Leveraging Library-Based Open Data Initiatives for Climate Change Mitigation and Sustainable Development in Nigeria

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Abstract

Climate change is an issue that is posing serious threats to Nigeria's environmental sustainability, food security, and economic development. The situation has necessitated data-driven and innovative mitigation strategies. Open data has surfaced as a critical solution for evidence-based climate action. Though, its potential has been underutilized by many developing countries like Nigeria. This paper attempts to examine how libraries can leverage on open data initiatives to support climate change mitigation and sustainable development in Nigeria. In the process, key concepts including open data, library-based open data initiatives, climate change mitigation, sustainable development were explicated, the role of libraries in advancing open data for climate action in Nigeria were discussed, and the challenges facing library-based open data initiatives in Nigeria were examined. Among others, the paper concludes with a recommendation for empowering libraries to lead and coordinate open data initiatives to enhance climate resilience, promote inclusive knowledge access, and contribute to the sustainable development of Nigeria.

Key words: Climate change, libraries, open data initiatives**,** sustainable development.

Introduction

Across the globe, every flood that envelops a community, or every farming season that is thrown off by unpredictable rainfall, carries with it, a quieter casualty: the data that could have warned the people of a possible upcoming disaster, alongside the data that could have helped them to plan better next time. With specifics to the Nigerian nation, however, the country is already living the consequences of a warming planet. According to Climate Action Tracker (2024), Nigeria's Long-Term Low-Emissions Development Strategy commits the country to net-zero emissions by 2060. Interestingly, the Federal government has acknowledged that financing this transition remains a major unresolved gap, and bridging that gap requires more than money. It will require adequate information on climate data, environmental records, and locally generated knowledge to reach the people, researchers, and policymakers who need it, in a form they can actually use. This is where libraries, being strategic institutions that are rarely mentioned in national climate strategies, quietly matter more than imagined.

Across the shores of Nigeria and beyond, libraries are increasingly recognised as knowledge hubs that are capable of providing access to climate data, research outputs, local knowledge systems, and disaster-warning information through digital repositories, open access platforms, and community-based information services (Dada and Musa, 2026). In consideration to their value, Dada and Musa (2026) stressed that open data is not a peripheral technical concern for libraries but a core extension of their mission: freely accessible, reusable, and shareable information has become an important vehicle for democratising climate knowledge and expanding public access to reliable environmental information. Based on the forestated, Jagabah (2025) noted that libraries that curate environmentally sustainable collections and actively facilitate climate education are already positioning themselves as community-based hubs for climate literacy and resilience building, rather than passive repositories of print materials.

Despite the aforesaid, Ishola *et al.,* (2025) reported that a nationwide survey of Library and Information Science practitioners found a significant lack of comprehensive climate change policies within Nigerian libraries, with inadequate infrastructure and funding constraints further limiting their ability to prioritise sustainable, climate-responsive practices. The consequences extend beyond institutional inconvenience: without deliberate policy attention, libraries risk losing valuable information resources to climate-related hazards such as flooding, even as those same collections could otherwise support the country's education, research, and disaster-preparedness needs (Ishola *et al.*, 2025). Also, Ajani *et al.*, (2024) reported that the broader green library movement argued that libraries must engage more assertively with international climate advocacy rather than waiting for external direction, since sustained global cooperation depends on grassroots institutions translating climate commitments into local action.

Howver, the gap between potential and practice is playing out against a backdrop of ambitious national commitment. For instance, Nigeria's 2025 Voluntary National Review reaffirms the country's resolve to implement the Sustainable Development Goals through an Integrated National Financing Framework and an Inclusive Data Charter Action Plan explicitly designed to strengthen the national statistical system (United Nations Nigeria, 2025). An inclusive, well-governed data ecosystem of this kind cannot be built by central government agencies alone; it requires distributed institutions, of which Nigeria's academic, public, and special libraries are among the most widespread, to curate, preserve, and disseminate climate-relevant data at the community level. Scholars have similarly argued that the wider 'green library revolution' positions libraries as

catalysts for climate action precisely because they reached into communities that formal government data portals rarely touch (Ajani, Tella, and Enakrire, 2024).

It is this convergence — a country under mounting climate pressure, a national data and sustainability agenda still taking shape, and a library sector already active in climate literacy but constrained by weak policy and infrastructure — that this paper sets out to examine. Specifically, it explores how library-based open data initiatives can be more deliberately leveraged to support climate change mitigation and sustainable development in Nigeria, and proposes a conceptual framework for understanding the pathway from library-held data to national development outcomes.

Conceptual Framework

The framework below situates libraries as an intermediary layer between raw climate and environmental data and the national outcomes Nigeria has committed to under Agenda 2030 and its own climate strategy. It distinguishes four interacting levels.

Data Sources	Library-Based Open Data Functions	Community & Institutional Outcomes	National Development Impact
Government climate/environmental data; research repositories; local & indigenous knowledge	Curation & preservation; open access provision; digital repositories; climate literacy programmes	Public climate literacy; disaster preparedness; informed research & policy; community resilience	Climate change mitigation; SDG progress; Nigeria's net-zero and NDC commitments

From an active translation layer, the above framework treats libraries as active, and not passive custodians of fragmented climate and environmental data. Much of it produced by government agencies, researchers, or communities, and convert it into curated, openly accessible, and locally meaningful information. The translation function produces the community-level outcomes (climate literacy, disaster preparedness, better-informed local research and policy engagement) on which Nigeria's national development impact ultimately depends. The framework's central proposition is that the weakest point in this chain, as the evidence above suggests, is not the availability of climate data itself but the capacity of libraries, infrastructure, policy, and funding, to perform the curation and dissemination function reliably. By implication, srengthening that capacity, rather than generating additional climate data becomes the most direct lever available for translating Nigeria's existing data and policy commitments into measurable climate and development outcomes.

Explication of Concepts

Open data refers to data that can be freely used, reused, and redistributed by anyone, for any purpose, subject at most to requirements of attribution and share-alike (Open Knowledge Foundation, n.d.). Further, the body stated that beyond mere availability, genuinely open data must be accessible in a convenient, machine-readable form and free of legal or technical restrictions that limit reuse. In the context of this paper, open data extends to climate and environmental datasets

including flood risk maps, emissions inventories, rainfall records, and local adaptation knowledge whose value for mitigation and sustainable development depends entirely on whether they are actually reachable by the researchers, policymakers, and communities who need them.

Library-based open data initiatives are the deliberate efforts of libraries, information centres, and community information services to curate, preserve, and openly disseminate data and knowledge, including climate-related data, through digital repositories, open access platforms, and community outreach (Dada and Musa, 2026). Rather than treating open data as a purely technical government function, this framing positions libraries as active intermediaries that convert raw or scattered data into curated, locally meaningful collections that support climate literacy, disaster preparedness, and evidence-based decision-making at community level (Dada and Musa, 2026; Jagabah, 2025).

Climate change mitigation refers to human interventions aimed at reducing the sources of greenhouse gas emissions or enhancing the sinks that remove them from the atmosphere, distinguishing it from adaptation, which concerns adjusting to climate impacts already underway (Intergovernmental Panel on Climate Change [IPCC], 2023). For the purpose of this paper, mitigation depends not only on technological and policy interventions but also on the availability of accurate, accessible climate data that allows researchers, planners, and citizens to identify emission sources, track progress, and make informed choices. In other words, it is a data function in which libraries can play a meaningful, if underrecognised, role.

Sustainable Development entails the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987). Operationalised globally through the Sustainable Development Goals, it requires functioning national data ecosystems capable of tracking progress and informing policy (United Nations Nigeria, 2025). In Nigeria, where the 2025 Voluntary National Review explicitly links SDG implementation to strengthening the national statistical system, the capacity of libraries to curate and share open data forms a small but significant part of the wider sustainable development data infrastructure that the country is building.

The Role of Libraries in Advancing Open Data for Climate Action in Nigeria

In Nigeria, many people often think of climate action as the business of government ministries, research institutes, or international donors, producing satellite data and policy reports. Sadly, libraries rarely make that list, despite being the only institution within the reach of ordinary Nigerian citizens that has both the mandate and infrastructure to turn scattered climate information into something tangible that a student, farmer, or local planner can actually use. Understanding what libraries are already doing, and what stands in their way, matters for anyone serious about closing Nigeria's climate data gap.

One of the clearest role libraries play is as curators and disseminators of climate knowledge. Document-analysis evidence across Nigeria, the United Kingdom, and the United States shows libraries and community information centres functioning as knowledge hubs that provide access to climate data, research outputs, local knowledge systems, and disaster-warning information through digital repositories and open access platforms (Dada and Musa, 2026). Frther, the authors argued that it is not a hypothetical function, but clearly how many libraries justify their relevance to funders and communities alike, positioning open knowledge services as vital to strengthening both sustainable development and community response to climate challenges.

Closely related to the above is the library's role in building climate literacy through the collections they choose to develop. Jagabah (2025) posited that by curating resources focused on environmental stewardship and local resilience strategies, and by facilitating community-based climate education, libraries help translate abstract climate science into locally relevant understanding. This curatorial role is what distinguishes a library from a government data portal. For example, while a portal publishes a dataset, a library can contextualise it, teach people to interpret it, and connect it to the specific drought, flooding, or heat risks a community actually faces.

Again, libraries also have a quieter but no less important role in disaster preparedness and information resilience via safeguarding the very collections and data infrastructure that climate action depends on. Nationwide survey evidence from Nigerian Library and Information Science practitioners found that inadequate infrastructure exacerbates the vulnerability of libraries themselves to climate-related hazards such as flooding and temperature fluctuations, threatening the loss of valuable information resources (Ishola *et al.*, 2025). A library that cannot protect its own collections from a flood is poorly positioned to help a community prepare for one; resilience, in this sense, has to start at home before it can be extended outward.

Beyond individual institutions, the library sector has begun positioning itself within the wider global climate advocacy movement rather than waiting passively for policy direction from government. The green library movement frames libraries as having a responsibility to engage international communities and cooperate across borders on climate action, treating environmental advocacy as core professional practice rather than an optional add-on (Ajani, Muhammed, *et al.,* 2024). This same movement argues that libraries function as catalysts for climate action precisely because they reach communities that formal, centralised data systems often do not (Ajani, Tella, and Enakrire, 2024).

Put together, the roles of curating and disseminating climate data, safeguarding information resources against the very hazards they document, building local climate literacy, and engaging in wider climate advocacy place the library sector with much potential. What consistently limits that potential in Nigeria is not a shortage of willing professionals or relevant data, but weak institutional backing. The same evidence base that documents libraries' climate functions also documents the absence of comprehensive climate change policy, inadequate infrastructure, and constrained funding behind them (Ishola *et al.*, 2025). By implication, advancing open data for climate action in Nigeria, then, is as much a matter of investing in libraries as it is a matter of generating better climate data in the first place.

Challenges Facing Library-Based Open Data Initiatives in Nigeria

For all the goodwill behind Nigeria's green library movement, most librarians trying to build an open climate data initiative are working without the basic scaffolding that would make it sustainable: a policy to point to, a server that will not crash the next time it rains, or a budget line that survives to the following fiscal year. The challenges below are not a list of excuses; they are the specific, evidenced constraints that separate what libraries could do from what they are currently able to do.

i **The absence of comprehensive policy frameworks:** The most fundamental constraint is the near-total absence of climate-responsive data policy at institutional level. A nationwide survey of 397 Library and Information Science practitioners found a significant lack of comprehensive climate change policies within Nigerian libraries, a gap that directly impedes effective

prioritisation and resource allocation for sustainable practices (Ishola *et al.*, 2025). Without a policy mandate, open data work becomes discretionary, dependent on the enthusiasm of individual librarians rather than embedded in institutional practice, which makes it fragile and difficult to scale beyond a handful of pioneering institutions.

ii **Inadequate infrastructure and technological barriers:** Even where the will exists, the infrastructure often does not. Inadequate infrastructure exacerbates the vulnerability of Nigerian libraries to the very climate hazards their data initiatives are meant to help communities withstand, including flooding and temperature fluctuations that threaten both physical and digital collections (Ishola *et al*., 2025). At the collection-development level, libraries face limited financial resources and technological barriers that make it difficult to invest in the digital repositories, reliable connectivity, and storage systems that open data work depends on (Jagabah, 2025). This is a double bind: the infrastructure gap makes libraries poor stewards of open data precisely because it also makes them vulnerable to the climate risks that data is meant to address.

iii **Funding constraints within a wider national financing gap:** Library funding constraints do not exist in isolation; they mirror a broader national pattern in which Nigeria's own climate transition remains under-financed. The country's Energy Transition Plan, aimed at achieving net-zero emissions by 2060, has yet to secure sufficient international financing despite an initial push to raise support ahead of COP27 (Climate Action Tracker, 2024). If flagship national climate initiatives struggle for funding at that scale, it is unsurprising that library open data work a comparatively low-visibility line item is rarely prioritised in institutional or government budgets, leaving many initiatives dependent on ad hoc grants or the goodwill of individual champions.

iv **Weak cross-sectoral engagement and limited community reach: L**ibraries have not yet fully embedded themselves within either the international climate advocacy community or their own local communities. Advocates argue that libraries need to engage international communities more assertively as part of global climate change action, rather than operating in isolation from the wider environmental movement (Ajani *et al*., 2024). Locally, curators note the continuing need for greater community engagement alongside collection development, since a repository of open climate data delivers little value if the people who need it most do not know it exists or do not trust the library as a source of climate information (Jagabah, 2025).

Strategies for Leveraging Library-Based Open Data for Climate Mitigation and Sustainable Development

The above challenges are neither unique to libraries, nor unsolvable. What is needed are strategies that are grounded in what is already working elsewhere in the sector, adapted to Nigeria's specific policy and funding environment.

1. **Developing and institutionalising climate data policy:** The starting point has to be policy, since the evidence directly links its absence to poor prioritisation and resource allocation (*Ishola et al.,* 2025). Library governing bodies such as the Nigerian Library Association (NLA), and the Librarians Registration Council of Nigeria (LRCN), down to institutional management, should adopt climate-responsive data management policies that specify what climate and environmental data libraries will curate, how it will be preserved, and who is accountable for it, converting open data work from an individual passion project into an institutional obligation.

2. **Aligning library data work with national data infrastructure:** Rather than building isolated repositories, libraries should position themselves as delivery partners within Nigeria's existing national data commitments. The 2025 Voluntary National Review highlights the government's Inclusive Data Charter Action Plan and its drive to strengthen the national statistical system as core planks of SDG implementation (United Nations Nigeria, 2025). Libraries that formally align their open data initiatives with this framework, for instance, by becoming recognised local data-access points stand a better chance of securing both legitimacy and funding than those operating entirely outside it.
3. **Adopting recognised open data standards:** To ensure the data libraries curate is genuinely usable, initiatives should be built around established open data principles, i.e. data that is freely available, in convenient and machine-readable form, and free of restrictive licensing (Open Knowledge Foundation, n.d.). Adopting these standards from the outset avoids the common failure mode of digitising climate records that remain technically 'available' but practically unusable by the researchers, journalists, and community groups who need them.
4. **Investing in infrastructure and staff capacity:** Government agencies, development partners, and university administrations should treat library digital infrastructure including servers, backup systems, and climate-resilient storage as part of national climate adaptation investment, not merely a library-sector concern, given how directly infrastructure gaps translate into vulnerability during flooding and other hazards (Ishola *et al*., 2025). This should be paired with structured staff training in open data curation and climate literacy, addressing the technological and financial barriers already identified in the collection-development literature (Jagabah, 2025).
5. **Strengthening Community Engagement and Climate Literacy Programming:** Open data is of no value if it is not used. Therefore, libraries should deliberately design outreach around the datasets they curate. Jagabah (2025) stated that flood-risk workshops built around locally held rainfall data, or school programming that pairs emissions information with practical climate literacy, should be mapped out to close the community engagement gap identified in the literature. Framing this work explicitly as climate mitigation, meaning it should be understood as supporting the identification of emission sources and informed local decision-making, not only disaster response, keeps libraries connected to Nigeria's broader mitigation goals rather than adaptation alone (IPCC, 2023).
6. **Building International and Cross-Sectoral Partnerships:** Individual libraries should not have to solve funding and capacity gaps alone. The call for libraries to engage international communities in climate action (Ajani *et al.*, 2024) points toward a practical strategy: formal partnerships with international library networks, climate research bodies, and open data organisations that can provide technical support, training, and co-funding, while local libraries provide the community reach and contextual knowledge that outside partners typically lack.

Conclusion

Nigerian libraries already have most of what leveraging open data for climate action requires. They have the community trust, professional expertise, and a growing body of evidence-based advocacy that projects them toward the required role. What they lack is not capability but institutional backing i.e., the policy, infrastructure, and funding that would let existing good practice scale beyond a handful of pioneering institutions (Ishola *et al.,* 2025). Nigeria's own climate and sustainable development commitments, from its net-zero pledge to its Voluntary National Review, depend on exactly the kind of accessible, locally grounded data that libraries are positioned to

provide (Climate Action Tracker, 2024; United Nations Nigeria, 2025). Meeting that potential requires treating libraries as genuine partners in the country's climate data infrastructure, not as an afterthought to it.

Recommendations

Based on the discussion above, the following recommendations are proposed for policymakers, library administrators, and development partners:

1. NLA, LRCN and the management of institutions in Nigeria should develop and adopt formal climate-responsive data management policies, specifying curation, preservation, and accountability for climate-related open data.
2. Governments in Nigeria across all levels of governance should recognise libraries as critical access points within the Inclusive Data Charter Action Plan and the wider national statistical system by extending the existing SDG data infrastructure funding to library-based initiatives.
3. Library open data projects should adopt recognised open data standards from inception to ensure datasets are genuinely reusable rather than merely digitised (Open Knowledge Foundation, n.d.).
4. Development partners and top administrations in our institutions of higher learning and should prioritise investment in climate-resilient library infrastructure and structured staff training in open data curation and climate literacy.
5. Libraries should deliberately design relevant community engagement and climate literacy programmes around the specific datasets they hold, rather than treating curation and outreach as separate activities.
6. Library associations should pursue formal partnerships with international library networks and climate research organisations to access technical support, training, and co-funding for open data initiatives (Ajani *et al.*, 2024).

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