Introduction: The role of adaptation to climate change and variability is increasingly gaining much recognition in academic research, and its significance is being recognized in national and international policy debates on climate change (Smit et al., 2000). The Afram Plains is located in the Eastern Region in Ghana. The district is virtually a peninsular cut off on three sides by the Volta Lake and on the fourth by lack of a connecting road to the outside world. The district in recent times has experienced the same amount of rainfall but decreased number of rainy days. This region is also characterized by limited social, political, technical and other resources to draw upon to combat issues of scarcity and poverty, constraining the ability to adapt to changing conditions (Westerhoff and Smit, 2008).

Data land methods: Primary data for the study was collected through collaboration with the Climate Change Learning and Observatory Network in Ghana (CCLONG) and Advancing Capacity for Climate Change Adaptation in Ghana (ACCCA) project. Data were derived primarily in the form of focus group discussions. Selection of target groups for the study was done by taking into consideration the age (i.e. above 30 years) and number of years (i.e. above 10 years) an individual has lived in the community. The "Akropong Approach" was used in the analysis of data. The approach uses a simplified cross-impact approach which can be applicable in many cross-sector or cross-disciplinary studies in which the work was carried out.

Results / Discussion

Table 1 provides information on the various adaptation options scored by female and male farmers, fishers and charcoal producers during a drought. Majority of the female farmers scored wells and boreholes (13), bushfires control and construction of fire belts (12) and water harvesting (11) as the adaptation options most preferred during drought. On the other hand, most male farmers scored irrigation (12), wells and boreholes (12) and drought tolerant genotypes or early maturing plants (11) as their first three adaptation options.

Furthermore, most female fishers highly preferred seasonal forecast, followed by post-harvest technology and fish ponds as adaptation options during drought whilst male fishers highly preferred fish pond, followed by fish culture and crop insurance. There were no variations of least preferred adaptation options between male and female fishers.

In addition, female charcoal producers highly scored seasonal forecast, wells and boreholes and sedentary pasture management as their first three adaptation options to be considered during periods of drought. There was a slight difference of choice of adaptation options between females and males charcoal producers. The males scored crop insurance, followed by seasonal forecast and sedentary pasture management as the top three adaptation options for a drought whereas the female charcoal producers most preferred seasonal forecast, wells and boreholes and sedentary pasture management.

Improved roofing and foundation against flood was most preferred by both male and female farmers (Table 2). Followed by improved roofing and foundation, female farmers

preferred post harvest technology and crop insurance whilst community drains and upland cultivation were highly preferred by male farmers. Observations from Table 2 reveal that female fishers scored seasonal forecast six times more than male fishers scored seasonal forecast. Moreover, drainage on farms and community drains were given lower scores by females compared to male fishers.

Apart from the cultivation of water loving crops that most female charcoal producers scored highly, all other adaptation options that were highly scored reflect those of female farmers and fishers (see Table 2). Most female charcoal producers have high preference for seasonal forecast, improved roofing and foundation, community drains and post-harvest technology. Similarly, male charcoal producers highly scored seasonal forecast, improved roofing, upland crop cultivation and channels to improve drainage on farms. These adaptation options are combinations of most preferred adaptation options of male farmers and fishers.

Finally, it is apparent from Table 3 that the net impact of bushfire control on all the adaptation options of female farmers, fishers and charcoal producers during periods of floods and drought was the highest which is 12. However, seasonal forecast had the highest net impact amongst the male target groups which was 8. From Table 3, bushfire control was found to have strong positive impact on post-harvest technology, vegetable cultivation after floods, fish pond, fish culture, cultivation of water loving plants and animal rearing. It was noted from the male group that information from seasonal forecast has strong positive impact on community drains, crop insurance and upland crop cultivation.

Conclusion

From the study, adaptation options of male farmers, fishers and charcoal producers during periods of floods and droughts are different from those of females within the various agriculture sectors. Bush fire control was found to have the most positive impact on the adaptation options of female target groups whilst seasonal forecast was observed to have the most positive impact on adaptation options of male target groups. Local experts within and outside the communities acknowledged the importance of governmental institutions such as the District Assembly, Afram Plains Agricultural Development Project and Non-governmental organizations as the panaceas to enhance the implementation of most of the adaptation options with positive impact. It is therefore important to emphasise that these institutions need to mainstream adaptation to climate hazards into their development projects to increase the adaptive capacity of both males and females in the communities.

Table 1: Adaptation preference of male and female target groups during a drought

Adaptation Options	Total Score of Preferred Adaptation Options **MALES**		
	Farmers	Fishers	Charcoal Producers
WH	8	0	0
WLC	1	2	3
BFC	4	3	5
IR	12	6	5
WB	12	4	10
SPM	8	-	11
NT	6	-	4
AR	9	7	8
FP	8	12	6
FC	-	11	-
NTFP	5	1	1
DTG	11	9	9
PHT	2	8	4
CI	3	10	13
SF	2	5	12
Adaptation Options	Total Score of Preferred Adaptation Options **FEMALES**		
	Farmers	Fishers	Charcoal Producers
WH	11	1	4
WLC	1	2	2
BFC	12	3	9
IR	10	7	6
WB	13	5	12
SPM	4	-	11
NT	7	-	1
AR	4	6	9
FP	2	9	8
FC	-	8	-
NTFP	0	0	0
DTG	6	7	5
PHT	7	10	7
CI	5	7	4
SF	9	12	13

Source: CCLONG/ ACCCA Data, 2009. WH= Water harvesting, WLC= Woodlots for charcoal production, BFC= Bushfires control, IR=Irrigation, WB= Wells and Borehole, SPM= Sedentary pasture management, NT=Non timber

forest products, AR= Animal rearing, FP= Fish pond, NTFP= Non timber forest products, DTG= Drought tolerant genotypes, PHT= Post-harvest technology, CI= Crop insurance, SF= Seasonal forecast

Table 2: Adaptation preference of male and female target groups during a flood

Adaptation Options	Total Score of Preferred Adaptation Options **MALES**		
	Farmers	Fishers	Charcoal Producers
CD	1	7	10
WH	1	0	6
WLC	3	2	1
UC	8	-	9
VCF	5	4	6
CWLP	4	-	8
IRF	9	8	11
DF	6	6	6
PHT	6	5	0
CI	11	-	4
SF	10	2	3
NTFP	2	2	2

Adaptation Options	Total Score of Preferred Adaptation Options **FEMALES**		
	Farmers	Fishers	Charcoal Producers
CD	7	2	10
WH	2	3	6
WLC	1	3	1
UC	7	-	9
VCF	3	5	6
CWLP	4	-	8
IRF	11	7	11
DF	7	2	6
PHT	9	6	0
CI	8	-	4
SF	7	8	3
NTFP	0	0	2

Source: CCLONG/ ACCCA Data, 2009.

CD= Community drains; WH= Water harvesting; WLC= Woodlot for charcoal production; UC=Upland cultivation; VCF= Vegetable cultivation after floods; CWLP= Cultivation of water loving plants; IRF= Improved roofing and foundation; DF= Drainage on farms; PHT= Post-harvest technology; CI= Crop insurance; SF=Seasonal forecast; NTFP= Non timber forest product

Table 3: Cross –sector impact on most preferred adaptation options of female and male target groups during flood and drought

FEMALES

	Farmers				Fishers				Charcoal producers				
Impacting strategies	IRF	PHT	WB	BFC	SF	VC	FP	FC	CD	CWLP	SPM	AR	**Impact of activities**
IRF		0	0	0	0	0	0	0	1	0	0	0	1
PHT	1		0	0	0	1	0	0	0	1	0	0	3
WB	1	0		0	0	1	0	0	0	0	1	1	4
BFC	0	2	0		0	2	2	2	0	2	0	2	12
SF	1	2	0	1		1	0	0	1	0	0	1	7
VC	0	1	0	0	0		0	1	0	0	0	1	3
FP	0	0	0	0	0	0		0	0	0	0	0	0
FC	0	0	0	0	0	0	0		0	0	0	0	0
CD	2	0	0	0	0	0	-1	1		0	1	1	4
CWLP	0	0	0	0	0	0	-1	-1	0		0	1	-1
SPM	0	0	0	1	0	1	1	1	0	1		0	5
AR	0	0	0	0	0	-2	0	0	0	-2	0		-4
impacts on target activity	5	5	0	2	0	4	1	4	2	2	2	7	**34**

MALES

	Farmers				Fishers				Charcoal producers				
Impacting strategies	IRF	IR	CD	WB	DF	PHT	FP	FC	CI	SF	SPM	UC	**Impact of Activities**
IRF	-	0	1	0	0	1	0	0	0	0	0	0	2
IR	1		0	0	-1	2	1	0	2	0	0	-2	3
CD	2	1		0	0	2	-1	2	0	0	1	0	7
WB	0	0	0		0	0	0	0	0	0	1	0	1
DF	0	1	0	0		0	-1	-1	0	0	0	0	-1
PHT	0	0	0	0	0		0	0	-1	0	0	0	-1
FP	0	0	0	0	0	2		1	2	0	0	0	5
FC	0	0	0	0	0	2	0		2	0	0	0	4
CI	0	0	1	0	0	2	0	0		0	0	0	3
SF	1	1	2	0	0	0	0	0	2		0	2	8
SPM	2	2	0	0	0	0	0	2	-1	1		1	7
UC	1	-2	0	0	0	1	-1	-1	0	1	1		0
impacts on target activity	7	3	4	0	-1	12	-2	3	6	2	3	1	**38**

Source: CCLONG/ ACCCA Data, 2009

IRF= Improved roofing and foundation; IR= Irrigation; CD= Community drains; WB= Wells and boreholes; DF= Drainage on farms; PHT= Post-harvest technology; FP= Fish ponds; FC= Fish culture; CI= Crop insurance; SF=Seasonal forecast; SPM= Sedentary pasture management; UC=Upland cultivation;