Policy Integration of Local and Indigenous Knowledge for Climate Adaptation among Farmers in South East Nigeria

Emmanuel Ezekwe
Department of Public Administration
Faculty of Management Sciences
Ebonyi State University, Abakaliki

Nwangele Sunday
Department of Business Management & Entrepreneurship Studies
Faculty of Management Sciences
Ebonyi State University, Abakaliki

Ene, Nnenna Linda
Department of Accountancy
Faculty of Management Sciences
Ebonyi State University, Abakaliki

Abstract
Climate change has direct impact on agricultural production in local communities where agriculture constitutes employment and income sources for the majority of the population. The study examined how indigenous knowledge can be effectively included into climate adaptation policy for farmers in Ebonyi State. The study adopted interview method. Six farmers two from each senatorial districts were selected using convenient sampling method. Data collected were analyzed and the research questions were answered using thematic analysis. The major factors constraining farmers from adapting to climate change were poverty; inadequate farmland and access to more efficient inputs, lack of information and poor skills. It was reported that the communities had undocumented knowledge of indigenous and local meteorologies which are based on observation and traditional practices and belief systems. The findings showed that the main adaptation practice used by the farmers in the state to adapt to climate change were relocation to the upper land during floods, mulching, mixed cropping, winter farming, and planting drought-resistant crops and usage of birds in weather forecast. The study concluded that the indigenous knowledge among the farmers in the communities of Ebonyi State could, to a large extent, be included in climate change mitigation and adaptation to ensure food security. The knowledge can help fill the gap by including it into the climate change policy and implementation of climate change initiatives. Therefore, it is recommended that inclusion of indigenous knowledge provides a robust approach to adapt to the changes in climate.

Keywords: Policy, Climate change, local and indigenous knowledge, adaptation, Practice

1.0 Introduction

Climate change poses a significant threat to global agricultural systems, livelihoods, and overall resilience and African continents in particular. Therefore, integrating local and indigenous knowledge into climate change adaptation planning can help identify traditional practices and techniques that have been used for generations to cope with climate variability and change (Anang, 2022). Available evidence suggests that there is an increasing effort to enable local and indigenous knowledge holders to participate directly in IPCC assessment reports (Naazie, Dakyaga and Derbile, 2023). Adaptation efforts have benefited from the inclusion of local indigenous knowledge and local knowledge (PCC, 2019). Farmers' continuous preference for traditional over climate-smart practices is due to their inability to obtain credit, improved seeds, farm implements, and weather information services, among other climate-smart practices (Anang, 2022). It is on record that degree of perceptions of climatic risks and traditional values, beliefs, knowledge, and experiences; and level of access to improved farm services and practices, farming experience, and geographical location are other factors (Anang, 2022). The continuous use of local and Indigenous knowledge in responding to climate change stresses the need to understand the application and the factors underlying the usage, particularly among farmers.

Ghana and Nigeria, indicates that smallholder farmers employ a diverse range of traditional soil and water management practices, such as the preparation and application of organic manure and compost, ridges formation, crop rotation, and cover cropping, to adapt food crop production to climate change (Naazie, Dakyaga and Derbile, 2023). While Nigeria has several local and indigenous practices related to climate-resilient agriculture include, the observance of the flowering of coffee trees, leaf-sprouting as an indication of the onset of rains, and indigenous soil and water conservation techniques, crucial for sustaining livelihoods and enhancing ecosystem resilience against desertification, soil degradation, and water scarcity (Udeh, Jajere and Ikpe 2024; Ikpe, 2021; Chaudhary *et al*., 2022). Observations of Kerikede and edekekwukwu birds for season forecast. Practices such as agroforestry, intercropping of cereals, tubers, and legumes, diversification, and mixed farming have been used to optimize food crop production under climate change (Ogunyiola *et al.,* 2022). National climate change policy (2021-2030) of the both countries' aims to reduce greenhouse gas emissions and promote local action.

It is praiseworthy, that the majority of farmers used Indigenous Knowledge System (IKS) weather indicators such as wild fruits, trees, worms, and wind for predicting seasonal quality in addition to

meteorological forecasts. Zvobgo *et al.* (2023) noted that a great proportion of farmers used local and Indigenous knowledge of weather and climate forecasts, and relied solely on local and Indigenous knowledge forecasts for climate adaptation decision-making. Therefore, integrating traditional knowledge into climate change policies is seen as a cost-effective, climate-smart approach and sustainable adaptation strategy to climate variability. Arguably, local and indigenous knowledge (LIK) could provide insight for effectively dealing with greater challenges of climate change (Zvobgo *et al.*, 2023). Despite the benefits, the unique knowledge and experiences of indigenous people remain largely underutilized in the planning and implementation of adaptation interventions. The public administration researchers are of the opinion that the suggested adaptation interventions although designed for the most vulnerable including indigenous people, in particular, LIK holders or experts should not be neglected. This knowledge held by local and indigenous communities is rarely considered in academic, policy, and public discourses on climate change

Moreover, inclusiveness of these knowledge is a welcome development not only improves the effectiveness and cultural relevance of agricultural climate change adaptation efforts, but it also respects local and indigenous communities' rights, traditions, and contributions. Also it will foster collaboration with local communities, preservation and transmission of traditional knowledge. African leaders and stakeholders meeting at the 5th CAADP Partnership Platform in Abuja, Nigeria, in 2009, called for the formation of the CAADP Climate Change Adaptation Framework (CCCAF). The CCCAF is an African agricultural-based climate change adaptation framework. However, there are various coordination challenges that need to be addressed, such as stakeholder fragmentation, and knowledge gaps. Many of the African countries have been persuaded to voluntarily domesticate climate change actions at home front due to the COP series of engagements. International conference in Rio, Brazil, in 1992 and the subsequent Kyoto Protocol of 1997, supported climate change related policies and institutional arrangements for local action. Indeed, the particular mechanism under which to consider LIK in climate change policies has not been clear.

1.2 Statement of Problem

Climate change poses significant threats to rural livelihoods in South Eastern Nigeria, where farming remains the primary source of income and food security. Increasingly erratic rainfall patterns, prolonged dry spells, and rising temperatures are affecting crop yields and water availability. While governmental and international climate policies propose technical solutions, they often overlook the wealth of local and indigenous knowledge systems that have evolved over generations to manage environmental risks. Indigenous practices, such as interpreting animal behavior for weather prediction, use of drought-resistant crops, sacred forest preservation, and traditional seed storage; offer culturally embedded, adaptive strategies. However, these practices are rarely acknowledged or integrated into formal climate adaptation policies.

It is worrisome that mainstreaming of indigenous and local knowledge into Africa's climate policy framework is limited, despite its importance in local adaptation efforts. Furthermore, indigenous knowledge can inform the development of context-specific and culturally appropriate adaptation measures more likely to be accepted and adopted by local communities (Ray, 2023). However, there are various coordination challenges that need to be addressed, such as stakeholder fragmentation, and knowledge gaps. This research seeks to bridge the disconnect between top-down climate governance and bottom-up, community-based resilience by exploring how indigenous knowledge can inform more inclusive and effective adaptation policies in South East Nigeria.

1.3 Main Objective:

To examine how indigenous knowledge can be effectively integrated into climate adaptation policies among farming communities in South East Nigeria.

Specific Objectives:

1. To identify indigenous climate adaptation practices used by farmers.
2. To explore farmers' perceptions of climate change and policy engagement.
3. To assess how current policies, recognize or exclude local knowledge.

2.0 Review of Literature

Bamigboye, Owombo, and Yusufu, (2024) averred that seven indigenous adaptation strategies were commonly utilized by arable crop farmers. However, crop diversification, consultation with rainmakers and involvement in non-agricultural ventures were prioritized. Similarly, Okorie, Onu, Agbo, and Nwagwu, (2020) asserted that there is low level of awareness among farmers of South-East Nigerians about the causes and effects of climate change. There is significant difference in the mean awareness ratings of urban and rural respondents on the causes and effects of climate change, with urban respondents being more aware than rural respondents. Dramani and Emmanuel (2025) affirmed that the current generation of smallholder farmers is more vulnerable to climate change than the past generation, the era of grandparents. Thus, farmers are exposed to higher intensity sunshine, temperature and wind in contemporary times than in the past. Consequently, their livelihoods are affected the most by the damaging effects of these climatic hazards. The community risk assessment process revealed the relevance of indigenous knowledge systems for vulnerability assessments and at the same time, underpins the need for adaptation of such knowledge if it is to sustain smallholder farmer efforts at climate change adaptation at community levels. Researchers, like Membele, Naidu and Mutanga, (2022c), further suggested that endogenous development approach to climate change adaptation planning (CCAP), one that will build on indigenous knowledge systems for effective community education, mobilization and participatory response to climate change. Policy interventions should aim at enhancing climate change adaptation through innovations in soil and water conservation, access to water for irrigation and domestic use, climate smart-housing architecture and agro-forestry within the framework of decentralization and district development planning. National climate change Act, 2021 and Ebonyi State are deficit with indigenous knowledge that offers a rich, practical foundation for climate-smart agriculture in the State. Evidence from the literature suggested institutional support, validation, and integration with modern scientific approaches to remain effective in the face of escalating climate variability in the country.

1.4 Materials and Methods

Research Design

Data for the study were acquired through key informant interview and participant field observation. Key informant interviews were conducted in the communities that have experienced major climate change in agricultural activities to examine how the disasters have affected the

community food security and livelihoods. The people selected for interviews included Local farmers and elders (holders of indigenous knowledge). The criteria used to select the key informants included those who had been living and working in the community for at least twenty years and those that had experienced at least one major climate hazards in the community. This study adopted a case study design allowing deep exploration of the social, cultural, and institutional dynamics around indigenous knowledge and adaptation. A multi-sited case study across selected communities in three senatorial zones in the states will capture variations in knowledge use and policy responsiveness.

Description of the Study Area with Community Analysis

This study will adopt a case study design allowing deep exploration of the social, cultural, and institutional dynamics around indigenous knowledge and adaptation. A multi-sited case study across selected communities in different states (Ebonyi, Enugu, Abia, Anambra, Imo) will capture variations in knowledge use and policy responsiveness. About 75% of the population dwells in the rural areas with farming as their major occupation. This region is predominantly agrarian, with a large proportion of the population engaged in smallholder farming. The climate is typically tropical with distinct wet and dry seasons, making the area highly sensitive to rainfall variability and other climate stressors (Okechukwu, 2020). Communities in these states possess rich indigenous knowledge systems shaped by generations of interaction with their environment, particularly in predicting weather, managing soil fertility, and conserving water. Despite this, formal climate policies often underrepresent their adaptive practices. Socio-culturally (Okpoko & Okpoko, 2016), the region is characterized by strong communal ties, traditional leadership structures, and gendered roles in farming, which will be essential considerations during community engagement and analysis.

Sampling Procedure

Purposive sampling technique; the selection of the study area is informed by spatial variability, recognizing that the vulnerability to climate change, its impacts, and corresponding adaptation strategies differ across locations. By capturing this geographic diversity within the state, the study aims to ensure a more representative understanding of how indigenous knowledge informs climate adaptation across varied environmental and socio-cultural contexts.

Data Collection Methods:

Since indigenous knowledge is deeply embedded in local cultures and practices, an interpretivist paradigm (Alharahsheh and Pius, 2020), allows us to understand how farmers and policymakers interpret and use climate knowledge. This paradigm recognizes multiple realities and privileges lived experiences, making it ideal for exploring complex local-environmental interactions. Key Informant Interviews (KIIs) with local farmers in the five Eastern States. Document analysis and review of national and state-level climate policies, agricultural plans, and international frameworks for references to indigenous knowledge.

Method of Data Analysis

Data analysis was carried out using ATLAS.ti version 25. The oral interviews were conducted with farmers across South Eastern States and the responses were recorded digitally using an audio device. The recordings were first transcribed directly into Microsoft Word documents to preserve the authenticity of participants' views. After transcription, each document was carefully checked against the original audio files to ensure accuracy.

The transcribed files were saved in Rich Text Format (.rtf) and uploaded into ATLAS.ti version 25 as primary documents within a newly created project. Each transcript was tagged with descriptive metadata such as interview location (zone), respondent ID, and date of interview to facilitate systematic organization and retrieval. A coding scheme was developed both inductively and deductively. Deductive codes were generated from the research objectives (e.g., *perceptions of climate change*, *adaptation strategies*, *weather forecasting practices*, *constraints*, and *knowledge transfer*). Inductive codes emerged from participants' narratives (e.g., *late farming*, *pig manure use*, *bird indicators*, *flood relocation*). These codes were created in ATLAS.ti's Code Manager and applied systematically to relevant text segments.

The coded data were grouped into categories and themes through iterative comparison across transcripts. The Code Co-occurrence Table and Code-Document Table functions were used to explore relationships between codes across different states (Ebonyi, Enugu, Anambra, Abia and Imo). This allowed for identification of patterns, similarities, and divergences in farmers' perceptions and practices. Memos were also created throughout the analysis process to capture

reflections, emerging insights, and links to theoretical frameworks on indigenous knowledge and climate adaptation. The use of networks in ATLAS.ti helped to visually map the connections between codes, categories, and themes, thus strengthening conceptual interpretation. The systematic use of ATLAS.ti 25 ensured rigor, transparency, and traceability in handling qualitative data.

1. Perceptions of Climate Change

Across all three zones (Ebonyi, Enugu, Abia, Anambra and Imo), farmers recognized climate change as a major threat to agricultural productivity. The responses revealed a common awareness of climate variability, albeit with slight differences highlighted. The Ebonyi farmers linked climate change to ozone layer depletion, pest outbreaks, and drought, those from Enugu emphasized both natural and anthropogenic origins, and also highlighting its unfriendly impact on living organisms and farmers' fields. On the other hand, the respondents from Abia, Anambra and Imo explicitly attributed climate change to anthropogenic activities. This indicates that all respondents are aware of climate change, although their perception on the causes varied across the five geopolitical Agro-ecological zones.

2. Farmers' Experiences with Climate Change

Experiences were broadly similar across zones, with all reporting:

1. Delayed rainfall (especially from April–May).
2. Increased drought and food insecurity.
3. Loss of soil fertility.
4. Hunger and disrupted farming calendars.

This convergence indicates that climate variability and soil degradation are the dominant manifestations of climate change across South Eastern States.

3. Indigenous Climate Change Adaptation Strategies

Farmers across the South Eastern States have developed indigenous, low-cost, eco-friendly practices to adapt to climate change. Some of the common strategies across the five states include; mixed cropping, mulching, tree planting, flood control using cross-bars (*oge*), re-cultivation cycles, manure (especially pig feces), and cultivation of drought-resistant crops. Furthermore,

there were few zone-specific strategies. Ebonyi and Enugu State emphasized rainy season yam farming (delayed yam cutting and heap covering). Imo, Abia and Anambra State, on the other hand, uniquely highlighted traditional veterinary practices using *oshrisha* and *ugboeluelu* leaves for animal health. These strategies illustrate a blend of crop diversification, soil fertility management, flood/drought mitigation, and traditional livestock care. However, most practices remain unstandardized and undocumented, making them difficult to transfer systematically.

4. Weather Forecasting Practices

Farmers in all States rely on indigenous meteorology based on biological and celestial indicators:

1. Bird behavior (e.g., *kerekede* and *ovu*).
2. Tree flowering (e.g., *akpuntu*, *okoko akputo*).
3. Moon phases for timing of farming operations.

These methods reflect deep ecological knowledge, though they remain qualitative, undocumented, and prone to misinterpretation under changing climate regimes.

5. Constraints in Implementing Indigenous Adaptation

All the states consistently identified constraints, which include: poverty and limited resources, inadequate farmland and access to improved inputs, lack of formal documentation of local and indigenous knowledge, and Poor technical skills and limited information. These systemic barriers show that while local and indigenous knowledge is valuable and widely practiced, it is fragile and vulnerable without integration into modern climate-smart agriculture.

6. Knowledge Transfer to Future Generations

Across all five States, knowledge is undocumented and passed orally through storytelling, agricultural practices, and cultural belief systems. This mode of transmission is fragile, as knowledge can be lost with migration, youth disinterest in farming, or generational gaps. Hence, there is an urgent need for documentation, validation, and integration of local and indigenous knowledge into formal agricultural extension systems.

Discussion of Findings

Across five States, farmers consistently recognized climate change as a serious challenge affecting agriculture and livelihoods. Respondents in Ebonyi and Enugu State perceived climate change primarily through manifestations such as ozone layer depletion, pest outbreaks, and recurrent drought. Abia and Anambra States, farmers emphasized both natural and anthropogenic origins, stressing that climate change is "not friendly to living beings." Meanwhile, farmers in Imo State directly attributed climate change to anthropogenic activities.

These perceptions align with findings from other smallholder farming communities in sub-Saharan Africa, where farmers interpret climate change through locally observable phenomena such as temperature shifts, rainfall variability, and ecological disruptions (Ajayi et al., 2020; Ofoegbu et al., 2021; Membele, et al., 2022c). The emphasis on delayed rainfall across all three zones underscores the salience of precipitation timing in farmers' understanding of climate change impacts, consistent with reports from Nigeria and Ghana (Mubaya & Mafongoya, 2018).

On farmers' experiences with climate change, all farmers reported increasing unpredictability in rainfall, with delayed onset of rains (months 4–5) as a recurring challenge. Drought, declining soil fertility, hunger, and late farming cycles were additional consequences noted across zones. These experiences resonate with studies showing that Nigerian and southern African farmers identify rainfall variability and drought as the most disruptive climate impacts, often leading to food insecurity and shifts in cropping calendars (Okpara et al., 2021; Adzawla et al., 2022).

Furthermore, farmers reported a diverse set of local and indigenous practices to mitigate climate risks. Common strategies across all states included soil fertility management through the use of pig manure and animal waste; avoidance of bush burning. Another adaptation strategy was through mixed cropping, mulching, tree planting, re-cultivation cycles, and cultivation of drought-resistant varieties. One other method was water and flood management by constructing cross-bars (*oge*) and relocating crops to higher ground. South Eastern States-specific practices were also evident. Farmers in South East highlighted "winter farming" of yam, where tubers are delayed and heaps are covered with grass to retain soil moisture. Ebonyi State uniquely reported herbal animal health treatments using *oshrisha* and *ugboeluelu* leaves. These reflect a blend of ecosystem-based adaptation, agronomic innovation, and ethnoveterinary practices. Similar adaptation measures

have been documented across Africa, where local and indigenous knowledge provides low-cost, ecologically grounded strategies for coping with climate shocks (Nyong et al., 2019; Mavhura, 2020). However, most practices in South East remain undocumented and transmitted orally, limiting systematic improvement or scaling.

Farmers across States rely on local ecological and celestial indicators for weather prediction. These include bird behavior (*kerekede* and *ovu*), tree flowering (*akpuntu*, *okoko akputo*), and moon phases to guide planting and harvest timing. Such local and indigenous forecasting methods have been widely reported across Africa as reliable within traditional contexts but increasingly challenged by climate variability (Derbile, 2023; Chisadza *et al*., 2021). The persistence of these practices demonstrates their cultural embeddedness, but their effectiveness may decline under rapidly changing climatic patterns.

Similarly, across all states, farmers highlighted systemic barriers to adaptation: Poverty and inadequate resources hinder the adoption of improved practices. Limited access to farmland and inputs constrains productivity. Lack of formal documentation of local and indigenous knowledge threatens intergenerational transfer. Weak technical skills and information access limit integration of new approaches. These findings are consistent with broader literature emphasizing that while local and indigenous knowledge is valuable, it must be supported by institutional, financial, and extension systems to remain effective in climate adaptation (Makate, 2019; Mavhura, 2020).

In all states, local and indigenous knowledge is undocumented and transmitted orally through storytelling, observation of practices, and cultural beliefs. While this mode sustains continuity, it also poses risks of knowledge erosion, particularly with youth migration, declining interest in farming, and modernization pressures. Scholars have emphasized the importance of documenting and integrating such knowledge into climate adaptation policies to ensure resilience and sustainability (Ajani *et al*., 2019; Ofoegbu *et al.,* 2021).

Conclusion

Farmers across five Eastern States share similar climate change perceptions, experiences, and adaptive practices, with minor State-specific variations. Their local and indigenous knowledge is rich but fragile due to poverty, lack of documentation, and weak institutional support.

Strengthening these practices through scientific validation, policy recognition, and extension services can enhance resilience against climate change. Thus, local and indigenous knowledge offers a rich, practical foundation for climate-smart agriculture in South Eastern States, but requires institutional support, validation, and integration with modern scientific approaches to remain effective in the face of escalating climate variability.

References

Adzawla, W., Alhassan, S. I., & Donkoh, S. A. (2022). Smallholder farmers' adaptation strategies to climate variability and their determinants in Ghana. *Climate and Development, 14*(1), 58–68.

Ajani, E. N., Mgbenka, R. N., & Okeke, M. N. (2019). Use of indigenous knowledge as a strategy for climate change adaptation among farmers in sub-Saharan Africa: Implications for policy. *Asian Journal of Agricultural Extension, Economics & Sociology, 31*(1), 1–12.

Ajayi, O. C., Akinnifesi, F. K., & Sileshi, G. W. (2020). Climate change adaptation and mitigation: The role of indigenous knowledge systems. *Sustainability, 12*(2), 593.

Alharahsheh, H. H., & Pius, A. (2020). A review of key paradigms: Positivism VS interpretivism. Global academic journal of humanities and social sciences, 2(3), 39-43.

Anang, B. T. (2022). Interceding role of agricultural extension services in adoption of climate-smart agricultural technologies in Northern Ghana. Asia Pacific Journal of Sustainable Agriculture Food and Energy, 10(2), 69–76.

Bamigboye, E. O., Owombo, P. T., and Yusufu, J. O. (2024) Utilization of Indigenous Knowledge Climate Change Adaptation Strategies Among Arable Crop Farmers in South –Western Nigeria. *International Journal of Agriculture and Earth Science (IJAES)* 10(2)106-119.

Chisadza, C., Tumbare, M. J., & Mupangwa, W. (2021). Indigenous weather forecasting and climate adaptation in smallholder farming systems of Southern Africa. *Climate Risk Management, 31*, 100262.

Derbile, K. E., (2023) Reducing vulnerability of rain-fed agriculture to drought through indigenous knowledge systems in north-eastern Ghana. *International Journal of climate change strategies and management* 5(1):71-94

Dramani, J. M. F. and Emmanuel, K. D., (2025) Sunshine, temperature and wind Community risk assessment of climate change, indigenous knowledge and climate change adaptation planning in Ghana. *International Journal of Climate Change Strategies and Management,* 12(1) 22-38.

Ikpe, E. (2021). Effect of climate change on the yield of selected crops and farmers' adaptation strategies in Sokoto State, Nigeria. An unpublished PhD Thesis submitted to the department of Geography and environmental management, Ahmadu Bello University, Zaria.

Makate, C. (2019). Effective climate change adaptation strategies and food security in sub-Saharan Africa: Evidence from smallholder farmers in Zimbabwe. *Ecological Economics, 162*, 82–93.

Mavhura, E. (2020). Documenting indigenous knowledge for climate change adaptation: Lessons from rural communities in Zimbabwe. *International Journal of Climate Change Strategies and Management, 12*(2), 181–196.

Membele, G. M., Naidu, M., & Mutanga, O. (2022c). Examining flood vulnerability mapping approaches in developing countries: A scoping review. International Journal of Disaster Risk Reduction, 69(2022), 1-25

Mubaya, C. P., & Mafongoya, P. (2018). The role of institutions in managing local-level climate change adaptation in semi-arid Zimbabwe. *Climate Risk Management, 20*, 52–63.

Naazie, G.K., Dakyaga, F., Derbile, E. K. (2023). Agro-ecological intensification for climate change adaptation: Tales on soil and water management practices of smallholder farmers in rural Ghana.

Nyong, A., Adesina, F., & Osman-Elasha, B. (2019). The value of indigenous knowledge in climate change mitigation and adaptation strategies in Africa. *Mitigation and Adaptation Strategies for Global Change, 24*(3), 445–463.

Ofoegbu, C., Chirwa, P. W., Francis, J., & Babalola, F. D. (2021). Indigenous knowledge systems for climate change adaptation in agriculture: Lessons from Nigeria. *Environmental Development, 39*, 100626.

Ogunyiola, A., Gardezi, M., & Vij, S. (2022). Smallholder farmers' engagement with climate smart agriculture in Africa: Role of local knowledge and upscaling. Climate Policy, 22(4), 411–426.

Okechukwu, M. E. (2020). Spatial distribution of rainfall and reference evapotranspiration in southeast Nigeria. Agricultural Engineering International: CIGR Journal, 22(1), 1-8.

Okorie, E. U., Onu, W. O., Agbo, R. C, and Nwagwu, N. R. (2020). Societal Awareness of the Causes and Effects of Climate Change (CC) in South-East Nigeria. *Journal of CUDIMAC (J-CUDIMAC)*, 8(1)131-150

Okpara, U. T., Stringer, L. C., & Dougill, A. J. (2021). Climate adaptation and resilience in Nigeria's drylands: A systematic review of farmer perceptions and practices. *Climate and Development, 13*(6), 479–491.

Okpoko, P. U., & Okpoko, C. (2016). Socio-cultural profiling and development in southeast Nigeria: A case study. Mediterranean Journal of Social Sciences, 7(5), 212-224.

PCC, (2019). Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (Shukla, P.R., Skea, J., Calvo Buendia, E., , M., Malley, J. (eds.). In press.

Ray, S. (2023). Weaving the links: Traditional knowledge into modern science. Futures, 145, 1–5. https://doi.org/10.1016/j. futures.2022.103081

Udeh L.E., Jajere I.A., and Ikpe E. (2024) Traditional Knowledge and Cultural Beliefs in Climate Adaptation Strategies for Food Security and Sustainable Development in Nigeria's Semi-Arid Regions: A Bibliometric Analysis (1996-2023) International Journal of Geography and Regional Planning Research, 9(1) 13-35.

Zvobgo, L., Oladapo, P. J., Olagbegi, M., Simpson, N. P., & Trisos, C. H. (2023). Role of Indigenous and local knowledge in seasonal forecasts and climate adaptation: A case study of smallholder farmers in Chiredzi, Zimbabwe. Environmental Science & Policy, 145, 13–28. https://doi.org/10.1016/j.env sci.2023.03.017.