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Conservation of Wetlands for Ecological Integrity and Species Diversity

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Abstract: *While the cornerstone of rural West African livelihoods is biodiversity and ecosystem services obtained from the natural environment, the continued supply of ecosystem services is threatened by unsustainable exploitation of natural resources, conflicts, and climate change. The integrity of the environment must be immediately protected in light of this threat. For the creation and expansion of sustainable conservation programs, the success of environmental conservation initiatives is essential. We evaluated current and finished conservation activities in the West African sub-region using secondary literature and project reports. In favor of Southern and Eastern Africa, Western Africa is frequently disregarded in sub-Saharan African scientific studies on incentives for environmental services. To provide region-specific incentives that should guide the design of conservation programs in the area, this study addresses a vacuum in the literature by combining knowledge from conservation efforts in West Africa. According to the study, the best course of action is to implement a comprehensive sustainable development strategy that addresses all of the SDGs, including No Poverty, End Hunger, Promote Sustainable Agriculture, Gender Equality, Decent Work and Economic Growth, Climate Action, and Partnerships for the Goals*

Keywords: Biodiversity; Ecosystem Services; Incentives; Sustainable Development Goals

I. INTRODUCTION

The phrase "biodiversity" refers to a group of living creatures that are influenced by both the natural world and, to some degree, human activities. However, ecosystem services (ESs) are benefits that individuals receive as a result of changes in biodiversity. Ecosystem services cover a variety of functions, such as supplying, supporting, regulating, and cultural. Wetlands, forests, and vegetation are the main sources of ESs and biodiversity hotspots in West Africa. These places make up West Africa's natural environment and are essential to the welfare of its population. These biodiversity centers' integrity is, however, gravely in jeopardy. Because of urbanization, climate change, overharvesting of biological resources, and population growth, ecosystems that support biodiversity are disappearing. The quantity and quality of native plant and animal species that live in streams and wetlands across sub-Saharan Africa are threatened by the introduction of invasive species as well as industrial and chemical waste. As a result, the size of biodiversity hubs has shrunk in several parts of West Africa. A few tiny sections of this old forest remain in Cote d'Ivoire, Nigeria, and Cameroon, but much of West Africa's original forest has vanished. The fragmentation of tropical forests and loss of biodiversity are being caused by the overuse of forest resources, mining, increased agricultural production, hunting, and population growth. Animals, people, and communities in West Africa that depend on ESs for their livelihoods are all in jeopardy (Jérôme Cimon-Morin & Poulin, 2018).

Governments and businesses in developing nations are putting environmental conservation laws and initiatives into place to manage and protect biodiversity resources and educate the public about problems that threaten biodiversity hubs in response to these dangers. To protect biodiversity hotspots and stop the overexploitation of forest resources, for example, conservation programs like Reducing Emissions from Deforestation and Forest Degradation (REDD), REDD+, Payments for Ecosystem Services (PES), and Forests and National Park Protections Laws are being implemented more frequently. The REDD mission is widened by the plus sign to include the conservation and sustainable management of forest carbon stocks in developing nations. Reviews of the implemented programs and policies are becoming increasingly prevalent as a result of the demand for them. The assessments' findings provide current, thorough information and act as a starting point for issues that are not addressed by the research from

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individual case studies. Policymakers might refer to the findings of reviews when they create and implement new programs, make changes to existing ones, and expand experimental ones (Ola & Benjamin, 2019).

It should be noted that fewer conservation projects are underway in Africa than in other developing nations. Initiatives for conservation in Africa and the sparse studies of its ecosystem services are primarily focused on Eastern and Southern Africa. The execution of conservation activities falls behind that in other emerging regions of the world in Sub-Saharan Africa. African conservation initiatives place a lot of emphasis on advancing equity and eradicating poverty. Both researches showed that Africa's capacity to develop trading networks and provide ecosystem services is constrained by severe legal constraints and a lack of technological know-how. The success of conservation initiatives in Eastern and Southern Africa depends on accurate assessments of ecosystem services, particularly those that are delivered. Africa's sustainability depends on them (Dananjaya, 2017).

This research bemoaned the absence of conservation initiatives and knowledge on them in other regions of Africa. A thorough study of the available literature showed that no studies had examined conservation initiatives in West Africa. This gap must be filled given the rising interest in conservation policies and practices in West Africa. The Sustainable Development Goals (SDGs), which include preserving biodiversity, reducing poverty, promoting sustainable agriculture, and achieving gender equality, can be used to gauge how effective these initiatives are (Biggs, Von Fumetti, & Kelly-Quinn, 2017).

This research fills that gap by examining current policies and initiatives for the preservation of West African rivers, wetlands, and forests. To provide region. specific incentives that influence the design of conservation initiatives in West Africa, we call attention to the activities of these programs, highlighting their successes and difficulties. In this study, incentives are described as the practices and material advantages that encourage environmental preservation. Incentives are more successful than other techniques for preservation, according to a study of conservation projects in Asia, Latin America, and Africa. The authors issue a warning that certain economic, cultural, and institutional issues must be taken into account before incentive projects are established if they are to succeed. We identify the crucial institutional, cultural, and economic components necessary for West African environmental conservation initiatives to succeed as we assess the effectiveness of these projects. Each area of Africa has a somewhat different priority due to its varying socioeconomic situations, topography, and vegetation. Our results should be put to use to direct the execution of conservation activities in Africa and to concentrate the attention of potential project managers and funders who are looking to create and support projects in West Africa (Wang, Feng, Liu, & Li, 2020).

Wetlands and Forests

Extremes in temperature and rainfall in West Africa are the main causes of droughts and flooding. The region's distinguishing characteristics include the Sahara Desert to the north and a beautiful, green tropical rainforest to the south that gives way to mangrove swamps connecting the beaches to the mainland. In the middle, there is savanna vegetation, which consists of grassland and tiny to medium-sized trees. The abundant greenery of West Africa supports a healthy environment and a hub for biodiversity. The Senegal River basin, the Volta River basin, the Niger River basin, and the Lake Chad basin are four of Africa's 17 major watersheds that are located in the western part of the continent (Jerome Cimon-Morin, Darveau, & Poulin, 2016).

The Senegal River basin is made up of Guinea, Mali, Mauritania, and Senegal. Six nations in West Africa Mali, Burkina Faso, Benin, Togo, Cote d'Ivoire, and Ghana share the Volta River basin. The Lake Chad basin is made up of seven nations; Nigeria, Niger, Algeria, Sudan, Central African Republic, Chad, and Cameroon, two of which are in the West. The seven West African nations of Nigeria, Burkina Faso, Mali, Algeria, Chad, Cameroon, Guinea, Cote d'Ivoire, and Benin make up the Niger River Basin. Each watershed in West Africa performs a crucial function that is essential to the local economy. Agriculture, clean water, hydropower, public health, and food production are crucial water supplies. Three million migratory and local birds from 400 different species live in the wetlands and watershed of West Africa, together with roughly 2000 diverse native freshwater fish species. In 2007, estimates indicated that ecosystem services provided by inland watersheds and wetlands ranged from US$5,000 to US$100,000 per hectare, but ecosystem services provided by coastal watersheds and wetlands ranged from US$500 to US$1,000,000 per hectare. The Hadejia-Nguru marshes, which are a component of the Komadougou-Yobe river basin in Nigeria and the Lake Chad basin, were worth more than US$16 million a year (Vaissière & Meinard, 2021).

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A biodiversity hotspot, the Guinean forest has an estimated size of 553,427 km2. It is a region of tropical forest in West Africa called "Upper and Lower," and it crosses several nations, from Guinea to Sierra Leone and beyond Nigeria's boundaries. The forest is divided into areas of forest and agricultural land by towns, cities, and villages. The forests are made up of a large variety of tree species that offer ecosystem services in addition to many forest products that are essential to human survival, such as lumber, fruits, carbon storage, disease prevention, tourism, pollination, and water management, among other ecosystem services. It is also home to more than 9000 distinct types of vascular plants, 500 freshwater fish, 100 reptiles, 700 bird species, 300 animal species, and more. This category includes the following species: 118 amphibians, 1800 plants, 48 birds, 65 mammals, and 20 reptiles are indigenous to West Africa. 172 bony fish species, 48 bird species, 65 mammal species, 11 reptile species, 483 plant species, and 48 bird species are all at risk of extinction. Local chimpanzees and gorillas, African elephants, pygmy hippopotamuses, and primates like mice and bats are among the most endangered mammalian species (Hughes et al., 2016). Given the mix of primary and secondary forest cover, we predict that the value for carbon storage, biodiversity conservation, hydrological benefits, and forest goods, including tourism, should be much more than US$2,000 per hectare. We are aware of very little writing that has established a value for the biodiversity and forest ecosystem in West Africa. While carbon-storing and emissions-reducing reforestation and afforestation activities also result in ES, agricultural production may be boosted by implementing ecologically sound and sustainable agriculture and pastoral practices. These products highlight the value of ESs to West African rural families. For instance, although accounting for 60% of employment, agriculture only contributes 35% of West Africa's Gross Domestic Product (GDP). The lack of a correlation between GDP and employment rates indicates that the majority of people in West Africa are not well off. Agriculture is produced on subpar soils with little to no use of agricultural technologies, which limits the sector's growth. Farmers in West Africa are particularly exposed to the effects of climate change since it largely affects agriculture. By 2030, West Africa's population is expected to increase more quickly than any other area in the world, although the majority of its residents are impoverished and vulnerable to climate change. As a result, the region's already-limited natural resource supplies will experience increased stress. The preservation of forests and watersheds has become a top concern because of the economic significance of ESs (Kingsford, Basset, & Jackson, 2016).

Conversation Projects

Africa doesn't have as many conservation initiatives as Latin America and Asia have. Although the bulk of voluntary carbon initiatives are concentrated in Asia and Latin America, just 3% of the projects funded by the Clean Development Mechanisms (CDMs) for agriculture, forestry, and land use are in Africa. Furthermore, 13% of watershed preservation initiatives globally are carried out in Africa. Because the majority of these projects are in Eastern and Southern Africa, West Africa only receives a minor portion of them. Through the literature review, we discovered about 14 active and dormant land-use conservation plans in West Africa. It is important to highlight that the area is home to 33 of the 234 CDM projects in West Africa and that 582,000 Certified Emission Reductions Certificates (CERs), or 5% of all CERs in Africa, have been given there. However, the bulk of these schemes prioritizes thermal, hydro, and renewable energy sources rather than placing a strong focus on land-use conservation (Schulte to Bühne & Pettorelli, 2018).

The conservation efforts in West Africa were distinctive and fit into many project categories based on their activities. All of the carbon sequestration initiatives, including the Sourou Valley Wetlands project, the carbon sequestration projects with soil organic matter and sustainable agriculture, as well as the carbon sequestration programs in Mali, Senegal, Burkina Faso, Senegal, and Benin, were research or experimental endeavors. Their objective was to evaluate the ability of various agroecological zones to sequester carbon from an economic and ecological perspective. The Ghana Cocoa Carbon Initiative tries to adapt current operations to fit into the REDD+ framework, in contrast to the Gola REDD+ project in Sierra Leone, which was developed as a REDD+ project. Similar to Integrated Conservation Development Projects (ICDPs), the regional project managing the Guinean forest hotspots scheme combines social, economic, and environmental conservation objectives. The World Bank-managed Biocarbon fund is providing funding for the planting effort and Acacia carbon schemes in Niger, Senegal, and Mali. The World Bank retained the carbon credits from the Mali project, while Achats Services International sold the carbon credits from the Nigerian project. Since it was carried out under the Kyoto Protocol's Activities Implemented Jointly framework, the Burkina Faso

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Sustainable Energy Management Project complies with the Kyoto Protocol. Similar procedures were used by Plan Vivo to manage the Plan-Vivo project in Burkina Faso, which was carried out under the guidelines of the Plan Vivo Voluntary Carbon Market. The other initiatives, such as Benin's Village-Based Management of Woody Savannah and Mauritania's and Senegal's Participatory Rehabilitation of Degraded Lands, have characteristics with schemes that compensate ES providers for employing sustainable land-use practices. However, in this case, social advancement and environmental protection were the main goals (T. Xu et al., 2019).

These initiatives involve land parcels ranging in size from 10,000 to 126,000 hectares. Mali's Sustainable Management Project has operating expenses of $143,000 as opposed to Senegal and Mauritania's Participatory Rehabilitation of Degraded Lands Project's $4-8 million. The cost of the recent extension of the Guinea Forest Hotspots program to 2021, which cost US$ 9 million, brought the whole expenditure for the first ten years to US$ 8.3 million (Kumari et al., 2020).

Institutional Actors

These operations were funded and overseen by a collaboration of public and private organizations. The majority of the funding for conservation efforts in Africa came from foreign sources. These grants came from the United Nations, McArthur foundations, and organizations that support climate change, notably the World Bank-run Biocarbon climate fund. The conception and execution of other initiatives were funded by the European Union, the United States Agency for International Development (USAID), and the governments of Norway, Japan, and Luxembourg. The bulk of these research initiatives were funded by the National Aeronautics and Space Administration (NASA) and other international research organizations, including various university departments. The activities were also backed by funding from non-governmental organizations. These NGOs offer support in addition to giving money and acting as intermediaries. They create, manage, and oversee programs in addition to training, preparing, and acquainting participating communities with sustainable land-use practices. By bridging the knowledge gap between ES providers and environmental protection, these projects promoted the expansion of regional NGOs and civil society groups. The host governments periodically partnered with NGOs in this supportive role at each project location, from the national to the local level (Calhoun et al., 2017).

Outcomes

Information regarding the results of just five of these projects is available. These projects had some positive effects on the local economies, institutions, and environments of the locations where they were implemented, based on the information available. In general, the schemes promoted reforestation and afforestation. In Benin's Woodlot effort, almost 842,000 tonnes of CO2 were stored, compared to 3.3 tonnes/ha in Senegal and Mauritania's Participatory Rehabilitation program. The planting of trees led to a decrease in bushfires and an increase in vegetation and forest cover. In the participating communities, the events were successful in increasing awareness of environmental degradation and climate change. As a result of the study's actions exposing problems with local land use practices, participant communities now practice sustainable farming methods that lessen their susceptibility to climate change. For instance, based on the propensity of grasslands to recover, the sustainable management project in Mali devised a ground-breaking approach for altering pastoral operations. A database was built by the Guinean Hotspots effort to record and monitor the many plant and animal species found in the Guinean forest (Feger & Mermet, 2022).

Additionally, the activities had beneficial macroeconomic impacts. Half of the households taking part in the participatory rehabilitation program in Senegal and Mauritania experienced an increase in income of 12% in addition to setting up a financial framework for micro-projects. The Woodlot Management Programme in Benin and the Guinean Hotspots Plan were also included in the plan; both initiatives decreased the use of intensive agricultural production methods while generating additional revenue through beekeeping, among other ventures. The programs gave local organizations in the participating communities more influence over activities relating to conservation. For instance, the Sustainable Management Programme in Mali and the Woody Lot project in Benin both actively included communities in the programming agency and promoted decentralized decision-making. Multiple communities were brought together under a unified institutional framework by the decentralized method, ensuring that project activities would be welcomed and continued long after financing had ended. The initiatives helped civil society organizations in West

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Africa that are devoted to environmental preservation flourish. The Guinea Hotspots program in Sierra Leone provided an example for smaller-scale conservation efforts and other NGOs. The inclusive strategy assisted in filling the knowledge gap that institutions and people in sub-Saharan Africa had about environmental challenges. This increased awareness of the risks presented by environmental deterioration and climate change (Petrosillo et al., 2019).

Challenges

Unsurprisingly, the lack of technical expertise among local partners was the biggest problem course designers had to deal with. Lack of technical skills was obvious in a lack of understanding of greenhouse gas monitoring, reporting, and verification procedures as well as sustainable land-use practices. People in Sub-Saharan Africa are familiar with the fundamentals of forest management, but they may not be as knowledgeable about practices like green accounting, creating baselines for additionality, monitoring, and certifying carbon offsets. Participant's lack of technical expertise typically makes it difficult to accept new technologies. To close this knowledge gap, training sessions must be organized, raising program operating expenses (W. Xu et al., 2019). Another obstacle was West Africa's institutional and legal system. Economic growth typically takes primacy over environmental preservation in both West African regimes. This made it challenging to implement conservation measures in regions where logging and forestry corporations had previously benefitted. The Ghana Cocoa Carbon Initiative program, for instance, is in danger due to the legislative and cultural frameworks in Ghana that favor the exploitation of trees. Another problem with the institution was resolving disputes concerning land rights among groups, Conflicts between various groups with different interests for access to the resources that are available in those regions exacerbate the situation. Another impediment was the absence of conservation fees to fairly reward ES suppliers and pay for opportunity costs. This demonstrated how difficult it is to strike a compromise between advancing environmental conservation objectives and fulfilling the socioeconomic needs of local citizens (Xu, Xie, Qi, Luo, & Wang, 2018) (Goswami & Mukhopadhyay, 2022).

II. CONCLUSIONS

This study looked at the funding sources for completed and continuing forest and watershed projects in West Africa. Based on the lessons learned from the projects, we describe several incentive schemes created to address region-specific problems and offer suggestions for possible conservation efforts in West Africa. We looked at incentives from three different perspectives: the demand-side incentives that reflect the interests of ES users and buyers, the supply-side incentives that encourage ES suppliers to internalize conservation attitudes, and the third perspective, the incentive mechanisms that represent conservation schemes. Our stance is that both economic and environmental goals need to be addressed concurrently before considerable environmental conservation can occur. To accommodate conservation measures, the current drive to reform West African institutions and legislation must continue. Because it signals to potential investors the acceptance of sustainable land use activities, this trend is crucial for the capacity to fund these mechanisms. However, it is impossible to ignore completely the goals of ending poverty. This is true considering that a significant amount of West Africa's population relies on the resources found in forests and streams.

Designing and implementing incentive mechanisms that make use of already-existing location platforms and systems is essential when it comes to particular rewards. This fosters the adoption of conservation principles and programming initiatives and builds trust. To bridge the knowledge gaps between potential ES customers who could support and fund activities and potential ES providers in the communities, intermediaries are also required. Establishing equality goals, equitable cost and benefit allocation, and inclusive decision-making should all be given top attention in these strategies. Simply put, a perfect incentive system for conservation in West Africa would integrate socioeconomic and conservation goals, be inclusive, fair, and transparent in its decision-making, and fairly pay ES providers.

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