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David R. Breininger,
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REVIEWED BY

Pelin Özden,
Izmir Kavram Meslek Yuksekokulu, Türkiye

*CORRESPONDENCE

Iniunam A. Iniunam

✉ i.iniunam2@gmail.com;

✉ ia.iniunam@aplori.org

Talatu Tende

✉ talatu.tende15@gmail.com

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Bridging citizen science and policy for bird conservation in Africa: lessons from the Nigerian bird atlas project

Iniunam Aniefiok Iniunam ^{1,2*}, Nanlep Kumle¹, Bello Adamu Danmallam^{1,2}, Anthony Gicheha Kuria², Rosie Trevelyan³, Ulf Ottosson¹, Adams Chaskda¹ and Talatu Tende ^{1*}

¹A. P. Leventis Ornithological Research Institute, Department of Zoology, University of Jos, Laminga, Jos, Plateau State, Nigeria, ²Tropical Biology Association, Nairobi, Kenya, ³Tropical Biology Association, Cambridge, United Kingdom

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Introduction

Birds are among the most visible and well-documented taxa in Africa, offering vital insights into ecosystem health, climate change impacts, and land-use transformations (Danmallam et al., 2024; Gaston, 2022). Yet, despite this visibility, the science–policy divide in avian conservation remains wide (IPBES, 2019). This gap persists amid accelerating biodiversity loss driven by habitat conversion, extractive industries, and weak institutional coordination across the continent (CBD, 2022).

Citizen science has emerged as a promising bridge, enabling public participation in biodiversity monitoring and expanding data coverage beyond the capacity of conventional scientific efforts (McKinley et al., 2017). Citizen science is the act of public volunteers in collaboration with professional scientists and scientific institutions to contribute to scientific research by collecting and sometimes helping frame questions or co-creating projects (Bonney et al., 2009). By engaging volunteers in data collection, analysis, and outreach, initiatives such as the South African Bird Atlas Project (SABAP2), the Kenya Bird Map (KBM), and the Nigerian Bird Atlas Project (NiBAP) have generated robust datasets that inform research and management (Nussbaumer et al., 2025; Ringim et al., 2022; Tende et al., 2024). These initiatives demonstrate how structured citizen science monitoring can strengthen both ecological understanding and participatory governance (Newing et al., 2024).

Despite these advances, the role of citizen-science data in driving policy remains inconsistent across much of Africa (Ambole et al., 2025; Pateman et al., 2025). Many national and subnational agencies lack mechanisms to validate, standardise, and integrate citizen science observations into official reporting frameworks (Fraisl et al., 2022; Falayi et al., 2021). As a result, valuable information on species distributions, habitat change, and

ecosystem threats remains underutilised in decision-making (Bonney et al., 2009; McKinley et al., 2017).

This Opinion draws on Nigeria's experience, particularly through the Nigerian Bird Atlas Project (NiBAP). It's also inspired by outcomes from the 2025 Abuja Stakeholder Meeting on *Communicating Citizen Science Data for Management and Advocacy*, to explore how citizen science can strengthen evidence-based policy in Africa. Between January and March 2025, NiBAP and the A. P. Leventis Ornithological Research Institute (APLORI) convened high-level consultations with the Federal Ministry of Environment, National Park Service, the Nigerian Conservation Foundation, academia, and media partners. Nigeria's case provides both a microcosm of continental challenges and a model of institutional innovation that can inform other African countries.

NiBAP held several meetings that showcased several citizen-science-generated outputs to diverse stakeholders, highlighting the importance of citizen science data to national biodiversity conservation (Danmallam et al., 2024, Danmallam et al., 2025; Iniunam et al., in press; Ngila et al., 2024). Stakeholders reached include the National Park Service (25 participants), the Ministry of Agriculture (15 participants), the National Environmental Standards and Regulation Enforcement Agency (15 participants), and university students (90 participants). These meetings culminated in a two-day participatory Abuja stakeholder meeting with approximately twenty-five participants drawn from federal and state agencies, NiBAP coordinators, academic institutions, NGOs, local bird clubs and media organisations. Notes from these sessions, together with follow-up interviews and written reflections from organisers, were synthesised thematically by the authors. Although not a formal qualitative study, these structured deliberations offer grounded insights into how stakeholders perceive the opportunities and limitations of citizen science data in Nigeria.

We examine three interlinked themes, namely 1) Data coordination and standardisation across institutions; 2) Capacity development and technology for sustained citizen participation; and 3) Stakeholder engagement and trust-building between scientists, policymakers, and communities. By situating the NiBAP experience within a pan-African context, this paper argues that citizen science can and should evolve from a data-generation mechanism into a strategic governance instrument for conservation. Specifically, it advances the thesis that integrating citizen science data into national biodiversity frameworks through improved data governance, capacity development, and stakeholder engagement can help bridge the science-policy gap in Africa, using Nigeria's NiBAP and the Abuja stakeholder process as a practical model.

Birding, citizen science, and policy gaps in Africa

Across Africa, birding and citizen science have transformed from niche activities to critical tools for biodiversity monitoring, education, public engagement and, potentially, policy influence (Darwin Initiative, 2025; Nussbaumer et al., 2025). The expansion of mobile technologies and digital platforms such as eBird,

BirdLasser, and the African Bird Atlas Project (ABAP) has enabled broader public participation, producing millions of records across the continent (Lee et al., 2022; Ringim et al., 2022). These data provide unprecedented insight into avian distributions and temporal trends, making citizen science a key contributor to continental biodiversity databases.

However, the integration of these datasets into national biodiversity monitoring and reporting frameworks remains limited (Danielsen et al., 2014; Tengö et al., 2017). In most African countries, overlapping mandates among ministries, weak institutional coordination, and inconsistent data standards hinder policy translation (Schade et al., 2021). For instance, environmental governance in South Africa has been hampered by fragmentation between conservation and environmental departments, resulting in duplicated monitoring and inefficient data sharing (Kotzé, 2006; Falayi et al., 2021). Similar fragmentation is evident elsewhere in Africa, where conservation, forestry, and agricultural ministries often operate in silos.

Beyond institutional barriers, capacity and perception challenges further constrain the policy relevance of citizen science. Many policymakers remain sceptical about data collected by non-professionals, despite mounting evidence of its reliability when guided by structured frameworks such as the Bird Atlas model (Burgess et al., 2017; Kosmala et al., 2016). Limited training opportunities, unstable funding, and insufficient digital infrastructure have also reduced project continuity, particularly in West and Central Africa (Pocock et al., 2019; Rigler et al., 2022).

Cultural perceptions add another layer of complexity. In several African societies, spiritual beliefs surrounding certain bird species influence public participation in monitoring programs. Owls and raptors, for instance, are often associated with death or misfortune, affecting their protection and reporting (Antonio et al., 2025; Ogada and Kibuthu, 2008). Such socio-cultural dynamics highlight the need to integrate traditional ecological knowledge and local governance systems into conservation frameworks (Newing et al., 2024). When combined effectively, scientific and indigenous knowledge systems can foster broader engagement, trust, and sustainability.

Within this landscape, the Nigerian Bird Atlas Project (NiBAP) provides a valuable model. Nigeria, like many African nations, faces severe biodiversity threats from deforestation and oil pollution to wetland degradation and urbanisation (Iniunam et al., 2025; Kumdet et al., 2025). Yet, through NiBAP, birding has emerged as an important platform connecting academia, citizen scientists, NGOs, and government actors as evidenced by joint field activities, training workshops and policy dialogues convened around atlas data (Darwin Initiative, 2025; Tende et al., 2024). The project demonstrates that with proper coordination and institutional support, citizen science can advance not only ecological understanding but also influence policy. The broader challenge, however, remains scaling these successes across Africa through trust-building, harmonised frameworks, and long-term investment.

Lessons from the Nigerian Bird Atlas Project (NiBAP): Bridging Data, People, and Policy.

NiBAP coordinated by the A. P. Leventis Ornithological Research Institute (APLORI) exemplifies the power of structured

citizen science in sub-Saharan Africa. Since 2015, NiBAP has mobilised hundreds of trained volunteers, students, and local bird clubs across Nigeria to document bird distributions systematically. Using a standardised grid-based mapping system, participants submit observations via mobile applications, building one of the country's largest biodiversity databases (Tende et al., 2024).

Institutional coordination and data governance

Weak institutional coordination and the absence of standardised data-sharing frameworks hinder the effective integration of citizen science outputs into environmental governance. This challenge mirrors broader issues in biodiversity management across the Global South, where fragmented structures reduce the responsiveness of policy-making (Danielsen et al., 2014). Data governance, which is the rules, standards and institutional arrangements governing how data are collected, curated, shared, and applied in decision-making, is critical in this context. In Nigeria, valuable datasets such as those from the Nigerian Bird Atlas Project (NiBAP) are mainly curated by an academic–NGO partnership led by the A. P. Leventis Ornithological Research Institute (APLORI). Meanwhile, federal and state agencies maintain separate monitoring and reporting systems with limited interoperability. For instance, bird occurrence records collected through NiBAP for protected areas and Ramsar sites are not systematically linked to reporting templates used by the Federal Ministry of Environment or to state-level land-use planning tools.

Moreover, both federal and state authorities sometimes underestimate the value and purpose of citizen science data. This situation reflects the wider structural challenges of Nigerian environmental governance, where overlapping mandates and weak horizontal coordination between ministries and agencies create “islands” of data that are rarely shared or jointly analysed.

Federal–state dynamics further influence the incorporation of citizen science into policy processes. While the Federal Ministry of Environment is responsible for setting national environmental policies, state ministries implement these policies and address region-specific issues. Citizen science data have the potential to inform multiple stages of the policy cycle, especially through publications that could guide conservation actions. However, without formal agreements and interoperable platforms linking citizen science data with both federal and state systems, these contributions remain largely unrealised.

Globally, similar constraints have been reported. For instance, despite the availability of large citizen science datasets in Europe, their incorporation into formal biodiversity monitoring frameworks remains inconsistent (Turbé et al., 2019). Conversely, in the UK and the US, citizen science is embedded within official monitoring systems, supported by standardised data management and long-term institutional partnerships (Conrad and Hilchey, 2011). African

countries can learn from these examples to develop central clearinghouse mechanisms, ensuring interoperability and quality assurance for citizen science data (Geijzenborffer et al., 2016).

Encouragingly, Kenya has pioneered the Kenya Bird Trends initiative (Nussbaumer et al., 2025), which has already informed the reassessment of species such as the Near Threatened *Euplectes jacksoni*. Such examples demonstrate how institutionalised citizen science can generate data that directly influences conservation policy and IUCN Red List assessments.

Building capacity and technical infrastructure

Limited human and technical capacity remains a key barrier to scaling citizen science. Even with motivated volunteers, inadequate training, weak institutional infrastructure, and inconsistent digital access limit data quality and utility (Balmford et al., 2003; Pocock et al., 2017). Long-term sustainability depends on continuous capacity development, stable funding, and government support.

NiBAP's experience shows that strengthening technical infrastructure, such as field stations, mobile apps, and data visualisation tools, can transform citizen observations into actionable intelligence. In Nigeria, targeted training of NiBAP volunteers at APLORI and partner universities has produced a small but growing cadre of birders who understand both atlas protocols and policy needs. However, gaps remain in institutional capacity within government agencies themselves, where limited staff time, unstable internet connectivity, and insufficient analytical skills restrict the regular use of NiBAP outputs in planning and reporting. Addressing these internal capacity deficits is as important as supporting citizen scientists in the field.

Globally, platforms like SMART (Spatial Monitoring and Reporting Tool) and drones have revolutionised wildlife monitoring in East Africa, improving accuracy and timeliness (Critchlow et al., 2015). Co-developing similar tools with agencies and NGOs in Nigeria and Africa at large would improve transparency and facilitate real-time decision-making.

Internationally, citizen science programs thrive when supported by long-term institutional commitment and diversified funding (Conrad and Hilchey, 2011; Skarzauskiene and Mačiulienė, 2021). Nigeria and other African nations could benefit from multi-sectoral partnerships that integrate academia, government, NGOs, and private foundations to ensure continuity and inclusivity in citizen science networks.

Partnerships, education, and stakeholder engagement

NiBAP's successes are rooted in partnerships among APLORI, universities, NGOs, and local bird clubs (Tende et al., 2024). Together, these actors have co-organised national and regional

workshops, where birders, government staff, and journalists collaboratively explore how atlas data can inform protected area management, environmental impact assessments and state biodiversity strategies. Such co-production spaces remain relatively rare in West Africa, but are essential for building trust in citizen science data and aligning expectations between data generators and policy users. This academic–community collaboration has also fostered experiential learning and nurtured young conservation scientists who understand both ecological and socio-political dynamics. However, many African countries still lack formal institutional mechanisms linking citizen science projects to government ministries or policy frameworks (Ampaire et al., 2017).

In South Africa, institutionalised collaboration through SABAP2 has enabled the integration of bird data into the South African National Biodiversity Institute’s decision-making frameworks (Lee et al., 2022). Replicating these governance models more broadly across Africa would strengthen data credibility and ensure that citizen science contributions meaningfully support national biodiversity assessments, protected area design, and species threat evaluations (Kühl et al., 2020).

The 2025 stakeholder meetings highlighted that inclusive engagement, particularly involving local communities and media, improves trust, data accessibility, and public understanding of conservation science. Structured partnerships would enhance both the quality and visibility of citizen science outputs and accelerate their translation into actionable environmental management strategies.

Cross-cutting constraints

Despite these opportunities, several persistent constraints limit the integration of citizen science into environmental governance in Nigeria and across Africa. First, data validation and quality assurance remain uneven, particularly where expert review capacity is limited, and protocols are not fully institutionalised. Second, long-term funding for coordination, training and data infrastructure is often project-based, creating uncertainty for volunteers and institutions once external grants end. Third, infrastructural inequalities, including unreliable internet, limited access to smartphones and computers, and gaps in basic electricity supply, can exclude rural communities from contributing or accessing data. Fourth, political barriers, such as low prioritisation of biodiversity relative to other development agendas, and a lack of formal mandates to use citizen science data, often prevent these datasets from entering policy processes. Finally, there are pronounced regional disparities: countries and regions with strong birding cultures and research institutions, such as southern and eastern Africa, are far better represented in citizen science databases than much of West and Central Africa. Recognising and addressing these constraints is essential to ensure that citizen science complements, rather than reproduces, existing inequalities in environmental governance.

Conclusion

Citizen science aligns strongly with global frameworks such as the Sustainable Development Goals (SDGs) and the Kunming–Montreal Global Biodiversity Framework (KM-GBF). Specifically, SDG 15 (“Life on Land”) and KM-GBF Targets 20–22 emphasise participatory monitoring and the integration of diverse knowledge systems. By embedding citizen science into these reporting structures, African countries can enhance accountability, build adaptive management systems, and foster community-driven conservation.

Moving forward, we propose four strategic actions: 1) Institutionalise citizen science through formal data governance frameworks, inter-agency coordination, and national biodiversity clearinghouses, led by the National Environmental Standards and Regulations Enforcement Agency and APLORI. 2) Strengthen capacity and technology. APLORI, national universities and NGOs should lead the co-designing training programmes and digital tools, supported by recurrent budgets that federal and state agencies commit to providing. 3) Foster partnerships among academia, government, NGOs, and citizen groups to enhance data reliability and advocacy, for example, through annual or biennial joint planning meetings and co-branded campaigns. 4) Integrate citizen science into policy frameworks. This will ensure local data informs land use planning, protected area management, and climate adaptation strategies. Referencing citizen science datasets in national environmental strategies and policies, and biodiversity reporting to global conventions can greatly enhance the process. In the short term, pilot integration of citizen science outputs into national reporting and a small number of state-level land use plans would demonstrate feasibility; in the medium term, standardised protocols can be rolled out nationally. Citizen science represents not merely a method of data collection, but a transformative approach to environmental governance. From Nigeria’s NiBAP to continental networks like ABAP, these initiatives reveal that when citizens are empowered to observe, record, and advocate for biodiversity, science becomes a bridge that connects knowledge, people, and policy across Africa.

Author contributions

IA: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. NK: Investigation, Methodology, Writing – original draft, Writing – review & editing. BD: Methodology, Writing – review & editing. AK: Funding acquisition, Methodology, Project administration, Resources, Supervision, Writing – review & editing. RT: Resources, Writing – review & editing. UO: Resources, Supervision, Writing – review & editing. AC: Resources, Supervision, Writing – review & editing. TT: Conceptualization, Funding acquisition, Methodology, Project administration, Resources, Supervision, Writing – review & editing.

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