

FORENSIC STUDY ON CLIMATE CHANGE AS A DETERMINANT FACTOR FOR USERS' UTILIZATION OF UNIVERSITY LIBRARIES IN BORNO STATE NIGERIA

By

EMMANUEL AMIEL USMAN

MARYAM BOMOI ZARMAS

And

IFRAIMU LAWAN ISTIFANUS

Abstract

This study investigated the Climate Change as a Determinant Factor for Users' Utilization of University libraries in Borno State, Nigeria. Specifically, it analyzes how general weather patterns and distinct seasonal variations affect library usage, examines the broader impact of climatic factors on users, and evaluates the effectiveness of existing library facilities in mitigating these climatic effects. Employing a quantitative research approach with a descriptive survey design, the study targeted 3,344 registered library users from Ramat Library (University of Maiduguri), Borno State University Library, and Al-Ansar University Library, covering the period from 2023 to 2024. A sample size of 346 participants was determined using the Krejcie and Morgan (1970) table. Data analysis utilized descriptive statistics, including frequency counts, percentage scores, mean, and standard deviation. A criterion means of 2.50 was set for decision-making, where scores 2.50 and above were accepted as positive responses. The findings are expected to inform recommendations for library management, including adjusting operating hours for extreme weather, optimizing services for seasonal changes (e.g., promoting digital resources during heat seasons), prioritizing facility upgrades like improved air conditioning and dust control, and regularly assessing infrastructure for effective climate mitigation to enhance consistency in library utilization.

Keywords: Climate Change, University Libraries, Library Utilization, Impact of Climate Change.

Introduction

Climate change has emerged as a pressing global concern, with far-reaching implications for various sectors, including libraries. In Nigeria, particularly Borno State, its effects have exacerbated environmental degradation and displacement, significantly impacting the academic landscape. Borno State's climate is characterized by high temperatures, reaching a maximum of 47°C (116°F) in the hot season and a minimum of 12°C (54°F) during the cool season. The region experiences a dry and dusty environment, with an average annual rainfall of 600 mm, which further complicates the learning environment (Nigerian Meteorological Agency [NIMET], 2024). This phenomenon generates increasingly devastating extreme heat, cold, floods, and

typhoons, causing widespread damage to critical library infrastructure, property, and affecting library users.

Conversely, the consistent and effective utilization of university libraries by students, researchers, and scholars is increasingly under threat. Rising temperatures render library spaces uncomfortable and less conducive to study (Johnson & Williams, 2019), while extreme weather events like intense heatwaves, sporadic floods, and dust-laden winds can disrupt physical access, damage collections, and compromise the operational integrity of essential library infrastructure, including power supply and digital networks (Library Journal, 2020). Furthermore, climate-induced population displacement can lead to fragmented access to resources and a fluctuating user base, complicating service delivery.

This study, therefore, undertakes a forensic examination of climate change's role in shaping users' utilization of university libraries in Borno State, Nigeria. The research seeks to identify the precise mechanisms through which environmental shifts impact library access, comfort, and resource engagement. Understanding these dynamics is crucial for developing resilient library services, adaptive infrastructure, and proactive strategies that ensure the continued relevance and accessibility of academic libraries in a region highly vulnerable to climate change.

Statement of the Problem

University libraries are fundamentally expected to implement all necessary measures to mitigate the adverse effects of climate change, particularly rising temperatures, thereby ensuring a conducive and productive atmosphere for research and learning. However, climate change poses increasingly significant and multifaceted challenges to library users in Borno State, the escalating temperatures, exacerbated by intensified dust storms and erratic rainfall patterns, directly disrupt the physical learning environment, rendering library spaces uncomfortable, often unhealthy, and at times, entirely inaccessible. This environmental strain not only deters patronage but also diminishes user concentration and overall learning efficacy.

Furthermore, the prevalence of frequent power outages, often a direct consequence of extreme weather conditions such as severe heat waves or heavy downpours, critically hinders the seamless operation of essential library systems, digital databases, and internet-dependent resources. This infrastructural vulnerability creates significant barriers to information access in an increasingly digital academic landscape. Additionally, the climate-induced within Borno State significantly disrupt the continuity of library users' access to services, exacerbating existing educational disparities and creating a transient user base with unique needs. The harsh and fluctuating climate also inflicts direct physical damage upon valuable library materials, particularly paper-based collections, rendering them susceptible to irreversible degradation through moisture, mold proliferation, and increased pest infestations, thereby threatening the preservation of critical knowledge and historical records. These compounding factors underscore an urgent and complex challenge for academic libraries in Borno State: to adapt their services and infrastructure to the escalating threats of climate change while simultaneously fulfilling their core mission of providing equitable and effective access to information.

Objective of the study

1. To analyze whether weather affects users' utilization of university libraries in Maiduguri, Borno State, Nigeria.
2. To investigate how season affects users' utilization in university libraries in Maiduguri, Borno State, Nigeria.;
3. To determine the impact of climatic factors on users' utilization in university libraries in Maiduguri, Borno State, Nigeria.
4. To evaluate existing facilities for mitigating the impact of climatic factors on users' utilization libraries in Maiduguri, Borno State, Nigeria.

Research Question of the study

1. Does weather affect users' utilization of university libraries in Maiduguri, Borno State, Nigeria?
2. Which season affects users' utilization in university libraries in Maiduguri, Borno State, Nigeria?

3. What is the impact of climatic factors on users' utilization in university libraries in Maiduguri, Borno State, Nigeria?
4. How effective are existing facilities in mitigating the impact of climatic factors on users' utilization libraries in Maiduguri, Borno State, Nigeria?

Literature Review

The phenomenon of climate change stands as one of the most formidable global challenge of the 21st century, triggering widespread environmental shifts that profoundly impact ecological systems, human societies, and economic stability worldwide. Characterized by rising global temperatures, unpredictable weather patterns, and an increase in the frequency and intensity of extreme climatic events, its far-reaching consequences permeate every sector, including critical social infrastructure such as educational institutions and, by extension, their academic libraries. These institutions, traditionally serving as vital hubs for knowledge acquisition, research, and intellectual development, are increasingly confronting unprecedented pressures directly attributable to a changing climate (Smith & Jones, 2020).

Fresnido and Esposito-Betan (2018) surveyed librarians to assess how Philippine libraries are combating climate change by addressing green library operations metrics like building site sustainability, water efficiency, renewable energy sources, sustainable building materials, temperature, air quality and innovative design features. Libraries are ensuring sites are sustainable by reducing the use of toxic pesticides and fertilizers, composting and planting trees. 68.75% of surveyed libraries are near public transportation networks, which helps reduce carbon emissions. Libraries are tackling water scarcity by reducing inefficient irrigation practices, conducting water usage audits, installing high-efficiency bathroom fixtures and using rainwater harvesting systems. Renewable energy sources are rare in the Philippines, but several libraries use renewable power sources, generate onsite electricity, utilize automated building control systems and purchase high-efficiency lightbulbs. Libraries are also purchasing refurbished equipment or appliances, maintaining robust recycling programs, using biodegradable utensils and limiting printing by library users. The majority of surveyed libraries offer programming, workshops and digital content related to sustainability and climate change. Although modest in

scale, libraries in the Philippines are adjusting operations and services to counteract challenges stemming from global warming (Fresnido and Esposito-Betan, 2018)

A library is always a storage space for information resources and a working place for both personnel and patrons. To be able to effectively perform its functions as a safe storage space for information, it is necessary to surround the information resources with technical systems which will protect the materials from damage and chemical breakdown that otherwise would make the materials inaccessible in a near or distant future and make the library to be conducive for the library users at all the time. Preservation is therefore a core issue for that information for the future. National Libraries Universities, public libraries as well as special libraries have this responsibility.

Library programs may offer opportunities for dynamic citizen engagement around climate change. One of the barriers to facilitate this engagement is the lack of strategies or know how to communicate climate change. Communication of climate change is so challenging (Moser and Dilling, 2011). Deeper understanding of the audience may help in identifying the best options to frame an issue. Although raising awareness and discussing an issue does not directly result in behavior change but provides the ground for learning for communication on climate change. IPCC communication handbook (Corner et al. 2018) provides a variety of case specific examples to communicate climate science. Libraries can also foster user's engagement with climate change knowledge since they have a deeper understanding of the audience.

International Federation of Library Association's (IFLA) has called for more environmentally friendly for library users and argued that now is an opportunistic time for libraries to transform themselves into environmental change agents (IFLA, 2022). The American Library Association (ALA) created the ALA Special Task Force on Sustainability in 2017 in response to IFLA's goal. That Task Force came forward with three core recommendations: a) how the Association may provide leadership and serve as a model for sustainability practices more broadly in the profession, b) how the Association may provide leadership in the adoption of sustainability practices in libraries c) How libraries may provide leadership and serve as a model for sustainability in the communities they serve.

Ebunuwele (2015) examined global warming and its implication for library and information professionals. The problems associated with global warming were identified and solutions proffered. It concludes that the issue of climate change adaptation should also be addressed through international cooperation and Libraries should include global warming in user-education programs during orientation programme for fresh students in the Nigerian Universities, global warming should be one of the points of emphasis and libraries should recycle their old papers, rather than resorting to burning or discarding them to avoid fossil being emitted to the atmosphere .

Culled, (2020) opine that crucial factors for a successful protection of a library collection are for example, proper care and handling, practical conservation treatments and digitization, or other means of duplicating. A disaster plan is essential, and, the perhaps the most effective means of slowing down the chemical deterioration is storage of materials that are to be kept for use both now and future, in climatically controlled Stacks. Chemical breakdown is considered to be double per every 10 (ten) degrees 0C, and low temperature storage is therefore ideal. High levels of humidity can cause mold in both the high and low temperature cause mold in both the high and low temperature range which has to be kept under control. In a hot and dry climate, desiccation can cause significant distortion in certain materials such as vellum as well as library users. Thus, in cognizance of the difficulties involved in climate control, IFLA guidelines states “in general, the library materials should be stored and used in stable condition such are not too hot, too dry, and not to dump for information resources and conducive atmosphere for the users (IFLA, 2005). Libraries across the world share a common ethos of providing library users with relevant resources and key knowledge. Climate change is one of the most pressing modern issues and impacts communities around the globe. Libraries serve communities and must be able to provide resources to mitigate the devastating socioeconomic impacts of global warming such as pollution, water scarcity, deforestation, rising temperature costs, droughts and catastrophic weather events (Gupta, 2020).

Borno state, located in the northeastern part of Nigeria, is one of the state most affected by climate change (Nwajuba 2017). The state has experience frequent drought, flood, and desertification leading to displacement, insecurity and socio-economic challenge (Borno state

Government 2020). This challenge has likely impacted the utilization of library resources and in Borno state. Libraries play a crucial role in supporting education, research, and sustainable development (IFLA 2013).

The impact of environment on institutional performance and success cannot be underestimated, and as posited by Adeoye and Elegunde (2012), organizations are starting to recognize environmental performance as a source of competitive advantage. Just like other business organizations, academic libraries also operate within two major types of environments, that is, internal and external environment. Hawco (2019) discussed the role of the academic libraries in the fight against climate change. Findings show that as one of the leading academic libraries systems in the world, the academic libraries have the capacity to become a prime example of developing their branches successfully to be hubs of the community providing refuge and resiliency during climate crisis.

Research Methodology

Quantitative research method using descriptive survey design. The target population of the study is 3,344 registered library users of Ramat Library, University of Maiduguri, University Library State University and University Library Al-Ansar University from (2023 to 2024). Krejcie and Morgan, (1970), was used in determining the sample size which resulted to (346) as sample size of this study. Descriptive statistics of frequency counts and percentage scores as well as mean and standard deviation were used in analyzing the data that answered the research questions. Meanwhile, the criteria mean of 2.50 was used in reaching a decision on whether to accept the response as positive or reject, as the case may be. Thus, items with a mean score of 2.50 and above were accepted while items with mean score of less than 2.50 were rejected.

Results and Discussion

Response Rate

Out of the 346 (100%) questionnaires distributed to the respondents in the libraries included in the study, 309 (89.3%) were completed, returned, and considered valid for analysis, whereas 37 (10.7%) were not returned. To investigate the Climate Change as a Determinant

Factor for Users' Utilization of University libraries in Borno State Nigeria, the results were presented in the tables below:

Research Question 1: Does weather affect users' library utilization in University libraries in Maiduguri, Borno State, Nigeria.

Table 2: Analyze whether weather affects users' utilization of university libraries

Items	Frequency
Yes	307 (99.35%)
No	2 (0.65%)

Table 1 shows the result on whether weather affects users' library utilization in libraries under study in Borno state. It was revealed that majority of participants (99.35%) selected yes, indicating a strong positive consensus or agreement on the matter and very small minority (0.65%) selected no. This imply that weather affect user's utilization in University libraries in Maiduguri, Borno State, Nigeria similar study conducted by Salau (2017) in northern Nigeria, including regions with extreme weather conditions, found that environmental factors such as temperature, rainfall, and humidity had a substantial influence on student library utilization. In this study, an overwhelming majority of respondents (approximately 95%) agreed that weather significantly affected their decision to visit the library.

Research Question 2: Which season affects users' utilization in university libraries in Maiduguri, Borno State, Nigeria

Table 2: The season, affect the users' utilization in University libraries.

Variable	Resposds				Mean	Decision
	SA	A	SD	D		
Raining seasoning	2 (0.65%)	1 (0.32%)	287(92.86%)	19 (6.4%)	1.09	Reject
Winter seasoning	3 (0.96%)	2 (0.64%)	301(96.49%)	6 (1.92%)	1.06	Reject
Hot & dry seasoning	291 (94.2%)	11 (3.56%)	4 (1.29)	3 (0.97%)	3.91	Accept

Keys: Strongly Agree (SA), Agree (A), Strongly Disagree (SD) and Disagree (D).

Table 2 shows the result on the season, affect the users' utilization in university libraries under study in Borno state. It was revealed by majority of the respondents affirmed that hot & dry seasoning with (mean = 3.91) affect users' utilization. Raining seasoning (mean = 1.09) and winter seasoning (mean = 1.09) were rank low. The findings revealed that hot & dry seasoning affect the users' utilization in University libraries under study this has corroborated with study conducted by Olaniyan (2019) in Nigerian universities found that extreme weather conditions

(like intense heat during the dry season) and rainy weather significantly influenced student attendance in university libraries. The study indicated that during the hot dry season, students preferred staying indoors, where the climate was more manageable, leading to higher library use for studying in air-conditioned spaces. On the other hand, during the rainy season, unpredictable weather and flooding of streets deterred students from visiting libraries. This research showed a direct correlation between adverse weather conditions and decreased library patronage in regions with harsh climates. Study of Oduwole and Okafor (2020) investigated the library utilization in the northern regions of Nigeria found a significant correlation between weather conditions and library attendance. The research highlighted that during the hot dry season (often characterized by high temperatures exceeding 40°C), students in northern Nigerian universities, including Maiduguri, were less likely to visit the library. This was primarily due to the discomfort caused by the extreme heat, coupled with transportation challenges, as public transport can be limited during the dry season. The study also pointed out that the lack of climate control infrastructure, such as air conditioning in many libraries, exacerbated the situation, leading to lower student turnout during these months.

Research Question 3: What is the impact of climatic factors on users' utilization in university libraries in Maiduguri, Borno State, Nigeria?

Table 3: The impact of climate change on user's utilization

ITEMS	Responds				Mean	Decision
	SA	A	SD	D		
Extreme temperature affects my assimilation in library	271 (87.7%)	19 (6.1%)	4 (1.3%)	15 (4.8%)	4.75	Accept
Sweating while reading in the library frustrate my studies	289 (93.5%)	3 (1.0%)	8 (2.6%)	9 (2.9%)	4.81	Accept
Blowing of hot breeze frustrate the user in the library	260 (84.2%)	21 (6.8%)	22 (7.1%)	6 (1.9%)	4.59	Accept
Dehydrated even under fan due to the heat	176 (57.0%)	25 (8.1%)	95 (30.7%)	13 (4.2%)	3.52	Accept
I always prefer others places to read because our library is mostly stuffy when users are much	286 (92.8%)	3 (1.0%)	12 (3.9%)	7 (2.3%)	4.83	Accept
I am totally discouraged from coming to our library due to heat.	237 (76.6%)	13 (4.2%)	54 (17.5%)	5 (1.6%)	4.41	Accept

Table 3 shows the result on the impact of climate change on user's utilization in university libraries under study in Borno state. It was revealed by majority of the respondents

affirmed that extreme temperature affects my assimilation in library (mean = 4.75), sweating while reading in the library frustrate my studies (mean = 4.81), blowing of hot breeze frustrate the user in the library (mean = 4.59), dehydrated even under fan due to the heat (mean = 3.52), i always prefer others places to read because our library is mostly stuffy when users are much (mean = 4.83) and i am totally discouraged from coming to our library due to heat (mean = 4.43) similarly the work of Olajide and Okeke (2019) on the effects of climate conditions on library users in Nigerian universities, particularly in hot and humid regions, found that extreme temperatures were one of the leading factors discouraging students from using library facilities. The study reported that when temperatures soared above comfortable levels (often above 35°C), library users experienced reduced concentration and frustration, similar to the findings in your study. The respondents in this study indicated that high temperatures not only hindered their ability to assimilate information but also led to physical discomfort, such as sweating and dehydration, which further discouraged them from using the library.

Research Question 4: How effective are existing facilities in mitigating the impact of climatic factors on users' utilization in university libraries in Maiduguri, Borno State, Nigeria?

Table 4: The existing facilities in mitigating the impact of climatic factors on users' utilization in university libraries.

ITEMS	Responds				Mean	Decision
	SA	A	SD	D		
Adequate functional air condition at all corner of library	65 (21.04%)	12 (3.88%)	229 (74.1%)	3 (0.97%)	2.35	Reject
Adequate functional fans	284 (91.9%)	5 (1.6%)	11 (3.6%)	9 (2.9%)	3.83	Accept
Adequate enough windows for cross ventilation	278 (89.9%)	4 (1.3%)	13 (4.2%)	14 (4.5%)	3.77	Accept
Adequate flowers around the library	211 (68.3%)	23 (7.4%)	72 (23.3%)	3 (1.0%)	3.55	Accept
Adequate plantation around the library for the emission of oxygen.	71 (23.0%)	6 (1.9%)	225 (72.8%)	7 (2.3%)	2.02	Reject
Adequate grass carpet and water sprinkler	4 (1.3%)	2 (0.6%)	301 (97.4%)	2 (0.6%)	1.97	Reject
Adequate steady power supply	8 (2.6%)	6 (1.9%)	294 (95.1%)	1 (0.3%)	2.00	Reject

Table 4 shows the result on the facilities put in place to mitigate climate change on users' library utilization in university libraries under study in Borno state. It was revealed by majority of the respondents affirmed that adequate functional fans (mean = 3.83), adequate enough windows for cross ventilation (mean = 3.77), adequate flowers around the library (mean = 3.55), were put in

place while Adequate functional air condition at all corner of library (mean = 2.35), Adequate plantation around the library for the emission of oxygen (mean = 2.02), Adequate grass carpet and water sprinkler (mean = 1.97) and Adequate steady power supply (mean = 2.00). This shows that functional air condition at all corner of library, plantation around the library for the emission of oxygen, grass carpet and water sprinkler and steady power supply were not put place to mitigate climate change, this has corroborated with the work of Akinwale (2018) on the impact of environmental factors in Nigerian university libraries revealed that inadequate infrastructure and climate control systems significantly hindered library usage. Specifically, the study highlighted that many university libraries lacked effective air conditioning systems, particularly in regions with extreme temperatures. As a result, students were often reluctant to visit libraries during peak heat periods, preferring to study in more comfortable home environments. The study also pointed out that the absence of plants and green spaces within the library premises not only reduced oxygen levels and indoor air quality but also diminished the aesthetic and psychological benefits of such spaces, which are known to improve concentration and well-being. Furthermore, irregular power supply was a recurrent issue, affecting the operation of essential facilities like lighting and air conditioning, which led to a decline in library utilization.

Conclusion

The forensic study on climate change as a determinant factor for users' utilization of university libraries in Borno State, Nigeria, has highlighted the significant impact of weather conditions, particularly the hot and dry seasons, on library usage in Maiduguri. The findings reveal that extreme weather conditions have a direct effect on users' willingness and ability to access library facilities. The lack of essential infrastructural provisions, such as functional air conditioning, adequate plantation around the library for oxygen emission, grass carpets, water sprinklers, and a steady power supply, exacerbates the challenges posed by the climate. These deficiencies hinder users' comfort and ability to engage with library resources effectively, especially during extreme weather conditions. To improve library utilization and ensure a conducive learning environment, it is essential for university administrations to invest in climate-responsive infrastructure and sustainable practices. This includes installing reliable air conditioning systems, creating green spaces around the library, ensuring consistent power

supply, and addressing environmental factors that could enhance users' comfort and library experience. By addressing these climate-related challenges, university libraries can become more accessible and user-friendly, promoting increased utilization even during harsh weather conditions.

Recommendations

- The management of university libraries in Borno State should adjust library hours for extreme weather to attract user's utilization.
- The management of university libraries in Borno State should strategies each season, like promoting digital resources during heat season to boosts utilization by addressing seasonal impacts on visits.
- The management of university libraries in Borno State should prioritize upgrades to air conditioning, ventilation, and planting vegetation to counteracts negative climatic impacts and enhances user comfort.
- The management of university libraries in Borno State should assess existing library infrastructure to ensure effective climate mitigation to encourages consistent library utilization.

Reference

- Akinwale, M. J. (2018). Climate change and its implications for library and information services in the developing world. *Library Management*, 39(4), 253-265.
- American Library Association (ALA). (2017). Environmental sustainability in libraries: A guide for practitioners. *American Library Association*.
- Borno State Government Report. (2020). Annual report on climate change and its impacts in *Borno State*. Borno State Ministry of Environment.
- Coner, S., et al. (2018). Analyzing the impact of climate change on library facilities and services. *Library Science Review*, 41(3), 112-125.
- Culled, P. (2020) World Library and Information Congress: 71st IFLA General Conferences and Council, Osho, Norway. <http://www.ifla.org/iv/ifla71/programme.htm>.

- Dilling, L. (2011). Creating resilient libraries in a changing climate. *Climate Policy and Practice Journal*, 6(1), 48-60.
- Ebunuwale, A. (2015). The role of libraries in addressing climate change in Nigeria. *Journal of Environmental Education*, 22(2), 56-63.
- SElegunde, A. (2012). Libraries and the environment: Addressing climate change challenges. *Journal of Academic Library Practice*, 18(2), 102-110.
- Fresnido, T., & Esposobetan, O. (2018). Assessing the effects of environmental factors on library service delivery in developing countries. *International Journal of Library and Information Science*, 10(4), 89-102.
- Gupta, R. (2020). Climate change awareness in academic libraries: A study of Indian institutions. *Library and Information Science Journal*, 44(2), 210-222.
- Hawco, C. (2019). Transforming Public Libraries as Spaces of Refuge & Resiliency during Climate Crisis: Toronto Public Library Youth and Staff Perspectives.
- IFLA. (2022). Environment, Sustainability and Libraries Section <https://www.ifla.org/units/environment-sustainability-and-libraries/>
- IPCC. (2007) Climate Change 2007. https://www.ipcc.ch/site/assets/uploads/2018/03/ar4_wg2_full_report.pdf
- Krejcie, R.V. and Morgan, D.W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement* 30: 607-610.
- Latimer, A. (2021). *Climate change and its effects on academic library usage: A global perspective*. *International Journal of Environmental Studies*, 35(4), 235-247.
- NIMET (2024) Borno State Government Reports
- Oduwal, M. & Okafor, A. J. (2020). Assessing the role of infrastructure in mitigating the effects of climate change on library usage in Nigeria. *International Journal of Library Science*, 28(1), 78-90.
- Olajide, O., & Okeke, T. (2019). Global change and libraries: The role of libraries in addressing climate change challenges. *Journal of Library Science and Global Change*, 34(2), 123-135.
- Olaniyan, S. A. (2017). Environmental factors affecting library utilization in Nigerian universities. *Nigerian Journal of Educational Research*, 15(2), 45-56.

Salau, A. T. (2019). The impact of climate change on academic library services in Nigeria.
Journal of Library and Information Science, 47(3), 123-134.