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Evaluation of the Impacts of Climate Variations on Coastal Communities and Tourism: A Case Study of the Commonwealth District, Grand Cape Mount County, Liberia 2003 - 2023

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DECLARATIONS

Candidate's Declaration:

I hereby declare that this study/research was conducted by me and that no part of this study/research was photocopied and/or presented to this university or any other institutions of learning for another degree.

Candidate's Name: Morris Kanneh

Candidate's Signature:  Date: August 14, 2024

Supervisors' Declaration:
This is to certify that we have reviewed and examined the Thesis (Proposal) submitted by the above-named student and hereby found it to be complete and satisfactory in all respects as established by the University of Liberia Graduate Studies and that all relevant revisions required by the Review Committee have been made:

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Supervisor's Signature:  Date: August 14, 2024

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DEDICATION

I firstly dedicate this work to my lovely wife, Mrs. Sianneh B. Kanneh for her care, dedication, patience and moral support throughout these studies. This paper is also dedicated to my children, Morris Kanneh Jr., Safiatu N. Kanneh, and Moraisha J. Kanneh for their understanding and patience during the period of my studies at the Graduate Program of the University of Liberia. Finally, this paper is as well dedicated to my late mom, Mrs. Jeanie Kanneh and late dad, Mr. Alieu Kanneh Sr. in memorial of their care, guidance and my successful upbringing.

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ABSTRACT

This research evaluated impacts of climate variations on coastal communities and tourism specifically in the Commonwealth District of Grand Cape Mount County for the period 2003 through 2023. The objectives include, to determine prevalence and extent of extreme sea erosion, floods, rainfall and storms; investigate the impacts of climate variations on the livelihoods of residents in coastal communities and its implications on tourism development; and finally, assess the political and socio-economic impediments to the adoption of adaptive practices that mitigate the growing impacts of climate variations on coastal communities in Liberia. The researcher used a descriptive survey design to generate data through questionnaires and interviews using a sample size of 150 participants with age ranges of 18 years old and above. The Statistical Package for Social Science (SPSS) was used to code and analyze data. Overall, results from the research revealed that factors, including deforestation, shifting cultivation, fishing, farming and sand-mining contribute more impacts to climate variability in the area with majority, 94% of respondents attributing major cause to these factors. However, some recommendations were proffered, as 66.9% of respondents confirmed that in order to employ the best adaptive measures and mitigate impacts, the creation of artificial reefs to dissipate wave energy and storm surges, conservation of existing ecosystems and reforestation of areas adjacent to coastlines, prohibition or control against the unsustainable removal of beach sediments including the natural vegetation (mangroves) and the use of meters (seawalls) against future potential flooding and erosions must be enforced to avoid future loss of lives and damages to properties in the district. These recommendations require the holistic supports of government, partners, stakeholders and residents of the area as well.

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CHAPTER ONE
INTRODUCTION

A. *Introduction*

This chapter introduces the background, problem statement on which this research seeks to address, theoretical and conceptual framework, significance or justification of this study, objectives, limitations, definition of terms and organization of the study. The chapter further identifies some delimitations of the research due to factors ranging from lack of economic resources to inaccessibility of land-road network connectivity.

- *Background to the Study*

The people of Grand Cape Mount County, most especially the poor, are critically dependent on fertile soil, clean water and healthy ecosystems for their livelihoods and wellbeing. This reliance creates complex, dynamic interactions between environmental conditions, people's access to and control over environmental resources, and poverty. In addition to being vulnerable to environmental hazards, the poor are usually confronted by economic, technological and policy-related barriers in deriving full social and economic benefits from their environmental assets (Grand Cape Mount CDA, 2008).

This paper identifies and investigates key indicators to climate events against coastal settlements in Liberia using the Commonwealth District including Robertsport of Grand Cape Mount County as an area of case study. The study further generates adaptation and mitigation measures as solutions to hurdles which continue to serve as impediments against efforts made to narrowing the gaps of these environmental disruptions and forward recommendations in an effort to mitigate and adapt to climate-related events against coastal communities and promote tourism in Liberia.

- *Statement of the Problem*

According to a joint survey prepared by the Liberian Government and the United Nations Development Programme on the state of environment in Liberia (2006), it cited that most of the erosions devastated against coastal settlements in Liberia are primarily caused by unregulated sand mining. Climate impacts including Sea erosions couple with landslides, floods, subsidence and storm surges among others, have continued to make many coastal settlements uninhabitable by removing meters from the coast lines, destroying important infrastructures and driving many citizens into homelessness (Moore, R. & Mclnnes, R. G., 2020).

In an effort to help mitigate some of the growing impacts on climate variability against coastal communities, this paper identifies and discusses some of the key factors responsible for these problems and explore sites along coastal settlements in Liberia where tourism is possible and why; then forward recommendations for harmonious solutions through preventive and adaptive measures.

- *Theoretical Support and/or Assumptions*

Climate change refers to the long-term changes in temperature and weather due to human activities (Shivanna, 2022). Climate variations are largely factored in by human induced activities, invasive species, pollution and storm devastations. These elements of climate variations have continued to threaten coastal communities and immensely contribute to sea level rise, thereby triggering erosion which in turn, inundate ecosystems and finally eliminate wetlands. Another factor also includes a warmer and acidic ocean which is likely to disrupt coastal and marine ecosystems (Berlie, 2018).

According to the United Nations Environment Programme (2022), wetlands which include marches and peatlands, are unsung heroes of the climate crisis. They store more carbon than any other ecosystem, with peatlands alone storing twice as much as all the world's forests. Inland wetland ecosystems also absorb excess and help prevent floods and drought which is widely seen as critical to helping communities adapt to a changing climate.

Climate change also contributes to saltwater infiltration which grossly encroaches on terrestrial ecosystems thereby causing great loss of native species. A rise in the sea level due to climate variability could result to an uncontrollable demoralizing storm surges, erosions and floods that have the propensity to set loose many residents of coastal settlements to being homeless, which in turn, accumulates more burdens on national government and demeans the true spirit of economic growth and development. Climate change affects capital accumulation and people's propensity to save which in turn, reduces economic growth, (Tol, 2005). Dell, Jones and Olken (2008), also found that because of climate change, the growth rate of developing countries would be reduced by about 0.6 to 2.9 percent annually. According to the United States Environmental Protection Agency (2023), Sea level rise enables saline water to make potential advancement upstream and inland, in estuaries, wetlands and aquifers.

Higher salinity can contaminate freshwater supplies and even threaten aquatic plant and animal species. While it is true that sea level rise from the ocean is consequentially detrimental against coastal settlements, it is also very effective at absorbing and storing heat (U.S. EPA, 2023). These two factors (absorbing and storing heat), play a huge role in how the ocean impacts our weather. Because the ocean releases heat more slowly than land, coastal environments tend to continue being more temperate (Deignan, 2019).

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The ocean influences weather and climate by storing solar radiation, distributing heat and moisture around the globe and by doing this, it drives the weather systems (Schuckmann, 2022). Anthropogenic activities including the burning of fossil fuels also generate greenhouse gas emissions into the atmosphere. These emissions from greenhouse gases then act like a blanket wrapped around the Earth trapping heat from the sunlight and thereby raising temperature (Ali, 2020). According to IPCC- Technical Paper-V of April, (2002), the effects of temperature-dependent changes on lakes and streams would be least in the tropics, moderate at mid-latitudes, and pronounced in high latitudes where the largest changes are expected. That is, the combined effect of climate change, including temperature, precipitation and changes to watersheds due to human activities are projected to affect the hydrological processes of many freshwater ecosystems. Extreme water temperature can kill organism, while more moderate water temperature variations control biological processes. In other words, the physiological rates and behavior performance can influence habitat preference (Rosen, 2021).

➢ *Significance of the Study*

The continuous mismanagement of the natural habitats including Liberia's beautiful physical features along the coastal belts and the resulting environmental consequences against their unending socio-economic benefits to society serve a good reason to allow this paper divulge some of the primary sources of the adverse effects of climate variations on coastal settlements in Liberia. In response to these challenges, this research investigated key indicators of climate change impacts then identified adaptation and mitigation measures that are applicable to sustainable management of the natural habitats in coastal communities of Liberia.

Due to the high reliance on climate-related activities, Liberia has become vulnerable to climate variability and change. The impacts of human activities from climate-related events are expected to manifest in higher temperatures, more extreme weather events including heavy rains, and a continuous rise in sea levels. The country has identified urban and coastal development, sea level rise, and potential salinization of coastal habitats as key areas for adaptation portfolios of climate change (CDA Grand Cape Mount, 2008).

Events including floods and erosions can lead to weakening of an area material content and because of their impacts; the indigenous geological elements are wiped or swept completely from their natural locations to elsewhere (Talbot, 2018). An example is the slump and coastal communities of Robertsport, Toso, Sembehum, Latia, and Falie in the Commonwealth District of Grand Cape Mount County, where storm devastations among others, coupled with extreme rise in the sea levels, which result to flood events and erosions have caused many troubling effects in the area. These climate change impacts have contributed to several environmental disorders including advancements of saline water in the forms of tsunamis from the Atlantic Ocean and its associated flood events from overflows of the Lake Piso onto the homes of many residents, thereby destroying many homes and displacing more people to being homeless. Hence, the sea is making that stretch of land smaller every year. This has led to environmental damages ranging from collapses of properties and loss of human lives to demolition of public infrastructures. It further poses a potential danger against tourism, sustainable preservation of biodiversity and coastal protection in the area (Jones, 2022).

According to the Grand Cape Mount County Development Agenda (2008), the people of the County, and especially the poor, are critically dependent on fertile soil, clean water and healthy ecosystems for their livelihoods and wellbeing. This reliance creates complex, dynamic interactions between environmental conditions, people's access to and control over environmental resources, and poverty. In addition to being vulnerable to environmental hazards, the poor are usually confronted by economic, technological and policy-related barriers in deriving full benefits from their environmental assets. Taking strategic actions based on knowledge of the poverty-environment relationship is a prerequisite for enduring success in an effort to reduce poverty. Investments in the productivity of environmental assets will generate large benefits for the poor and for the enhancement of overall growth (CDA Grand Cape Mount, 2008).

The six years' coastal defense project of the United States Agency for International Development indicated a risk in Liberia's Coastal Zones. This is characterized in sea level rise and associated coastal flooding which are already putting overwhelming stress on Liberia's extensive and productive coastal zones. It also recommended that to support agricultural and fishing activities sustainably along the coast lines of Liberia, coastal communities must be well protected, and sustainably regulated (USAID Fact Sheet on Climate Change, 2022). The CDA of the county also identified that the "resource curse" that characterized Liberia's past was typified by mismanagement of the proceeds from extractive industries and their misuse that undermined national security, governance and rule of law; and channeled most of the benefits of economic growth to small elite. Eliminating this curse requires the establishment or restoration of proper administration and management of natural resources (CDA Grand Cape Mount, 2008).

➢ *Objectives of the Study*

The general objective of this study is to evaluate the impacts of climate variations on the livelihoods of households in coastal communities of the Commonwealth District in Grand Cape Mount County; and investigate its implications for tourism development.

- *The Specific Objectives are:*

✓ to determine prevalence and extent of extreme sea erosion, floods, rainfall and storms;
✓ to investigate the impacts of climate variations on the livelihoods of residents in coastal communities of Liberia;

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- ✓ to determine the implications of the impacts of climate variations on tourism development;
- ✓ to assess the political and socio-economic impediments to the adoption of adaptive practices that mitigate the growing impacts of climate variations on coastal communities.

- *Research Questions or Hypothesis*

This research focuses on the following questions:

- ✓ How do residents in coastal communities in the Commonwealth District perceive climate change?
- ✓ What measures can be taken to mitigate and adapt to the impacts of climate change against residents of coastal areas in Liberia?
- ✓ What are factors that repel adaptation strategies against climate change in the study area?
- ✓ How do residents of the research area perceive tourism?
- ✓ What are the economic benefits and associated challenges of tourism to government and local residents of study area?

➢ *Scope of work (Limitations and Delimitations)*

This research focuses on the perspectives of local fishermen, permanent residents, business people, small farm holders, wood suppliers who sell wood including mangroves and sand miners who mine sand for commercial purposes. The study also covers small-scale fish sellers' views regarding the impacts of climate change from the emissions of greenhouse gases through the burning of fossil fuels (burning of woods used to dry fish) which result to climate events such as flooding, erosions and subsidence against residents of the study area. Households' views were also considered on how they would cooperate in working with adaptive approaches in respond to these environmental hurdles. This research was conducted in five towns of the Commonwealth District; Robertsport, Toso, Sembehum, Latia and Falie. Inclusive of two county administrators, two youth leaders and two women leaders out of the targeted population of the research area, a total of 150 respondents (households) comprising mainly of local fishermen, permanent residents, business people, small farm holders and small-scale fish sellers from the five selected towns participated in this research. In addition to interviewing two experts from government policy institutions; the Environmental Protection Agency of Liberia (EPA) and Liberia Land Authority (LLA) and one from a non-governmental but environmental institution, the United Nations Framework Convention on Climate Change (UNFCCC); and a gender focus-person, and supervisor for psychosocial services from the Ministry of Gender, Children and Social Protection was also interviewed.

➢ *Limitations of the Research*

While it is true that there were reasonably a good receptive behavior of respondents and exhibited their honest cooperation to the process, yet there were still some limitations of this research. Due to inadequate financial resources, limited time, inaccessibility of nearby towns that are not close in proximity to the research area, the human impossibilities, and lack of cooperation to furnish information due to traditional or cultural reasons, this research could not cover vast amount of the areas that the study would have wished to capture. Furthermore, given the amount of time allotted for this research, a single semester is never enough for a vast coverage of areas to be examined on the impact of climate variations against coastal communities in the entire Republic of Liberia.

This time limitation clearly focused on getting feedbacks from selected residents of all the coastal communities within the territorial boundary of the Republic of Liberia who could not easily be reached due to water demarcations, long-distances to be covered, unavailability of transport and its associated cost, lack of land-road network connectivity, poor communication network system and the absence of reliable internet connectivity. Besides, it was humanly impossible for a single individual to conduct detail interview or investigation with all the residents of the various coastal communities within Liberia, considering the limited economic resources and associated elaborate process of research involved.

➢ *Delimitations of the Study*

Taken into consideration factors outlined as limitations of this research including religious and cultural factors repelling the acquisition of detail information and the lack of human resources for the collection of decentralized data and its associated costs, this research concentrated only on a sample size of 150 participants from the total population of the research area. Experts from governmental and non-governmental institutions involved in environmental activities were also covered. More besides, instead of a wider coverage area that would have required longer time duration, the research covered just five designated towns for a period of twenty (20) years comprising of the time duration ranging from the year 2003 to 2023. In addition to the above delimitations outlined, due to limited time factor, the research covered just few experts from governmental and non-governmental institutions.

➢ *Definition of Terms*

This section defines terms that are used in this work based on the researcher's perceived definitions and are therefore used differently than their original meanings or usages. Because the words take on the meanings assigned them by the researcher, for easy comprehension, there is an essential need to provide their meanings in the context of this paper. The following words listed are alphabetically ordered for easy references.

- **Aquifers** –is a body of rocks and /or sediment that holds groundwater.
- **Climate** –is a long-term pattern of weather at a particular area.

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- **Climate change/variations** –refers to a long-term shift or change in temperature and weather pattern and includes all the variations or changes in the climate that last longer than individual weather events.
- **Cumulonimbus**- is an extremely dense, vertically developed cloud with a low, dark base and fluffy masses that tower to great heights.
- **Ecosystems** –a biological community of interacting organisms and their physical environment.
- **Estuaries** –is a partially enclosed, coastal water body where freshwater from rivers and streams mix with salt water from the ocean.
- **Evapotranspiration**-the process by which water is transferred from the land to the atmosphere by evaporation from the soil, other surfaces and by transpiration from plants.
- **Greenhouse gas** –also known as (GHGs) are gases in the earth's atmosphere that trap heat.
- **Groundwater** –is the word used to describe precipitation that has infiltrated the soil beyond the surface and collected in empty spaces underground. Contrasted against
- **Habitat** –the natural home or environment of an animal, plant, or other organism.
- **Invasive species** –is an organism that is not indigenous, or native, to a particular area.
- **Native species** –is an organism that currently lives in an area due to naturally occurring acts without any human involvement.
- **Ocean** – (Atlantic Ocean) a very large expanse of sea, in particular each of the main areas into which the sea is divided geographically.
- **Precipitation** –rain, snow, sleet, or hail that fall to the ground.
- **Surface-water**, representing water that set on top of the surface of the ground.
- **Temperature** –the intensity or degree of hotness and coldness of the Earth's atmosphere.
- **Watersheds** –an area or ridge of land that separates waters flowing to different rivers, basins, or seas.
- **Weather** –the state of the atmosphere bearing the temperature and other outside conditions such as rain, cloudiness, etc., at a particular time and place.
- **Wetland** –is a distinct environment that is often flooded or saturated by water, either permanently or seasonally.

➢ *Organization of the Study*

This paper encompasses five chapters. The first chapter of this work covers the introduction and discusses the problem that the paper intends to address, which is the background to the research. It also incorporates the theoretical support and/or assumptions, significance, justification and objectives of the research. It then further comprises the specific questions/hypothesis addressed by this paper. It also contains the organization, limitations and delimitations of the study and finally addresses the scope and organization of this research work. Chapter two covers the general review of the related literature and the theoretical framework/ support around which the study centers. Chapter three covers the research methodology of the study which consists of the research design and procedure, population and sampling procedures, sources of data and research setting.

The fourth chapter of this work focuses exclusively on the presentation and analysis of the data collected from the study area in line with the research objectives. Furthermore, this chapter discusses the major findings associated with the data collected using simple descriptive statistics. The final chapter (Chapter five), summarizes and concludes the research work. This chapter takes into consideration summary of the findings, implications of the findings, then forwards recommendations and provides references and appendices for the entire research work.

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CHAPTER TWO
REVIEW OF LITERATURE

A. *Introduction*

This chapter discusses the theoretical and conceptual framework of the subject matter under study; looks through the specific techniques used to avoid the potential consequences and setbacks brought forth by climate change and human activities which hugely contribute to the adverse effects of climate variability in coastal communities. This is followed by a review of existing publications on climate variations in general. It also explores Liberia National Climate Change circumstances and catalogues solutions on urban recreational planning on tourism and the environment.

➢ *Theoretical and Conceptual Framework on Climate Variations*

According to the Environment Protection Agency of the United States (2023), higher sea level also makes coastal infrastructure more vulnerable to storm surges and flood devastations. Climate change as a result of long term changes in our weather conditions has continued to increase the risk and frequency of events including floods, erosions, subsidence, landslides, and storm devastations for coastal communities in Liberia. A rise in the sea level inundates low-lying wetlands and even dry lands thereby eroding shorelines and contributing to storm surges and flood events. When this happens, excesses of salt water overflow into estuaries and nearby groundwater aquifers which result not only to contamination of fresh water supplies but also to subsidence and erosions.

- *Theoretical Foundation for Place-based Engagement*

According to the Metaphysics Research Lab of Stanford University (2021), scientists obtain a great deal of the evidence they use by collecting and producing empirical results. The following theoretical foundation for place-based Engagement was propounded to test a theoretical framework for place-based climate change engagement. The framework is based on principles from place attachment theory, place-based education, free-choice learning, and norm activation theory. The framework demonstrates the power of engaging citizens in action-based learning at physical, material places, which are also symbolic sites for inspiring political action and learning about climate change impacts.

The goal of this investigation is to better understand diverse audiences' connection to place, desire for place-based and free-choice learning as well as desire for empowerment when attempting to understand climate change science and impacts. The framework and results presented here are an attempt to enhance the potential for communicators, interpreters, and managers to serve a more prominent and meaningful role in educating diverse members of the public about climate change. According to this theory, research has shown that climate change will resonate with diverse audiences when: (1) it is situated in cultural values and beliefs, (2) it is meaningful to that audience, and (3) it empowers specific action. This theory emphatically stated that there are four theoretical threads that create the foundation for developing a multi-faceted, holistic framework for place-based climate change engagement: (1) place attachment, (2) place-based education, (3) free-choice learning, and (4) norm activation theory (NAT) (Schweizer et al., 2013).

- *Place Attachment Theory*

Place attachment theory suggests that people have an emotional relationship with specific landscapes. The environmental psychology field has defined place attachment as the bonding of people to places (Altman & Low, 1992). However, Brown and Perkins (1992) discussed the complexity and dynamics of emotions in place attachment. In Disruptions in Place Attachment, they note ''Place attachments are not static either; they change in accordance with changes in the people, activities or processes, and places involved in the attachments. They are nurtured through continuing series of events that reaffirm humans' relations with their environment''.

- *Place-Based Education Theory*

The practice of learning outside has been called by many names, including bioregional education, environmental education, outdoor education, place-based education, and experiential learning. Despite different labels these concepts are often interconnected and have similar meanings. For the scope of this framework, we focus on place-based education and experiential learning as communication and engagement opportunities to link climate change with places and individual or group-based experiences. Both of these paradigms are based on connecting people to the land through applied learning and experiences in the field. People will remember lessons and adopt behaviors when they feel a sense of responsibility and have knowledge of consequences. Thomashow (2002) states that the most effective way to understand and learn about the changes in the environment is by developing an intimacy with the land around you.

- *Free-Choice Learning Theory*

Free-choice learning is guided by the desires and motivations of each idiosyncratic learner, and therefore exhibits different learning outcomes as varied as the learners themselves (Falk, 2005; Falk & Dierking, 2002). Free-choice learning typically occurs in areas such as national parks, national wildlife refuges, aquariums, zoos, and museums where a highly structured learning atmosphere is absent (Falk, 2005; Falk & Dierking, 2002). According to Falk and Dierking (2002), free-choice learning integrates

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three factors of place, person, and others, also known as the physical, personal, and social contexts. Learning of this nature occurs in particular places where the learner can discuss and form personally relevant knowledge with friends, family, and others. Free-choice learning has been suggested as a major means in which many individuals learn about the environment (Falk, 2005; Heimlich & Falk, 2009). Even though many learners may not receive the intended message from the venue, the experience is still enriching and continues to sculpt the identity of the individual learner (Falk, 2005; Heimlich & Falk, 2009).

Norm Activation Theory Originally, Schwartz (1977) proposed the NAT to explain pro-social behaviors, or behaviors which benefit society or others at the giver's expense, such as donating to charity. This original theory held that personal norms, or self-expectations of performing pro-social behaviors, were activated by four situational variables: (1) problem awareness*an individual's knowledge of a person or subject in need; (2) ascription of responsibility*how responsible an individual feels for the need; (3) outcome efficacy*the usefulness of actions to alleviate the need; and (4) ability to help*an individual's perception of their ability to help alleviate the need (Schwartz, 1977). An activated personal norm thus led to pro-social behaviors. In more recent applications of NAT in the environmental field, personal norms were found to be a better predictor of pro-environmental behavior than the new environmental paradigm scale (Wildegren, 1998).

Other studies which have successfully employed NAT involve participation in curbside recycling programs (Schultz, 1998), home water conservation (Harland, Staats, & Wilke, 2007), littering (de Kort, McCalley, & Midden, 2008), and car use (Harland et al., 2007; Klo¨ckner & Matthies, 2009). Relatively few studies have been conducted on NAT and climate change, and studies that have addressed climate change include the issue among other environmental variables (eg. Guagnano, Dietz, & Stern, 1994). Climate change is different from many environmental problems, in that the causes are globally diffused and impacts are not uniformly spread or universally noticeable. Current confusion among people regarding the causes of and solutions to climate change (Leiserowitz et al., 2010) also acts to deactivate situational variables of problem awareness, ascription of responsibility, outcome efficacy, and ability to help.

Counter Reactions on the Place-Based Climate Change Engagement Framework Based on the theoretical threads introduced, place-based climate change engagement should provide a meaningful dialog in a specific place, where audiences interact with each other and the landscape to develop a deeper understanding about ecological and social interrelationships and impacts on the ecosystem. Through this framework, communicators have the opportunity to create a public engagement forum that is place-based and social with an emphasis on learning and personal responsibility. Such engagement has the potential to inspire the necessary behavior change to curb anthropogenic climate change impacts and ultimately change the public conversation through simplifying and connecting climate change impacts to people's values, personal experiences, and daily lives. This framework allows us to integrate multiple dimensions of climate change communication and argue for the potential power of landscapes to assist in telling the story of climate change. Offering place-based illustrations will encourage and influence individuals perceived response efficacy and self-efficacy to combat climate change on a local, regional, national, and global scale.

✓ *Floods*

According to Cutter (2018), flooding is a disaster that could cause serious disruption of the normal functioning of society, causing human, material or environmental losses, which exceed the ability of affected society to cope on its own resources. Flood can also cause dangerous landslides (Hong et al., 2007). Floods occur when low-lying areas that are typically dry become temporarily inundated with water outside of their normal confines (Rojas et al., 2013) The impacts of flood emanating from climate change, as a result of socio-economic processes and other anthropogenic activities have significantly contributed to the vulnerability of human settlements and the ecological systems of the earth (Woodward et al., 2016). One of the most undesirable impacts of climate variation on coastal communities is flood. Climate change, as a result of global warming has significantly contributed to the high risk of flood events globally. The frequent occurrence of flood disasters in the world varies from one region to another (Douben, 2006).

According to Liberia Floods- IFRC (2023), the highest flood incident recorded in flood-prone and low-lying areas in Monrovia was on the 4th of September 2023 with a five-day severe flood-incidents affecting an overall population of 12,450 people from 32 different communities in Montserrado since the 30th of August to the 4th of September 2023.

In the context of the least developed regions of Africa, Asia, and the South-American continent, flood vulnerability is high and is primarily related to the economic, physical, and institutional aspects of these societies; while in the context of developed regions in Europe and the North-American continent, vulnerability is minimized due to higher economic values such as durable infrastructural developments and layouts, better governance systems, and sustainable technological setups. In most cases, vulnerability to flood devastation in rural communities of least developed nations, such as Liberia is mainly attributed to high poverty rate, unauthorized and illegal mining, total dependence on sustenance agriculture, limited access to basic economic services, lack of proper layout systems of urban communities with inadequate physical infrastructures, and inequitable distribution of national income against rural settlements by government authorities (Rodrigues et al., 2002). As a result of these elements, rural communities in developing countries are left with lesser degree of preparedness and fewer coping mechanisms to weather or climate-related events like floods (Jamshed et al., 2020). Flooding can also provide many benefits, including recharging groundwater, increasing fish production, creating wildlife habitat, recharging wetlands, constructing floodplains, and rejuvenating soil fertility (Poff, 2002).

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❖ *Types of Flooding*

According to Zurich Insurance (2024), the followings are types of flooding:

- Riverine Flood: This occurs when rivers overflow their banks and flow into surrounding areas. It is most likely experienced in Africa and Asia.
- Flash Flooding: This flooding is caused by heavy or excessive rainfall in a short period of time which impedes more environmental disorder. This occurs often in the South and North American continents.
- Pluvial Flooding: This occurs when the amount of rainfall exceeds the capacity of the urban storm water drainage system, or the ground to absorb it. It contributes even more destructive impacts globally.
- Direct Flooding: This takes place when the land is lying lower than the sea level or height where the sea waves have not yet created natural barriers such as dunes.
- Coastal flooding: This flooding emanates when low-lying land that is usually dry gets flooded with seawater. In general, coastal flooding originates from sea level rise which then makes potential advancement onto shores, while the spill of water over a dry land area due to sea level rise is primarily due to several contributing factors to global warming.
- Fluvial (River): This type of flooding occurs when rivers, screams or creeks break loose their banks and run onto low-lying land (natural floodplains). This is usual when runoff emanating from heavy rainfall exceeds the natural capacity of surrounding river channels and can be inundated when river channels are blocked or constrained or waterways to estuaries, where high tide levels impede the flow of the river out into the sea.
- Groundwater Flooding: When there are excesses of water stored into the ground due to a heavy prolong rainfall, to the extent that the ground cannot absorb such extra amount of excesses, there is an overflow of ground water, thus, resulting to groundwater flooding. This type of flooding lasts for an extended length of time and its disruption may often result to huge property or infrastructural damages.

✓ *Causes of Flooding*

A persistent rise in the sea level characterized with changes in precipitation, and increased rates of storm surges and erosion have continued to exacerbate the vulnerability in coastal communities, water and energy infrastructures. There are many possible causes of flooding on or near the coast. Major among other factors are the height of land above sea level, degree of erosion and subsidence and the removal of vegetation such as mangroves which serve as defense system. Storm surges, which are temporary rises in local sea levels produced when a depression, a storm or tropical cyclone reaches the coast and this has a large contribution to local flood risk most especially in lower elevated land areas (Mimura et al., 2013).

❖ *According to Global Spill and Safety (2024), Most Often, Coastal Flooding Emanates from the Followings:*

- Spills of Water over a Barrier: This happens during storms or high tides when the height of tides from the sea water is greater than the height of the sea defense barrier. The water will spill over the barrier and cause flooding on the other side where there is dry land. Such a barrier can be natural, like a dune, or artificial, like a dam.
- Barrier Breach by the Water - This happens usually when the seawater carries large and powerful wave and breaks through a sea defense system (barrier). It will either break down the barrier, dodge the barrier; or it can completely destroy the barrier. Again, this can be a natural or artificial barrier.
- Size and Slope of the Catchment: If the size of the material contents that block an overflow of water is lesser than the weight and force of the moving body of water, the extra force of the water will break through the catchment onto the shores with devastating effects of flooding, most especially when the land area is sloping against a human settlement.
- Permeability of the Soil and Underlying Rock: If the material contents of the soil where water sets or flows is not permeable enough to allow the soil to absorb the excess water faster, or there are underlying impermeable solids, such as rocks blocking the excess water from being absorbed into the soil, there exist flooding. That is, the degree to which flood waters can be stored and moderately released into nearby lakes and along the floodplains or rivers.
- Degree of Urbanization of the Catchment, the more inflows of people concentrated in a particular urban settlement for some economic reasons, the more human activities such as building homes along drainage pathways; thereby blocking the free movement of running water and thus creating flooding.

- *Erosion*

According to the National Geographic Society (2024), erosion is when materials are being worn away from an area, for example, by waves, and in the context of sea erosion, by sea waves and soft geology then transported elsewhere by natural forces such as wind or water. In other words, materials, such as earth or sand, are being taken away from their original locations and deposited elsewhere. Erosion can lead to a weakening of an area material content or even wipes or sweeps completely the indigenous geological elements from their natural locations to somewhere else; thereby creating an environment for future flooding.

✓ *Subsidence as a Result of Erosion*

According to National Ocean Service (2023), Subsidence occurs when underground material moves, causing the ground to sink. This can be due to natural causes, such as earthquakes or erosion, or it can be due to artificial causes, such as mineral resource

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mining or removing natural gas for economic purposes. Slump communities and Low-lying coastlines are subjected to natural subsidence. Human activities can also cause local subsidence through drainage of saturated sediment or due to unsustainable use of the soil for agricultural purposes. The total weight of infrastructures of coastal towns and cities or the built environment can also compress sediment, leading to subsidence. Land reclamation is subject to subsidence due to water abstraction via crop evapotranspiration, (Bateson, 2023).

✓ *Major Signs of Subsidence*

In Buildings Few major signs of subsidence are observed in our homes. The followings include signs of subsidence in our homes: cracks in the walls, which will usually run diagonally, dropping floors that create an uneven floor surface in our houses, doors and windows are difficult to open/close or unable to open/close all due to the property being out of line. Extensions can show cracks where the extension is attached to the main building, which could indicate that the extension is pulling away, (Bruno, 2020).

- *Rainfall*

According to National Geographic Education (2023), precipitation forms in the clouds when water vapour condenses into bigger and bigger droplets of water. When the droplets are heavy enough, they fall to earth. If cloud is colder, like it would be at higher altitudes, the water droplets may freeze to form ice. Rain occurs when air rises into the upper atmosphere and cools. The cool temperature causes water vapour to condense into water droplets, which fall from the clouds as rain when the air becomes saturated. Air pressure contributes to this process. In other words, the sun heats the land, waters and warms the air above sea level, then warm air rises, cools and condenses forming clouds resulting to rainfall.

✓ *Importance of Rainfall*

According to National Oceanic and Atmospheric Administration (2024), rain and snow are significant elements in the Earth's water cycle, which is vital to all life on Earth. Rainfall is the main way that the water in the skies comes down to Earth, where it fills our lakes and rivers, recharges the underground aquifers, and provides drinks to plants and animals.

✓ *Measures to Control Runoffs from Rainfall*

According to this thesis paper, runoff is defined as "an overflow and movement of liquid through pavement media onto the ground surface and being discharged underground or into a creek, stream, river, lake, ocean or cistern". The pavement media as expressed above could be a roofing sheet, concrete pavement or a drain pipe transporting liquid.

When it rains following a storm-blow, precipitations from the top of roofs or drain-pipes flow down onto the ground surface and as a result, it generates stormwater. If not properly directed and controlled, this may lead to erosion which paves way for urban flooding. It is a good practice to use a blue roof to hold precipitation after a storm event and let it discharge at a controlled rate. A blue roof is designed to hold up to eight inches of precipitation on its surface or in engineered trays. Blue roofs can greatly reduce the peak discharge of runoff and allow water to evaporate into the air prior to being discharged. Precipitation discharges are controlled on a blue roof through a flow restriction device around a roof drain. The water can either be slowly released to a storm sewer system, scream, river, lake, ocean or to another green infrastructure practice, such as a cistern or bioretention area (LeFevre et al., 2015).

✓ *The use of Bioretention as an Alternative Measure Against Runoff*

Bioretention is an adapted landscape feature that provides onsite storage and infiltration of collected storm water runoff. Storm water runoff is directed from impervious surfaces to a shallow landscaped depression planted with water-tolerant vegetation that allows runoff to pond temporarily before infiltration, then steadily being discharged in an underground temporary storage stone-base underdrain perforated receptacles prior to infiltrating into the ground. Small-scale bioretention areas are often called rain gardens. Putting into use bioretention practices, such as the establishment of rain gardens, which are landscaped depressions that treat on-site stormwater discharges from impervious surfaces such as driveways, sidewalks, roofs, parking lots and compacted lawns, is another means of avoiding urban flooding (Roseen et al., 2013). They are used to collect stormwater runoff and filter it through a mixture of soil, sand and gravel before being released into a river, pond, cistern, or supplied as underground water. They are shallow landscaped-depressions filled with sandy soil, topped with a thick layer of mulch, and planted with dense vegetation. These stormwater vegetation management areas are designed in a way that stormwater producing runoff can percolate through the soil which act as a filter before eventually being drained into groundwater. Some of the water is absorbed in a rain garden by the plants through their roots. These areas are specially designed to capture stormwater and remove pollutants such as nutrients, solids, metals, and even dissolved phosphorus from runoff before being discharged (Hirschman, et al., 2017).

Bioretention is often designed with an overflow outlet to prevent flooding during larger storm events especially for areas where permeability of soils is very low. The designs and use of bioretention aim at significantly reducing the volume of stormwater and removing pollutants from an environment. This filtered water can provide water to plants and help recharge the local groundwater supply. Through these processes, bioretention practices reduce peak flows within downstream sewer systems and allow pollutant removal through filtration and plant uptake (Center for Watershed Protection, 2000).

✓ *Permeable Pavements and Pavers*

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Permeable pavement includes both pavements and pavers with void space that allow runoff to flow through the pavement. Permeable pavers are very effective in removing heavy metals, oils, and grease from within runoff before being discharged. Specially designed permeable pavements can remove nutrients, as well as phosphorous and nitrogen from runoff prior to being discharged. Soil and other expressly engineered media can also filter different types of pollutants from runoff through porous surfaces before infiltration. The void spaces in permeable pavement surfaces and reservoir layers provide storage capacity for runoff. Any permeable pavement system designed can reduce the peak volume of runoff. Underground receptacle storage systems are designed differently according to the variety of functions they perform. Underground receptacles receive and temporarily detain runoff then steadily discharge them. An underground receptacle can be a culvert, a designed engineered stormwater detention vault or specially designed underground storage tanks with perforated pipes (Mishra, 2012).

- *Storms*

A storm is an acute disturbance of the atmosphere that is couple with a mighty wind and usually by heavy or light rain, show, hail, sleet, or thunder and accompanied by lightning. Storms are created when a center of low pressure gets developed with the high-pressure system that surrounds it. These opposing forces can also create winds which result in the formation of the storm clouds like cumulonimbus. The localized areas of low pressure can also form from hot air rising off from the hot ground, which results in smaller disturbances like dust devils and whirlwinds. During a storm, the wind has a speed of 64 to 72 miles (103 to 117 kilometers) per hour. Storm surges are short-term changes in sea levels caused by events such as tsunamis and cyclone, (Kato, 2021).

❖ *Types of Storms*

The devastating effects of storms vary from one type of storm to another. Types of storms include the followings:

- **Hurricanes** are the most powerful and dangerous types of cyclone and are identified by low-pressure systems, high winds, heavy rainfall, storm surges and swells.
- **Ice storms** produce freezing rain that covers everything in an ice, thereby making everything slippery and causing hazardous conditions with high potential of affecting homes, public roads and vehicles.
- **Snow storms** are heavy snow which inconvenience can cause damage to homes, heavy build-ups leading to collapsing of roofs or cutters and blockades of drainages.
- **Lightning storms** occur during weather events, such as lightning causing trees to fall, wildfires, structural fires and also power outages.
- **Tropical storms** are storms that have high wind speeds between 39 to 73 miles per hour. They are prevalent in the Pacific and Atlantic oceans.
- **Tornadoes** are forceful and dangerous winds gushing in excess of 300mph speed. This type of wind uproots trees; remove roofs of buildings and in some instances, picks up humans like flying balloons in the air to different locations (Kato, 2021).

✓ *Storm Surges and its Contributing Factors*

A storm surge is only measured by the water level that exceeds the normal tidal level, excluding waves. These places are biologically diverse, and coastal flooding can cause significant biodiversity loss and potentially the extinction of a number of species. Agricultural land which is submerged by saltwater for a long period can result in the salination of the soil resulting in a loss of productivity for long periods. Food crops and forests can be ultimately killed off by the salination of soils or wiped out by the movement of floodwaters. Several meteorological factors contribute to a storm surge and its severity. Contributing factors resulting to storm surges include, when water is pushed towards the coast over a long fetch by high-speed winds, the shallowness and orientation of the body of water, the timing of tides and a drop in the atmospheric pressure of an area. The term fetch as used in this context, refers to the process in which ocean waves are generated and brought forth towards the shorelines by the wind (Simpson et al., 2017).

It also refers to the length of the fetch area, measured in the direction of the wind. There are a variety of additional factors that exacerbate storm surges. Some of these factors include; land subsidence, which occurs through tectonic activity or post-glacial adjustment. Also removing natural vegetation from the coastal defense lines, such as mangroves that protect the environment against extreme weather events like cyclones, results to storm surges. Global warming, which is due to severe solar radiation, as the surface of the oceans gets warmer, the frequency and intensity of storms will also increase; as a result, the severity of storm surges and flooding will increase as well (Hebert et al., 2021).

✓ *Adaptation Strategies Against Threats of Climate Change*

Adaptation refers to adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli and their effects. It refers to changes in process, practices and structures to moderate potential damages or to benefit from opportunities or to benefits from opportunities associated with climate change (UNFCCC, 2024).

According to UNDP Climate Profile (2024), climate change adaptation refers to actions that help reduce vulnerability to the current expected impacts of climate change like weather extremes and hazards, sea-level rise, biodiversity loss, or food and water insecurity. Adaptation refers to a wide range of measures to reduce vulnerability to climate change impacts, form planting crop varieties that are more resistant to drought to enhancing climate information and early warning systems to building stronger defenses against floods. Despite constraints, developing countries are among those leading the way on adaptation. Adaptation faces

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challenges including inadequate finance, knowledge gaps, and institutional constraints, particularly in developing countries. Measures including planting crop varieties that are more resistant to drought and practicing regenerative agriculture, improving water storage and use, managing land to reduce wildfire risks, and building stronger defenses against extreme weather events like floods and heat waves (UNDP Climate Profile, 2024). Adaptation involves adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation (IPCC, 2007).

❖ *The Following Include Adaptation Measures for Responding to Multiple Threats Resulting from Climate Change:*
- Raise public awareness
- Not permitting development on land vulnerable to climate hazards
- Establishing construction codes appropriate to the forecasted climatic conditions
- Management plans to efficiently and effectively respond to natural disasters in future
- Increase in financial incentives and avoidance of political criticism
- Insurance to cover personal and government costs of future natural disaster damages
- Adjustments in Labor and professional skills in responding to new adaptation strategies
- Adaptation Strategies for Protecting Property and Infrastructures
- The protection of coastal lines with meters and mangroves against potential flooding
- Protection of existing ecosystems and reforestation of areas adjacent to coastlines
- Prohibition or control against the removal of beach sediments
- Creation of artificial reefs to dissipate wave energy
- Adaptation Options for Protecting Natural Systems
- Better environmental management strategies for improved coastal defense systems
- Provision of incentives for conservation in farming areas including carbon sequestration opportunities.

❖ *Adaptation Options for Protecting Food Production*
- Adapt new cropping techniques and monitor species characteristics and development
- Improve qualities in water, environmental and soil management systems
- Provide financial and technical support to farmers to cope with weather-related challenges.

❖ *Adaptation Options for Protecting Availability of Fresh and Drinking Water*
- Installation of devices to prevent seawater from back flowing into storm drains
- Create farm dams or dikes in other locations
- Require households and businesses to install rainwater tanks to supplement reticulated water supply system;
- Develop and apply desalinization technologies; and
- Create irrigation systems to ensure hydration of vegetation

✓ *Importance of the Mangroves as a Coastal Defense System*

Coastal vegetation, including mangroves, marshes and other trees that intercept rainfall by slowing down surface water movement and storing some whilst the rest evaporates are natural coastal defense system against flooding. The vegetation also absorbs water from the soil through their roots and allows more significant infiltration into the ground, as a result, it reduces surface run-off. When vegetation is removed, infiltration and interception are reduced and surface run-off increases. This contributes to a greater risk of flooding as more water reaches the river channels. The vegetation also stabilizes existing sediments and traps new sediments, raising the height of the land above sea level. In addition, it absorbs wave energy, reducing wave impact and erosion, and reduces the distance the waves travel onshore before their power is exhausted, (Revell, 2022).

Vegetation like mangrove and salt marshes can minimize the risk of flood events, thus removing them is likely to increase the risk of coastal flooding in an area. When coastal flooding occurs, waves can reach further inland, causing damage to houses and other infrastructures. The mangroves can then be used as a defense system to reduce the height and energy of the wind and swell waves passing through them, thus reducing the ability of the water to erode sediments and to cause damage to structures such as dikes and seawalls. Mangrove forest can stabilize existing sediments and traps new ones thereby raising the height of a land. The mangroves also absorb wave energy thereby reducing the rate as well as distance wave travels onto shore. It is estimated that a one hundred meters (100 m) belt of mangrove forest is potential enough to reduce wave height by forty percent (40%) and one kilometer (1km) belt of mangrove forest minimizes the size of a storm surge by half a meter (0.5 m). It is also estimated that half of the world's mangrove forest have been removed, while twenty-five percent (25%) of those mangroves destroyed account for reasons ranging from creating shrimp farms to the creation of tourist beaches, (Khairuddin, 2013).

➢ *Liberia National Climate Change Circumstances*

Liberia is situated at the heart of the world's top zones of biodiversity. The country lies at the center of the Upper Guinea Rainforest region along the West Coast of Africa. The region was originally covered by a dense tropical rainforest, ranging from Guinea, continuously south through to Ghana (NDC Liberia, 2018).

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According to Climate Risk Country Profile of Liberia (2024), Liberia submitted its Nationally-Determined Contribution (NDC) to the UNFCCC in 2016, which it updated in 2021, and its Second National Communication to the UNFCCC (SNC) in 2021. The revised NDC unconditionally commits to reducing greenhouse gas emissions by 10% below the business-as-usual level by 2030 and coordinates its cross-sector mitigation and adaptation targets with the U.N. Sustainable Development Goals (SDGs). The SNC identified five priority adaptation sectors – agriculture, forestry, coastal zones, fisheries, and health – which align with the 2018 National Policy and Response Strategy on Climate Change (NPRSCC) to complement or scale up subnational actions, as well as the 2020–2030 National Adaptation Plan (NAP) framework that guides NAP development and implementation over the ten-year period indicated. High reliance on climate-sensitive activities renders Liberia vulnerable to climate variability and change, expected to manifest in higher temperatures, more extreme weather events such as heavy rains, and rising sea levels (World Bank Group, 2024).

According to the Nationally Determined Contribution of Liberia submitted by the EPA, NDC (2018), for the Agriculture sector, Liberia commits to the following mitigation targets to reduce GHG emissions related to agriculture and livestock systems: Reduce agricultural GHG emissions by 40% below BAU levels by 2030 (reduction of 13 $GgCO_2e$) through promoting low-emissions rice cultivation and reducing the burning of field residues. Reduce GHG emissions from the livestock sector by 40% below BAU levels by 2030 (reduction of 211 $GgCO_2e$) through incentivizing improved feed, e.g., with legume fodder species, to reduce enteric fermentation (reduction of 103 $GgCO_2e$), improved waste management, e.g. with bio-digesters and composting (reduction of 108 $GgCO_2e$) (NDC Liberia, 2018).

According to the National Adaptation Programme of Action (NAPA) of Liberia (2008), Liberia is divided into four distinct zones in term of its climatic patterns. The first is a coastal belt which constitutes tidal creeks, shallow lagoons, and mangrove marshes. The second belt comprises of rolling hills, the third constitutes plateaus; and lastly the northern highlands. In Liberia, the dry and rainy seasons are the two weather seasons which do not necessarily depend on changing temperature but are determined by the prevailing moisture-laden monsoon winds that come from the southwest, hitting the Liberian coast roughly at a right angle. As the air rises, air masses condense, and heavy precipitation results. During the months from November to March, the dust-laden harmattan wind, originating from the Sahara Desert, blows in from the northwest producing a chilly and dry climate in Liberia. The Dry Season runs from November through March, while the Rainy Season runs from April through October. Liberia falls within the West African Monsoon Climate, which alternates between wet and dry periods, with intermittent rain and dry seasons. The average rainfall ranges between 4,770 mm along the coast and 2,030 mm in the interior. Due to the position of Liberia on the equator, the sun is overhead at noon throughout the year producing a temperature range of 28^0C to 32^0C.

NAPA (2008), also cited that much of the effects of increasing climatic variability and climatic change threaten key economic sectors in Liberia, namely agriculture, fisheries, forestry, energy, health, meteorology/hydrology. Production systems in each of these sectors have already experienced reduced productivity that is linked to changing climatic patterns. The socio-economic consequences fall particularly on rural populations whose livelihoods depend on natural resources and for whom prevailing poverty persists despite national efforts to rebuild the country. It further laments that 70% of the rural communities of the country's population and the overwhelming majority of these people live below the poverty belt. For this reason, it is important to emphasize that national strategies including poverty reduction strategies for economic development do not currently account for climatic risks.

- *It Emphatically States that the Key Development Challenges vis-à-vis Climate Risks are Linked to Issues Including the followings:*

✓ Degradation of the agricultural lands and the loss of biodiversity, putting small holder households at risk;
✓ Absence of an effective early warning system (i.e., a system of meteorological stations) that could allow farmers and other stakeholders to make informed decisions on production strategies;
✓ Coastal erosion mainly in low-lying areas such as the urban centers of Robertsport, Monrovia, Buchanan and Cestos.

Primarily, one of the driven forces to Liberia's inclusive economic growth and poverty reduction goals is the agricultural sector through activities such as, fisheries and forestry. Furthermore, due to the high reliance on climate-related activities, Liberia has become vulnerable to climate variability and change which is expected to manifest in higher temperatures, more extreme weather events such as heavy rains, and rising sea levels. The country has identified urban and coastal development, sea level rise, and potential salinization of coastal areas as key areas for climate change adaptation portfolios (NAPA Liberia, 2008).

➢ *Tourism*

Tourism refers to the activity of visitors who take a trip to a main destination outside of their usual environment, for less than a year, for any main purpose related to business, leisure, or other personal purposes, other than to be employed by a resident entity in the country or place visited (IRTS, 2008). Like the law of supply is quoted in economics, when the price of a commodity increases due to increase in its importance, so the supply of that commodity also increases. Similar law applies to tourism. Tourism is currently considered as a life-enhancing moment and an economic activity of global significance. According to UNWTO Tourism Highlights (2014), for the last few decades, tourism, mainly international tourism, has expanded more substantially. In 2013, the arrival of international tourist increased by 5% worldwide, reaching a world record of 1.087 billion arrivals, while the receipts of international tourism increased by about 7.5%.

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By attracting international tourists, tourism contributes significantly to economic growth by accumulating foreign exchange earnings, providing employment opportunities, and improving infrastructure, among other reasons. Accordingly, tourism has been widely regarded as an important stimulus to supporting export trade and economic growth in many countries. However, the empirical studies have shown inconsistent results regarding the overall impact of tourism on economic growth. As a result, considerable attention has been devoted to tourism-related research from an economic perspective. The economic impetus of tourism can be evaluated firstly, from perspectives of the following:

- The direct effects – which usually involve changes in 'sales, employment, tax revenues, and income levels' due to the immediate impacts from tourist spending.
- The indirect effects –which are changes in the general price level, quality and quantity of goods and services, property and other taxes, and social and environmental impacts.
- The induced effects - are often related to changes in household spending, a result of the additional income generated from tourist spending (Kim et al., 2017).

The outlined effects above are widely perceived in tourism-related industries (Khan et al., 1990, Stynes and Arnold, 1997, Brida et al., 2008). Thirdly, there is an increasing number of researchers on tourism due to the critical roles played by tourists in the accumulation of capital, alleviating poverty, and improving social welfare, (Deller, 2010, Lee, 2009, Scheyvens, 2007, Scheyvens and Russell, 2012). Thirdly, the efficiency of tourism and its productivity shed light on the allocation of economic resources in order to reduce costs in tourism-related sectors by improving the performance of the tourism industry, and maintaining high level of competitiveness in the tourism industry, (Chen, 2007, Dwyer et al., 2007, Goncalves, 2013, Hong, 2009). Finally, considering globalization, the interaction between external economic factors and a country's tourism industry will be of great interest and highly prioritized. For instance, the causal relationship between foreign direct investment (FDI) and international tourism was addressed by Fereidouni and Al-mulali (2014). As important exports of services, tourism demand is sensitive to exchange rates (De Vita, 2014, Tang, 2013). The significance of exports of tourism services and global economic conditions is sensitive to the exchange rates of an economy (Boukas and Ziakas, 2013, Meng, 2014, Okumus and Karamustafa, 2005).

➢ *Tourism in Liberia (Robertsport)*

One of the world's top water sports has now set the coastal communities of Robertsport on top of the game of tourism. Surf tourism has seen the birth of a budding business ecosystem in Robertsport. In the past few decades, this coastal settlement paled in comparison with bigger cities such as Monrovia. However, times never remain the same; tourism for Robertsport has taken a trend of positive change since a new community of surfers found their home along the beautiful beach fronts of Robertsport. As it stands, the coastal town of Robertsport is racking in travelers from different parts of the globe primarily due to the tremendous growth of the water sports in the area. As a result of this growth, local businesses are experiencing economic boom in term of marginal upticks of their business sales (RSC, 2024).

Additionally, the surf club Robertsport Surf Club (RSC) organizes surfing competitions with cash prizes and eye-catching offers and as well provides scholarships for young apprentice surfers at the primary school level of education in Robertsport. The coastal settlement of Robertsport is now the jewel in Liberia's surfing crown, with year-round warm weather and long waves that peel along the coast in gorgeous arcs proving ideal conditions for bodysurfing, surfing or sliding as commonly referred to in Liberia. The Robertsport Surf Club is also expanding its reach by providing shelters for local surfers. In collaboration with the Universal Outreach Foundation (UOF), a humanitarian organization that runs the surf club has built a surf house right by the fisherman's break and further intends to expand its programs (RSC, 2024).

➢ *Government's Intervention in Tourism*

According to Bondo (2022), the government of Liberia is not ignorant to these local strides. The Liberian government has now made pronouncement of plans to invest in the tourism efforts ongoing in Robertsport as a means to boost the tourism industry in the country. When implemented, the project seeks to develop tourist reception facilities at the Robertsport beach-front and develop a tourism marketing strategy focusing on Robertsport as a surf tourism destination in Liberia.

➢ *Challenges to Tourism in Robertsport*

Despite the impact of tourism in Robertsport, it is not without its own challenges. While it's no secret that there are no certainties in surfing, a sport dependent on the whims of the ocean, there is also a dearth of funding for local surfers and organizations. Access to surfing gears is also a mounting challenge. The surf club has partnered with an organization (Provide the Slide) and there has been some tremendous efforts made by this organization. However, surf boards most often break, so boards have still remained a challenge for local surfers in Robertsport. Not escaping these challenges, currently the surf club has built a restaurant which will employ local surfers in the area and those from low-income backgrounds. The surf club also plans on a campaign for surf lessons and board repairs. The surf club has also bought canoe for leasing to go sightseeing. Liberia does not have visa on arrivals which probably serve as the biggest challenge for tourism in Robertsport, (Bondo, 2022).

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➢ *Review of Existing Publications on Climate Change in Liberia*

According to the National Policy and Response Strategy on Climate Change, EPA (2018), topographically Liberia is diverse, ranging from features of coastal plains, lagoons and mangrove marshlands, to rain forests and plateaus rolling towards the interior. The Northern Highlands mark the highest elevation, which includes Mount Wutivi (1350 meter). Six major rivers; Mano, Lofa, St. Paul, St. John, Cestos and the Cavalla traverse the northern and southern boundaries of the country, of which the Cavalla River is the longest (515 km). Two major lakes; Lake Shepard in Maryland and the largest being Lake Piso covering an area of 103km^2 (40 mi^2) in Grand Cape Mount are found in the country also.

Liberia has a tropical climate with heavy rainfall from May to October and a short interlude in mid-July to August. The dry season extends from November to April. Liberia is endowed with several explored and unexplored natural resources. Currently, however, the main economic sectors of Liberia's economy are mining, agriculture, and forestry, while the main natural resources are iron ore, rubber, timber, diamonds, and gold. The rain forest occupies roughly 45% of Liberia's land and is the source of its timber resources. Liberia is home to many rare and endemic species and is listed as one of 34 global biodiversity hotspots. The forest resources are severely pressurized by logging, road building, agriculture, and human settlement. Scant studies show that there are 167 species of freshwater fish and 464 saltwater fish known for Liberia, three of which are endemic to Liberia. 54 of Liberia's fish species are listed in the Red List of IUCN, 14 as critically endangered, 18 as endangered and 22 as vulnerable, National Policy and Response Strategy on Climate Change, (EPA, 2018).

According to the Liberia Climate Change Assessment (2013), Liberia has a 565-km long coastline, and an estimated 95 km^2 of land along the coast of Liberia would be inundated if sea level rises 1 meter. Under a scenario of a 1-m rise in sea level about 50% (48 km^2) of the total land loss due to inundation will be the sheltered coast. For example, parts of the capital city of Monrovia, West Point, New Kru Town, River Cess, Buchanan, and Robertsport will be lost because much of those areas are less than 1meter above mean sea level. Likewise, seaward portions of the remaining mangrove wetlands will be lost. About $250 million worth of land and infrastructure will also be lost.

Also as related by the World Bank Group on Climate Variation with Climate Profile (2021), Liberia submitted its first Nationally-Determined Contribution (NDC) to the UNFCCC in 2016 and its Second National Communication to the UNFCCC in 2021. These documents provide the platform to integrate its Low Carbon Development Strategy into the country's long-term sustainable development Vision by 2030. According to Climate Change Risk Profile, Liberia (2017), agriculture, fisheries and forestry are instrumental to Liberia's inclusive economic growth and poverty reduction goals. High reliance on climate-sensitive activities renders Liberia vulnerable to climate variability and change, expected to manifest in higher temperatures, more extreme weather events such as heavy rains, and rising sea levels. The country has identified urban and coastal development, sea level rise, and potential salinization of coastal areas as key areas for climate change adaptation portfolios.

According to Human Climate Horizons (2024), collaboration between the United Nations Development Programme (UNDP) and the Climate Impact Lab (CIL), the extent of coastal flooding has increased over the past 20 years as a result of sea level rise, meaning 14 million more people worldwide now live in coastal communities with a 1-in-20 annual chance of flooding. Hundreds of highly populated cities will face increased flood risk by midcentury, relative to a future without climate change. Flood risk exposure is anticipated to double to 10 percent of the world population by the end of the twenty-first century. According to the U.S National Oceanic and Atmospheric Administration (NOAA), king tides normally occur once or twice every year in a coastal area. Coastal cities are increasingly experiencing flooding on days with less extreme tides or little wind, even on sunny days. Floods are happening more often as rising sea level reduces the gap between average sea level and the height of the land. This type of tidal flooding is expected to increase in depth, frequency, and extent most especially in developing countries of West Africa during this twenty-first century. The risks of coastal flooding and erosions create an uncertain future for coastal community dwellers (NOAA, 2024).

Henceforth, there is a need to design plans as mitigation and adaptation techniques against these disastrous environmental disturbances. Plans designed to adapt or mitigate coastal flooding varies from one location to another depending on their confidence levels. Some predictions on the impacts of coastal flooding associated with global warming are more confident than others. For example, the IPCC's summary forecasts ranged from high to low confidence. It also made a fascinating statement about coast change which might be attributed to global warming. In providing solutions to coastal flooding it is wise to consider the complexity of coastal systems across different locations of the glob that could be affected by several factors. Therefore, attributing it to a single factor will then ignore the many factors that affect the level of risk involved in coastal flooding (IPCC, 2021).

Key among the variety of measures, there are two possible approaches to dealing with the risk involved in coastal flooding; which are adaptation and mitigation approaches. Adaptation is vital as making changes lessens the impact of flooding. This can be done by: building sea walls, constructing storm-surge barriers, Building earth dams, restoration of mangrove forests, among others. An example is Sri Lanka; as a result of the tsunami devastation in just a single village in the year 2004, the death recorded as a result was 60,000 in the village where the mangroves had been removed compared to only two deaths in an adjacent village protected by a mangrove forest. Mitigation also requires reducing greenhouse emissions to limit global warming, thus, mitigating sea level rise and cyclone intensity (Jayasurita et al., 2006).

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CHAPTER THREE
RESEARCH METHODOLOGY

A. *Introduction*

Chapter three of this research paper presents the methodology used for collecting data. It includes the methods that was used to collect and analyze data. The chapter also presents the design which lays out the format of the research procedures; it identifies the targeted population and sample size, or a segment of the sampling population and techniques in the study area. The chapter finally discusses the instrument in the form of self-designed questionnaires used for the data collection and relates procedures for both data collection and data analyses.

➢ *Description of the Study Area*

- *Location*

Fig 1 Political Map of Liberia
Source: www.nationsonline.org

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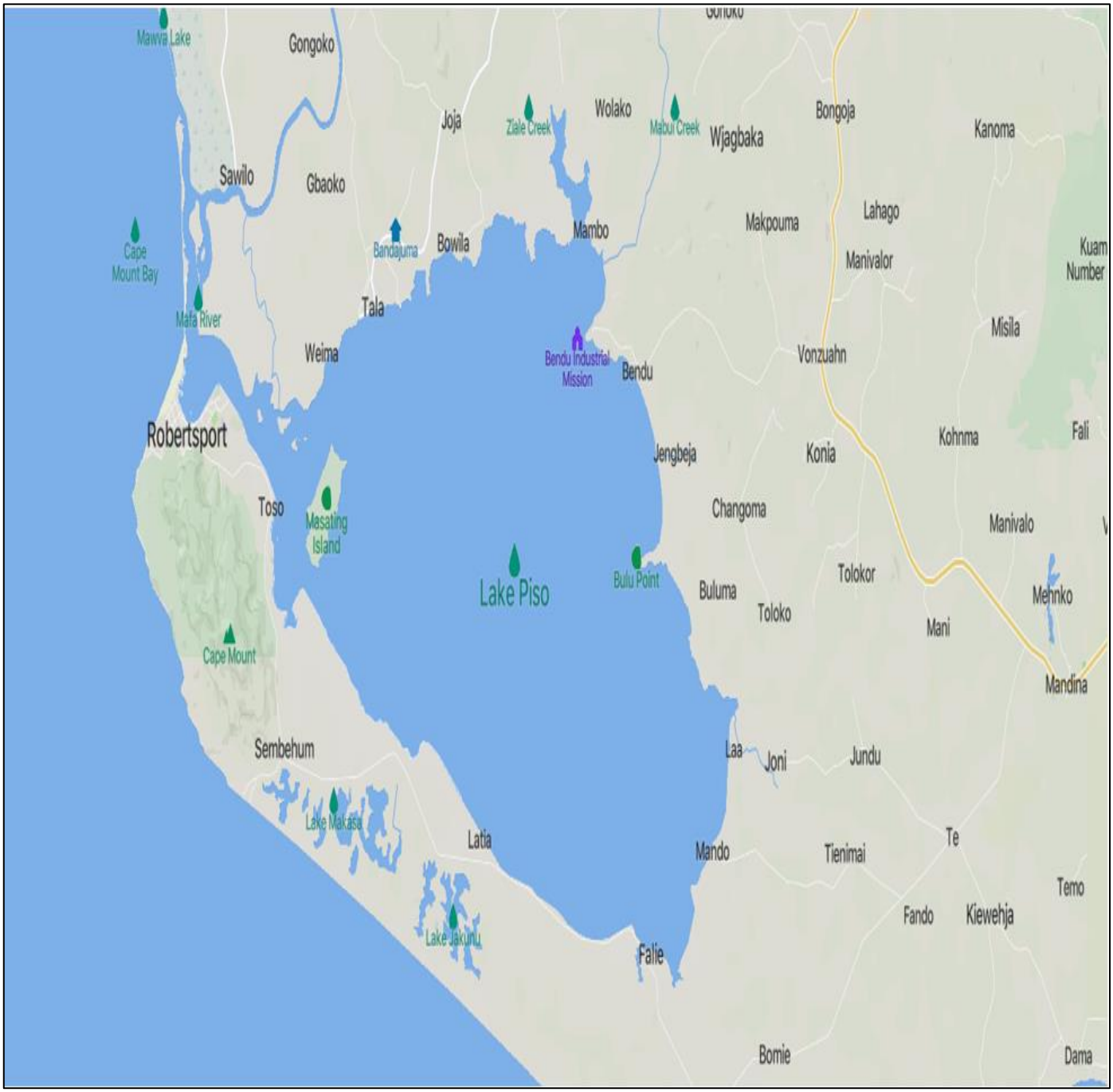

Fig 2 Map of the Commonwealth District Showing Study Area
Source: Map Data, 2024

Robertsport, the Capital of Grand Cape Mount County along with Toso, Sembehum, Latia and Falie, are settlements situated within the Commonwealth District of Grand Cape Mount County. Robertsport lies along the Cape Mount peninsula separating the Atlantic Ocean from the Fisherman's Lake (Lake Piso) which covers an area of 76,091 ha (761km^2). The settlement is 50 miles (80 kilometers) north-west of Monrovia. The area lies in western Liberia and is 10 miles or 16 kilometers away from the Sierra Leone border. On a steady rate, Robertsport is 2 hours 44 minutes' drive away from Monrovia. Many regard the area regarded as the jewel in Liberia's surfing crown or the tourist city of Liberia, with a year-round warm weather and long waves that peel along the coast in gorgeous arcs.

The climate of the County is humid and tropical with two distinct seasons: the wet season and the dry season. The wet season begins in April and ends in October with an average rainfall of 400 cm and temperatures ranging from 28 degrees and 34 degrees Celsius, while humidity goes as high as 90 to 100 percent. The dry season is from November to March. Cape Mount, being a coastal County, has high annual average rainfall because the coastline runs approximately from South-east to Northwest and at right angles to the prevailing south-western rain-bearing winds (Grand Cape Mount CDA, 2008).

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- *Administration and Demographics*

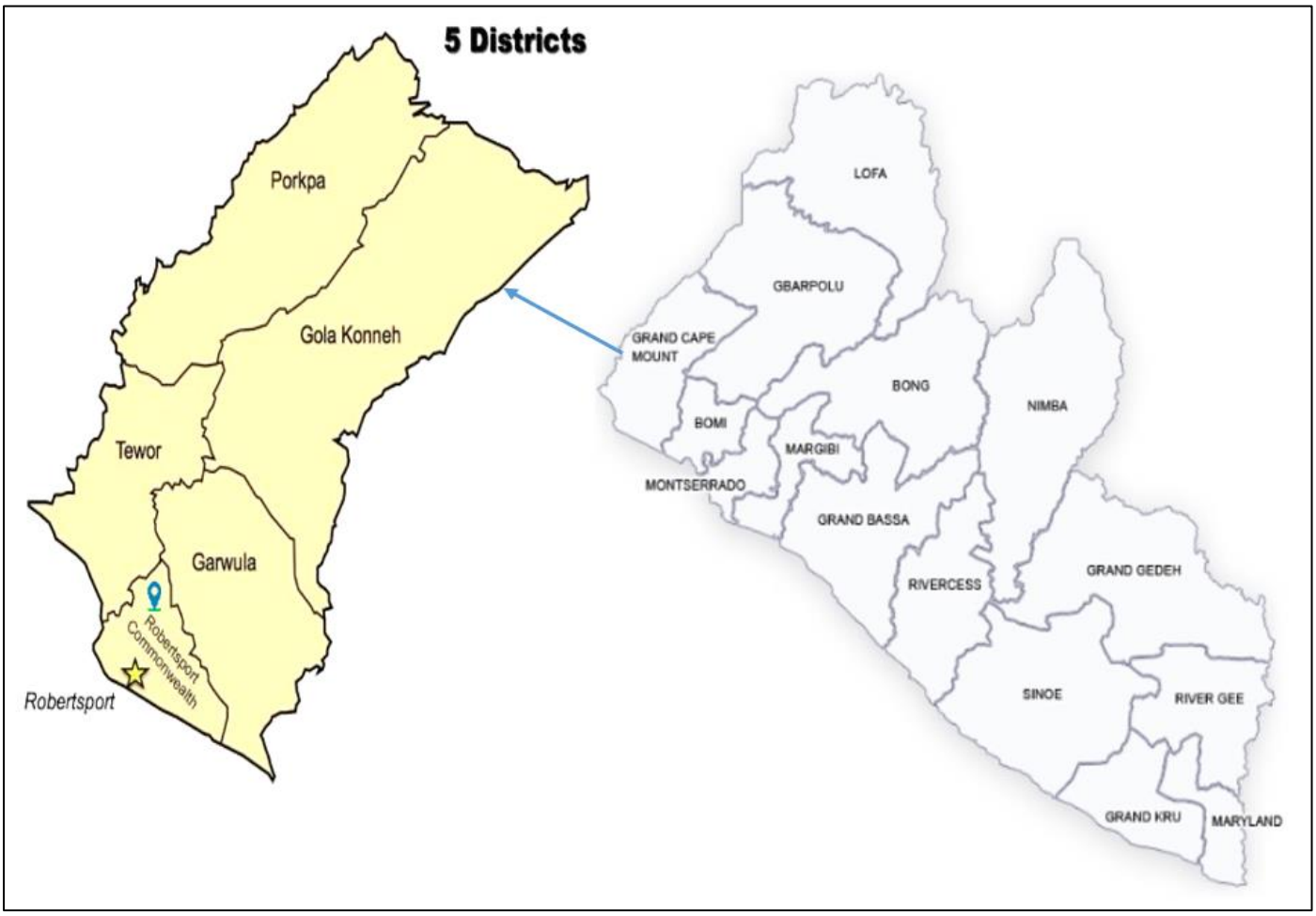

Fig 3 Map of Grand Cape Mount County (Left)
Source: (News Public Trust, 2022)

Administratively, the head of the county is the Superintendent whose office is seated in Robertsport. The superintendent is deputized by the county development superintendent. Robertsport has eight major communities, Up Town, Central Ward, Kru Town, Gombo's Town, Nlondijaye, Gbassaalor, Grassfield and Fanti Town. The area hosts the county's circuit court, and presides over all administrative matters of the county. Grand Cape Mount County is one of the 15 counties that constitutes the first-level of administrative division in Liberia and it contains three electoral districts and five administrative districts; namely: Tewor, Porkpa, Garwula, Gola Konneh, and the Commonwealth. Robertsport, the capital of Grand Cape Mount County is situated in the Commonwealth District. Hence, the county produces two senators with three representatives. Grand Cape Mount County is the home of the 5th Judicial Circuit Court which sits on criminal, civil and probate matters and is housed in the Ministry of Internal Affairs Building. The Court has three specialized courts and oversees the functions of a total five magisterial courts located across the county. The 5th Judicial Circuit Court of Robertsport is presided by a resident circuit judge (Grand Cape Mount CDA, 2008).

- *Demographics*

As of 2022 Liberia National Population and Housing Census, the total population of the Commonwealth District where Robertsport is situated, registered a total of 14,057 people with 51% comprising of 7,138 and 49% comprising of 6,919 people accounting for male and female population respectively. The total population of the Commonwealth District is 7.86% of Grand Cape Mount County's total population of 178,867. Likewise, 0.27% of the total national population of 5,250,187 represents percentage of population for the study area. The ratio of male to female population in the research area is 51:49 respectively, LISGIS (2022).

- *Physical Features*

✓ *Lake Piso Hydrological Basin*

The Fisherman's Lake or Lake Piso, also known as Lake Piso Hydrological Basin, is the largest natural lake in Robertsport, Grand Cape Mount County, Republic of Liberia. The lake is named after Cape Mount's highest peak, Mount Piso, which overlooks

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the lake. Lake Piso covers an area of approximately 103 square kilometers (39.77 square miles). It is a shallow, freshwater lake with an average depth of around 2 meters (6.5 feet) and stretches at a length of about 19.01 miles with width of 10 miles. The lake is known for its diverse ecosystem, including wetlands, mangrove swamps, and surrounding forests (Streissguth & Thomas, 2006).

✓ *Hydrogeological Connections*

The brackish water lake borders the Cape Mount peninsula, and is connected to the Atlantic Ocean by a narrow inlet known locally as the "bar mouth" . Various rivers empty into Lake Piso, including Mole Creek and Mafa River, before the lake discharges at the 'bar mouth'. There are a number of islands in the lake, including the Massatin Island, which is home to many different monkey and bird species (Marine Conservation Institute, 2024).

✓ *Wakolor Mountain Hike*

The natural beauty of Robertsport is hugely reflected by the thick forested canopy of the Wakolor Mountain close to the shores of the Atlantic Ocean. The Capital of Grand Cape Mount, Robertsport is overlooked by Mount Wakolor 300 ft. high above sea level. Along the hike are spots where friends can gather and commune with their beautiful natural settings. Wakolor Mountain is endowed with abundance of untouched flora and fauna. The beautiful sounds of birds, like the Hornbill are heard deeper in the mountain. Some of the biodiversity along the way including interesting trees, like the tree used for dice making are quite expressive. In addition, in depth of the mountain there are natural creeks with cold cleaned running water which residents close to the mountain side most often use for drinking. There is an old canoe that is dated more than a century in the mountain which history says was used to protect the territorial boundaries along the coastlines of Liberia. The mountain itself serves as a natural coastal defense lines for Robertsport (Cole et al., 1962).

➢ *Method of Data Collection*

- *Data Sources*

A questionnaire form was used to collect data from a targeted sample of 150 respondents from five towns (Robertsport, Torso, Sembehum, Latia and Falie) in the Commonwealth District of Grand Cape Mount County. surveyed sample for data collection included fishermen, local wood suppliers, small-scale fish sellers, farmers, business people and permanent household residents who were 18 years old or above.

Table 3.1 shows the five towns in the Commonwealth District where the study was conducted. A sample of 150 participants were interviewed. Out of this total sample size, 60 respondents came from Robertsport, 15 of the respondents came from Torso, 20 of them came from Sembehum, 25 were interviewed from Latia and 30 participants were surveyed from Falie. The sample size of each town was selected based on the population density of the area. The table also presents geographical features and climatic implications for tourism in each selected region of the study area.

Table 1 Surveyed of Towns and Physical Characteristics of Natural Features

Community	Participants per Town	Geographical Features	Climate Impacts and Implication for Tourism
Robertsport	60	Partly high elevated land areas above sea level, and low-lying lands and wetlands Atlantic Ocean, mountain (Mount Wakolor), lake (Lake Piso), islands, stoning sand beaches, rocks and partly slumps lowlands, and rivers (River Mafa) and lies at the heart of biodiversity.	The area intermittently experiences terrible storm and flood events, subsidence and erosions. It is a sub-urban settlement very suitable for tourism with activities such as surfing, swimming and soccer sports, while fishing remains the primary economic activity along with small-scale businesses.
Toso	15	Low-lying land area below sea level, partly featuring Lake Piso and Mount Wakolor along with smaller islands (Massating Island), sandy soil and partly slumps lowlands.	The area experiences minor storm and flood events, subsidence and erosions. Primary activity is sustenance farming and Fishing, cutting and supply of woods, and charcoal burning.
Sembehum	20	Low-lying land area slightly above sea level, partly featuring Mount Wakolor with other small rivers, islands and lakes (Lake Makasa)	Fishing, burning of charcoal, wood fetching, soccer sports, small-scale businesses and
Latia	25	Low-lying land area slightly above sea level, partly featuring Lake Piso and other small rivers, islands and lakes (Lake Jakunu)	Mostly fishing activities, surfing, swimming sports and most attacked coastal flooding
Falie	30	Low-lying land area slightly above sea level, partly featuring Lake Piso and other small rivers, islands and lakes (Lake Jakunu)	Mixture of economic activities such as fishing, local wood supply, soccer, swimming and canoeing sports

Source: Field Survey, 2024

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- *Sampling Technique and Method*

By establishing a more precise relationship between the aims and goals of a study, judgmental sampling strengthens the relevance of an investigation and the trustworthiness of a set of data collected (Campbell et all, 2020). This kind of sampling is purposive sampling, that is, a collection of nonprobability sampling approaches. It is also referred to as subjective or selective sampling. This sampling technique focuses on the segment of the population that the researcher views as samples that represent the true characteristics of a given population on the average to answer research questions most effectively (Seif et al., 2016).

Therefore, a non-probability sampling method was used to identify the sampling size of this research. Using a purposive sampling, the interviews were centered on how climate change impacts affect residents of coastal communities in the Commonwealth District, and the significance of the sustainable management of the natural habitats; considering the practice of different adaptation and mitigation measures against the adverse impacts of climate variabilities in the study area. The investigation further dived into inquiry of the importance of biodiversity conservation including ecological restorations of the study area. In addition to the three experts' opinions, this research incorporated female heads including a gender focus-person for psychosocial services in a cross-section discussion with different perspectives impacts of climate change affecting women and children.

This paper investigated the adaptive strategies practiced by residents when responding to the adverse impacts of climate change, and obstacles that repel the adaptive strategies for coping measures against the negative impacts of climate variations when responding to climate change variability. Chapter four of this paper incorporated previous literature relevant to the analysis and interpretation of data. This research work used a descriptive survey design to evaluate objectives. A descriptive survey design was used because it generates data through questionnaires and interviews, which are features of the survey conducted for this paper.

➢ *Method of Data Analysis*

- *Climate Data*

Climate data sets analyzed and interpreted in chapter four were determined by how respondents perceive long-term changes in climatic variables including temperatures, precipitations, using frequencies, percentages, and adaptation approaches against impacts of climate change. One important tool for understanding the Earth's climate is statistical descriptive analysis, which is a set of techniques used to summarize, describe and make sense of large sets of data. These techniques help to identify patterns, trends and relationships in data, which can be used to understand how the climate is changing, (Istanto, 2023). In this research, the data were coded analyzed through Statistical Package for Social Science (SPSS).

- *Questionnaire Design*

This research is inclusive of Open-ended questions that have measurable results. This method of research was used to collect numerical data that have been analyzed and interpreted to help draw the study's conclusions. A self-designed questionnaire forms were developed to conduct the research interview of 150 participants.

- *Data Management and Quality Control*

All respondents surveyed, voluntarily participated in this research, free from any coercion or undue influence, and their rights, dignity and autonomy were well respected and appropriately protected. According to Drolet & Girard (2023), to ensure rich and most complete representation of perceptions, researchers must seek the views of participants with varied complementary characteristics with regard to their social roles they occupy in the research practice. For ethical consideration, this paper also acknowledged that the interview process of participants was conducted in a form and manner that ensured informed-consent of participants and the avoidance of coercion, using nonjudgmental and non-denigrating languages. This research also considered key among ethical elements, the followings: credibility, interpersonal relationships, clear expectations, honesty, integrity, and fraternization. In conclusion of the process, a debriefing section for feedbacks and thank-you remarks were also considered.

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CHAPTER FOUR
RESULTS PRESENTATION AND DISCUSSION

A. *Introduction*

This chapter describes and discusses data analyses. The analyses comprised of research findings derived from designed research questionnaire and in person interviews. The findings generated from interviews and surveys were interpreted and analyzed from SPSS as results presented in the forms of tables, line charts, bar charts and pie charts.

➢ *Results Presentation*

- *Demographic Characteristics*

Table 2 Demographic Characteristics of Respondents

Gender of Respondents		
Gender	Frequency	Percentage
Male	77	51.3%
Female	73	48.7%
Total	**150**	**100%**
Age of Respondents		
Age Range of Respondents	Frequency	Percentage
18----35 years	42	28.0%
36----52 years	78	52.0%
53 years and above	30	20.0%
Total	**150**	**100%**
Educational Level		
Level	**Frequency**	**Percentage**
College / University	20	13.3%
Secondary / Primary	85	56.7%
No Education	45	30.0%
Total	**150**	**100%**

Source: Field Survey, 2024

- *Years of Experience and Source of Livelihood*

Table 3 Respondents' years of Experience and Source of Livelihood

Respondents' Experience (Years of Stay) in Study Area		
Year of Stay	**Frequency**	**Percentage**
1---40 years	38	25.3%
41---60 years	82	54.7%
60 years and above	30	20.0%
Total	**150**	**100%**
Respondents' Main Source of Livelihood		
Source of Livelihood	**Frequency**	**Percentage**
Employment / Business	30	20.0%
Fishing /Farming	92	61.3%
Sand Mining / Charcoal Burning	28	18.7%
Total	**150**	**100%**

Source: Field Survey, 2024

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- *Cultivated Land Types for Agriculture by Households*

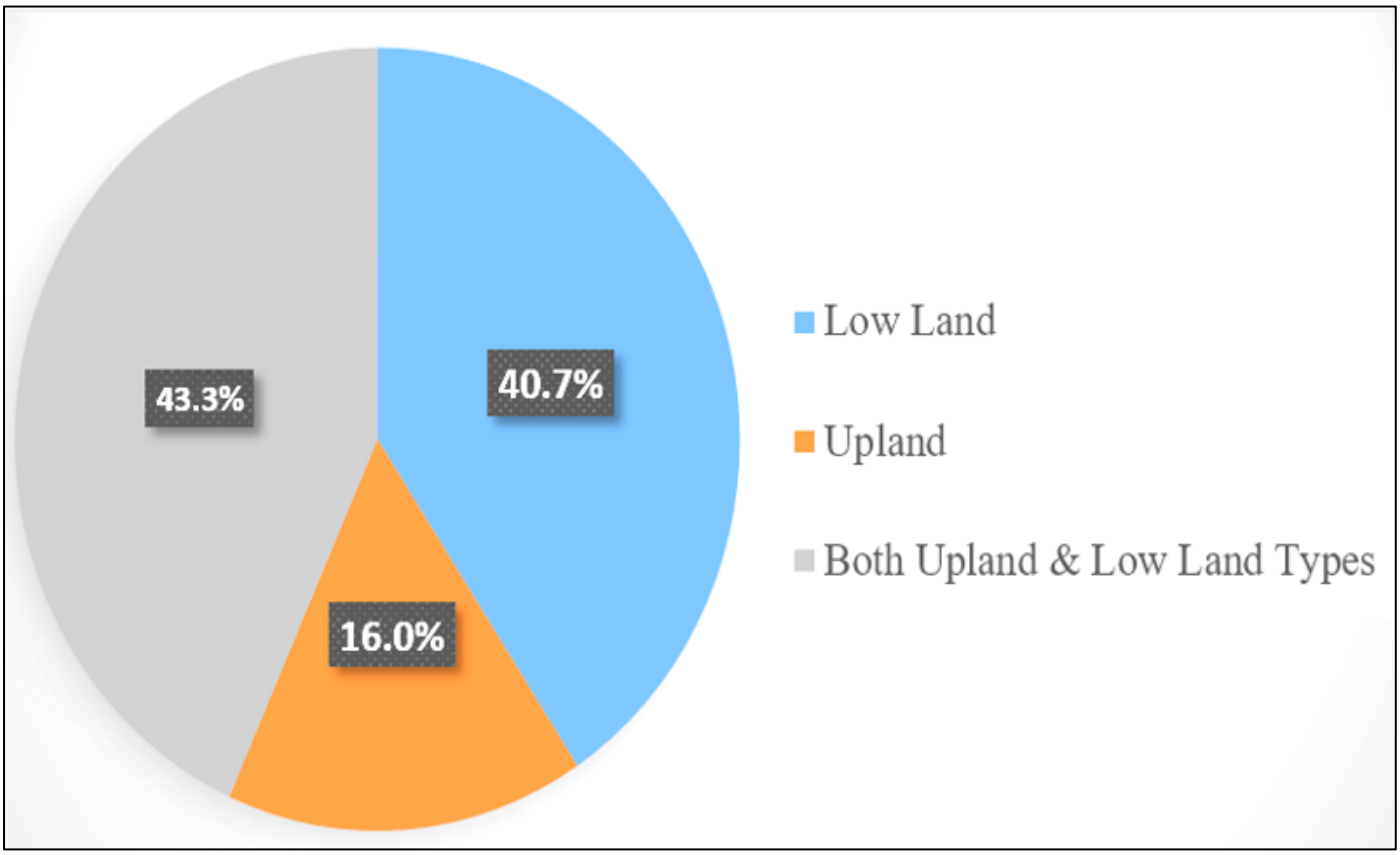

Fig 4 Types of Land Cultivated for Agriculture by Farmers
Source: Field Survey, 2024

- *Knowledge of Importance of Mangroves as a Natural Coastal Defense System*

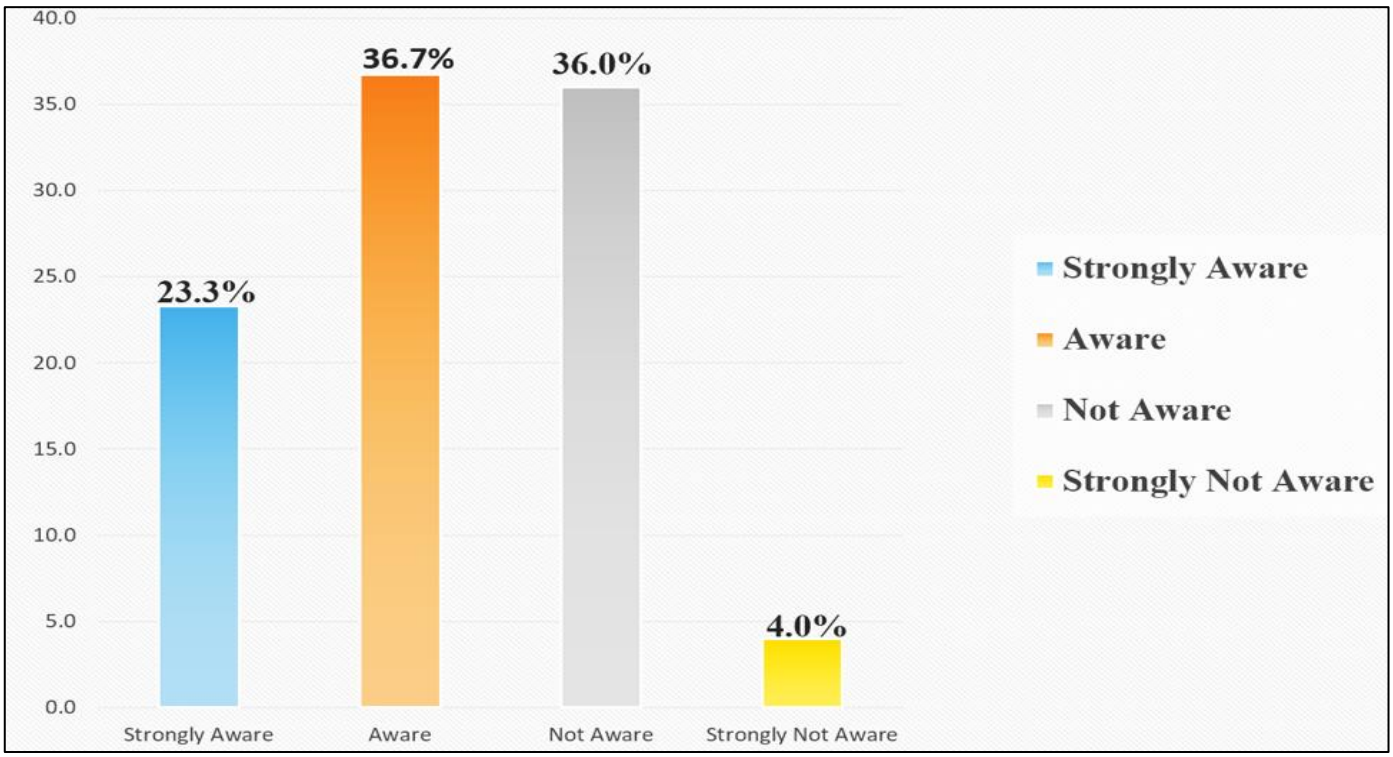

Fig 5 Respondents' Awareness of the Mangroves as a Natural Defence System
Source: Field Survey, 2024

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- *Perception about Benefits of the Green Vegetation (Trees)*

Table 4 Respondents' Perception about Benefits of the Green Vegetation (Trees)

Specific Benefits of the Green Vegetation (Trees)	Frequency	Percentage
Create coastal defense against erosions, tsunamis and floods	39	26.0%
Absorb storm wave energy	33	22.0%
Create environment for tourism	17	11.3%
Server as nursery habitats for small fishes, mollusks, crabs & shrimps	12	8.0%
Provide herbal medications for residents	39	26.0%
Provide no specific benefits	10	6.7%
Total	**150**	**100%**

Source: Field Survey, 2024

- *Lake Piso Multiple Use Reserve as a Protected Area in Liberia*

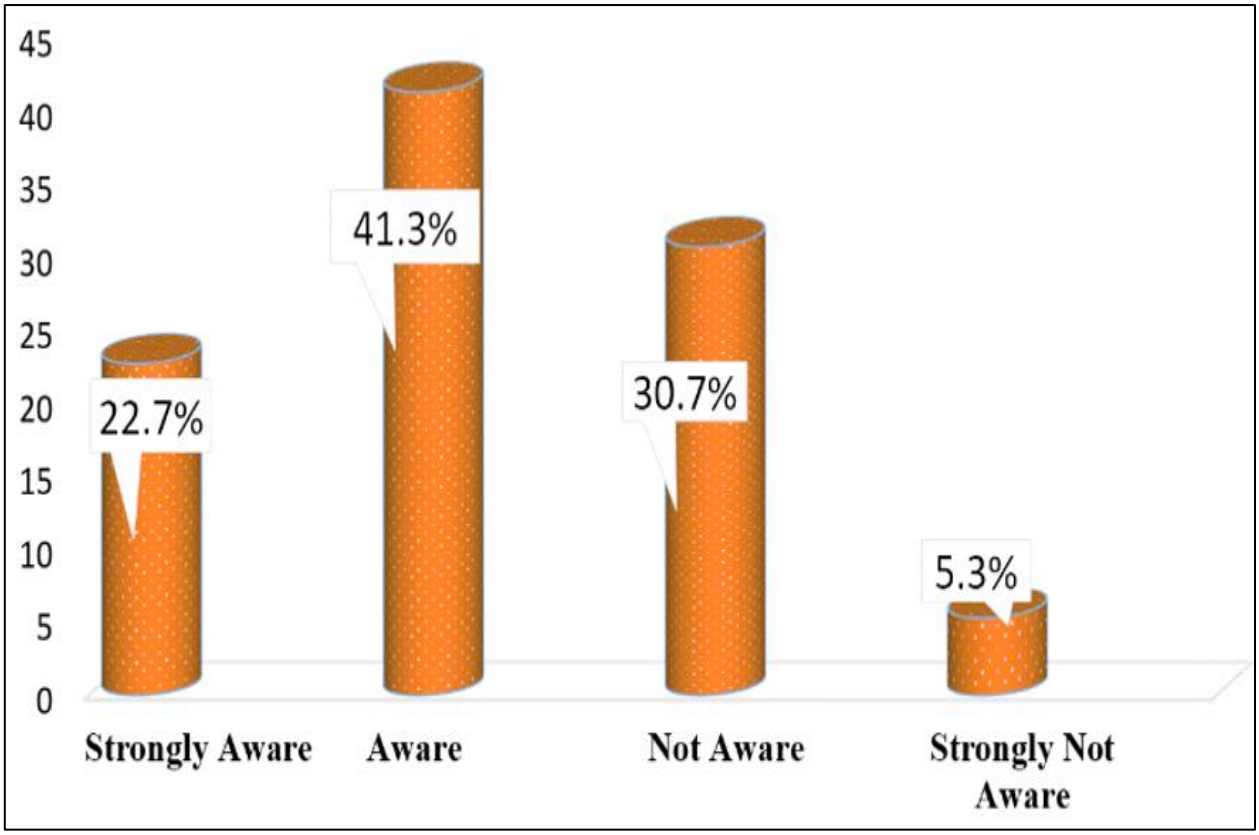

Fig 6 Awareness about Lake Piso Multiple Use Reserve as Protected Area in Liberia
Source: Field Survey, 2024

- *Most Prevalent Impacts of Climate Variation for the Last Five Years*

Table 5 Most Prevalent Climate Change Impacts for the last five Years in Study Area

Impacts of Climate Change	Frequency	Percent
Floods/Erosions	40	26.7%
Storm / volcanic devastations	34	22.7%
Loss of fish species / Soil Infertility to produce Crops	44	29.3%
Pests / Drought Encroachments	6	4%
Landslides/ Wildfires	20	13.3%
Other Impacts	6	4.0%
Total	**150**	**100%**

Source: Field Survey, 2024

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- *Month with the Heaviest Rainfall during the Year*

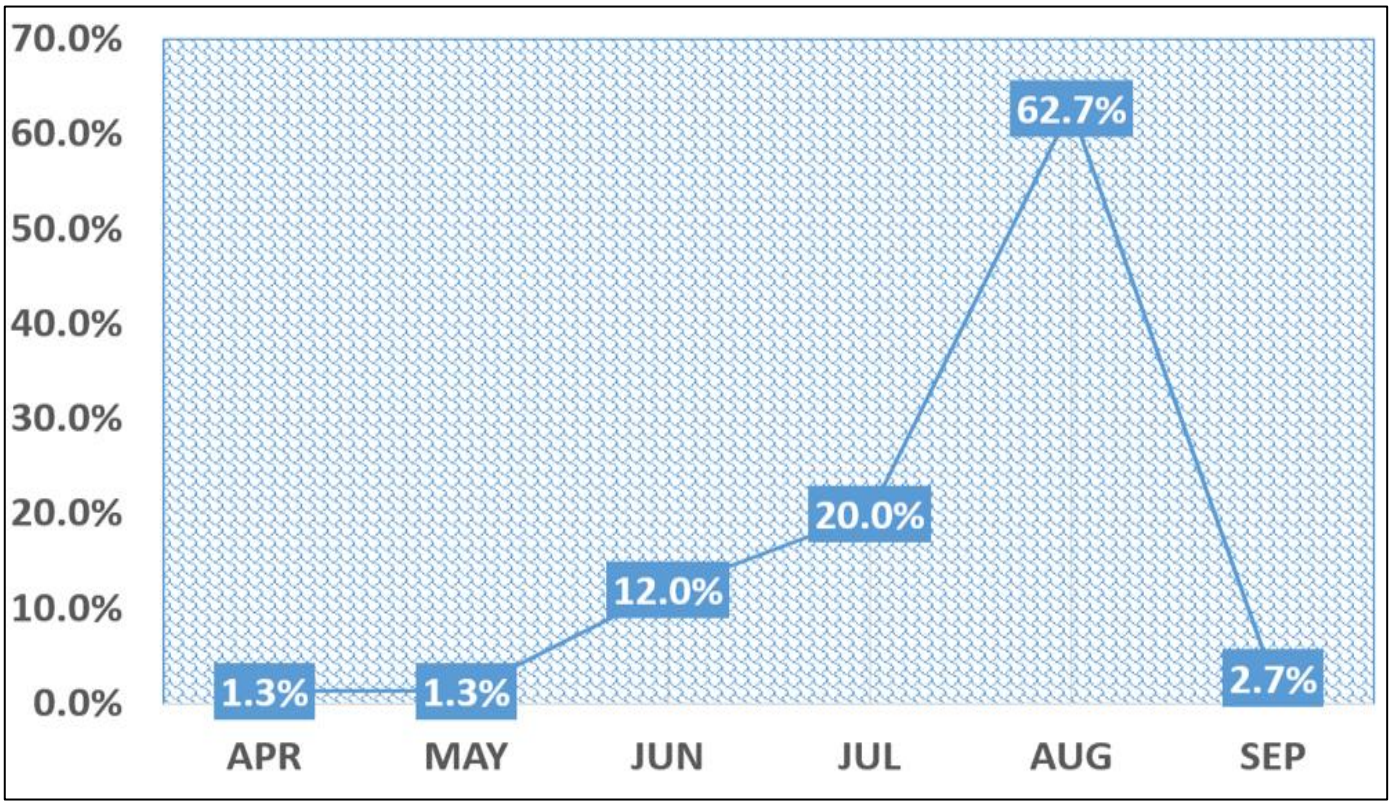

Fig 7 Month with the Heaviest Rainfall in the Commonwealth District
Source: Field Survey, 2024

- *Hottest Month of the Year in the Commonwealth District*

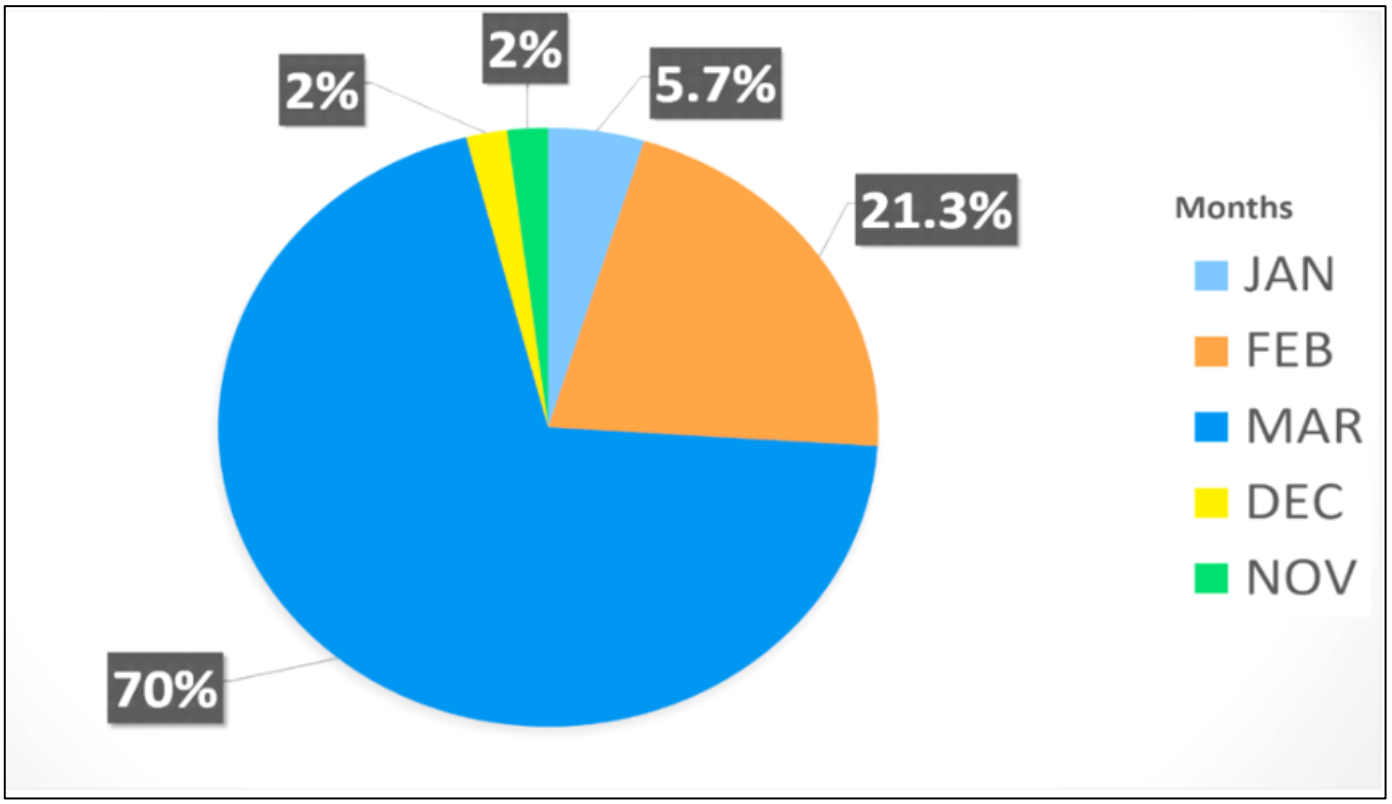

Fig 8 Respondents' Perceptions about the Hottest Month of the of the Year
Source: Field Survey, 2024

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- *Greatest Perceived Contributing Factors to Impacts of Climate Variation*

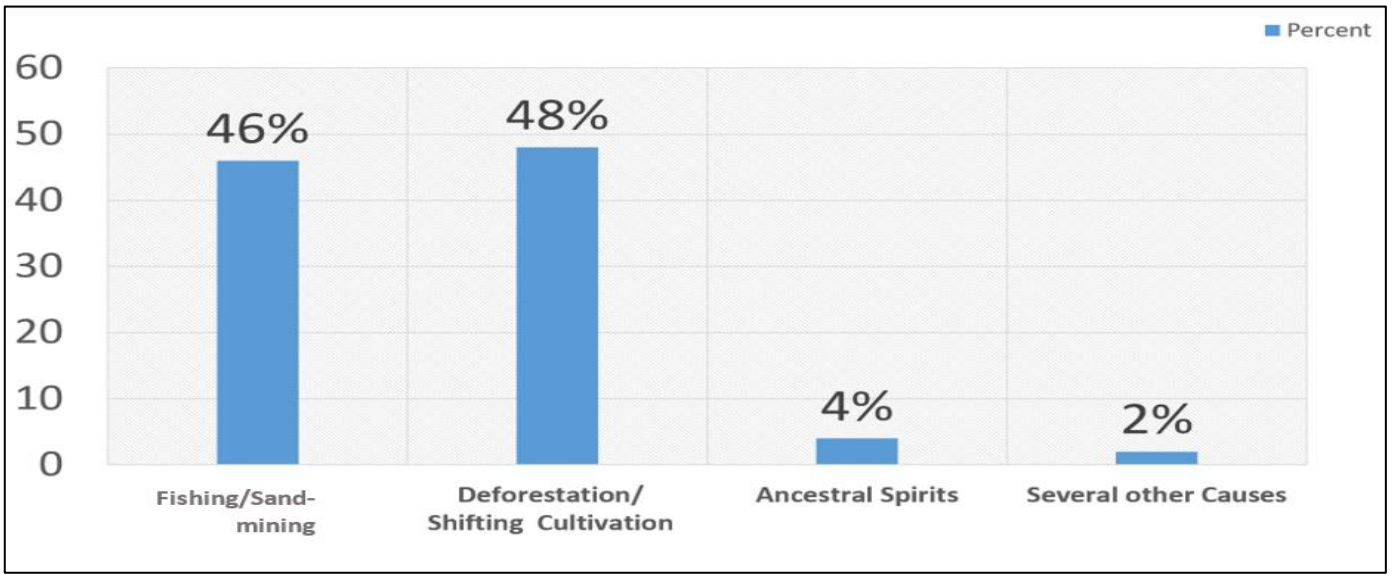

Fig 9 Greatest Perceived Contributing Factors to the Impacts of Climate Change
Source: Field Survey, 2024

- *Coping Measures to Negative Impacts of Climate Variation in the Study Area*

Table 6 Coping Measures to Negative Impacts of Climate Variation in the Study Area

Adaptation Strategies	Frequency	Percent
Raise public awareness	18	12.0%
Stop development on lands vulnerable to climate hazards	13	8.7%
Employ plans to efficiently and effectively respond to natural disasters in future	32	21.3%
Increase in financial incentives and avoidance of political criticism	37	24.7%
Adjust the professional skills of Labor in responding to new adaptation strategies	50	33.3%
Total	**150**	**100 %**

Source: Field Survey, 2024

- *Awareness about Tourism in the Commonwealth District*

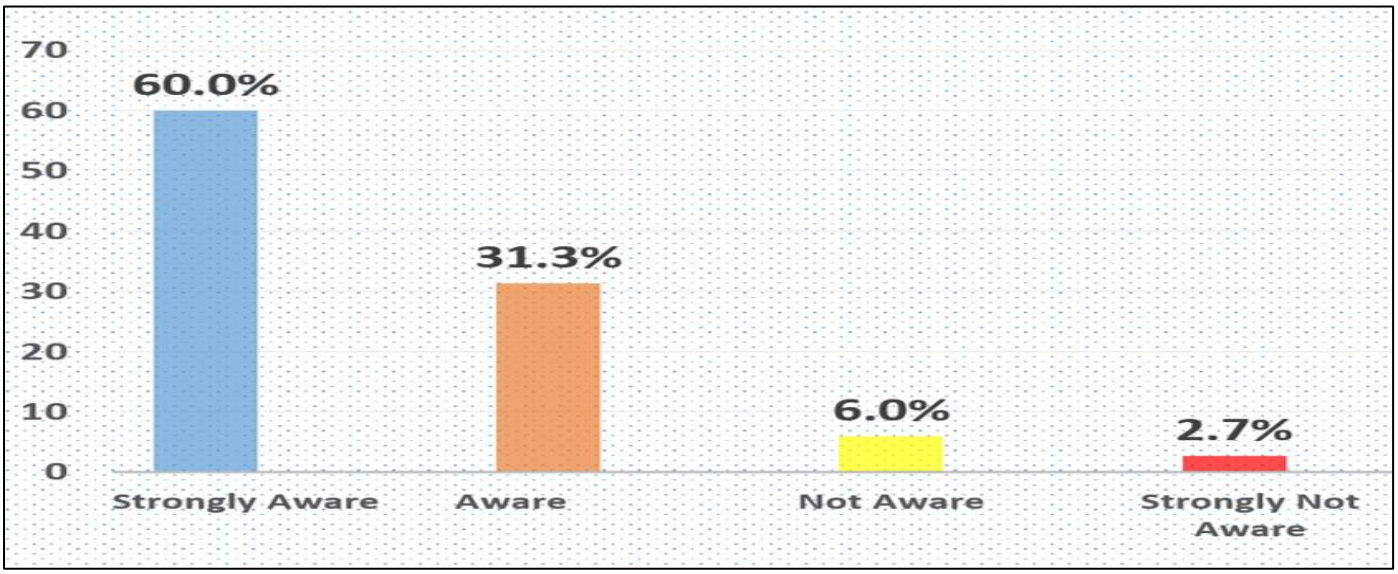

Fig 10 Respondents' Awareness about Tourism in Study Area
Source: Field Survey, 2024

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- *Government's Intervention to Regulate, Support and Promote Tourism*

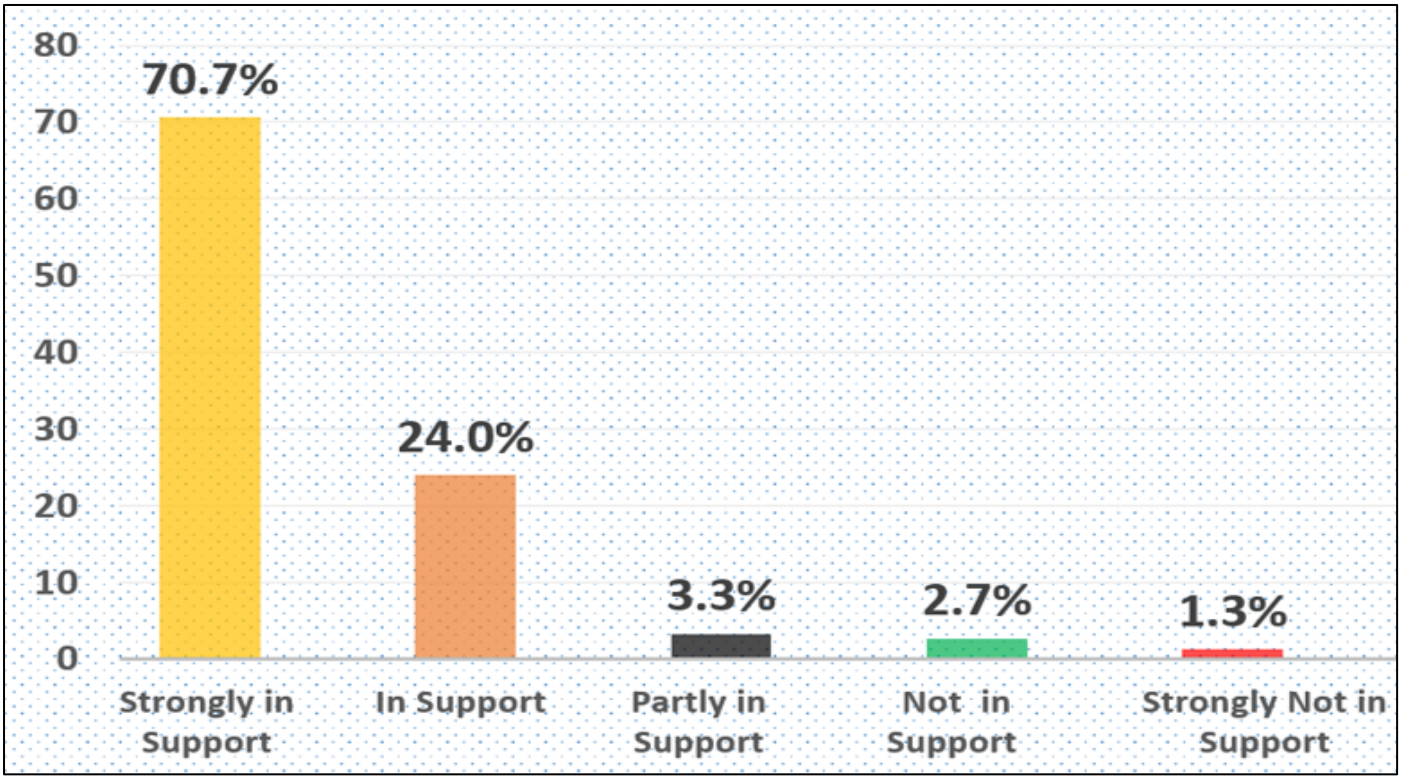

Fig 11 Respondents in support of National Governments to Intervene in Tourism
Source: Field Survey, 2024

- *Suitability of Robertsport for Sustainable Tourism*

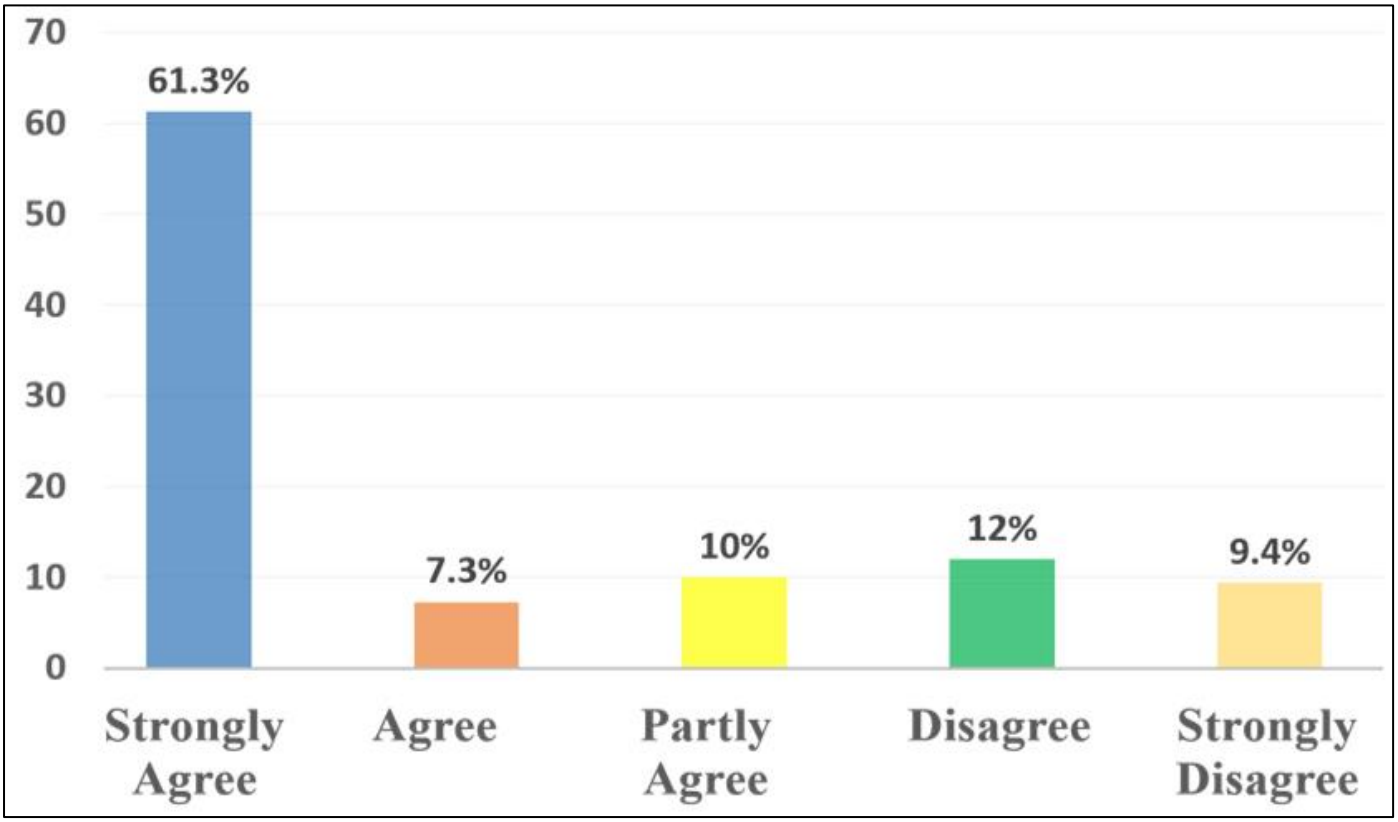

Fig 12 Suitability of Robertsport for Sustainable Tourism
Source: Field Survey, 2024

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- *Tourism Activities Currently Practiced in the Commonwealth District*

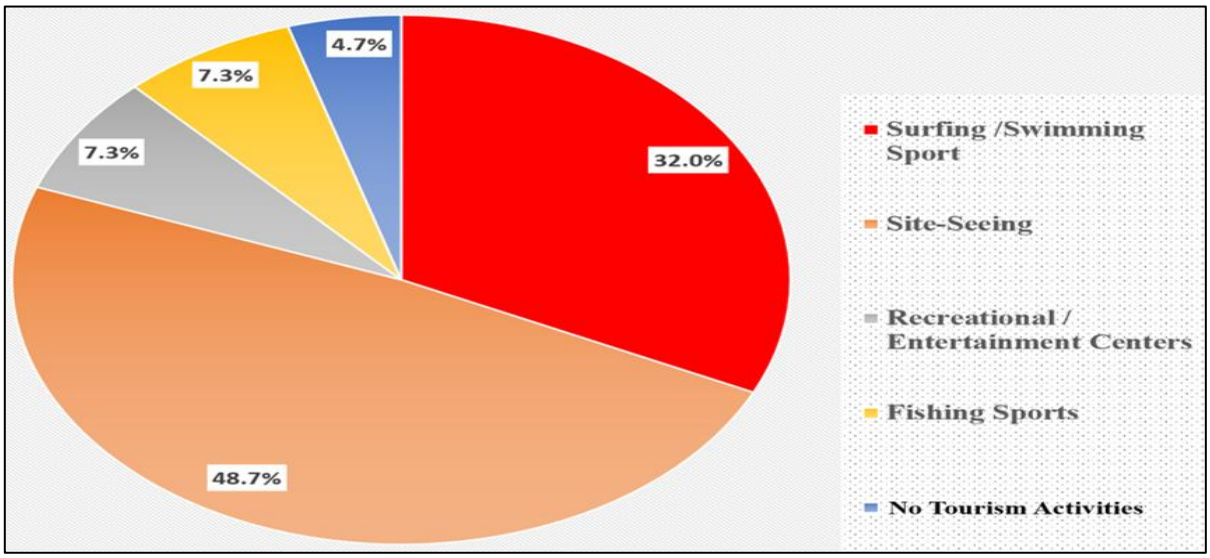

Fig 13 Type of Tourism Activities Currently Practiced in the Study Area
Source: Field Survey, 2024

- *Perception of Benefits Accrued from Tourism in Study Area*

Table 7 Perception of Benefits accrued from Tourism in Study Area

Economic and Environmental Benefits of Tourism	Frequency	Percent
Improved conservation, preservation and promotes environmental sustainability	16	10.7%
Generates revenues for national government	20	13.3%
Stimulates investment & increases demand for goods and services	30	20.0%
Creates new jobs / reduces poverty	30	20.0%
Infrastructure development & social and cultural benefits	46	30.7%
Improve quality of life and social cohesion	8	5.3%
Total	**150**	**100%**

Source: Field Survey, 2024

- *Primary Challenges Faced with Tourism in the Commonwealth District*

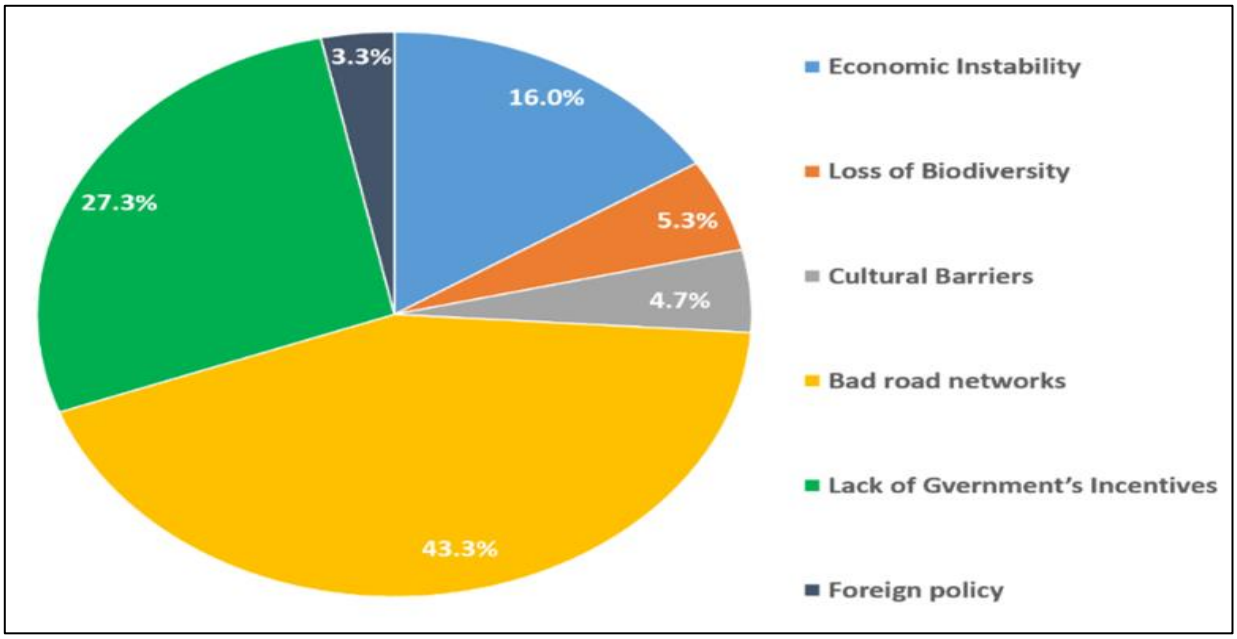

Fig 14 Challenges Currently Facing Tourism in Study Area
Source: Field Survey, 2024

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➢ *Discussion*

- *Demographic Characteristics*

The findings in Table 2 show distribution of respondents by gender and reveal that more than half 51.3% of the respondents were males, and 48.7% were females. Thus, vulnerability to climate change particularly among women and children has now been established with 48.7% of participants being females in the research area, which represent close to half of the population in the area.

Additionally, data reveal that 52% of the respondents were between the ages of 36 and 53 years. As presented by the second class of age range, respondents within this age bracket are at the peak of their productive and economically active years of working age and could make decisions for growth and environmental sustainability in the best interest of society. This age range also have the ability to critique how successful the different measures against impacts of climate change can be sustained. Results in this section further present 28% of the respondents in the age range of 18 to 36 years, while 20% represents respondents who were above 53 years and were not actively involved with labor-intensive activities in the area. These findings suggest that majority (80%) of respondents who participated in the survey, that is the combined age ranges of respondents between 18-35 years and 36-52 years; 28% and 52% respectively, are the active labor force engaged in labor intensive activities including fishing, farming, sand-mining, business and charcoal burning activities in the Commonwealth District of Grand Cape Mount County.

Statistics further show that only 13.3% of the population on average, had obtained college education, 30% have had no formal education while 53.7% of the population are either going through primary schooling, or have gone through secondary education.

- *Years of Experience and Source of Livelihood*

Results in Table 3 establish that 20% of the population are elderly people who have permanently resided in the Commonwealth District for up to 60 years of stay and 54.7% have resided in the area for up to 40 years with greater experience in adapting to climate impacts in the area. The findings also reveal that only 25.3% of the respondents had stayed for up to 20 years with some experience related to climate variability and adaptation in the area. These findings inform us that respondents had good amount of experience to climate resilience, vulnerability, adaptation and mitigation approaches relative to their ages and years of stay in the study area.

Statistics also reveal that in order to meet up with demands for livelihood, 61.3% of the population are engaged in fishing and farming activities, 21.3% represents households who are formally employed or engaged in business, while 18.7% are involved in charcoal burning and sand-mining in the area. This informs us about how vulnerable households are to climate change impacts with 92 out of 150 respondents being involved in fishing and farming activities in the area.

- *Cultivated Land Types for Agriculture by Households*

Figure 2 shows that 40.7% of the respondents confirmed that they cultivate lowland, 16% said they use upland and 43.3% indicated they cultivate both upland and low land for agricultural and aquaculture. Thus, contrary to the demerits of the uplands, lowlands have gained importance in the food production cycles of Liberia. Liberia has many ideal lowlands (swamps) where erosion deposits the rich topsoil from the uplands, thus making the lowlands more fertile. One outstanding merit for lowlands is their increased and sustained productivity resulting from the many possible cycles of rice and other crops produce within the same area, once developed.

- *Knowledge of Importance of Mangroves as a Natural Coastal Defense System*

Figure 3 presents respondents' perceptions about the importance of the role played by the mangroves in coastal defense. Findings also show 36.7% of the respondents' acknowledgement that they are aware of the key roles the mangroves play in our environments, in term of coastal defense system, ecosystem services, biodiversity conservation, vulnerability and restoration practices. Acknowledging awareness on the importance of mangroves, 23.3% of the respondents agreed that they are strongly aware of the natural protections the mangroves offer. However, 36% of them said they are not aware of the coastal protection services these tree species provide for coastal settlements. Due to lack of awareness education to some people of the area, 4% of the respondents said they are strongly not aware of the important roles the mangroves serve against the adverse impacts of climate variability in coastal communities. This finding implies that majority, 60% consisting of 23.3% and 36.7% of the people in the Commonwealth District have knowledge of the importance of the mangrove species in coastal defense system, ecosystem services, biodiversity conservation, vulnerability and restoration practices.

- *Perception about Benefits of the Green Vegetation (Trees)*

Table 4 reveals that 26% of respondents consider some specific benefits of the green vegetation (trees) to their community as creating coastal defense against erosions, tsunamis and floods. Number of respondents who perceived that some of the specific benefit of trees include absorbing wave energy represents 22%, while 11.3% of the respondents said the trees create favorable environment for tourism. Additionally, 26% of respondents pointed out that the green vegetation provides herbal medication for residents and 8% indicated the benefits of trees along coastal communities include Serving nursery habitats for small fishes, mollusks, crabs & shrimps. However, only 6.7% viewed the green vegetation as providing no benefits to residents.

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This finding informs us that 93.3% of residents in the Commonwealth District know the significant benefits of the green environment in the area. These benefits are outlined in terms of creating coastal defense against erosions, tsunamis and floods, absorbing wave energy, creating favorable environment for tourism, providing herbal medication and Serving nursery habitats for small fishes, mollusks, crabs & shrimps; while only 6.7% of the residents perceived no benefits.

- *Lake Piso Multiple Use Reserve as a Protected Area in Liberia*

Figure 3 shows respondents' awareness about the protection of the Lake Piso wetlands. Finding revealed that 41.3% of respondents said they are aware of the protected area, 22.7% strongly confirmed awareness. However, 30.7% indicated that they are unaware of the area been protected environmentally, while 5.3% even show stronger unawareness about the protection of the area. These findings suggest that there is still a need of more awareness programs with evidence that 36% of residents in the area are still not aware of Lake Piso been a protected area in Liberia.

- *Most Prevalent Impacts of Climate Variation for the last five years*

Table 5 presents respondents' perception about the most prevalent climate change impacts in the commonwealth district for the last five years. Finding show that 26.7% of respondents perceived that floods/erosion account for the most prevalent impacts of climate change in the district, 22.7% attributed impacts to storm/volcanic devastations, 29.3% supposed that it leads to extinction of fish species or soil infertility to produce crops, while 13.3% ascribed the most prevalent impact to landslides and wildfires. Pests and drought encroachment was indicated by 4% of respondents and 4% outlined other factors being responsible for the most prevalent climate change impacts in the last five years within the region.

- *Month with the Heaviest Rainfall During the Year*

Figure 4 presents respondents' experience with the month holding record for the heaviest rainfall during the year in the Commonwealth District. Majority, 62.7% of respondents indicated the month of August as the month with the heaviest rainfall during the year. July holds the record for the month with the second highest rainfall received in the Commonwealth District per 20% of the respondents' view. Only 1.3% each of respondents said the month with the heaviest rainfall are April and May, while 12% and 2.7% of respondents considered June and September respectively for month with the heaviest rainfall during the year.

- *Hottest Month of the year in the Commonwealth District*

Figure 5 shows percentages of respondents' experience with the hottest month of the year in the Commonwealth District. More than half, 70% of the respondents inidcated the month of March as the hottest month during the year.

However, 21.3% of the respondents considered Februray, while 5.7% indicated January being the hottest month of the year. Only 2% of respondents indicated each for the months of December and November as the month with most heat of the year. These findings suggest that residents in the Commonwealth District experience their hottest days in the month of March with 105 out of 150 respondents indicating March with the hottest days during the year. This result also suggeted that the trend of extreme heat starts from the month of February and extend significantly to the month of March with the hottest days of the year being experienced in the area.

- *Greatest Perceived Contributing Factors to Impacts of Climate Variation*

Figure 6 brings forth results from respondents' greatest perceived contributing factors to the impacts of climate change in the Commonwealth District. Findings from this figure show 48% of respondents indicating that they perceive deforestation and shifting cultivation as factors contributing more impacts of climate variability in the area, while 46% attributed cause of climate change impacts to fishing and sand-mining activities in the district. However, 4% of respondents believe that demolition of traditional sites which host ancestral spirits contribute to climate variability in the area, and 2% of the respondents indicated that several other contributing factors are responsible for changes in the climatic condition of the region. These result show that factors, including deforestation, shifting cultivation, fishing, and sand-mining contribute more impacts to climate variability in the area with majority, 48% and 46% of respondents attributing cause to these factors.

- *Coping Measures to Negative Impacts of Climate Variation*

Table 6 shows respondents' coping measures used to adjust to the adverse impacts of climate change in the Commonwealth District. Results from the table inform us that 33.3% of respondents reported they adjust their professional skills of labor in responding to new adaptation strategies, 24.7% said they would increase in financial incentives and avoid political criticism. Additionally, 21.3% of respondents indicated that they would employ plans to efficiently and effectively respond to future natural disasters, 12% of respondents said they would raise public awareness ahead of these unforeseen environmental natural disasters, while 8.7% opted that they would avoid development on lands vulnerable to climate hazards. Training programs in support of skills development for climate change adaptation tend to take a sectoral approach. Skills development is also an adaptation strategy because it helps displaced workers to move on to sectors where there is employment growth, thus protecting them against income losses and other adverse effects of climate change. A shortage of skills would in any case be an obstacle to the implementation of adaptation and mitigation measures in the area.

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- *Knowledge of Awareness about Tourism in the Commonwealth District*

Figure 7 shows respondents' perceptions about current on-going tourism activities in the Commonwealth District, more specifically in Robertsport. Findings show 60% of respondents strongly confirmed knowledge of awareness about tourism activities currently on-going in the area. Additionally, 31.3% of respondents said they are aware. However, 6% and 2.7% of respondents said they not aware and strongly not aware respectively. These finding suggest that majority of residents in the Commonwealth District are aware of tourism activities currently being practiced in the area.

- *Government's Intervention to Regulate, Support and Promote Tourism*

Figure 8 presents perceptions of respondents about National Government's intervention to regulate, support and promotion tourism in the Commonwealth District. Results show that 70.7% of respondents confirmed their strong support for government's intervention to regulate, support and promote sustainable tourism in the area; 24% of respondents assured their supports while 3.3% of respondents said they are partly in support. However, 2.7% and 1.3% of respondents expressing their disagreement of support that they are not in support and strongly not in support respectively. These finding suggest that majority, for 94.7% of residents in the region are in support to have national government intervened to support, regulate and promote sustainable tourism activities in the area.

Thus, tourism is recognized as an important driver of the local, regional and national economy of Liberia, and therefore is a central component of economic ambitions of all local authorities for various counties including Grand Cape Mount County in Liberia. Tourism plans, policies and development objectives are core elements of a country's development agenda. Authorities need to invest in tourism attractions and infrastructure, maintain public realm and environmental assets such as beaches, interpret local heritage and more importantly, mobilize a network of stakeholders, including agencies, community groups and the private sector to invest in and promote local tourist offerings most especially, in the Commonwealth District.

- *Suitability of Robertsport for Tourism*

Figure 9 shows residents' perceptions about Robertsport being environmentally, socially and economically a potential site for national and international tourism in Liberia. Findings revealed that 61.3% of respondents strongly agreed that the area is a good sited for tourism activities, 7.3% of respondents agreed while 10% partly agreed. However, 12% and 9.4% of respondents disagreed and strongly disagreed respectively. These findings conclude that majority, 68.6% of residents fully agreed that the region is most suitable for national and international tourism.

Known for its good waves, sandy white beaches, serene landscape and wonderful people, Robertsport has become home to many local surfers who have settled in search of new means. Robertsport, which is a three hours' drive from Monrovia, Liberia's Capital city, has blossomed into the prime surfing destination in the country that attracts both local and international tourists.

- *Tourism Activities currently practiced in the Commonwealth District*

Figure 10 presents respondents' acknowledgements about the types of tourism activities currently being practiced in the Commonwealth District. Results show 48.7% of respondents considered site-seeing for social and education purposes, 32% of respondents indicated watersports including surfing and swimming, 4.7% of respondents indicated that the area is attractive due to its recreational activities and entertainment centers, while 7.3% of respondents said fishing sports is another types of tourism activities on-going in the area. However, 7.3% of respondents said the area has no tourism activities on-going. These findings inform us that tourism activities including site-seeing for educational and social purposes, watersports including surfing, fishing and swimming with recreational and entertainment activities are currently being practiced in the area with 95.3% of respondents pointing to these activities current being practiced in the region for tourism.

One of the world's top water sports has now set the coastal communities of Robertsport on top of the game of tourism. Surf tourism has seen the birth of a budding business ecosystem in Robertsport. As it stands, the coastal town of Robertsport is racking in travelers from different parts of the globe primarily due to the tremendous growth of the water sports in the area. As a result of this growth, local businesses are experiencing considerable economic boom in term of marginal upticks of their business sales.

- *Perception of Benefits accrued from Tourism in Study Area*

Table 7 shows respondents' perceptions about benefits accrued from tourism in the Commonwealth District. Findings in the table revealed that 20% of respondents said tourism in the area creates new jobs, thereby alleviating poverty, 30.7% said tourism brings about new infrastructural development and integrates social and cultural benefits in the region, while another 20% said it stimulates investment & increases demand for goods and services and 10.7% said it improves conservation, preservation of biodiversity and promotes environmental sustainability while 13.7% indicated that tourism contributes to national revenues with 5.3% considering that it improves quality of life and social cohesion in the area. These findings suggest that there are huge economic, environmental and social benefits, ranging from new jobs creation through biodiversity conservation to infrastructural development in tourism investment in the District.

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- *Primary Challenges Faced with Tourism in the Commonwealth District*

Figure 11 presents respondents' perceived challenges as impediments currently facing tourism in the Commonwealth District. Respondents who considered bad road networks as challenge to tourism in the area comprised of 43.3%, and 27.3% of respondents comprised of those who pointed to lack of government's incentives as challenge to tourism in the district; while 16% of respondents indicated economic instability as a challenge to tourism activities in the region. Moreover, 5.3% of respondents indicated loss of biodiversity, 4.7% indicated cultural barriers and 3.3% pointed to lack of improvement in foreign policy to attract international tourists as challenges to sustainable tourism in the region. Overall result indicate that lack of government incentives and bad road network connectivity serve as the two most germane challenges to tourism in the area.

Despite the impact of tourism in Robertsport, it is not without its own challenges. While it's no secret that there are no uncertainties for surfing in the area, a sport dependent on the whims of the ocean, there is also a dearth of funding for local surfers and organizations. Access to surfing gears is also a mounting challenge to local surfers in the district.

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CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. *Introduction*

This chapter contains the summary, conclusions and recommendation of the research. It encompasses overall findings of the study.

➢ *Summary*

This research targeted five towns; Robertsport, Torso, Sembehum, Latia and Falie in the Commonwealth District of Grand Cape Mount County, Liberia. The study primarily placed focus on the perceptions of business people, farmers, fishermen, and households on how they perceive impacts of climate change and what adaptive approaches they practice in response to the adverse impacts of climate variability in the area. This paper further investigated impediments or barriers to the implementation of coping strategies as climate resilient measures in response to the negative effects of climate change in the district. A sample size of 150 respondents was used to generate data through open-ended questionnaire forms. Using descriptive statistics in Statistical Package for Social Science (SPSS), field data were analyzed and discussed.

➢ *Conclusions of the Research*

At the inception, results from the data reveal that majority of the participants in the research area are within the age range of 36 and 53 years; constituting 52% of the total sample size. Participants in this age range are in their prime or active years of economic productivity in the area. Males participants dominated the sample size with just four respondents over female participants. Additionally, findings showed that most of the participants, 85 respondents constituting 56.7% have had primary or secondary education with one to forty years of experience residing in the area. Majority, 92 of the respondents comprising of 61.3% of residents are said to be involved in fishing and farming activities in the district. The results also showed that majority, 43.3% of farmers in the area cultivated both lowland and upland for farming purpose in the area. Additionally, findings revealed that majority, 60% consisting of 23.3% and 36.7% of the people in the Commonwealth District are aware of the importance of the mangrove species serving as a natural defense system, ecosystem services, biodiversity conservation, vulnerability and restoration practices. In addition, However, due to lack of education on awareness of protecting the environment, most especially for coastal communities, 37.3% of respondents confirmed their unawareness while 2.7% acknowledged even stronger unawareness of how significant the sand beaches provide natural defense system against sea erosion and flooding.

Likewise, findings suggest that there is still a need for more awareness programs in the area, with evidence that 36% of residents in the area are still not aware of Lake Piso been a protected area in Liberia. Moreover, 94% of the residents in the area agreed that a systematic control of how people build private and public infrastructures and proper management of the drainage system in their communities can help avoid flood events, subsidence and erosions.

Additionally, 118 respondents constituting 78.7% of participants identified events such as floods, erosions, storm devastations, loss of fish species and soil infertility as most prevalent climate change impacts for the last five years in the district. Statistics also indicated 81.3% of respondents acknowledging that their rights will not be violated if they are asked to stop accessing environmental resources unsustainably, including cutting down trees, mining sand along the coasts or building along drainage paths.

It is also estimated that there could be huge future impacts of climate variability due to changes in patterns of precipitations and temperature. Most of those surveyed, 76.7% of respondents projected adverse impacts of long-term changes in temperature to be high, or could exacerbate, triggering future occurrences of natural disasters in the area. Majority of farmers perceived an extensive reduction in precipitation (rainfall), which is considered as the major factor responsible for decline in crop productivity and reduction in catches of fish. Responses from this survey revealed that the month with the heaviest rainfall in the region is August, while the month of October is identified as the month with the heaviest thunderstorm and lightning effects. The month of March was considered by residents as the month with the most sunshine (solar radiation) in the district.

Moreover, most of the respondents identified support in training programs for enhancing developmental skills of residents with climate change adaptation approaches as key to environmental management and control. Residents in the area perceived investment training programs serve a major national priority, especially for displaced workers who move on to sectors where there is employment growth, thus protecting them against income losses and other adverse effects of climate change.

Shortage of skills would in any case serve as an impediment to the implementation of adaptation and mitigation measures in the area. Findings infer that there is a dare need for conservation of biodiversity, restoration of natural habitats with strong policy implementations and evaluations by government, stakeholders and residents of the district. Furthermore, the results also suggest a need for the construction of seawalls and drainage infrastructures in order to prevent potential dissipation of wave energy and avoid flash flooding, erosions and subsidence in the area.

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The application of desalinization technologies, followed by creation of irrigation system and the compulsory installations of rainwater tanks, represent the best adaptation measures in order to ensure the safety of fresh and drinking water supplied for residential utilities as indicated by 88.7% of respondents as best adaptation practices.

Majority of residents in the region are aware of Robertsport being environmentally, socially and economically a potential site for national and international tourism in Liberia with current on-going tourism activities in the district. Also, most of the residents are in strong support of national government's intervention to regulate and promote sustainable tourism activities in the area.

Some expert respondents considered how factors including political interferences, lack of institutional and human resource capacity development on climate sensitive issues, local, national and international coordination on updated climate information and national government's involvement in working with local communities, stakeholders and experts in an effort to upgrade sustainable adaptation and mitigation techniques against long-term climate impacts on vulnerable communities

Finally, findings also identified tourism activities including site-seeing for educational and social purposes, watersports including surfing, fishing and swimming with recreational and entertainment activities are currently being practiced in the Commonwealth District with 95.3% of respondents pointing to these activities as currently being practiced in the region for tourism.

- *Recommendations*

To the Government of Liberia, national and international climate related institutions, environmental experts, academic institutions, local and international donor partners, local community leaders, stakeholders and individual households, this paper recommends the followings:

- Introduce early warning systems, provide climate insurance schemes to protect affected victims, build seawalls and regulate construction of private and public infrastructure developments in order to avoid future potential risks of flood events.
- Equip the agricultural sector with climate resilient technologies, introduce planting of crops that are resilient to climate impacts, changing planting dates, planting varieties of crops that are heat-tolerant and drought-resistant and provide irrigation systems against poor water conservation and harvesting in order to increase the productive capacity of crops and expand output for wider domestic income streams.
- Provide road network connectivity, for both farm-to market and for international movements; in order to encourage sustainable adaptation and mitigation efforts and promote national and international sustainable tourism practices in Liberia.
- Introduce technical research-based programs which will enable accurate database informed decision-making practices; most especially in approaching delicate unforeseen cases of climate impacts in the region.
- Ensure timely provision of subsidies as direct benefits to affected communities of climate change impacts, including relocation and resettlement packages with more emphasis on gender-based recognition, especially when women and children are the most victimized during events of natural disasters, such as flooding, storm devastations among others.
- Set guidelines to stainable economic activities including sand mining, fishing, farming and introduce reforestation practices that will balance economic and social rights to access environmental resources and rights to the protection of the environment in coastal communities of Liberia.

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APPENDIXES

A. *Appendix-A: Research Data Collection Instrument (Questionnaire)*

This questionnaire targeted five towns of the Commonwealth District in Grand Cape Mount County, with 60 respondents from Robertsport, 15 from Torso, 20 from Sembehum, 25 from Latia and 30 from Falie. A total of one hundred fifty (150) respondents from the five selected towns were interviewed on their perceptions on the impacts of climate change and adaptation strategies. It was due to the population size of the selected towns, that the above targeted numbers of respondents were chosen from each town. Additionally, considering gender balance and social equity, one women head and one youth head from each town was interviewed and they were asked to complete several questionnaires on their experiences of climate change in their communities. Data were collected based on respondents' perceptions on the impacts of Climate Change and variables responsible for impediments to adaptation measures.

➢ *Section One*

- *Demographic Characteristics of Respondents*

Gender	Female	=2	Male	=1		
Age	Age 18-35	=2	36-52	=1	53 above	=0
Educational Level	College /University	=2	Secondary / Primary Level	=1	No Education	=0
Years of Stay	1-40 years	=2	41-60 years	=1	61 years and above	=0
Main Source of Livelihood	Employment / Business	=2	Fishing /Farming	=1	Sand Mining / Charcoal Burning	=0
Cultivated Land Type	Lowland	=2	Upland	=1	Both Lowland and Upland	= 0

➢ *Section Two*

- *Respondents' Perceptions about Biodiversity Conservation and Restoration Against Climate Change*

1. *Are you aware that mangrove ecosystems play key roles in our environments, in term of coastal defense system, ecosystem services, biodiversity conservation, vulnerability and restoration practices?*

Strongly Aware	Aware	Not Aware	Strongly Not Aware
= 3	= 2	= 1	= 0

2. *What would you consider as some specific benefits of the green vegetation (trees) to your community?*

Create coastal defense against erosions, tsunamis and floods	Absorb storm wave energy	Create environment for tourism	Server as nursery habitats for small fishes, mollusks, crabs & shrimps	Provide herbal medications for residents	Provide no specific benefits
= 5	= 4	= 3	= 2	= 1	= 0

3. *Are you aware that the Lake Piso wetlands have been declared by law as world protected area and thus, it becomes our responsibility to conserve and restore said habitats then protect its sustainability for current and future generation?*

Strongly Aware	Aware	Not Aware	Strongly Not Aware
= 3	= 2	= 1	= 0

4. *Which one of the following climate change impacts is most prevalent in the last five years in your community?*

Floods/Erosions	Storm / volcanoes devastations	Loss of fish species / soil infertility to produce crops	Pests / Drought encroachments	Landslides/ Wide fires	Other Impacts
= 5	= 4	= 3	= 2	= 1	= 0

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5. *Which of the following months would you consider the hottest month during the year in your community?*

JAN	FEB	MAR	NOV	DEC
= 4	= 3	= 2	= 1	= 0

6. *What do you perceive as the greatest contributing factor to climate change in your community?*

Fishing / Sand- Mining	Deforestation/ Shifting Cultivation	Ancestral Spirits	Several other Causes
= 3	= 2	= 1	= 0

➢ *Section Three*

- *Respondents' Adaptation Strategies used to Adjust to the Impacts of Climate Change*

7. *Which of the following coping measures do you practice in adjusting to the adverse impact of climate change?*

Raise public awareness	Stop development on lands vulnerable to climate hazards	Employ plans to efficiently and effectively respond to natural disasters in future	Increase in financial incentives and avoidance of political criticism	Adjust the professional skills of Labor in responding to new adaptation strategies
= 4	= 3	= 2	= 1	= 0

8. *Which one of the followings best describes support(s) you currently receive from government and/or partners to help you adapt to climate change in the Commonwealth District?*

Subsidies in Financial and material Supports	Supply of Fishing equipment or farm inputs	Human resource capacity building	Environmental policy implementation and monitoring	Provision of health facilities and farm-to-market road connectivity	No support
= 5	= 4	= 3	= 2	= 1	= 0

➢ *Section Four:*

- *Respondents' Perceptions about Tourism in the Commonwealth District and the Associated Challenges to Economic Growth*

9. *Are you aware of tourism activities currently ongoing in Robertsport?*

Strongly Aware	Aware	Not Aware	Strongly not Aware
= 3	= 2	= 1	=0

10. *Do you support national government's intervention to support and promote tourism in the Commonwealth District?*

Strongly in support	In support	Partly in support	Not in support	Strongly not in support
= 4	= 3	= 2	= 1	= 0

11. *Do you agree that Robertsport represents a good site for tourism in Liberia?*

Strongly Aware	Aware	Not Aware	Strongly not Aware
= 3	= 2	= 1	=0

12. *Which type (s) of tourism activities is/are currently being practiced in the Commonwealth District?*

Surfing /Swimming Sport	Site-Seeing	Recreational / Entertainment Centers	Fishing Sports	No Tourism Activities
= 4	= 3	= 2	= 1	= 0

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13. *Which of the followings best describe economic benefits associated with tourism in the Commonwealth District?*

Improved conservation, preservation and promotes environmental sustainability	Generates revenues for national government	Stimulates investment & increases demand for goods and services	Creates new jobs / reduces poverty	Infrastructure development & social and cultural benefits	Improve quality of life and social cohesion
= 5	= 4	= 3	= 2	= 1	= 0

14. *What would you describe as primary challenge to tourism in the Commonwealth District?*

Economic Instability	Loss of Biodiversity	Cultural Barriers	Bad Road Networks	Lack of Government's Incentives	Foreign policy
= 5	= 4	= 3	= 2	= 1	= 0

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Appendix –B
Photos from Field Survey

Researcher in a special interview with the Grand Cape Mount County Gender Focus Person for Psychosocial Services in Robertsport during Field Survey

Source: Survey Field Visit, 2024

A pictorial view of Lake Piso (The Fisherman's Lake) in the Commonwealth District of Grand Cape Mount County

Source: Survey Field Visit, 2024