

Dynamics of Communicable and non-communicable Health Shocks in the Campo Ma'an National Park: Implications on Natural Resources Dependent Livelihoods

Abstract

Issues of health shocks continue to gain traction across scientific discourses especially over the past few decades, with severe impacts on livelihoods and well-being across the globe especially in countries of sub-Saharan Africa. However, the relative absence of a comparative analysis of communicable and non-communicable diseases and their implications on natural resources dependent communities calls for scientific attention especially in the context of the communities of the Campo Ma'an National Park. This study sought to identify the types and determinants of health shock dynamics, analyze their implications on resources dependent communities of the Campo Ma'an National Park, as well as analyze the socio-demographic characteristics of the Campo Ma'an National Park communities. To obtain this objective, Key informant interview (n= 6), expert interview (n= 4) and a survey of natural resources dependent household (n=200) were conducted to generated relevant data in the Campo Ma'an landscape. The results indicate that health shock dynamics are determined more by socio-demographic factors, followed by ecological and economic factors. Also, communities and individuals experienced serious illness/death of people, job loss, and slowdown in economic development, poverty and hunger due to the effect of communicable and non-communicable diseases in the region. This analysis established an increase in the number of households affected by health shocks over the past five years. Moreover, a significant proportion of the population of the landscape were engaged in livelihood diversification, others engaged in livelihood intensification and others, it was business as usual. The logistic regression disclosed gender, education, age, income, occupation, proximity to park, as the variables that significantly predict livelihood implications during health shocks. Furthermore, the financial, social and physical capital base of households significantly contributed to livelihoods implications. Analysis reveals distinct patterns of risk factors across Malaria, COVID-19, and HIV/AIDS for communicable diseases. In terms of non-communicable diseases the comparative analysis reveals distinct patterns of risk factors across Cancer, Heart Disease, and Hypertension, highlighting the complex nature of non-communicable disease epidemiology. While this paper provides fresh evidence to inform the vulnerability dimension of the sustainable livelihoods framework, it further calls for policy intervention to build health shock resilient livelihood strategies and severity in and around the Campo Ma'an National Park.

Keywords: communicable disease, non-communicable disease, natural resources, households.

1. Introduction

1.1 Dynamics of Communicable and non-communicable Health Shocks

Issues of global health security have gained international concerns and pertinence as the world's populations, recently, are more exposed to imminent threats from the emergence and re-emergence of infectious and chronic diseases (Mackenzie et al., 2013; Kuuwil et al., 2022; Lederberg, et al.,1992). The continuous and increasing dependence on natural resources especially forests leads to its transformation, a daunting challenge that has been documented extensively as a significant determinant for the spread of several zoonotic diseases especially Ebola and Covid-19 (Acquaah et al 2024; Gile-Vernick and Rupp, 2012). These exert significant impacts on the world economies and especially natural resources (Wang et al 2023; Nguyen et al 2021; Omotayo and Ogunniyi, 2024; Kim, 2021). The concept of diseases as well as the drivers of its emergence prime through microbial threat to human health, propagated through the consumption of bush meat as well as human – wildlife contact as

triggers of COVID 19 and Ebola virus (Acquaah et al 2024,). Drawing from the report of the Institute of Medicine's seminal 1992, diseases have the potential to cross the specie barrier between wildlife, humans and domestic animals, with over 70% of new emerging infectious diseases having origins in animal reservoirs (Mackenzie et al., 2013). Examples of these diseases have been documented by the institute of Medicine to include the H1N1 pandemic influenza virus, Nipah and Hendra viruses, the SARS coronavirus, avian influenza H5N1, Australian bat lyssavirus amongst others. This highlights the fact that there is a strong interconnection between the health of humans, animals and ecosystems (ibid). Contextually, these diseases are categorized as communicable and non-communicable diseases (Boutayeb, 2010; Ackland and Puska, 2003). Communicable diseases are caused by infectious agents such as bacteria, viruses, fungi, and parasites; examples, tuberculosis, malaria, hepatitis, HIV and AIDS, COVID-19, measles amongst others. Non – communicable diseases, on the other hand, are caused by non-infectious factors such as lifestyle, genetics, and environmental factors and include diseases like cardiovascular diseases, cancers, hypertension, blindness, diabetes, and various others (WHO Africa region, 2024; Alam and Mahal, 2014) having an unprecedented impact across the globe (WHO, 2023). An adequate and rapid respond to zoonotic diseases requires a holistic approach through effective coordination, collaboration, multidisciplinary, and cross sectional approaches especially at the human-animal-environment interfaces. This approach has been referred to as the 'One Health' which highlights the commonality of human and animal medicine and their interconnection with the environment, building bridges that interconnect health in the global world. Through the Manhattan Principles, there are priorities and interdisciplinary strategies for combating threats to human health on earth.

In the developed world, increasing intercontinental mobility has triggered an upsurge of communicable diseases to Europe, North America and other parts of the world, where they have been absent or confined for decades (United Nations, 2020; Rights and Resources Institute, 2020). For instance, measles epidemics in Iceland reveals the effects of changing conditions for diffusion, introduced from abroad, usually from Scandinavia or Britain (Rights and Resources Institute, 2020), with severe implications on households. Several efforts have been made to share responsibilities and the coordination of activities at the human- animal – ecosystem interfaces like the FAO-OIE-WHO collaborations, the world bank, Institute of Medicine, Asian Development Bank, Global risk forum amongst others, to tackle disease spread, transmission and possible treatment especially the H5N1 (Avian influenza). This has led to the formation of GLEWS (Global Early Warning System for Major Animal Diseases and zoonoses), providing intelligence for the identification and amelioration of human and animal disease through information sharing on diseases outbreaks, analysis of epidemiology and risks assessments. It is worthy to note that linkages underlying environmental and socio-economic determinants of emerging diseases and the risk of pandemic emergence is essentially fruitful for rapid detection and improved predictive abilities to manage diseases (Mackenzie et al 2013).

In developing countries, health shocks are triggered by various factors, for example in the Americas, decreasing investment in public health due to economic recession and less efficient public sector diverting resources meant for disease management to other needs. Also, increasing human population becoming urban, creating problems like poor sanitation and portable water arising from inadequate housing, and commercial activities putting pressure on natural resources especially forest. This exposes the population to agents of disease transmission and zoonotic diseases like arenavirus, yellow fever,, rabies transmitted through vampire bats. Human interventions tend to contribute to diseases in Peru leading to the spread of cholera. Also, deforestation and climate change are contributory factors (Pinheiro, 1996). Non-communicable diseases especially cardiovascular diseases are acknowledged as the primary determinant of death and disability with prospects of these diseases tripling in the nearest future especially ischemic heart disease as well as stroke in countries of Latin America (Pramparo et al 2007). Conversely, In southeast Asia, the extraction of natural resources are triggered by weather

shocks and market shocks, low education and limited access to power supply, which trigger health shocks (Nguyen et al 2021).

In Africa, Communicable diseases constitute a fundamental impediment to the human health and development in Africa (Rweyemamu, 2006). Tackling this challenge would prosper the continent's development. Others suggest the need for a step-change in approach or a quantum leap. The continent is acknowledged as having the heaviest burden of communicable diseases as a result of increasing urbanization, increase mobility of people, animals and agricultural produce, including aquaculture, increasing human wild and livestock contact as well as the impact of climate change on disease vectors. These diseases plunge the continent in a state of more future marginalization than the present. Ensuring a successful future for the African continent requires addressing the challenges posed by communicable diseases (Rweyemamu, 2006). Communities in several parts of Sub-Saharan Africa (SSA) host a significant proportion of global forest cover that supports about 80% of its population regarding natural resource use and livelihood sustenance (Kimengsi *et al.*, 2023). Heavy dependence and pressure on natural resources through international trade on natural products determine the prevalence of health shocks, especially in sub-Saharan Africa. This is grossly linked to poverty, market imperfections, and socio-ecological factors (WEF, 2023).

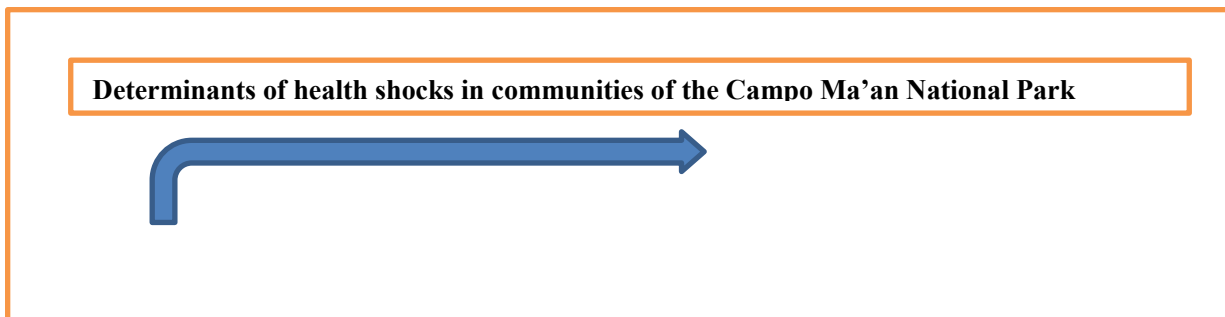
In Equatorial Africa, communicable and non-communicable diseases are triggered more by socio-economic factors like poverty, human-wildlife interaction, exposure to environmental hazards, hygiene and sanitation, migration and ecotourism (Giles-Vernick and Rupp, nd) with huge implications on individuals and communities (Dhanara, 2014; Walters *et al.*, 2021; Scottish government, 2021). For instance, in Ghana, it is reported that the Covid 19 pandemic caused over 1400 deaths, mostly income earners (Kuuwill *et al.*, 2022) and the rural people, many of whom are in the primary sector and associated employment and enterprise activities for their livelihoods, are vulnerable to the broad food system context created by the communicable diseases (*ibid.*).

In Cameroon, there have been great concerns especially in the context of communicable and non-communicable diseases over the past few decades (Brashares, 2006). Cameroon hosts over 30 protected areas which span across the country covering over 4.4 million hectares including the Campo Ma'an National Park (Tchouto *et al.*, 2006), highly exposed to health shocks such as malaria, sleeping sickness, tuberculosis, hepatitis and the COVID-19 pandemic (WWF, 2021). Malaria, HIV/AIDS, and tuberculosis, represent 23.66% of the Cameroon's morbidity burden (Ministry of Public Health, 2016). Studies argue that most communicable and non-communicable diseases originate from Cameroon's natural regions, such as Nature Reserves and National Parks (WWF, 2021), while others attribute increase in mortality to non-communicable diseases (NCD), notably cardiovascular conditions, cancers, mental diseases and traumas due to road accidents and behavioral patterns (Ajonina *et al.*, 2010). The communities around the Campo Ma'an National Park are natural resources dependent. That is, their livelihoods hinge on natural resources. With the occurrence of health related shocks, these livelihood systems seem to have been affected by the shocks. Currently, the emergence of communicable diseases or infectious disease (EID) like corona virus disease COVID-19, malaria and some neglected tropical diseases has reshaped the Campo communities with prospects of continuity. It appears that some livelihood activities in the Campo Ma'an National Park were suspended or communities decided to diversify further. Also, it appears some communities decided to intensify resources harvesting further. The extent, to which these livelihood strategies were distorted, altered or modified remains incomprehensive in terms of assets, strategies and outcomes. Additionally, there appears to be spatial variations in the changes that occur around these livelihood systems. Health shocks like the covid-19 pandemic, malaria are infectious diseases that spread over a wide geographical area affecting a significant proportion of the population. Despite their salience, micro-scale evidence on how these shocks (re)shapes the livelihood systems of natural resources communities in Campo Ma'an National Park is lacking. Also, very few studies have examined the role of health shocks in (re)shaping resources

systems (assets strategies and outcomes) and livelihood strategies (diversification, intensification or business as usual) especially on resources exploitation choices in Campo Ma'an National Park. The dearth of scientific knowledge of health shocks implications on resources based livelihoods systems in the Campo Ma'an national park, begs for scientific edification and policy integration.

Varied opinions exist on drivers of health shocks over space and time. Some findings attribute health shocks to human wildlife interactions, pathogens coming from animals or products of animals origin (Lederberg *et al* 1992; Mackenzie *et al* 2013; Oppong and Harold 2014; report on health technical and ministerial, (2016), others to variations in landscapes, interactions and migrations (Rights and Resources Institute, 2020). Nsabimana (2022) attributes health shocks to drought, floods, climate change, affecting natural resources and livelihoods. With these diverse perspectives, little is known about the main drivers of health shocks in natural resources dependent communities like the Campo Ma'an National Park. This motivates the study as shocks affects livelihoods systems in terms of access, use and management, inducing difficulty in obtaining food and other livelihoods. These however, require the use of sustainable health and livelihoods frameworks. Also, the extent to which livelihoods in the Campo Ma'an National Park are reshaped by health shocks remains incomprehensive. That is, whether it let to resources intensification, extensification or business as usual. Therefore an understanding of the potential to provoked in-depth continuous ramifications on the health and welfare of the populations' adjacent natural resources based areas such as the Campo national park is unclear. Biodiversity, human health and animal health in these areas have been greatly affected by the emergence and re-emergence of pandemics. The lack of integration between these three concepts triggers the spillover of zoonotic diseases, a critical challenge that requires convergence.

2. Conceptual framework



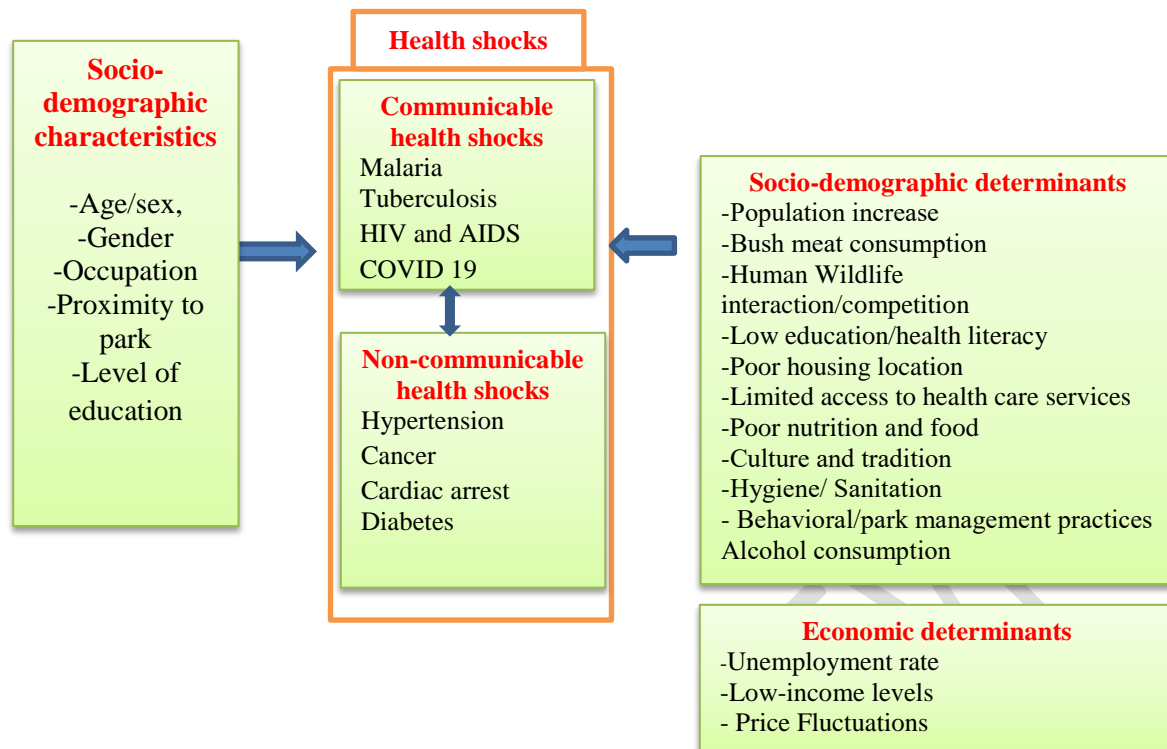


Figure 1. Framework on socio-ecological health perspective around the Campo Ma'an National Park (Adapted from DFID 2000, Ellis 2000, and IDRC 1994)

3. Materials and methods

3.1. Study area

The Campo Ma'an National Park is located on the South Cameroon plateau and constitutes part of Cameroon's coastal landscape (CMNP 2014). Its existence dates back to 1932, though it was officially declared a National Park through Decree No. 2000/004/PM of January 6, 2000, as compensation for the environmental damage of the Chad-Cameroon pipeline project covering a surface area of 264,064 ha. The park constitute an integral part of the first category's Technical Operational Unit (TOU). It falls between latitudes 2°10'-2°52' north of the Equator and longitudes 9°50'-10°54' east of the Greenwich Meridian. Its peripheral zone occupies the extreme southwest of the Republic of Cameroon. The area borders the Republic of Equatorial Guinea and the Atlantic Ocean. The landscape has attracted continuous attention at all scales, beginning with its appellation "Campo Fauna Reserve" in 1932 and the establishment of the Technical Operation Unit of Campo-Ma'an in 1999 (CMNP, 2014). The park falls within the forest belt of Cameroon involving selected villages like Campo beach, Akak, Nko'elon, Mvini, Nkwadjap, Mabiogo, Ebodje, Ebianemeyong, Akom II, Nieta II, and Nazareth, which constitute the context of the study based on their exposure to health shocks, the risk of Disease. The potential for Disease in these villages seems to be higher through contact with wildlife, trade and the consumption of dead and living species of animals (Wirsiy *et al*, 2021). Figure 1 presents the location of the Campo Ma'an National Park in the south region of Cameroon.

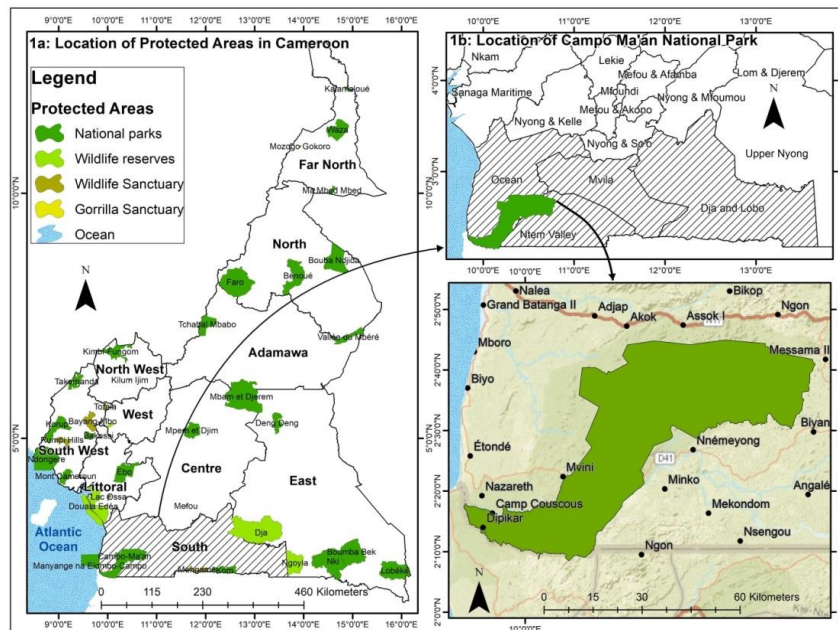


Figure 2. Location of Campo Ma'an National Park in Cameroon

3.2 Data collection, Data treatment and Analysis

Four instruments were designed to carry out the research namely, key informant interview guide (5 items), expert interview guide (4 items), a focused group discussion guide (4 items) and semi-structured questionnaire (n=200). These instruments were used to capture questions on household socio-demographic and economic characteristics. The key informant interview guide consisted of eight main questions focused on the identification of social and demographic characteristics of communities exposed to health shocks, issues of well-being, vulnerability to health shocks and links to natural resources with a focus on ethnic and livelihood differences. The next section of the interview guide captured the natural, human and economic determinants of health shocks (communicable and non-communicable diseases) in the resource landscape. This was preceded by mapping the health infrastructure and areas of intervention. For the expert interview guide, emphasis was laid on the typology of communicable and non-communicable diseases in communities of the Campo Ma'an National Park. Regarding focused group discussions, the seven questions revolved around participants' views on health shocks' contributions to socio-demographic changes and perceptions, which are linked to resource diversity, ethnic affiliations, and healthcare access. It equally captured perspectives on dealing with health shocks. These instruments were carefully reviewed and pilot tested (N= 6), and based on the feedback, the instruments were revised and translated into French. Before data collection, the data collection team explained the research objectives to the respondents, and they were assured the research objectives that the study was intended purely for academic purposes. Thus, the free prior informed consent of the respondents was sought, and participants were assured of confidentiality in their responses. In the four zones- Campo, Ma'an, Nieme and Akom II- villages were selected depending on their population size, proximity to the park and the risk of spreading diseases. Two field assistants were employed and trained to facilitate the data collection process. A field guide/translator was recruited to gain access to the communities and supported in the selection of respondents. Regarding key informant and expert interviews, 12 were conducted in the four communities. A purposive selection was employed, targeting traditional authorities, doctors, patients, foresters, hunters, fishermen, and farmers. The respondents were selected considering their length of stay in the communities. All respondents had lived in the communities for at least 8-10 years, and thus this period was considered sufficient enough for the respondents to respond to the determinants of health shocks in the communities. The interviews lasted between 40 and 50 minutes. The expert interviews were

conducted with civil society actors, health personnel, traditional healers, and state officials in forestry and agriculture. To further generate data, 6 focus group discussions were carried out with women groups, mixed groups, and youth groups in each zone. The focus groups ran between 50 to 60 minutes. Recorders were used to collect the data, and field notes supported the data acquisition process. Through the assistance of field guides/translators who were natives of the communities, it was easy to organize meetings with respondents as trust was easily established. The theme and objective of the research was explained to the participants and their consent was sought before recording the data. The instruments were designed and validated between October and November 2023, while the entire data collection process was accomplished between December 2023, January and August 2024.

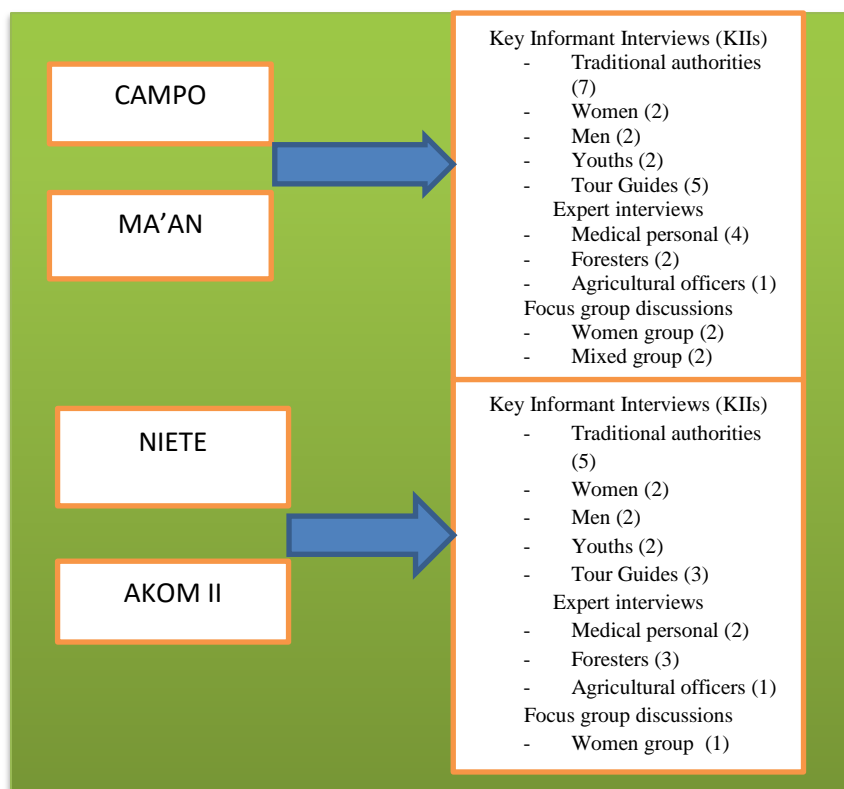


Figure 3. Data collection

A total of 200 households were randomly drawn from a box using raffle draws. This was to provide equal chances for sample representativeness and to obtain essential information. By this method, the total population of the selected villages from the four zones surrounding the Campo Ma'an National Park was obtained alongside the total number of households in the selected villages. In each community, more than 10% of the population in each community were sampled to ensure robustness and high explanatory power of the results. Based on the number of questionnaire (N=200), the percentage of questionnaires administered per village were obtained. This constituted the sampling unit. In addition, the numbers interviewed per community (N=12) were representative of the community through the total population of the communities.

Data collection was done mostly in the evening when most household members had returned from their job sites. A recall period of five years was established for the evolution of health shocks and 23 years for determinants of health shocks to minimize data inconsistency. The Spear Man Rank Correlation Coefficient was used to rank health shocks and socio-demographic characteristics of communities exposed to health shocks over the past five years.

Table 1. Study communities, population and sample selected

S/N	NAMES OF SELECTED VILLAGES	NUMBER OF HOUSEHOLDS	Households SAMPLED
1	Nkwadjap	20	10
2	Campo Beach	98	52
3	Nazareth	07	4
4	Ebodje	60	32
5	Ebianemeyong	30	16
6	Mabiogo	19	10
7	Mvini/Akak	24	13
8	Nkoelon	22	11
9	Niete (Nyamabande/Ngoek)	50	27
10	Ndageng (Akom II)	42	25
Total	12 villages	372 households	200 respondents

The quantitative data obtained through semi-structured household interviews were coded in the Statistical Package for Social Sciences SPSS version 20.

The Binary Logistic Regression Analysis was used and the model is given as:

$$\text{Logit}(P) = \ln\left(\frac{P}{1-P}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon \dots \dots \dots 1$$

In the model, P represents the dependent variable's probability where 1 denotes communicable diseases and 0 denotes non-communicable diseases. α is the constant term if all the independent variables are stationary. Further, β_1 represents the slope coefficient of the first independent variable X_1 . Similarly, $\beta_2 X_2$ represent the second slope coefficient and the second independent variable w . At the same time, β_n denotes the coefficient of the last independent variable X_n used in the model. At the same time, ε accounts for all possible factors that may likely influence the model but are not captured in the analysis.

Three separate models were tested (one for ecological determinants with 6 explanatory variables; one for human drivers with 11 explanatory variables and one for economic drivers with 3 explanatory variables), all following the Logit Model specification of equation 1. The results of the regression analysis have been presented in the Table 5.

Table 2. Socio-demographic characteristics of Campo Ma'an Communities and selected health shocks

Socio-demographic characteristics	selected communicable health shocks
Gender	COVID 19

Age/sex
 Proximity to park
 Education
Health shock determinants
 Pathogen presence
 Vector population
 Biodiversity loss
 Land use change
 Health system predictor
 Limited health facilities

HIV and AIDS
 Malaria
 Tuberculosis
selected non-communicable diseases
 Hypertension
 Cancer
 Heart disease
 Cardiac arrest

Qualitative data obtained through key informant interviews, expert interviews, and focused group discussions were transcribed. Codes and themes were assigned to the data and subsequently elaborated in narratives, such as the main categories and determinants of health shocks perceived over the past five years, their socio-demographic characteristics like income levels, proximity to the park, age and occupation were explored. The recorded data were transcribed and further translated in to English language. From the transcribed and translated interviews, the content that had health shock determinant elements stood as the relevant finding to guide initial coding. Data interpretation and transcription was facilitated through directed content analysis.

4. Results

4.1 Characteristics of the respondents

Table 3 shows that about 68.9% of the respondents were natives of the Campo Ma'an area, while 31.1% were migrants. Close to 59% of the respondents were household heads while 41% were family members representing their households. Also, 62% of the respondents were males, while 36.8% were females. In addition, 71% of household heads were males, while 28.9% were females. Regarding educational level, a greater proportion of the respondents, especially household heads, had no formal education. The majority of the respondents had aged between 31 to 60 years. Income analysis revealed that most respondents had incomes between 31,000FCFA and 90,000FCFA a month and live 1-3 km from to park. The sample in this study consists of respondents from various sectors, such as farming, hunting, NTFP collectors, fishermen, hunters, and bush meat traders.

Table 3. Socio-demographic characteristics of communities of Campo Ma'an National Park exposed to health shocks

Respondents' status		Gender of respondent		Gender of household head	
Household head	Family member	Male	Female	Male	Female
58.9%	41.1%	63.2%	36.8%	71.1%	28.9%
Literacy rate	No school	Primary	Secondary	Vocational	B.Sc. and above
Respondent	39.5%	18.9%	24.2%	12.1%	5.3%
Household head	33.7%	29.5%	21.6%	10%	5.3%
Age of respondents/years	20-30	31-40	41-50	51-60	60+
	17.4%	25.8%	26.8%	18.4%	11.6%
Income of respondents/FCFA	10,000-30,000	31,000-50,000	51000-70,000	71000-90,000	90,000 +
	19.5%	33.6%	19.5%	13.7%	13.7%
Proximity to park	<1km	1-2km	2-3km	4-5km	6+km
	26.8%	36.3%	24.2%	7.9%	4.8%
Main occupation	Farming	NTFPs collector		Fisher man	Hunter

	15.8%	20.5%	18.9%	13.7%
	Tour guide	Bush meat trader	Beach work	Plantation work
	4.2%	13.2%	9.5%	4.2%

Table 3 presents the socio-demographic characteristics of communities exposed to health shocks in the Campo Ma'an National Park communities. From the sample unit, 58.9% of the respondents were household heads, (of which 71% were males and 28.9% females). With regards to education, 39.5% of the respondents said they had no formal education. Moreover, 18.9% attained primary education, 24.2% attained secondary education, 12.1% attained vocational education and 5.3% had attained BSc or equivalent in the region. Figure 4 shows the level of scholarisation around the Campo Ma'an National Park. Furthermore, in terms of age of respondents, 17.4% were respondents between the ages 20-30 years, also, 25.8% were respondents between 31-40 years, 26.8% were respondents between 41-50 years, 18.4% were respondents between 51-60 years and 11.6% were respondents who were 60 years plus. In addition to income, 19.5% of the respondents earned between 10.000-30.000FCFA, while 33.6% of the respondents earned between 31.000 -50.000FCFA, also, 19.5% of the respondents earned between 51.000- 70.000FCFA, while 13.7% of the respondents earned between 71.000- 90.000. Lastly, 13.7% of the respondents earned from 90.000FCFA plus. In terms of proximity to the Campo Ma'an National Park, 26.8% of the respondents live less than 1km to the Park, while 36.3% of the respondents live between 1-2km to the park. Also, 24.2% live between 2-4km to the park, 7.9% of the respondents live between 4-5km to the park and 4.8% of the respondents live between 6km plus to the Campo Ma'an National Park. The risk of diseases spread within the Campo Ma'an region is a function of the socio-demographic characteristics of the communities of the park. Some communities experienced health shocks as a result of one or a combination of several socio-demographic characteristics of the region, which exposed single or several communities to the adverse effects of health shocks in the landscape.

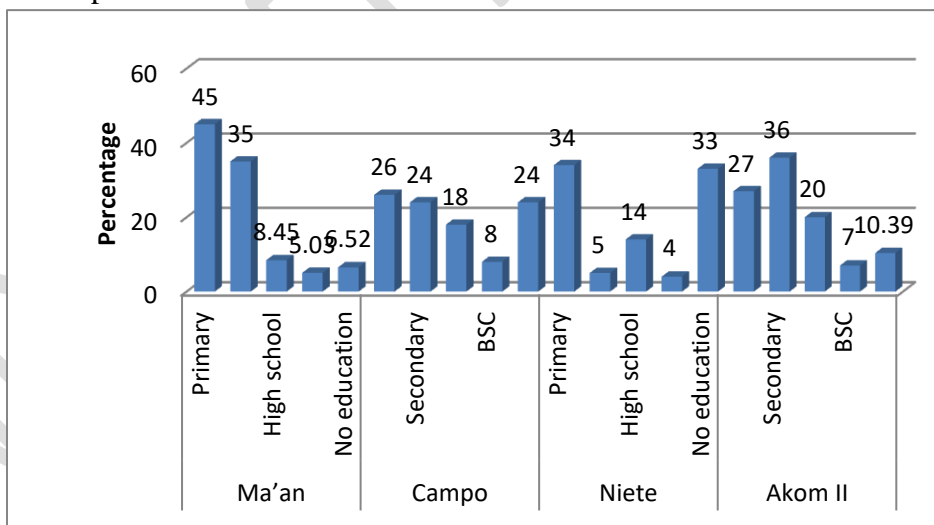


Figure 4. level of scholarisation around the Campo Ma'an National Park

The education levels in the Campo Ma'an landscape are mostly made up of primary education, with the highest percentage in the Ma'an area at 45%, and the lowest is the Campo area at 26%. Secondary education is predominantly in the Ma'an area at 35%, the lowest percentage is in the Niete area at 5%. The Akom II area has the highest percentage of high school education at 20%, the lowest at 8.45%. Regarding Bachelor's degrees or equivalent, the Campo area has the highest percentage at 8%, while Niete has the lowest at 4%. A significant proportion of the

population in the Campo Ma'an landscape is uneducated, with the highest percentage in the Nieta area at 33% and the lowest in the Ma'an area at 6.52%.

Communicable diseases are unevenly distributed around the Campo Ma'an National Park. While some communities are significantly affected by communicable health shocks, others are less affected. For instance, malaria significantly impacts the communities surrounding Campo Ma'an National Park in Cameroon more than other diseases. Non-communicable diseases also significantly impact the population of the Campo Ma'an National Park (CMNP). The most prevalent non-communicable diseases in this area are hypertension, rheumatism, cardiac arrest, rabies, heart disease, mental ailments, and blindness. Households face enormous economic challenges in managing and coping with health shocks in the region. Figure 5 presents the spatial distributions of communicable and non-communicable diseases in the Campo Ma'an National Park communities.

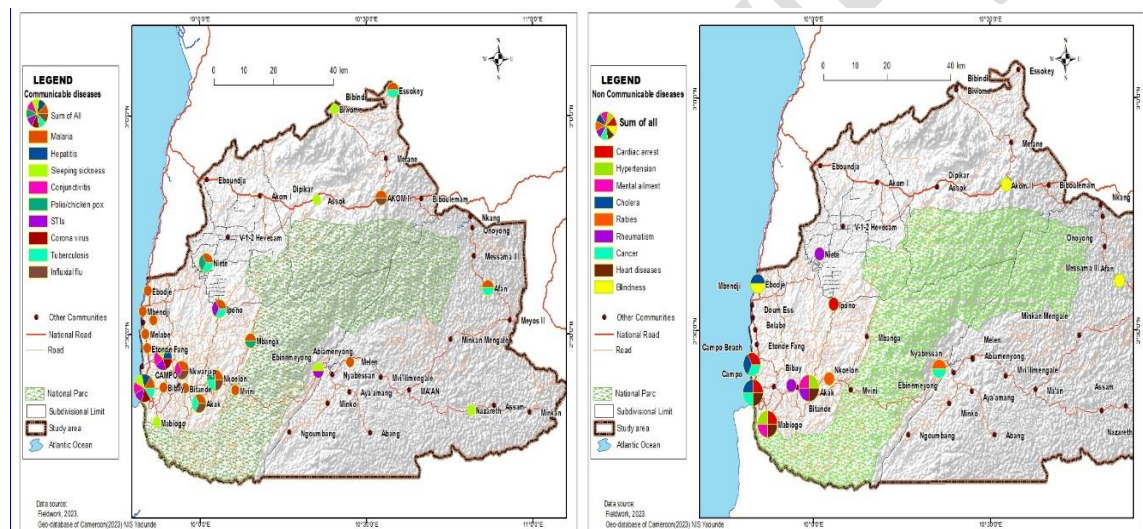


Figure 5 the spatial distribution of communicable and non-communicable diseases in the Campo Ma'an National Park communities.

4.2 Determinants of health shocks in communities of the Campo Ma'an National Park

Communities of the Campo Ma'an National Park were affected by communicable and non-communicable diseases. These diseases were triggered by ecological, socio-demographic and economic determinants.

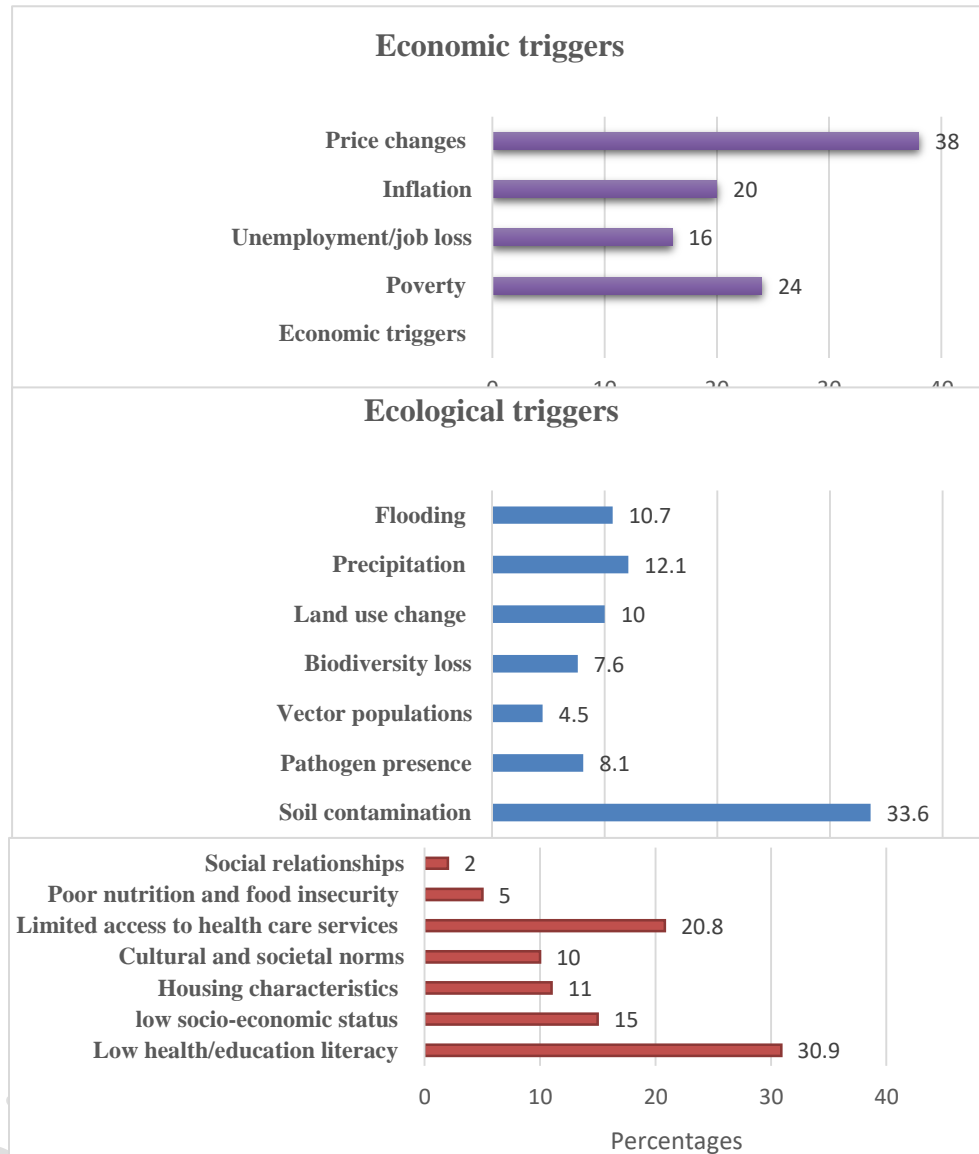


Figure 6. perceived triggers of health shocks in Campo Ma'an National Park communities

4.3 Ecological determinants

The ecological determinants of health shocks in communities of the Campo Ma'an National Park include the presence of pathogens, such as bacteria, viruses, protozoa, and fungi, in the landscape. In Campo Ma'an National Park, pathogens and vector-borne agents like mosquitoes and tsetse flies are present in water, forests, and land leading to the transmission of diseases. This exposes the population to lots of diseases. In an expert interview in Mabiogo, it was reported as follows:

“malaria is the most common communicable disease here. We also have diseases like hepatitis. For non-communicable diseases, we have prostate cancer, cardiovascular diseases and stroke. Mental illnesses are relatively rare”.

Another testimony from a focused group discussion in Ma'an area on disease prevalence in the Campo Ma'an National Park communities recounts that:

"we have a lot of diseases here. Some are influenced by natural phenomena like insect bites while others are triggered by environmental factors. For example, Campo and Ma'an have a significant problem with HIV and AIDS. However, in the southern region, Campo have the highest number of infected people. In fact, in every group of five people, there are at least four infected people from Campo. The constant movement of people in and out of Campo especially the non-permanent settlers has contributed to the presence of HIV/AIDS in the region".

Soil contamination accounted for 33.6%, followed by pathogen presence. Changing rainfall pattern stood at 12.1%. Flooding accounted for 10.7%, while pathogen presence stood at 8.1%. Also, biodiversity loss was recorded at 7.6% and lastly vector population at 4.5%. The pattern of rainfall in communities of the Campo Ma'an National Park is declining compared to past decades. This decrease is linked to increased deforestation, which reduces the amount of water vapor in the atmosphere through transpiration. As a result, waterborne diseases become more prevalent during the rainy season due to contaminated water sources from rainfall and flooding, leading to a higher risk of diseases such as typhoid, hepatitis, and diarrhea. Figure 7 provides a visual representation of the rainfall pattern in the communities of the Campo Ma'an National Park over the past decades.

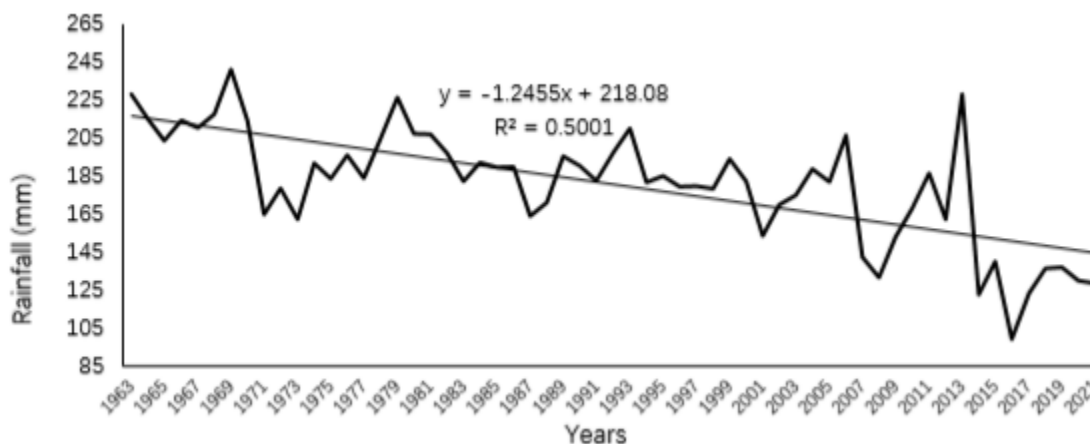


Figure 7. changing pattern of rainfall in the campo Ma'an landscape (1963-2021)
Source: Regional Meteorological Service, Ebolowa

The extensive and continuous deforestation of forest for agriculture and agro-industrial plantations is a significant cause of reduced rainfall patterns in the Campo Ma'an region. This disruption of natural habitats has altered the area's rainfall patterns, resulting in an increase in diseases. Figure 8 illustrates the rate of deforestation in communities of the Campo Ma'an National Park

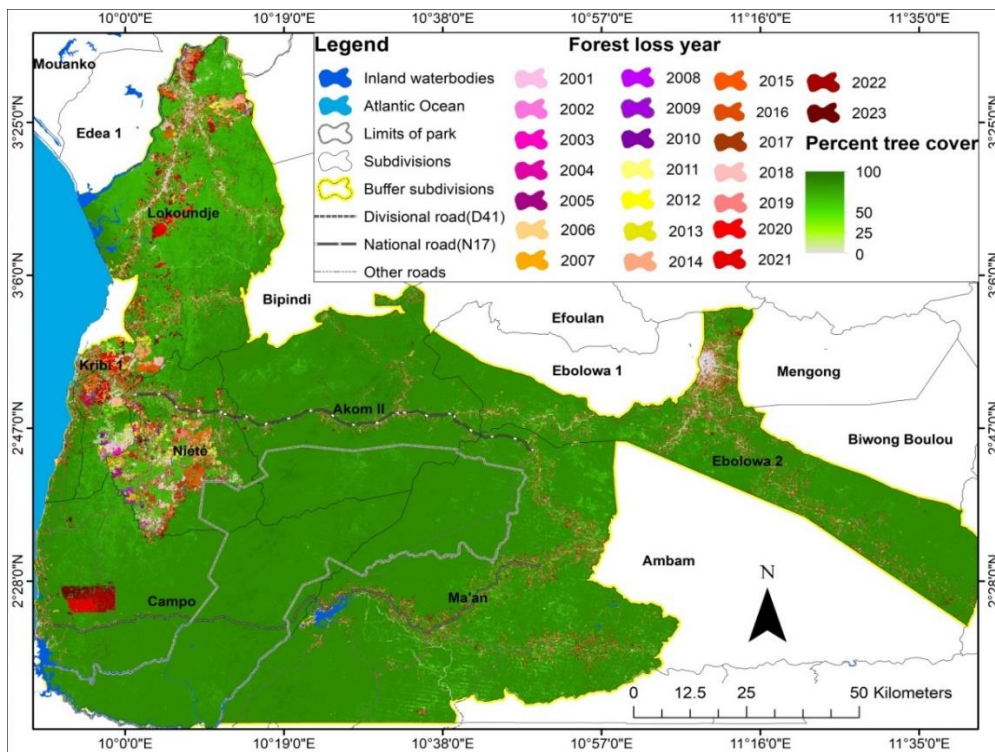


Figure 8 forest cover change from the year 2000 to 2023 in and around the Campo Ma'an National Park.

Source: Developed based on geospatial tools 2024

The Camp Ma'an National is experience severe threats due to socio-economic and demographic factors linked to several current and future projects in the region. This projects destabilizes the ecological health of the park.

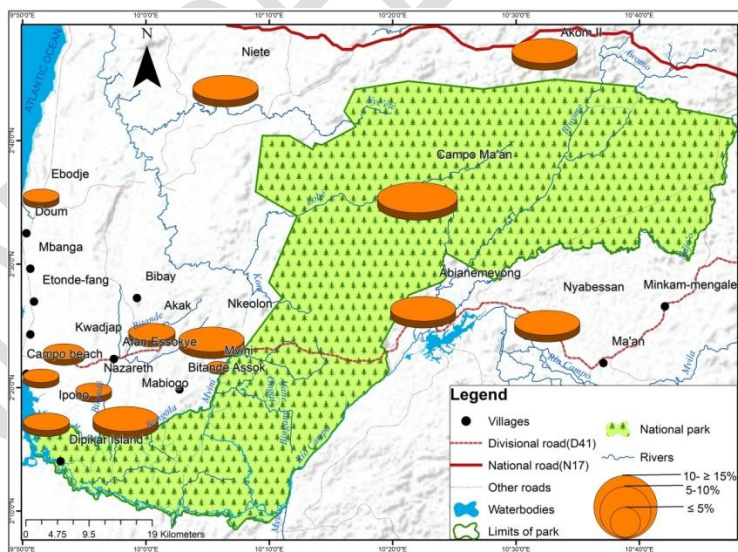


Figure 9 The spatial distribution of ecological determinants of health shocks in communities of the Campo Ma'an National Park

There is an unequal spatial distribution of ecological determinants of health shocks in communities of the Campo Ma'an National Park. Some of these determinants were more in some communities making them more susceptible to disease transmission. Generally, villages with closer proximity to the park (1-3km) were exposed more to disease-carrying vectors and pathogens, contaminated water sources, and wildlife that easily transmit these health risks to humans. This includes villages like Nkeolon, Mvini,

Abianemeyong, Niete, and Akom II. On the other hand, communities located farther away from the park have a lower prevalence of certain diseases, especially those linked with ecological triggers.

4.4 Socio-demographic determinants of health shocks around the Campo Ma'an National Park

The Campo Ma'an National Park communities were also affected by health shocks due to socio-demographic determinants. Over 70% of the population in the Campo Ma'an area have limited access to healthcare and no formal education, contributing to the development of chronic illnesses that impact mental health and overall well-being. The communities most affected by health shocks caused by socio-demographic determinants were Akak, Mvini, Bibay, Ipono, Mbanga, Niete, Nkeolon and Ebianemeyong. The distance between villages and healthcare facilities in the area exacerbates typically the situation. Socio-demographic determinants of health shocks in and around the Campo Ma'an National Park include low education and health literacy, limited access to health facilities, poor housing characteristics, poor nutrition and food scarcity, cultural and societal norms and limited social support networks to the region. These determinants are the major factors that cause health shock in communities of the Campo Ma'an National Park. Health statistics from the Campo Ma'an Landscape indicate an upward trend in communicable and non-communicable diseases over the past five years in communities at Campo Ma'an National Park. Malaria is the most significant communicable Disease in the region, affecting a majority of the population. Close to 70% of the landscape is affected by infectious diseases such as malaria. In terms of non-communicable diseases, hypertension tends to affect a portion of the population.

In the Campo Ma'an area, we experience both communicable and non-communicable diseases. The most widespread communicable diseases include Malaria, followed by STDs, typhoid, dysentery, and rheumatism. There have been numerous cases of Covid-19 due to movement in and out of Equatorial Guinea. As for non-communicable diseases, there are many cases of hypertension, some instances of mental illnesses, and hepatitis. Additionally, cases of gastritis, cardiac arrest due to lack of treatment follow-up, and even strokes have been reported

Generally, over 70% of the population in the communities of the Campo Ma'an area has limited access to healthcare Table 4. The population of Campo Ma'an has a high percentage of individuals with low educational literacy, accounting for 40.9% of the population. This leads to difficulties in understanding health information, resulting in poor health decision-making, non-adherence to medical treatments, and increased health risks. In addition, the region lacks adequate access to health facilities, as illustrated by 22.8% of the population. Most villages are situated several kilometers away from health facilities. This distance challenge makes it extremely challenging and frustrating to the population to access healthcare, especially for indigenous groups such as the Bagyeli settlements, the Mvae, and Mabeas, where traditional healing practices are often relied upon due to the absence of healthcare infrastructure in their villages

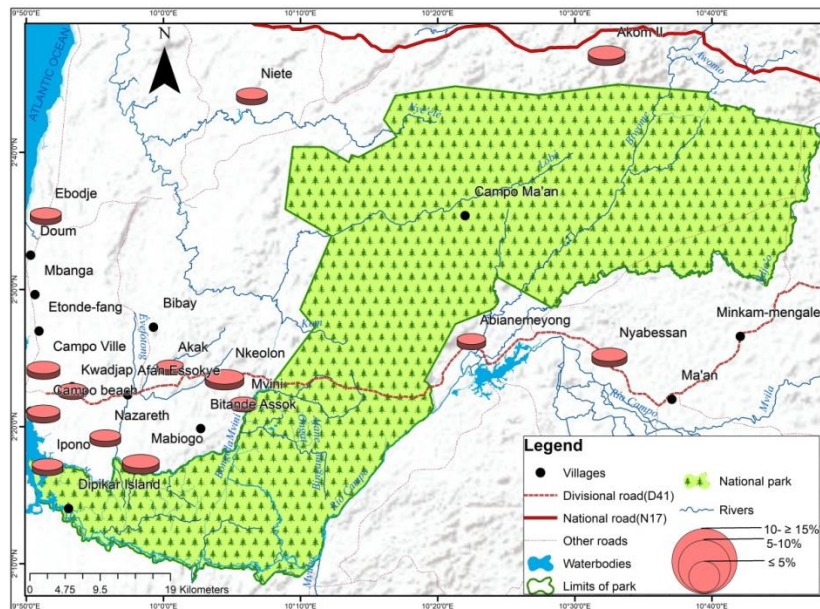


Figure 10. The spatial distribution of socio-demographic drivers of health shocks around the Campo Ma'an National Park

Most village communities are far from healthcare units near the Campo Ma'an National Park. Nkeolon village is about 40km from the nearest functional health unit (CMA Campo, St Joseph, or the Military hospital). Afan Essokye and Ebianemeyong are approximately 35km away. On the other hand, inhabitants of Campo ville only need to travel a few meters to get treatment at the CMA Campo, and St Joseph. The military hospital treats mostly children. These distances deviate from the WHO/Cameroon standard of 5km to a primary health care facility. Each village has non-functional clinics, and the distance from the health units contributes to the increased prevalence of health shocks around the National Park.

Moreover, poor housing characteristics around the park alongside cultural and societal norms constitute other determinants of health shocks. Many huts in the heart of the rainforest have roofs made of mud, sticks, and grass. Additionally, the situation is exacerbated by the lack of sanitation and limited access to health facilities within the park communities.

4.5 Economic determinants of health shocks around the Campo Ma'an National Park.

Economic determinants of health shocks in the Campo Ma'an National Park the Campo Ma'an National Park communities' communities include unemployment, low-income levels and price fluctuations in the region. The economic impacts of health shocks vary among the Campo, Ma'an, Niete, and Akom II zones. The unemployment rate is highest in Akom II at 46%, followed by Campo at 44%. Niete has the lowest income level in the region at 60%, followed by Ma'an at 50%, and then Akom II at 41%, and finally Campo at 38%. In terms of price changes, the Campo area has the highest at 20%, followed by Ma'an at 18%. Akom II has experienced a price change of 13%, while Niete has only experienced 8%. Income levels in the Campo Ma'an area are low, especially for the indigenous population. Areas around Campo Ma'an Park where economic factors significantly influence health issues.

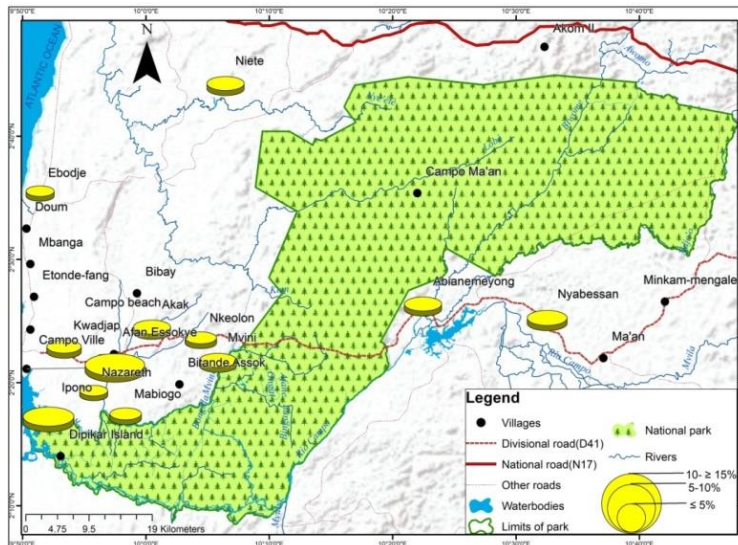


Figure 11. the spatial distribution of economic drivers of health shocks in communities of the Campo Ma'an National Park.

The communities near the park, particularly vulnerable populations, experience low income due to factors such as unemployment and price fluctuations for agricultural products, fishery resources, and NTFPs collected. Low income status in the landscape limit out of pocket expenses on health shocks. Table 4 shows the comparative analysis of communicable and non-communicable diseases in the Campo Ma'an National Park communities.

Table 4. Comparative analysis of communicable and non-communicable diseases in communities of the Campo Ma'an National Park

Communicable shocks	Rank			Non-communicable shocks	Rank		
	F	%	R		F	%	R
Malaria	55	29.1	1	Hypertension	82	43.4	1
Tuberculosis	28	14.8	3	Cancer	27	12.3	3
Sleeping sickness	13	6.9	7	Cardiovascular diseases	30	15.9	2
COVID 19	9	4.7	8	Chronic respiratory diseases (chronic obstructive pulmonary Disease, asthma)	14	7.4	4
STIs	39	20.6	2	Mental health ailments	10	5.3	6
Negligible Tropical Disease	15	7.9	5	Blindness	19	10.1	5
Influenza (flu)	19	10.1	4	Diabetes	7	3.7	7
Poliomyelitis	11	5.8	6				

Source: Fieldwork, 2023

Malaria is the most common communicable disease in the Campo Ma'an National Park communities while hypertension is the the most common non-communicable disease in the Campo Ma'an National Park communities. This put the region in an epistomiological transition. The logistic regression results are presented on Table 5. The result shows that at the 10% significant level, a 1% increase in

pathogenic presence increases communicable Disease by about 11.5% more than non-communicable Disease.

Table 5 The regression results of the determinants of communicable and non-communicable diseases in communities of the Campo Ma'an National Park.

Category	Determinants of health shocks	Beta (B)
Physical drivers	Pathogen presence	.115 (.325)
	Vector population	.467* (.329)
	Biodiversity loss	-.458* (.322)
	Land use changes	-.400 (.326)
	soil contamination	.887*** (.339)
	Flooding	.870*** (.329)
Human drivers	Low socio-economic status	-.313 (.385)
	Low education literacy	.126 (.347)
	cultural and societal norms	.166 (.323)
	Poor housing conditions	-.557 (.353)
	Limited access to health care services	.291 (.333)
	low health literacy	-.759** (.327)
	Poor nutrition and diet	.470 (.340)
	Limited social support	.567* (.354)
	Human-wildlife interactions	-.179 (.386)
	Road network accidents	.367 (.376)
	Alcohol consumption	-.565* (.346)
Economic drivers	Unemployment	-.118 (.326)
	Price fluctuation	.996*** (.331)
	Low income status	-.363 (.318)

t statistics in parentheses * p < 0.05, ** p < 0.01, *** p < 0.001

5. Discussion of findings

The debate on the emergence and reemergence of communicable and non-communicable Disease continue to attract much attention. this paper attempts to shed light on the determinants and socio-demographic catalysts of health shocks in natural based dependent communities.

5.1 Ecological determinants

From the results obtained in model 1, four ecological determinants significantly contribute to the emergence and re-emergence of communicable and non-communicable diseases in Campo Ma'an National Park communities. These include vector population, soil contamination, biodiversity loss and flooding. The Campo Ma'an National Park's vector population are organisms that transmit contagious pathogens between humans and animals to humans. The presence of pathogens in wildlife is transferred to humans through carrion flies, biting flies, ants, termites, moths, and attacks on humans. In the domain of pathogen sharing, molecular analyses are done at the WWF office in Campo to identify infectious pathogens found in great apes like "Akiba" and "Taraba," for example, by using insects conserved in ethanol, dried and stored in test tubes containing silica gel at WWF biobank. Disease spread is significant, especially within the range of the Dipikar Island of the Campo Ma'an National Park. This area has a dominant great ape population due to abundant food, water, and reduced poaching pressure. Some diseases in the Campo Ma'an landscape include malaria, dengue, schistosomiasis, human African trypanosomiasis, and yellow fever. These vector-borne diseases affect a significant proportion of the population each year. In an expert interview in Campo, the following report was recorded.

Flooding constitutes another significant contributor to non-communicable disease in Campo Ma'an National Park communities. In the Campo Ma'an National Park context, direct contact with contaminated water causes skin rashes, infected cuts, and wounds. Also, stomach illnesses such as vomiting and diarrhoea are the greatest risk from swallowing contaminated flood water. Thus, flood water contaminated with sewage continues to pose a higher risk to individuals' health as many communities rely on streams and brooks for domestic use. However, the pattern of rainfall in the Campo Ma'an National Park is declining compared to past decades. This is attributed to increasing and continuous deforestation, which results in waterborne and/or vector-related diseases, especially during the rainy season. Diseases prevalent are due to contaminated water sources and flooding, leading to a higher risk of diseases such as typhoid, hepatitis, and diarrhoea. This finding contradicts Obase-Nkoghe (2024), who observed that the ecological determinant of health shocks in Africa is climate change. Also, in Europe, the European Environment Agency attributes ecological determinants of diseases to heat waves. However, it is consistent with findings in other contexts. For example, in equatorial African forests, ecological changes, wildlife population movements, and shifts within animal reservoirs contribute to health shocks (Giles-Vernick and Rupp, 2012; Oppong and Huddleston, J. 2014; UN, 2021; Fiorella *et al.*,2020; WWF, 2020) especially as the study identifies disease threads posed by bacteria and viruses as well as protozoans and Fungi.

Moreover, rainfall patterns in the Campo Ma'an National Park are declining compared to past decades. This is attributed to increasing and continuous deforestation, which results to waterborne and/or vector-related diseases, especially during the rainy season. Diseases prevalent are due to contaminated water sources and flooding, leading to a higher risk of diseases such as typhoid, hepatitis, and diarrhea. An unequal spatial distribution of ecological factors contributes to health risks. These factors affect some villages more, making them more susceptible to disease transmission. Generally, villages closer to the park (1-3km) were more exposed to a higher presence of disease-carrying vectors and pathogens, contaminated water sources, and wildlife that easily transmit diseases to humans. This includes villages like Nkoelon, Mvini, Ebianemeyong, Nieta, and Akom II. On the other hand, communities located

farther away from the park have a lower prevalence of certain diseases, especially those linked with ecological triggers like ebodje, Mbanga, Etonde fang etc. This finding corresponds to Oppong and Harold, 2014; UN, 2021; Fiorella et al 2020 especially as the study identifies disease threads posed by bacteria and viruses as well as protozoans and Fungi.

5.2 Human (socio-demographic) determinants of Health shocks around the Campo Ma'an national park

The results (Model 2) indicate that socio-demographic characteristics contribute much to the emergence and re-emergence of communicable and non-communicable diseases in Campo Ma'an National Park communities. The respondents argue that socio-demographic factors significantly determine health shocks in Campo Ma'an National Park communities, including cultural and societal norms, low literacy level, low socio-economic status, poor housing conditions, human-wildlife interaction and alcohol consumption. The most significant socio-demographic determinant of health shocks in communities of the Campo Ma'an area is low literacy level. Education and health care have a negative bidirectional relationship in Campo Ma'an National Park communities. Lower educational level in the region leads to lower incomes, less options for investing in healthcare, less knowledge about medicine, and greater vulnerability as lower education and health literacy in the region continue to trigger poor health and underdevelopment.

In addition, human-wildlife interaction constitutes another significant problem, leading to health issues among human populations. In the Campo Ma'an area context, Humans and wildlife, such as gorillas, chimpanzees, and elephants, are major players in the evolutionary history of health issues, sharing frequent and close contact patterns. This means that the prevalence of health issues in the Campo Ma'an National Park is increasing. This is because transmission between humans and wildlife occurs through contact with meat and bodily fluids during hunting, trapping, and butchering. It also occurs during scientific research and human-to-human interactions, especially in healthcare settings. The forest was the major source of livelihood before the park's creation. Additionally, oral historical testimonies from pygmies highlight past relationships between humans and wildlife, including ancestral connections with chimpanzees. Despite the passage of time, the human population continues to occupy and compete for the same ecological space as before.

Furthermore, alcohol consumption constitutes another determinant of health shock in the region. Statistics from the Delegation of Commerce at Campo revealed the quantity of alcohol imported from Equatorial Guinea on a monthly and yearly average. In the Campo Ma'an National Park context, metabolic risk factors are the major contributors to the emergence and prevalence of diseases within the landscape. Age and level of education were found to increase the incidence of disease emergence in communities of the Campo Ma'an area. This means that some non-communicable diseases are triggered by alcohol intake. Some major non-communicable diseases include hypertension, heart disease, cardiovascular issues, mental health ailments, and cancer. Several thousand cases of Non-Communicable Diseases (NCDs) emerge each year around the CMNP, some of which are recorded while others go unrecorded. These diseases trigger severe health conditions in the area, affecting livelihood systems and shifting supply chains within the population. This finding is consistent in different contexts. For instance, Oppong and Harold (2012) use the concept of vulnerable places in Africa to argue that health shocks involve risk behaviours, population or place characteristics, and vulnerability to diseases then inevitably tied to specific places and the behaviours and choices of vulnerable people create vulnerable environments that weaken or undermine resilience and result in poor health. Moreover, Wirsiy et al., 2021 also established that education was the leading cause of the cause of Ebola virus in West and Central Africa as their source of information was mostly informal discussions and misconceptions in their communities. Generally, the level of education, occupation,

and ethnic group significantly affected the health of the region's population. By contrast, findings from the Amazon revealed that socio-demographic determinants of health shocks are linked to environmental modifications like road building, the building of large dams, and expansion for agriculture (Confalonieri *et al.* 2014). Thus, communicable diseases like malaria and cutaneous rapidly change in response to environmental modifications. Furthermore, determinants like precarious housing and working conditions in the Amazon region are the leading determinants of communicable diseases like malaria (Tauli 2009). Similarly, in the United States of America, socio-demographic determinants of health shocks were found to include the youth population ratio, and residents' average health risk factors (Ying *et al.*, 2022)

Socio-demographic factors also significantly determine health shocks in communities of the Campo Ma'an National Park. Limited access to health care units contributed significantly to health shocks in the region. For instance, over 70% of the population has limited access to healthcare services. Road accidents, food insufficiency, inadequate social support and wildlife destruction of crops and farmlands have led to stress and trauma, contributing to the development of chronic illnesses that impact mental health and overall well-being of the population around the Campo Ma'an National Park. The communities most affected by socio-demographic stressors leading to diseases are Akak, Mvini, Bibay, Ipono, Mbanga, and Ebianemeyong. Access to healthcare services by some villages is extremely difficult as more than 60% of the population of Campo Ma'an National travel an average distance of 10km before they can access health care. This is contrary to 5km rule by WHO on healthcare access. Most villages are situated several kilometers away. The population experienced delayed diagnoses and treatment for health conditions affecting a greater majority of the population. This distance makes it extremely challenging to access healthcare, especially for indigenous groups such as the Bagyeli settlements, the Mvae, and Mabeas, thus traditional healing practices are often preferred, practiced and relied upon for centuries due to the inadequate healthcare infrastructure available. Moreover, there is a significant proportion of individuals with low educational literacy, accounting for 40.9% of the population. This leads to difficulties in understanding health information, resulting in poor health decision-making, non-adherence to medical treatments, and increased health risks. Oppong and Harold (2018) uses the concept of vulnerable places to argue that health shocks involve risk behaviors, population, or places characteristics, vulnerability to diseases then inevitably tied to specific places, and the behaviors and choices of vulnerable people create vulnerable environments that weaken or undermines resilience and result in poor health. Moreover, Wirsiy *et al.*,(2021) also established that education was the leading cause of the Ebola virus as their source of information was mostly informal discussions and misconceptions in their communities. Generally, the level of education, occupation and ethnic group significantly affected the health of the population of the region.

It has been highlighted that these facilities have limited healthcare resources to handle emerging and re-emerging health crises in the area. Consequently, critical cases are often referred to the District Hospital in Kribi, which is 75km away from Campo. In addition, housing characteristics are a significant factor that triggers health shocks within the Campo Ma'an region. Many structures in the heart of the rainforest are made of thatch, sticks, and grass. This is exacerbated by the lack of sanitation, good quality water and limited access to health facilities within the park region, leading to longer distances to health services, higher transport costs, and financial challenges for the population, particularly the indigenous people of Campo Ma'an landscape. Access to health services is limited in the Campo Ma'an area. FAO, (2021) is in conformity with this finding. However, the study emphasized growing recognition of the diverse ways that environmental degradation, such as deforestation and climate change, triggers health shocks.

5.3 Economic determinants

Economic determinants (Model 3) also significantly contributed to Campo Ma'an region health shocks. Among these factors, price fluctuation was the lone significant determinant. Price fluctuations in commodity supply and demand contribute to exacerbating communicable and non-communicable diseases, particularly in areas such as Mabiogo, Campo Beach, Campo Ville, Ebianemeyong, and Ebodje. The livelihoods of natural resources dependent people in the Campo Ma'an landscape show variations in average monthly and yearly incomes influenced by changing market conditions which affect the prices of goods and services negatively. As a response strategy, households use a range of livelihood sources such as savings, borrowing, using loans or mortgages and selling assets and livestock to meet health needs as health shocks cause significant reductions in labour supply among households in the Campo Ma'an region. Price changes affect production levels as goods were largely sold below market prices, affecting mostly vulnerable households. This is a major factor that trigger poverty and underdevelopment at the household and community level. Low incomes cause stress and degenerate in trauma, and in some cases death, especially when funding for health shocks is a problem. This result conforms to the findings of Kim 2021; Oquadika *et al.*, 2020 who argue that health shocks are triggered by poverty status impoverishing poverty in Africa. Thus, households cope with health shocks mainly by borrowing from more sources. However, this finding contradicts the scenario in Southeast Asia as population growth and economic development trigger health shocks by creating consequences for rural ecosystems (Islam and Parasnis, 2021). Other findings reveal that, households in low- and middle-income countries bear a variable burden of health shocks expenditures. Households use a range of sources such as income, savings, borrowing, using loans or mortgages and selling assets and livestock to meet health needs as health shocks cause significant reductions in labour supply among households in Low- and Middle-income countries (Alam and Mahal 2014).

In conclusion, Communicable and non-communicable diseases continue to affect Campo Ma'an National Park communities. Malaria was the most prevalent communicable Disease in the landscape affecting more than 70% of the population with widespread implications on humans, livelihoods and the environment. The least communicable Disease in the landscape was COVID-19 pandemic. Hypertension was the most prevalent non-communicable, while blindness was the least prevalent. The southern part of the park had a higher risk of disease prevalence than the eastern and northern parts. This is explained by increasing human interference through frequent human wildlife contact and the creation of agro-industrial plantations on formerly wildlife habitat areas, exposing wildlife to human attacks. Several drivers significantly triggered health shocks in the region. The most significant driver of health shocks in the landscape was socio-demographic drivers with educational literacy playing a crucial role while limited social support network was the least significant. In addition, the region's most significant ecological driver of health shock was land use change while the least significant was vector population. Moreover, in terms of economic drivers, unemployment was the most significant economic determinant of health shocks while price fluctuation was the least significant economic driver.

Several cases of Non-Communicable Diseases (NCDs) like hypertension, heart disease, cardiovascular issues, mental health ailments, and cancer emerge each year around the CMNP, some of which are recorded while others go unrecorded. These diseases trigger severe health conditions in the area, affecting livelihood systems and shifting supply chains within the population. This finding is consistent with Oppong and Harold (2018), who used the concept of vulnerable places in Africa to argue that health shocks involve risk behaviours, population or place characteristics, and vulnerability to diseases. These diseases are inevitably tied to specific places and the behaviours and choices of vulnerable people create vulnerable environments that weaken or undermine resilience and result in poor health. Moreover, Wirsy *et al.*, (2021) also established that education was the leading cause of the Ebola virus in West and Central Africa as their source of information was mostly informal discussions and misconceptions in their communities. Generally, the level of education, occupation, and ethnicity

significantly affected the health of the region's population. In addition, findings from the Amazon revealed that socio-demographic determinants of health shocks are linked to environmental modifications like road building, the building of large dams, and agricultural expansion (Confalonieri *et al.* 2014). Thus, communicable diseases like malaria and cutaneous rapidly change in response to environmental modifications. Furthermore, precarious housing and working conditions in the Amazon region are the leading determinants of malaria (Tauil, 2009). Similarly, in the United States of America, socio-demographic determinants of health shocks were found to include the youth population ratio, and residents' average health risk factors (Ying *et al.*, 2022). In Latin America and the Caribbean countries, the mortality rate is high due to cardiovascular diseases. This is associated with high prevalence of cardiovascular risk factors like tobacco, diabetes, hypertension, physical inactivity and obesity, in some cases death (Pramparo *et al.*, 2007). This result also aligns with the findings of Kim (2021) and Ouadika *et al.* (2020) who argue that health shocks are triggered by the poverty status of African households. Thus, households cope with health shocks mainly by borrowing from other sources. However, this finding contradicts the scenario in Southeast Asia as population growth and economic development trigger health shocks by creating consequences for rural ecosystems (Islam and Parasnis, 2021)

6. Conclusion

The Campo Ma'an National Park communities are exposed to health shocks. These include communicable and non-communicable diseases. Communicable diseases like malaria, tuberculosis, COVID-19 and STIs are more prevalent than non-communicable diseases like hypertension, cancer, cardiovascular diseases, and mental ailment. Furthermore, the prevalent of health shocks is triggered more by socio-demographic factors than by ecological and economic factors. Based on the analysis, over 70% of the Campo Ma'an National Park population have limited access to basic health care, low education and health literacy level, accounting for 40.9% of the population, thus hindering basic understanding and adherence to medical knowledge and instructions. Poor housing characteristics, food availability and nutrition issues, customs and traditions, human-wildlife interactions and/or conflicts, and consumption habits constitute the socio-demographic factors triggering health shocks in the CMNP. These factors contribute directly and indirectly to the emergence and re-emergence of health shocks affecting livelihoods and overall wellbeing in the region. Malaria for instance, affects all communities in the landscape. Ecological determinant associated with health shocks were linked to soil contamination, forest/biodiversity loss, changing rainfall pattern, flooding, pathogen presence and vector populations. Economic determinants of health shocks were associated with unemployment and price fluctuations.

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