Conserving Biodiversity through Smart Technology for Sustainability in the Global South: An Appraisal

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Kariuki Muigua

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Abstract

This paper discusses how the ideal of sound biodiversity conservation can be realised in the Global South. The paper argues that the Global South is rich in biodiversity including unique species and vital ecosystems. It posits that biodiversity plays a fundamental role in ensuring human health, well-being and prosperity in the Global South. Despite being endowed with biodiversity, the paper notes that biodiversity loss is a major problem in the Global South with severe impacts for people and planet. The paper discusses the causes and effects of biodiversity loss in the Global South. It argues that biodiversity loss impacts development in the Global South. Consequently, the paper posits that strengthening biodiversity conservation in the Global South is an urgent and fundamental objective if the Sustainable Development agenda is to be realised. The paper explores how smart technology can be harnessed and utilised to strengthen biodiversity conservation in the Global South for sustainability.

1.0 Introduction

Biological diversity/biodiversity refers to variety of life on Earth and the natural patterns it forms[1]. Further, the *Convention on Biological Diversity*[2] defines biodiversity as the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; including diversity within species, between species and of ecosystems[3]. Biodiversity

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[1] United Nations Environment Programme., 'UNEP and Biodiversity' Available at https://www.unep.org/unep-and-biodiversity#:~:text=Biological%20diversity%20is%20the%20variety,of%20human%20influence%20as%20well. (Accessed on 07/12/2025)

[2] Convention on Biological Diversity, 5 June 1992 (1760 U.N.T.S. 69)

[3] Ibid, Article 2

comprises not only the world's species with their unique evolutionary histories, but also genetic variability within and among populations of species and the distribution of species across local habitats, ecosystems, landscapes, and whole continents or oceans[4]. The term biodiversity thus describes the richness and variety of life on Earth[5]. According to the United Nations, biodiversity is the variety of life on Earth, in all its forms, from genes and bacteria to entire ecosystems[6].

Biodiversity is the foundation of life on Earth. It has been argued that biodiversity forms the web of life that humanity depends on for many vital needs and resources including food, water, medicine, clean air, a stable climate, livelihoods, and economic growth among others[7]. Further, it is estimated that over half of the global Gross Domestic Product (GDP) is dependent on nature[8]. According to the United Nations Environment Programme (UNEP), biodiversity forms the web of life, of which humans are integral and upon which people and the planet fully depend on for their health and well-being[9].

Despite sustaining life on the planet, it has been pointed out the world is witnessing an alarming loss of biodiversity with species disappearing hundreds, or even thousands, of times faster than the natural background rate of extinction[10]. It is estimated that nearly 1 million species face the risk of extinction[11]. Global biodiversity loss is largely driven by human activities such as unsustainable urban development, agricultural expansion into habitats and ecosystems, pollution, deforestation, land degradation, over extraction of

[4] What is Biodiversity?., Available at https://www.ncbi.nlm.nih.gov/books/NBK224405/ (Accessed on 07/12/2025)
[5] Biodiversity Definition., Available at https://byjus.com/biology/biodiversity/ (Accessed on 07/12/2025)
[6] United Nations., 'Biodiversity - our strongest natural defense against climate change' Available at https://www.un.org/en/climatechange/science/climate-issues/biodiversity (Accessed on 07/12/2025)
[7] Ibid
[8] Ibid
[9] United Nations Environment Programme., 'UNEP and Biodiversity' Available at https://www.unep.org/unep-and-biodiversity (Accessed on 07/12/2025)
[10] Ibid
[11] United Nations Environment Programme., 'Five drivers of the nature crisis' Available at https://www.unep.org/news-and-stories/story/five-drivers-nature-crisis (Accessed on 07/12/2025)

resources, and human-induced climate change[12]. The ongoing loss of biological diversity has serious consequences for both people and planet. It has been argued that biodiversity loss impacts the availability and quality of vital ecosystem goods and services including food, clean water, clean air, medicines, pollination, nutrient cycling, erosion control and climate regulation thus impacting livelihoods and human and ecosystem health[13].

In light of the foregoing, conserving biodiversity is a vital global goal for the health and well-being of both humanity and nature. The *Convention on Biological Diversity*[14] provides the global framework for the conservation of biodiversity in the pursuit of Sustainable Development. The Convention aims to foster the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources[15]. In addition, the *Kunming-Montreal Global Biodiversity Framework (GBF)*[16] was adopted in order to strengthen efforts to conserve biodiversity worldwide for Sustainable Development. The Framework aims to halt and reverse biodiversity loss and ensure sustainable use of biodiversity towards meeting the objectives of the Convention on Biological Diversity and enhancing the role of biodiversity in the Sustainable Development agenda[17]. Biodiversity conservation is also a key theme under the United Nations *2030 Agenda for Sustainable Development*[18]. Under the Agenda, Sustainable Development Goal (SDG) 15 seeks to *inter alia* halt the loss of

[12] United Nations Environment Programme., 'Tackling Ecosystem Degradation & Pollution' Available at https://www.unep.org/topics/ocean-seas-and-coasts/ecosystem-degradation-pollution (Accessed on 07/12/2025)

[13] World Health Organization., 'Biodiversity' Available at https://www.who.int/news-room/fact-sheets/detail/biodiversity#:~:text=Biodiversity%20loss%20is%20occurring%20at,healthier%2C%20more%20resilient%20food%20production (Accessed on 07/12/2025)

[14] Convention on Biological Diversity, Op Cit

[15] Ibid, article 1

[16] Convention on Biological Diversity., 'Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity: 15/4. Kunming-Montreal Global Biodiversity Framework' Available at https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf (Accessed on 07/12/2025)

[17] Ibid

[18] United Nations General Assembly., 'Transforming Our World: the 2030 Agenda for Sustainable Development.' 21 October 2015, A/RES/70/1., Available at https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf (Accessed on 07/12/2025)

biodiversity for Sustainable Development[19]. Strengthening biodiversity conservation is therefore vital in the pursuit of Sustainable Development.

This paper discusses how the ideal of sound biodiversity conservation can be realised in the Global South. The paper argues that the Global South is rich in biodiversity including unique species and vital ecosystems. It posits that biodiversity plays a fundamental role in ensuring human health, well-being and prosperity in the Global South. Despite being endowed with biodiversity, the paper notes that biodiversity loss is a major problem in the Global South with severe impacts for people and planet. The paper discusses the causes and effects of biodiversity loss in the Global South. It argues that biodiversity loss impacts development in the Global South. Consequently, the paper posits that strengthening biodiversity conservation in the Global South is an urgent and fundamental objective if the Sustainable Development agenda is to be realised. The paper explores how smart technology can be harnessed and utilised to strengthen biodiversity conservation in the Global South for sustainability.

2.0 Biodiversity in the Global South: Opportunities and Challenges

The Global South is endowed with biodiversity including unique species and critical habitats and ecosystems. For example, it has been observed that the Global South is home to 29 of the world's 36 biodiversity hotspots and most of the planet's biosphere reserves, including critical ecosystems such as the Amazon and Congo Basin rainforests[20]. Most of the planet's biodiversity hotspots are concentrated in the Global South including in Africa, South America and the Asia-Pacific region[21]. For instance, Africa has been identified as one of the most biodiverse regions on Earth, hosting nearly a quarter of

[19] Ibid
[20] Where are the world's biodiversity hotspots?., Available at https://www.green.earth/blog/where-are-the-worlds-biodiversity-hotspots (Accessed on 08/12/2025)
[21] Ibid

global biodiversity including unique mammal, bird and plant species[22]. Africa is also home to critical ecosystems and habitats including mangroves, deserts, tropical forests, grasslands, savannahs and ice-capped mountains which are crucial for biodiversity conservation[23].

Further, it is estimated that of the world's 17 most biodiverse countries, 15 are developing countries or emerging economies in the Global South[24]. Consequently, it has been correctly noted that the Global South encompasses the vast majority of the world's biodiversity with regions such as Africa, Asia and Latin America and the Caribbean (LAC) hosting most of the global biodiversity hotspots and biosphere reserves[25]. The abundance of biodiversity in the Global South provides immense opportunities to fast-track progress towards Sustainable Development. For example, it has been argued that the Global South's rich biodiversity is crucial for maintaining the balance of ecosystems and providing ecosystem services essential for human well-being including clean air, water, food, energy, climate regulation and disease control[26]. Biodiversity supports livelihoods and economic growth in the Global South[27]. Further, it has been argued that biodiversity in the Global South promotes natural resilience in the face of mounting challenges including climate change[28].

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[22] Biodiversity loss in Africa: A critical risk and opportunity for impact., Available at https://www.controlrisks.com/our-thinking/insights/biodiversity-loss-in-africa-a-critical-risk-and-opportunity-for-impact?utm_referrer=https://www.google.com (Accessed on 08/12/2025)

[23] UNEP-WCMC (2016) The State of Biodiversity in Africa: A mid-term review of progress towards the Aichi Biodiversity Targets. UNEP-WCMC, Cambridge, UK., Available at https://www.cbd.int/gbo/gbo4/outlook-africa-en.pdf (Accessed on 08/12/2025)

[24] Protecting biodiversity – ensuring survival., Available at https://www.bmz.de/en/issues/biodiversity (Accessed on 08/12/2025)

[25] Joseph. J., Sahu. A.K., & Vuori. J., 'Securitization, three streams model and biodiversity in the Global South: A case study of Western Ghats of India' *Earth System Governance*., Volume 25, 2025

[26] African Development Bank Group., 'Biodiversity' Available at https://www.afdb.org/en/topics-and-sectors/topics/biodiversity#:~:text=Africa%20is%20one%20of%20the,%2C%20savannas%2C%20and%20coral%20reefs. (Accessed on 08/12/2025)

[27] Rich countries must compensate the Global South for biodiversity loss., Available at https://www.eco-business.com/opinion/rich-countries-must-compensate-the-global-south-for-biodiversity-loss/ (Accessed on 08/12/2025)

[28] Ibid

The Global South's vital ecosystems are also driving progress towards Sustainable Development. For example, the Amazon rainforest has been identified as one of the planet's most important ecosystems containing millions of species[29]. It is estimated that 47 million people live in the Amazon region and depend on it for their livelihoods, including almost 2.2 million indigenous peoples[30]. UNEP describes the Amazon as a mega-diverse ecosystem that is not only vital to the livelihoods of local people, but also plays a critical role in tackling the climate and nature crisis[31]. In addition, the Congo Basin rainforest in Africa is one of the most important ecosystems in the world since it supports the livelihoods of over 80 million people across 6 countries[32]. The Congo Basin rainforest has been identified as the world's largest carbon sink storing more than 60 billion metric tons of carbon making it an indispensable regional and global resource in the fight against climate change[33].

Despite being endowed with biodiversity, the Global South is witnessing an alarming nature crisis. Human activities including poor agricultural practices, intensive extraction and use of natural resources, rapid urbanisation, infrastructural development, pollution and climate change are fuelling the loss of biodiversity in the Global South with severe impacts on people and planet[34]. In addition, vital ecosystems in the Global South such as the Amazon and the Congo basin rainforest are being degraded due to several threats including deforestation, illegal mining, forest fires, agribusiness intrusion and large infrastructure projects[35].

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[29] World Wildlife Fund., 'The Amazon Rainforest' Available at https://www.worldwildlife.org/places/amazon/ (Accessed on 08/12/2025)

[30] Ibid

[31] United Nations Environment Programme., 'Last Chance to Save the Amazon' Available at https://www.unep.org/news-and-stories/statements/last-chance-save-amazon (Accessed on 08/12/2025)

[32] White. L et al., 'Congo Basin rainforest — invest US$150 million in science' Available at https://www.nature.com/articles/d41586-021-02818-7 (Accessed on 08/12/2025)

[33] United Nations Environment Programme., 'Supporting sound ecosystem management' Available at Available at https://www.unep.org/regions/africa/regional-initiatives/supporting-sound-ecosystem-management (Accessed on 08/12/2025)

[34] Protecting biodiversity – ensuring survival., Available at https://www.bmz.de/en/issues/biodiversity (Accessed on 08/12/2025)

[35] United Nations Environment Programme., 'Last Chance to Save the Amazon' Op Cit

The ongoing loss of biodiversity in the Global South impacts human health and livelihoods since it affects the availability and quality of natural resources and ecosystem services such as clean air, water, food, energy and medicines which sustain life on the planet[36]. In addition, degradation of vital carbon sinks such as the Amazon and the Congo basin rainforest triggers the release of stored carbon with negative consequences for humanity and nature[37].

In light of the foregoing concerns, it is imperative to strengthen biodiversity conservation in the Global South for Sustainable Development.

3.0 Harnessing Smart Technology for Sound Biodiversity Conservation in the Global South

In light of mounting biodiversity loss, strengthening biodiversity conservation in the Global South is a vital goal for sustainability. Biodiversity loss affects the availability and quality of vital ecosystem goods and services in the Global South including food, clean air, water, energy, medicines and climate regulation with severe impacts on people and planet[38].

Technology provides effective solutions towards bolstering biodiversity conservation in the Global South for Sustainability. As the nature crisis intensifies, technology has become an important and transformative force towards ensuring sound biodiversity conservation for Sustainable Development[39]. It has been argued that technology provides decision makers with tools and approaches to monitor, model, and mitigate

[36] Rich countries must compensate the Global South for biodiversity loss., Op Cit
[37] World Wildlife Fund., 'The Amazon Rainforest' Op Cit
[38] Protecting biodiversity – ensuring survival., Op Cit
[39] Introduction to Conservation Technology., Available at https://wildlabs.net/courses/introduction-conservation-technology#:~:text=As%20environmental%20challenges%20intensify%2C%20conservation,technical%20expertise%2C%20and%20resource%20constraints. (Accessed on 08/12/2025)

biodiversity loss more creatively and effectively than ever before[40]. According to UNEP, access to the right science, technology and technical skills is key in bolstering the capacity of all countries to safeguard biodiversity[41].

In particular, it has been argued that harnessing smart technology is an effective approach towards enhancing efforts to conserve biodiversity both in the Global South and all over the world. Advancements in smart technologies such as artificial intelligence (AI), big data, machine learning, remote sensing (RS), and geographic information systems (GIS) is strengthening biodiversity conservation efforts[42]. Smart technologies have the ability to monitor ecosystems, predict environmental changes, and address threats to biodiversity such as poaching, illegal logging, and habitat degradation[43]. For example, RS technology has the ability to monitor large and often inaccessible areas, tracking changes in habitats and land use thus being able to detect challenges such as deforestation, habitat fragmentation, and other environmental changes in real-time[44]. In addition, it has been pointed out that drones and Unmanned Aerial Vehicles (UAVs) can cover vast areas quickly and efficiently, capturing high-resolution images and videos that provide insights into animal populations and their habitats[45].

In addition, it has been argued that AI is increasingly becoming a powerful force in biodiversity conservation, with applications ranging from monitoring wildlife to

[40] Ibid
[41] United Nations Environment Programme., 'Science and technology for healthy biodiversity' Available at https://www.unep.org/news-and-stories/speech/science-and-technology-healthy-biodiversity (Accessed on 08/12/2025)
[42] Harnessing Technology for Conservation: The Role of AI, Big Data, and GIS in Biodiversity Protection., Available at https://www.frontiersin.org/research-topics/72622/harnessing-technology-for-conservation-the-role-of-ai-big-data-and-gis-in-biodiversity-protection (Accessed on 08/12/2025)
[43] Ibid
[44] Mbeti. S., 'New technologies for monitoring and conserving biodiversity' Available at https://africasustainabilitymatters.com/new-technologies-for-monitoring-and-conserving-biodiversity/ (Accessed on 08/12/2025)
[45] Ibid

collecting environmental DNA[46]. AI has the potential to enhance our ability to monitor and safeguard habitats and ecosystems, mitigate human-wildlife conflicts and optimize the management of natural resources towards harmony with nature[47]. Further, it has been argued that AI has the ability to process the massive amount of data needed to develop sound biodiversity conservation plans[48].

Harnessing smart technologies including AI and RS is therefore key towards strengthening biodiversity conservation in the Global South. However, inadequate investments, funding, and ineffective government policies are some of the key challenges hindering the application of smart technology in biodiversity conservation and environmental governance in the Global South[49]. Most countries in the Global South are yet to put in place appropriate legal, institutional and human capacities to harness smart technologies and their role in biodiversity conservation[50]. Further, it has been argued that barriers to technology development and transfer including capacity constraints and inadequate infrastructure are hindering effective application science and technology in promoting sound environmental governance in the Global South[51].

It is imperative to address the foregoing challenges in order to effectively apply smart technology in conserving biodiversity in the Global South for sustainability.

[46] World Economic Forum., 'AI in conservation: Where we came from — and where we are heading' Available at https://www.weforum.org/stories/2024/03/ai-in-conservation-where-we-came-from-and-where-we-are-heading/ (Accessed on 08/12/2025)
[47] Ibid
[48] AI's role in protecting biodiversity., Available at https://www.ibm.com/think/news/ai-role-biodiversity (Accessed on 08/12/2025)
[49] United Nations., 'Science, Technology and Innovation for Sustainable Development in the Global Partnership for Development Beyond 2015.' Available at https://www.un.org/en/development/desa/policy/untaskteam_undf/thinkpieces/28_thinkpiece_science.pdf (Accessed on 08/12/2025)
[50] Ibid
[51] Johnson. D., & Kristina. M. L., 'Challenges to Technology Transfer: A Literature Review of the Constraints on Environmental Technology Dissemination.' *Colorado College Working Paper* No. 2009-07

4.0 Conclusion

The abundance of biodiversity in the Global South provides immense opportunities to foster sustainability for people and planet. However, biodiversity is declining and disappearing in the Global South at an alarming rate undermining efforts towards Sustainable Development. Consequently, strengthening biodiversity conservation in the Global South is necessary for sustainability.

Smart technologies including AI, big data, machine learning, RS, and GIS provide valuable tools and solutions towards strengthening biodiversity conservation efforts in the Global South[52]. It is therefore imperative to harness smart technologies in the Global South by enhancing investments and putting in place appropriate legal and policy frameworks for their uptake[53]. In addition, it is necessary for developing countries to bolster their capacity to utilise technology in environmental governance including through increased focus on education, training, research, and innovation in Science, Technology and Innovation (STI)[54]. International cooperation through technology development and transfer is also key in disseminating smart technologies in the Global South for sound biodiversity conservation[55]. It is therefore necessary to bolster North-South and South-South cooperation for effective technology development and transfer in order to enhance the capacity of developing countries to conserve biodiversity[56].

[52] Harnessing Technology for Conservation: The Role of AI, Big Data, and GIS in Biodiversity Protection., Op Cit

[53] The African Manifesto for Science, Technology and Innovation., Available at https://atpsnet.org/wp-content/uploads/2017/05/the_african_manifesto_for_sti.pdf (Accessed on 08/12/2025)

[54] African Union., Science, Technology and Innovation Strategy for Africa., Available at https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-stisa-english_-_final.pdf (Accessed on 08/12/2025)

[55] United Nations Economic Commission for Africa., 'Advancing Technology Transfer for Sustainable Development in Africa' Available at https://www.uneca.org/sites/default/files/TCND/STIF2023/Advancing_Technology_Transfer.pdf (Accessed on 08/12/2025)

[56] United Nations General Assembly., 'Transforming Our World: the 2030 Agenda for Sustainable Development.' 21 October 2015, A/RES/70/1., Op Cit

Conserving biodiversity through smart technology in the Global South is an ideal that is achievable. It is imperative to actualise this dream for Sustainable Development.

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