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CLIMATE CHANGE PARTNERSHIP ACTIONS FOR SUSTAINABLE FUTURE AND RESTORING LIFE ON EARTH

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PREFACE

There is a growing concern on the adverse impacts of climate on biodiversity. This phenomenon is greatly manifested in form of shifting weather patterns threatening global food security, health and species existence. Humanity is at the receiving end of the consequences of climate change hence there is a need to step up actions on all fronts- overtime, everywhere all at once.

This calls for collaboration, partnership and networking to strengthening synergy among relevant stakeholders in a bid to tackling climate change menace. This forms the basis for the theme of this year world Environmental conservation conference: **CLIMATE CHANGE PARTNERSHIP ACTIONS FOR SUSTAINABLE FUTURE AND RESTORING LIFE ON EARTH.** The theme is conceived with a view to create an interface for information sharing and offer opportunities for participants to refine their commitments and pledges in the quest to achieving Sustainability in the face of climate change.

This year World Environmental Conservation Conference is memorable in the sense that it received overwhelming funding from the host - West African Science Service on Climate Change and Adapted Land use). WASCAL is posed to provide information and knowledge at the local, national and regional level to cope with the adverse impacts of climate change. Thus, this conference will offer opportunities for participants to learn from good practices demonstrated and showcase by WASCAL during the course of the conference. It will also strengthen staff-student exchange and provide prospect for Doctorate Research Doctoral Research in West Africa Climate System Programme (DRP WACS) – WASCAL among others.

Special appreciation goes to the management of The Federal University of Technology, Akure the host institution, National Park Service and African Regional Center for Space Science and Technology Education-English (ARCSSTE-E) that co-host this conference. We equally acknowledge other private, individual and corporate organizations that have contributed towards the success recorded in this event.

All the submitted articles were subjected to strict double blind peer-review process by the reviewers that are experts in the area of the particular submitted manuscript. The accepted manuscripts are published in WECC 2023 proceedings and also available for download on the organization website (www.necorng.org).

The accepted manuscripts fall within the underlisted subthemes:

- Climate change adaptation strategies in Agriculture, Forestry and Other Land Use (AFOLU)
- Climate smart city and architectural landscape design
- Retrofitting and decarbonization in tourism and hospitality industry
- Indigenous knowledge and local innovation in climate change adaptation
- Climate risk management, health, safety and hygiene
- Carbon credit-offset marketing/circular economy
- ICT development in environmental conservation (image processing and acquisition, computer vision, graphics, speed, interface technology, HMD devices, GIS: Body Tracking, AI and IOT, VRT, IVE).

We commend our keynote speaker Prof. Douda Kone Director Capacity Building Department, WASCAL Headquarter, Ghana and other guest speakers Prof. Babatunde Rabiu, Director General, Chief Executive Office, African Regional Centre for Space Science and Technology Education-English (ARCSSTE-E) and Dr. Goni I. M., Conservator General National Park Service.

It is hoped that researchers, students and policy makers will find the papers in this book very useful. Even though all the papers were reviewed and edited, the content and option expressed remain essentially that of the authors and not necessarily that of Netlink Environmental Conservation Organization.

Dr. Oladeji S. O.

President Netlink Environmental Conservation Organization

Convener World Environmental Conservation Conference

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GENDER ANALYSIS OF FISH FARMERS' VULNERABILITY AND ADAPTABILITYTO CLIMATE CHANGE IN IDO LOCAL GOVERNMENT AREA OF OYO STATE

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ABSTRACT

Fish farmers are considered to be vulnerable to climate change but little is known about how that vulnerability differs between men and women. This study was carried out to determine gender vulnerability and adaptability to climate change in Ido Local Government Area (ILGA) of Oyo state. Multi-stage sampling techniques were used to select 120 respondents from eight villages in four wards in ILGA of Oyo State. The results of this study showed that majority (66.7%) of the respondents were male. The male (25.8%) and female (15.0%) were in the age range 36 and 45 years with mean ages of 40.76±1.09 years (male) and 38.9±9.54 years (female). Educational status showed that male (40.0%) and female (18.3%) had tertiary education while 29.2% (male) and 18.3% (female) of the respondents had between 1 and 10 years of fish farming experience. Also, the results show that extension workers and newspapers were the major sources of adequate information on climate change. Likewise, both genders were aware of climate change where vulnerability in terms of poor quality harvest (M-1.4±0.06, F-1.43±0.08) and heat stress on fish (M-1.43±0.06, F-1.4±0.08) top their perception list. Furthermore, the results show that for both gender, adaptation strategies in terms of short cycle of production (M-1.36±0.05, F-1.38±0.08) and use of borehole (M-1.39±0.05, F-1.35±0.08) top their adoption list but in reverse order. In addition, both gender ranked inadequate capital as the major constraints. It is recommended that financial institutions should provide soft loan with low interest rate for the farmers.

Keyword: *Climate change, awareness, Fish farmers, vulnerability and adaptability, Gender analysis, Ido Local Government.*

INTRODUCTION

Aquaculture or fish farming is the culturing of aquatic animals under controlled environment (Nwabueze, 2010). It plays important roles for security and income generation (FAO, 2012). In Africa, it is an important livelihood activity (Roscher *et al.* 2018). It has provided both direct and indirect job opportunities for different households in urban and rural communities in Nigeria. According to FAO (2011), women comprise on average forty-three percent of the agricultural labour force. Despite women's immense contribution, their livelihoods, rights and socio-economic status are weakly asserted compared to men (Terry, 2009).

Aquaculture activities are vulnerable to environmental changes caused by climate change. These changes according to Brander *et al.,* (2018) are great threats to aquaculture-dependent communities especially in tropical regions. It has been reported that aquaculture activities have also been identified as significant contributors to climate change generating about seven percent of global agricultural greenhouse gas emissions (He *et al.,* 2018). Climate change in reflected in the deterioration of water quality, fish stress, poor or delayed fish hatching, and changes in growth and mortality rates as well as outbreak of diseases.

Climate change is expected to disproportionately affect smallholder fish farmers by exacerbating their socio-economic risks (Tschakert, 2012). Its drivers are causing shifts in the socio-economic sustainability of households, especially women, which depend on fish for food and income generation. Gender inequality is reported to undermine women's ability to respond to the impact of climate change on food production (Demetriades and Esplen, 2008). This impact of climate change, according to Arora-Jonsson (2011) will further increase due to discriminatory policies.

Climate variability is increasing vulnerability of fish farmers, especially small-scale or individual farmers, as it contributes to production and livelihood losses. A system becomes vulnerable when it is unable to cope with the negative impacts of climate change (IPCC, 2007). It has been reported that the least-developed and developing countries are the most vulnerable because the capacity to adapt may be most limited (Allison *et al.,* 2009). Mani *et al*., (2008) opined that adaptation includes efforts to adjust to ongoing and potential effects of climate change.

Although, the gender dimensions of climate change and food security have been discussed in several development literature (Dankelman (2010), World Bank (2013), Farnworth and Colverson (2015), Mukasa and Salami (2016), Parker (2016)), yet, according to Omolo (2010), the confluence of climate change with socio-economic realities confronting vulnerable communities is weakly understood. Therefore, it is imperative to assess gender vulnerability of some fish farmers and how they are adapting to these changes in order to preserve their means of livelihood. Thus, this study assessed gender vulnerability and adaptability to climate change in Ido Local Government of Oyo State.

METHODOLOGY

Description of the Study Area

Ido Local Government area is located in the rainforest zone of Nigeria between Latitude 6º 45'N and 9º 41'N and Longitude 2º 30'E and 5º 15'E. It occupies a land mass of 865,490km with population of 103,261 according to the 2006 census and about 57% of the total land is being used for agricultural purposes.

Sampling Procedure and Data Collection

The data were collected through administration of a well-structured questionnaire administered directly to the respondents. The sampling technique used was multi-stage sampling procedure. The first stage involved simple random sampling of four (4) wards out of ten (10) principal wards, namely, Akufo, Bakantari, Omi-Adio, and Ido. In the second stage, two (2) villages were randomly selected from each ward to give a total of 8 villages. In the third stage fifteen (15) fish farmers were randomly selected from each village which resulted to sample size of 120 respondents in the study. Data for this study were analyzed using descriptive statistics such as frequency distribution, mean and percentage.

RESULTS AND DISCUSSION

The results of this study are presented and discussed according to the specific objectives of the study.

Socio economic Characteristics of the Respondents

Gender of Respondents

Table 1 shows that 66.7% of the respondents were male. This indicates that more male engaged in fish farming than female in the study area. The finding agrees with the report of Digun-Aweto and Oladele (2017).The male dominance implies the laborious nature of fish farming operations which are very tedious for female. It can be implicated that gender roles in fish production and climate change perception can be effectively distributed among men and women.

Age

Results of analysis in Table 1 show that 25.8% and 15.0% in the age range 36 and 45 years, were male and female, respectively. The mean ages of the respondents were 40.76±1.09 years (male) and 38.9±9.54 years (female).The result indicates that slight majority of the respondents were in their active age, and this may have implication in adoption of technologies for adapting to climate change. This agrees with the opinion of William *et al*.,(2012) that age greatly influence decision making.

Educational Status

Educational status as indicated in Table 1 shows that 40.0% and 18.3% of the male and female respondents, respectively had tertiary education. This implies that both gender are highly educated. Since education is reported by Ojuekaiye (2001) as an essential socio-economic factor that influences farmer's decision on quick adoption of innovation, it can therefore be opined that the level of education of respondents in this study will influence their adoption of innovations to adapt to climate change.

Fish Farming Experience

Results of analysis in Table 1 show that 29.2% and 18.3% of the respondents who had between 1 and 10 years of fish farming experience were male and female, respectively. This indicates that slightmajority of the female respondents were new entrants into fish farming and this is likely to have effect on their knowledge of adaptive measures on climate change. This is in agreement with the findings of Williams *et al*., (2012) that stated correlation between decision-making and age.

Pond Ownership

It is revealed in Table 1 that 57.5% and 30.8% of the respondents who owned personal ponds for fish production were male and female, respectively. This reflects the gender inequality being observed in agricultural production as reported by Arora-Jonsson (2011).

Membership of Cooperative Society

Membership of cooperative society as shown in Table revealed that 52.5% (male) and 29.2% (female) are registered members of one social group or the other. This shows that majority of the respondents have a social affiliation in their communities. This may be attributed to the benefits members of a social group can have access to. This confirms the opinion of Basorun and Olakulehin (2007) that fish farmers joined the association when they heard about the association's link to markets, credit facilities and extension service.

Table 1: Socio-economic Characteristics of the Respondents

Variables	Male Frequency (%)	Mean ± S.E	Female Frequency (%)	Mean ± S.E
Gender	80 (66.7)		40 (33.3)	
Marital status				
Married	60 (50.0)		31 (25.8)	
Single	17 (14.2)		8 (6.7)	
Widowed	3 (2.5)		1 (0.8)	
Age		40.76±1.09		38.9±9.54
< 25	8 (6.7)		5 (4.2)	
26-35	17 (14.2)		8 (6.7)	
36-45	31 (25.8)		18 (15.0)	
46-55	9 (7.5)		4 (3.3)	
>56	15 (12.5)		5 (4.2)	
Educational status				
Primary	8 (6.7)		2 (1.7)	
Secondary	23 (19.2)		15 (12.5)	
Tertiary	48 (40.0)		22 (18.3)	
No formal	1 (0.8)		1 (0.8)	
Household size		3.6±1.60		3.6±1.66
< 4	64 (53.3)		31 (25.8)	
5-10	16 (13.3)		9 (7.5)	
Fish farming experience		11.54±5.71		10.8±5.17
1-10	35 (29.2)		22 (18.3)	
11-20	39 (32.5)		18 (15.0)	
21 and above	3 (2.5)		0 (0)	
Member of cooperative society				
Yes	63 (52.5)		35 (29.2)	
No	17 (14.2)		5 (4.2)	
Access to credit				
Yes	57 (47.5)		31 (25.8)	
No	23 (19.2)		9 (7.5)	
Number of fingerlings stocked				
< 1000	10 (8.3)		7 (5.8)	
1001-2000	35 (29.2)		19 (15.8)	
2001-3000	13 (10.8)		4 (3.3)	
3001-4000	7 (5.8)		5 (4.2)	
> 4000	15 (12.5)		5 (4.2)	
Do you own a pond				
Yes	69 (57.5)		37 (30.8)	
No	11 (9.2)		3 (2.5)	
Sources of water				
Stream	66 (55.0)		30 (25.0)	
River	9 (7.5)		8 (6.7)	
Well	5 (4.2)		2 (1.7)	

Source: Field Survey, 2022

Sources of Information on Climate Change

The results of analysis in Table 2 show that the respondents have multiple sources of information on climate change. It is revealed in the Table that extension workers and newspapers, extension workers and neighbours/friends were the major sources of adequate information on climate change for male and female, respectively. This is probably according to expectation. There are many factors that could have influenced the choice of the sources of information adopted by the respondents in this study. These results contradict the findings of Ijatuyi (2016) which reported that radio is most commonly used by farmers.

Table 2: Source of Information on Climate Change

	Male			Female		
Sources	**Yes**	**No**	**Mean ± S.E**	**Yes**	**No**	**Mean ± S.E**
Extension workers	31(25.8)	49(40.8)	1.61±0.05 (1st)	12(10.0)	28(23.3)	1.7±0.07 (1st)
Fish famers' association	66(55.0)	14(11.7)	1.08±0.03 (6th)	37(30.8)	3(2.5)	1.03±0.03 (6th)
Internet	58(48.3)	22(18.3)	1.28±0.05 (4th)	26(21.7)	14(11.7)	1.35±0.09 (3rd)
Neighbors/Friends	47(39.2)	33(27.5)	1.41±0.06 (2nd)	25(20.8)	15(12.5)	1.38±0.08 (2nd)
Newspapers	47(39.2)	33(27.5)	1.41±0.06 (2nd)	27(22.5)	13(10.8)	1.33±0.08 (4th)
Radio/Television	12(10.0)	68(56.7)	1.15±0.04 (5th)	6(5.0)	34(28.3)	1.15±0.06 (5th)

Source: Field Survey, 2022

*****All figures in parentheses are in percentage

Fish Farmers' Awareness of Climate Change

It is revealed in Table 3 that the respondents have different levels of awareness about climate change, though, both gender had the same perception on the duration of harmattan period. This variation can be traced to what they experienced during their period of production. They were aware of floods but this ranked low probably because they did not have such experience. This result did not agree with the report of Oyebola *et al.* (2018) that flood represents a major threat to fish farming in Nigeria and other developing countries.

Table 3: Fish Farmer's Awareness of Climate Change

	Male			Female		
Climate change variables	**Yes**	**No**	**Mean ± S.E**	**Yes**	**No**	**Mean ± S.E**
Flood	65(54.2)	15(12.5)	1.21±0.05 (7th)	31(25.8)	9(7.5)	1.2±0.06 (5th)
Short period of harmattan	33(27.5)	47(39.2)	1.59±0.06 (1st)	19(15.8)	21(17.5)	1.53±0.08 (1st)
High temperature	58(48.3)	22(18.3)	1.28±0.05 (4th)	26(21.7)	14(11.7)	1.35±0.08 (2nd)
Excessive wind	51(42.5)	29(24.2)	1.36±0.05 (2nd)	28(23.3)	12(10.0)	1.3±0.07 (3rd)
High heat waves	58(48.3)	22(18.3)	1.28±0.05 (4th)	32(26.7)	8(6.7)	1.2±0.06 (5th)
High sunshine drought	56(46.7)	24(20.0)	1.3±0.05 (3rd)	31(25.8)	9(7.5)	1.2±0.07 (4th)
Increase incident of pest and diseases	58(48.3)	22(18.3)	1.28±0.05 (4th)	32(26.7)	8(6.7)	1.2±0.06 (5th)

Source: Field Survey, 2022

*****All figures in parentheses are in percentage

Vulnerability Effect of Climate Change on Fish Farming

Table 4 shows the vulnerability effect of climate change on fish farming in the study area. The results show that for both gender, vulnerability in terms of poor quality harvest (M-1.4±0.06, F-1.43±0.08) and heat stress on fish (M-1.43 ± 0.06, F-1.4 ± 0.08) top their perception list. This is traceable to insufficient water, especially during dry season. This view agrees with the opinion of Adebo and Ayelari (2011) that successful aquaculture production hinges on adequate water in terms of quality and quantity. The stress will resulted in fish mortality and invariably affect farmer's income. This supports the assertion of Dewit and Stankiewicz (2006) that negative impacts of climate change are being experienced by fish farmers through reduction in the quantity of fish cultured and decrease in their income.

Table 4: Vulnerability Effect of Climate Change on Fish Farming

	Male			Female		
Vulnerability	**Yes**	**No**	**Mean ± S.E**	**Yes**	**No**	**Mean ± S.E**
Change in quantity of fish cultured	64(53.3)	16(13.3)	1.2±0.05 (9th)	28(23.3)	12(10.0)	1.3±0.07 (3rd)
Reduces farmers income	67(55.8)	13(10.8)	1.16±0.04 (11th)	33(27.5)	7(5.8)	1.12±0.06 (10th)
Climate change has led to fish infestation and disease	62(51.7)	18(15.0)	1.23±0.05 (7th)	30(25.0)	10(8.3)	1.25±0.07 (6th)
Reduction in size of the fish	64(53.3)	16(13.3)	1.2±0.05 (9th)	31(25.8)	9(7.5)	1.23±0.07 (8th)
Death of fish is increasing due to climate change	55(45.8)	25(20.8)	1.31±0.05 (3rd)	29(24.2)	11(9.2)	1.28±0.07 (4th)
Increase in heat stress on fish because of climate change	46(38.3)	34(28.3)	1.43±0.06 (1st)	24(20.0)	16(13.3)	1.4±0.08 (2nd)

Reduction in egg production in brood stocks due to climate change	57(47.5)	23(19.2)	1.29±0.05 (5th)	30(25.0)	10(8.3)	1.25±0.07 (6th)
Climate change has caused reduction in quality of fish	56(46.7)	24(20.0)	1.3±0.05 (4th)	29(24.2)	11(9.2)	1.28±0.07 (4th)
Frequent occurrences of floods during the raining season is a result of climate change	62(51.7)	18(15.0)	1.23±0.05 (7th)	33(27.5)	7(5.8)	1.12±0.06 (10th)
Poor quality harvest	48(40.0)	32(26.7)	1.4±0.06 (2nd)	23(19.2)	17(14.2)	1.43±0.08 (1st)
Poor growth of the fish	61(50.8)	19(15.8)	1.24±0.05 (6th)	31(25.8)	9(7.5)	1.23±0.07 (8th)

Source: Field Survey, 2022

All Figures in Parentheses are in Percentage

Adaptation Strategies to Climate Change by Fish Farmers

Table 5 shows the adaptation strategies to climate change by fish farmers in the study area. The results show that for both gender, adaptation strategies in terms of short cycle of production (M-1.36±0.05, F-1.38±0.08) and use of borehole (M-1.39 ± 0.05, F-1.35 ± 0.08) top their adaptation list. These results contrast the findings of Onyeneke *et al.* (2018) who reported that planting banana and plantain tree were majorly used by both gender as their adaptive strategies to climate change.

Table 5: Adaptation Strategies to Climate Change by Fish Farmers

	Male			Female		
Adaptation strategies	**Yes**	**No**	**Mean ± S.E**	**Yes**	**No**	**Mean ± S.E**
Planting of banana trees as shade	77(64.2)	10(8.3)	1.13±0.04 (8th)	37(30.8)	3(2.5)	1.08±0.04 (10th)
Biosecurity	70(58.2)	3(2.5)	1.04±0.02 (10th)	35(29.2)	5(4.2)	1.13±0.05 (9th)
Isolation of sick fish	58(48.3)	22(18.3)	1.28±0.05 (6th)	33(27.5)	7(5.8)	1.18±0.06 (7th)
Avoiding pond linkages	68(56.7)	12(10.0)	1.15±0.04 (7th)	32(26.7)	8(6.7)	1.2±0.06 (6th)
Stocking healthy fingerlings	72(60.0)	8(6.7)	1.1±0.03 (9th)	34(28.3)	6(5.0)	1.15±0.06 (8th)
Diversion of water ways	68(56.7)	12(10.0)	1.15±0.04 (7th)	32(26.7)	8(6.7)	1.2±0.06 (6th)
Ensure use of borehole	49(40.8)	31(25.8)	1.39±0.05 (1st)	26(21.7)	14(11.7)	1.35±0.08 (2nd)
Avoid construction of pond near stream	56(46.7)	24(20.0)	1.3±0.05 (4th)	29(24.2)	11(9.2)	1.28±0.07 (3rd)
Use of plastic net to prevent flooding	54(45.0)	26(21.7)	1.33±0.05 (3rd)	29(24.2)	11(9.2)	1.28±0.07 (3rd)
Short cycle of production	51(42.5)	29(24.2)	1.36±0.05 (2nd)	25(20.8)	15(12.5)	1.38±0.08 (1st)
Low stocking during dry season	57(47.5)	23(19.2)	1.29±0.05 (5th)	30(25.0)	10(8.3)	1.25±0.07 (5th)

Source: Field Survey, 2022

All Figures in Parentheses are in Percentage

Constraints to the use of Adaptation Strategies to Climate Change used by Fish Farmers

Results of analysis as shown in Table 6 revealed the constraints to the use of adaptation strategies to climate change used by fish farmers in the study area. The results show that both gender ranked inadequate capital as the major constraints in the study area. This implies that inadequate capital was the major constraint to adopting modern adaptation strategies to climate change. This corroborates the opinion of Otitoju and Enete (2016) that inadequate capital was the major constraint in mitigating the effects of climate change.

Table 6: Constraints to the use of adaptation strategies to climate change used by fish farmers

Constraints	Male				Female			
	Very severe	Severe	Not severe	Mean±S.E	Very severe	Severe	Not severe	Mean±S.E
Inadequate capital	55(45.8)	20(16.7)	5(4.2)	2.63±0.07 (1st)	30(25.0)	8(6.7)	2(1.7)	2.7±0.09 (1st)
Poor access to information on climate change	35(29.2)	30(25.0)	15(12.5)	2.25±0.08 (8th)	18(15.0)	17(14.2)	5(4.2)	2.33±0.11 (9th)
Poor infrastructural facilities	43(35.8)	31(25.8)	6(5.0)	2.46±0.07 (2nd)	21(17.5)	17(14.2)	2(1.7)	2.48±0.09 (2nd)
Land tenure system	27(22.5)	40(33.3)	13(10.8)	2.18±0.08 (11th)	15(12.5)	21(17.5)	4(3.3)	2.28±0.1 (10th)
Low level of education	31(25.8)	34(28.3)	15(12.5)	2.2±0.08 (10th)	14(11.7)	22(18.3)	4(3.3)	2.25±0.1 (11th)
Lack of improved fishing technologies	36(30.0)	33(27.5)	11(9.2)	2.31±0.08 (8th)	16(13.3)	21(17.5)	3(2.5)	2.33±0.1 (8th)
Lack of credit facilities	40(33.3)	33(27.5)	7(5.8)	2.41±0.07 (4th)	21(17.5)	16(13.3)	3(2.5)	2.45±0.1 (4th)
Absence of government policy on climate change	41(34.2)	32(26.7)	7(5.8)	2.43±0.07 (3rd)	22(18.3)	15(12.5)	3(2.5)	2.48±0.1 (3rd)
Low level of awareness	39(32.5)	30(25.0)	11(9.2)	2.35±0.08 (7th)	20(16.7)	16(13.3)	4(3.3)	2.4±011 (6th)
Lack of cooperative society	41(34.2)	28(35.0)	11(9.2)	2.38±0.08 (6th)	20(16.7)	16(13.3)	4(3.3)	2.4±0.11 (6th)
Inadequate agricultural extension service delivery	42(52.5)	33(27.5)	5(4.2)	2.46±0.07 (2nd)	18(15.0)	20(16.7)	2(1.7)	2.4±0.09 (5th)
High cost of farm inputs	40(33.3)	32(26.7)	8(6.7)	2.4±0.07 (5th)	117(97.5)	18(15.0)	5(4.2)	2.3±0.11 (10th)

Source: Field Survey, 2022

All Figures in Parentheses are in Percentage

CONCLUSION

It is revealed in this study that majority of the respondents were male. The male dominance implies the laborious nature of fish farming operations. Higher percentage of the respondents were in the age range of 36 and 45 years. In addition, majority of the respondents had tertiary education. Also, slight majority of the respondents had between 1 and 10 years of fish farming experience.

Furthermore, majority of the respondents identified extension workers and newspapers as the major sources of adequate information on climate change. Likewise, it is revealed that the respondents have different levels of awareness about climate change. Also, the study showed that the vulnerability of the respondents, differs. In addition, and inadequate capital was reported as the major constraints in adapting to climate change in the study area.

RECOMMENDATION

Financial institutions should provide soft loan with low interest rate since lack of capital hinders farmers from getting the necessary resources and technologies for adaptation to climate change.

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