

Achieving Environmental Sustainability in Africa

Subjects: Environmental Sciences

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The concept of sustainability requires that the production of goods and services fulfills present demands without jeopardizing the potential to satisfy the needs of future generations. The environment is a finite resource; a healthy environment benefits the ecosystem and all life. Therefore, to sustain the planet, the ecosystem, and all life on it, it is critical that environmental resources be appropriately managed and preserved. Fighting environmental degradation has been a key priority for advanced and emerging countries. Environmental degradation has posed a danger to the economic well-being of the entire world, as it is linked to the success of various macroeconomic factors.

Keywords: environmental sustainability ; ecological footprint ; renewable energy ; government effectiveness ; natural resources ; Africa ; ARDL

1. Introduction

Located between Europe and Asia, Africa is the world's second-most populous and biggest continent. Despite countless worldwide crises, Africa has grown at a rate of 5% per year on average during the last decade ^[1]. This quick expansion has sparked numerous conspiracy theories about Africa, resulting in its notable change from a continent of instability, violence, and famine to commercial opportunity and progress ^[1]. Climate change is becoming a more significant issue in Africa, one of the most susceptible continents to global warming ^[2]. Less than 10 percent of the world's greenhouse gas emissions come from Africa ^[2]. Africa's limited adaptation ability renders it so much more susceptible to the effects of climate change ^[3], notwithstanding its modest contribution to global greenhouse gas emissions ^[4]. The changing climate is already taking a toll on Africa. Africa appears to be among the world's severely impacted areas, with regular occurrences of global-warming-related developments ^[5]. Water shortages, flooding, hot temperatures, and cyclones have affected infrastructure profoundly and disrupted the lives of millions of families ^[2]. According to the United Nations (UN), African nations will be badly impacted by increasing temperatures in the following decades unless efforts are made to mitigate global warming.

In Africa, natural resource extraction is a significant cause of environmental degradation ^[6]. Africa has a diverse range of natural resources. The continent produces a substantial amount of the world's natural resources and earns tremendous income from natural resource exports ^[7]. Unsustainable resource use and extraction, coupled with mismanagement and weak policy enactment ^[7], have contributed to the increasing rate of deforestation ^[8] and climate change ^{[9][10]}. The constant decline of forests has made it increasingly difficult for Africa to combat climate change ^[11]. The Food and Agricultural Organization (FAO) of the United Nations reports that Africa lost 4.4 million hectares of forest yearly from 2015 to 2020 ^[12], double the global average. While deforestation increases agricultural land, it also rips the land of vital nutrients, resulting in only short-term crop production. According to UNEP, over 50% of Africa's eco-regions have lost 50% of their land to degradation, agriculture, or urbanization. Over 2 million square kilometers of protected areas remain in Africa. Issues linked with oil and mineral exploitation, unregulated fishing, inefficient management of tropical forests, and coastline expansion continue to plague the continent's coastal cities. Many species' habitats are being destroyed by exploiting forest trees for shelter and charcoal. The utmost task of preserving the environment and ensuring the replenishment of resources necessitates a worldwide collaboration between governments, local communities, and the general public. In this context, sustainability necessitates those natural resources are not used beyond their regenerative capacity ^[13].

African governments attempt to cut carbon emissions and establish sustainable ecosystems in their nations, as global climate change becomes more severe. However, environmental sustainability necessitates considering environmental boundaries. These limits specify the highest rate of deterioration that a resource may undergo before being substantially damaged. Environmental laws and policies exist to protect natural resources from being exploited in this way. These laws safeguard the quality of life and economic prosperity while not jeopardizing the well-being of the environment. Environmental regulations may not always minimize environmental deterioration, since their ineffective enforcement can

sometimes outweigh their anticipated advantages. While prosperous industrialized nations have shown that strong governance is the source of their better performance, there is significant evidence that inefficient governance impacts Africa's economic performance. Africa's poor governance has resulted in poor economic development, often reflected in the weak rule of law and institutions [5]. Studies have shown that good governance and institutions are needed to achieve environmental sustainability targets [14][15][16]. This justifies the inclusion of the function of governance effectiveness in terms of assessing environmental sustainability in Africa. Because political institutions control environmental policy, it is important to incorporate governance effectiveness in the model.

The ecological footprint has lately gained attention from researchers to measure environmental degradation [8][17][18][19][20][21][22]. Initially proposed by Rees [23], the ecological footprint meets all the criteria for an extensive, progressive, and comprehensive assessment of human-caused environmental harm [6][17][24]. The ecological footprint is an all-encompassing measurement of resource use that reveals the ways human consumption exceeds acceptable limits [13][25]. According to the global footprint network, ecological footprint monitors how productive surface areas are used. At the same time, biocapacity tracks the performance of ecological resources [24][26]. Cropland, forest, grazing, fishing, built-up land, and carbon emissions are the six components of this indicator, demonstrating the effects of human activities on the environment. The ecological footprint is acknowledged as the best proxy for environmental deterioration as a policy instrument since it provides a broader and complete assessment of human-caused strain on the environment [22][27][28]. An ecological deficit will emerge if the ecological footprint is higher than the biocapacity of a region, that is, when natural resources are depleted faster than they are replenished [17][29]. Conversely, there is an ecological reserve when the ecological footprint is lower than biocapacity. The ecological footprint is a valuable indicator of resource sustainability and consumption pattern throughout the world [17].

Each African country has its ecological footprint data, even though most countries have similar characteristics. Africa is in an ecological deficit; its production footprints are greater than its biocapacity, implying domestic natural capital is being destroyed by emitting more carbon dioxide than the environment can absorb. Africa's ecological footprint was 1.35 hectares per person in 2018, which is much less than the world average of 2.8 hectares per person and a biocapacity of 1.15 hectares per person. Gabon, Congo, and the Central African Republic are among the top ten nations globally with the highest biocapacity compared to the population. Africa experienced a constant decline in biocapacity from 1960 until 2014, when an ecological deficit was recorded in 60 percent of countries on the continent [24]. Since then, the ecological deficit has been increasing, and though minimal compared to the world average, it is a cause for concern. The ecological footprint and biocapacity per capita of Africa are illustrated in **Figure 1**.

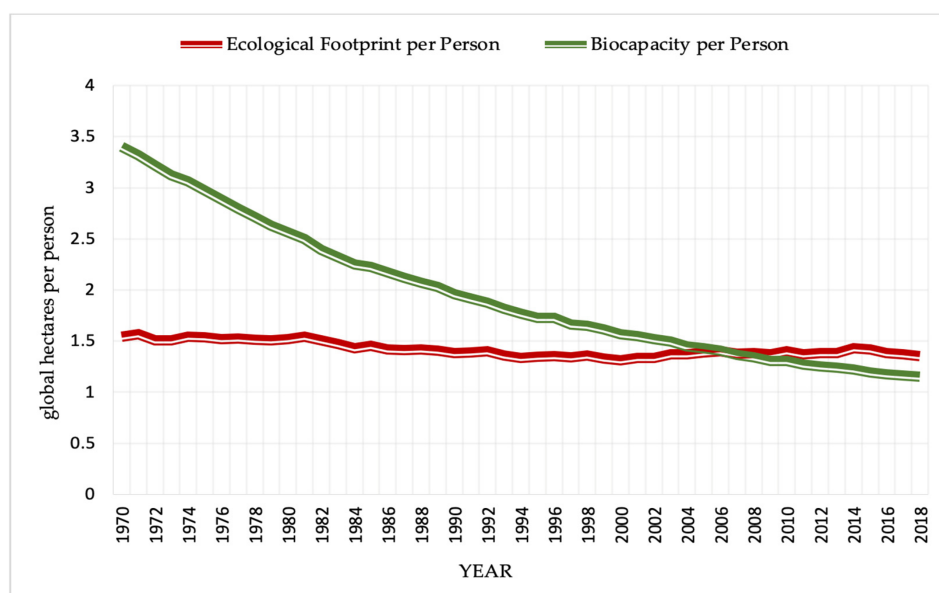


Figure 1. Africa's ecological footprint and biocapacity per person from 1990 to 2018.

Energy generated from fossil fuels has been identified as a significant cause of pollution [15][28][30][31]. Despite being a major cause of pollution, fossil fuels remain the most used source of energy in Africa and the rest of the world [32][33]. In most African countries, the lack of sufficient and reliable energy supplies has been a significant impediment to economic growth [34]. According to a recent assessment by the International Energy Agency, Africa's energy demand is expected to rise by 50 percent in 2040, and renewable energy has the greatest potential to meet this demand [35]. In this respect, international conventions (the Kyoto Protocol and the Paris Agreement) urge that nonrenewable energy be substituted with renewable energy sources [30][36]. Despite being the continent with the highest solar energy resource globally, Africa

generates less than 1 percent of the global total of solar energy [35]. The capacity to leverage the available renewable energy sources has proven to be a big challenge for many African nations [37][38]. Numerous advanced and developing countries have embraced renewable energy sources as viable green energy sources to comply with global environmental conventions. Renewable energy sources derived from natural resources are considered clean energy sources with less negative environmental consequences [39][40][41]. Furthermore, these sources are long-term viable for current and future economic demands [28]. Renewable energy is highly praised for its ability to reduce ecological impacts [40]. Renewable energy consumption has expanded globally due to its environmental advantages [42].

2. Renewable Energy Consumption and the Environment

Renewable energy is produced from naturally existing sources that are automatically replenished [33]. Many governments have made renewable energy one of their primary goals for minimizing environmental deterioration [28][43]. Danish et al. and Qamruzzaman and Jianguo [42][44] attest that renewable energy consumption will provide a means for sustainability and a green economy. In exploring the relationship between green energy consumption (renewable energy) and the environment, Imisi and Philip [45] put forth that renewable energy and nonrenewable energy consumption have an enormous capacity to influence the environment since they can change the ecological footprint of a country [28]. Salim, Rafiq, and Shafiei [46] found that renewable energy consumption negatively predicted ecological footprint. Khan et al. [15] discovered that using energy from renewable sources rather than fossil fuels is advantageous to the environment since nonrenewable energy use increases carbon emissions. In a similar study of south Asian countries with data from 1996 to 2019 using the cross-sectional autoregressive distributed lag method (CS-ARDL), Mehmood [16] found that renewable energy reduces carbon emissions substantially. The findings of Mehmood align with Zeb et al. [47] and Khan et al. [48], who also found a negative relationship between carbon emissions and renewable energy consumption. Contrary to many findings, the empirical evidence from Mulali, Solarin, and Ozturk [49] showed an insignificant relationship between renewable energy consumption and environmental degradation. Mulali et al. [50] studied the effect of renewable energy consumption on the ecological footprint in 58 developed and developing countries from 1980 to 2009 using the fixed effect, difference, and system generalized method of moments. Their results indicated that renewable energy production increases ecological footprint in the long run.

There are currently no satisfactory solutions to how renewable energy consumption affects ecological footprint and environmental damage in Africa's diverse countries. This question concerning the link between renewable energy and the environment requires empirical data to give the necessary knowledge for mitigating climate change, reducing ecological footprints, and implementing more effective energy plans. This research addresses this issue by providing an improved and robust analysis of these interactions in the African context.

3. Natural Resources and the Environment

Previous literature on natural resource studies primarily concentrates on the relationship between natural resources and economic growth [51][52]. Natural resources are undoubtedly a strong determinant of economic growth [53][54]. The pursuit of high economic prosperity has led to large-scale and unsustainable resource extraction and consumption that have caused damage to the environment [48][55]. For this reason, recent studies are more focused on the environmental impacts of natural resource extraction and consumption. Jahanger et al. [48] studied a panel on 73 developing countries from 1990 to 2016 and concluded that natural resources increase ecological footprints. In a recent study, Sun et al. [54] investigated the asymmetric effect of natural resources on environmental pollution in China's 30 regions using the GMM system with data from 2000 to 2019. They concluded based on their finding that natural resource has a substantial negative impact on the environment. Over the period 1980 to 2016, Erdoğan et al. [7] found that natural resource use accounts for increases in the ecological footprints of 23 Sub-Saharan African countries. The findings of Ahmad et al. [56] conform to those of Refs [7][48][54]. Ahmed et al. add that advanced technology in restoring natural resources could help reduce environmental degradation and ecological footprints. Negative links between natural resources and ecological footprint resonate with the findings of Sun et al. [57].

A few other studies believe natural resources are good for the environment and reduce ecological footprints. In one such study, Kongbuamai et al. [58] investigated the impact of natural resources in ASEAN countries from 1995 to 2016. They concluded that natural resources improve the quality of the environment in ASEAN countries. In the context of BRICS countries, the findings of Danish et al. [17] conform to those of Kongbuamai et al. when they found that the use of natural resources has a negative relationship with the ecological footprint. Zafar et al. [59] add that natural resource abundance reduces ecological footprint.

4. Government Effectiveness and the Environment

The function of government in influencing the quality of the environment is highly relevant ^[16]. The government's responsibility is to enact and implement policies that encourage the sustainable use of resources and determine better ways of achieving environmentally friendly growth ^[60]. Only a few studies have looked at the effects of governance on the environment but have produced mixed results. Khan et al. ^[15] reveal that government effectiveness has not yet achieved the intended level in countries with regard to the environment. As a result, it does not play a sufficient role in maintaining the quality of the environment. According to the findings of Adekunle ^[5], government effectiveness has a negative relationship with environmental sustainability. Based on the above, it is crucial to provide empirical evidence to show the role of government effectiveness in achieving environmental sustainability.

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