Drivers of Migration Intentions in the Volta Delta: The Role of Climate-Related Hazards and Adaptation Strategies

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Abstract

The decision to migrate involves multiple causes and motivations with environmental risks subsumed by economic and other dimensions. Deltas are known to have resources that serve as an attraction to migrant, but recent climatic impacts on deltas makes them very vulnerable to climatic hazards. Specifically, the Volta Delta is rich in natural resources but vulnerable to flood, erosion, drought, and salinity, which has resulted in some out-migration in the region. There have been some interventions in the delta to minimize the climate-related effects however, there is no information on how that has helped in reversing the out-migration situation. Again, there is little knowledge on the key drivers of migration in the area. Using data from the 2016 DECCMA household survey in the Volta delta in Ghana, we found that exposure to drought does not trigger migration intentions however, exposure to erosion and salinity does. We also found that, households whose main livelihood is ecosystem based were less likely to have the intention to migrate compared with those whose livelihoods were non-ecosystem based. The study provides insight into future migration intentions among populations in the Volta delta and the drivers of migration intentions, which could serve as critical inputs in the development and implementation of the Coastal Development Authority in Ghana.

Key words: Migration, Adaptation, Climate-related hazards, Vulnerability, Volta Delta

Introduction

Migration has been used by households and individuals in situations where environmental thresholds pushes populations to consider it as a better option than staying put (Bardsley and Hugo, 2010). The flow of migration in recent times is still dominated by movement from rural to urban areas. The motivation behind these migrations are a fusion of social, economic and environmental factors at both the individual and aggregate levels (Van Dalen and Henkens, 2008; De Jong, 2000). Populations will, however, continue to stay in an area based on several factors including economic and social factors, especially with regard to issues of culture and identity. The decision to migrate therefore is considered after all other options have proven futile.. Climate-related hazards have increased globally and having a significant effect on natural resource dependent populations who have high inclination to move out of their present condition (Abu, Codjoe and Sward, 2014; Bardsley and Hugo, 2010). Deltaic populations

rely heavily on natural resources which are negatively affected by climate change impacts leading to high out-migration (Szabo et al, 2016). The level of vulnerability of delta regions have also attracted some interventions from governments to minimize the effect. There is, however, no information on how these interventions have helped to reverse the out-migration situation. More so, little is known about the kind of migration that people in deltaic regions embark upon and the key drivers of migration.

Theoretically, there is a clear distinction between actual migration and migration intention. There is a school of thought that is of the view that, actual migration is a better measure of migration than migration intention. Literature has also shown that intentions usually translate into reality and in dealing with complex issues like migration, measuring people's intentions provides a better option of understanding the situation. In this paper, we measured migration intentions because it provides an opportunity to understand how population affected by climate-related hazard are considering migration as an option especially in areas where there is already high out-migration. Migration intentions have shown in other studies to have translated into actual migration, and it also provides opportunity to follow-up with the population to find out if their intentions have been achieved.

Deltaic population in sub-Saharan Africa are vulnerable to sea level rise, erosion, drought and salinity. The main occupation of the population in the delta is fishing and farming, which are all climate sensitive. The recent low fish catch in the region and destruction of landing beaches by high tidal waves is having a significant effect on the livelihood of the people. Also, the soil is not rich in nutrients and there is limited rainfall to enable the population to go into meaningful agriculture. As a result, households have resorted to using migration as a strategy to supplement household income. There is generally the difficulty in determining whether migration from a household is climate-related or it is due to other social and economic problems in the area. This is because the climate-related factors are usually nested in other economic and social factors. This study will therefore, contribute to the existing knowledge on migration and climate change by critically investigating the following research questions: 1) how does adaptation influence migration intentions in the Volta Delta? 2) what are the drivers of migration intentions in the Volta Delta? 3) how does climate-related hazards affects migration intentions in the Volta Delta?

This study uses data from the Deltas, Vulnerability and Climate Change: Migration and Adaptation (DECCMA) project collected in the Volta Delta in 2016 to understand how migration has been used as an adaptation strategy to climate-related hazards. The DECCMA data was collected in high out-migration areas that are affected by environmental hazards in the Volta Delta. In all, nine administrative districts in Ghana constituted the Volta Delta, which was defined by the project as the land below the 5 metre contour in the lower portion of the Volta River basin within the Accra-Ho-Keta Plains (Addo et al., 2018). This study therefore focuses on an environment that has gone through several environmental challenges and migration history to understand the crucial debate on how climate-related hazards affects migration intentions .

[Insert Figure 1 about here]

Why focus on Deltaic region

Delta regions are dynamic with rich resources that attracts a lot of social and economic activities. As a result, most deltaic regions are usually densely populated because it is attractive to migrant population who anticipate availability of job opportunities in these places. It has been estimated that about 7% of the global population reside in delta regions which only occupy 1% of the global land area (Erickson et al., 2006). There are, however, fast changing trends in delta regions in recent times. These changes are a result of multiple factors including human activities such the construction of dams on major rivers, deforestation, crop farming, mining, and urbanization (Milliman, Broadus, and Gable, 1989; Walling and Fang, 2003; Woodroffe et al., 2006; Nicholls et al.,2016).

As a result of these biophysical changes, deltas are attracting major research attention in recent times. The impact of climate-related hazards on deltas have exacerbated the already stressful conditions of deltaic population requiring some policy interventions to minimize the impact (Agrawala et al., 2003). The natural vegetation of deltas has changed, and this has affected the livelihood of the population. Even though some deltas have received some interventions, such as the construction of sea defense walls to project the shoreline, these have not attracted population back into the area due to the destruction of livelihoods which are still a major concern.

The Volta Delta located in the Keta basin has a history of human interference over the years. The construction of dams (Akosombo Dam in 1964, Kpong in 1982 and Bui in 2013) along the catchments have had significant impact on water discharge systems in the area ((Anthony, Almar, and Aagaard, 2016). The livelihoods of the population in delta have been negatively impacted by such activities, and some households choose migration as a strategy to address the environmental and economic challenges in the area. The impact of climate-related hazards in the area is an additional stress to the already existing problems in the Volta delta that requires urgent research attention to provide practical solutions to the problem.

Data and Methods

Data for the study is based on the DECCMA survey collected in the Volta Delta in Ghana. The DECCMA survey was conducted in the Volta delta between March-October 2016. Data on migration and household demographics were collected and these are key variables in examining the relationship between climate-related hazards and migration. Also, data on environmental hazards, socio-economic situation of households and household adaptation strategies were also collected. In all, 1363 households responded to the questions in the Volta delta.

The dependent variable in the study is future migration intention, which is measured as a dichotomous variable. The question asked in the survey was “Do you or other household members intend to migrate in the future?” The responses were coded as 1 for those who expressed the intention to migrate and 0 for those who do not. Measuring migration intention of a population is very important in understanding the future migration aspirations of a population (Van Dalen and Henkens 2008). It has been found in other studies that migration intentions are translated into reality, even though, some literature are strongly against

measuring migration intentions because it is different from actual migration. However, it has been established that migration intentions are the first steps in the actual migration processes, especially in discussing internal migration issues (Macleod 1996; Van Dalen and Henkens 2008). The survey also asked questions about actual migration from each of the households. In all, 49% of the households indicated that they have member(s) who have migrated. We used future migration intentions and not actual migration because it provides an opportunity to find out from the population at the place of origin, whether despite the adaptation interventions in the area, they still consider migrating out of the area. The use of migration intention also eliminates the flaw in trying to use current happenings in the area to explain migrations that have taken place decades ago.

The main independent variable is exposure to climate-related hazards (flood, drought, erosion, salinity and storm surges). These are the main hazards experienced in the Volta delta. Households that responded to have experienced any of these events in the last 10 years (annually, seasonally, once per decade) were coded 1, otherwise 0. We examined all the hazards because households are exposed to these hazards differently, and different hazards may affect different households depending on their location in the study area. Also, there will be households who will be experiencing multiple hazards while others may experience none. The differences in exposure will therefore bring about differences in adaptation strategies.

The adaptation strategies of households reduce their vulnerability to climate-related hazards and the risk of migration from the area. Households may be involved in single, multiple on no adaptation. The adaptation strategies considered in this study included taking up a loan, insurance, cooperative, improvement on house, planted trees around home, using hired labour to support in generating income, moved to a new house, planted or stopped planting climate tolerant crops, increased or reduced use of fertilizer, and put up or taken out irrigation. These adaptation strategies were coded as 0=no adaptation; 1=single adaptation; and 2=Multiple adaptation.

We controlled for socio-demographic and economic variables that significantly predicts migration intentions to enable us to test the relationship between climate-related hazards and migration intentions. Specifically, we controlled for the sex of the household head, which has proven in literature to have implications for the wellbeing of individual household members. In a patriarchal society like that of the Volta delta, women are at a disadvantage in terms of ownership or resources like agricultural land. It is expected therefore that people who belong to male headed household will do better than those in a female headed household. We also controlled for the mean age of the household members, level of education completed by the head of the household, household size, marital status of household head, household income, household dependency ratio, place of residence, and migration network, which we used the question on whether a respondent has a family member or friend who has migrated as proxy to measure network. In addition, we controlled for the main livelihood of household head, which we recoded into 0=non-ecosystem based, and 1=ecosystem based.

In terms of analysis, we employed a binary logistic regression to examine how climate-related hazards drive migration in the Volta delta. In all, two models were run. The first model examined the relationship between climate-related hazards and migration intentions in the Volta delta. The second model controlled for the effect of the sociodemographic and economic variables to test the robustness of the relationship between climate-related hazards and migration intentions in the Volta delta. The level of significance for interpreting the results is $p<0.05$.

Results

Descriptive statistics

Table 1 shows the descriptions of the outcome and the explanatory variables. A little over two-fifth (44%) of the respondents had intentions to migrate from the Volta delta in future. In terms of exposure to climate-related hazards, a higher proportion (48%) of the respondents indicated that they were exposed to drought. A little over one-third mentioned that they were exposed to flood (35%) whilst 30% indicated that they were exposed to erosion. Also, more than one-third mentioned that they were exposed to storm surges whilst 31% said they were exposed to salinity. Overall, drought is the hazard that is experienced by majority of the households in the Volta delta. As a result of household's exposure to different climate-related hazards, several adaptation strategies are embarked on by households to reduce the impact of hazards.

Table 1 indicates that more than half (54%) of households embark on multiple adaptation whilst 24% embark on single adaptation. There are also a little over one-fifth (22%) of households who do not embark on any adaptation strategy. We argue that multiple adaptations are embarked on because of the multiple hazards in the Volta delta which makes it difficult to address with a single adaption strategy among populations that are located in high risk hazard areas in the delta.

The socio-demographic profile of the population Table 1 shows that 41% of household heads were females, indicating a higher proportion of female headship in the delta compared to national average of 31%. The mean age of household members is 30 years indicating a young population in the delta. Household size in the Volta delta is about4 persons per household while the dependency ratio is 0.83. Also, majority (38%) of the household heads had secondary level education whilst 29% and 28% had primary and no education respectively. More than half (57%) of household heads were currently married whilst 12% were single. In terms of economic activity, a higher proportion (52%) of the household heads were engaged in non-ecosystems based livelihood. The mean annual income per household is $134.4. A little over half of households (51%) did not have migration networks, and a higher proportion (84%) of the households interviewed were in in rural areas.

[Insert Table 1 about here]

Association between climate-related hazards, sociodemographic variables and migration intentions

The bivariate analysis in Table 2 shows that all the climate-related variables, adaptation strategies, sex of household head and level of educational attainment were statistically significantly associated with migration intentions. More than half of households that were exposed to erosion and salinity have the intention to migrate in the future. Also, a little over two-fifth of households that experienced floods, drought and storm surges had the intention to migrate in the future. In terms of adaptation, a higher proportion (47%) of households that were engaged in multiple adaptation had the intention to migrate in the future. Again , a little over two-fifth (42%) of those who were engaged in single adaptation and 39% of those who were not engaged in any form of adaptation also had the intention to migrate in the future. A higher proportion (48%) of male household heads had the intention to migrate in the future compared to female household heads (38%). In addition, the intention to migrate is higher among household heads with higher education compared with those with lower or no education.

In addition, marital status of household head, and migration network of household are also statistically significantly associated with the intention to migrate. Household heads that were single (70%) and those that were cohabiting (62%) had the highest proportion of members who had the intention to migrate in the future compared to other households. A higher proportion of household's without migration (51%) networks had the intention to migrate in the future compared with those who had migration networks (36%). There is a significant correlation between household dependency ratio, mean age of household members and intentions to migrate in the future.

[Insert Table 2 about here]

The multivariate results of Model 1 in Table 3 show that about three percent of the variation in the intentions to migrate in the future is explained by climate-related factors in the Volta delta. Households exposure to drought, erosion, and salinity are significant predictors of the intentions to migrate in the future, while exposure to flood and storm surges is not. Exposure to drought has a negative effect on intentions to migrate in the future whilst exposure to erosion and salinity have a positive effect on intentions to migrate in the future. Household that were exposed to drought were less likely to consider migration in the future, whilst households that were exposed to erosion and salinity were more likely to have intentions to migrate in the future. Model 1 also show that households engaged in multiple adaptation were more likely to have the intentions to migrate in the future compared to those who do not engage in any form of adaptation.

To test the robustness of the relationship established in Model 1, Model 2 controlled for socio-demographic and economic variables to see if the relationship will hold. In Model 2 eight percent of the variation in the intention to migrate in the Volta delta is explained by the climate related hazards, adaptation strategies and socio-demographic and economic variables. The results show that exposure to drought, erosion, storm surges, adaptation strategies, mean age of household members, marital status of household head and main livelihood of household head are significant predictors of intentions to migrate in the future. Households exposed to drought are less likely to have intentions to migrate in the future compared to those who were exposed. However, exposure to erosion and salinity is more likely to trigger future migration intentions in households compared with those who are not

exposed to erosion and salinity. A unit increase in the mean age of household will decrease migration intentions in households by 0.997. Also, household heads that are currently married, cohabiting, widowed or abandoned are less likely to have migration intentions in the future compared with household heads who have never married. Finally, a household head whose livelihood is ecosystem based is less likely to have intentions to migrate in future compare with household heads whose livelihood is non-ecosystem based.

[Insert Table 3 about here]

Discussion

The study hypotheses that exposure to climate-related hazards will trigger intentions to migrate in the future in the Volta delta, which is already going through some environmental and social stress (Addo et al., 2018). The analysis show that exposure to various climate-related hazards is high in the Volta delta. Overall, more than 30% of the sampled households have experienced any flood, drought, erosion, salinity and storm surges. It is also evident in the analysis that more than half (54%) of the households were engaged in multiple adaptation to address the challenges they encounter. The main livelihood of a little over two-fifth (48%) of households was ecosystem based and these households will face major challenges with regards to the climate-related hazard conditions.

At the bivariate level we established a statistically significant association between exposure to the climate-related hazards and intentions to migrate. Also, some socio-demographic factors such as sex of household head, level of education attained by households head, marital status of household head, mean age of household members, household dependency ratio, migration network and main livelihood of household head were significant predictors of intentions to migrate in the Volta delta. These socio-demographic and economic factors determine household's resilience capacity and play a critical role in the decision to migrate or stay.

The final model of the study shows that households' exposure to drought, erosion and salinity is a significant predictor of intention to migrate in the future. These hazards generally occur slowly, and they tend to have significant impact on the livelihood of the population over a long period of time. Exposure to drought is less likely to trigger migration intentions whilst exposure to erosion and salinity is more likely to trigger migration intentions in the future. Droughts in the Volta delta have received some attention from the population, which has resulted in several wells that have been dug for irrigation purposes by the population. Water from these wells are used mostly for vegetable cultivation to supplement the major livelihood activity in the area, which is fishing. Exposure to salinity and storm surge is critical because the population do not have any solutions to the problem, and the most available option is usually migration. Salinity destroys the fertility of the soil and makes it difficult for the people to have an alternative livelihood, while erosion, destroys landing places for fishing activities. Also, households that are engaged in multiple adaptation are more likely to have the intentions to migrate in the future compared with households that do not engage in any form of adaptation. Households engaged in multiple adaptation may be going through multiple hazards and one of the solutions that such households may consider is migration to avoid all the troubles that are associated with to climate-related hazards.

Conclusion

The study shows the importance of climate-related hazards on migration intention in the Volta delta. Exposure to drought, erosion and salinity are the issues that need policy attention to help the population cope with the situation. Multiple adaptation embarked upon by household put a lot of stress on limited household resources and rather trigger migration intentions in households. It is important for policy makers to come up with a comprehensive adaptation solution to climate-related hazards in the Volta delta. This will reduce the troubles households go through in trying to find solutions to climate-related problems by engaging different strategies that can be expensive to households.

It is surprising to note that households that are engaged in ecosystem livelihood were less likely to have migration intention as a result of exposure to climate-related hazards. All things being equal, these are households who will be hardly hit by climate-related hazard and therefore, should rather have high inclination to migrate. However, these are households that are solely dependent on natural resources and are afraid to embark on migration if they are not sure of what they can do when they migrate. It could also be that populations whose main livelihood is ecosystem based get trapped in this situation because they have no alternatives to switch to. The only option is to hang on to the situation and hope that things may get better in the future.

It is important to pay attention to climate-related hazards by introducing policies that provide solutions to address the consequences of these hazards, especially among natural resource dependent population. Government's effort at addressing migration problems in the country should provide sustainable solutions to climate-related problems in very vulnerable areas and make them attractive to the general population.

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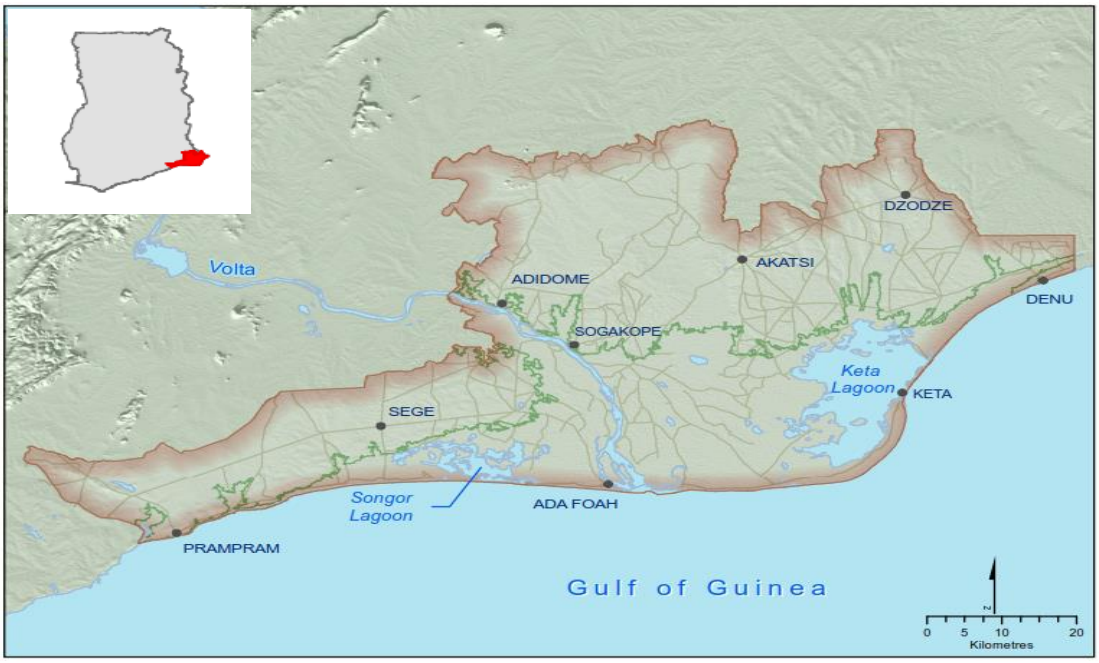

Populated Places

5m Contour

Roads

Ghana Study Region

Water (SRTM Water bodies)

Figure 1: Study Area

Table 1. Description of intention to migrate, exposure to environmental hazards, adaptation strategies and household socio-demographic and economic factors.

Variable	Count (Mean)	% (SD)
Outcome		
Intention to migrate		
No	769	56.4
Yes	595	43.6
Explanatory Variables		
Exposure to flood		
No	888	65.1
Yes	476	34.9
Exposure to drought		
No	701	51.4
Yes	663	48.6
Exposure to erosion		
No	955	70.0
Yes	409	30.0
Exposure to salinity		
No	946	69.4
Yes	418	30.6
Exposure to storm surges		
No	870	63.8
Yes	494	36.2
Adaptation Strategies		
No adaptation	304	22.3
Single adaptation	322	23.6
Multiple adaptation	738	54.1
Sex of household head		
Male	804	58.9
Female	560	41.1
Mean Age of household members	(30.42)	(15.39)
Level of education of household head		
No education	386	28.3
Primary	391	28.7
Secondary	523	38.3
Higher	64	4.7
Marital status of household head		
Never married	158	11.6
Currently married	776	56.9
Co-habiting / living together	39	2.9
Widowed	206	15.1
Divorced	85	6.2
Abandoned / separated	96	7.0
Missing data	4	.3
Household size	(3.98)	(2.51)
Household dependency ratio	(0.83)	(0.90)
Household income	($135.44)	($170.91)
Main livelihood of household head		
Non-ecosystem based	713	52.3
Ecosystem based	651	47.7
Migration network of household		
Yes	665	48.8
No	699	51.2
Place of residence		
Rural	1146	84.0
Urban	218	16.0
Total	1364	100.0

Table 2. Association between exposure to environmental hazards, socio-demographic and economic variables and intention to migrate

	Intention to migrate				
Variables	No	Yes	Total	Chi-square test	P-value
Exposure to floods				5.987	0.014
No	58.8	41.2	888		
Yes	51.9	48.1	476		
Exposure to drought				6.996	0.008
No	52.9	47.1	701		
Yes	60.0	40.0	663		
Exposure to erosion				11.604	0.001
No	59.4	40.6	955		
Yes	49.4	50.6	409		
Exposure to salinity				14.06	0.001
No	59.7	40.3	946		
Yes	48.8	51.2	418		
Exposure to storm surges				2.355	0.07
No	57.9	42.1	870		
Yes	53.6	46.4	494		
Adaptation strategies				5.829	0.054
No Adaptation	61.2	38.8	304		
Single Adaptation	58.4	41.6	322		
Multiple Adaptation	53.5	46.5	738		
Sex of household head				14.477	0.001
Male	52.1	47.9	804		
Female	62.5	37.5	560		
Mean age of household members	r=-0.059				0.001
Level of education of household head				25.822	0.001
No education	66.1	33.9	386		
Primary	56.8	43.2	391		
Secondary	50.3	49.7	523		
Higher	45.3	54.7	64		
Marital status of household head				75.452	0.001
Never married	30.2	69.8	162		
Currently married	56.6	43.4	776		
Co-habiting/living together	38.5	61.5	39		
Widowed	71.4	28.6	206		
Divorced	67.1	32.9	85		
Abandoned	64.6	35.4	96		
Household size	r=-0.002				0.930
Household dependency ratio	r=-0.059				0.035
Household income	r=0.047				0.080
Livelihood of household head				2.68	0.057
Non-ecosystem based	54.3	45.7	713		
Ecosystem based	58.7	41.3	651		
Migration network				32.368	0.001
Yes	64.2	35.8	665		
No	48.9	51.1	699		
Place of residence				1.837	0.1
Rural	55.6	44.4	1146		
Urban	60.6	39.4	218		
Total	769	595	1364		

Table 3. Binary logistic regression of predictors of migration intentions as a result of exposure to climate-related hazards

	Odds ratio		Robust Std. Err.	Odds ratio		Robust Std. Err.
Variables	Model 1			Model 2		
Exposure to flood (RC=No)						
Yes	1.139		0.125	1.244		0.135
Exposure to drought (RC=No)						
Yes	0.607	***	0.120	0.732	*	0.133
Exposure to erosion (RC=No)						
Yes	1.553	***	0.128	1.514	**	0.140
Exposure to Salinity (RC=No)						
Yes	1.418	**	0.125	1.470	**	0.135
Exposure to storm surges (RC=No)						
Yes	1.123		0.122	1.211		0.132
Adaptation Strategies (RC=No Adaptation						
Single adaptation	1.159		0.166	1.155		0.179
Multiple adaptation	1.412	*	0.141	1.555	**	0.157
Sex of household head (RC=Male)						
Female				0.842		0.147
Mean age of household members				0.977	***	0.006
Household size				0.968		0.033
Marital Status of household head (RC=Never Married)						
Currently married				0.359	***	0.215
Co-habiting / living together				0.645		0.390
Widowed				0.344	***	0.284
Divorced				0.321	***	0.318
Abandoned / separated				0.316	***	0.306
Household head level of education (RC=No Education)						
Primary				1.156		0.171
Secondary				1.297		0.166
Higher				1.606		0.307
Income				1.000		0.000
Main Livelihood of household head (RC=Non-ecosystem based)						
Ecosystem based				0.764	*	0.129
Household dependency ratio				0.871		0.084
Migration Network (RC=No)						
Yes				0.781		0.133
Place of Residence (RC=Rural)						
Urban				0.942		0.178
Constant	(-0.56962)	***	0.133	(1.230)	***	0.325
Pseudo R2			0.025			0.080
Wald Chi	(7, 1364) = 44.58***			(23, 1280) = 129.42***		

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$