

Assessing Socio-Economic Factors Influencing Household Vulnerability to Climate Change in Kaskazini (A) District, Zanzibar.

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Abstract: Climate change is a time ticking bomb that for far too long humanity has paid lip-service to its redress. The reverberating consequences have been causing devastating losses, driving inequalities and exacerbating vulnerabilities calling for prudent interventions. Addressing vulnerability requires quality information and although there is extensive literature on vulnerability to climate change globally, information on what influences household vulnerability from the socio-economic paradigm in Zanzibar is dearthful. This study sought to fill this void by investigating the socio-economic factors that influence household vulnerability to the impacts of climate change in Kaskazini (A) district, Zanzibar. The research adopted a descriptive research methodology with quantitative methods to collect data from household heads. Collected data were augmented with data collated from a review of documentaries and case studies. Findings reveal that due to low education and poor access to information, perceptions on climate change, variability, and its causes are daunting. Additionally, a higher household population that is dependent on natural resources and climate-sensitive sectors indicated a higher sensitivity to the impacts of climate change. Moreover, a lack of ownership of physical assets compromise the local's ability to secure loans and credit services to cushion themselves against climate-related shocks. In addition to low income, lack of safety nets and marginalization in decision-making characterize the island. This study recommends that investment in education, diversification of livelihoods as well as easing access to livelihood assets is necessary. To complement this, climate change information should be made accessible, in a timely and inclusive manner.

Keywords: Climate Change, Household Vulnerability, Perception, Socio-economic factors.

1. Introduction

Climate change is an existential threat facing human societies in the 21st century (Ord, 2020; Richards et al., 2021). United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”. Climate change has a pervasive influence transcending borders and making systems susceptible to perturbations, this makes them vulnerable to both internal and external pressures. According to Intergovernmental Panel on Climate Change (IPCC, 2007 & IPCC, 2013), further changes in climate will expose regions having variable weather patterns and trends to more vulnerabilities; this includes small islands and the least developed countries to which Zanzibar belongs.

According to the Summary for Policymakers (IPCC, 2001:6), vulnerability in the context of climate change is “the degree to which a system is susceptible to and unable to cope with, adverse effects of climate change, including climate variability and extremes”. It is a function of exposure, sensitivity, and adaptive capacity. These three components are the key determinants of a system's vulnerability to climate change, providing a pathway for reducing climatic threats. Adger et al., (2003) opine that societal vulnerability to the risks associated with climate change may exacerbate current societal challenges, particularly for those parts of societies dependent on resources that are sensitive to changes in climate. Risks are evident in agriculture, fisheries, and many other areas that constitute the livelihood of rural populations in developing countries and according to Sarris et al., (2006), a household facing a risky situation is subject to future loss of welfare and thus vulnerable.

Analysing vulnerability at the household level can help in pinpointing the threats that households face and potential coping and adaptation approaches, especially given the increasing vulnerability to the impacts of climate change (Ribot, 2013; Fang et al., 2016). This notion is supported by the UNFCCC (2007) assertion that assessing the impacts of and vulnerability to climate change and subsequently working out adaptation needs requires good quality information. This information includes climate and non-climatic data for different sectors which constitute socio-economic parameters like perceptions, levels of education, social capital, participation in decision making *inter alia*. More often than not, there is a paucity of this crucial information despite being potentially valuable in decision-making (Shepherd et al., 2018; Etana et al., 2021).

1.1 Perceptions of Climate Change and how it influences Vulnerability.

There is a general concordance that understanding perceptions provides an entry point in devising response strategies to any societal challenge. This is equally relevant to the climate change discourse where understanding what people perceive is

critical in determining the courses of action to undertake in order to build capacities to adapt and reduce vulnerabilities. Understanding how people perceive climate change and its impacts is important in devising responsive policies, and effective adaptation interventions (Whitmarsh & Capstick, 2018). Essentially, a clear understanding provides a strategic direction for government policy, adaptation strategies and development of community-based guidelines (Kabir et al., 2016). The research discourse presently argues that the key to understanding vulnerability lies in the interaction between social dynamics within a social-ecological system and as Adger et al., (2006) puts it, these dynamics are important in building resilience.

To understand vulnerability, more emphasis on social context and perception of vulnerability on a local scale is of critical importance. For instance, culture is an important aspect of understanding vulnerability both as a way to provide indigenous knowledge that can be leveraged in adaptation and as a tool for local communities to communicate their vulnerabilities (Eriksen et al., 2005). Factors influencing peoples' perceptions include observation, current economic conditions, socio-political events and availability of information; moreover, individual-level factors, particularly a person's socio-economic status plays a bigger role.

Vedwan and Rhoades (2001) and Nyanga et al., (2011) argue that environmental perceptions are key in helping farmers determine the next courses of action to pursue when faced with climate variability. Evidence point out that the success or failure of adaptation to local climate variability depends largely on the people's perception in relation to climate variability (Makame, 2013), this essentially means that whatever the locals perceive will go a long way in determining the success of adaptation options and thus the imperative that is perception to climate change and variability. Therefore, there is need to build on perceptions and local knowledge in response to climate change impacts (Vedwan, 2006).

1.2 Socio-economic factors influencing Vulnerability

The imperatives of understanding the socio-economic factors within a community that are driving household vulnerability to climate change lies in the fact that impacts are differentiated across socio-economic spectrums due to social stratification (Ribot, 2013). There has always been the indispensable need to understand the causes and or drivers of vulnerability and as Ribot (2014) argues, understanding causality provides direction for pragmatic, transformative adaptation and vulnerability-reducing strategies that can be undertaken to change the status quo.

The research discourse has always highlighted a number of pathways of understanding vulnerability that has always been defined by the relationship between humans and the environment (Adger, 2006). One of the approaches emphasizes biophysical processes and is delineated in the risk-hazard framing (Karim & Mimura, 2008; Preston, 2012). In this paradigm, vulnerability arises due to the sensitivity of a system to hazards as well as the hazard itself and its characteristics of spatial dispersion, magnitude, frequency, duration, and speed of onset (Ford & Smit, 2004; Patterson, 2013).

The social constructivists or the opponents of hazard-based frameworks of vulnerability focuses on socio-economic and political causes of vulnerability (Preston, 2012; Ribot, 2014). These frameworks argue that vulnerability is socially constructed and that the causes involve a range of socio-economic factors such as population, race, and socio-economic status (Schröter et al., 2005; Cutter & Finch, 2008). Other social and livelihood-entitlement approaches and frameworks find causality in the processes of entitlement, empowerment, and political economy (Kelly & Adger, 2000; Adger, 2006). Entitlements in the climate vulnerability context include access to assets, social protections, and capital that, if lacking, can compromise abilities to cushion against harm whilst reducing political advantage and empowerment (Ribot, 2014).

Understanding the factors influencing vulnerability to climate change within households, communities and or societies from the socio-economic paradigm therefore calls for the deliberate use of explicit socio-economic indicators of vulnerability. Indicators of social and economic status includes the region's per capita income; percentage of the less privileged or dependent population like children, elderly and disabled; availability and extent of access to public amenities, inter alia. Additionally, awareness about climate change, quality of housing, infrastructure and service provision, participation in adaptation decision-making, as well as institutional capacities play a role in determining households' vulnerability (Owusu & Nursey-Bray, 2019).

1.3 Zanzibar's Vulnerability to Climate Change Impacts

Zanzibar's characteristic built-environment which includes its small size, remoteness, narrow resource and export base, exposure to global environmental challenges as well as external economic shocks puts it in the path of vulnerability (Betzold, 2015). Despite an upward economic growth over recent years (World Bank, 2021), considerable population is dependent on climate-sensitive sectors and as noted by Sovacool (2012), the island depends on agriculture and fisheries for food and livelihoods with little diversification. The dependence on agriculture, fisheries, and tourism, has resulted in the national economy being very susceptible to external shocks and stresses. Furthermore, recent human activity within Zanzibar attributable to infrastructure, land conversion, removal of vegetation, unsustainable resource use, as well as construction and

development often associated with a burgeoning tourism industry has contributed to the increasing vulnerability (Sovacool, 2012; Hay, 2013).

Zanzibar is particularly vulnerable to climate change due to changes in temperature, precipitation patterns as well as sea-level rise (UNDP, 2012). The Island has in the recent past experienced waves of climate change impacts including floods, storm surges, coastal erosion, inundation of gardens and wells as well as localized food shortages (Makame, 2013). This vulnerability trickles down all the way to the household and individual levels. The Government of Tanzania through the development of the National Adaptation Program of Action and Nationally Determined Contributions (IPCC. (n.d).), amongst other relevant policies and strategies like the Zanzibar Climate Change Strategy (ZCCS-2014) has always shown commitments to address these challenges at the policy level. Nonetheless, several barriers to effective climate change adaptation remain. One of the profound challenges is weak institutions that are otherwise mandated to be the vanguards but fall short of expectations. Additionally, the difference in perceptions, understandings, and priorities around climate change between policy makers, researchers, donor agencies, and those immediately and directly affected by changes in the environment, has been a bottleneck, as ineffective policies and programs are developed (Spence et al., 2011; Arnall & Kothari, 2015).

Despite an ever-increasing number of vulnerability studies worldwide, few studies have been undertaken in Zanzibar; those that have been undertaken have focused mainly on climate change impacts related to the bio-physical environment and national economy (Makame, 2013). Globally, micro-level analyses have always been overlooked in favour of wide and contemporary ecosystem-scale studies on biophysical vulnerability (Marshall et al., 2014). Most of these studies focus on particular sectors of the economy and by far adopting a top-down approach thus limiting the opportunities to get an in-depth understanding of what drives vulnerability, especially at the local level.

This presents a knowledge gap as adopted interventions turn out to be more generic yet we are seeking pathways to tailored solutions that are site-specific, multidimensional, and respect the dynamism of vulnerability contexts. Therefore, this study sought to fill this gap by assessing the underlying socio-economic factors influencing household vulnerability to climate change with an aim of providing recommendations on appropriate pathways to pursue in building capacities of households, communities, and the country to withstand the impacts of climate change and ultimately build resilience. To achieve this, the study sought to;

- Establish households' perception of Climate Change and how this influences Vulnerability.
- Identify socio-economic factors having a significant influence on household vulnerability in the District.

2 Study Area and Methods

2.1 Study Area

It is estimated that Kaskazini (A) district has 21,838 households and a population of about 105,780 persons, which grows at an annual rate of 3.2% p.a. (Tanzania, 2012) The high population growth rate has led to increased rate of unemployment, shortage of quality health services, increased pressure on agricultural land, high demand for fuel and energy, overcrowding in educational facilities, more demand for better housing and increased stress on natural resources (UNICEF, 2017).

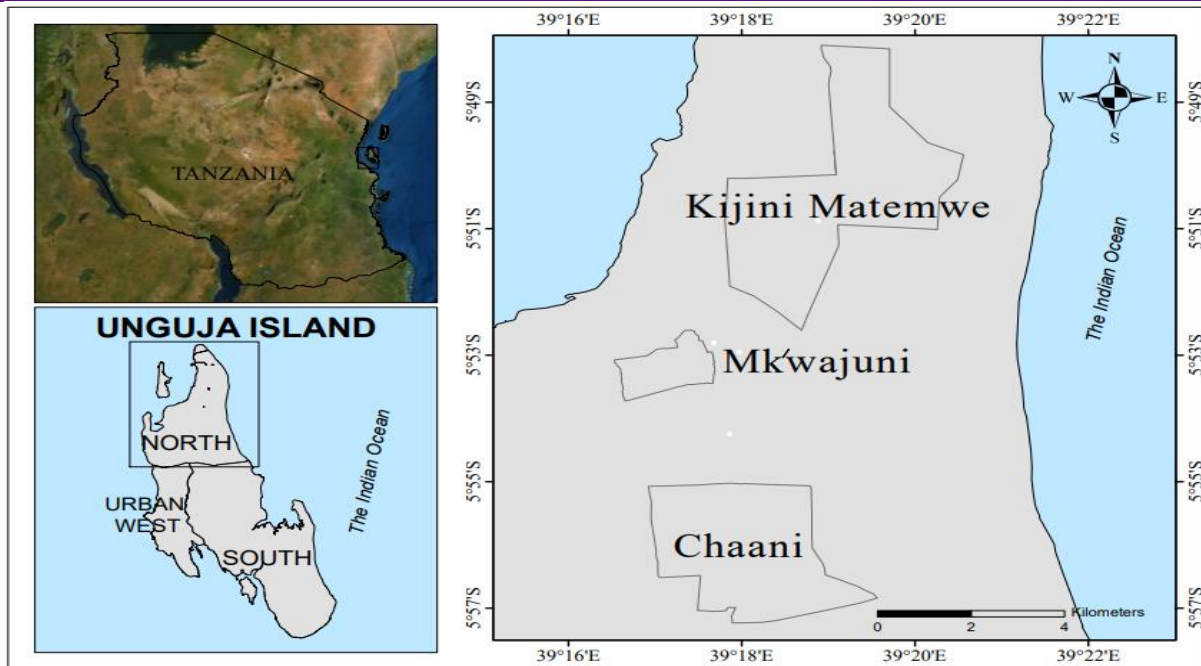


Figure 1. Map of Kaskazini (A) District, showing the study sites.

This district was chosen purposely for this study as it is one of the poorest districts on the island and thus highly vulnerable to the impacts of climate change and variability (RGZ, 2009), additionally, the main livelihood activities in Kaskazini (A) District constitute fishing, farming, and tourism (Tanzania, 2012) which are generally sensitive to climate variability and change (Makame, 2013).

2.2 Methods

This study utilized a descriptive research methodology with a cross-sectional study design to capture quantitative data at one particular point in time regarding varied characteristics of the intended respondents for instance their age, gender, income, education *inter alia*. This design was chosen since it facilitates the understanding of the current drivers of household vulnerability as it focuses on a particular time; additionally, it allows the testing of multiple variables at the same time (Rivers, 2010). Moreover, Quantitative methods were used due to their ability to summarize vast sources of information, make comparisons across categories as well as minimizing bias by keeping a distance from participating subjects and using accepted computational techniques (Babbie, 2020).

This study employed a probability sampling design utilizing a multistage random sampling strategy to select a final sample of 293 respondents from the district, this was done to ensure representativeness and validity of data. In the first stage, a cluster-sampling procedure was applied to the district to get five clusters (constituencies). Utilizing systematic sampling, the first, third, and fifth clusters were sampled. The sample for this research was then calculated by using the Yamane (1973) formula based on the number of registered households (using the 2012 Census data), as well as the desired confidence interval being set at 95% and margin of error set at 10%. This formula was chosen due to its wide acceptance and reference in the scholarly world in addition to it providing a simplified way to calculate sample sizes (Israel, 1992). The final stage was on determining which households will participate in the exercise. With the use of a list of households from each shehia sourced from the district registry, systematic random sampling was applied to select the households that participated in the interviews. This sampling method was chosen because it ensures a high degree of representativeness by providing the respondents with equal chances of being selected into the sample (Acharya et al., 2013).

Data for this study were collected through a household survey and key-informant interviews which were recorded in a structured questionnaire, this was later augmented with data collated from a review of documentaries and case studies. Household survey was chosen because besides being a convenient data gathering method offering good statistical significance, it is cheaper, provides higher representativeness, and has little or no observer subjectivity (Sarah, 2012). The quantitative data collected from questionnaires were curated and coded appropriately prior to analysis by using the Statistical Package for Social Sciences (SPSS v.20). Descriptive such as frequencies, means, and percentages were generated to summarize the quantitative data, inferential such as Chi-square tests for independence, and analysis of variance were used to analyse the data and deduce trends and patterns across the data set. For Chi-square tests, Cramer's V values were used to determine the strength of the association found: values less than 0.10 indicate a weak association; values between 0.11 and 0.30 indicated a moderate association while those above 0.31 indicated a strong association.

3 Results and Discussions

3.1 Socio-demographic characteristics of Respondents

According to the antithesis of the hazard-based framework, vulnerability is socially constructed, therefore in this paradigm, social and economic factors play a role in determining the vulnerability of a system. Socio-economic factors can singly or collectively determine the vulnerability of a system by influencing either its exposure, sensitivity and or adaptive capacity. As part of the social factors, socio-demographic characteristics of households were assessed in a bid to analyse how social factors influence vulnerability of households to the impacts of climate change. The results from this analysis lays the ground for the subsequent analyses in the other sections aimed at realizing the general objective of this study.

The study focused on sex, age, education, size of household, marital status, languages and finally disabilities and sickness. The chosen indicators influence the functions of vulnerability, for instance a female-headed household is often considered to be more vulnerable than a male-headed household due to general low adaptive capacities and heightened sensitivities akin to their normal day to day life.

Table 1. Socio-demographic characteristics of Respondents

Socio-demographic variable		Percentage %
Sex of the H.H Head	Male	81.9
	Female	18.1
Age of the H.H Head	20-30	13.3
	31-40	33.1
	41-50	28.7
	51-Above	24.9
Education level	No Education	18.1
	Madhrasa/Primary	44.0
	Secondary Education	31.4
	College Education	4.80
	University Education	1.7
Household Size	1	4.40
	2	6.8
	3	13.3
	4	28.7
	Above 5	46.8
Marital Status	Never Married	5.8
	Married	72.4
	Divorced	10.6
	Widowed	10.8
	Other	0.3
Languages	Swahili Only	84.6
	English	10.6
	Arabic	3.8
	Italiano	1.0
Disability and Sickness	None	69.3
	Sick	17.1

Aged	8.2
Disabled	5.5

The results in Table 1 indicated that a majority of household heads were male (81.9%), while female-headed households were 18.1%. The reason behind the higher number of male-headed households could be due to the highly patriarchal nature of the society. The most prevalent age group was 31-40 (33.1%), followed closely by the 41-50-year age group (28.9%). Across the district most households had above five members (46.8%) followed by four members (28.7%), households with less than three members represented only (20.5%). This clearly indicates that the island has a higher population as most households have an average of five persons residing in the household further affirming the results of the national census survey (Tanzania, 2012). However, the high household membership indicates a higher dependency, which compromises adaptive capacities and thus increasing households' vulnerability. This is consistent with findings from Hay (2013) who argue that increased population and rapid development have resulted in reduced resilience and increased exposure for many Small Islands.

In terms of language, results indicated that most of the household heads spoke only Swahili (84.6%), those who spoke and understood English and Swahili were (10.6%) while other languages accounted for the rest 4.8%. Additionally, Table 1 indicates that across the district most household heads just had a primary/Madhrasa education (44.0%) followed by those with secondary education (31.4%), those with no education at all made (18.1%) while those with college and university education made up the remaining dismal percentage of (5.9%).

The results on education depicts the status of education in the region and further affirms results from previous reports and studies (RGZ, 2012; Makame, 2013). On further probing, education achievement is seen to have an inverse relationship with poverty as results indicated that those who achieved higher levels of education were better off in livelihood terms and ultimately resilient to changes. Moreover, results indicated that male household heads achieved higher levels of education than female household heads. This, in essence, evokes a sense of inequality and according to the Revolutionary Government of Zanzibar (SMZ, 2016), this may be due to socio-cultural barriers, early marriages, and low emphasis on girl child education as well as high poverty levels. Putting this into perspective, this trend weighs down on adaptive capacity and thus making households vulnerable as they cannot make informed decisions or respond to early warnings in the event of a climate-related hazard (Etana et al., 2021), compounding to this is its relationship to poverty. It is therefore imperative that the government and other actors champion equality at all facets of the society and more importantly the education sector.

3.2 Perceptions on Climate Change and Impacts

3.2.1 Perceived changes

According to the results in Figure 2, an assessment on whether the climate has changed indicated that 77% of respondents affirmed to have experienced changes; those who perceived a no change were 12% while those who were unsure made up for the remaining 11%. A Chi-square test was applied to test if there is a relationship between the household heads' perception on a changing climate and having an education. The results indicated an association between perception and having an education with a moderate relationship ($X^2(8) = 23.468, p=0.003$), Cramer's $V=0.200$.

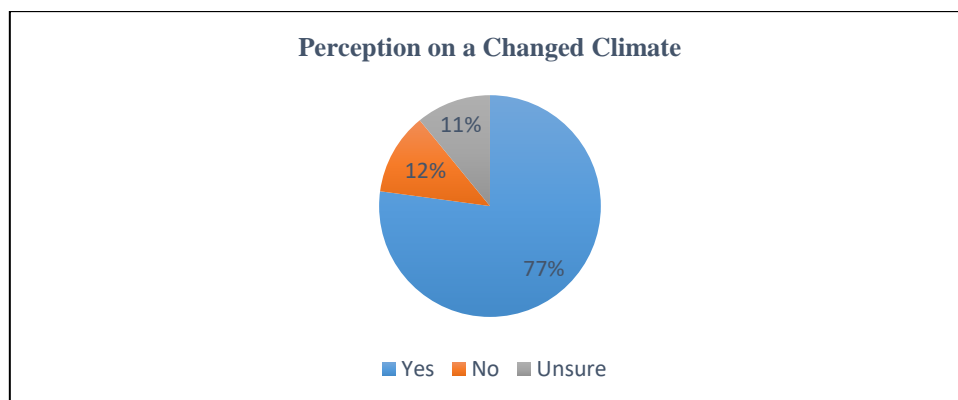


Figure 2. Perceptions on a changed climate.

The findings from this research indicated that a majority of people are aware of the current climatic changes. Despite this, there are quite a number of residents who are not aware (unsure) of the changes or do not agree that the climate has indeed changed. The majority of those who affirmed to a changing climate cited less overall and erratic distribution of rainfall as their main concern, this trend is also reported in a similar study by Makame (2013). The concern that is erratic distribution

of rainfall further confirms the fact that the locals are farmers and thus have been feeling the brunt of the changing climate. The lack of awareness by some of the respondents on the current climatic changes paints a dull picture on the quest to address the associated impacts and thus raises societal vulnerability. Therefore, there is need for concerted efforts to raise awareness on climate change through education and information dissemination.

3.2.2 Perceived Causes of Climate Change

Results in figure 3 below on an assessment on the causes of climate change indicated that 45% of the household heads cited natural forces as the reason behind a changing climate, 18% cited human influences like agriculture, forests, and land use cover changes as well as urbanization. Additionally, another group (37%) was unsure about the causes of climate change and thus were unable to comment on this.

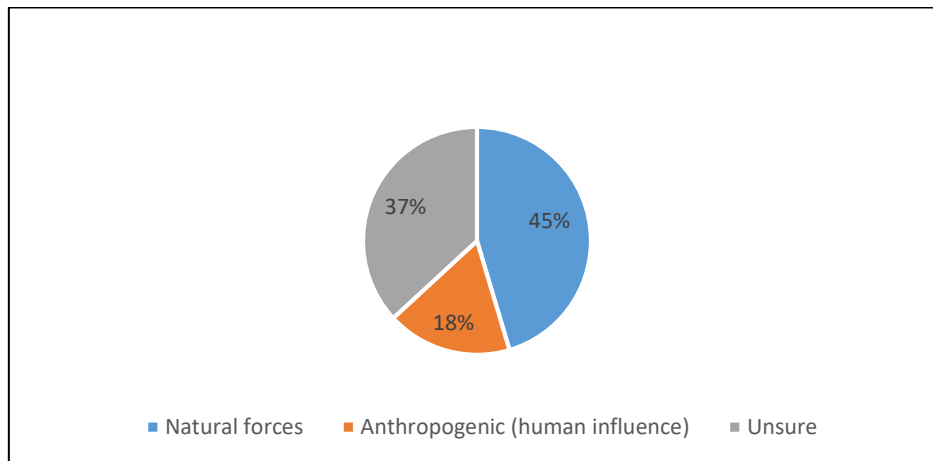


Figure 3. Perceived Causes of Climate Change

Furthermore, an assessment on changes in livelihoods due to climate change depicted in figure 4 indicated that 60% of households had experienced changes in their livelihoods, 22% were not sure of the changes whereas 18% indicated a no change in their livelihoods due to a changing climate.

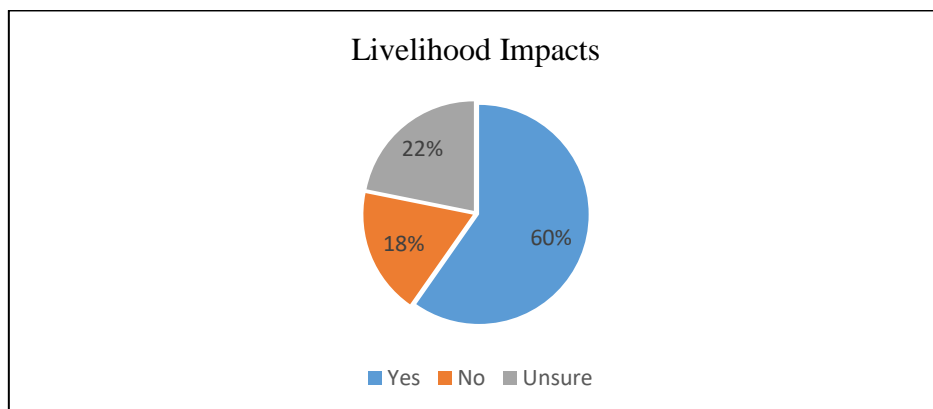


Figure 4. Livelihood Impacts

Astonishingly, the majority of those who affirmed to a changing climate cited natural causes as the reason behind the changes. Similar findings have been reported by Nyanga et al., (2011) and Makame (2013) which indicated that respondents attributed climate change to supernatural forces which is inconsistent with the current paradigm where scientific facts and basis for action indicate that largely, man is responsible for the changes. In another study, Misana and Tilumanywa (2019) found that a considerable number of respondents perceived climate as wind and they argue that this could be due to lack of knowledge on climate change issues. On the brighter side, the study revealed that awareness on a changing climate is increasing. This relates to findings by Majule et al., (2009), Lyimo and Kangalawe (2010) and Juana et al., (2013)) which argues that awareness on climate change and its causes among local communities in the Sub-Saharan Africa is increasing.

Understanding perceptions of climate change is critical as it provides an entry point to the development of effective strategies, sound policies, and socially robust interventions that are responsive to a specific context (Whitmarsh and Capstick, 2018). Conversely, in this case the eccentricity in perceptions on climate change drives the exposure of households as perceptions influences interventions. This misguided notion could possibly be due to low awareness and or education on climate change

issues (Makame, 2013) that compromises the ability to comprehend climate-related information in the public domain. On livelihood changes, new immigrants could also have not lived long enough in the regions to discern a change in the climate of the area (McNamara et al., 2016). Therefore, as it stands, perceptions contribute to the vulnerability of a region since without a clear understanding and a common *locus standi*, efforts to address these issues will always be scuttled due to other competing interests. Therefore, there is need to change this status quo through sensitization and awareness creation.

3.2.3 Access and Comprehension of Information

An assessment on the levels of access and comprehension of climate-related information depicted in figure 5 below indicated that 38.6% of households had timely information, 32.4% do not have access while 29.01% are not sure. Level of comprehension was grouped into understanding easily, considerable understanding, difficulty in understanding and to gather for those who initially had indicated that they are unsure or do not have access to information, they were categorized as not applicable.

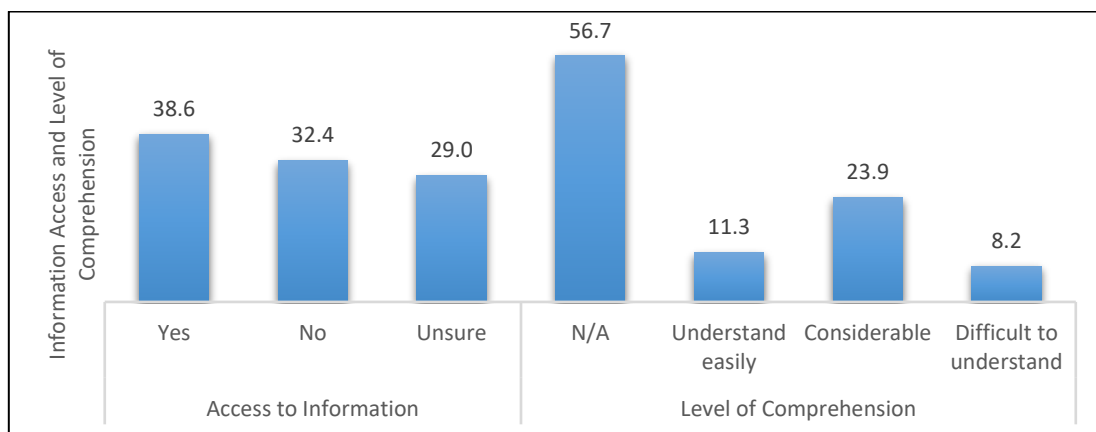


Figure 5. Access and Comprehension of Information.

Related studies by Sanga and Elia, (2021) indicated that the majority of residents do not have access to information on climate change Unfortunately, for those who had access to information, a dismal proportion of them clearly understood the information provided (Kaddu et al., 2021). These findings show that most of these people are vulnerable to climate change due to heightened exposure conditioned by the inaccessibility and incomprehensibility of climate-related information. These findings resonate with those by Nunn (2009), which points out that there is still a relatively low level of awareness and understanding at the community level on many islands about the nature of the threat posed by climate change.

Kola (2018), on the imperatives of climate change information argues that a lack of information poses a threat since it can cultivate a lackadaisical attitude towards taking action further exposing people to the devastating impacts of climate change. Additionally, the importance of education and information is underscored here, as those without an education and or information in most cases would give a false perception due to poor understanding further increasing their vulnerabilities to the impacts of climate change (Fosu-Mensah et al., 2012). It is therefore crucial that interventions be tailored to respond to the perception of the local people through dissemination factual and scientific information that demystify witherward perceptions.

3.3 Socio-Economic Factors Influencing Household Vulnerability.

3.3.1 Sources of Livelihood.

Results from an analysis of sources of livelihood in figure 6 below indicated that most of the households had farming and livestock keeping (33%) as their primary source of livelihood. Those in private business ownerships were (21%), those who derived a salary from formal employment were 15%, those in the fishing industry (14%), those who derived their livelihoods from the tourism sector (7%) while pension, social security and undocumented sources made up 5%, 1%, and 5% respectively.

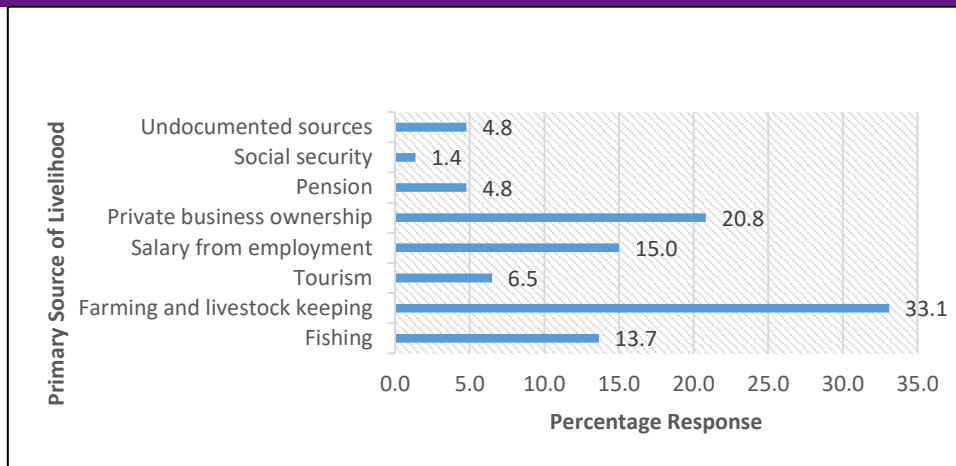


Figure 6. Primary Source of Livelihood

An assessment on the degree of difficulty in securing a job indicated that the majority of respondents (52%) agree very strongly that it is difficult to secure employment with residents earning between Tshs 250,000 and Tshs 500,000 per month with the majority of the respondents hinting at difficulties managing with their incomes.

Deducing from the results, we can argue that most households have lower incomes and depended on climate-sensitive sectors which increases their sensitivities and ultimately their vulnerabilities. Findings indicate that in the district, households depend on farming and livestock keeping with an underdeveloped and unregulated fisheries sector (Sarris et al., 2006; Salum et al., 2015). This is affirmed by UNDP (2012) which opine that households in Zanzibar are particularly vulnerable to climate change since a large proportion of the GDP, employment, and livelihoods in the archipelago are reliant on climate-sensitive activities such as agriculture (Sovacool, 2012). This notion is further supported by the sentiments of Sovacool (2012) and Makame (2013) who argue that sensitivity in most island communities is heightened by the over-dependency on fisheries for income and food thus indicating a higher vulnerability due to rapid changes in the support systems. Therefore, there is the urgent need for actors to develop interventions that will diffuse this stress through diversification of livelihoods, investment in sectors with comparative advantages and building support infrastructure as well as a creating a conducive business environment.

3.3.2 Decision Making and Sense of Belongingness.

In analysing levels of decision making and belongingness, results depicted in figure 7 indicated that most of the household heads (35.8%) lament of poor access to community-level decision-making, while a majority of households agrees very strongly that they feel they belong to the community (60.1%) indicating a strong aspect of social capital.

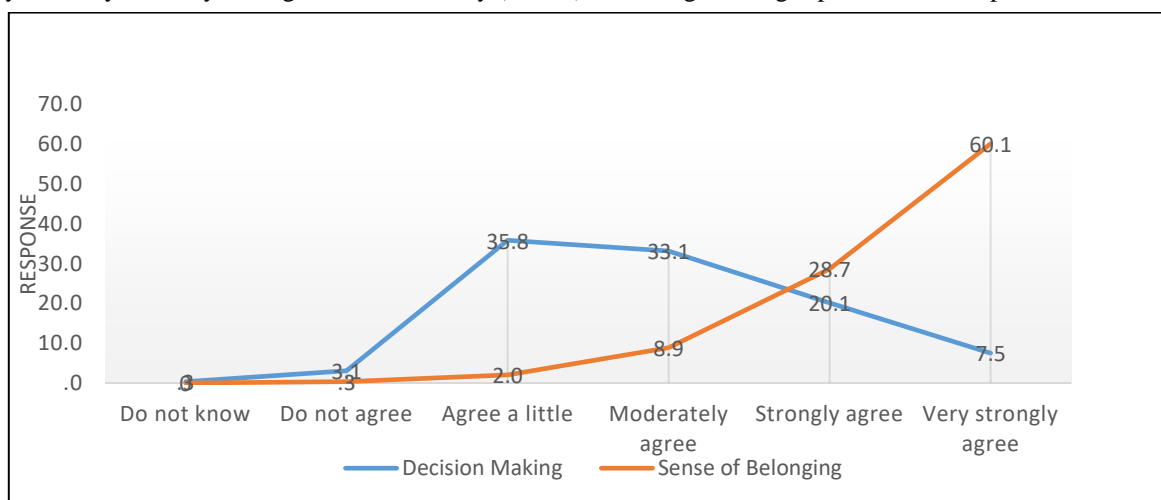


Figure 7. Levels of Decision Making and Sense of Belongingness

In a related study, Demetriades and Esplen, (2010) found that the majority of the residents and especially women were not satisfied with the way they were involved in decision-making. This makes them vulnerable since their capacities to adapt are compromised by their inability to influence decisions and as Zambrano-Barragán, (2010) argues, citizen participation in

decision-making is the foundation of a fair and effective implementation of adaptation policies and strategies. Therefore, there is the need to ensure fair representation and gender equality across all sectors and programmes through streamlining participation and governance.

3.3.3 Title Deeds

Results from the analysis of data depicted in figure 8 below indicated that 80.2% of the households had no title deeds for their land and thus have limited legal rights of ownership to the land. This further compromises their ability to adapt to changes in their environment and further heightens their sensitivities.

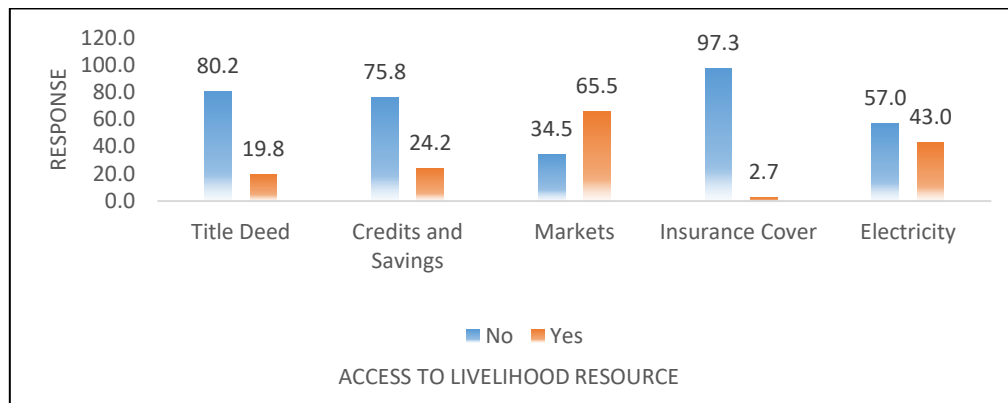


Figure 8. Access to Livelihood Resource

This acts as an impediment to smallholder farmers as insecure access to land limits their abilities to achieve maximum returns from their farming. In a similar study, Makame, (2013) notes that the lack of title deeds is due the inability to raise finances to process the ownership documents (Makame, 2013). Therefore, there is need for the government to expedite efforts to ease the acquisition of such assets as they are crucial in building adaptive capacities.

3.3.4 Credits and Savings

As highlighted in figure 8, an analysis on access to credits and savings indicated that 75.8% did not have access to credit or savings services and thus are not creditworthy (Makame, 2013; McNamara et al., 2016). This implies that they cannot secure loans to cushion themselves against economic shocks and vulnerabilities set forth by a changing climate and thus compromising their abilities to adapt due to high sensitivities thereby resulting in more vulnerabilities. It is worth noting that most residents earned less than Tshs 250,000 monthly, considering the average household size (4.8 persons), this means that daily each individual lived on Tshs 1736, which is much lower than the \$1.90 per person per day international poverty line (World Bank, 2015). Additionally, the majority of respondents indicated having greater difficulties securing employment (Makame, 2013).

With this inadequacy, households are left with few options and their sensitivity to the impacts of climate change increases due to competing wants, as households tend to focus more on the immediate pressing needs of survival rather than contributing towards building adaptive capacities and resilience. It is therefore imperative and timely to develop policies that facilitate ease of credit access and encourage a culture of savings amongst the people.

3.3.5 Access to Water

Analysis on water access for domestic use depicted in figure 9 below indicated that most households in this district (66.9%) sourced their water from wells and boreholes. The remaining 33.1% bought water from vendors and other sources. However, with increasing cases of saltwater intrusion (Kombo, 2011; Makame, 2013), households have had to bear the extra cost of procuring water from vendors and other sources further putting stress on their already dwindling resources.

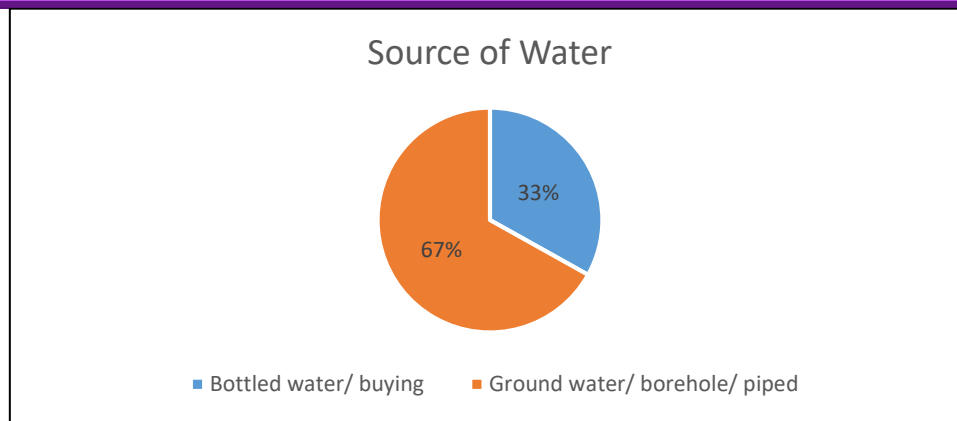


Figure 9. Source of Water

This results in cases of gendered vulnerabilities as women are in most cases responsible for providing this resource, therefore there is need to develop gender responsive and climate resilient solutions (Dickin et al., 2020).

3.3.6 Access to Electricity

In analysing access to and quality of household resources, results depicted in figure 8 indicated that only 43% of households had access to electricity, this implies that the rest 57% have to incur extra resources (time and money) to access most energy-dependent services. This shows a slight difference from the findings of Makame, (2013) where close to 80% of residents had no access to electricity. This change can be attributed to socio-economic improvement over time. Conversely, bearing in mind that adaptation to the impacts of climate change requires the commitment of a myriad of resources, the key to this being energy, efforts to upscale it is compromised when such critical inputs are missing thus most households are exposed, and their vulnerabilities heightened. There is therefore the need for the government to support and ensure equal access to key services and support infrastructure through investment and partnerships with private investors

3.3.7 Social Security and Safety Assets

In assessing the association between socio-demographic characteristics and entitlements, results depicted in Table 1 indicated that a number of the residents either had a sick person, disabled person and or an aged person under their care. This coupled up with the fact that a whopping 97.3% (see figure 8) of households had no medical or health insurance coverage (Makame, 2013; SMZ, 2016) and in addition to poor access and quality of healthcare services, the residents in the district are sensitive to changes in climate and thus more vulnerable. It is important to note that safety assets in the form of such things as medical insurance serve to create a sense of security and contribute towards reducing vulnerabilities (Samson, 2009). Therefore, there is need to support and encourage residents to acquire the social securities in addition to the governments' investment in access and quality of these essential services.

While most of the results dwelled on what drives vulnerability, it is important to note that in the district there are notable socio-economic indicators that stood out and helped build resilience. In addition to commendable access to markets conditioned by the good access and quality of main roads in the district, most of the residents had a strong sense of belonging and were proud of being members of their societies, this trend is also seen in the Maldives as noted by McNamara et al., (2016) and reported in Matemwe-Unguja (Makame, 2013). This positivity contributes to their adaptive capacities especially in the wake of climate-related hazards as they can count on each other. Additionally, demographic dividend evidenced by an average of five persons per household contributes to building resilience as it contributes to their adaptive capacities when leveraged on, as Munang (2018) argues, the accumulation of capital, which represents both human and physical capital, is an entry point for socio-economic development and climate resilience; however, this is contentious especially if the majority of the people in the household are not productive, lacking skills, uneducated, sick or disabled.

4 Conclusions and Recommendations

In conclusion, this study argues that socio-economic factors do play a big role in determining the vulnerability and or resilience of a people especially at the lowest levels of the society. Analysing vulnerability through the socio-economic lens provides a nuanced and practical approach to reducing societal vulnerability to the impacts of climate change. This study therefore recommends that, due to the daunting nature of perceptions in Zanzibar, there is need to invest in education and information systems so as to change the trajectory. To complement this, participatory decision-making should be prioritized

with a stress on gender equality. Additionally, state, non-state actors, organizations and individuals should strive towards helping the residents diversify their livelihoods as well as easing ownership of livelihood assets.

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References

- Acharya, A. S., Prakash, A., Saxena, P., & Nigam, A. (2013). Sampling: Why and how of it. *Indian Journal of Medical Specialties*, 4(2), 330-333.
- Adger, W. N., Huq, S., Brown, K., Conway, D., & Hulme, M. (2003). Adaptation to climate change in the developing world. *Progress in development studies*, 3(3), 179-195.
- Adger, W. N., & Agnew, M. (2004). *New indicators of vulnerability and adaptive capacity* (Vol. 122). Norwich: Tyndall Centre for Climate Change Research.
- Adger, W. N. (2006). Vulnerability. *Global environmental change*, 16(3), 268-281.
- Arnall, A., & Kothari, U. (2015). Challenging climate change and migration discourse: Different understandings of timescale and temporality in the Maldives. *Global Environmental Change*, 31, 199-206.
- Babbie, E. R. (2020). *The practice of social research*. Cengage learning.
- Betzold, C. (2015). Adapting to climate change in small island developing states. *Climatic Change*, 133(3), 481-489.
- Cutter, S. L., & Finch, C. (2008). Temporal and spatial changes in social vulnerability to natural hazards. *Proceedings of the national academy of sciences*, 105(7), 2301-2306.
- Demetriades, J., & Esplén, E. (2010). The gender dimensions of poverty and climate change adaptation. *Social dimensions of climate change: Equity and vulnerability in a warming world*, 133-143
- Dickin, S., Segnestam, L., & Sou Dakouré, M. (2020). Women's vulnerability to climate-related risks to household water security in Centre-East, Burkina Faso. *Climate and Development*, 1-11. DOI: <https://doi.org/10.1080/17565529.2020.1790335>
- Eriksen, S. H., Brown, K., & Kelly, P. M. (2005). The dynamics of vulnerability: locating coping strategies in Kenya and Tanzania. *Geographical Journal*, 171(4), 287-305.
- Etana, D., van Wesenbeeck, C. F., & de Cock Buning, T. (2021). Socio-cultural aspects of farmers' perception of the risk of climate change and variability in Central Ethiopia. *Climate and Development*, 13(2), 139-151. DOI: <https://doi.org/10.1080/17565529.2020.1737796>
- Fang, Y. P., Zhao, C., Rasul, G., & Wahid, S. M. (2016). Rural household vulnerability and strategies for improvement: An empirical analysis based on time series. *Habitat International*, 53, 254-264.
- Ford, J. D., & Smit, B. (2004). A framework for assessing the vulnerability of communities in the Canadian Arctic to risks associated with climate change. *Arctic*, 389-400.
- Fosu-Mensah, B. Y., Vlek, P. L., & MacCarthy, D. S. (2012). Farmers' perception and adaptation to climate change: a case study of Sekyedumase district in Ghana. *Environment, Development and Sustainability*, 14(4), 495-505.
- Hay, J. E. (2013). Small island developing states: coastal systems, global change and sustainability. *Sustainability Science*, 8(3), 309-326.
- IPCC. (2001). Climate change 2001: Impacts, Adaptation and Vulnerability, Summary for Policymakers, WMO.
- IPCC. (2007). Synthesis report of the fourth assessment report for Intergovernmental Panel on Climate Change, Retrieved on 10th April 2021, from www.ipcc.ch/assessment-report/ar4/syr/ar4-syr.pdf.
- IPCC. (2013). The physical science basis: Summary for policymakers. Retrieved on 12th April 2021, Available online at https://www.ipcc.ch/report/ar5/wg1/docs/WGIAR5_SPM_brochure_en.pdf.
- IPCC. (n.d). Nationally Determined Contributions Registry of the IPCC, Retrieved on 8th April 2021, from: <https://www4.unfccc.int/sites/NDCStaging/Pages/Search.aspx?k=United%20Republic%20of%20Tanzania%E2%80%8B>
- Israel, G. D. (1992). Determining sample size.
-

- Juana, J. S., Kahaka, Z., & Okurut, F. N. (2013). Farmers' perceptions and adaptations to climate change in sub-Saharan Africa: A synthesis of empirical studies and implications for public policy in African agriculture. *Journal of Agricultural Science*, 5(4), 121.
- Kabir, M. I., Rahman, M. B., Smith, W., Lusha, M. A. F., Azim, S., & Milton, A. H. (2016). Knowledge and perception about climate change and human health: findings from a baseline survey among vulnerable communities in Bangladesh. *BMC public health*, 16(1), 1-10.
- Kaddu, S., Nanyonga, D., & Haumba, E. N. (2021). Role of small-scale farmers in making agricultural market information systems relevant and sustainable in Bugiri district, Uganda. *University of Dar es Salaam Library Journal*, 15(2), 69-83.
- Karim, M. F., & Mimura, N. (2008). Impacts of climate change and sea-level rise on cyclonic storm surge floods in Bangladesh. *Global environmental change*, 18(3), 490-500.
- Kelly, P. M., & Adger, W. N. (2000). Theory and practice in assessing vulnerability to climate change and Facilitating adaptation. *Climatic change*, 47(4), 325-352.
- Kola, O. O. (2018). The Intrinsic Role of Information in Combating Climate Change. *Global Media Journal*, 16, 31.
- Kombo, K. A. (2011). *Effects of climate change and variability on freshwater quantity and availability: a case study of Jozani-Chwaka Bay–Zanzibar* (Doctoral dissertation, M. Sc. Dissertation) University of Dodoma, Tanzania).
- Lyimo, J. G., & Kangalawe, R. Y. (2010). Vulnerability and adaptive strategies to the impact of climate change and variability. The case of rural households in semi-arid Tanzania. *Environmental Economics*, (1, Iss. 2), 89-97.
- Majule, A. E., Kauzeni, A. S., & Mujwahuzi, M. (2013). Exploring opportunities for climate change adaptation in semi arid areas of Tanzania: A case of Nzega District in Tabora region. *African Journal of Environmental Science and Technology*, 7(8), 758-769.
- Makame, M. O. (2013). *Vulnerability and adaptation of Zanzibar east coast communities to climate variability and change and other interacting stressors* (Doctoral dissertation, Rhodes University).
- Marshall, N. A., Stokes, C. J., Webb, N. P., Marshall, P. A., & Lankester, A. J. (2014). Social vulnerability to climate change in primary producers: A typology approach. *Agriculture, Ecosystems & Environment*, 186, 86-93.
- McNamara, K. E., Clissold, R., Piggott-McKellar, A., & Buggy, L. (2016). Vulnerability and vulnerable groups: Baseline, indicators and assessments for Laamu Atoll, Maldives.
- Misana, S. B., & Tilumanywa, V. T. (2019). An assessment of the vulnerability and response of coastal communities to climate change impact in Lindi region, southern Tanzania. In *Climate Change and Coastal Resources in Tanzania* (pp. 117-153). Springer, Cham.
- Munang, R. (2018). *Making Africa Work Through the Power of Innovative Volunteerism*. AuthorHouse.
- Nunn, P. D. (2009). Responding to the challenges of climate change in the Pacific Islands: management and technological imperatives. *Climate Research*, 40(2-3), 211-231.
- Nyanga, P. H., Johnsen, F. H., & Aune, J. B. (2011). Smallholder farmers' perceptions of climate change and conservation agriculture: evidence from Zambia.
- Ord, T. (2020). *The precipice: existential risk and the future of humanity*. Hachette Books.
- Owusu, M., & Nursey-Bray, M. (2019). Socio-economic and institutional drivers of vulnerability to climate change in urban slums: the case of Accra, Ghana. *Climate and Development*, 11(8), 687-698.
- Patterson, M. (2013). *Vulnerability: A short review* (Vol. 3). ICR Working Paper.
- Preston, B. L. (2012). Climate change vulnerability assessment: from conceptual frameworks to Practical heuristics. *Proceedings of the CSIRO Climate Adaptation Flagship Working Paper*, (16).
- Ribot, J. (2013). Vulnerability does not just fall from the sky: Toward multi-scale pro-poor climate policy. In *Handbook on climate change and human security*. Edward Elgar Publishing.
- Ribot, J. (2014). Cause and response: vulnerability and climate in the Anthropocene. *The Journal of Peasant Studies*, 41(5), 667-705.
- Richards, C. E., Lupton, R. C., & Allwood, J. M. (2021). Re-framing the threat of global warming: an empirical causal loop diagram of climate change, food insecurity and societal collapse. *Climatic Change*, 164(3), 1-19.
- RGZ. (2009). Zanzibar human development report 2009: Towards pro poor growth. The Zanzibar Revolutionary Government, Zanzibar, Tanzania.
- RGZ. (2012a). Household Budget Survey 2009/2010: Final report. The Zanzibar Revolutionary Government, Zanzibar, Tanzania.
-

- Rivers, J. (2017). Cross-sectional study: Definition, advantages, disadvantages & example.
- Salum, L. A., Kangelawe, R. Y., & Makame, M. O. (2015). Climate change and household food insecurity among fishing communities in the eastern coast of Zanzibar.
- Samson, M. (2009). Social cash transfers and pro-poor growth. *Promoting pro-poor growth: Social protection*, 43-59.
- Sanga, E. E., & Elia, E. F. (2021). Socio-demographic determinants of access to climate change information among tomato growing farmers in Mvomero district, Tanzania. *University of Dar es Salaam Library Journal*, 15(2), 121-136.
- Sarah Mae Sincero. (Mar 18, 2012). Advantages and Disadvantages of Surveys. Retrieved on Mar 27, 2021 from Explorable.com: <https://explorable.com/advantages-and-disadvantages-of-surveys>
- Sarris, A., & Karfakis, P. (2006, March). Household vulnerability in rural Tanzania. In *CSAE Conference: Reducing poverty and inequality: How can Africa be included*.
- Schröter, D., Polsky, C., & Patt, A. G. (2005). Assessing vulnerabilities to the effects of global change: an eight step approach. *Mitigation and Adaptation Strategies for Global Change*, 10(4), 573-595.
- Shepherd, T. G., Boyd, E., Calel, R. A., Chapman, S. C., Dessai, S., Dima-West, I. M., ... & Zenghelis, D. A. (2018). Storylines: an alternative approach to representing uncertainty in physical aspects of climate change. *Climatic change*, 151(3), 555-571.
- SMZ. (2016). The Zanzibar HBS 2014/15, Retrived on 17th April 2021, from <http://www.ocgs.go.tz/index.php>
- Sovacool, B. K. (2012). Perceptions of climate change risks and resilient island planning in the Maldives. *Mitigation and Adaptation Strategies for Global Change*, 17(7), 731-752.
- Spence, A., Poortinga, W., Butler, C., & Pidgeon, N. F. (2011). Perceptions of climate change and willingness to save energy related to flood experience. *Nature climate change*, 1(1), 46-49.
- Tanzania, N. B. S. (2012). Population and housing census: population distribution by administrative areas. *Ministry of Finance, Dar es Salaam*.
- UNICEF. (2017). Kaskazini A District Profile. Retrieved on 10th May 2021, from https://www.unicef.org/tanzania/sites/unicef.org.tanzania/files/2018-10/Tanzania-2017-Kaskazini-A-District-Profile_0.pdf .
- UNDP. (2012). Enhancing climate change resilience in Zanzibar, Retrieved on 12th April 2021, from <https://www.tz.undp.org/content/tanzania/en/home/projects/zanzibar-climate-change-resilience.html>
- United Nations Framework Convention on Climate Change. (2007). Impacts, vulnerabilities and adaptation in developing countries.
- Vedwan, N., & Rhoades, R. E. (2001). Climate change in the Western Himalayas of India: a study of local perception and response. *Climate research*, 19(2), 109-117.
- Vedwan, N. (2006). Culture, climate and the environment: Local knowledge and perception of climate change among apple growers in northwestern India. *Journal of Ecological Anthropology*, 10(1), 4-18.
- Whitmarsh, L., & Capstick, S. (2018). Perceptions of climate change. In *Psychology and climate change* (pp. 13-33). Academic Press.
- World Bank. (2015). World Development Indicators, Retrieved on 17 April 2021, from <https://datatopics.worldbank.org/world-development-indicators/world-development-indicators-reports.html>
- World Bank. (2021). Tanzania Economic Update (TEU), Retrieved on 19 April 2021, from <https://www.worldbank.org/en/country/tanzania/publication/tanzania-economic-update-teu>
- Yamane, T. (1973). Statistics: an introductory analysis-3.
- Zambrano-Barragan, C. (2010). Decision Making and Climate Change Uncertainty: Setting the Foundations for Informed and Consistent Strategic Decisions. *World Resources*, 2011.