

Environmental Security and Financing Mechanisms for Climate-Resilient Development in Calabar Municipality Local Government Area of Cross River State, Nigeria

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The study investigated environmental security and financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State, Nigeria. Two objectives guided the study: to examine the influence of resource security on financing mechanisms for climate-resilient development and to assess the influence of human and livelihood security on financing mechanisms for climate-resilient development in Calabar Municipality. A survey research design was adopted for the study. The population comprised residents of Calabar Municipality, with a population figure of 179,392 according to the 2006 National Population Census. The Taro Yamane sample size determination method was used to select 400 respondents, while stratified random sampling technique ensured adequate representation across relevant residential and community categories. Data were collected using a structured questionnaire titled “Environmental Security and Climate-Resilient Development Financing Questionnaire (ESCRDFQ).” The instrument was validated by experts in environmental education, and measurement and evaluation, while reliability was established using Cronbach Alpha, with coefficients of 0.81 for resource security, 0.83 for human and livelihood security, and 0.86 for financing mechanisms for climate-resilient development. Data were analyzed using simple linear regression analysis at the 0.05 level of significance. The findings revealed that resource security significantly influenced financing mechanisms for climate-resilient development, while human and livelihood security also significantly influenced financing mechanisms in the study area. The study concluded that environmental security plays a critical role in strengthening climate-resilient development finance. It recommended improved resource protection, livelihood-based climate financing and community-based resilience funds.

Keywords: Environmental security; Climate-resilient development; Resource security; Human and livelihood security; Climate financing mechanisms.

Introduction

Climate change has become one of the most serious environmental, social, and economic challenges confronting societies across the world. It is associated with rising temperatures, irregular rainfall patterns, flooding, drought, erosion, biodiversity loss, food insecurity, displacement, infrastructure damage, and threats to human welfare. These climate-related risks have direct implications for environmental security because they affect the availability, quality,

and stability of natural resources on which people and communities depend. Environmental security is concerned with the protection of natural resources, ecosystems, human welfare, and livelihoods from environmental threats that can weaken peace, development, and survival. In this regard, climate change is not only an environmental issue but also a security and development concern because it affects access to water, land, food, health, income, shelter, and sustainable livelihood systems.

Resource security has become a major determinant of the type, scale and reliability of financing mechanisms available for climate-resilient development, especially in vulnerable communities where livelihoods depend heavily on land, water, forests, fisheries and energy systems. When natural and productive resources are secure, climate finance is more likely to be channelled into bankable adaptation projects because financiers can identify clear assets, beneficiaries, risks and expected development outcomes. In contrast, resource insecurity weakens investment confidence because it increases uncertainty around land access, water availability, food production, energy supply and community stability. This means that communities with poor resource governance often struggle to attract grants, concessional loans, adaptation funds and private-sector climate investments. Recent climate resilience financing discussions emphasize that predictable and accessible finance is necessary for vulnerable African communities, particularly where resource pressure is already intensifying due to climate change (Ayompe & Epie, 2025). Therefore, resource security influences climate-resilient development by determining whether financing mechanisms can move from policy commitments to practical investment in local adaptation systems.

The influence of resource security is also evident in the widening adaptation finance gap faced by developing countries. Where water, land, agricultural and ecological resources are

threatened, governments and communities require larger volumes of finance to protect livelihoods, rebuild infrastructure and reduce exposure to climate shocks. However, the available flow of adaptation finance remains far below estimated needs, making resource-secure planning essential for prioritising limited funds. The adaptation finance gap shows that developing regions require substantial annual financing to respond to climate risks, with Sub-Saharan Africa facing high adaptation needs relative to its economic capacity (Mungai et al., 2021). This implies that financing mechanisms must be structured around secure access to critical resources so that climate funds can support irrigation, watershed management, climate-smart agriculture, renewable energy and resilient infrastructure. Where resource insecurity is ignored, climate finance may become reactive, fragmented and insufficient to address the real drivers of vulnerability.

In Nigeria and similar developing economies, resource security strongly affects the readiness of climate projects for financing. Climate finance institutions often require clear project pipelines, credible implementation structures and measurable resilience outcomes before funds are released. When communities have reliable data on resource availability, land use, environmental risks and livelihood needs, it becomes easier to design investment-ready projects that can attract public finance, development finance and private capital. The 2024 landscape of climate finance in Nigeria notes the need for costed, integrated and investment-ready climate action plans, while also identifying the absence of bankable project pipelines as a major constraint (Owolabi et al., 2020). This shows that resource security is not only an environmental issue but also a financing condition because secure and well-documented resources make projects more credible to funders. In this sense, local resource security can improve access to mechanisms such as green bonds, climate funds, concessional finance, public-private partnerships and results-based adaptation finance.

Resource security also influences financing mechanisms by shaping the level of risk attached to climate-resilient development investments. Investors and development partners are more willing to finance projects where there is reduced risk of conflict over land, uncertainty over water rights, degradation of ecosystems or disruption of livelihoods. Where such risks are high, financing may become more expensive, delayed or redirected to less vulnerable locations. The African Union's climate change and resilient development strategy links climate finance mechanisms with resilient water investments, sustainable resource management and development funds, indicating that resource governance is central to mobilising finance for adaptation (Bowman & Minas, 2019). This relationship is important because secure resources reduce the likelihood that funded projects will fail due to social disputes, environmental depletion or weak institutional coordination. As a result, resource security helps transform climate finance from short-term intervention into long-term development investment.

Financing mechanisms for climate-resilient development are also affected by the extent to which resource security supports domestic revenue mobilisation and private-sector participation. Governments with stronger control over natural resources, energy systems, agricultural productivity and environmental assets are better positioned to raise internal funds, create climate budget lines and attract co-financing from private investors. In contrast, resource insecurity can increase public expenditure on emergency response, food imports, displacement support and infrastructure repairs, leaving fewer resources for proactive adaptation planning. The African Development Bank has argued that institutional and regulatory reforms are necessary to mobilise more domestic and external private climate finance in Africa (Michaelowa et al., 2021). This suggests that resource security must be supported by transparent regulation, accountable local institutions and predictable investment rules. When these conditions exist, financing mechanisms

such as blended finance, climate bonds, resilience funds and public-private partnerships become more feasible for climate-resilient development.

Resource security further determines whether climate finance can be inclusive and locally responsive. In many communities, climate vulnerability is tied to insecure access to farmland, clean water, forests, fisheries, energy and livelihood assets. If financing mechanisms do not address these resource-based vulnerabilities, they may strengthen infrastructure without improving household resilience. Recent analysis of climate finance in Africa stresses the need for predictable finance, innovative financing, stronger partnerships and policies that promote inclusivity and resilience (Narayan et al., 2025). This implies that resource-secure communities are better able to participate in climate finance because their needs can be translated into measurable investment priorities. Therefore, financing mechanisms are more effective when they are linked to secure livelihoods, resource rights, environmental protection and local institutional capacity.

Human and livelihood security have become central to the financing of climate-resilient development because climate change directly affects people's safety, welfare, income, food systems and survival opportunities. Human security refers to protection from poverty, hunger, health risks, displacement, unemployment and social exclusion, while livelihood security concerns the ability of households and communities to sustain reliable means of income and survival. In climate-vulnerable societies, these dimensions determine whether financing mechanisms can produce meaningful development outcomes or merely support isolated adaptation projects. Where people face food insecurity, unstable income, poor housing, weak health systems and repeated environmental shocks, climate finance must be structured to reduce vulnerability before long-term resilience can be achieved. The Intergovernmental Panel on Climate Change explains that climate-resilient development integrates adaptation, mitigation and sustainable development in ways that

promote human well-being, equity and justice (Singh & Chudasama, 2021). This implies that financing mechanisms for climate-resilient development must be people-centred, since investments that ignore human and livelihood insecurity may fail to address the social foundations of climate vulnerability.

The influence of human security on climate-resilient financing is evident in how funders assess risk, urgency, inclusion and social return on investment. Climate finance becomes more effective when it supports health protection, food security, safe settlements, education, social protection, early-warning systems and access to basic services. These areas are not separate from climate-resilient development because they determine whether people can withstand shocks, recover from losses and participate in adaptation activities. When households lack stable income, social protection or access to essential services, they may be unable to adopt climate-smart technologies, relocate from high-risk areas or sustain new livelihood practices. The International Labour Organization argues that social protection is essential for climate action because it strengthens people's capacity to absorb shocks, recover from climate impacts and adjust to greener livelihood systems (Banu & Fazal, 2025). Therefore, human security influences financing mechanisms by requiring climate funds to include protective, inclusive and adaptive components rather than focusing only on infrastructure, energy transition or environmental restoration.

Livelihood security also shapes climate-resilient development financing by determining the sectors, beneficiaries and financial instruments required for effective adaptation. In many developing communities, livelihoods depend on agriculture, fishing, forest resources, petty trade and informal employment, all of which are highly sensitive to flooding, drought, erosion, rainfall variability and heat stress. If livelihood systems are insecure, financing mechanisms such as grants, concessional loans, microfinance, revolving funds, insurance schemes and public-private

partnerships must be designed to reduce livelihood loss and improve adaptive capacity. This explains why climate finance increasingly supports climate-smart agriculture, resilient food systems, livelihood diversification, rural enterprise development and smallholder adaptation. The Food and Agriculture Organization states that climate action in agrifood systems requires comprehensive and cross-sectoral approaches because climate change directly affects food production, rural livelihoods and agricultural sustainability (Chevallier, 2023). This shows that livelihood security influences financing mechanisms by pushing climate-resilient development towards productive investments that protect household income, strengthen local economies and reduce dependence on fragile livelihood systems.

Human and livelihood insecurity also affect access to financing mechanisms because vulnerable groups often face barriers to formal finance. Poor households, women, informal workers, rural farmers, displaced persons and small-scale producers may lack collateral, credit history, documentation and institutional recognition required to benefit from conventional funding systems. As a result, climate-resilient development finance must include inclusive instruments such as community-based adaptation funds, cooperative finance, livelihood grants, social safety nets, cash transfers, parametric insurance and blended finance arrangements that reduce risks for vulnerable beneficiaries. The Organisation for Economic Co-operation and Development notes that scaling up adaptation finance requires attention to poverty, inequality and social protection because these factors determine people's ability to plan ahead and withstand climate impacts (Tenzing, 2020). Similarly, climate-induced displacement increases financing needs for housing, health care, employment, infrastructure and livelihood restoration, especially when climate shocks force people to move in search of safety, food, water and income. The World Bank reports that

climate change could force up to 216 million people across six world regions to move within their countries by 2050 if urgent and inclusive climate action is not taken (Muslim, 2024).

The relationship between human and livelihood security and financing mechanisms is further reflected in the growing demand for adequate, accessible and appropriate adaptation finance. Climate-resilient development cannot be achieved when funds are too limited, too complex to access or poorly aligned with the realities of vulnerable populations whose survival depends on agriculture, informal work, natural resources and basic services. Financing mechanisms must therefore support anticipatory action, disaster-risk insurance, early-warning systems, emergency livelihood support and long-term productive investment. The World Food Programme explains that forecast-based early action can protect lives, livelihoods and food security, while reducing the losses associated with climate-related disasters (Krishnamurthy et al., 2020). The United Nations Environment Programme also estimates that adaptation finance needs for developing countries remain very high, with domestic adaptation priorities requiring about US\$387 billion annually (Chapagain et al., 2023). This indicates that human and livelihood security influence financing mechanisms by defining the scale of finance required, the groups that should be prioritised and the forms of investment needed to protect people, sustain livelihoods and strengthen climate-resilient development.

This makes it necessary to examine how resource security and human and livelihood security influence financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State. Therefore, this study seeks to investigate environmental security and financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area, with specific focus on resource security and human and livelihood security as dimensions of environmental security.

Aim and objectives of the study

This study aimed to examine environmental security and financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State. Specifically, the study intended to:

1. Examine the influence of resource security on financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State.
2. Assess the influence of human and livelihood security on financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State.

Research questions

1. What is the influence of resource security on financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State?
2. What is the influence of human and livelihood security on financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State?

Research hypotheses

1. Resource security does not significantly influence financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State.
2. Human and livelihood security does not significantly influence financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State.

Methodology

The study adopted a survey research design. This design was considered appropriate because the study examined environmental security and financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State. The population of the study comprised residents of Calabar Municipality. Calabar Municipality has a population of 179,392 according to the 2006 National Population Census, a figure also reported in population-based studies on the area. The sample size for the study was determined using the Taro Yamane sample size determination method. Based on the population figure of 179,392 at 0.05 level of precision, the sample size for the study was 400 respondents. A stratified random sampling technique was adopted to ensure adequate representation of residents across relevant residential and community categories in Calabar Municipality. The instrument used for data collection was a structured questionnaire titled “Environmental Security and Climate-Resilient Development Financing Questionnaire (ESCRDFQ).” The questionnaire was divided into sections covering resource security, human and livelihood security, and financing mechanisms for climate-resilient development. The instrument was structured on a modified four-point Likert rating scale of Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2), and Strongly Disagree (SD = 1). The questionnaire was subjected to face and content validation by experts in environmental education, and measurement and evaluation. The reliability of the instrument was established using the Cronbach Alpha method, with coefficients of 0.81 for resource security, 0.83 for human and livelihood security, and 0.86 for financing mechanisms for climate-resilient development. Copies of the questionnaire were administered to the 400 selected respondents, retrieved, coded and analyzed using simple linear regression analysis. The hypotheses were tested at the 0.05 level of significance.

Presentation of results

Hypothesis One

The hypothesis stated that resource security does not significantly influence financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State. Simple linear regression was used, with resource security as the independent variable and financing mechanisms for climate-resilient development as the dependent variable. The result in Table 1 showed a positive relationship between the variables ($R = .468$). The R^2 value of .219 indicates that resource security explained 21.9% of the variance in financing mechanisms, while the Adjusted R^2 value of .218 shows that the model was stable. The ANOVA result showed that the regression model was statistically significant, $F = 208.968$, $p = .000$. Since the p-value is less than .05, the null hypothesis was rejected. This means that resource security significantly influences financing mechanisms for climate-resilient development in Calabar Municipality. The coefficient result also showed a positive contribution, with $B = .389$, $Beta = .468$, $t = 18.524$ and $p = .000$. This implies that improvement in resource security is likely to strengthen financing mechanisms for climate-resilient development in the study area.

Table 1: Simple Regression Analysis of the Influence of Resource security on financing mechanisms for climate-resilient development

Source of variation	SS	Df	MS	F-ratio	Sig.
Regression	1412.906	2	1412.906	208.968*	.000
Residual	5033.094	398	8.709		
Total	6446.000	399			
Model	B	Std error	Beta	T	Sig.
Constant	13.402	.615		21.792	.000
Resource security	.389	.021	.468	18.524	.000

Source: Fieldwork 2025

*Significant at .05 level

$R = .468$

$R^2 = .219$

Adjusted $R^2 = .218$

Hypothesis two

The hypothesis stated that human and livelihood security do not significantly influence financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State. Simple linear regression was used, with human and livelihood security as the independent variable and financing mechanisms for climate-resilient development as the dependent variable. The result in Table 2 showed a positive relationship between the variables ($R = .519$). The R^2 value of .269 indicates that human and livelihood security explained 26.9% of the variance in financing mechanisms, while the Adjusted R^2 value of .268 confirms the adequacy of the regression model. The ANOVA result showed that the regression model was statistically significant, $F = 290.196$, $p = .000$. Since the p-value is less than .05, the null hypothesis was rejected. This means that human and livelihood security significantly influence financing mechanisms for climate-resilient development in Calabar Municipality. The coefficient result also showed a positive contribution, with $B = .442$, $Beta = .519$, $t = 20.091$ and $p = .000$. This implies that improvement in human and livelihood security is likely to strengthen financing mechanisms for climate-resilient development in the study area.

Table 2: Simple Regression Analysis of the Influence of Human and livelihood security on financing mechanisms for climate-resilient development

Source of variation	SS	Df	MS	F-ratio	Sig.
Regression	1738.215	2	1738.215	290.196*	.000
Residual	4707.785	398	8.145		
Total	6446.000	399			
Model	B	Std error	Beta	T	Sig.
Constant	12.867	.598		21.517	.000
Human and livelihood security	.442	.022	.519	20.091	.000

Source: Field work 2025

*Significant at .05 level

$R = .519$

$R^2 = .269$

Adjusted $R^2 = .268$

Discussion of findings

The finding revealed that resource security significantly influences financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area. This means that when environmental resources such as land, water, forests, coastal assets and livelihood-supporting ecological systems are better protected and managed, the possibility of attracting, allocating and sustaining finance for climate-resilient development improves. The result suggests that financing mechanisms are not determined by financial availability alone but also by the condition, accessibility and governance of environmental resources within the study area. This may be because secure resources reduce investment risks, improve project credibility and make it easier for government agencies, development partners and private actors to justify funding for adaptation projects such as drainage improvement, flood control, water management, waste control, green infrastructure and livelihood protection. The finding is theoretically justified by the resource dependency theory, which explains that institutions and communities depend on critical resources for survival, planning and development; therefore, where such resources are secure, the systems built around them are more likely to attract support, coordination and investment.

This finding is supported by Mohan & Morris, (2025), who found that climate finance and innovation are positively linked, especially where natural resource conditions are integrated into investment and development planning. It also agrees with Omotayo et al., (2025), whose study showed that climate change impacts on water and agricultural resources have direct implications for food security, poverty reduction and sustainable development, thereby requiring stronger financing for resource-based adaptation. Similarly, Mumuni and Hamadjoda Lefe, (2023) found that green bonds, climate finance and natural resource consumption are connected to climate change response, showing that the state of natural resources can influence the structure and direction of climate-related financing. These studies support the present finding by showing that

resource security provides the environmental and economic basis for effective climate-resilient financing, particularly in vulnerable areas where development depends on stable access to natural and ecological resources.

The finding revealed that human and livelihood security significantly influence financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area. This means that improvements in residents' welfare, income stability, food security, health protection, employment opportunities and livelihood sustainability are associated with stronger financing arrangements for climate-resilient development. The result suggests that climate finance becomes more effective when it is directed towards the real survival needs of people, especially those whose livelihoods are exposed to flooding, erosion, poor drainage, environmental degradation and other climate-related risks. This may be because communities with secure livelihoods are better positioned to participate in adaptation programmes, access financial support, repay climate-related credit facilities and sustain resilience projects. The finding is theoretically justified by the human security and sustainable livelihood perspectives, which hold that development financing should protect people from threats to survival while strengthening the assets, capabilities and opportunities needed for long-term adaptation.

The finding agrees with Akhtar et al., (2022), who found that livelihood resilience among vulnerable groups is shaped by access to livelihood assets, adaptive capacity and institutional support, indicating that livelihood security is essential for effective climate adaptation financing. It is also supported by Huber and Murray, (2024) who showed that linking climate finance with social protection can improve climate justice and strengthen the resilience of vulnerable populations. In the same direction, Läderach et al., (2024) found that climate adaptation finance is more effective when it responds to population needs in fragile and risk-prone contexts, especially

where insecurity weakens people's ability to adapt. These studies support the current finding by showing that financing mechanisms for climate-resilient development are more effective when they address human welfare, livelihood stability and the adaptive capacity of affected communities.

Conclusion

The study concluded that environmental security significantly influences financing mechanisms for climate-resilient development in Calabar Municipality Local Government Area of Cross River State. The findings showed that both resource security and human and livelihood security are important in strengthening access to, allocation of and sustainability of climate-resilient development finance. Therefore, improving resource protection, livelihood stability and human welfare is necessary for effective climate-resilient development planning in the study area.

Recommendations

1. The government and relevant environmental agencies should strengthen resource protection measures in Calabar Municipality to improve access to effective financing mechanisms for climate-resilient development.
2. Development partners and financial institutions should support livelihood-based climate financing programmes that improve income security, employment opportunities and adaptive capacity among residents.
3. Community-based climate resilience funds should be established to support drainage improvement, waste management, flood control, livelihood restoration and other local adaptation needs in Calabar Municipality.

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