

## Chapter 3

# Harnessing indigenous knowledge for climate action: Bridging traditional wisdom with modern solutions in Nigeria

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## 1 Introduction

Climate change poses significant challenges globally, with Nigeria being no exception, as its effects are increasingly evident across various societal sectors (Raimi et al., 2021). This review examines the vital role of leveraging indigenous knowledge for climate action in Nigeria, highlighting the importance of merging traditional practices with contemporary solutions to effectively tackle climate-related issues. As Africa's most populous nation and largest economy, Nigeria is particularly vulnerable to climate change impacts (Nwankwo et al., 2022). The country's diverse geography, which includes coastal zones, savannas, forests, and arid regions, faces distinct climate risks. Climate change intensifies existing environmental stresses, threatening critical sectors like agriculture, water resources, health, and infrastructure (Anukwonke et al., 2022). Increasing temperatures, shifting rainfall patterns, and extreme weather events significantly challenge agricultural productivity (Onyeneke et al., 2021). Nigeria's reliance on rain-fed agriculture makes it especially vulnerable to climate variability, resulting in reduced crop yields, food insecurity, and livelihood losses for millions of smallholder farmers (Hlophe-Ginindza and Mpandeli, 2020). Additionally, coastal erosion, rising sea levels, and extreme weather events such as floods and storms endanger coastal communities, infrastructure, and ecosystems (Griggs and Reguero, 2021). Climate change also intersects with socio-economic factors, worsening existing inequalities and vulnerabilities. Marginalized groups, including women, children, and rural communities, are disproportionately affected, facing issues like displacement, food insecurity, and heightened health risks (Tantoh et al., 2022).

Indigenous knowledge refers to the collective wisdom, practices, and beliefs developed by indigenous peoples over generations, deeply connected to their local environments and cultures (Abas et al., 2022). In Nigeria, indigenous communities hold a wealth of

knowledge and traditional practices that have enabled them to adapt to environmental changes for centuries. Indigenous knowledge systems (IKS) provide valuable insights into sustainable resource management, climate adaptation strategies, and community resilience. Traditional farming methods, for instance, are often tailored to local ecological conditions, incorporating practices such as agroforestry, crop diversification, and water conservation to improve soil fertility and mitigate climate risks (Gifawesen et al., 2020; AL-Falahi et al., 2023). Additionally, indigenous communities have developed sophisticated weather forecasting and seasonal calendars based on natural observations, enabling them to anticipate and adapt to climatic changes (Ochieng et al., 2020). This local knowledge not only enhances climate resilience but also strengthens the bond between communities and their environments, fostering stewardship and sustainability (Burgos-Ayala et al., 2020). Given the complex and multifaceted nature of climate change challenges in Nigeria, addressing these issues requires an integrated approach that combines traditional wisdom with modern solutions (Sharma et al., 2024). By integrating indigenous knowledge with scientific expertise and technological innovations, Nigeria can develop more comprehensive and contextually appropriate climate adaptation and mitigation strategies (Adeola et al., 2023). This review explores the potential of merging traditional wisdom with modern approaches, emphasizing the importance of collaboration among indigenous communities, researchers, policymakers, and other stakeholders. Through such partnerships, Nigeria can harness the strengths of indigenous knowledge systems to enhance climate resilience, promote sustainable development, and ensure a more equitable and prosperous future (Agboola and Tunay, 2023).

## **2. Understanding Indigenous Knowledge**

Indigenous knowledge systems (IKS) encompass the accumulated knowledge, practices, beliefs, and wisdom developed by indigenous peoples over generations (Odora Hoppers, 2021). These systems are deeply rooted in local environments, cultures, and traditions, reflecting the close relationship between indigenous communities and their surroundings (Turner et al., 2022). Key characteristics of IKS include:

1. **Oral Transmission** : Indigenous knowledge is often passed down orally through storytelling, rituals, songs, and other cultural practices (Falola, 2022).
2. **Holistic Integration** : IKS integrates diverse fields such as ecology, agriculture, medicine, spirituality, and governance, reflecting a comprehensive understanding of life's interconnectedness (Zidny et al., 2020).

## 2.1 Overview of Indigenous Communities in Nigeria and Their Knowledge Systems

Nigeria is a nation rich in cultural diversity, comprising a multitude of indigenous ethnic groups, each characterized by unique traditions, languages, and systems of knowledge (Isidienu and Onyekelu, 2020). These communities are spread across varied ecological zones, such as rainforests, savannas, river deltas, and arid regions, as depicted in Figure 1 (Nwokporo *et al.*, 2022). Among the most notable indigenous groups in the country are the Hausa, Yoruba, Igbo, Fulani, Ijaw, and Kanuri. These indigenous communities possess rich and diverse knowledge systems that have evolved over centuries in response to local environmental conditions and cultural traditions. Traditional ecological knowledge, agricultural practices, medicinal plant use, and weather forecasting techniques are integral components of indigenous knowledge systems in Nigeria (Imoro *et al.*, 2022).

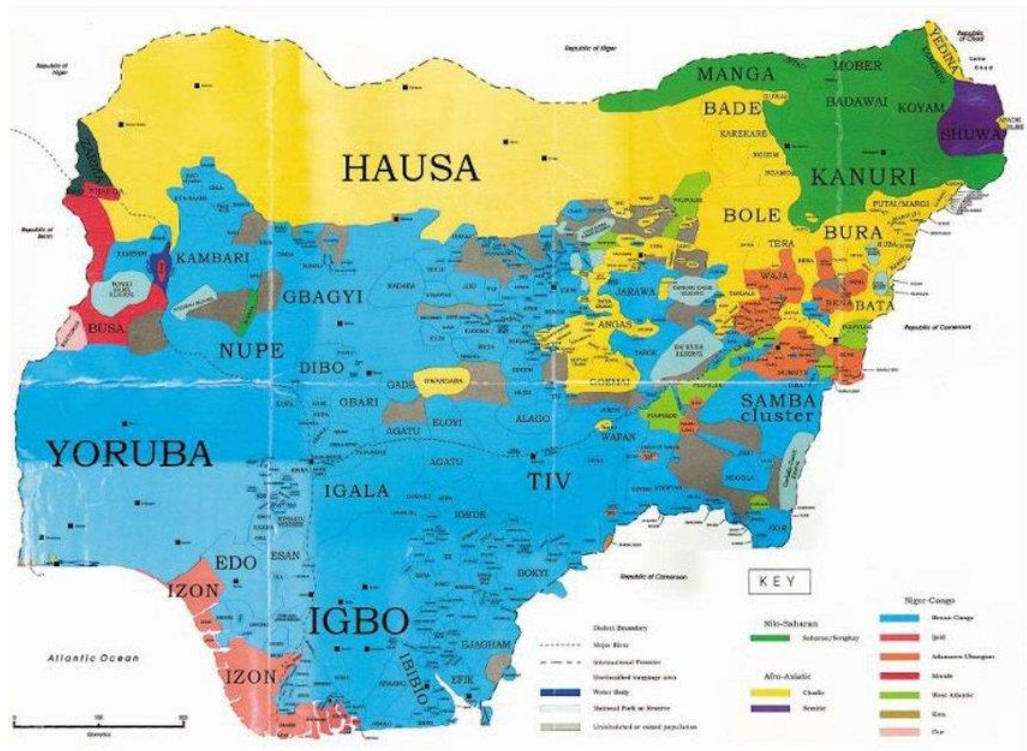


Figure 1: Map of Nigeria showing the geographical distribution of indigenous societies in the country (Nwokporo *et al.*, 2022)

## **2.2. Examples of Indigenous Knowledge Practices Relevant to Climate Change Adaptation and Mitigation in Nigeria**

Traditional farming methods like agroforestry, intercropping, and crop rotation improve soil health, preserve water resources, and boost resilience to climate fluctuations (Burgess et al., 2022). For instance, Fulani pastoralists in northern Nigeria engage in transhumance, relocating their livestock seasonally based on shifting weather patterns and the availability of grazing land. Indigenous groups in Nigeria possess deep expertise in medicinal plants and their healing properties. These plants have been utilized for generations to address various health issues, including those worsened by climate change, such as malaria, waterborne diseases, and respiratory conditions (El-Sayed and Kamel, 2020).

Additionally, indigenous communities in Nigeria have developed advanced weather prediction systems rooted in observations of natural indicators, such as animal behavior, plant growth patterns, and celestial movements (Bol and van Niekerk, 2023). These traditional forecasting techniques enable communities to predict and prepare for weather-related risks like floods, droughts, and storms. Indigenous knowledge systems in Nigeria also encompass traditional water management practices, including rainwater harvesting, groundwater replenishment, and irrigation methods (Ngene et al., 2021). These strategies help communities manage water scarcity and secure access to clean water for drinking, farming, and household needs.

## **2.3. Role of Indigenous Knowledge in Enhancing Resilience to Climate Variability**

Indigenous knowledge is a vital asset in bolstering resilience to climate variability, offering communities adaptive strategies, coping mechanisms, and locally tailored solutions that align with their unique environments (Leal Filho et al., 2022). These knowledge systems are inherently dynamic and adaptable, enabling communities to modify their practices in response to shifting environmental conditions and climate challenges (Desjardins et al., 2020). Grounded in local ecosystems and cultural heritage, indigenous knowledge equips communities with context-specific, effective, and sustainable responses to climate change (Mbah et al., 2021). Furthermore, it strengthens community bonds, fosters solidarity, and enhances self-reliance, thereby improving the ability of communities to endure and recover from climate-induced disruptions. Indigenous knowledge also embodies cultural resilience, safeguarding traditional practices, heritage, and languages that are crucial for maintaining cultural identity and well-being amid environmental and socio-cultural shifts (Ali et al., 2021).

In Nigeria, indigenous knowledge significantly contributes to climate change adaptation and mitigation by offering valuable insights, practices, and strategies that enhance resilience, promote sustainability, and preserve cultural vitality in a rapidly evolving world (Darjee et al., 2023; Hussain and Reza, 2023). Integrating and respecting indigenous knowledge systems into climate policies, programs, and research is critical for achieving climate resilience, social equity, and environmental sustainability both in Nigeria and globally (Petzold et al., 2020).

**Strengths of Indigenous Knowledge (Olaopa and Ayodele, 2022) :** Indigenous knowledge provides a comprehensive understanding of human-environment relationships, highlighting the interconnectedness of social, cultural, and ecological systems. It incorporates spiritual, ethical, and emotional dimensions of environmental stewardship, fostering a profound respect for nature's intrinsic value. Over centuries, indigenous peoples have developed adaptive strategies to manage environmental variability and change. Their deep understanding of local ecosystems, weather patterns, and natural resources allows them to effectively address environmental challenges. By relying on traditional practices and ecological wisdom, these communities demonstrate remarkable resilience. Indigenous knowledge also promotes sustainable resource management, guided by principles of reciprocity, respect, and intergenerational equity (Turner et al., 2022). Traditional ecological knowledge informs practices such as harvesting, land use, and conservation, which help maintain biodiversity and ecosystem health. By prioritizing long-term sustainability over immediate benefits, indigenous communities play a key role in preserving natural resources for future generations. Additionally, indigenous knowledge is deeply connected to cultural identity, language, and spiritual beliefs, fostering a sense of belonging and collective responsibility. Practices such as rituals and storytelling serve as tools for transmitting knowledge across generations and strengthening social cohesion, thereby sustaining cultural diversity and intergenerational solidarity (Burnette et al., 2020).

**Limitations of Indigenous Knowledge (Nyadzi et al., 2021) :** Indigenous knowledge is often context-specific and may not be easily transferable to different environments or cultural settings. Practices effective in one region may not work elsewhere due to variations in ecological, social, and cultural factors. Thus, careful consideration is needed when applying indigenous knowledge in diverse contexts. Additionally, indigenous knowledge is primarily passed down orally and through experiential learning, resulting in limited formal documentation. This lack of formalization can hinder its validation, replication, and integration into academic and policy frameworks, where formal evidence is often required. Moreover, traditional knowledge systems may reflect gender and power imbalances, often marginalizing women, youth, and other groups in decision-making and

knowledge-sharing processes. Addressing these inequalities is essential for ensuring equitable participation in indigenous knowledge initiatives. External pressures such as globalization, urbanization, and environmental degradation also threaten the preservation and transmission of indigenous knowledge (Ford et al., 2020). Rapid socio-economic changes, loss of land rights, and cultural assimilation further exacerbate these challenges, necessitating efforts to support community-led cultural revitalization and knowledge preservation. Understanding the strengths and limitations of indigenous knowledge is crucial for leveraging its potential in sustainable development. By acknowledging its holistic nature, supporting community-driven initiatives, and fostering equitable partnerships between indigenous and non-indigenous stakeholders, the full potential of indigenous knowledge can be harnessed to address pressing environmental and social challenges (Kenney and Phibbs, 2021). Embracing a pluralistic approach that values diverse knowledge systems is essential for achieving inclusive and sustainable development that respects the rights, dignity, and wisdom of indigenous peoples (Campos Navarrete and Zohar, 2021).

### **3. Climate Change Impacts in Nigeria: Current Trends, Vulnerabilities, and Adaptation Strategies**

Climate change poses significant global challenges, and Nigeria is no exception. As the most populous country in Africa, Nigeria is particularly vulnerable to the impacts of climate change because of its varied geography, reliance on natural resources, and socio-economic challenges, as depicted in Figure 2 (Shiru et al., 2020). The current trends, vulnerabilities, and consequences of climate change on Nigeria's agriculture, water resources, biodiversity, and livelihoods, as well as the adaptation strategies being implemented, have been extensively analyzed. Over the past century, Nigeria has experienced a steady increase in temperatures, and this upward trend is expected to persist. The Intergovernmental Panel on Climate Change (IPCC) forecasts that if greenhouse gas emissions continue at their current pace, Nigeria's temperatures could rise by 1.5 to 2.5 degrees Celsius by the end of the century. Climate projections also predict changes in rainfall distribution, with some regions receiving more rainfall and others becoming drier. These unpredictable rainfall patterns present major obstacles for agriculture, water resource management, and food security, particularly in areas reliant on rain-fed crops. Furthermore, Nigeria is increasingly facing extreme weather events such as floods, droughts, and heatwaves, which are becoming more frequent and severe due to climate change (Joshua, 2021). These events amplify existing vulnerabilities, disrupt economic activities, and pose significant risks to public health and critical infrastructure.

### 3.1. Vulnerable Regions and Communities

Communities along Nigeria's coastline face significant threats from rising sea levels, coastal erosion, and storm surges, which endanger homes, infrastructure, and local economies. Major urban centers like Lagos, Port Harcourt, and Calabar, with their high population densities, are especially at risk (Nwankwo et al., 2022). In the arid and semi-arid zones of northern Nigeria, droughts and desertification are becoming more prevalent, negatively impacting agriculture, livestock, and food security. Climate change intensifies

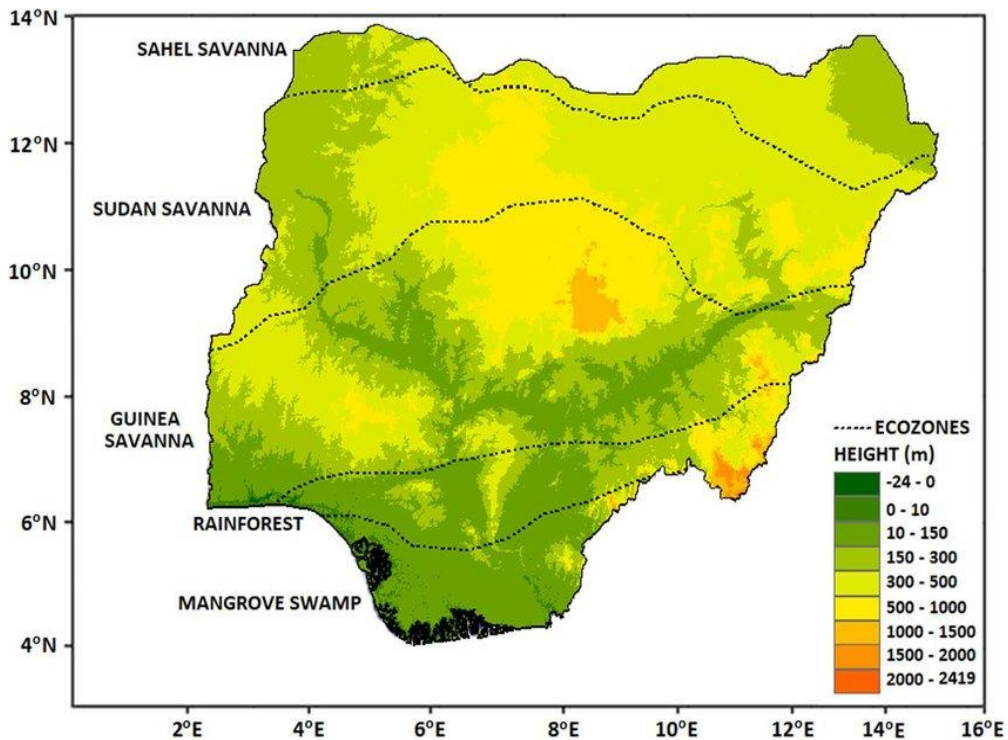


Figure 2: Topography and eco-climatic zones of Nigeria, showing the influence of annual precipitation (Shiru *et al.*, 2020)

these issues, resulting in the loss of fertile land and the reduction of available water resources. Rural populations, particularly those whose livelihoods depend on farming and natural resources, are disproportionately impacted by climate change (Verma and Sudan, 2021). Their vulnerability is further compounded by limited access to adaptation strategies, insufficient infrastructure, and socio-economic challenges, making them more exposed to climate-related hazards.

### 3.2. Impacts on Agriculture, Water Resources, Biodiversity, and Livelihoods

Climate change significantly influences agriculture in Nigeria by altering temperature levels, rainfall distribution, and the occurrence of extreme weather events. Unpredictable rainfall patterns result in crop losses, diminished agricultural productivity, and heightened susceptibility to pests and diseases, which threaten food security and the livelihoods of rural communities. Additionally, climate change impacts the availability and quality of water resources in Nigeria, affecting drinking water supplies, irrigation for farming, hydropower production, and the health of aquatic ecosystems. Droughts and floods disrupt water infrastructure, worsen water shortages, and can lead to conflicts over water resources in certain areas, as illustrated in Figure 3.

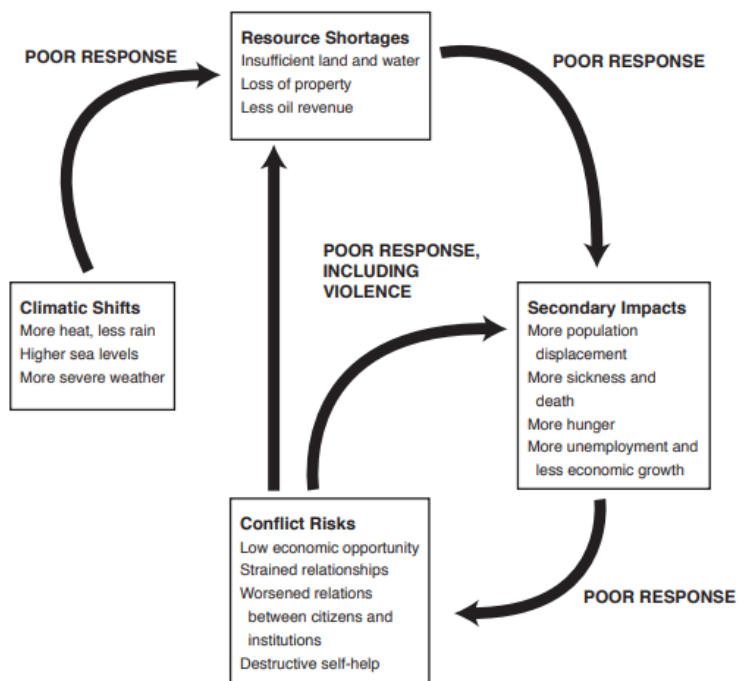


Figure 3. Climate Change and Conflict in Nigeria (Sayne, 2011)

Nigeria’s diverse ecosystems and rich biodiversity are increasingly endangered by climate change, habitat destruction, deforestation, and unsustainable land management practices. Shifts in temperature, altered rainfall patterns, and more frequent extreme weather events are destabilizing ecosystems, endangering species, and weakening the vital services these ecosystems provide for human survival and well-being (Shukla et al., 2021). These changes also severely impact livelihoods in Nigeria by disrupting farming activities, diminishing water resources, worsening food insecurity, and deepening socio-economic disparities. Marginalized groups, such as small-scale farmers, herders, and fishing



communities, are disproportionately affected, struggling to adapt to the rapidly changing environmental conditions. Adopting climate-smart agricultural methods, including diversifying crops, integrating agroforestry, conserving soil, and utilizing water-saving techniques, can strengthen the resilience of farming communities against climate change. Enhancing water management through investments in irrigation systems, rainwater collection, groundwater replenishment, and conservation strategies can help alleviate the effects of climate change on water supply and quality. Additionally, conserving and rehabilitating ecosystems like forests, wetlands, and mangroves boosts biodiversity resilience, stabilizes climate patterns, and delivers critical services such as carbon storage, flood control, and soil preservation (Anu et al., 2024). Strengthening local communities through inclusive approaches, skill development, and the incorporation of traditional knowledge can improve their ability to adapt and build resilience to climate change.

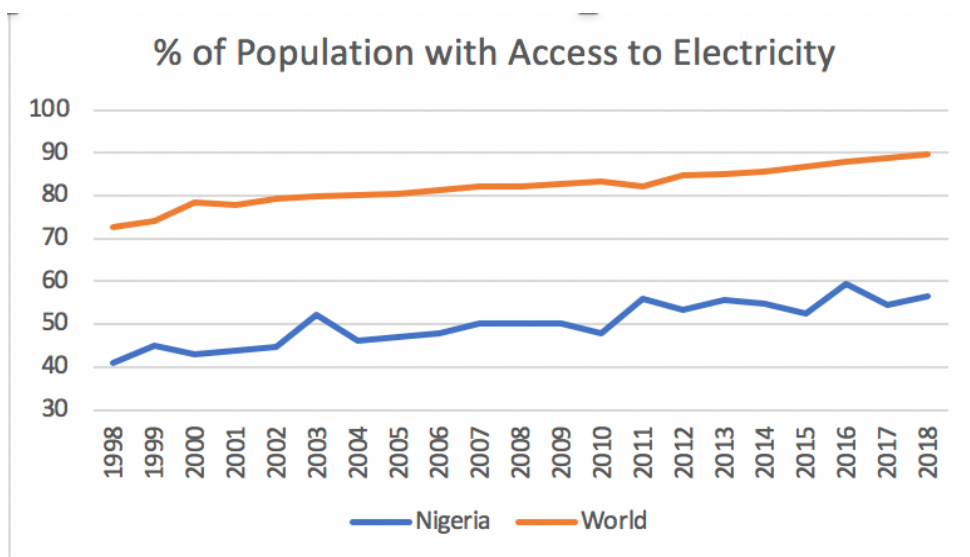


Figure 4: Percentage of population having access to electricity (Oseni, 2012)

Climate change presents substantial obstacles to Nigeria’s socio-economic progress, environmental health, and overall human well-being. Tackling these issues demands coordinated action at local, national, and global levels to reduce greenhouse gas emissions, adapt to environmental shifts, and enhance the resilience of vulnerable populations. The growing reliance on natural gas for power generation in Nigeria has led to a steady increase in CO2 emissions, as shown in Figure 4 (Oseni, 2012). By embracing climate-resilient approaches, advancing sustainable development, and fostering fair collaborations, Nigeria can mitigate the adverse effects of climate change and protect the well-being of its people and ecosystems for future generations (Etowa et al., 2022).

## **4. Integration of Indigenous Knowledge with Modern Solutions in Climate Action**

The integration of indigenous knowledge (IK) with modern scientific approaches is crucial for addressing complex environmental challenges, including climate change. Indigenous knowledge systems (IKS) offer unique insights, adaptive strategies, and holistic perspectives that complement and enhance the effectiveness of modern scientific methods (Al-Mansoori and Hamdan, 2023). The importance of integrating IK with modern solutions can be understood through the following points. Indigenous communities have developed resilient practices and adaptive strategies over generations to cope with environmental variability and change. By integrating IK with modern approaches, societies can enhance their resilience to climate impacts, such as extreme weather events, changing precipitation patterns, and shifting ecosystems (Srivastava and Maity, 2023). Indigenous knowledge is deeply rooted in local environments, cultures, and traditions, providing contextually relevant insights into ecosystem dynamics, natural resource management, and community needs (Lam *et al.*, 2020). Integrating IK with modern solutions ensures that climate actions are tailored to local contexts, increasing their effectiveness and sustainability. Indigenous knowledge systems emphasize sustainable resource use, biodiversity conservation, and ecosystem stewardship, aligning closely with principles of ecological sustainability (Turner *et al.*, 2022). By incorporating IK into climate action strategies, societies can promote sustainable development practices that balance environmental conservation with social and economic needs. Integrating IK with modern solutions acknowledges the contributions of indigenous peoples to environmental stewardship and climate resilience. Collaborative approaches that respect and value indigenous knowledge systems contribute to cultural diversity, equity, and social justice, empowering indigenous communities as active partners in climate action efforts (Zurba and Papadopoulos, 2023).

### **4.1. Collaborative Frameworks between Indigenous Communities, Researchers, and Policymakers**

To successfully combine indigenous knowledge with contemporary solutions, it is crucial to establish cooperative partnerships and active engagement among indigenous communities, researchers, policymakers, and other key stakeholders (Adade Williams *et al.*, 2020). Such collaborative frameworks enable the exchange of knowledge, mutual learning, and the joint development of climate adaptation and mitigation strategies (Giordano *et al.*, 2020). By involving indigenous communities as equal partners and co-creators in research, their expertise, perspectives, and priorities are respected and

integrated (Gardner-Vandy et al., 2021). This co-design approach ensures that climate initiatives are shaped by a blend of indigenous wisdom and scientific evidence. Collaborative frameworks also support knowledge-sharing and capacity-building efforts, empowering indigenous communities to effectively communicate their knowledge, priorities, and needs (Lepore et al., 2021). Initiatives such as training programs, workshops, and community-driven projects enhance the ability of indigenous peoples to participate meaningfully in climate action and decision-making processes. Furthermore, partnerships between indigenous groups, researchers, and policymakers help embed indigenous knowledge into policy frameworks, regulations, and governance systems. Institutional backing for indigenous-led projects, recognition of indigenous rights, and their inclusion in decision-making platforms are vital for integrating indigenous knowledge into climate policies and programs (Schilling-Vacaflor and Gustafsson, 2022). Collaborative approaches also affirm the rights of indigenous peoples to self-determination, cultural autonomy, and land ownership, acknowledging their role as stewards of traditional knowledge and protectors of biodiversity (Ciornei, 2023). Upholding these rights and valuing traditional knowledge systems are essential for building trust, fostering genuine partnerships, and advancing social justice in climate action initiatives.

#### **4.2. Case Studies Showcasing Successful Integration Efforts in Nigeria**

Cross River State government in Nigeria has implemented participatory forest management initiatives in collaboration with indigenous communities, researchers, and NGOs (Isyaku, 2021). These initiatives integrate indigenous knowledge of forest ecosystems with modern scientific approaches to promote sustainable forest management, biodiversity conservation, and carbon sequestration. Indigenous communities in the Niger Delta region are collaborating with researchers and civil society organizations to develop community-based adaptation strategies to address climate impacts such as sea-level rise, coastal erosion, and oil pollution (Ukhurebor *et al.*, 2021). These initiatives combine traditional knowledge of mangrove restoration, fishing practices, and flood resilience with modern technologies and climate modeling tools to enhance community resilience and livelihoods. Indigenous farmers in northern Nigeria are adopting agroecological farming practices that integrate traditional knowledge of crop diversification, soil fertility management, and water conservation with modern agronomic techniques. These integrated approaches enhance agricultural productivity, food security, and climate resilience in the face of droughts, heatwaves, and erratic rainfall patterns. Indigenous communities in Bauchi State are collaborating with researchers and government agencies

to revive traditional water management systems, such as terracing, pond construction, and rainwater harvesting as explain in Figure 5 (Aliyu *et al.*, 2019). These initiatives harness indigenous knowledge of hydrology, soil conservation, and watershed management to mitigate water scarcity, erosion, and flash floods, thereby enhancing community resilience and sustainable water supply (Ward *et al.*, 2020).

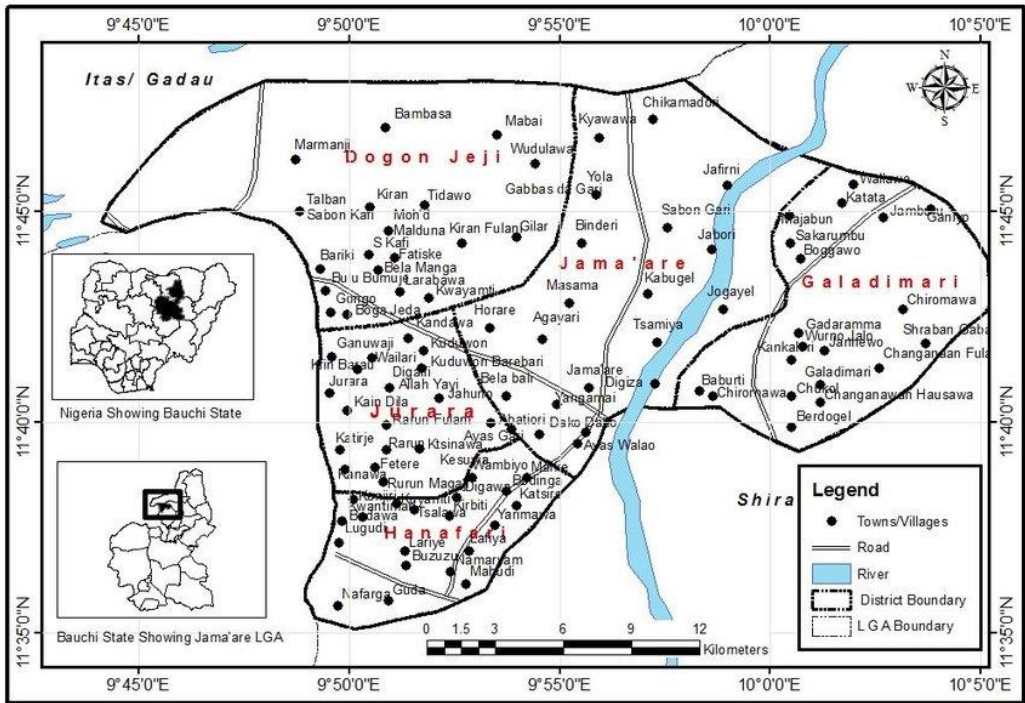


Figure 5: Map of study area (Aliyu *et al.*, 2019)

The integration of indigenous knowledge with modern solutions is essential for building climate resilience, promoting sustainability, and fostering social equity in Nigeria and beyond (Nyadzi *et al.*, 2021). Collaborative frameworks that respect indigenous rights, promote knowledge sharing, and facilitate co-creation of climate actions are vital for mainstreaming indigenous knowledge in climate policies, programs, and decision-making processes (Bhawra, 2022; Poto, 2023). By harnessing the collective wisdom of indigenous peoples and scientific expertise, societies can develop more effective, contextually relevant, and socially inclusive responses to climate change.

## 5. Examples of Integration: Harnessing Indigenous Knowledge for Climate Action in Nigeria

Traditional agricultural practices in Nigeria have long been shaped by indigenous knowledge systems (IKS), which are deeply rooted in local ecosystems, climate patterns, and cultural traditions (Adedeji, 2023). In recent years, efforts have been made to integrate these traditional practices with modern agroecological techniques to enhance agricultural productivity, promote sustainability, and build resilience to climate change (Amoak *et al.*, 2022).

Agroforestry, a traditional practice in many indigenous communities in Nigeria, involves the integration of trees and shrubs into agricultural landscapes (Kuyah *et al.*, 2020). This practice provides multiple benefits, including soil conservation, water retention, biodiversity enhancement, and carbon sequestration. Modern agroecological approaches combine indigenous agroforestry techniques with scientific knowledge of tree species selection, spacing, and management to optimize ecosystem services and enhance climate resilience (Mbow *et al.*, 2020; van Noordwijk *et al.*, 2020). Indigenous farming systems in Nigeria often feature diverse crop varieties adapted to local climatic conditions and soil types. Crop diversity not only reduces the risk of crop failure due to climate variability but also enhances ecosystem resilience and food security (Vernooy, 2022). Modern agroecological approaches promote the conservation and utilization of indigenous crop varieties, alongside modern breeding techniques, to develop climate-resilient crop varieties that are adapted to changing environmental conditions (Hossain *et al.*, 2022; Kamakaula, 2024).

Indigenous farmers in Nigeria employ various soil conservation techniques, such as contour plowing, mulching, and terracing, to prevent soil erosion, improve soil fertility, and enhance water infiltration (Ahuchaogu *et al.*, 2022). Modern agroecological practices integrate these traditional soil conservation methods with innovative techniques, such as cover cropping, no-till farming, and organic composting, to build soil health, mitigate climate risks, and increase agricultural productivity sustainably (Reicosky, 2020; Francaviglia *et al.*, 2023). Indigenous water management systems, such as traditional irrigation techniques, water harvesting, and small-scale reservoirs, have been developed by communities in Nigeria to cope with water scarcity and seasonal fluctuations in rainfall (Ngene *et al.*, 2021; Ayanlade *et al.*, 2022). Modern agroecological approaches complement these traditional water management practices with advanced technologies, such as drip irrigation, rainwater harvesting systems, and precision agriculture, to optimize water use efficiency, minimize water waste, and improve crop yields in drought-prone areas (Praharaj *et al.*, 2023; Tarolli *et al.*, 2024). Indigenous fire management

practices have been integral to the sustainable management of fire-prone ecosystems in Nigeria for centuries (Nieman *et al.*, 2021). These practices, informed by indigenous knowledge of local fire regimes, vegetation dynamics, and cultural traditions, play a crucial role in wildfire prevention, control, and ecosystem restoration. Integrating indigenous fire management practices with modern wildfire management strategies can enhance landscape resilience, protect biodiversity, and safeguard livelihoods (Nikolakis *et al.*, 2020).

Indigenous communities in Nigeria practice controlled burning as a traditional land management tool to clear vegetation, stimulate new growth, and reduce fuel loads, thereby minimizing the risk of catastrophic wildfires (Ajibola *et al.*, 2020; Esavwede and Ojo, M, 2022). Modern wildfire management approaches recognize the value of controlled burning in reducing fire hazards, restoring ecosystem health, and promoting biodiversity conservation, particularly in fire-adapted ecosystems such as savannas and grasslands (Rego *et al.*, 2021; Souza-Alonso *et al.*, 2022). Indigenous fire management practices often incorporate cultural and spiritual beliefs, rituals, and ceremonies that regulate the timing, intensity, and frequency of fires (Vázquez-Varela *et al.*, 2022). Cultural burning fosters a deeper connection between indigenous communities and their landscapes, reinforcing traditional ecological knowledge and promoting stewardship of fire-prone ecosystems (McGranahan and Wonkka, 2020). Integrating cultural burning practices into modern wildfire management plans respects indigenous traditions, strengthens community resilience, and enhances collaboration between indigenous peoples and fire authorities (Nikolakis and Roberts, 2020; Atkinson and Montiel-Molina, 2023).

Indigenous fire management practices prioritize community participation, collaboration, and decision-making, reflecting the collective responsibility of indigenous peoples for maintaining healthy landscapes and reducing fire risks. Modern wildfire management strategies can benefit from engaging indigenous communities as partners in fire prevention, monitoring, and response efforts, leveraging their local knowledge, resources, and expertise to improve fire management outcomes and enhance ecosystem resilience (Dunn *et al.*, 2020; Tedim *et al.*, 2020). Integrating indigenous fire management practices with modern approaches involves knowledge exchange, capacity building, and mutual learning between indigenous communities, fire practitioners, researchers, and policymakers. Collaborative initiatives that facilitate dialogue, training, and shared decision-making processes promote a more inclusive and effective approach to wildfire management, grounded in indigenous wisdom, scientific evidence, and cultural respect (Essen *et al.*, 2023; Croker *et al.*, 2024). Indigenous medicinal plants have been integral to traditional healthcare systems in Nigeria for millennia, providing communities with essential medicines, remedies, and healing practices that are tailored to local

environments, cultural beliefs, and health needs (Ibrahim and AhmedOlaitan, 2022; Jacob *et al.*, 2023). Integrating the utilization of indigenous medicinal plants with modern healthcare systems can enhance climate resilience, promote sustainable health practices, and support community well-being.

Indigenous healing traditions in Nigeria encompass a rich diversity of medicinal plants, herbal remedies, and traditional healing practices that have been passed down through generations. These traditional medicines are often effective, affordable, and culturally appropriate, addressing a wide range of health conditions, including infectious diseases, chronic illnesses, and mental health disorders. Integrating traditional medicine into modern healthcare systems expands access to healthcare services, complements biomedical treatments, and promotes holistic approaches to health and wellness (Kasilo and Wambebe, 2021.). Indigenous medicinal plants are an integral part of Nigeria's rich biodiversity heritage, harboring valuable medicinal compounds, genetic resources, and ecological functions (Ogwu *et al.*, 2023). Sustainable utilization of indigenous medicinal plants contributes to biodiversity conservation, habitat protection, and ecosystem restoration, safeguarding vital ecosystem services and supporting climate adaptation efforts (Shafi *et al.*, 2021). Integrating traditional knowledge of medicinal plants with modern conservation practices promotes sustainable resource management, protects endangered species, and preserves cultural heritage for future generations. Indigenous medicinal plants offer a valuable source of bioactive compounds, phytochemicals, and natural products with therapeutic potential for drug discovery, pharmaceutical development, and biomedical research (Krishnaprabu, 2020). Collaborative research partnerships between indigenous healers, scientists, and pharmaceutical companies can harness traditional knowledge of medicinal plants to identify novel drug candidates, validate traditional remedies, and develop evidence-based healthcare interventions. Integrating indigenous pharmacological knowledge with modern research methodologies enhances scientific understanding of medicinal plants, facilitates drug discovery processes, and promotes biocultural innovation in healthcare (Davis and Choisy, 2024). Integrating indigenous medicinal plants into climate-resilient healthcare systems empowers local communities, traditional healers, and indigenous knowledge holders as active partners in health promotion, disease prevention, and health equity initiatives (Orlovic Lovren, 2020; Al-Worafi, 2023). Community-based approaches that support traditional healers, herbal medicine practitioners, and local heal.

## 6. Challenges and Opportunities in Preserving Indigenous Knowledge

In an era of rapid global transformation, the preservation and acknowledgment of indigenous knowledge confront significant obstacles. Indigenous communities often experience marginalization, the erosion of their traditional wisdom, and the impacts of socio-economic changes, all of which jeopardize the profound insights they hold. Yet, within these challenges, there are opportunities to foster inclusivity, celebrate cultural diversity, and support initiatives led by indigenous peoples (Mallick et al., 2024). Globally, indigenous communities are frequently marginalized, subjected to discrimination, and excluded from critical decision-making processes (Suarez-Balcazar et al., 2022). This exclusion often leads to the disregard or undervaluation of their traditional knowledge systems. Despite possessing invaluable insights into sustainable practices, biodiversity conservation, and ecosystem management, indigenous knowledge is often overshadowed by mainstream scientific methods. This marginalization not only violates the rights and dignity of indigenous peoples but also deprives humanity of essential wisdom needed to tackle modern environmental and societal issues (Añaños Bedriñana et al., 2020). The swift pace of socio-economic changes, such as urbanization, globalization, and the spread of modern technologies, further threatens the survival of traditional knowledge. As younger generations move to urban centers for economic opportunities, there is a growing risk that traditional practices and beliefs may be lost or weakened. Additionally, the commercialization of indigenous culture for tourism or profit often results in the distortion or misuse of traditional knowledge, hastening its decline (Hrenyk and Salmon, 2024). This loss not only erodes the cultural identity of indigenous communities but also deprives the world of critical insights that could inform sustainable development efforts.

Despite these hurdles, there are opportunities to promote inclusivity, cultural diversity, and indigenous-led initiatives. Acknowledging and respecting the rights of indigenous peoples, including their rights to land, self-governance, and cultural expression, is crucial (Oguamanam, 2020). Empowering indigenous communities to engage in decision-making processes that affect their lives and territories can amplify their voices and ensure their knowledge is valued and incorporated into policies and practices (Taitingfong and Ullah, 2021). Additionally, fostering partnerships and collaborations between indigenous communities, governments, academia, and non-governmental organizations can facilitate the exchange of knowledge and expertise (Doucet et al., 2024). Supporting initiatives that document, revitalize, and transmit traditional knowledge can help preserve it for future generations. Integrating indigenous perspectives into educational curricula and research agendas can also enhance cultural understanding and promote cross-cultural dialogue and cooperation (Cross et al., 2020). While the challenges to preserving and recognizing



indigenous knowledge are substantial, they are not insurmountable (Kuru et al., 2021). By addressing issues such as the marginalization of indigenous communities and the erosion of traditional knowledge, we can unlock opportunities to promote inclusivity, cultural diversity, and indigenous-led initiatives. Embracing indigenous knowledge not only enriches our global understanding but also offers practical solutions to pressing global challenges (Brondízio et al., 2021).

**Policy Recommendations for Integrating Indigenous Knowledge into Climate Action Plans:** As the world faces increasing climate change challenges, there is a growing acknowledgment of the critical role indigenous knowledge (IK) plays in shaping effective adaptation and mitigation strategies (Srivastava and Maity, 2023). Indigenous communities hold a wealth of ecological wisdom and adaptive practices that can significantly enhance climate resilience and sustainable development. This section outlines key policy recommendations for leveraging indigenous knowledge in climate action, focusing on recognizing indigenous rights, investing in participatory research, integrating indigenous perspectives into national climate plans, and fostering dialogue between indigenous communities and policymakers.

**Recognizing and Respecting Indigenous Rights and Knowledge Systems :** Governments should implement laws that formally recognize and protect the rights of indigenous peoples to their traditional lands, territories, and resources. This includes acknowledging indigenous knowledge as intellectual property and ensuring its protection under national and international laws (Fernández-Llamazares et al., 2021). Policies must uphold the principle of Free, Prior, and Informed Consent (FPIC), which mandates that indigenous communities must consent to any projects or policies affecting their lands, resources, or traditional knowledge. This ensures indigenous peoples have control over decisions impacting their lives and environments. Measures should also be established to protect indigenous cultural heritage, including languages, rituals, and traditional ecological knowledge. Preserving indigenous languages and oral traditions is vital for maintaining the integrity of their knowledge systems. Governments should allocate resources to support indigenous-led initiatives aimed at preserving, revitalizing, and transmitting traditional knowledge within their communities. This includes funding for cultural centers, language revitalization programs, and capacity-building initiatives for indigenous knowledge holders.

## **7. Investing in Participatory Research and Community-Led Initiatives**

To foster effective climate action, it is essential for governments, research bodies, and non-governmental organizations (NGOs) to prioritize collaborative research initiatives with indigenous communities. This collaboration should involve jointly designing research projects, incorporating indigenous methodologies, and ensuring active involvement of indigenous knowledge experts at every stage of the research process (Ebekozen, 2020). By adopting participatory methods for monitoring and evaluation, indigenous groups can better evaluate how climate change affects their ecosystems, traditional practices, and ways of life. Governments should actively back community-driven monitoring programs that integrate indigenous metrics for assessing environmental shifts and resilience. Additionally, it is crucial to systematically document and preserve the traditional ecological knowledge possessed by indigenous communities. This includes capturing oral histories, recording indigenous practices, and establishing knowledge repositories that can guide climate adaptation and mitigation strategies. Governments should also allocate resources to capacity-building programs aimed at enhancing the research expertise and technical skills of indigenous knowledge holders. These training initiatives should be tailored to the specific needs of indigenous communities, focusing on research techniques, data gathering methods, and information management systems.

### **7.1. Integrating Indigenous Perspectives into National Climate Action Plans**

To foster comprehensive and equitable climate policies, it is essential to create national climate action plans using inclusive and participatory approaches that actively involve indigenous representatives, traditional leaders, and community-based organizations. By doing so, the unique perspectives, priorities, and concerns of indigenous communities can be seamlessly integrated into climate policy frameworks from the initial stages (Nyadzi et al., 2021). Additionally, governments should prioritize the inclusion of indigenous adaptation methods and practices within national climate adaptation strategies.

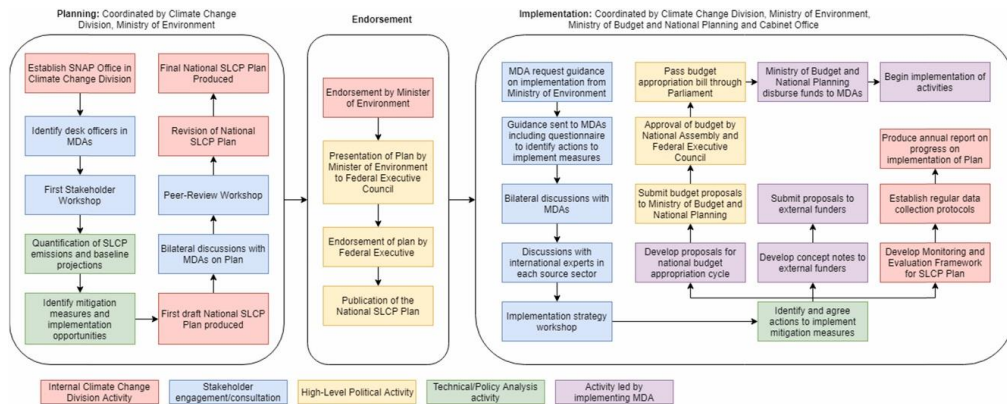


Figure 6 Sequencing of activities in Nigeria’s national SLCP planning process (Malley et al., 2021)

Figure 6 shows the Sequencing of activities in Nigeria’s national Short-Lived Climate Pollutants planning process. This includes recognizing the role of traditional ecological knowledge in enhancing resilience to climate impacts such as extreme weather events, changing precipitation patterns, and sea-level rise. climate adaptation and mitigation efforts. This may involve establishing dedicated funding streams for indigenous-led projects, providing technical assistance for project development, and simplifying bureaucratic procedures for accessing climate finance. Total CO<sub>2</sub> (Mt of CO<sub>2</sub>) emissions in Nigeria is shown in figure 7 and sea-level rise. climate adaptation and mitigation efforts. This may involve establishing dedicated funding streams for indigenous-led projects, providing technical assistance for project development, and simplifying bureaucratic procedures for accessing climate finance. Total CO<sub>2</sub> (Mt of CO<sub>2</sub>) emissions in Nigeria is shown in figure 7. Policies should support indigenous land management practices that promote ecosystem conservation, restoration, and sustainable use. Indigenous land tenure systems, customary land management practices, and community-based conservation initiatives play a crucial role in preserving biodiversity and mitigating greenhouse gas emissions.

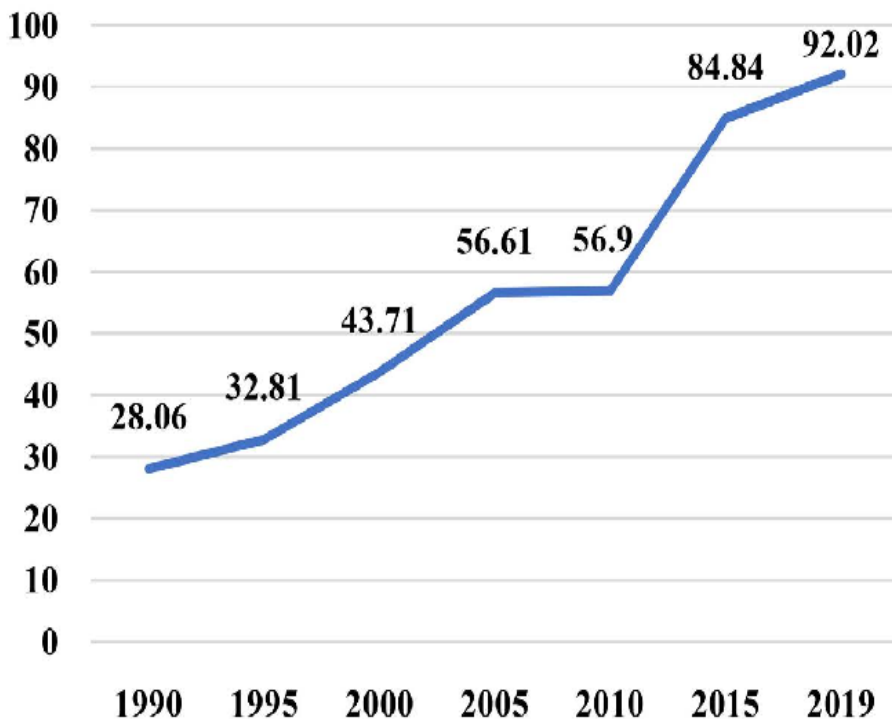


Figure 7: Total CO<sub>2</sub> (Mt of CO<sub>2</sub>) emissions in Nigeria (Ekpotu *et al.*, 2023)

### 7.3. Creating Platforms for Dialogue and Knowledge Exchange between Indigenous Communities and Policymakers

To effectively address climate change, governments should promote multi-stakeholder discussions that unite indigenous leaders, policymakers, researchers, and civil society groups. These forums can serve as platforms for exchanging insights, sharing experiences, and collaboratively developing solutions to climate-related issues. Such interactions can enhance mutual understanding, strengthen trust, and drive joint efforts (Oni *et al.*, 2020). Additionally, creating indigenous advisory boards or councils within climate-focused government agencies can ensure that indigenous viewpoints are consistently integrated into policy decisions. These bodies can offer input on policy design, execution, and evaluation, ensuring that climate strategies are culturally appropriate and aligned with indigenous priorities. Governments should also encourage the creation of digital tools, knowledge databases, and networking spaces that enable the dissemination of indigenous knowledge, successful practices, and lessons from past experiences. These resources can

act as central hubs for information exchange, peer learning, and amplifying indigenous voices in climate policy discussions. Furthermore, investing in capacity-building programs is crucial to help policymakers, officials, and development professionals better understand the significance of indigenous knowledge in climate action. Workshops, training sessions, and seminars can increase awareness of indigenous perspectives, improve cultural sensitivity, and enhance partnerships between indigenous communities and decision-makers (Nguyen et al., 2020). The recommendations presented in this essay outline a clear path for incorporating indigenous knowledge into climate strategies. By acknowledging indigenous rights, supporting participatory research, embedding indigenous perspectives into national policies, and encouraging dialogue between indigenous groups and policymakers, governments can tap into the vast reservoir of indigenous wisdom to tackle the multifaceted challenges of climate change (Brondízio et al., 2021). Adopting a cooperative and inclusive approach that honors indigenous sovereignty, cultural diversity, and traditional knowledge systems is vital for building climate resilience, promoting environmental sustainability, and advancing social justice in an era of rapid climate transformation.

## **8. Conclusion**

In summary, the importance of leveraging indigenous knowledge for climate action cannot be emphasized enough. Indigenous communities hold a wealth of time-tested insights and practices that promote sustainable living and environmental harmony. As discussed in this review, the marginalization of these communities and the gradual loss of their traditional knowledge present significant obstacles to preserving and acknowledging this invaluable wisdom. Yet, these challenges also open doors for promoting inclusivity, cultural diversity, and initiatives led by indigenous peoples. Reiterating the critical role of indigenous knowledge in climate action, it is clear that these communities offer essential solutions to the urgent challenges of climate change. Their holistic methods of environmental care, resilience-building practices, and adaptive techniques provide crucial lessons for mitigating climate impacts and advancing sustainable development.

A strong call to action is needed to empower indigenous communities and encourage collaboration among all stakeholders. This involves acknowledging and upholding the rights of indigenous peoples, ensuring their voices are heard in decision-making processes, and supporting efforts to document, revive, and pass on traditional knowledge. By taking these steps, we can unlock the rich reservoir of indigenous wisdom and apply it to inform climate mitigation and adaptation strategies at local and global levels. Additionally, it is vital to highlight the importance of blending diverse knowledge systems

to enhance climate resilience, particularly in regions like Nigeria. Nigeria, like many nations, grapples with multifaceted climate challenges, including extreme weather, biodiversity loss, and food insecurity. In this context, combining indigenous knowledge with scientific expertise can deepen our understanding of local environmental conditions and help craft tailored adaptation measures. By integrating varied knowledge systems, we can strengthen community resilience, safeguard ecosystems, and secure sustainable livelihoods for future generations.

Utilizing indigenous knowledge for climate action is not just about environmental sustainability; it is also a matter of social justice and cultural preservation. Empowering indigenous communities, fostering partnerships, and merging diverse knowledge systems are essential steps toward creating a more resilient and equitable future. As we confront the realities of climate change, let us draw on the wisdom of indigenous peoples and collaborate to build a world where diverse knowledge systems are respected, valued, and utilized for the well-being of both humanity and the planet.

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