climate

MDPI

Article

Adapting To Changing Climate: Understanding Coastal Rural Residents' Relocation Intention In Response to Sea Level Rise

Richard Adade[1,2*], Dukiya Jaiye, Nana Ama Browne Klutse[4], Appollonia A. Okhimamhe[1,5]

[1] School of Physical Science, WASCAL Doctoral Research Programme in Climate Change and Human Habitat, Federal University of Technology Minna, Nigeria.
[2] Centre for Coastal Management-African Centre of Excellence in Coastal Resilience University of Cape Coast, Ghana.
[3]Department of Urban and Regional Planning, Federal University of Technology, Minna, Niger State, Nigeria.
[4]Department of Physics, University of Ghana, Accra, Ghana
[5]Department of Geography, Federal University of Technology, Minna, Niger State, Nigeria

* Correspondence: richard.adade@ucc.edu.gh, Tel: +233 242530909

Abstract: Ex situ adaptation in the form of relocation has become inevitable in some low-lying coastal zones where other adaptation strategies becomes impractical or uneconomical. Although, relocation of coastal low-lying communities is anticipated globally, little is still known about the factors that influence household level adoption. This study draws on an extended version of Protection Motivation Theory (PMT) to assess the factors influencing the relocation intention of three highly vulnerable coastal rural communities in Ghana. A total of three hundred and fifty-nine (359) household heads were randomly selected for a questionnaire survey. The study employed logistic regression to identify key factors that influence residents' readiness to relocate. The results indicated that cognitive and compositional factors were more important than contextual factors in predicting the intention to relocate among coastal rural communities in Ghana. However, contextual factors mediated or attenuated the influence the cognitive and compositional factors on relocation intention. Based on the finding, the study advocated for an intensive education on the effects of future sea-level rise impacts on communities as well as structural and non-structural measures to improving socio-economic capacity of the rural communities.

Keywords: Ghana, Sea Level Rise, Coastal Rural Community, Climate Change Adaptation, Relocation, Perceived Risk

Citation: To be added by editorial staff during production.

Received: date
Revised: date
Accepted: date
Published: date

Copyright: © 2023 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Coping with Sea-Level Rise (SLR) as a result of climate change is one of the biggest societal challenges of this century [1]. Sea-level rise adaptation strategies require regulations, plans, and measures that reduce risks and build resilience. The International Panel on Climate Change (IPCC), in their 5th Assessment Report (AR5), posited a tripartite framework of retreat (moving away from the coast), protect (structural and soft measures) and accommodate (changes in human activities and infrastructure). According to stated that among the three basic categories of sea-level rise SLR risk reduction approaches (protection, accommodation, and retreat) reviewed in literature, managed retreat will be the only long-term adaptation approach in many flood-prone areas. Managed retreat means rethinking coastal life and accepting that certain coastal infrastructures, neighborhoods, or even cities will have to be completely relocated (Lebbe et al., 2021). This adaptation

response can be carried out at different scales and with varying degrees of complexity. It may involve the relocation of a few vulnerable homes, a community, or a large city. It can be even more complicated when it involves relocating inhabitants of an island to a new country.

An important issue with relocation is the cooperation of the affected population, which is sometimes difficult. Relocation of low-lying areas is anticipated worldwide, especially in areas where sea-level rise causes flooding and coastal erosion, reduces arable land, depletes groundwater supplies, destroys infrastructure, and endangers human lives and well-being [3], [4]. Some countries such as Fiji, Mozambique and the Solomon Islands have developed and included planned relocation strategies as part of National Adaptation Programmes of Action (NAPAs) in their various countries [5], [6].

Over the years, the Ghanaian government has used gabions and boulders to protect some major cities and towns from sea-level rise. However, in the most vulnerable coastal rural areas, relocation of entire community is often proposed, but residents are usually unwilling to relocate due to various reasons reported by Appeaning Addo et al. (2018) and World Bank (2017). Relocation costs are also underestimated because social and cultural values are not always completely considered. Although, the government's prioritization of adaptation strategies, the understanding of individual-level adaptation, especially in the coastal rural area, has been inadequate. According to Amos et al. (2015), climate change adaptation strategies will be ineffective unless they are implemented in the context of households' perceptions of climate change risk and self-efficacy in hazard mitigation. Although several studies have highlighted the factors that influence climate change adaptation action globally [8]–[10], nonetheless, there are few studies on people's attitudes toward sea-level rise adaptation strategies (Song & Peng, 2017). More importantly, there are few studies linking behavioral aspects to adaptation to sea-level rise, and no such studies have been conducted in Ghana.

Several studies have adopted the Protection Motivation Theory (PMT) as the foundation of a socio-cognitive model to describe individual adaptation behavior in response to climate change (Bubeck et al., 2013; Feng et al., 2017; Keshavarz & Karami, 2016; Reynaud et al., 2013). Protection Motivation Theory explains the cognitive process people go through when assessing their own ability to avoid a particular risk (Bubeck et al., 2013). Drawing on the PMT, this study examines relocation intention in three coastal rural communities in Ghana, each affected by coastal erosion and flooding. The study aims to understand the relocation intention of rural coastal residents in anticipation of sea-level rise. The study provides insight into the behavioral aspects of implementing managed retreat as an adaptation response to mitigate the impacts of sea-level rise. Additionally, the study will highlight the application of PMT in the context of climate change adaptation.

2. Conceptual Framework

2.1. Factors Influencing Household-Level Adaptation Action to Climate Change

The study developed a theoretical model based on an extended version of Protection Motivation Theory that comprises a combination of cognitive, socio-demographic and physical factors that may influence coastal rural resident relocation intention (see Figure 1). PMT was originally formulated by [18] based on the work of [19]. It was first used in health threat and safety and later used beyond health-related issues to a more general theory to solve problems like political issues, environmental issues, injury prevention, and other social issues. The PMT suggests that individuals protect themselves based on the perceived probability of the occurrence, the perceived severity of a threatening event, the efficacy of the recommended preventive behavior, perceived self-efficacy and finally, the response cost [20]. According to [18], people balance different risks and potential benefits based on their motivation to protect themselves from threats such as natural disasters, nuclear explosions and global climate change. As a result, PMT assumes that people's

decisions to engage in risk-reducing behaviors are based on two cognitive processes.; threat appraisal and coping appraisal.

Roger (1983) [18] stated that threat appraisal and coping appraisal mediate the effects of the components of fear appeals on attitudes by arousing individuals, motivation to protect. Threat appraisal is a cognitive process that refers to the perceived expectation of being exposed to a particular threat/risk. It has two key components: assessing the threat's perceived intensity and the likelihood of suffering negative consequences as a result of the threat (vulnerability). Perceived severity of the threat means the referred to the level of gravity of the potential damages that an individual perceives. Perceived vulnerability reflects an individual's perceptions of their susceptibility to harm. continuing to engage in dangerous behavior. These perceptions of vulnerability, severity, and reward can motivate individuals to perform adaptation actions such as relocation in anticipation of sea-level rise. The coping appraisal comprises self-efficacy and response efficacy. Self-efficacy is an individual's perception of their capability to perform the behaviors. Response efficacy refers to the perceived effectiveness of the recommended risk preventative behaviors. Coping appraisal also considers the response cost, which is the cost of performing the recommended behavior [18]. A high cost of performing preventative behaviors might hinder people from being involved in recommended behaviors. Roger (1983) [18] asserts that, coping appraisal is also the product of the appraisals of the self-efficacy and the response efficacy minus the costs of performing the recommended preventive behavior. PMT has been used by many researchers in natural hazards, disasters and pro-environmental behaviors. For instance, Reynaud et al. (2013) [17] conducted a study in Vietnam based on the conceptual framework on Protection motivation proposed to investigate the determinants of household flood protective strategies and risk perception using data from a household-level survey. Another study was conducted on household adaptation and intention to adapt to coastal flooding using PMT in Greece in 2013. The authors [21] explored the existing adaptation behavior of the coastal households, identified determinants that influence the precautionary behaviors, and assessed the intention of adaptation of the households in the future.

In addition to the traditional components, the extended version of the PMT used in the study includes three additional components that were identified through the literature review (see Figure 1). These includes risk perception, compositional and contextual factors. Compositional factors are linked to sociodemographic traits of an individual or a group [22]. These factors were subdivided into biosocial and socio-cultural factors. Biosocial factors are underlying biological or physical qualities of people that are fixed from birth and cannot be changed whilst Socio-cultural factors related to beliefs, values and way of life [23]. Contextual factors include biophysical attributes (slope, elevation, distance to hazard prone areas etc.). An increasing body of literature examines individual responses to sea-level rise impacts such as flooding, storm surge, erosion and other related risks, with the majority focusing on determining the relationship between these factors and adaptation efforts. For example, several studies have shown that risk perception positively influences individual adaptation behavior. A person with a high risk perception is more likely to undertake adaptation measures [13], [24]–[26]. However, Zheng et al. (2015), in their study on the factors that motivate rural households to adapt to climate change, established that adaptation appraisal rather than risk perception is a better predictor of climate change adaptation. In comparison to risk perception, the relationship between socio-demographic variables and protective behavior adoption is significantly less clear. Notwithstanding, several studies have identified various socio-demographic factors related to climate change adaptation efforts such as educational level [28], income [25], age [13], [28], gender [29] and location in terms of rural or urban setting [30]. Hazard experience is also considered to have a significant influence on risk recognition and appears to be a significant component in individual adaptation behavior [31]. For instance, Individual views of flooding resilience were explored in four communities in Birmingham and London by Soetanto et al., (2017) [32], who found that people's social responsibility

for adaptation measures was influenced by their experience with floods as well as other demographic factors. Ling et al., (2015) [33] and Frondel et al., (2017) [34] confirmed that hazard experience was positively associated with adaptation efforts in their respective studies. On the other hand, Lawrence et al. (2014) [35] maintains that experiencing flood hazards did not motivate citizens to take more proactive adaptation measures. The capacity of human systems to adapt to a changing climate is linked to characteristics of the physical environment. Physical factors such as a lack of high elevation to relocate, for example, can limit relocation [36]. Also, proximity to hazard can also limits adaptation efforts. Studies have revealed that hazard proximity can influence risk perception and people living close to hazard areas will adopt coping strategies to mitigate the risk [37], [38]. In addition, studies have been conducted to assess the relationship between proximity to hazards and adaptation efforts. However, their findings have been inconsistent; although some researchers have discovered a positive link, others have not. Bubeck et al. (2013) [14] discovered in their study about analyzing risk perception and precautionary behavior, that the distance to a river or waterbody had only a minor impact on people's current mitigation efforts whiles Kellens et al., (2011) [39] came out with contradictory findings.

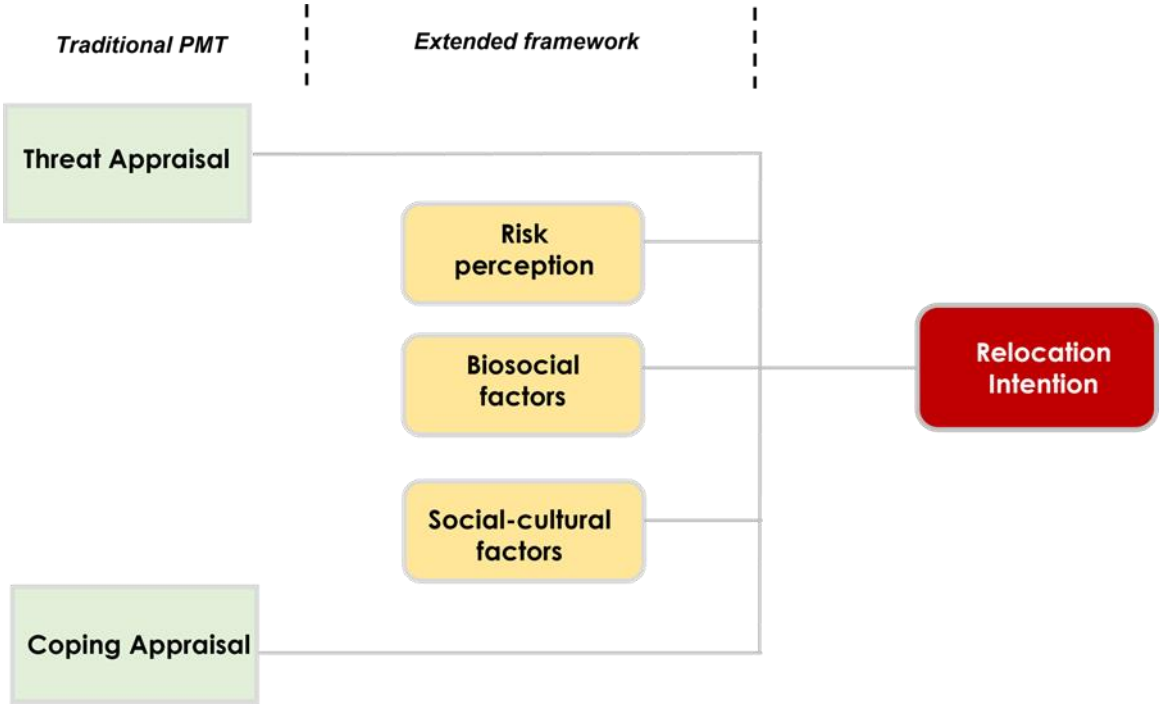


Figure 1. An extended framework of Protection Motivation Theory.Source: Modified from [25]

3. Materials and Methods

3.1. Study Area

The study was carried out in three rural coastal communities in the Greater Accra and Western Regions of Ghana (Figure 2). The three selected rural communities, namely Sanwoma (4° 54' 08.9" N; 2° 16' 14.1" E), Anlo Beach (5° 14' 5.4" N; 1° 36' 28.9" W) and Glefe-Wiaboman (5° 31' 3.2" N; 0° 17' 21.2" W) have been identified as coastal erosion and flooding hotspots with reports of loss of settlements and livelihood assets[40]–[42]. The proximity to some major estuaries and wetlands of these three communities makes them highly susceptible to impacts from sea level rise. These communities were selected based on some criteria – located in a rural area, estuarine communities, and documented reports of frequent coastal flooding and erosion. The communities under study are low-lying coastal plains located at the mouth of the Ankobra (Sanwoma), the Pra (Anlo Beach), and the Densu River (Glefe-Wiaboman), with portions of the land occasionally flooded and often hit by tidal waves leading to the displacement of residents. The climate of the

study communities falls within the dry equatorial climate with a double rainfall maxima. The major rainy season is from March to June and the minor is from September and ends in November, followed by a dry season from December to March. The temperatures in Ghana's coastal savannah region are high throughout the year, with an annual mean temperature of 26.5°C. The average monthly temperature is between 24.5°C (August) and 28°C (March) and the average daytime temperature is 30 C (August). Humidity is generally high (65–95%) but is lower during the warmer months, especially in January with dry northeast harmattan winds. The vegetative cover is made up of coastal strands and mangroves and freshwater vegetation. Mangroves of the genera Avicennia, Rhizophora and Laguncularia fringe the banks of the estuaries. The adjoining marshland mostly has the saltwater grass Paspalum vaginatum (Poaceae) as the main vegetation. The mangrove trees are highly exploited as the main source of firewood for cooking and smoking fish in the communities, thereby resulting in the degradation of the mangrove forest. Fishing (beach seining) and fish mongering are the major livelihood activities in the study communities running from mid-July to late April. Fishing is done mostly by the men while the females are involved in fish processing. Subsistence farming becomes the predominant occupation after April, lasting for about three months in the off-fishing season. The community switches back to fishing in mid-July or early August for the main fishing season. In some of the communities, however, a few of them are involved in agricultural activities and grow crops such as cowpea, sweet potatoes, maize, okro, tomatoes, pepper, etc. Additionally, most of the inhabitants in the study communities are engaged in some livestock rearing, animals such as cattle, sheep, goats, pigs and poultry can be found in the community.

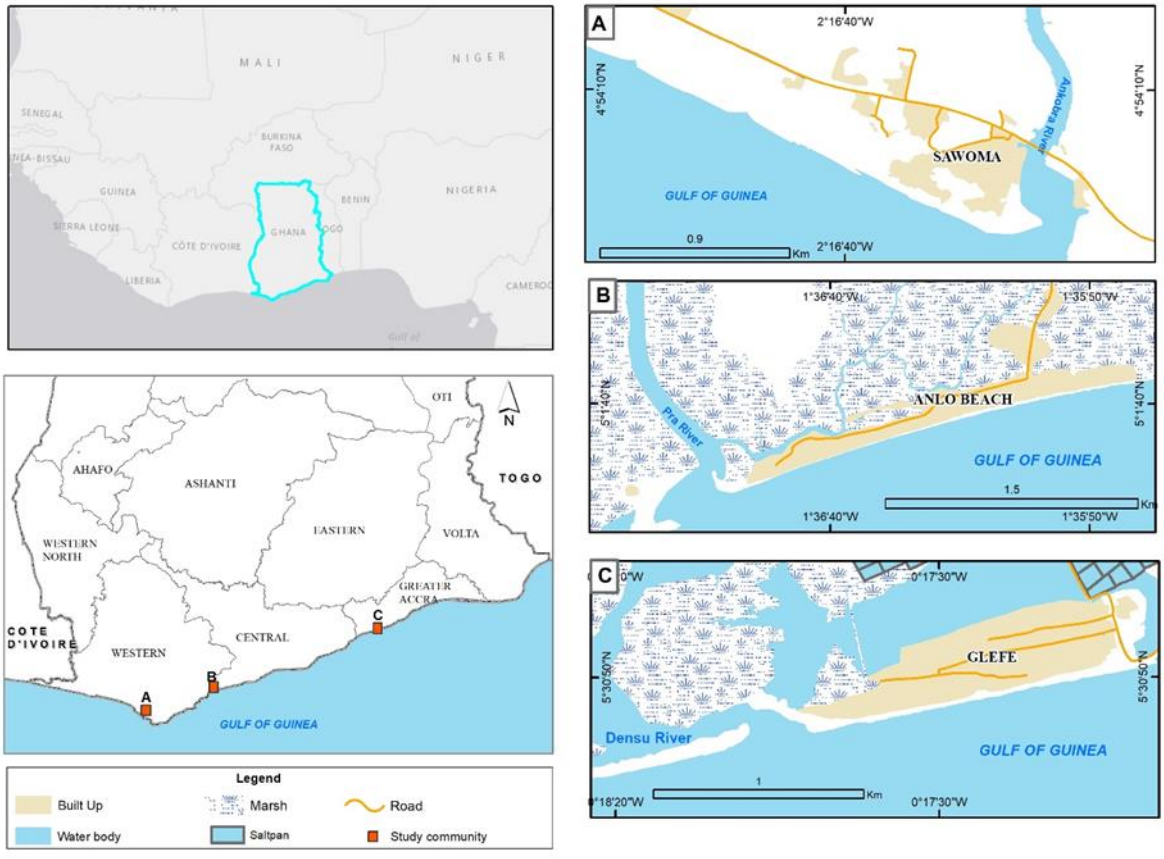


Figure 2. Map showing the location of study communities.

3.2. Questionnaire design and data collection

The study was based on primary data from a structured questionnaire. An initial draft of the instrument was designed and pretested to see the practicalities in administering the instrument and identify possible challenges that could be faced. The outcome variables considered in this study was relocation intention in anticipation of sea level rise and it was represented as binary variable, with '1' representing 'will relocate' and '0' representing 'will not relocate'. Also, the predicted/independent variables considered in the study included variables stipulated in the traditional components and the extended version of the PMT. These include cognitive, contextual factors and compositional (biosocial and socio-cultural) factors (Table 1). The structured questionnaire was administered using KoBoTool box mobile application. The instrument was mainly designed based on the work of Song & Peng, (2017) [13] and also information from the three Focus Group Discussion (FDG) conducted in the study communities. The survey targeted heads of households in the various communities. A total of three hundred and fifty-nine respondents (359) were randomly selected from a target population of 1468 household heads based on [43] sampling technique. The multistage sampling method was employed to select the respondents for the study. For the first stage, a cluster sampling procedure was applied where the study communities were divided into clusters using a georeferenced hexagon with a side of a 2000 square meter grid (Figure 2). The number of buildings (digitized on-screen from the 2021 UAV image) was chosen as the unit for the proportional allocation of respondents for the hexagon grid. The number of respondents in a grid was calculated based on the number of buildings and a grid with only one building was not included in the sample. A simple random sampling was used to select the specific building in the grid to be visited at the third stage. In order to know the particular buildings selected and to be visited, the spatial extent of all the selected buildings was converted to shapefile and loaded onto SW Map App on mobile phone, which led the researcher to the actual building on the field. Lastly, a convenience sampling technique was used to select the household head to be interviewed in the selected building. However, buildings with no occupants at the time of the interview and those with no adult in charge of the household in the absence of the household head were excluded. As a result, the next building with a household head was chosen as a replacement.

Table 1: Measured factors and their coding scheme

Factors	Measurements	Coding scheme
Relocation Intention	Relocation decision	Binary scale (1- Will relocate, 0- Will not relocate)
Risk perception	Sea-level rise is taking place	Likert scale: 1-5 (strongly agree to strongly disagree)
	Sea level rise poses a danger to the natural environment	
	sea-level rise poses a danger to the built environment	
Threat appraisal	Sea level rise impacts become too frequent and destructive	5-point scale: 1 (not important at all) to 5 (very important)
	Safety of myself and/or my family	
	Neighborhood, friends, and/or family decide to leave the area	
	Property is severely damaged	
	No provision of adaptation measures	
Coping Appraisal	Relocation cost	5-point scale: 1 (not important at all) to 5 (very important)
	Distance to current workplace	
	Job opportunities at the new location	
	Social and family ties	
Biosocial factors	Sex of respondent	**1**= Female, **2**= Male
	Age of respondent	**1**= <35, **2** =35-55, **3**= >55
	Experienced damage as a result of sea-level rise	Binary scale (**1**- yes, **0**- No)
Socio-cultural factors	Educational level of respondent	**1** =No formal education, **2**=Primary, **3**=JHS/Middle **4**=SHS/Voc/Tech and above
	Income level of respondent	**1**= > GHC 100, **2**= GHC101-500, **3**= GHC 501-999, **4** =GHC 100
Contextual factors	Elevation	**1**= < 4m **2**=4.01- 7m, **3**= 7.01 and above
	Location of house From Shoreline	**1**= < 100m, **2**=101-400m, **3**= 401-700m, **4**= Above 700m

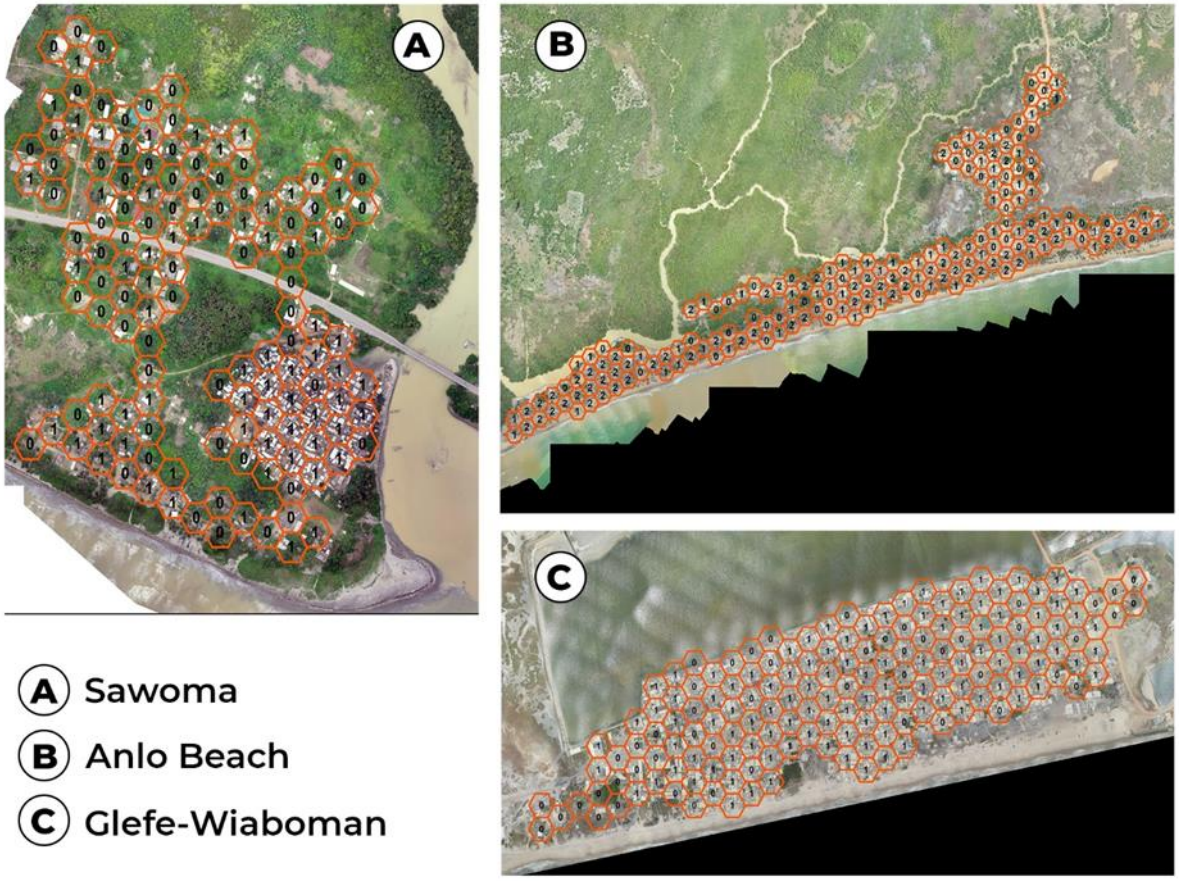


Figure 2. Sample grids for the three study communities.

3.3. Data processing and analysis

The statistical analyses were carried out with IBM SPSS version 24. Descriptive statistics were used to quantitatively describe and summarize the characteristics of the explanatory variables. Secondly, the cognitive factors (risk perception, threat appraisal and coping appraisal) were subjected to Exploratory Factor Analysis (EFA) to examine the strength and relationship between measured variables before including them in the model. The KMO value (Kaiser–Meyer–Olkin) was 0.782, which was higher than the crucial limit of 0.7 [44]. The Barlett sphericity test yielded a significant value of p = 0.000, indicating that the original dataset was suitable for factor analysis. In the EFA process, constructs were extracted from all original items using principal component analysis with varimax rotation and factor loadings greater than 0.6. Three items TA3, TA5 and CA1, which had a factor loading lower than 0.6, were deleted. Cronbach's values for internal validity were determined to test the revised scale's reliability. The Cronbach's values of all derived variables were around or greater than 0.7, ranging from 0.801 to 0.901 (See Table 2). Cronbach's value should be higher than 0.700, according to Hair et al. (2010)[44]. Thus, it can be inferred that all the cognitive variables in the modified scale were internally consistent and reliable enough to be included in the model. The relationship between the dependent variable (relocation intention) and the explanatory variables was examined using both univariate and multivariate statistical techniques. The association between the

dependent variable (relocation intention) and compositional and contextual factors was examined using Pearson's Chi-square test. The Cramer's V statistic was employed to determine how strongly the variables were associated. Analysis of variance (ANOVA) was also carried out to assess the relationship between cognitive factors and the dependent variable. Post Hoc Tests was employed to compare the differences between the cognitive factors, compositional and contextual factors. With regards to the sex of respondent and hazard experience variable, the mean difference comparison was done using independent T test. The factors that influence relocation intention were modelled using ordered logistic regression. Ordered logistic regression was used for the analysis because it considers the ordering of the dependent categorical variable. Subsequently, four models were run: model 1 examined the influence of the cognitive factors, model 2 looked at cognitive and biosocial factors, model 3 focused cognitive, biosocial, and sociocultural factors, and model 4 combined cognitive, biosocial, sociocultural, and contextual factors.

Table 2. Varimax-rotated component analysis factor matrix and Cronbach's α values for the cognitive variables**.**

Constructs	Items	Main factors			Cronbach Alpha
		1	2	3	
Risk perception	RP1	0.907			0.901
	RP2	0.906			
	RP3	0.915			
Threat appraisal	TA1		0.893		0.861
	TA2		0.922		
	TA4		0.847		
Coping appraisal	CA2			0.835	0.801
	CA3			0.817	
	CA4			0.765	

Kaiser-Meyer-Olkin Measure of Sampling Adequacy= 0.782 and Bartlett's Test of Sphericity p= 0.000

4. Results

4.1. Descriptive statistics

Table 3 summarizes the respondent's socio-demographic characteristics. As the communities studied are not homogeneous, it is important to understand their socio-economic composition in order to assess their behavior towards climate adaptation measures. Other variables considered in the study are also summarized using figures.

4.1.1. Socio-Demographic Characteristics of Respondents

Out of the 359 respondents from the three coastal rural communities, 64 (17.8 %) were from Sanwoma, 193 (53.8%) from Anlo Beach and 102 (28.4 %) from Glefe-Wiaboman (Table 3). The percentages of male and female respondents were nearly equal among the 359 respondents, with 46.0 % and 54 %, respectively. The majority of respondents (49.0 %) were between the ages of 35 and 55. In terms of educational level, the majority of the respondents had completed middle school/junior high school (42.9 %). Most of respondents (53.2%) earned GHC101-500 every month. Only 10% of the respondents earned less than GHC 100 per month.

Table 3. Socio-demographic characteristics of respondents.

Background characteristics	Community							
	Sanwoma		Anlo Beach		Glefe-Wiaboman		Total	
	N	%	N	%	N	%	N	%
Community	64	17.8	193	53.8	102	28.4	359	100
Sex								
Male	23	13.9	96	58.2	48	27.9	165	46.0
Female	41	21.1	97	50.0	58	28.9	194	54.0
Age (years)								
<35	22	17.2	55	43.0	51	39.8	128	35.7
35-55	33	18.8	98	55.7	45	25.6	176	49.0
>55	9	16.4	40	72.7	6	10.9	55	15.3
Educational level								
No formal education	13	20.0	46	70.8	6	9.2	65	18.1
Primary	19	19.4	67	68.4	12	12.2	98	27.3
JHS/Middle	25	16.2	66	42.9	63	40.9	154	42.9
SHS/Voc/Tech	7	16.7	14	33.3	21	50.0	42	11.7
Average monthly income								
> GHC 100	8	22.2	17	47.2	11	30.6	36	10
GHC101-500	44	23.0	104	54.5	43	22.5	191	53.2
GHC 501-999	8	10.3	48	61.5	22	28.2	78	21.7
<GHC 1000	4	7.4ss	24	44.4	26	48.1	54	15.0

4.1.2. Risk perception, Threat and Coping Appraisal

As shown in Figure 4, communities had some differences in terms of cognitive factors. Anlo Beach and Sanwoma had a score greater than 4.0 for all factors of threat appraisal except for TA3 (Neighborhood, friends, and/or family decide to leave the area) which Sanwoma scored less than 4.0. Glefe-Wiaboman, on the other had a score of less than 4.0 for all the threat appraisal factors (Figure 4a). For coping appraisal factors, Anlo Beach had a score greater than 4.0 for all the factors. Sanwoma had a score of less than 4.0 except for CA1 (Relocation cost), with a score of 4 (Figure 4b). Anlo Beach and Sanwoma scored the highest mean score greater than 3 in all the risk perception factors whilst Glefe had a mean score less than 3 (Figure 4c).

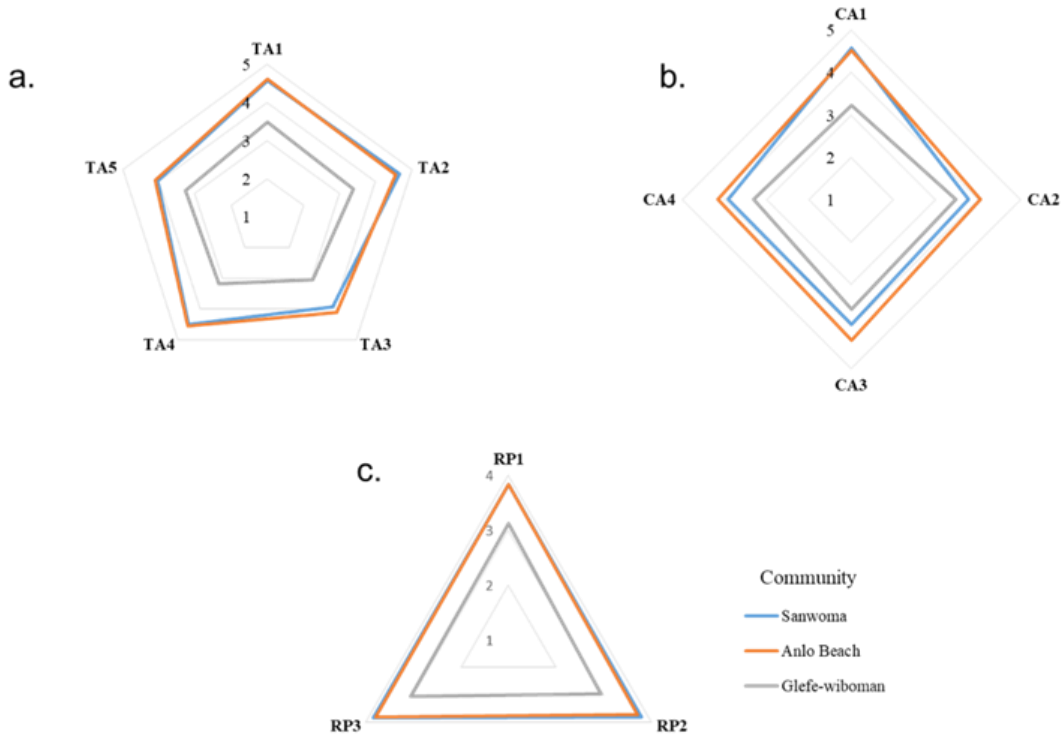


Figure 4. Scored values of factors associated with (a) Threat appraisal (b) Coping appraisal and (c) Risk perception.

4.1.3. Hazard experience

Out of 359 respondents interviewed, 293 indicated that they have experience hazards resulting from sea-level rise (Figure 5). Of these, 185 (63.1 %) were reported in Anlo beach whilst 57 (19.5 %) and 51 (17.4 %) were in Sanwoma and Glefe-Wiaboman, respectively.

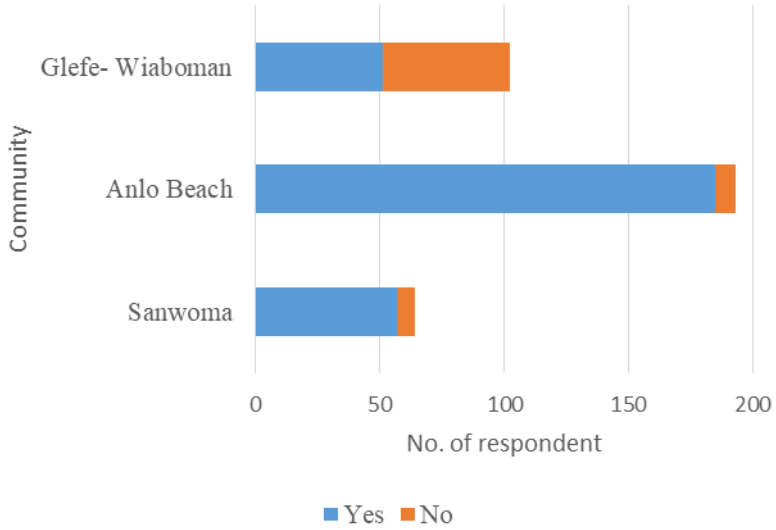


Figure 5. Respondents' experience of sea-level impacts (Coastal erosion/flooding) in the study communities.

4.1.4. Proximity to shoreline

Most of the respondents in study communities were affected by the flood and/or erosion depending on their proximity to the coastline. The results presented in Figure 6 indicated that, 40 % of the respondents in Sanwoma were located 101- 400 metres to the shoreline and 5 % were located 700 m and beyond away from the shoreline. In the Anlo beach community, 88 % of the respondents were less 100 m to the erosion risk areas and 5 % were within 401-700 m to shoreline. A vast difference was noted in Glefe-Wiaboman community, where 51% of the respondents were located less than 100 m to the shoreline and 49 % live between 101 and 400 metres of the shoreline.

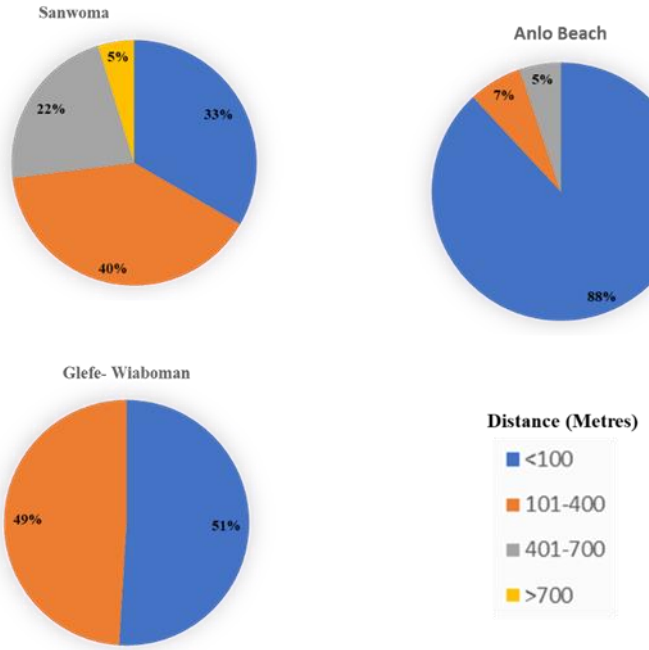


Figure 6. Respondents proximity to shoreline in the study communities.

4.2. Measures of association

Post Hoc Tests was conducted to find difference between the compositional/contextual factors and the cognitive factors (Table S1). The results indicated that the age group middle-aged adult and older adults were statistically associated with risk perception (P< 0.008 and P< 0.005 respectively) compared to young adult. In terms of level of education of the respondents with primary education had statistically significant influence on coping appraisal (P < 0.027). compared to respondents with no formal education. Respondents within the income category GHC 101-500 and GHC501-999 had statistically significant influence on both threat appraisal and coping appraisal. Hazard experience of the respondents had statistically significant influence on risk perception (P < 0.000) and threat appraisal (P < 0.019). Respondents living at a distance between 100 and 300 metres from shoreline showed statistically significant association with risk perception (P < 0.000), threat appraisal (P < 0.009), and coping appraisal (P < 0.015). Distance to flood risk areas of the respondents had statistically significant influence on both threat appraisal (P < 0.002) and coping appraisal (P < 0.036).

ANOVA conducted examine the association between the cognitive factors and relocation intention whilst Pearson chi-square and Cramer's V statistics was employed to assess the relationship between compositional/ contextual factors and relocation intention. The results of the one-way ANOVA (Table 4) show that among the three cognitive factors risk perception had statistically significant relationship with relocation

intention. Additionally, the Pearson chi-square and Cramer's V statistics results (Table 5) indicated there is no association between relocation intention and the compositional and contextual factors.

Variable	P-value
Risk perception	0.000*
Threat Appraisal	0.084
Coping Appraisal	0.040*

Table 5. Distribution of compositional and contextual variables by predictor variables.

Variable	Relocation Intention		
	Will relocate	Will not relocate	Inferential statistics
Sex of respondent			
Male	147	18	χ^2=0.79, p-value =0.456;
Female	171	23	Cramér's V = 0.15
Age of respondent			
Young adult	117	11	χ^2=1.879, p-value =0.391;
Middle-aged adult	152	24	Cramér's V = 0.72
Older Adult	49	6	
Educational level			
No formal education	55	10	χ^2=2.700, p-value =0.440;
Primary	85	13	Cramér's V = 0.087
JHS/Middle	141	13	
SHS/Voc/Tech and above	37	5	
Average monthly income			
> GHC 100	33	3	χ^2=2.700, p-value =0.440;
GHC101-500	170	21	Cramér's V = 0.087
GHC 501-999	71	7	
<GHC 1000	44	10	
Elevation			
>4m	233	30	χ^2=1.780, p-value =0.411;
4-9m	73	11	Cramér's V = 0.070
<9m	12	0	
Distance to shoreline			
>100m	134	12	χ^2=3.671, p-value =0.160;
100-400m	159	27	Cramér's V = 0.101
<400	25	2	
Hazard experience			χ^2= 3.654, p-value =0.440;
Yes	264	29	Cramér's V = 0.101
No	54	12	

4.3. Factors affecting relocation intention

The relationship between relocation intention and the key predictors (cognitive factors), compositional and contextual were examined using four different models in the multivariate analysis. The models employed were cognitive factors (model 1), biosocial factors (model 2), sociocultural factors (model 3), and contextual factors (model 4). Table 5 presents the proportional odds ratios, robust standard errors, probability values, and confidence intervals for the cognitive factors, compositional, and contextual components.

Table 6. Ordered logistic regression model showing the relation between relocation intention and household characteristics.

Variables	Odds ratio	Robust SE	P-value	Conf. Interval	
Model 1: Cognitive Factors					
Risk perception	1.495	0.179	0.001	1.182	1.890
Threat Appraisal	1.334	0.160	0.017	1.054	1.688
Coping Appraisal	1.304	0.190	0.068	0.980	1.734
Model 2: Model 1 + Biosocial factors					
Risk perception	1.572	0.200	0.000	1.225	2.018
Threat Appraisal	1.327	0.165	0.023	1.040	1.692
Coping Appraisal	1.290	0.182	0.071	0.979	1.700
Sex (ref: Female)					
Male	1.202	0.350	0.527	0.679	2.128
Age (ref: Young adult)					
Middle-aged adult	0.440	0.155	0.020	0.221	0.876
Older adult	0.919	0.490	0.875	0.323	2.614
Model 3: Model 2 + Socio-cultural factors					
Risk perception	1.633	0.215	0.000	1.261	2.115
Threat Appraisal	1.359	0.177	0.019	1.052	1.754
Coping Appraisal	1.208	0.178	0.198	0.906	1.611
Sex (ref: Female)					
Male	1.141	0.346	0.664	0.629	2.068
Age (ref: Young adult)					
Middle-aged adult	0.397	0.154	0.017	0.185	0.850
Older adult	0.725	0.402	0.562	0.245	2.148
Education (ref: No formal education)					
Primary	1.370	0.608	0.478	0.574	3.270
Middle School/JHS	1.383	0.615	0.467	0.578	3.308
Secondary School and above	1.290	0.717	0.646	0.434	3.832
Household monthly income (GHC) (ref: below 100)					
101-500	0.394	0.218	0.093	0.133	1.167

501-999	1.014	0.692	0.984	0.266	3.862
1000 and above	0.303	0.189	0.056	0.089	1.030
Model 4: Model 3+ Contextual factors					
Risk perception	1.421	0.223	0.025	1.045	1.933
Threat Appraisal	1.316	0.175	0.039	1.014	1.707
Coping Appraisal	1.178	0.171	0.260	0.886	1.565
Sex (ref: Female)					
Male	1.141	0.352	0.668	0.623	2.090
Age (ref: Young adult)					
Middle-aged adult	0.403	0.155	0.018	0.190	0.857
Older adult	0.693	0.380	0.504	0.237	2.030
Education (ref: No formal education)					
Primary	1.473	0.676	0.398	0.599	3.620
Middle School/JHS	1.547	0.702	0.336	0.636	3.765
Secondary School and above	1.519	0.908	0.485	0.471	4.900
Household monthly income (GHC) (ref: below 100)					
101-500	0.375	0.200	0.067	0.132	1.069
501-999	0.995	0.661	0.994	0.271	3.657
1000 and above	0.302	0.184	0.049	0.092	0.995
Hazard Experience (ref: No)					
Yes	1.704	0.683	0.184	0.777	3.739
Elevation	1.010	0.100	0.918	0.832	1.226
Distance of house from Shoreline (ref: below 100m)					
100-300m	0.655	0.238	0.244	0.321	1.335
Above 300m	0.862	0.469	0.785	0.297	2.502

The results of model 1 indicate that risk perception (p-value < 0.005) and threat appraisal (p-value < 0.05) among the cognitive factors have a positive significant relationship with relocation intention. This suggests that households who believe that sea-level rise is taking place and its poses danger to both natural and built environments are more likely to consider relocating. In Model 2, where we controlled for biosocial factors, found that risk perception and threat appraisal continued to have a positive significant relationship with relocation intention. Furthermore, households headed by middle-aged adults were found to be 56% (p-value < 0.05) less likely to relocate compared to households with young adult heads. However, there was no significant relationship between sex and relocation intention. The results of Model 3 (sociocultural) showed no substantial differences from Model 2 concerning risk perception, threat appraisal, sex, and age, except for minor variations in the proportional odds ratios. Moreover, the sociocultural factors, including education and household income, had no significant relationship with relocation intention. In the final model, where contextual factors including hazard experience and distance of house from shoreline were controlled for, there were slight changes in the proportional odds ratios for the variables, including risk perception, threat appraisal, and age, that had a significant relationship with relocation intention in Model 3. Besides, the study found that household monthly income, which

was not significant in Model 3, became a significant predictor in the contextual model. Households with a monthly income of 1000 cedis and above were 70% less likely to relocate (p-value < 0.05) compared to those with a monthly income below 100 cedis. However, neither of the two contextual factors exhibited any significant association with relocation intention.

4. Discussion

The study reveals some new trends in how coastal rural communities react to long-term threats arising from the impacts of climate change. This provides insights into the behavioral aspect of implementing managed retreat as an adaptation strategy to curb the impacts of sea-level rise. According to protection Motivation Theory [18] and other previous studies [13], [21], adaptation behavior is linked to cognitive variables such as risk perception, threat and coping appraisal. In this study, risk perception appears to be a significant factor for explaining relocation intention. The prominent role of perceived sea level rise risk in promoting adaptation has been found by [21] and [13]. Since risk perception increases the intensity of adaptation, it is important to emphasize this to encourage the coastal rural households to take protective measures and one way to improve risk assessment would be to educate them on the impending sea level rise impacts. Contrary to the study by Zheng et al., (2015) risk perception as shown in this study is a better predictor of climate change adaptation compared to adaptation appraisal. In addition, the study also established that threat appraisal is a better predictor for relocation intention than coping appraisal. This echoes the findings of Song et al., (2017)[13]. Indeed, Table 6 model 1 shows that the perceived risk and the perceived expectation of being exposed to the risk in the study communities positively influence respondents' intentions to relocate, but capacity to perform risk preventative behaviors does not significantly influence these intentions. The study also confirms the conclusion drawn by researchers such as Kellens et al., (2011) [39] and Song & Peng, (2017) [13] that the influence of biosocial factors on climate change adaptation action is mixed and varies between contexts. In this study, age appears not to be a significant factor for explaining adaptation behavior. Age, on the other hand, was found to have a strong positive association with risk perception (Table S1). In general, the older the respondent, the higher the sea level rise risk perception level they have. This may be because older respondents have experienced many historical sea-level rise impacts and that they are accountable for the safety of their family. Song and Peng (2017) [13] further argued that in the event of a sea-level rise disaster, young people are more likely to stay since they have stable income sources and strong social ties. As a result, letting go of these areas of one's life and relocating to a new location might be difficult. People with higher education should be more likely to pursue individual-level adaptation strategies in theory, however as the results in Table 6 indicated no association between relocation intention and education in the three rural coastal communities. However, studies have also reported a strong association between education and mitigation behavior [13], [21] and climate change action [28] [45]. According to these studies higher-educated persons were less likely to adapt to climate change because they were more likely to understand issues of climate change and they also believe its government obligation to undertake high-cost adaptation strategies and while they are able to implement low-cost and low-effort preventative steps. In terms of the respondents' monthly income, there was a significant relationship between income and relocation intention. This study revealed that high income households were more likely to relocate compared to lower income households as they can afford the cost of relocation and also take other adaptation measures since they have more assets to protect themselves from sea-level rise disasters. Similar conclusions were also drawn by [45]. As seen in Figure 5 and 6 majority of the respondents have experience hazards in their lifetime and also live close to the shoreline. This was not surprising as these communities were situated along major estuaries and wetlands, making them highly susceptible to impacts from sea level rise. In Anlo Beach, for example, the community is flooded for several weeks by seawater twice every year, destroying

properties and obstructing economic activities. In July 2009 alone, 78 houses were destroyed, rendering several inhabitants homeless [46]. Despite these events, these hazard experiences and proximity to risk areas do not seem to influence their intention to relocate to a new area. However, these factors significantly influence the cognitive factors, as indicated in (Table S1). Although the study provided important insights into the factors influencing relocation coastal rural households, a few limitations should be noted. First, this study only looked at residents' relocation intention, which is the most aggressive adaptation option to curb sea level rise impacts. Individual perception of sea defense, beach nourishment, and other sea-level rise adaptation strategies are equally significant. A comparison of different strategies' perspectives is fascinating and can add greatly to the climate change resilience literature. Secondly, the factors considered in the extended version of the PMT may be limited. Finally, since some factors considered played a mediating role between the cognitive variables and relocation intention, the study could be extended further in the following-up research.

5. Conclusions

Using an extended version of Protection Motivation Theory, the study highlighted a range of factors that influence relocation intention of rural coastal residents in anticipation of sea-level rise. The results of this study showed that apart from the cognitive factors, compositional factors such as household age and income were found to be more important for predicting the relocation intention of coastal rural communities in Ghana. Contextual factors such as hazard experience and proximity to shoreline did not appear to be significant in influencing resident relocation intention, which was explained by the fact that most of the households were already used to sea levels rise impacts such as erosion and flooding. As a result, strategies to relocate these rural communities should focus on cognitive as well as compositional characteristics and, in particular, promote household-level adaptation as a viable and cost-effective approach to responding to sea-level rise impacts. This implies that disseminating information about the various aspects of impact of sea level rise can be utilized to create strategies and programmes that will encourage relocation action. Thus, increased information dissemination by the government and civil society organizations could motivate households to relocate. The campaigns should emphasize the effects of future sea-level rise impacts on communities, increasing household self-confidence in adaption strategies and educating people about the benefits of relocation at the community level. Additionally, structural and non-structural measures are required for improving socio-economic capacity of coastal rural communities in order to adopt this adaptation strategy. This can be achieved through the provision of alternative livelihoods as well as making relocation cost-effective and affordable.

Supplementary Materials: The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Table S1: Multiple Comparisons between compositional/contextual factors and cognitive factors.

Author Contributions: Conceptualization, R.A. D.J. and N.A.B.K.Y; methodology, R.A. D.J. and N.A.B.K.Y.; software, R.A.; validation, D.J., N.A.B.K.Y. and A.A.O.; formal analysis, R.A.; data curation, R.A.; writing—original draft preparation, R.A.; writing—review and editing, D.J., N.A.B.K.Y. and A.A.O.; supervision, D.J. and N.A.B.K..; All authors have read and agreed to the published version of the manuscript.

Funding: This study is part of PhD research funded by the German Federal Ministry of Education and Research (BMBF) through the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL). The APC was funded by the Africa Centre of Excellence in Coastal Resilience (ACECoR), University of Cape Coast (Grant Number 6389-G).

Data Availability Statement: The data presented in this work are available upon request from the corresponding author.

Acknowledgments: Special appreciation is expressed to Mr. Bernard Ekumah for his support.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. [1] T. B. Lebbe et al., "Designing coastal adaptation strategies to tackle sea level rise", doi: 10.3389/fmars.2021.740602ï.
2. [2] N. Abel et al., "Sea level rise, coastal development and planned retreat: Analytical framework, governance principles and an Australian case study," Environ Sci Policy, vol. 14, no. 3, pp. 279–288, 2011, doi: 10.1016/j.envsci.2010.12.002.
3. [3] T. Bongarts Lebbe et al., "Designing Coastal Adaptation Strategies to Tackle Sea Level Rise," Front Mar Sci, vol. 8, p. 1640, Nov. 2021, doi: 10.3389/FMARS.2021.740602/BIBTEX.
4. [4] M. Hino, C. B. Field, and K. J. Mach, "Managed retreat as a response to natural hazard risk," Nature Climate Change 2017 7:5, vol. 7, no. 5, pp. 364–370, Mar. 2017, doi: 10.1038/nclimate3252.
5. [5] P. P. Wong et al., "Coastal Systems and Low-Lying Areas Coordinating," in Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, 2014, pp. 361–409.
6. [6] J. Mcadam and E. Ferris, "Planned Relocations in the Context of Climate Change: Unpacking the Legal and Conceptual Issues," Cambridge Journal of International and Comparative Law, vol. 137, 2015, doi: 10.7574/cjicl.04.01.137.
7. [7] K. Warner et al., "Integrating Human Mobility Issues within National Adaptation Plans UNU-EHS PUBLICATION SERIES," 2014.
8. [8] K. Appeaning Addo, P. N. Jayson-Quashigah, S. N. A. Codjoe, and F. Martey, "Drone as a tool for coastal flood monitoring in the Volta Delta, Ghana," Geoenvironmental Disasters, vol. 5, no. 1, 2018, doi: 10.1186/s40677-018-0108-2.
9. [9] E. Amos, U. Akpan, K. O.- Environment, development and, and undefined 2015, "Households' perception and livelihood vulnerability to climate change in a coastal area of Akwa Ibom State, Nigeria," Springer, vol. 17, no. 4, pp. 887–908, Aug. 2015, doi: 10.1007/s10668-014-9580-3.
10. [10] U. Boyer-Villemaire, P. Bernatchez, J. Benavente, and J. A. G. Cooper, "Quantifying community's functional awareness of coastal changes and hazards from citizen perception analysis in Canada, UK and Spain," Ocean Coast Manag, vol. 93, pp. 106–120, Jun. 2014, doi: 10.1016/J.OCECOAMAN.2014.03.016.
11. [11] B. Y. Fosu-Mensah, P. L. G. Vlek, and D. S. MacCarthy, "Farmers' perception and adaptation to climate change: A case study of Sekyedumase district in Ghana," Environ Dev Sustain, vol. 14, no. 4, pp. 495–505, 2012, doi: 10.1007/s10668-012-9339-7.
12. [12] T. Gebrehiwot and A. Van Der Veen, "Farm level adaptation to climate change: The case of farmer's in the ethiopian highlands," Environ Manage, vol. 52, no. 1, pp. 29–44, 2013, doi: 10.1007/s00267-013-0039-3.
13. [13] J. Song and B. Peng, "Should we leave? Attitudes towards relocation in response to sea level rise," Water (Switzerland), vol. 9, no. 12, pp. 1–17, 2017, doi: 10.3390/w9120941.
14. [14] P. Bubeck, W. J. W. Botzen, H. Kreibich, and J. C. J. H. Aerts, "Detailed insights into the influence of flood-coping appraisals on mitigation behaviour," Global Environmental Change, vol. 23, no. 5, pp. 1327–1338, 2013, doi: 10.1016/j.gloenvcha.2013.05.009.
15. [15] X. Feng, M. Liu, X. Huo, W. M.- Sustainability, and undefined 2017, "What motivates farmers' adaptation to climate change? The case of apple farmers of Shaanxi in China," mdpi.com, 2017, doi: 10.3390/su9040519.
16. [16] M. Keshavarz and E. Karami, "Farmers' pro-environmental behavior under drought: Application of protection motivation theory," J Arid Environ, vol. 127, pp. 128–136, 2016, doi: 10.1016/j.jaridenv.2015.11.010.
17. [17] A. Reynaud, C. Aubert, and M. H. Nguyen, "Living with floods: Protective behaviours and risk perception of vietnamese households," Geneva Papers on Risk and Insurance: Issues and Practice, vol. 38, no. 3, pp. 547–579, Jul. 2013, doi: 10.1057/GPP.2013.16.
18. [18] R. Rogers W., "Cognitive and physiological processes in fear appeals and attitude change: a revised theory of protection motivation," in Social Psychophysiology: A Sourcebook, 1983, pp. 153–177. Accessed: Dec. 06, 2021. [Online]. Available: https://ci.nii.ac.jp/naid/10004535663/
19. [19] R. Lazarus and S. Folkman, Stress, appraisal, and coping. 1984. Accessed: Dec. 06, 2021. [Online]. Available: https://books.google.com/books?hl=en&lr=&id=i-ySQQuUpr8C&oi=fnd&pg=PR5&dq=Lazarus+R+and+Folkman+S+(1984)+Stress,+Appraisal+and+Coping.+Springer,+New+York.&ots=DgFUpwilTg&sig=TFJRk0I6MeH55Hm8CTKJr0V67FU
20. [20] D. L. Floyd, S. Prentice-Dunn, and R. W. Rogers, "A meta-analysis of research on protection motivation theory," J Appl Soc Psychol, vol. 30, no. 2, pp. 407–429, 2000, doi: 10.1111/J.1559-1816.2000.TB02323.X.
21. [21] J. Koerth, A. T. Vafeidis, J. Hinkel, and H. Sterr, "What motivates coastal households to adapt pro-actively to sea-level rise and increasing flood risk?," Reg Environ Change, vol. 13, no. 4, pp. 897–909, 2013, doi: 10.1007/s10113-012-0399-x.

22. [22] J. Collins, B. M. Ward, P. Snow, S. Kippen, and F. Judd, "Compositional, Contextual, and Collective Community Factors in Mental Health and Well-Being in Australian Rural Communities," Qual Health Res, vol. 27, no. 5, pp. 677–687, Apr. 2017, doi: 10.1177/1049732315625195.
23. [23] F. A. Armah, B. Ekumah, D. O. Yawson, J. O. Odoi, A. R. Afitiri, and F. E. Nyieku, "Predictive Probabilities of Access to Clean Cooking: Evidence from the Demographic and Health Surveys in 31 Countries in Sub-Saharan Africa," https://home.liebertpub.com/env, vol. 12, no. 3, pp. 118–131, Jun. 2019, doi: 10.1089/ENV.2019.0002.
24. [24] R. Zaalberg, C. Midden, … A. M.-R. A. A., and undefined 2009, "Prevention, adaptation, and threat denial: Flooding experiences in the Netherlands," Wiley Online Library, vol. 29, no. 12, pp. 1759–1778, Dec. 2009, doi: 10.1111/j.1539-6924.2009.01316.x.
25. [25] J. K. Poussin, W. J. W. Botzen, and J. C. J. H. Aerts, "Factors of influence on flood damage mitigation behaviour by households," Environ Sci Policy, vol. 40, pp. 69–77, Jun. 2014, doi: 10.1016/j.envsci.2014.01.013.
26. [26] W. J. Wouter Botzen and J. C. J. M. Van Den Bergh, "Monetary valuation of insurance against flood risk under climate change," Int Econ Rev (Philadelphia), vol. 53, no. 3, pp. 1005–1026, Aug. 2012, doi: 10.1111/J.1468-2354.2012.00709.X.
27. [27] Y. Zheng and M. Dallimer, "What motivates rural households to adapt to climate change?," Clim Dev, vol. 8, no. 2, pp. 110–121, Mar. 2016, doi: 10.1080/17565529.2015.1005037.
28. [28] E. Bryan, T. T. Deressa, G. A. Gbetibouo, and C. Ringler, "Adaptation to climate change in Ethiopia and South Africa: options and constraints," Environ Sci Policy, vol. 12, no. 4, pp. 413–426, 2009, doi: 10.1016/j.envsci.2008.11.002.
29. [29] D. De Silva, R. P.-A. Economics, and undefined 2014, "Going green: does it depend on education, gender or income?," Taylor & Francis, vol. 46, no. 5, pp. 573–586, Feb. 2013, doi: 10.1080/00036846.2013.857003.
30. [30] F. X. K. Mwinkom, L. Damnyag, S. Abugre, and S. I. Alhassan, "Factors influencing climate change adaptation strategies in North-Western Ghana: evidence of farmers in the Black Volta Basin in Upper West region," SN Appl Sci, vol. 3, no. 5, pp. 1–20, May 2021, doi: 10.1007/S42452-021-04503-W/TABLES/11.
31. [31] N. D. Weinstein, "Effects of Personal Experience on Self-Protective Behavior," Psychological Bulletin, vol. 105, no. 1. pp. 31–50, 1989. doi: 10.1037/0033-2909.105.1.31.
32. [32] R. Soetanto, A. Mullins, N. Achour, and R. Soetanto RSoetanto, "The perceptions of social responsibility for community resilience to flooding: the impact of past experience, age, gender and ethnicity," Springer, vol. 86, pp. 1105–1126, 2017, doi: 10.1007/s11069-016-2732-z.
33. [33] F. H. Ling, M. Tamura, K. Yasuhara, K. Ajima, and C. Van Trinh, "Reducing flood risks in rural households: survey of perception and adaptation in the Mekong delta," Clim Change, vol. 132, no. 2, pp. 209–222, Sep. 2015, doi: 10.1007/S10584-015-1416-0.
34. [34] M. Frondel, M. Simora, and S. Sommer, "Risk Perception of Climate Change: Empirical Evidence for Germany," Ecological Economics, vol. 137, pp. 173–183, 2017, doi: 10.1016/j.ecolecon.2017.02.019.
35. [35] J. Lawrence, D. Quade, and J. Becker, "Integrating the effects of flood experience on risk perception with responses to changing climate risk," Natural Hazards, vol. 74, no. 3, pp. 1773–1794, 2014, doi: 10.1007/s11069-014-1288-z.
36. [36] J. Clark, D. Bell, … M. H.-G. C., and undefined 2011, "Climate change vulnerability of forest biodiversity: climate and competition tracking of demographic rates," Wiley Online Library, vol. 17, no. 5, pp. 1834–1849, May 2011, doi: 10.1111/j.1365-2486.2010.02380.x.
37. [37] J. P. Arias, N. C. Bronfman, P. C. Cisternas, and P. B. Repetto, "Hazard proximity and risk perception of tsunamis in coastal cities: Are people able to identify their risk?," PLoS One, vol. 12, no. 10, p. e0186455, Oct. 2017, doi: 10.1371/JOURNAL.PONE.0186455.
38. [38] Y. Zhang, S. N. Hwang, and M. K. Lindell, "Hazard Proximity or Risk Perception? Evaluating Effects of Natural and Technological Hazards on Housing Values," Environ Behav, vol. 42, no. 5, pp. 597–624, 2010, doi: 10.1177/0013916509334564.
39. [39] W. Kellens, R. Zaalberg, T. Neutens, W. Vanneuville, and P. De Maeyer, "An Analysis of the Public Perception of Flood Risk on the Belgian Coast," Risk Analysis, vol. 31, no. 7, pp. 1055–1068, Jul. 2011, doi: 10.1111/J.1539-6924.2010.01571.X.
40. [40] P. W. K. Yankson, A. B. Owusu, G. Owusu, J. Boakye-Danquah, and J. D. Tetteh, "Assessment of coastal communities' vulnerability to floods using indicator-based approach: a case study of Greater Accra Metropolitan Area, Ghana," Natural Hazards, vol. 89, no. 2, pp. 661–689, 2017, doi: 10.1007/s11069-017-2985-1.
41. [41] A. Osman, B. K. Nyarko, and S. Mariwah, "Vulnerability and risk levels of communities within Ankobra estuary of Ghana," International Journal of Disaster Risk Reduction, vol. 19, pp. 133–144, 2016, doi: 10.1016/j.ijdrr.2016.08.016.
42. [42] O. Donkor, "SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP) Vulnerability assessment for Axim Fish Landing Site, Nzema East District," 2016.
43. [43] D. M. Dusick, "Sample size calculator," 2014. https://www.calculator.net/sample-size-calculator.html?type=1&cl=95&ci=5&pp=50&ps=55&x=119&y=16%0Ahttp://www.raosoft.com/samplesize.html (accessed Oct. 03, 2021).
44. [44] J. F. Hair, R. E. Anderson, B. J. Babin, and W. C. Black, Multivariate data analysis: A global perspective. Pearson Upper Saddle River, 2010.
45. [45] D. L. González-Hernández, E. W. Meijles, and F. Vanclay, "Factors that influence climate change mitigation and adaptation action: A household study in the Nuevo Leon Region, Mexico," Climate, vol. 7, no. 6, 2019, doi: 10.3390/cli7060074.

46. [46] Coastal Resources Centre, "Shama District Integrated Coastal Management Toolkit. Integrated Coastal and Fisheries Governance Initiative (Hen Mpoano)," Rhode Island, 2013.