Climate Change in the Grand Lomé Region of Togo: Perception of Impacts on Health Systems

Piniouwe Andje *, Tossou Atchrimi , Kossi Komi

Posted Date: 13 September 2023

doi: 10.20944/preprints202309.0847.v1

Keywords: Impacts; climate change; risk perception; health system; Greater Lomé

Article

Climate Change in the Grand Lomé Region of Togo: Perception of Impacts on Health Systems

Piniouwe ANDJE [1,*], Tossou ATCHRIMI [2] and Kossi KOMI [3]

[1] Laboratory: CERVIDA-DOUNEDON, University of Lomé, 01 BP 1515 Lomé 01-Togo
[2] Associate Professor at the Laboratory: CEVRIDA-DOUNEDON, University of Lomé, Research center: CERVIDA-DOUNEDON, 01 BP 1515 Lomé 01 -Togo, Telephone: 00228 92 48 30 01, batchrimi@yahoo.fr
[3] Doctor associated with the CEVRIDA-DOUNEDON Laboratory Research center : CERVIDA-DOUNEDON University of Lomé, 01 BP 1515 Lomé 01-Togo, Telephone: 00228 93 28 57 52, kossik81@yahoo.fr
* Correspondence: andjesophie@yahoo.fr; Tel.: +00228 90 28 14 67

Abstract: The perception of the impacts of climate risks on health systems in the Grand Lomé region of Togo is diverse. This study was carried out based on information collected in the field. The investigation was based on a questionnaire, individual interviews and field observations. Data collection was carried out in a purposive manner in twenty-four (24) health facilities with a total of 112 health service people and 13 resource people affected. This article presents the results on the perception of the impacts of climate change on health personnel, the environment and buildings. The results show that 92.31% of respondents attest that climate change has impacts on health personnel; 84.62% on the environment and 84.62% on buildings and other health infrastructure. This study shows that climate change has real consequences on human health. It is therefore urgent that those responsible for health systems in the Grand Lomé region, which is home to the capital of Togo, can focus on finding adaptation measures in relation to each health structure and according to its intervention platform.

Keywords: Impacts; risks; climate change; health system; Greater Lomé

1. Introduction

For several years, the issue of climate change has been a concern of governments, international organizations and many scientific entities. All sectors, especially health, are vulnerable due to their limited adaptation capacities and their great dependence on resources with high climate sensitivity [1].

Areas without good health infrastructure, as in most developing countries, will be least able to prepare and cope with the situation without assistance [2]. Indeed, climate change has a strong impact on health [3].

According to the WHO, floods are increasing in frequency and intensity. They increase the risk of water-borne diseases and create breeding grounds for disease-carrying insects such as mosquitoes [2]. They cause water pollution, thus leading to hygiene problems. Despite the measures undertaken at the international level to reduce the risks induced by climate change, they persist and negatively affect health systems. This situation has been demonstrated and confirmed in one of the latest IPCC reports for West Africa [4]. However, key questions remain unanswered and the demand for further research, for example on the evaluation of implementation in countries, persists [3].

Climate change has a direct impact on certain categories of diseases, especially vector-borne and water-borne diseases. In addition, the increase in precipitation increases the dissemination of infectious agents and the temperature promotes their growth, thus making waterborne or foodborne diseases very susceptible to climate change [4]. Floods are increasing in frequency and intensity. They increase the risk of water-borne diseases and create breeding grounds for disease-carrying insects such as mosquitoes. They also cause drowning and physical trauma, damage housing and disrupt the delivery of care and health services [2]. Togo shares the same difficulties as other states in the world and has undertaken strategies after ratifying the United Nations Framework Convention on

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 13 September 2023 doi:10.20944/preprints202309.0847.v1

Climate Change (UNFCCC) in 1995. This is how it developed several institutional documents following the latest report from the Intergovernmental Panel on Climate Change (IPCC) [5].

Adhering to most mitigation plans, the impacts of climate change risks on health systems persist. There is therefore an urgent need for analyzes of the impacts of these risks in order to attract the attention of decision-makers and health service managers looking for solutions to avoid the worst in the future.

In Togo, very little work has been done in the knowledge of climate impacts on health systems. To this end, our contribution through this article is to analyze the impacts of climate change on buildings, personnel and the environment in health facilities in the Grand Lomé region.

2. Methodological approach

2.1. Framework of the study

The study was carried out in the Grand Lomé region which is made up of two districts, namely the district or prefectures of Agoé Nyvé and that of the Gulf.

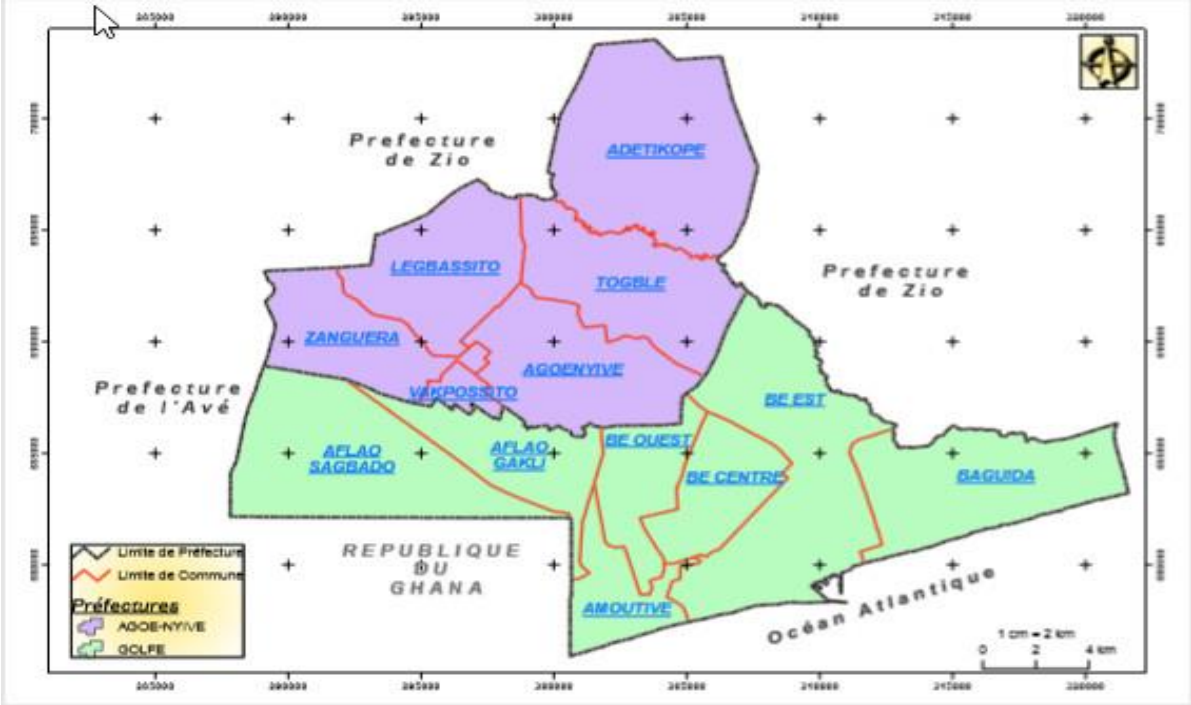

Figure 1. Geographical location of the Grand Lomé region with its different districts and communes.

With an area of 425.6 km² and a population of 2,188,376 inhabitants [22], the Grand Lomé region is limited to the north by the prefecture of Zio (Maritime region), to the northwest by the prefecture of Avé, to the south by the Atlantic Ocean, to the southeast by the Lacs prefecture, to the southwest by Ghana. It has a subequatorial climate characterized by an alternation of two rainy and two dry seasons with average annual temperatures between 27.2 and 30 °C on the coast [6]. Annual rainfall is low, 700 to 800 mm, due to the position of the coast in relation to the Monsoon flows and the limited number of squall lines in the area [6].

This climate is dominated by two antagonistic trade winds including the northeast trade wind, regionally called harmattan (hot, dry and dusty) coming from the Sahara and the southwest trade wind or monsoon (humid) originating from the ocean. Atlantic. The zone of demarcation (convergence) between these two trade winds is called the Intertropical Front (ITF). It is the movement of the FIT which determines the four seasons, namely two dry seasons and two rainy seasons in the intertropical zone [6].

 doi:10.20944/preprints202309.0847.v1

2.2. Sampling

The Grand Lomé region has 30 health areas and about 250 health facilities (FS). The sample covered public, private or religious health facilities in risk areas from July to September 2022. For field surveys and observations, 24 health facilities (FS) including 10 FS in the district of Agoé Nyvé and 14 FS in the gulf were visited. A total of 125 people were interviewed in the period from July to September 2022.

2.3. Field work

The actual investigations were the essential phases of investigation with the entities.

Initially, apart from health personnel who are mainly the targets of investigations, exploratory visits to centers, decentralized structures and ministries of health, environment and WHO/Togo made it possible to identify the resource people involved in climate-health debates, the development of climate and health policies to clearly identify the question in question. The objective being to collect the perceptions of stakeholders and resource people on climate impacts, note that only people over the age of 18 were considered survey targets.

Knowledge of the climatic risks to which the components of health systems are subject in the Grand Lomé region has led to several methods and tools which are combined for research. An individual questionnaire was used to conduct the discussions. From these discussions, the perception of the impacts of climate risks on the components of health systems are collected in the structures visited.

2.4. Quiz

The collection of data on the perception of the impacts of climate risks in the Grand Lomé region was the subject of surveys which were carried out using a questionnaire.

2.5. Data collection and analysis

Data collection was carried out in a purposive manner using the questionnaire from 24 FS and 13 resource people. Direct observation of infrastructure and the immediate environment allowed us to appreciate the defects and the living environment during the occurrence of extreme events. The data collected was processed using Excel software and SPSS (Statistical Package for the Social Sciences).

3.Results

The literature has allowed us to identify several impacts relating to climate change as illustrated in the following tables :

Table 1. Main categories of diseases linked to climate change.

Categories	Impacts (diseases)	Climatic factors
Vector-borne diseases	Malaria	Flood, high heat
Waterborne diseases	Diarrhea, Cholera	Flooding
Heat and air related illnesses	Meningitis, cardiovascular and cerebrovascular diseases, Acute bronchitis, pneumonia, Asthma, Bronchiolitis	Drought, high heat
Accidents	Injuries, deaths	Strong winds

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 13 September 2023 doi:10.20944/preprints202309.0847.v1

Health personnel or workers	Fatigue, Cramps, Panic, Heatstroke, Lack of alertness and increase in work accidents (injuries), Low productivity, mental health disturbance (physical discomfort=emotional state), Lateness, Delays, Stress, dehydration, kidney infections	Flooding, high heat

Source : DARE, 2014.

Considering the environmental effects, Table 2 gives examples of damages linked to climate change.

Table 2. Main environmental impacts linked to climate change.

Categories	Impacts (damage)	Climatic factors
Flooded house (water invasion)	Collapse of houses	Flood
Coastal erosion (sea level rise)	Reduction of land, Invasion of buildings by water	Sea level rise
Damage to buildings	Unraveling of buildings, in buildings, Rapid depreciation, Power cut, Overflowing of pits and cesspools, Humidity in buildings (mold)	Strong winds, high heat
Environmental pollution	Air and water pollution, Unsanitary environment, Emergence of diseases (water, food, respiratory etc.), Lack of hand hygiene, Lack of hygiene of biomedical equipment, Poor management of medical care waste, Proliferation of insects and rodents, Mosquito bites	Flooding, strong winds, drought

Source : DARE, 2014.

According to Table 3, 76.92% of respondents confirm the excess rainfall currently causing flooding; 69.23% for the delay in the start of the rains; 92.31% break of rains in high season and 53.85% confirm early cessation of rains.

Table 3. Experience on the impacts of climate risks.

	YES	NO
Current rainfall trend		
Excess rainfall/flooding	10 (76,92%)	3 (23,08%)
Delay in the start of the rains	9 (69,23%)	4 (30,77%)
Break of rains in high season	12 (92,31%)	1 (7,69%)
Early end of rains	7 (53,85%)	6 (46,15%)
No change		13 (100%)
Current thermometric trend		

 doi:10.20944/preprints202309.0847.v1

Increasing heat	11 (84,62%)	2 (15,38%)
No change	2 (15,38%)	11 (84,62%)
Current wind trend		
Increasingly violent winds	10 (76,92%)	3 (23,08%)
No change	3 (23,08%)	10 (76,92%)
Current trend of sea advance		
Increasingly advanced sea level	13 (100%)	
No change		13 (100%)

Regarding current temperatures, 84.62% speak of extreme heat; for the winds, 76.92% notice them becoming more and more violent and 100% attest to the remarkable advance in sea level.

Addressing the causes of climate change, 100% of those interviewed say that they are due to deforestation, 92.31% speak of the emission of greenhouse gases, for 76.92% of those interviewed it is climate anomalies, for 46.15% of respondents it is non-compliance with specifications, 30.77% say it is non-compliance with social prohibitions and 15.38% speak of disobedience to a divinity.

According to Table 4, 92.31% of those interviewed are aware that climate change has impacts on health personnel, 84.62% on the environment and 84.62% on buildings.

Table 4. Perception of the impacts of climate risks.

Impact of climate change on health systems:	YES	NO
Le Health personnel	12 (92,31%)	1 (7,69%)
The environment	11 (84,62%)	2 (15,38%)
Buildings and other infrastructure (incinerators, etc.)	11 (84,62%)	2 (15,38%)

By addressing the different types of effects suffered by health facility buildings, it appears that 69.7% of respondents in the Golfe district compared to 73.17% in that of Agoé Nyvé say that climate change affects efficiency. , the lifespan and safety of infrastructure and buildings; 42.42% against 80.49% speak of the subsidence of the structures; 46.97% against 31.71% address power cuts; 51.52% against 29.27% talk about the corrosiveness of materials; 46.97% versus 68.29% mention the removal of roofs and 40.91% versus 73.17% speak of the flooding of buildings by water; 40.91% against 31.71% say that the high aggressiveness on the materials used for construction is noted; 50% against 29.27% talk about the coating of the reinforcements becoming greater because of the salinity of the air; 69.7% against 78.05% talk about the cracking of the protection slabs and 56.06% against 80.49% say that humidity/mold is noticed in the buildings.

These results support [16] which notes that 12 cases of damage were reported in the health district of Agoé Nyvé and 144 in that of Golfe, i.e. a total of 156 roof removals which caused 7 cases of death in the district. health center of Agoé Nyvé and 5 in that of Golfe. Regarding damage to buildings, 29 cases were recorded in the Gulf prefecture during the same period [16]. This shows that the risks identified in the Grand Lomé region affect the efficiency, lifespan and safety of infrastructure and buildings.

Addressing the effects of climate change on the environment (water - soil - air), 83.33% of surveys in the Golfe district confirmed their existence compared to 82.61 in that of Agoé Nyve, an average of 83.04 % in the Grand Lomé region. According to the results, for the degradation of the distribution network systems (e.g. electric power, water, gas, etc.), the following percentages were obtained: 60.61% in the Gulf district and 56.52% in the by Agoé Nyvé; for air pollution 66.67% against 56.52%; water pollution 62.12% against 34.78%; unsanitary environment of the health facility 53.03% against 54.35%; proliferation of insects and rodents (mosquitoes, flies, rats, etc.) 60.61% versus 43.48% and for mosquito bites 62.12% versus 47.83%.

 doi:10.20944/preprints202309.0847.v1

Regarding the effects of climate change on personnel, 92.42% of surveys in Golfe confirmed their existence and 84.78 in Agoenyve, an average of 89.29% in the region according to graph 18.

By addressing the different types of effects on personnel in health facilities, the following percentages were obtained: exposure of workers (staff) to new working conditions or new dangers 63.64% in the Gulf district against 65 .22% in that of Agoé Nyvé; emergence of diseases (water, food, respiratory etc.) 80.3% against 69.57%; heat stroke 71.21% versus 69.57%; low productivity 59.09% versus 30.43%; mental health disturbance (physical discomfort=emotional state) 51.52% versus 36.96%; late for work 60.61% versus 36.96%; demotivation at work 54.55% against 26.09% and stress 65.15% against 30.43%.

4. Discussion

The results of this study show that in the region of Grand Lomé, 92.31% of the interviewees recognize the existence of effects on health workers, 84.62% on the environment and 84.62% on buildings. These results confirm that extreme events are only increasing over time and agree with [8] who said that according to several climate models, we can expect until the end of the 21st century, depending on the scenarios and the effectiveness of climate policy measures, to global warming of up to 4.8°C. Likewise, as mentioned by [9], this climate change characterized by rising temperatures, rising sea levels, distribution of precipitation and frequency as well as intensity of extreme weather events (heat waves , storms, floods, droughts, cyclones, etc.) constitutes a certain risk for human health. Our results agree and give us, according to the respondents in the Grand Lomé region, 53.22% for the rise in temperatures; 99.87% for abnormal rainfall trends; 96.77% for strong winds; 77.27% for sea level rise for the district concerned and 65.29% for drought. Addressing the impacts of climate change on personnel and the environment, the results clearly show the different effects. According to the WHO, climate change impacts the social and environmental determinants of health: clean air, drinking water, sufficient food, housing security [2]. Our results are not outside of this assertion according to our respondents. Regarding the responses on environmental impacts, it reveals that: 58.57% for the degradation of distribution network systems (e.g.: electrical energy, water, gas, etc.; 61.60% for the air pollution; 48.45% for food pollution (food poisoning); 63.11% for water pollution (water-borne diseases) which corroborates with the WHO assertion that, diseases diarrheal diseases are not the rest [10]. They are due to a microbe (protozoa, virus, bacteria) which is spread by the fecal-oral route, in particular by infection of fresh water or food contaminated by stools or by contact direct with infected stools; 53.69% for the unsanitary nature of the environment; 52.04% for the proliferation of insects and rodents (mosquitoes, flies, rats, etc.) and 54.98% for mosquito bites. According to the forecasts of [2], between 2030 and 2050, we will realize that climate change will cause nearly 250,000 more deaths per year, linked to malnutrition, malaria, diarrhea and stress linked to heat. Also, we would risk having the cost linked to direct damage to health (costs in sectors determining health such as agriculture and water and sanitation excluded) of between 2 and 4 billion dollars (US$) per year by 2030. Our following results are consistent with this assertion. Thus, they show us that in relation to the effects on workers, 64.43% for the exposure of workers (personnel) to new working conditions or new dangers; 74.93% for the emergence of diseases (water, food, respiratory, etc.); 47.60% for fatigue; 70.39% for heatstroke; 48.79% for lateness and 47.79% for stress.

In relation to infrastructure and buildings, our results support the assertion of [2], according to which, areas without good health infrastructure, mostly in developing countries, will be least able to prepare and deal with the situation without assistance. Thus 71.44% of respondents say the impacts concern the reduction in efficiency, lifespan and safety of infrastructures and buildings; 50% for the subsidence of structures; 57.63% for roof removal; 57.04% for the invasion of buildings by water; 73.88% for cracking of protection slabs and 68.27% for humidity in buildings (mold).

Regarding the rise in sea level, our results are not far from confirming the results of the analysis of the CPDN Togo document, which confirms that the country has a maritime coast of 50 km subject to the erosion. And this impacts both surrounding homes and health facilities in these areas. 77.27% of our respondents attest that the sea level is rising as the years go by. In short, the analysis of our results agrees with the writings of several authors, namely: climate change has an impact on the

 doi:10.20944/preprints202309.0847.v1

health status of millions of people, due in particular to the intensification of malnutrition, the increase the number of deaths, illnesses and accidents due to extreme weather events [1]. Added to this is the aggravation of the consequences of diarrheal diseases, the multiplication of cardiorespiratory diseases linked to high concentrations of tropospheric ozone in urban areas and changes in the geographical distribution of certain infectious diseases. According to IPCC projections, this the situation will be even more alarming because climate forecasts indicate, for example, that in the future, episodes of strong heat will be more frequent and intense. Along the same lines, it is recognized that the effects of this rapid and persistent climate change on health are likely to be very largely negative, especially for the poorest, weakest and most ill-prepared populations [11]. This is the case for several regions in Africa where populations are exposed to climate change directly, under the effect of changing meteorological conditions, and indirectly, due to changes in water bodies, air, food quality and quantity, ecosystems, agriculture, livelihoods and infrastructure [12]. Our results are also consistent with analyzes that both direct and indirect exposure jeopardize the improvement of human health and the well-being of populations. And again, these modifications are likely to promote, for example, a rapid development of vectors and parasites favorable to vector-borne diseases [13]. Climate change is therefore a fundamental determinant of health [14].

The observation prior to this study is that despite the efforts made at the international and national levels to mitigate the adverse effects of climate change on the environment and human health in developing countries, the associated risks and effects persist [15].

Over the past 130 years, the temperature has increased by around 0.85°C worldwide. Over the last 25 years, the pace has accelerated and there is more than 0.18°C of warming per decade COP26, [2]. Thus, after our research, in the region of Grand Lomé, it was observed in the period of 2017-2020, the occurrence of floods, high heat, overflow of sea level and increased violent winds [16]. According to the 72nd session of the WHO for Africa, the temperatures are out of the norms and the floods destroy human lives by the spread of diarrheal diseases by the pollution of well water and the spread of infectious diseases. Which also confirms the increase in negative effects on buildings, personnel and the environment covered by our study. Also, the United Nations Climate Conference (COP26) mentions that extreme weather events are increasing in intensity and frequency with all the negative effects they cause [2]. During the COP26 process in Glasgow, WMO Secretary General Petteri Taalas explained for his part that during the year 2020, climate indicators in Africa were characterized by a continuous increase in temperatures, an acceleration sea level rise, extreme weather and climate events, such as floods, landslides and droughts, and associated devastating impacts [17]. In the same context, the observation is that heat waves and extreme maximum and minimum temperatures are expected to become more frequent. Likewise, the increase in the prevalence and/or incidence of diseases transmitted by mosquitoes due to increased precipitation is an illustration of climate variability [20]. Humidity generates mold, a source of discomfort and this study confirms previous studies by the PNAS which stipulates that the relative humidity in the country will change from 51% in the north to reach 86% in the south, more precisely in the Maritime Region including was part of the Grand Lomé region after the administrative reforms (PNAS). This study made it possible to obtain the assigned results. The categories of rainy seasons are shortening in favor of dry months, which is in agreement with the conclusions of numerous studies in this area. The rainfall trend is reflected in a drop with a rise in temperatures in the Grand Lomé region. Climate change has a direct impact (effect) on certain types of diseases and primarily on vector-borne diseases, by transforming their conditions for survival and reproduction of vectors more favorable [19]. Also, the increase in precipitation increases the dissemination of infectious agents and the temperature accelerates their growth, thus allowing water-borne or food-borne diseases that are very susceptible to climate change [2]. In addition, harsher climatic conditions also lead to a deterioration in air quality and promote certain diseases such as respiratory infections or meningitis [18]. By 2030, it is estimated that up to 118 million extremely poor people (those living on less than $1.90 a day) will be exposed to drought, floods and extreme heat in Africa if adequate measures are not taken [17].

Apart from all of the above, it is difficult to measure the effects of climate variability, since several indicators could be used, for example greenhouse gas emissions, atmospheric concentrations

of different environmental factors as use of the energy, mode of food and water waste, transport etc. Meteorological data such as median temperatures, precipitation, sea level are generally used, while long-term indicators such as decadal temperature variations and rainfall are not considered.

5. Conclusions

Climate disruption unfortunately has negative effects on health systems and particularly on healthcare personnel, buildings and the environment, as confirmed by the results of this study. The impacts are visible through the damage caused to buildings, the disruption of health care services and the environmental problems caused. It was noted in this study that the impacts of climate change on health systems are not known to all respondents. Health system managers must encourage the search for solutions to this phenomenon by encouraging researchers to take an interest in it to make their contributions to reducing impacts and propose adaptation approaches that take into account the realities of the country. Also, managers of health facilities must focus on finding adaptation measures in relation to each health structure according to its intervention platform.

Funding: This research was funded by the Regional Center of Excellence on Sustainable Cities in Africa (CERViDA_DOUNEDON), the Association of African Universities (AAU) and the World Bank.

Statement by the Institutional Review Board: not applicable.

Declaration of informed consent: not applicable.

Declaration of data availability: data will be made available on request.

Acknowledgments: We would like to thank the Regional Center of Excellence on Sustainable Cities of Africa (CERViDA_DOUNEDON), the Association of African Universities (AAU) and the World Bank for providing the necessary funding that facilitated our research work leading to these results. We would also like to express our gratitude to Cyprien AHOLOU, and Kossiwa ZINSOU-KLASSOU, for their support and enlightened leadership in promoting this Center of Excellence.

Conflicts of interest : The authors declare no conflicts of interest.

References

1. IPCC, 2007 : Climate Change Review 2007, Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Lead writing team, Pachauri, R.K. and Reisinger, A.), published under the direction of GIEC, Geneva, Switzerland, 103 p.
2. ANPC, 2021: Analysis of data on damage and loss of hazards occurring in Togo: 2017-2020 accessed on June 9, 2022. URL: https://anpctogo.tg/wp-content/uploads/2021/08/Rapport_ADD_ANPC_2017-2020-1.pdf
3. WHO, 2021: United Nations climate conference COP26, countries commit to designing climate-friendly healthcare, accessed June 12, 2022. URL: https://www.who.int/fr/news/item/09-11-2021-countries-commit-to-develop-climate-smart-health-care-at-cop26-un-climate-conference
4. Sorgho R, Quiñonez CAM, Louis VR, Winkler V, Dambach P, Sauerborn R, Horstick O. Climate Change Policies in 16 West African Countries: A Systematic Review of Adaptation with a Focus on Agriculture, Food Security, and Nutrition. Int J Environ Res Public Health. 2020 Nov 30;17(23):8897. doi:10.3390/ijerph17238897. PMID: 33265971; PMCID: PMC7731384.
5. Dare G. N. 2014: Vulnerability of yam cultivation to climate variability and peasant adaptation strategies in the Bassar prefecture (Northern Togo), Single Doctoral Thesis, University of Lomé
6. GIZ, 2019: Study of risks and vulnerabilities linked to climate change in the health sector in Togo, final report. URL: http://news.alome.com/p/71773.html
7. DGMN, 2021: Directorate General of National Meteorology, 2021 report
8. DGMN, 2022: Directorate General of National Meteorology, 2022 report
9. Damiano U., Nino K. (2015). Climate change also concerns health. Bull Med Suisses. 96(3132).DOI: https://doi.org/10.4414/bms.2015.03852
10. [9]United Nations. (2019), accessed 07 April 2022. https://www.un.org/fr/global-issues/climate-change.
11. WHO, (1993): Course on diarrhoea. Student manual, Geneva, Switzerland, 147 p
12. Howard C., Huston P. (2019). The health effects of climate change: Discover the risks and be part of the solution. Report on Communicable Diseases in Canada. DO - 10.14745/ccdr.v45i05a01f
13. Confalonieri, U., et al. (2007) Human Health. In: Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J. and Hanson, C.E., Eds., Climate Change 2007: Impacts, Adaptation and Vulnerability, Contribution of

Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, 391-431.
14. Menne B., Ebi KL. (2006). Climate change and adaptation strategies for human health. Springer, Darmstadt, 449 p.
15. Fraser S. (2021). Climate change is a health issue. Canadian family physician Medecin de famille canadien, 67(10), 720. https://doi.org/10.46747/cfp.6710720.
16. Kouamé PK, Fokou G, Koffi AJD, Sani A, Bonfoh B, Dongo K. Assessing Institutional Stakeholders' Perception and Limitations on Coping Strategies in Flooding Risk Management in West Africa. Int J Environ Res Public Health. 2022 Jun 6;19(11):6933. doi:10.3390/ijerph19116933. PMID: 35682515; PMCID: PMC9180679.
17. ANPC, 2021: General Directorate of National Meteorology, Report 2021.
18. WMO, 2021: World Meteorological Organization, 2021 report.
19. Kassankogno, Yao 2019: Research summary of vulnerability documents. Unpublished report. Togo: GIZ
20. Ministry of Health 2018: National Strategic Plan to Fight Malaria 2017-2022. Togo: Ministry of Health and Social Protection.
21. Giesen C, Roche J, Redondo-Bravo L, Ruiz-Huerta C, Gomez-Barroso D, Benito A, Herrador Z. The impact of climate change on mosquito-borne diseases in Africa. Pathog Global Health. 2020 Sep;114(6):287-301. doi:10.1080/20477724.2020.1783865. Epub 2020 Jun 25. PMID: 32584659; PMCID: PMC7480509.
22. Rim, K.T. COVID-19 pandemic and the protection of workers' health from disinfectant chemicals. Toxicol. Approximately. Health Sci. 13, 1–7 (2021). https://doi.org/10.1007/s13530-020-00077-z
23. INSEED, 2022: Final results of the fifth General Census of the Human Population of Togo, consulted on April 17, 2023 URL : https://inseed.tg/presentation-des-principaux-resultats-definitifs-du-rgph-5/.