responsibilities of procreating the children and also feeding the family, outside working long hours in the field, they must come back to cook the family meal and also care for the children like bathing them, feeding them and also making sure the men of the house also feed. Most often, the women also fetch water for the men to bath. Women bear the burden of doing extra jobs based on their role analysis as shown on figure2 and table 1. Based on this result, it can be concluded that despite the gender disaggregated roles analyses, the women had been identified as having a greater workload in every agricultural setting than the men. This position has come to confirm the finding of Mcdowell, et al., (2013); Panda & Singh, (2016); Pandey, et al., (2018).

Question3: What is the difference in the workload burden of the impacts of climate change between men and women?

This question sought to examine if there is any significant difference between male and female in their burden of work schedule in the rural communities as a result of climate change effects on agriculture? To answer this question, the mean, standard deviation and standard error of the mean were computed to identify if there are any differences in the workload between males and females in the agrarian society of Cross River State. The Independent sample t-test was then applied to compare the group means between males and females. The result is as presented in Table 2.

From Table 2, the P-values (.000) associated with the computed t-values 3.988, for mean difference between males and females, with a critical value of 1.93 and a df of 1249, the result shows a mean p-value of 3.988, which is greater than the critical value of 1.93. Since the calculated p-value of 3.988 is greater than the critical table value of 1.93, there is a significant difference between the burden of works done by men and women during climate change effects. The implication of this result is that during the period where climate change effects are mostly felt, to mitigate the effects, there is a significant increase in the burden of work done between women and men in the agrarian communities of Cross River State (table 2).

From figure 2, the result indicates that more work needs to be done, the result shows a significant difference in the mean score between men and women in their activities to mitigate the effect of climate change.

Table 2: Independent t-test analysis of differences in the increased burden on gender roles in the agrarian communities, (N-1251)

Increased burden of gender roles in the community	Mean	Std deviation	Std error	Mean difference	t-value	p-value
Male	25.50	3.902	.690	2.606	3.988*	.000
Female	23.13	3.679	.650	.787		

*significant at .05 level, Crit. Value= 1.93, $p < .05$ df = 1249

To further identify the direction of this increased burden, a simple percentage analysis was carried out again, the result shows that 986 respondents representing 78.8% ticked that women have considerable increase in the burden of the work they do, especially to mitigate the devastating effects of climate change during their farming seasons and after that period than the men. While 265 respondents representing 21.2% said the direction of increased burden is more on the men than the women. Based on the result on table 1 and figure 2, it is observed that women have more responsibilities than the male folk, hence any significant increase in the jobs to be done in the community will definitely increase their burden of activities, hence extra time and energy would be needed to meet these activities by the womenfolk. The implication therefore is that women would have more increased workload burden than men.

The result here shows a gender disaggregated information pertaining to work schedule done by men and women respectively in the rural agrarian society of Northern Cross River state. Men do about one third of the activities in their communities, whereas women do two third of the activities. This is shown on the activities that are mostly performed during climate change effects to address issues of shortage or delayed rains, increased temperature, crop failure and crop pest infestation. Authors like Arora-Jonsson, (2011); Alston & Whittenbury, (2012); Carr& Thompson, (2014) all observed that women

fetch water for both domestic and agricultural activities like during spraying of insecticides and other agrochemicals, they weed the grasses, and they mulch the farms and also harvest and carry crops from the farms to the house and even to the markets for sales. The women also plant cover crops like potatoes, groundnuts, cowpea, legumes, long beans, mucuna and hedgerows among others to check flooding, erosion (wind and water), reduce temperatures and carbon dioxides from accumulating in the atmosphere. All these are activities that are geared towards mitigating the effects of climate change.

Furthermore, women also engage in fetching of fire woods (fuelwoods), instead of using power chain saw like the men to deforest or log trees that should act as carbon sink (carbon sequestration) and wind breakers, the women only harvest dead branches from wood or those sawn by men during their logging operations, these are latent ways of conserving our forest woods and improving our climatic conditions through the reduction of temperature intensity and carbon accumulations. This result further buttressed those of Carr, (2011); Arora-Jonsson, (2011); Bee, et al., (2013) who found a significant difference in the burden of work women do during climate change effects in the rural farming communities. Their observation was anchored on the fact that women are integral part of every domestic and farming activities in every rural community in Africa and the world over.

This finding has come to further strengthen the position of Chant, (2010) who found that most women in the rural agrarian sector are from poor background, and because poverty is gendered, women must struggle to meet their daily requirement, so they must put in their best to try every activity that can improve their wellbeing, hence their increased work load. Due to the effects of global climate change, women must do all within their powers to improve their crop production and abate crop failure in order to fight food insecurity, to do this, women engaged themselves in mitigation activities like mulching of mounds and beds, planting of cover crops and legumes, potatoes, cowpea, planting of home garden and hedgerows, live sticks, watering of farms and gardens and engagement in market gardening among others.

Question4: What are the strategies adopted by these rural farmers to mitigate the effects of climate change in their agricultural activities?

To answer this questions on the strategies adopted to mitigate climate change effects by these rural farmers, nine strategies were listed, the strategies include: planting of cover crops to reduce wind and soil erosion, mulching of mounds and beds to retain moisture and reduce evaporation of moisture from the soil, planting of crops after the on-sets of the rains, planting of trees and hedgerows, use of organic farm yard manure/compost of green vegetables instead of inorganic fertilizers, clearing of perimeter round the farms to avoid unprescribed bush fire, clearing of farm lands and allowing the grasses to decay instead of burning them and channeling of water flow into farmland and irrigation by manual watering.

Responding to how each of these strategies have been used by these rural farmers, respondent's opinion showed on table 3 and figure 3 indicates that, five hundred and fifty two (552) respondents representing 44.1% ticked that the nine listed strategies have been highly used by them, three hundred and nineteen respondents (25.5%) ticked that they often use the nine listed strategies, 106 (8.5%), respondents said they barely used the nine listed strategies, 274 (21.9%) respondents said they do not use any of the listed strategies.

Taking a further critical look at the strategies listed, 819 respondents (65.5%) observed that planting of cover crops, mulching, watering of crops, planting of crops after the on-set of rains and the use of organic farm yard manure seem to have the widest acceptability and applicability, while 432 respondents, (34.5%) observed that planting of hedgerow, clearing of perimeters round the farms, planting of trees and channeling of water flow into farmland seems to have very poor recognition and rarely practiced as strategies for mitigating climate change effects in the rural agrarian communities of Northern Cross River State, Nigeria.

Table 3: Some strategies for mitigating climate change in the rural communities of CRS

S/No	Some strategies to mitigate climate change		Response options			
			Highly used	Often used	Barely used	Not used
1	Planting of crops after the on-sets of rains		380	578	223	70
2	Mulching of mounds and beds		756	455	40	--
3	Planting of cover crops		741	382	113	15
4	Planting of trees and hedge rows		385	191	60	615
5	Watering of farms/irrigation		720	354	112	65
6	Use of organic farm yard manure/compost from green vegetables for manure instead of inorganic fertilizer		362	113	103	673
7	Clearing of perimeters round farm lands to reduce bush fire		313	195	58	685
8	Clearing of farms land and allowing the grasses to decay instead of burning		802	221	140	88
9	Channeling water flow into farmlands		496	389	113	253
	Total	**11259**	**4955**	**2878**	**962**	**2464**
			551	**320**	**107**	**273**
			44.0	**25.6**	**8.5**	**21.9**

This is another confirmation of the result obtained by Bee, et al., (2013)who listed four strategies adopted by rural farmers based on their experience to mitigate climate change to include planning of hedgerow, trees and live sticks around the houses to prevent and reduce wind and rain storm, channeling of stream flows through channels to farmlands in swampy areas, clearing of perimeters round farm lands and reduction in the use of prescribed bush fire. Though these were practices used in the area where these authors carried out their study.

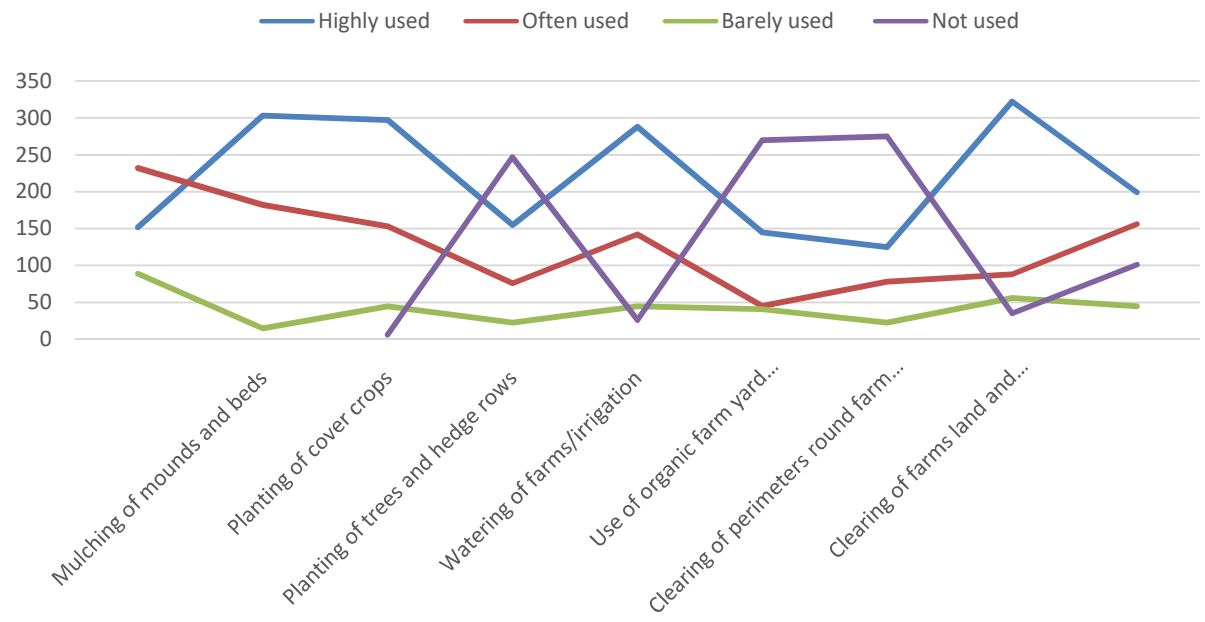

Figure 3: Some strategies for tigating climate change in Northern communities of Cross River State

Carr& Thompson, (2013) found a similar result, when they listed climate change awareness creation, engagement of local farmers in strategies that can reduce climate change effects among others. The findings here shows that there are some levels of climate change awareness among the rural farmers of Northern Cross River State, this has also influenced their perception of climate change as affecting their agricultural productivities, but with the introduction and practice of these strategies, some reprieve had come the ways of these rural farmers.

Question 5: What roles can Environmental Education play in helping the rural farmers to design and adopt sustainable adaptation and mitigation strategies to reduce or completely eradicate their vulnerability to climate change effects?

Based on the objectives of Environmental Education, five key questions were set on the five key objectives to include:

Creating Environmental Awareness to help all social groups and individuals to acquire the awareness needed and the sensitivity to solve existing environmental problems while preventing the occurrence of new ones.

Knowledge of Environmental Education to help social groups and individuals to gain varieties of knowledge and experience to acquire basic understanding of the environment and its associated problems.

Attitude to help individual and social groups acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

Skills, needed to help social groups and individuals acquire skills to identify and solve environmental problems.

Participation to provide social groups and individuals with the opportunity to be actively involved at all levels in working towards the resolution of environmental problems.

The result of simple percentage analysis to answer this question is presented on table 4.

Based on data generated using the instrument from the field as shown on table 3; 857 respondents (68.5%) ticked that it is very possible for Environmental Education to provide the needed awareness , provide the knowledge, create the needed attitude, provide the skills and the encourage the participation of both social groups and individuals in adopting sustainable strategies needed to mitigate climate change effects on agricultural activities and other forms of rural livelihoods. 394 respondents representing 31.5% also stated that it is possible Environmental Education can create the awareness, provide the knowledge, skills, attitude and encourage the participation of individuals and groups in the mitigation of climate change effects through the local strategies so identified on table 2 above.

Table 4: Respondent's opinion on the roles of Environmental Education in Climate change mitigation in the rural communities of Cross River State

S/No	Objectives of Environmental Education	VP	P	IP	UD
1	Providing the awareness creation about causes and effects of climate change on agriculture and livelihoods	825	215	133	78
2	Providing knowledge about the effects of climate change on agriculture and crop production	719	334	96	102
3	Bring about the attitude to identify the negative effects of climate change on agricultural activities and how to solve them	862	323	30	36
4	Providing the skills needed to identify different strategies to mitigate climate change effects on agriculture and general livelihoods	444	645	74	88
5	Providing the needed skills and attitude to individually and collectively participate in the implementation of activities (strategies) to mitigate climate change effects on agriculture and other forms of livelihoods in the rural communities in Cross River State	775	452	-	24
Total scores (6255)		**3625**	**1969**	**333**	**328**
Individual respondents, (1251)		**724**	**394**	**67**	**66**
Percentage (100%)		**57.9**	**31.6**	**5.3**	**5.2**

Sixty-seven (67) respondents (5.3%) said that it is impossible for Environmental Education to create the awareness, knowledge, attitude, skills and the capacity for people to participate in strategizing to mitigate the effects of climate change on rural agriculture. While, another sixty-six (66) respondents, representing 5.2% ticked that they undecided whether Environmental Education can provide the needed awareness, create the knowledge and attitude, provide the skills and encourage the participation of rural farmers in mitigating the effects of climate change on rural agricultural activities in Cross River State. From this result, and the data analyzed, it is important to conclude that Environmental Education can create the needed awareness, knowledge, attitude, skills and the participation of individual or social groups in strategizing and implementing such strategies as listed in the study to mitigate the effects of climate change in agriculture in the rural Cross River State, Nigeria.

Taking a closer look at the result, nearly all the respondents, 1120 respondents (89.5%) ticked that Environmental Education can play very enormous roles in creating the needed awareness, knowledge, attitude, skills and the capacity to enable individuals and social groups to participate in the implementation of various strategies for mitigating climate change effects on agriculture in the rural agrarian societies of Cross River State, Nigeria. This finding that climate change education is very crucial in combating global climate change is derived from the core objectives of Environmental Education. Environmental Education will provide a fulcrum through which the tenets of awareness creation in terms of prevention, mitigation and adaptation strategies can be delivered to the rural farmers in their rural setting. Education is knowledge, knowledge to bring or map out strategies to combat the effects of global climate change in agriculture within the rural setting. The finding of this study is in line with those of Akerlof, et al., (2011); Adger, et al., (2013) and Alan, (2019) who found that education in whatever form be it climate change education or Environmental Education brings about the inculcation of the right type of awareness, knowledge, ideas, skills, attitude, values and the capacity to change the perception of the rural farmers and give them the push to engage in different activities to prevent or mitigate climate change and in extreme conditions or situations, the ability to adapt to the changing climatic conditions.

Anderson, (2010) found that Environmental Education has the capacity to influence people's knowledge to actively participate in carrying out strategies design to mitigate or prevent environmental crisis, these crises could be climate change, flooding, drought, emergency environmental disaster etc. Anderson, (2012); Armstrong, et al., (2018) also found a similar result, that Environmental Education imbues in the learners (in this case rural farmers) who are both individuals and social groups the skills needed to identify climate change situation, how to prevent their occurrence by mitigating their effects and adapting to the situation, by developing resistivity and resilience to climate change effects on their agricultural productivities and wellbeing.

This research was carried out to ascertain the extent of climate change awareness, the effects of global climate change on the burden of workload on gender role analysis and what roles Environmental Education can play in preventing, mitigating and adapting to the effects of these climate change. Based on the result of this study and the finding there from, most rural farmers in the Northern parts of Cross River State have some reasonable level of climate change awareness, based on this awareness levels, the people are aware of the effects of climate change and are aware that climate change increases the burden of gender roles in the agrarian society. Therefore, in attempting to prevent, mitigate and adapt to climate

change effects on agricultural productivity, Environmental Education can imbue in the individual and social groups the skills, knowledge, awareness, attitudes and the capability to participate actively in mitigating climate change effect in the agrarian communities of Northern Cross River State, Nigeria. The purpose for which this research was carried out has been achieved and the gap so identified has been also sufficiently filled.

Conclusion

The research examined the extent of climate change awareness among rural farmers, identify how the effects of climate change increases or reduces the burden of gender roles on both men and women and what roles can Environmental Education play in preventing, mitigating and adapting to climate change effects and conditions of Northern Cross River State, Nigeria. After a rigorous analysis of data, it was observed that the rural farmers have average knowledge of the effects of climate change based on the variations in weather conditions and the effects which it has on their agricultural activities and productivity from their experience over the years. The rural farmers identified that when climate change effects are being experienced, local farmers struggle to mitigate the effects of climate change using their local strategies and when this happens, the gender role burden on women increases due to the additional workload added to their original schedules. This increase comes in form of mulching of farms, watering of crops (manual irrigation), planting of cover crops, using of compost manure to improve crop yield among others. To be able to change attitude, get more knowledge, skills, and awareness and to effectively participate in mitigating, preventing or adapting to the climate change conditions, Environmental Education will be handy to perform these roles. Based on the finding of this study, the local farmers under study have an average level of climate change awareness, they have identified some local strategies they use in mitigating and preventing climate change conditions in the rural communities, when these happens, the burden of work load for the women increases more than those of the men. To be able to mitigate this situation, Environmental Education can provide the awareness, knowledge, skills, attitude and

the ability to participate in designing and carrying out mitigation activities in the agrarian society of Northern Cross River State, Nigeria.

Recommendations for policy directions

Arising from these research findings, the following recommendations were made:

There should be occasional climate change awareness campaign and training for these rural famers to improve their mitigation and adaptation strategies.

Since the burden of workload for the women will increase more than those of men, men should assist in the best way they can to ameliorate the burden of work load on the women.

Environmental Education both formal and non-formal including Environmental adult education should be introduced and used to teach social groups the strategies that best suit the local conditions for climate change mitigation.

Grants should be given to local farmers to enable them buy high yielding crop species (improved varieties), and other farm inputs and tools like sprinklers irrigation system,

Farmers should be encouraged to patronize compost or organic manure instead of inorganic manure.

Farmers should be encouraged to form cooperative societies where soft loans can be given to them as groups to purchase some farm implements that can help reduce the burden of workload on them.

Farmers should be encouraged to plant hedgerow, live stick fencing, clearing of perimeter around farm lands to discourage bush burning or wildfire.

Government should formulate policies to safe guard food security, by providing water scheme for poor farmers with hose to help them get water to their farms within a certain or specified cluster.

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