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# Preserving Biodiversity and Ecosystem Services in West African Forest, Watersheds, and Wetlands: A Review of Incentives

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**Abstract:** While biodiversity and ecosystem services derived from the natural environment are the backbones of West African rural livelihood, unsustainable exploitation of natural resources, conflicts, and climate change threaten the continued provision of ecosystem services. This threat creates an urgent need to safeguard the integrity of the environment. Evaluating the effectiveness of environmental conservation projects is central towards designing and scaling-up successful conservation projects. Using secondary literature and project reports, we reviewed ongoing and completed conservation projects in the West African sub-region. Scientific work on incentives for ecosystem services in sub-Saharan Africa typically focuses on Southern and Eastern Africa, leaving Western Africa underserved. This study fills this literature gap by compiling lessons from conservation projects in West Africa to offer region-specific incentives that should inform the design of conservation projects in the region. The study shows that the way forward is a holistic, sustainable development approach that mirrors and meets strategies outlined in Sustainable Development Goals 1, 2, 5, 8, 13, and 17: No Poverty, End Hunger and Promote Sustainable Agriculture, Gender Equality, Decent Work and Economic Growth, Climate Action, and Partnerships for the Goals, respectively.

**Keywords:** biodiversity; ecosystem services; West Africa; incentives; Sustainable Development Goals

## 1. Introduction

Biodiversity is described as a stock of living resources determined by nature as well as, to some extent, human activity [1,2]. Ecosystem services (ESs), on the other hand, are biodiversity flows beneficial to man. Ecosystem services include provisioning services (food, drinking water, medicine, and hydroelectric power), regulating services (carbon sequestration, climate regulation, and clean air and water), cultural services (tourism and religious and cultural benefits), supporting services (agriculture, soil formation, and flood and erosion control) [3]. In West Africa, watersheds, wetlands, forest, and vegetation are biodiversity hubs and primary providers of ESs. These hubs characterize the environmental landscape in West Africa and are crucial to the livelihood of its citizens.

However, the integrity of these biodiversity hubs is at serious risk. Agricultural expansion, overexploitation of biological resources, population explosion, urbanization, and climate change is destroying biodiversity ecosystems [4]. The occurrence of invasive species as well as industrial and pesticide discharge are threatening the quality and volume of native flora and fauna species residing in watersheds and wetlands across sub-Saharan Africa [4,5]. Consequently, these have degraded and reduced the size of biodiversity hubs in parts of West Africa [3]. Close to 90% of West Africa's original forest has disappeared with small fragments of this natural forest existing in Cote d'Ivoire, Nigeria, and Cameroon [6]. Over-exploitation of forest resources, mining, agricultural expansion,

hunting and population growth is fragmenting tropical forests and driving biodiversity losses [7]. These losses threaten both wildlife as well as the current and future livelihoods of those individuals and communities that depend on ESs in West Africa.

In response to these threats, governments, and private sector organizations in developing countries are implementing environmental conservation policies and programs to regulate and preserve biodiversity resources and raise awareness of threats facing biodiversity hubs. For instance, conservation programs such as Reducing Emissions from Deforestation and Forest Degradation (REDD), REDD+, Payments for Ecosystem Services (PES), and Forests and National Park protections laws are increasingly being implemented to protect biodiversity spots and curtail the over-exploitation of forest resources. The + sign adds conservation and sustainable management of forest carbon stocks in developing countries to the existing REDD mandate [8–10]. Reviews of the implemented policies and programs are becoming common because programs and policies must adapt to the changing environmental, institutional, and economic conditions surrounding these programs. Findings from the reviews uncover up-to-date, comprehensive information and steers discussions absent in individual case study research [11]. The results of reviews, therefore, guide policymakers in the design and implementation of new programs as well as in adjusting and scaling-up pilot programs.

In Africa, the few reviews of ecosystem services and conservation programs in Africa concentrate mainly on Eastern and Southern Africa while it should be noted that there are fewer conservation programs in Africa compared to other developing regions of the world [5,11–14]. Sub-Saharan Africa lags behind other developing parts of the world in the implementation of conservation programs [11]. Furthermore, poverty alleviation and equity are dominant themes in conservation (watershed) programs in Africa [5]. Both studies demonstrated that strict regulatory requirements and poor technical knowledge limit opportunities for trading ecosystem services and implementing trading schemes in Africa. Sustainability in Africa depends on the assessment of ecosystem services, especially provisioning ecosystem services, and these assessments are dominant in conservation programs in Eastern and Southern Africa [14].

These studies also lamented the dearth of conservation programs and information on those programs in other parts of Africa. Indeed, an extensive literature search revealed that no study has reviewed conservation programs in West Africa. Given the growing interest in conservation policies and programs in West Africa, it is important that this gap is filled. Assessing the effectiveness of these programs underscores their contribution towards protecting biodiversity, combating poverty, and promoting sustainable agriculture and gender equality, in addition to achieving the Sustainable Development Goals (SDGs).

This study fills that gap by reviewing ongoing (and defunct) policies and programs that protect watersheds, wetlands, and forests in West Africa. We draw attention to the activities of these programs, highlighting their outcomes and challenges to offer region-specific incentives that inform the design of conservation projects in West Africa. Incentives, in this study, refer to mechanisms and tangible benefits that motivate environmental conservation. In a review of conservation programs in Asia, Latin America, and Africa, it was discovered that incentives are more effective environmental conservation measures compared to other instruments [12]. The authors, however, caution that, for incentives to achieve their goals, specific economic, cultural, and institutional conditions must be considered before introducing incentive initiatives. In evaluating conservation programs in West Africa, we tease out those critical cultural, economic, and institutional conditions crucial to successful environmental conservation programs in the region. In different parts of Africa, dependence on ESs differs as socioeconomic conditions, geography, and vegetation changes, creating slight differences in priorities for each region [15]. Our findings should inform the implementation of conservation initiatives in Africa and target potential project sponsors and managers seeking to design and finance projects in West Africa.

The rest of the study is organized as follows. Section 2 introduces the materials and methods used in this study. Section 3 presents an overview of the current state of biodiversity spots in West

Africa. Section 4 summarizes ongoing (and completed) conservation projects in West Africa in Section 4. This section focuses on the objectives of these programs, the ecosystem services they provide, the institutional actors involved in the projects, their outcomes and the challenges they faced. Section 5 discusses various incentives for increasing investments in environmental conservation and projects in West Africa, while Section 6 concludes the paper.

## 2. Materials and Methods

In putting together this study, a desk review of reports on active and defunct conservation programs in West Africa was conducted. According to [16], qualitative reviews attempts to understand the meaning of and contextualize events and processes. We find this approach suited to the aims and scope of this study. This process unfolded in two stages.

In the first stage, we searched for information on environmental conservation programs implemented in West Africa between September 2017 and January 2018 using the following online social science database: Google Scholar, PubMed, ISI Web of Science, ResearchGate, and ScienceDirect. The search focused on conservation projects that transformed vegetation and forest cover, i.e., deforestation, afforestation, and watershed protection projects. Project implementation and evaluation reports published by the implementing agency in English were consulted to obtain information on these projects. Some of the official reports released by National Governments on some programs in Fracophone West Africa were written in French. The reports were supported by information collected from peer-reviewed articles investigating these projects. The Watershed Markets Database, The Economics of Ecosystem and Biodiversity (TEEB), Forest Trends, Global Environmental Facility (GEF), and the United Nations Framework Convention on Climate Change (UNFCCC) websites were consulted for additional information.

Multi-criteria analysis was employed to evaluate these programs and collect the necessary information [17]. Information on the location of each project, motivation behind its formation, program design, program objectives, ESs, costs, and the actors involved—both implementers and beneficiaries—were gathered. Information on the environmental, economic, and social outcomes of each program as well as the challenges each program faced was also collected.

In the second stage, we consulted reports and documents on ongoing conservation projects in other parts of Africa and developing regions of the world. The information obtained from these projects were combined with information from our case studies in West Africa to structure the discussion on incentives for conservation projects in West Africa and make policy recommendations.

## 3. West African Wetlands, Watersheds, and Forests

In West Africa, temperature and rainfall operate in the extremes engendering droughts and flooding. The region is characterized by the Sahara Desert to the north and lush green tropical rainforest to the south, which gives way to mangrove swamps connecting the coasts to the mainland. In the middle is the savanna vegetation characterized by grassland and short-to-medium height trees. The diverse vegetation in West Africa supports a vibrant ecosystem and biodiversity hub.

Four of the 17 primary watersheds in Africa (see Figure 1) are located in the Western part of the sub-continent, namely the Senegal River basin, the Volta River basin, the Niger River basin, and the Lake Chad basin [18].

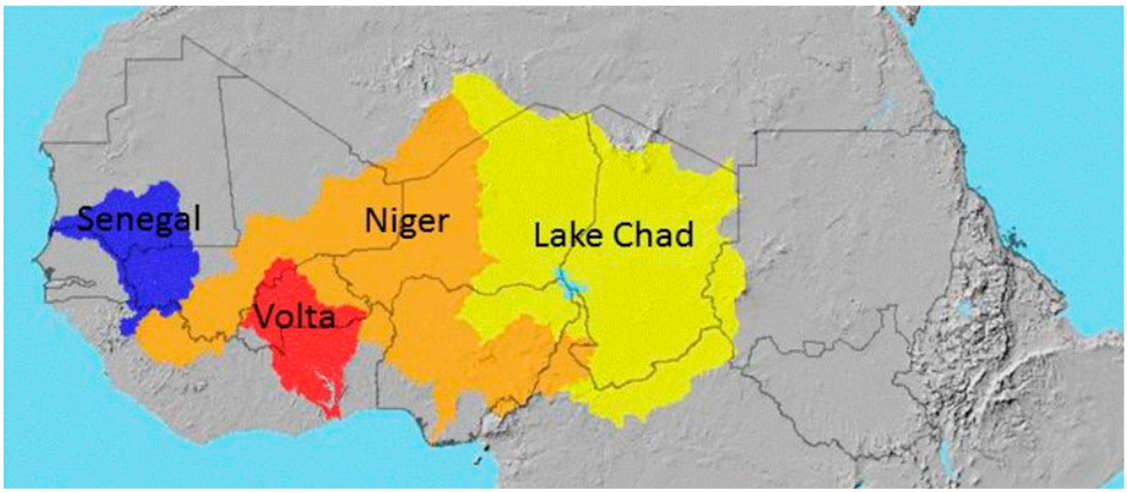


**Figure 1.** Niger, Lake Chad, Volta, and Senegal basins. Source: [19] Van Der Wijngaart et al., 2019.

The Senegal River basin cuts across four countries: Guinea, Mali, Mauritania, and Senegal. The Volta River basin is shared by six West African countries, namely Mali, Burkina Faso, Benin, Togo, Cote d´Ivoire, and Ghana. The Lake Chad basin spreads to over seven countries, two of which are in the West: Nigeria, Niger, Algeria, Sudan, Central Africa Republic, Chad, and Cameroon. The Niger River Basin spreads through seven West African countries, namely, Guinea, Cote d´Ivoire, Mali, Burkina Faso, Benin, Niger, and Nigeria, as well as Algeria, Chad and Cameroon. Each of the watersheds plays significant roles vital to local economies across West Africa. They are essential sources of water for agriculture, public health, food, clean water, and hydroelectric power. The watershed and wetlands in West Africa are home to 3 million endemic and migratory birds spanning 400 species and support over 2000 known species of indigenous African freshwater fishes [7]. The estimated value of ecosystem services that can be attributed to inland watershed and wetlands ranges between US$5000 and US$100,000 per hectare, while coastal watershed and wetlands were between US$500 and US$1,000,000 per hectare in 2007 [20]. The economic value of Hadejia-Nguru wetlands, which forms part of the Komadougou-Yobe river basin of the Lake Chad basin in Nigeria, was estimated at over US$16 million per year [21].

The Guinean forest, with an estimated area of 553,427 km$^2$, is also a biodiversity hub. It is a tropical forest in West Africa, "Upper and Lower," that cuts across several Africa countries from Guinea to Sierra Leone as well as beyond the borders of Nigeria (see Table 1) comprising fragmented forest separated by agricultural land, cities, and villages [7].

**Table 1.** Total area and proportion of hotspots in West African countries.

| Country | Total Area (km$^2$) | Area of Overlap with Guinean Forest Hotspots (km$^2$) | Percentage of Hotspots in Each Country | Percentage of Countries in Hotspots |
|---|---|---|---|---|
| Benin | 117,650 | 1462 | 0.3% | 1.2% |
| Côte d'Ivoire | 325,990 | 150,300 | 27.2% | 46.1% |
| Equatorial Guinea | 28,051 | 1965 | 0.4% | 7.0% |
| Ghana | 242,178 | 79,902 | 14.4% | 33.0% |
| Guinea | 249,691 | 48,488 | 8.8% | 19.4% |
| Liberia | 96,861 | 95,376 | 17.2% | 98.5% |
| Nigeria | 926,744 | 127,583 | 23.1% | 13.8% |
| São Tomé and Príncipe | 1001 | 1001 | 0.2% | 100.0% |
| Sierra Leone | 73,316 | 47,350 | 8.6% | 64.6% |

Source: Adapted from. Carr. et al. (2015) [7].

The forests comprise numerous species of trees providing ecosystem services and various forest products that support human livelihood, e.g., timber, fruits, carbon storage, disease control, tourism, pollination, and water regulation, among other ecosystem services. It also houses over 9000 species of vascular plants, 700 species of birds, 300 species of mammals, 100 reptiles, and 500 freshwater fish [7,22]. Of these species, 1800 plants, 48 birds, 65 mammals, 20 reptiles, and 118 amphibians are native to West Africa [7]. There are approximately 483 plant species, 48 bird species, 65 mammal species, 11 reptile species, 77 amphibian species, and 172 bony fishes under threat of extinction [7]. Among the most threatened mammalian species are indigenous chimpanzees and gorillas, African elephants, pygmy hippopotamus, and primates such as rodents and bats [7].

To the best of our knowledge, few literature has specified a value for forest ecosystem and biodiversity in West Africa; we assume that, for carbon storage, biodiversity conservation, hydrological benefits, and forest products including tourism should be well above US$2,000 per hectare given the combination of primary and secondary forest cover [23,24].

The provisioning services of ES, which improves agricultural productivity, can be achieved through sustainable and environmentally friendly agricultural and pastoral practices, while regulating services are embodied in reforestation and afforestation activities that sequester and reduce carbon emissions. These services reflect the relevance of ESs to agrarian households in West Africa [14,15]. For instance, agriculture accounts for 60% of the labor force but only 35% of the Gross Domestic Product (GDP) in West Africa [25]. The disparity between the GDP and employment figures implies that the majority of West Africans are poor [25]. Indeed, farmers cultivate on poor soils, with limited agricultural technology uptake and adoption, which impedes agricultural development [26]. Climate change affects the poor primarily via agriculture, thus making West African farmers especially vulnerable to climate change [27]. West Africa's population is projected to grow faster than any other region in the world by 2030 [28], putting more pressure on already dwindling natural resource stocks in a region where the majority live in poverty and is vulnerable to climate change. The economic importance of ESs has made forest and watershed (wetland) conservation an absolute priority.

## 4. Conservation Projects in West Africa

Compared to Latin America and Asia, there are few conservation programs in Africa. Only 3% of Agriculture, Forest, and Land Use projects under the Clean Development Mechanisms (CDMs) are in Africa, while the majority of the Voluntary Carbon projects are in Asia and Latin America [11,29]. Furthermore, about 13% of global watershed protection programs are situated in Africa [13]. West Africa's share of those programs is small because most projects are established in Eastern and Southern Africa.

From the literature search, we identified 14 ongoing and defunct land-use conservation programs in West Africa (see Table 2). We should note that 33 of the 234 CDM projects in Africa are in West Africa, with about 582,000 Certified Emissions Reductions Certificate (CERs) issued, i.e., 5% of total CERs in Africa [29]. Most of these projects, however, are not land-use conservation projects, but thermal, hydro, and renewable energy projects.

**Table 2.** Conservation Projects in West Africa.

| Project | Location | Source (s) |
|---|---|---|
| A Sustainable Management Program (SANREM) | Mali | [11,30] |
| Acacia Community Carbon Plantation | Niger | [31] |
| Carbon Sequestration and Sustainable Agriculture | Senegal | [32] |
| Carbon Sequestration Pilot Projects in West African Savannah Optimum | Mali, Benin, and the border between Ghana and Burkina Faso | [32] |
| Guinean Forest Hotspots | Guinea, Sierra-Leone, Liberia, Ghana, Cote "d" Ivoire, Togo, Benin, Nigeria, Sao Tome and Principe | [7] |
| Participatory Rehabilitation of Degraded Lands Project | Senegal and Mauritania | [11,33] |
| Rehabilitation of Degraded Pasture Land Project | Burkina Faso | [34] |
| Senegal Plantation Project | Mali | [11,31] |
| Sequestration of Carbon in Soil Organic Matter Program (SOCSOM) | Senegal | [11,25] |
| Sourou Valley Wetlands Valuation Project | Burkina Faso | [35] |
| Sustainable Energy Management Project | Burkina Faso | [11] |
| The Ghana Cocoa Carbon Initiative (GCCI) | Ghana | [36,37] |
| The Gola REDD Project | Sierra-Leone | [38] |
| Village-based Management of Woody Savannah and the Establishment of Woodlots for Carbon Sequestration Project | Benin | [11,31,32] |
| Restoration of Degraded Forest Land Projects | Ghana | [39,40] |

### *4.1. Types of Project*

Based on their activities, the conservation programs in West Africa were different and fell under various project types. The sustainable management program, sequestration of carbon in soil organic matter program, Sourou Valley Wetlands project, Carbon Sequestration and Sustainable Agriculture program, and Carbon Sequestration projects in Mali, Senegal, Burkina-Faso, Senegal, and Benin, respectively, were experimental or research projects (see Table 2 for full names). Their goal was to assess the economic and ecological potential of various agro-ecological zones to sequestrate carbon. The Gola REDD+ project in Sierra Leone was conceived as a REDD+ project, while the Ghana cocoa carbon initiative is attempting to modify its activities to fit into the REDD+ framework. The regional program to manage the Guinean forest hotspots program combines social, economic development and environmental conservation objectives and bears a strong resemblance to Integrated Conservation Development Projects (ICDPs). The Acacia carbon projects in Niger and Senegal and the plantation project in Mali are funded by the Biocarbon fund managed by the World Bank. Achats Services International sold the carbon credits from the Nigerian project, while the credits from the Malian project remained with the World Bank. The sustainable energy management project in Burkina Faso was implemented under the Activities Implemented Jointly (now Joint Implementation) framework of the Kyoto Protocol, meaning they are Kyoto-compliant. Similarly, the Plan-Vivo project in Burkina Faso was implemented under the Plan Vivo Voluntary Carbon Market requirements, with Plan Vivo managing the carbon credits. The remaining projects, the Participatory Rehabilitation of Degraded Lands in Mauritania and Senegal, and the Village-Based Management of Woody Savannah in Benin

have features synonymous with programs that remunerate ES providers for adopting sustainable land-use activities (or PES). However, in this instance, socioeconomic development was a primary objective along with environmental conservation.

The size of land enrolled in these projects varies between 10,000 and 126,000 ha (see supplementary file; Table S1, Column 5). Operating costs range from US$143,000 for the Sustainable Management Project in Mali to US$4–8 million for the Participatory Rehabilitation of Degraded lands project implemented in Senegal and Mauritania. The Guinea Forest Hotspots program initially costs US$ 8.3 million dollars over 10 years, but the program was recently extended to 2021 with an additional US$ 9 million dollars bringing the total cost to US$15.2 million dollars.

### 4.2. Institutional Actors

A consortium of both public and private organizations sponsored and coordinated these programs (see supplementary file; Table S1, Column 7). Similar to findings from [5], the conservation programs in Africa were mainly financed by external bodies. These funds ranged from climate funds, e.g., the Biocarbon climate fund managed by the World Bank, to funding from United Nations agencies and foundations such as McArthur. Funds from foreign government agencies such as the United States Agency for International Development (USAID), governments of Norway, Japan, and Luxembourg and the European Union were used to develop and implement other projects. International research institutes, e.g., National Aeronautics and Space Administration (NASA) and various university departments financed most of these research projects. Programs were also sponsored with funds from international agencies and Non-Governmental Organizations (NGOs) such as Global Environment Facility and Conservation International. In addition to funding, these NGOs also act as intermediaries, playing support roles. They initiate, implement, and monitor programs, as well as sensitize, train, and acquaint participating communities with sustainable land-use practices. These activities helped to reduce the environmental conservation know-how deficit among ES providers and induced the rise of local NGOs and civil society organizations. NGOs were sometimes joined in this supporting role by host governments in each program locale, from the national to the local level.

### 4.3. Objectives

Even though all the programs employed various strategies to achieve their objectives, all those objectives revolved around environmental conservation (see supplementary file; Table S2, Column 4). Most telling, however, is the effort to link economic development and environmental conservation objectives. This reflects the reality in developing regions where conservation programs fundamentally disrupt the livelihood activities of ES providers and where conservation programs without poverty alleviation/socioeconomic development objectives are often deemed unattractive [41].

### 4.4. Outcomes

Information on the outcomes of these programs was only available for five programs (see supplementary file; Table S2, Column 5). The available information showed these programs had some positive effects on the environment, local economies, and institutional units within the participating communities.

The programs mainly promoted reforestation, afforestation, and avoided deforestation. About 842,000 tonnes of $CO_2$ was sequestered in the Woodlot program in Benin and 3.3 tonnes/ha was sequestered in the Participatory Rehabilitation Program in Senegal and Mauritania [31,33]. The tree planting activities contributed to increased vegetation and forest cover and decline in bush burning. The programs also succeeded in raising awareness of environmental degradation and climate change within the participating communities. The research projects identified deficiencies in local land use practices to ensure that participating communities utilize sustainable agricultural practices that reduce their vulnerability to climate change. For instance, the sustainable management program in Mali introduced a novel system of shifting pastoral activities based on the regenerative abilities of pastures.

The Guinean Hotspots program created a database to store and track the number of flora and fauna species present in the Guinean forest.

The programs also had positive socioeconomic effects. In addition to creating a credit scheme for micro-projects, half of the households participating in the participatory rehabilitation program in Senegal and Mauritania improved their income by 12% [33]. The program, along with the Guinean hotspots program and the Woodlot management program in Benin, introduced activities such as beekeeping that provided alternative sources of income and reduced intensive agricultural production activities.

Within the participating communities, the programs empowered local institutions on conservation activities. For instance, the Woody Lot program in Benin and the sustainable management program in Mali pursued a decentralized decision-making process that actively integrated locals in the program agency. The decentralized process brought together several communities under a single institutional framework that ensured the continued adoption and use of the program activities even after payments had stopped. Furthermore, the programs induced the rise of civil society organizations in West Africa dedicated towards environmental conservation. In Sierra-Leone, the Guinea hotspots program gave rise to other smaller conservation initiatives and multiple NGOs [7]. Overall, the inclusive approach helped to reduce the knowledge gap related to environmental issues that characterize institutions and communities in sub-Saharan Africa. This raised awareness of environmental degradation and the threats posed by climate change.

### *4.5. Challenges*

Unsurprisingly, the leading challenge program developers faced was the poor, technical know-how among local partners (see supplementary file; Table S2, Column 6). The poor, technical know-how manifested in terms of little knowledge of sustainable land-use practices and monitoring, reporting and verifying greenhouse gases. This supports the findings of [10] that, while the basic knowledge of forest management activities is not particularly new in sub-Saharan Africa, locals are unfamiliar with activities such as green accounting, establishing baselines for additionality, monitoring, and verifying carbon offsets. The poor technical know-how often slows down technology uptake by program participants [42]. Organizing training seminars to close this knowledge gap translates to higher costs of operating the programs.

In addition, the legal and institutional framework in West Africa constituted another challenge. Both frameworks in West Africa tend to subordinate environmental conservation, and instead promote economic development [43]. This made introducing conservation activities (e.g., avoided deforestation and reforestation) very difficult in areas that previously favored logging and timber companies. For instance, this was noticeable in Ghana where legal and cultural frameworks supported the exploitation of trees (to promote economic growth) which threatened to undermine the Ghana Cocoa Carbon Initiative program. Managing the conflicts over land rights among communities was another institutional challenge. This situation exacerbates when conflicts among multiple stakeholders with divergent interests arise over access to the resources present on those lands.

Finally, the inability of conservation payments to adequately compensate ES providers and cover opportunity costs was another limiting factor. This highlighted the delicate balance between pursuing environmental conservation goals and meeting the socioeconomic interests of the communities.

## 5. Discussion

So far, we have provided a synopsis of the conservation programs in West Africa, their activities, outcomes and challenges. In addition to lessons from the programs, we highlight lessons from environmental policies enacted by West African governments, as well as policies and programs in other parts of the developing world to discuss incentives that could encourage the conservation of West African ecosystems. We frame these lessons based on identifying and utilizing incentives that are needed for conservation programs to make headway in West Africa.

We consider incentives from three dimensions: incentive mechanisms, demand-side incentives, and supply-side incentives. Incentive mechanisms are policies, programs, and markets that encourage and promote conservation, e.g., PES, carbon emissions trading markets and REDD+ programs. Demand-side incentives identify potential sources of funding for these programs and conditions that motivate investors to finance biodiversity conservation projects in West Africa. Economic, social, and psychological benefits that induce ES providers in West Africa to adopt environmental conservation activities and mindsets are considered as supply-side incentives.

### 5.1. Incentive Mechanisms

The development and promulgation of the Kyoto protocol engendered various frameworks that support programs developed solely for environmental conservation. These frameworks, such as Clean Development Mechanisms (CDMs) and Voluntary Carbon Standards (VCS), established markets for ecosystem services and biodiversity protection. Markets operating under CDM and VCS frameworks allow developed countries to channel funds to developing countries to financially support carbon sequestration projects that protect forests and watersheds. Carbon stored in these projects is then sold on market exchanges by developed countries to meet their emission obligations. Carbon credits sold in CDM markets allow developed countries to meet their emission reductions pledges under the Kyoto protocol. On the other hand, credits sold in VCS markets involve entities, both private and public, interested in voluntary emissions reductions. Markets for carbon sequestration are well developed and better funded compared to other ecosystem services, especially since sequestered carbon is a public good whose benefits are widespread [44]. While the benefits of carbon sequestration, focusing on tree planting activities, constitutes a medium to attract funding, the ability of soils to store carbon and adapt to climate change is also gaining attention.

The UNFCCC developed the REDD and, later, the REDD+ frameworks to reduce emissions from forest degradation and promote sustainable forest management. Like CDMs and VCMs, REDD+ facilitates the sale of carbon credits in carbon exchanges or markets. The difference is that the requirements for monitoring, reporting, and verifying carbon credits under these frameworks decrease in rigor from CDMs to VCMs and REDD+. Under these frameworks, PES, Payment for Watershed Services (PWS), and carbon forestry programs, among other programs, have been introduced in developing countries.

Several challenges impeding the implementation of conservation programs in Africa have been highlighted by a number of studies [5,10,45]. These challenges are conflicting legal frameworks defining property rights, limited technical and market information, a lack of institutional experience and adequate business models, and a mistrust of markets for public goods. Clearly defined property rights and access to resource use are crucial to establishing conservation programs, and conflicts between state and customary property rights laws in West Africa undermine this concept [46]. In both the private sector and government agencies, knowledge gaps exist on how to execute and administer processes linked to, and policies that promote, conservation: establishing ES baselines, monitoring, reporting, and verifying ESs, and awareness of sustainable land-use activities [10]. The latter challenge becomes noticeable when the rigorous process of complying with CDMs, VCMs, REDD+, and other markets for public goods requirements becomes necessary. Tradeoffs between environmental goals and developmental goals promulgated by governments to combat food insecurity and reduce poverty hinder conservation. In our case study, the GCCI in Ghana exemplifies this tradeoff. Working around this tradeoff is difficult because three-quarters of poor West Africans live in rural areas and depend on ESs provided by the environment to sustain their livelihood [47]. Finally, corruption that disrupts equitable transfer and distribution of payments from programs to participating communities constitutes another challenge [10]. All these challenges significantly raise the costs of implementing conservation programs in West Africa. Hence, potential project investors are reluctant to invest in conservation projects in West Africa.

However, governments in West Africa are making several policy moves to tackle these problems. These policy moves point to several targets outlined in SDG 13 to alleviate the negative impact of climate change. Specifically, governments at different levels are incorporating conservation measures into development plans and strategies. All the countries in West Africa, except Mauritania, have joined the Forestry Partnership Carbon Facility (FPCF) and UN-REDD REDD+ readiness platforms [48]. A third REDD+ platform, the Forest Investment Program (FIP), is investing in forest management projects in Burkina Faso, Ghana, and Ivory Coast. In addition to the Gola REDD+ project from our case studies, about 10 REDD+ demonstration pilot projects are underway in Liberia, Ghana, and Nigeria [5,8].

The increasing number of REDD+ programs is closing the local knowledge gap regarding conservation practices, green accounting, and raising awareness on climate change. Countries are required to articulate, in concrete terms, strategies and plans for tackling forest degradation, protect watersheds, and reduce carbon emissions to qualify for REDD+ programs. These plans and strategies are changing the institutional landscape in West African countries towards conservation. For instance, the evaluation of the REDD+ strategic framework in Nigeria and Ghana found that previous forest laws that favor logging companies were restructured to push forward responsible forest stewardship [48]. The evaluation also found that various institutions nest together to lay the groundwork for REDD+ and that actors at the local or regional level are actively involved or even drive the process. This decentralized decision-making trend is also consistent with observations from our case studies in Mali and Senegal [30,32]. Burkina Faso and Liberia recently reformed their land tenure laws in 2009 to promote the responsible use of natural resources by recognizing and empowering customary laws above state laws [34,49].

Therefore, what incentive mechanisms are better positioned to take advantage of the evolving environmental conservation landscape in West Africa? There are three general incentives that underpin conservation initiatives: direct payments, compensation-based welfare measures and biodiversity protection [50]. Protecting biodiversity hubs and their ESs entails strict regulations that restrict the ability of ES providers to access ESs supporting their livelihood. This issue becomes more pronounced since governments own most lands and forests that support poor ES providers [49]. Hence, regulations guiding natural resource use are difficult to enforce because they are subject to political pressure [51]. In instances where regulations are enforced, ESs providers often exploit open lands, thereby creating leakages. This implies previous destructive production activities being carried out on lands not enrolled in the program.

On the other hand, direct payments and welfare measures, in the West African socioeconomic context, are more attractive avenues to pursue conservation. This is because they compensate ES providers for forgone alternatives and for switching to new production practices. Examples include compensatory programs such as PES, PWS, and Community-Based Forest Management (CBFM) programs. PES, according to [52], transfers payments from ES users to providers with payments conditional on an agreed process for managing natural resources. The institutional arrangement underpinning PES and PWS is flexible enough to leverage funding from CDMs as well as VCMs and REDD+ frameworks. If implemented under the right circumstances, direct payments and welfare-based programs could be beneficial to both the environment and participating communities [53,54]. In the case of PWS, apart from the Sourou wetland valuation project in Burkina Faso financed by Environment and Agriculture Research Centre (EARC) and Economic and Social Policy Centre (ESPC), no other projects have explicitly focused on watershed and wetland protection in West Africa. There are 15 watershed projects that are currently active or in the works in Africa, with one of the projects currently being developed in West Africa [55]. This raises the question of how to fund these programs.

### 5.2. Demand-Side Incentives

External funding sources sustained all the programs in our case studies. This is consistent with the view that local markets for ecosystem services in Africa are less developed than their counterparts in Latin America or Asia [56]. However, the increasing development of environmental conservation

frameworks by West African governments is providing opportunities for countries to exploit several funding channels.

For countries involved in REDD+, three funding channels currently exist. The first channel allocates funds from the Green Climate Fund, the Forest Investment Program, and the Forest Carbon Partnership Facility to governments participating in REDD+ readiness and demonstration projects [57]. Currently, the Acacia carbon projects in Mali and Niger and sustainable energy management program in Burkina Faso benefit from these carbon funds. The REDD+ pilot projects in Senegal, Malawi, and KawiSafu in East Africa started with funds from the green climate fund [58]. In the second channel, developed countries sign bilateral agreements with developing countries to finance and provide technical support to national governments at different levels of readiness for REDD+. In this model, notable NGOs such as the World Wide Fund for Nature and Global Environmental Facility also provide technical support. From our case study, the Gola REDD+ project in Sierra Leone falls under this category. Another example is the bilateral agreement to support the REDD+ strategic framework between the German Federal Ministry for Economic Cooperation and Development and the Togolese Ministry of Environment and Forest Resources, the governments of Norway and Burkina Faso [11,59]. The third channel establishes VCMs that sell carbon credits generated from REDD+ projects. The projects, however, must fulfill carbon offset requirements set by VCS or by certifiers such as Plan Vivo [60]. To illustrate, Plan Vivo currently sponsors 17 operational projects worldwide: six projects were implemented in East and South Africa and two in Burkina Faso (see Table 2 for the projects).

These funding channels were set up by developed countries to cater mostly to carbon sequestration projects in developing countries. This underscores the first target outlined in SDG 17 to promote global partnerships for sustainable development by encouraging developed countries to assist developing countries financially in achieving sustainable development objectives. Still, developing local markets for ESs is imperative, especially true for watershed and biodiversity protection programs, where location matters both in providing ESs and funding the programs [44,50]. In general, funds for watershed protection come from five sources: hydroelectric power suppliers, large industrial users, municipal water suppliers, irrigation water users, and general tax revenues [61]. Thus, the sound financial health of institutions is an essential prerequisite for PWS schemes, a quality lacking in many public and private African institutions [61].

Still, we can learn from narratives in other parts of the world. Most notable is the Quito Water Trust fund model in Latin America. A consortium of water users in Quito, Ecuador, established a water trust fund in the late 1990s [62]. The fund is managed by a local bank, and returns from investments are used to finance watershed protection projects whose activities are managed by an external environmental NGO. This funding model has since inspired similar models in different parts of the world [63]. The Payments for Watershed Services programs in the Uluguru Mountains in Tanzania and in Lake Naivasha Basin Kenya are similar models that already exist in Africa. In the former program, the local Coca-Cola Company and a public water provider created a trust fund and subsequently entered into contractual agreements with upstream farmers to adopt sustainable land use practices that protected the Ruvu river basin in the Uluguru Mountains [64]. In the latter program, a consortium of water companies, horticultural growers, and tourism industry organizations established a fund from which they compensated farmers cultivating land near the Lake Naivasha to adopt ES generating activities [65].

The trust fund arrangement can be replicated in West Africa, with urban dwellers, public and private utility companies, mining companies, and breweries operating in West Africa as primary funding sources. What incentives can induce these companies to sponsor conservation programs? For instance, declining water quality and quantity that threatened their water source motivated the Quito Trust Fund and subsequent models. Therefore, the first incentive can be tied to service provision. If, for instance, water scarcity threatens water supply for utility companies and breweries, a clear incentive exists to invest in watershed protection and biodiversity conservation programs. Tourist

companies and NGOs, both internal and external, are potential funding sources for biodiversity conservation projects. Declining flora and fauna species that attract tourists is a potential incentive for financing conservation programs. We also acknowledge that other viable alternatives such as water treatment and filtration plants that efficiently utilize water exists. Watershed protection programs in cities in North and South America were observed to be more cost-effective, and support a larger population compared to building a treatment plant [66,67].

In instances where the services provided by target companies are not threatened, corporate social responsibility (CSR) could be used to incentivize companies to sponsor conservation programs [68,69]. CSR projects promote the image of the implementing companies and generate public goodwill. In this regard, some multinationals are already active. In Nigeria, oil drilling companies SHELL and Chevron sponsor community development programs in the oil-rich Niger-Delta region and are listed in the Nigerian REDD+ framework as partners and potential buyers of carbon offsets [48]. Furthermore, a local brewery built by Heineken in Sierra Leone and SABMiller in Ghana sponsor projects ranging from water recycling to health care and community development initiatives [70]. See [71] for a review of various CSR projects in Nigeria, and [72] for that of CSR projects in Ghana, Liberia, and Guinea.

A common thread among all these companies is their preference for socioeconomic development programs. Preferences for socioeconomic initiatives align with the priorities in West Africa where environmental conservation is secondary to livelihood improvements. This means that investments in environmental conservation only rise when environmental degradation poses a direct threat to the supply of ecosystem services. Therefore, changing attitudes towards conservation is essential, starting with governments emphasizing environmental conservation alongside the socioeconomic development in their development plans. While we are not advocating prioritizing conservation projects over economic development projects, it would be prudent to link conservation efforts to socioeconomic development. Failure to tackle current environmental degradation decreases the stock of ecosystem services available to future West African ES providers.

### 5.3. Supply-Side Incentives

Incentives on the supply side revolve around inducing behavioral changes conducive to environmental conservation. Successful conservation programs require proper organization, resource tenure, consultation with local stakeholders, and the provision of consistent incentives [52]. The two latter points are pertinent in West Africa because the success of all incentives mechanisms is contingent on how it builds up the socioeconomic interests of the people [73].

However, will poor ES providers in West Africa show any interest in conservation programs? Narratives from studies suggest that adequate payment incentives might stimulate conservation behavior among ES providers. For instance, despite differences in Willingness to Accept (WTA) estimates, it was shown in [74] that opportunity costs largely dictated farmers WTA payments for a watershed program near Lake Naivasha in Kenya. Given sufficient incentives, 74% of ES providers in Liberia demonstrated a willingness to adopt responsible land management practices [75]. Furthermore, among those who expressed opposition to conservation, distrust of government authorities was cited as the main reason. Adequate payments has been highlighted as a critical factor that motivates the uptake of conservation programs [76]. These results imply that, even though conservation programs might intrude on their livelihoods, farmers might be willing to participate in conservation programs provided they are sufficiently compensated.

Thus, the design and magnitude of incentive payments are significant. Payments or incentives must cover opportunity and transaction costs of switching to new livelihood activities or participating in conservation programs [77,78]. Inadequate payments undermine environmental conservation goals by discouraging participation in conservation programs or engendering leakages. What incentives should be considered when designing payment incentives that adequately cover the costs of those participating in conservation programs in West Africa?

One incentive is encouraging diversified livelihood strategies. The UN acknowledged diversification as an SDG 8 target to drive economic growth and provide decent employment. Diversification provides alternative income sources, bolsters income flows, and helps to reduce leakages and pressure on the environment [79,80]. However, diversification activities should be designed to align with the needs of its target group [81]. This should come in various forms, for instance, via business start-ups or upgrading activities. In our case studies, beekeeping was the main diversification activity, but others exist. Alternative environmental activities, such as agroforestry, ecotourism, and poultry-keeping, and informal activities, such as woodcarving and tailoring, are viable diversification activities.

While human capital deficiencies can limit diversification [82], skill and knowledge acquisition training and seminars can reduce these deficiencies and build human capital. Apart from encouraging diversification, skill and knowledge acquisition also helps to reduce knowledge on conservation activities in West African institutions. The reduced knowledge gap becomes significant because future conservation initiatives can reduce initial start-up costs of organizing training seminars to build local capacity. The dissemination of knowledge and training underscores the importance of NGOs (or intermediaries) to the environmental conservation process and activities in West Africa and Africa. This further highlights SDG 17 targets: enhance the flow of information and technology on conservation from developed to developing countries to facilitate capacity building.

Another incentive is introducing conservation activities that build on already existing production systems. This is because ES providers might not be receptive to new production systems, especially if they disrupt everyday livelihood activities. In West Africa, the majority of ES providers engage in agricultural production, with agroforestry often promoted as a viable conservation production system [83,84]. Benefits from agroforestry run from payments for carbon sequestered from afforested trees to water conservation, improved soil fertility, and future returns from the sale of trees, among other benefits. Empirical evidence from TIST and ECOTRUST agroforestry schemes in East Africa reveals that farmers earn payments for carbon sequestration as well as indirect benefits such as access to credit, improved farm productivity, and knowledge of sustainable and efficient farming techniques [31,85,86]. Inherent in agroforestry is the synergy between food security and climate change mitigation (also known as 'Climate Smart Agriculture') [87]. This is why SDG 2 strategies to promote sustainable food production and resilient agricultural practices commonly hinge on agroforestry as its cornerstone, and why opportunities to scale up agroforestry activities should be explored.

Building on existing production systems raises the need to work with local communities or regions. An inclusive decision-making process builds trust and identifies the interests of all stakeholders. The inclusion of all stakeholders in a program's decision-making is central to achieving sustainable forest management [6]. In our case studies, project activities were internalized by ES providers when they were involved in the program decision-making process. Sustainable grazing and land use practices introduced by the Guinea Hotspots and Sequestration of carbon in soil organic matter programs in Senegal continued to be used by the communities after both projects were canceled [30]. Both programs were not only built on pre-existing land management practices but also pursued an inclusive decision-making process that recognized the peculiarity of different participating stakeholders and attempted to reconcile these peculiarities under a single framework [30]. In Ghana, local stakeholders were involved at every stage of the decision-making process of the restoration projects. This approach was singled out as the main driver of success of the projects [40]. Conversely, the impacts of the sustainable management program in Mali was slightly diminished when influential groups hijacked decision marking, which created conflicts over resource use and property rights [30]. Although the REDD+ readiness design are initially inclusionary, an exclusionary approach often emerges when programs are implemented [48].

Therefore, in engaging with participating communities, notions of equity and justice should be strongly considered. Studies that examined the dimensions of justice in REDD+ in West Africa advocated for the inclusion of transparency, equity, and legitimacy as specific elements of justice

in conservation instruments [9]. Similarly, equity is crucial to planning and implementing effective policies, and assessing social effects engendered by changes in the value of ESs [88]. In concrete terms, the notion of equity starts with an inclusive decision-making process. A transparent and accountable system that ensures equitable distribution of benefits, costs, and risks is equally urgent. Understanding the cultural, historical, and social background of regions in West Africa is key to achieving this objective. For instance, the immense contribution women make to agriculture in West Africa fails to translate to increased decision-making or ownership of production resources; an area dominated by men. Corrective institutional interventions to correct this imbalance such as equal access to resources and skill acquisition for men and women constitutes a credible pathway to climate smart agriculture [89,90]. Pursuing inclusive decision-making and corrective institutional interventions ensure targets outlined in SDG 5 such as the full participation of women in the leadership process and embarking on reforms aimed at facilitating access to economic resources are met.

The notions of equity also extend to the international community. Western impressions of sustainable development and its manifestation in international conservation frameworks such as REDD+ are, in some instances, incompatible with the prevailing social, economic, and institutional settings in Africa [46]. Expectations regarding environmental conservation must align with realities in West Africa. For instance, understanding that environmental projects can disrupt livelihood activities of rural West Africans and further drive them into poverty. How this plays out would depend on country, regional, and local specifics in West African communities [46].

Efforts at conservation in West Africa holds promises and pitfalls. Current trends suggest that environmental conservation is seeping into the national, regional, and local consciousness in West Africa. Most relevant to environmental conservation are incentives that enhance the environmental, socioeconomic, institutional, and cultural interests of West Africans. From advancing measures that alleviate poverty, improve technical know-how, connect partners from diverse backgrounds, build local institutions, tackle climate change, and promote equity, this incentive approach entails empowering West African ES providers, an approach reminiscent of the ideals of the SDGs and that meets several targets articulated in SDGs 1, 3, 5, 8, 13, and 17 to end poverty, end hunger, promote sustainable agriculture, reduce gender inequalities, push for climate action, and build partnerships for sustainable development.

## 6. Conclusions

This study reviewed on-going and completed forest and watershed (wetlands) projects in West Africa and their corresponding financing mechanism. From the lessons gleaned from the projects, we outline several incentive measures tailored to address region-specific challenges and inform prospective conservation projects in West Africa. We considered incentive from three dimensions: incentive mechanisms representing conservation programs, demand-side incentives representing the interests of ES users and buyers, and supply-side incentives that induce ES providers to internalize conservation attitudes.

We argue that both environmental conservation and economic objectives should proceed together before meaningful environmental conservation can occur. The current movement towards restructuring existing laws and institutions in West Africa to accommodate conservation programs needs to continue. The ability to finance these mechanisms depends on this movement and signals to potential investors the embrace of sustainable land use activities. Still, poverty alleviation objectives must not be completely ignored. This is because many West Africans rely on resources from forest and watershed (wetlands) to support their livelihoods.

Regarding specific incentives, it is crucial to design and implement incentive mechanisms that build on already existing location systems and platforms. This engenders trust and facilitates uptake of program activities and conservation principles. Intermediaries are also needed to reduce knowledge gaps among potential ES providers in the communities and link them to potential buyers/users of ES

who will sponsor and fund programs. Articulating equity goals, fair distribution of costs and benefits, and participatory decision-making should feature prominently in these mechanisms.

Put simply, an ideal conservation incentive mechanism in West Africa should adopt a bottom-up, inclusive, fair, and transparent decision-making process, must combine socioeconomic and conservation objectives, and adequately compensate ES providers.

**Supplementary Materials:** The following are available online at http://www.mdpi.com/1999-4907/10/6/479/s1. Table S1. Conservation programs in West Africa; Table S2. Conservation programs in West Africa (continued).

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