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Achieving Sustainable Development Goals in Ghana: The Contribution of Non-Timber Forest Products towards Economic Development in the Eastern Region

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Abstract: Globally, non-timber forest products (NTFPs) continue to contribute vastly to addressing the food, poverty reduction, income, and livelihood requirements of people in rural areas. However, as of now, there are no specific existing data highlighting the periodic contributions of NTFPs to the economy of the eastern region and the country. In Ghana, insufficient attention has been paid to the legislative and regulatory environments for the creation of NTFPs. Since forest policies continue to classify NTFPs as “minor” forest products, they receive less attention than wood in forest management initiatives and policies. The absence of a definitive policy on NTFPs has hampered their promotion, commercialization, and supply chain management. This study analyses the contribution of NTFPs towards economic development in the eastern region and the achievement of SDGs in Ghana. Through focus group discussions and a thematic analysis, it was concluded that NTFPs contribute immensely towards the economic development of the eastern region and the country through employment and direct taxes. Ultimately, it is evident from the study that the destruction of the Atiwa Forest Reserve for the purpose of bauxite mining will widely hinder the country’s achievement of its SDGs. Additionally, the study found that residents will continue to exploit forest resources if the core concerns of institutional deficiencies and rural poverty are not addressed. To curb this situation, there should be the sustainable, regulated, and authorized harvesting of NTFPs/NWFPs, community/user empowerment, and sectoral education and training programmes, etc. Even though these are common solutions, the study found them extremely rare within the study area.

Keywords: non-timber forest product; Sustainable Development Goals; sustainable forest management; forest policy; forest degradation; endangered species

1. Introduction

Major forests in Africa and the tropics serve as enhancers to resilience against climatic changes, and as a backbone to the livelihoods of millions of rural dwellers and cities alike. Approximately 1.3 billion people in the world are believed to rely on forests and forest products as a source of their livelihoods [1]. Most of them are believed to be living below the poverty line, especially in low- and middle-income countries [2]. Be that as it may, forest resources and services are thought to contribute from at least one fifth to a little over one quarter to family income, which is almost a comparable amount to that of agriculture, particularly for those that live close to forests [3]. Major forests contribute about USD 250 billion per annum to developing economies, which is more than double the amount of money provided by International Development Assistance and a little more than the

yearly global yield of gold and silver combined [4]. According to the World Bank [5], the rates of rural and urban poverty are 25% and 14%, respectively, while the rate was 27% in regions with smaller villages, 17% in those with small towns, and 6% in those with cities. The African wood industry is dominated by informal and small-scale companies. For example, in Ghana, the formal forest sector employs 50,000 people, but the informal sector employs 260,000. The country's informal sawmill sector employs over 97,000 people and generates approximately USD 18 million in yearly income, the majority of which is unreported. The charcoal business in Tanzania generates an estimated USD 650 million per year and employs over two million people [6]. Agriculture in Africa is highly reliant on rain, making it extremely sensitive to climate change. When there is failure in crop yield, many rural populations turn to forests and trees for wild foods such as fruits, tubers, fish, bushmeat, edible insects, beeswax, and honey. Forests also serve as sources of herbal medicine and livelihood [7]. In sub-Saharan Africa, wood fuel (firewood and charcoal) is the principal source of residential energy for more than 90% of the population. Wood fuel use is increasing as a result of population growth and expanding urbanization trends; for example, a 1% increase in urbanization has been related to a 14% increase in charcoal usage [8]. It is predicted that Africa generated 649 million m³ of wood fuel in 2013, accounting for 35% of the world output in that year. The per-capita use of wood fuel in Africa is predicted to be 0.585 m³ [9], which is more than double the world average (0.259 m³). The number of Africans who rely on charcoal is expected to rise from 583 million in 2000 to 823 million by 2030 [10]. Tropical forests are posed with threats from deforestation and degradation, largely owing to overexploitation, logging, and their transformation to other land uses [11]. During dry seasons, or when food is scarce, due to the harvesting of NTFPs for food and forage supplies, many tree varieties become vulnerable, endangered, and at risk of overexploitation. This typically amounts to savannah degradation and, consequently, to a loss of biodiversity [12].

The overall poverty rate in Ghana fell from 51.7% in 1991–92 to 24.2% in 2018, while the percentage of people living below the extreme poverty line also fell from 36.5% to 13.2% over the same period [13]. Consequently, Ghana has achieved the first Millennium Development Goal (MDG1) of reducing by half the proportion of the population living in extreme poverty before the expected 2015 date [14]. This achievement, however, is only applicable at the national level, whereas the situation in rural areas, including in forest fringe communities, is quite different at the household level. The geographical placement of communities along or in forests provide them with the ability to cope with the severity of poverty by directly or indirectly relying on forest resources, particularly on non-timber forest products (NTFPs) [15]. Although the country can boast the achievement of this Millennium Development Goal (MDG), it is still far from achieving any of the Sustainable Development Goals (SDGs).

It is evident that the eastern region of Ghana can boast of several forests and forest reserves [7] that can be managed with regard to the achievement of the Sustainable Development Goals (SDGs). The SDGs emphasize the significance of poverty reduction and advocate for policy implementation that contributes to the socioeconomic development of low-income people. The SDGs are categorised into two main parts, i.e., environmental goals and human development (socioeconomic) goals. Figure 1 shows a conceptualizing framework of the socioeconomic effects of forest degradation on the achievement of the SDGs. It shows how any negatively hypothesized (H1) environmental and/or socioeconomic issues can affect the achievement of the SDGs and how positive SDG measures (H2) can improve both environmental and socioeconomic issues.

Considering the economic potential of the eastern region of Ghana, this study seeks to assess how natural resources (forests) could be maximally utilized in a way that could lead to the achievement of the Sustainable Development Goals focusing on NTFPs. The Atiwa Forest Reserve in the eastern region and its fringe communities are used in this research. When the Atiwa Range was originally designated as a forest reserve in 1926, it was to protect its value as a watershed source. The Atiwa Forest Reserve hosts the Birim,

Densu, and Ayensu headwaters and their affluent rivers, which are important sources of water for the surrounding communities, including the capital of Ghana, Accra. Not only that, streams such as Awusu, Kokoben, Obiri ne Obeng, Abudwusu, and others, which are highly depended upon by the people of the Atiwa West District, also have their headwaters in the Atiwa Forest Reserve. As the years have passed, people have begun to recognize other values of the forest as well. More than 100 species that live in the forest are globally threatened, and more than 227 species of birds call the Atiwa Forest home [15]. However, for some, the value of the Atiwa Range is not the forest itself, but the minerals that lie beneath its soil. The Atiwa Forest Reserve is situated on top of about 150 million tons of bauxite deposit, which is a precious mineral used for aluminium processing. The government of Ghana intends to mine the bauxite in the Atiwa Range Forest Reserve as part of a national infrastructure development programme. The bauxite deposit will be used as a mortgage to China to fund the country's development drive [16]. Several organizations, such as Rocha Ghana, Friends of Earth Ghana, the Ghana Wildlife Society (a BirdLife Partner), the West African Primate Conservation Action, and a number of specialist and state agencies oppose this initiative of mining in the Atiwa Reserve. This is because, in order to mine the Atiwa Range Forest Reserve, the entire forest would have to be removed. While this forest is not seen as irreplaceable, it will be almost impossible to restore the forest after the bauxite mining, because the soil will be devastated throughout the operation [17]. The Ghanaian government is adamant that they will establish a devastating bauxite mine in the Atiwa Forest [18], despite intense resistance from local and international conservation organizations. This is a globally recognized and important ecosystem that serves as a home to exceptional biodiversity and provides water to five million residents (as mentioned earlier). Again, it is the main source of numerous non-timber forest products in the region. In Ghana, insufficient attention has been paid to the legislative and regulatory environments for the creation of NTFPs. Because forest policies continue to classify NTFPs as "minor" forest products, they receive less attention than wood in forest management initiatives and policies [7,15]. The absence of a definitive policy on NTFPs has hampered their promotion, commercialization, and supply chain management. Forest policies have historically been controlled by the economic interests of succeeding administrations for the utilization of wood resources that are used for the generation of foreign exchange. Ghana's forestry policies have failed to recognize the significance of NTFPs and provide an enabling climate for their promotion and growth [15].

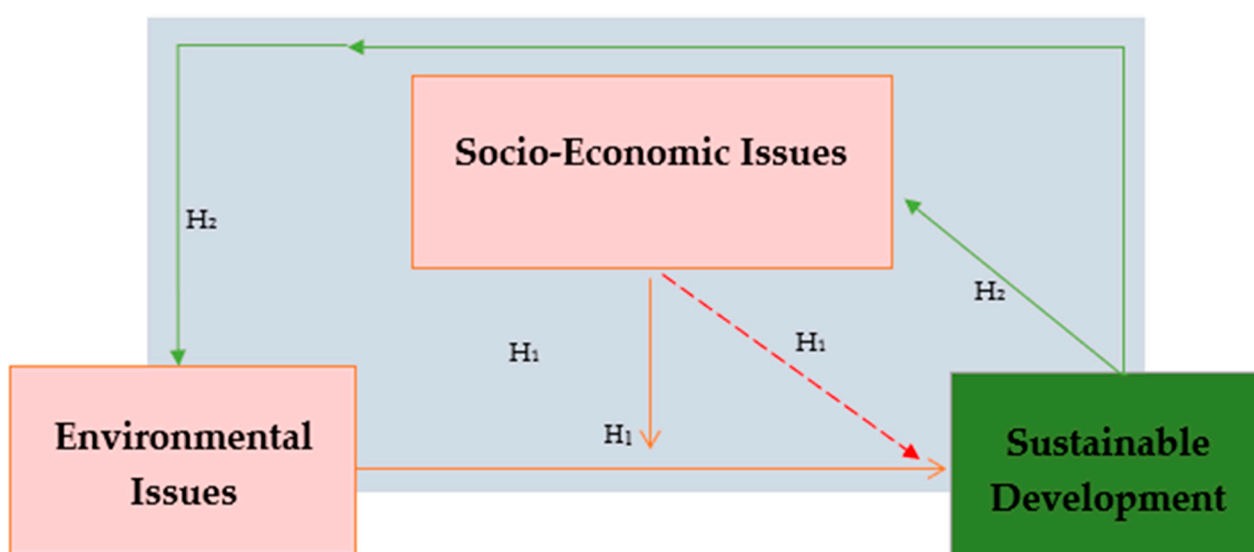


Figure 1. Conceptualizing the socioeconomic effects of forest degradation on the achievement of SDGs.

The destruction of the Atiwa Forest Reserve and other primary forests in the eastern region does not only threaten their domestic and agricultural importance to the people, but also their non-agricultural and commercial exploits. In view of this, the main objective of this study is to analyse the contribution of non-timber forest products towards economic development in the eastern region of Ghana. Additionally, it will generally assess their role towards the achievement of the SDGs. As of now, there are no specific existing data highlighting a periodic contribution of NTFPs to the economy of the eastern region and the country as a whole [7,15]. This brings to light the uniqueness of the study, as it points out the economic importance of NTFPs/NWFPs in the livelihoods of the residents of forest fringe communities and the economy of the region.

2. Materials and Methods

This study mainly used primary data for the analysis, however, during the review of the literature and discussions, a broader range of internet sources were searched by entering keywords into popular search engines and scientific data banks such as Scopus, the Web of Science, ScienceDirect, and many others to obtain more information in response to the following research questions.

1. How does the degradation of the Atiwa Forest Reserve affect the achievement of the SDGs and increase the poverty in the eastern region?
2. How does sustainable forest management ensure socioeconomic development?
3. How does sustainable forest management ensure environmental development and preserve biodiversity?

Since the objective was clear to the authors from the onset, and the group of people to be involved in the data collection was known, purposive sampling was deemed fit for the study. A common data collection tool in purposive sampling is focus group discussions (FGD) [19], which involves selecting a focus group sample with specific characteristics. In this study, the focus group was made up of people who directly depend on NTFPs/NWFPs from forests in the eastern region, especially the Atiwa Forest Reserve, for economic gains. Any person who met this criterion was a potential participant.

An FGD is a type of in-depth interview conducted in a group setting, with meetings presenting features specified by the proposal, size, composition, and interview techniques. The interactions within the group are the focus or targets of the analysis. The members influence each other throughout the discussion by responding to questions and making contributions. The moderator facilitates discussion by making remarks or bringing up topics. The transcripts of the group conversations, as well as the moderator's thoughts and commentaries, are the primary data produced by this approach. The general features of the focus group are: people's engagement, a series of sessions, the homogeneity of the participants in terms of the research interests, the collection of qualitative data, and the conversation centred on a topic chosen in relation to the objective of the study [19]. An FGD is an excellent technique to get people with comparable backgrounds or experiences together to explore a specific topic of interest. A moderator (or a group facilitator) guides the group of participants by introducing themes for discussion and assisting the group in participating in a vibrant and natural dialogue among themselves.

To obtain these data the researcher travelled to Ghana between 30 September and 30 October 2021 under the sponsorship of the Bilateral Agreement Program of Mendel University. As the researcher was considered to be an intern with the Environmental Protection Agency of Ghana, the host supervisor coordinated with community leaders who assisted the author in organising the focus groups. A total of two focus groups were involved in the discussions, with each lasting for at least 1 h. Although various viewpoints disagree on the appropriate size, focus groups are typically small. Some propose a group of eight to fifteen persons [20,21]. Based on this assertion, the first and second FGDs consisted of 15 participants each. The first group was made up of vendors of non-medicinal NTFPs (bushmeat, mushrooms, chewing sticks, firewood, snails, wood carvers, and honey). This discussion took place at Akyem Anyinam. The second FGD took place at Akyem Moseaso,

Table 1. Guide for focus group discussions.

Focus Group Discussion (FGD)	Location	Participants	Questions
FGD 1	Akyem Anyinam	NTFP vendors (non-medicinal), 15 participants	<ol style="list-style-type: none"> 1. Gender of participant 2. Age of participant 3. Occupation/sector 4. Sources of goods 5. What is/are your derivative(s) of the forests? 6. What is your annual income range? 7. Do you pay taxes? 8. Means of tax payment? 9. Do you know of any government policies regarding your business activities? 10. Are you part of any recognized organization? 11. What challenges do you face in your industry?
FGD 2	Akyem Moseaso	Herbal/traditional medicine practitioners, 15 participants	<ol style="list-style-type: none"> 1. Gender of participant 2. Age of participant 3. Occupation/sector 4. Sources of goods 5. What is/are your derivative(s) of the forests? 6. What is your annual income range? 7. Do you pay taxes? 8. Means of tax payment? 9. Do you know of any government policies regarding your business activities? 10. Are you part of any recognized organization? 11. What challenges do you face in your industry?

3. Results and Discussion

3.1. Response from Focus Group Discussion 1

FGD 1 was held at Akyem Anyinam, the capital of the Atiwa East District Assembly in the eastern region of Ghana. Table 2 presents the sociodemographic characteristics of the participants.

This group consisted of 15 people: 9 males and 6 females who were within the age range of 26 and 62 years and were dealers in various non-medicinal NTFPs. With this age range, it could be concluded that all the participants were matured enough to make informed decisions, and any submissions made during the discussion could be used for the analyses. Apart from the 2 wood carvers who had Higher National Diplomas in Sculpture from polytechnics, none of the other participants had a senior high school education. Nonetheless, all of them had a basic education.

From the discussions, it was identified that the main source of their products were primary forests, forest reserves (notably, Atiwa), farms, and from hunters who hunted in the forests. Examples of the woods mentioned by the carvers included false rubber tree, Scented Guarea, Cordia Daniellia, natal white stinkwood, stool wood, and African teak. However, due to scarcity, they now used woods such as mahogany, Mansonia, and Aningeria. Examples of the bushmeats from the forest were grey rhebok, grasscutter, ground pangolin, bushbuck, mangabey monkey, African hog, and antelope. From these businesses, they were able to make an annual net income ranging from 5500 cedis to 20,000 cedis. They stated that they paid taxes to the district and regional authorities through a daily tax collection by Internal Revenue Service representatives, or a monthly income tax which was also collected by the representatives. They were asked if they knew

about any policies that regulated their businesses and sources of goods. In response, apart from the wood carvers who mentioned that they knew about illegal logging, the other participants had no knowledge about any existing policies for their businesses. However, with the exception of the chewing sticks and firewood vendors, all of the other participants belonged to at least one traders' association pertaining to their ventures. They mentioned that these associations serve as support groups. Sometimes they contributed financially to help each other in times of funerals, birth, and even the education of other participants' wards (which is more like a "non-interest" loan). With respect to the challenges they faced, a profound submission made by the mushroom sellers was that they sometimes had to trek deep into the forest to locate anthills, and that it was very dangerous. The firewood vendors mentioned that they did not go into the forest reserves to harvest dead/dry woods, but that sometimes they were chased by forestry officers when they were gathering woods along the boundaries, and equally, when they were gathering woods from farms, that they were tagged as thieves. The bushmeat sellers mentioned the scarcity of bushmeats. Generally, they agreed that, since they paid taxes, they expected the government to provide them with some sort of education to improve their businesses.

Table 2. Sociodemographic characteristics of participants of FGD 1.

Gender	Male: 9 Female: 6
Age	26–30: 2
	31–35: 2
	36–40: 4
	41–45: 2
	46–50: 1
	51–55: 1
	56–60: 2
	61–65: 1
Highest education	Basic education (junior high/middle school): 13
	Secondary school: 0
	Tertiary (training college/polytechnic/university): 2
Business/sector	Bushmeat: 4
	Mushrooms: 2
	Chewing sticks and firewood: 3
	Snail traders: 2
	Wood carvers: 2
	Honey vendors: 2

3.2. Response from Focus Group Discussion 2

FGD 2 was held in Akyem Moseaso, also in the Atiwa East District Assembly in the eastern region of Ghana. This FDG was organised solely for individuals who dealt with traditional/herbal medicine. As presented in Table 3, the group was made up of 10 males and 5 females, of whom 5 utilized leaves and plant-based medicines, and the remaining 10 worked with tree bark and root-based medicines. The youngest participant was 29 years old, and the oldest was 64 years old. Like FGD1, the age range of the participants confirmed that they were matured enough to make informed decisions, and that any submissions made during the discussion could be used for the analyses. In total, three of them had never had any formal education, and the remaining twelve participants had a basic education (Middle School Leavers Certificate or Basic Education Certificate Examination).

Table 3. Sociodemographic characteristics of participants of FGD 2.

Gender	Male: 10 Female: 5
Age	26–30: 1
	31–35: 1
	36–40: 1
	41–45: 2
	46–50: 1
	51–55: 3
	56–60: 4
	61–65: 2
Highest education	No formal education: 3
	Basic education (junior high/middle school): 12
	Secondary school: 0
	Tertiary (training college/polytechnic/university): 0
Business/sector	Leaves and plants: 5
	Tree bark and roots: 10

The main sources of their goods were the Atiwa Forest Reserve, other primary forests, bushes, and farms. Examples of the medicinal plants from the forests were: *Paullinia* (*Paullinia pinnata* (L.)), which is used for the treatment of waist pain, ulcers, sexual weakness, piles, rheumatism, bone fracture, impotency, fatigue, fever, stroke, and HIV / AIDS), mahogany (*Khaya ivorensis*, which is used to cure coughs, fevers, and anaemia, as well as wounds, sores, ulcers, and tumours, and as an anodyne to alleviate rheumatic symptoms and lumbago), Ethiopian pepper (*Xylopi aethiopica* (A. Rich), which is used for the treatment of stomach ache, chickenpox, bladder trouble, leprosy, diabetes mellitus, strengthening pregnancy, asthma, mental illness, convulsions, arthritis, and inflammation), African neem (*Azadirachta indica* (A. Juss), which is used for the treatment of malaria, tuberculosis, cancer, worm infections, and wounds), moringa (*Moringa oleifera* (Lam.)), which is used for the treatment of hypertension, ulcers, fever, malaria, typhoid, blood tonic, urine retention, bilharzia, and diarrhoea), Schrad (*Bambusa vulgaris* (J.C. Wendl.)), which is used for the treatment of malaria, hypertension, and cancer), *adenia cissampeloides* (planch, ex benth. Herms, which is used for the treatment of fever, malaria, wounds, gastrointestinal disease, numbness, hypertension, and wounds), and black pepper (*Piper nigrum* (L.)), which is used to treat malaria, cancers, and excipient), among others. From their businesses, they were able to make an annual net income between GHS 7300 and 32,000. Even though they were all members of at least one traders' association, the majority of them did not have a recognised license for their business, and therefore did not really pay taxes. Those who had licenses for their operations mentioned that they paid taxes to the IRS through their representatives. Even though they were all aware that they needed to operate under a license provided by the Food and Drugs Authority of Ghana, they were not aware of the policies that governed their source of goods. Their main challenge was the influx of fake traditional medicine dealers. They all claimed that they inherited their knowledge of herbal medicine from their parents or grandparents, without any formal education. Another challenge was that most Ghanaians associated traditional medicine with African spiritual practices, which were seen as “evil” by believers of other religions. Since the majority of them operated without a license, they were not concerned about government policies, because they believed that these might lead to the collapse of their businesses. Nonetheless, the 2 participants who had licenses believed that government policies would help to protect the industry and would compel them to obtain a professional and formal education, which would eventually help their business to boom.

3.3. Degradation of Atiwa Forest Reserve and Its Impact on the Achievement of SDGs and Poverty in the Eastern Region

SDG 15, “Life on Land: Protect, Restore, and Promote Sustainable Use of Terrestrial Ecosystems, Sustainably Manage Forests, Combat Desertification, Halt and Reverse Land Degradation, and Halt Biodiversity Loss,” could be addressed by the forest sector. Target 15.1 states, “By 2020, ensure the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems and their services, particularly forests, wetlands, mountains, and drylands, in accordance with international agreements,” while Target 15.2 states, “By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests, and significantly increase afforestation” [23]. The Atiwa Forest Reserve is critical in terms of sustainable development. According to McCullough et al. [15], Atiwa has been officially categorized in a number of ways over the past 90 to 100 years in recognition of its importance as a repository for biodiversity, including by the National Forest Reserve in 1926, the Special Biological Protection Area in 1994, the Hill Sanctuary in 1995, and in one of Ghana’s 30 Globally Significant Biodiversity Areas (GSBAs) in 1999. BirdLife International designated Atiwa as an Important Bird Area (IBA) in 2001. This is because, as already indicated, the Atiwa Range serves the headwaters of three river systems: the Ayensu River, the Densu River, and the Birim River. The most significant sources of domestic and industrial water for nearby settlements and for several of Ghana’s largest population cities, particularly Accra, are these three rivers. As a result, the Atiwa Forest safeguards and supplies sources of clean water for a large portion of Ghana’s populace, and has critical facets of the nation’s biodiversity. Atiwa has also been acknowledged as a reserve of national significance. Globally, the 2020 objectives for preventing biodiversity losses are falling short, with over 31,000 species facing extinction [23,24]. From the focus group discussions, it became clear that the area’s communities mostly relied on these forests and forest reserves for their economic gains, and therefore, the degradation of the forest reserve will have a significant impact on both the environmental and human-centred SDGs. Ultimately, seven Sustainable Development Goals and their respective targets would be directly impacted. These are goal 1: no poverty; goal 2: zero hunger; goal 3: good health and wellbeing; goal 6: clean water and sanitation; goal 13: climate action; goal 14: life underwater; and goal 15: life on land (see Figure 3).

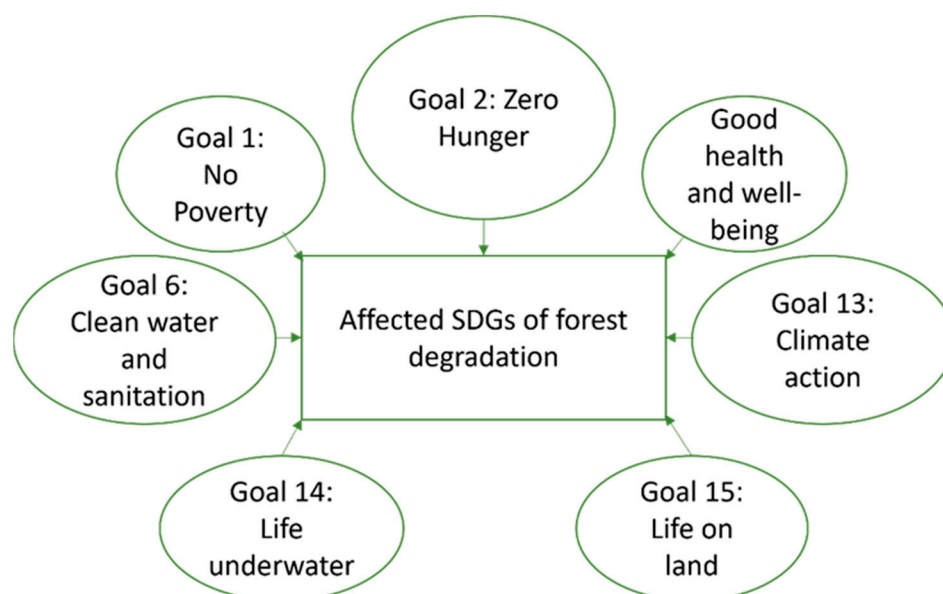


Figure 3. Affected Sustainable Development Goals (SDGs) of forest degradation.

In fact, forests may be connected to all of the SDGs, either directly or indirectly. Forests produce plant- and animal-based goods that are vital as meals and medicines, thus con-

tributing to the achievement of the SDGs of eliminating hunger and guaranteeing health and wellbeing. Forest employment may help to provide decent work and forest-based income can help to eradicate poverty [25], as mentioned earlier, and these earnings can be used to buy food, which helps to ensure food security. Forests also produce clean water and have an impact on hydrological cycles and downstream water supplies, thereby contributing to water and sanitation. Forest biomass may help to reduce the world's reliance on fossil fuels for energy, and forests can help with responsible consumption and production by supplying sustainable materials to replace non-renewable ones. Forests may also contribute to economic development and innovation. Some forest communities are among the most egalitarian in the world in terms of gender and equality, while participatory forest management techniques help to develop inclusive societies and institutions. Forests are critical for carbon storage and climate regulation; they also provide essential support services, including nitrogen cycling and crop pollination, which are critical for long-term agricultural productivity. Furthermore, mangroves provide coastal protection, increasing the resilience of coastal communities against climate-related risks. Recreational, spiritual, religious, and other nonmaterial advantages are among the forest-related cultural ecosystem services. These advantages are significant for both rural and urban people, since they contribute to learning and physical and mental wellbeing, as well as more resilient and sustainable communities. Furthermore, forests contain the majority of the world's terrestrial biodiversity.

3.4. Sustainable Forest Management and Socioeconomic Development

From the results, it is evident that the people of the eastern region rely on forests and forest resources for their livelihoods. From the focus group discussions, there is the realization that the forest sector provides array of (informal) jobs. These are not only timber/wood related jobs, but non-wood related jobs as well, including mushroom selling, wild honey supplying, snail selling, bushmeat vending, firewood and chewing stick selling, and herbal/traditional medicine businesses. Evidently, these people make enough money from the NTFPs derived from the Atiwa Forest Reserve and other forests in the region, and from these monies, they are able to make a living.

The economic importance of NTFPs for Africa's rural livelihoods has been widely acknowledged, both in terms of their subsistence and monetary revenue. The fact that NTFPs are sited in forests that are home to indigenous communities is at the heart of their economic relevance. The gathering of NTFPs is a crucial source of income and employment for rural low-income, indigenous populations, and for people who live in forests [26]. According to Ammal and Mariam [27], in northern Ghana, the lowest weekly revenue from NTFPs ranged from GHS 1 to 25, while the highest weekly income was over GHS 65. In Malawi, their contributions towards annual total household earnings ranged from 15% [28], and in Mali, from around 40% [29]. Evidently, from the study, the participants from the FGDs indicated that they directly contribute to the region's economic growth through the payment of taxes. The lack of information on the ecology and physiology of NTFP species is a serious hindrance to resource management attempts. Nonetheless, contrary to this, there is limitless information about the make-up of the Atiwa Forest Reserve, and this makes it ready for sustainable management.

3.5. Impact of Sustainable Forest Management on Environmental Development and Biodiversity Preservation

Forest biodiversity is rapidly disappearing, and this is a matter of great concern. Major publications like the Red List of Threatened Species [30] show that a large and growing number of forest ecosystems, species, and inhabitants are endangered or being lost worldwide as a result of forest habitat loss and forest degradation, and that the effects of climate change will exacerbate this loss of forest biodiversity. Tropical wet forests have the highest concentration of endangered species of any biome [31], and the Atiwa Forest Reserve is one of them. It is thought that many species, which have not yet been officially

named, are now being lost along with their tropical forest habitats [30]. According to the Millennium Ecosystem Assessment, non-timber forest products (NTFPs) and services account for up to 96 percent of the value of forests [31]. In central Africa, for instance, the utilization of forest wildlife (bushmeat) accounts for up to 80% of the protein consumption of rural families [32]. Nonetheless, the critical significance of NTFPs in national and particularly in rural economies is sometimes overlooked in national statistics, as well as in pertinent initiatives and plans. This is similar in the case of Ghana. As it was identified from the FDGs, the regional and local authorities receive daily and monthly taxes from NTFP/NWFP traders, yet there is no evidence/records of their contribution to the economies.

It is evident from the study that even regular citizens know of the scarcity of many of these species in the forests. In this case, sustainable forest management would be very important in order to ensure that biodiversity and livelihood are on a par. In December 2007, the United Nations General Assembly approved the most commonly accepted, inter-governmentally agreed definition of sustainable forest management (SFM): “Sustainable Forest Management as a dynamic and evolving concept aims to maintain and enhance the economic, social, and environmental value of all types of forests, for the benefit of present and future generations. It is characterized by seven elements, including: (i) extent of forest resources; (ii) forest biological diversity; (iii) forest health and vitality; (iv) productive functions of forest resources; (v) protective functions of forest resources; (vi) socio-economic functions of forests; and (vii) legal, policy and institutional framework” [33]. Again, from the FDGs, it became obvious that the residents are actively using endangered species (plants and animals) in their daily economic activities. The International Union for Conservation of Nature has *Milicia excelsa* on the Red List under “Near Threatened”. The carvers who participated in the FGD also mentioned that this is one of the woods under scarcity, and that this is why they are now resorting to woods such as *Aningeria* and *Piptadenia* for carvings.

In the same way, the bushmeat dealers mentioned a number of animals that are usually on their list, including pangolins. Pangolins are highly threatened by poachers who persistently hunt them for their flesh and scales, which are used in traditional medicine [30,34]. The excessive deforestation of their native habitats has also caused a great harm to these species. They are the world’s most trafficked animals [30]. There are eight pangolin species whose conservation status is categorized as endangered as of January 2020. On the International Union for Conservation of Nature’s Red List of Threatened Species, three (*Manis culionensis* (de Elera), *Manis pentadactyla* (Linnaeus), and *Manis javanica* (Desmarest)) are critically endangered, three (*Phataginus tricuspis*, *Manis crassicaudata*, and *Smutsia gigantea*) are endangered, and two (*Phataginus tetradactyla* and *Smutsia temminckii*) are considered vulnerable [30]. The Atiwa Forest Reserve, characteristically, is an important area of nature that needs to be sustainably managed and conserved for both economic use and biodiversity protection.

4. Conclusion and Policy Recommendation

In contrast to timber commercialization, which is frequently covered in the literature on forestry, the understanding of NTFP/NWFP commercialization is limited and scant, especially in less developed countries where collectors are primarily people on low incomes, who sell these items to supplement their livelihoods. The focus on global markets for NTFPs frequently obscures the relevance of NTFP commerce in developing nations and in local contexts. NTFPs/NWFPs continue to contribute immensely to addressing the food, poverty reduction, income, and livelihood requirements of people in rural areas. It is projected that NTFP/NWFP provide income to about 20 to 25 percent of Ghana’s economically engaged people [35].

It is impossible to overlook the fact that, even though people are benefiting from the forests and the forest reserves economically, their actions need to be thoroughly monitored by the Forestry Commission of Ghana.

Considering the fact that in the 2020 SDG 15 report, over 31,000 species are under the threat of extinction, and that Atiwa is home to many of these threatened species, it is the recommendation of the authors, and also the suggestion of many stakeholders and some of the people in the fringe communities, that the forest be turned into a national park and groomed towards ecotourism, which will present a win-win for all the stakeholders, and thereby help the country in achieving the Sustainable Development Goals. Forests are frequently used as a basis for sustainable development and, as such, they must be thoroughly included in the SDG decision making processes. Human-caused deforestation and desertification pose enormous obstacles to sustainable development and have impacted the lives and livelihoods of millions of people. Forests are critical to the survival of life on Earth and play a crucial role in the battle against climate change. Investing in land restoration is also essential for improving livelihoods, decreasing vulnerabilities, and lowering economic risks. The discussions held throughout this study revealed that residents will continue to exploit forest resources as long as the core concerns of institutional deficiencies and rural poverty are not addressed. Under the current conditions, habitat degradation, the disruption of ecosystem services, and biodiversity erosion are all expected to continue. It is consequently required of policymakers to comprehend the nuances of these difficulties, particularly by the local authorities, in order to devise effective solutions. Even though the suggested solutions are not new, they are not found in the study area.

Firstly, there should be the sustainable, regulated, and authorized harvesting of NTFPs/NWFPs. Government development initiatives generally ignore non-timber forest products (NTFPs) and other forest ecosystem services. This is problematic, because NTFPs and forest services such as medicinal and food plants, clean water, bushmeat, and rattan, etc., are vital in rural lives and local and national economies, but are mostly under-represented or not included in development initiatives and national databases. The absence of NTFPs from government development objectives and programmes exposes them to unsustainable, uncontrolled, and unlicensed harvesting, such as bushmeat overhunting. Bushmeat hunting is the capture of any non-domesticated terrestrial animal, bird, reptile, or amphibian from the wild. Food hunting in tropical forests is a cause for concern, since there is substantial evidence that the extent of the harvesting in these areas constitutes a major danger to several tropical forest species. Furthermore, wildlife depletion is inextricably tied to the food security and livelihood of many communities in tropical forest regions, because many of these forest-dwellers or forest-dependent individuals have few other sources of protein and money. The “bushmeat issue” is a problem of uncontrolled shared resources being exploited in an unsustainable manner due to insufficient governance and legislative frameworks. Most of these fundamental factors of unsustainable wildlife usage are similar to those of poverty. A greater emphasis must subsequently be placed on governance concerns, such as policy, regulation, the incorporation of the high value bushmeat trade into national economy policies. Although the hunting of some animals is prohibited in between 1st August and 1st December in Ghana, these animals are still being poached during this period.

Community/user empowerment is essential. Empowering the residents of forest fringe communities/forest resource users might be a vital tool for long-term sustainability. However, this transfer of rights must be accompanied by a transfer of the responsibility for the resource’s protection, in accordance with the resource’s characteristics, such biodiversity, as a national and global good. At the same time, it is impossible to transfer the rights to bushmeat resources, for example, to local populations without also addressing the rights to timber and mining. There are no general answers to the problem of unsustainable bushmeat hunting in tropical forests. The approaches must be adjusted to local cultural, social, and political situations, and must be nation-, location-, and context-specific. Forest activities and the land use planning of authorities should always consider the rights and indigenous practices of the residents of fringe communities. The core idea for accomplishing this is via the effective involvement of local peoples, as well as of local stakeholders, when it comes to the decision making and governmental systems regarding any prior and affirmative

decisions about any initiatives or changes affecting their societies, traditional practices, and environments.

Sectoral education and training programmes will go a very long way in ensuring sustainability and biodiversity preservation.

Extensive education and training on mushroom farming should be considered. Ghana has a large potential for mushroom production due to its abundance of natural resources and its favourable climate for mushroom germination. Mushrooms, which are high in protein, vitamins, and minerals, yet low in fat, are a favourite meal in Ghana. The collecting of edible mushrooms in rural regions, and their subsequent sale in urban areas, is a historical custom that is still practiced by certain dealers. Mushroom production in Ghana began many centuries ago, with the use of the traditional pit technique, which produced very poor and irregular yields. Even though the eastern region of Ghana is known to be one of the places to get the best wild mushrooms, little to nothing is known about their economic contribution to the region's economy. As it has been identified from the study, these collectors are mainly people on low incomes that live in rural communities and therefore do not have the financial capability to seek external training on producing mushrooms in and out of season. Due to this, according to the study, mushroom collectors operate on seasonal basis. An over-reliance on the wild for mushrooms can eventually lead to their extinction. The study recommends that the government, in partnership with NGOs, should organise training, seminars, and symposiums for these collectors. Although the National Mushroom Development Project (NMDP) was established in June 1990 by a cooperative effort between the Food Research Institute Council for Scientific and Industrial Research, the Ghana Export Promotion Council, and the MoFA, with the primary goal of methodically developing and promoting intensive mushroom farming, use, and exports, many mushroom collectors, as per the results, are not aware of any existing programmes.

With regard to plant medicine trainings for informal practitioners, thorough measures must be in place to separate traditional medicine practices from traditional spiritualism. In Ghana, the practice of medicine is inextricably linked with the practice of religion, as is their idea of medicine, and Africans are often considered to be fairly devout. Aside from the acknowledged and accepted strictly biological causes of illnesses, there are also traditional interpretations for them [36]. The Ministry of Health in Ghana is already aware of the effectiveness of herbal medications and the possible complications that may result from their abuse and/or misapplication. For this reason, there should be thorough and periodic training for its practitioners. In Ghana, the process of normalizing traditional medicine has been guided by the policies and regulations of previous governments. For example, the collapse of the Nkrumah administration hampered prior attempts to embrace these traditional medical practices. Nevertheless, Acheampong's military regime relaunched these efforts in the 1970s. This approach was intensified in 1973, with the founding of the Centre for Scientific Research into Plant Medicine (CSRPM) at Mampong in the eastern region. Under the Rawlings administration, the Ghana National Association of Traditional Healers (GNATH) was founded in 1991. Its objective was to mobilise healers with an extensive understanding of traditional remedies. The Ghana Federation of Traditional Healers (GFTH) was established in 1993. It was later reformed, and is now known as the Ghana Federation of Traditional Medicine Practitioners Association (GHAFTRAM). This organization serves as the parent body for all traditional healer unions in Ghana and provides recognition and legal status to these organisations and their members. Therefore, the MoH of Ghana, through the media, should mobilise all the traditional medicine practitioners and make sure that they are registered with a recognised association, and that they are operating with the right license after going through thoroughly sponsored training.

Apicultural education/training in rural areas is another area to look at. This study has brought to light that most of the honey dealers in the eastern region, and in the country as a whole, obtain their honey from the wild. This has a great impact, not only in terms of the danger it poses to the bees, but also on the yield. Studies such as Kiros and Tsegay [37] show that, when compared to traditional beehives, the use of upgraded hives such as the

frame hive can result in an increased honey yield. As mentioned by Hanspal [38], Ghana's honey industry, up until now, has not been regulated. In Ghana, insufficient attention has been paid to the legislative and regulatory environments for the creation of NTFPs. Because forest policies continue to classify NTFPs as "minor" forest products, they get less attention than wood in forest management initiatives and policies. The absence of a definitive policy on NTFPs has hampered their promotion, commercialization, and supply chain management. Forest policies have historically been controlled by the economic interests of succeeding administrations for the utilization of wood resources that are used for the generation of foreign exchange. Ghana's forestry policies have failed to recognize the significance of NTFPs and provide an enabling climate for their promotion and growth. According to the World Bank, as indicated in *The Africa Report* [38], honey producers in Ghana will receive a new policy to control their business operations and exports, in order to strengthen the National Honey Production and Investment Policy, allowing the country to attain a trillion-dollar industry by 2030. This shows that the government is aware of how honey, a NWFP, can contribute to the booming of the nation's economy. It is eminent, therefore, that rural producers are extensively trained and financially supported towards this course, to achieve the set goals.

Meanwhile, local governments' powers for job creation should be increased. Even though Ghana operates a decentralized economy, policies and activities are still centred in the cities. More powers should be given to the local government to establish jobs and ensure its functionality in the rural area. Most of the forest reserves in Ghana are considered to be potential ecotourism sites, however, as of now, none have been confirmed as such. The apparent beautiful and endowed nature and characteristics of the Atiwa Forest Reserve should be well-broadcasted and made accessible to attract tourists from all parts of the world. The butterfly sanctuary in the forest makes it unique among the other reserves (both major and minor) in the country. The government, together with private organisations, could commission these reserves into tourist sites, which would bring tremendous improvement to people's livelihoods within fringe communities. New jobs would be created for the people living nearby.

Lastly, there should be new measures in place to enforce the existing policies. Recent cases of illegal mining activities in Ghana are found in forests and forest reserves. The Atiwa Forest Reserve is a victim, as already presented in the study. Implementing a policy framework as an approach to enhancing environmental practices is therefore necessary. These strategies should concentrate on encouraging miners' moral accountability by educating, advertising, and using social pressure to bring about a shift in their behaviour. Consequently, the enforcement of the current legislation, using forces such as police, will increase the policy implementation. This strategy would ensure that small-scale miners would extract minerals by suitable means, without destroying the environment. Despite the fact that there were countrywide force actions against illegal mining, additional research suggests that projects such as Operation Vanguard under the Akufo-Addo administration were only transitory. As things stand now, that once-helpful policy has been suspended, and illegal miners have returned to numerous sites around the country, mining in and around forests and forest reserves. As a result, the author recommends that the government establishes a separate security unit that is solely responsible for land degradation actions, such as water pollution, illegal mining, and deforestation, etc. This division would serve as a taskforce, with capable men and women being recruited on a regular basis and undergoing extensive training, with the goal of preventing environmental (land, water, and air) degradation.

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Appendix A

Table A1. Some woods used for carving (FGD1).

Local/Twi Name	Name of Wood	Botanical Name
Sese	False rubber tree	<i>Holarrhena floribunda</i> (G.Don) T.Durand & Schinz
Gyenygyene	Scented Guarea	<i>Guarea cedrata</i> (A. Chev.) Pellegrin
Dua Tweneboa	Cordia	<i>Cordia gaudensis</i> (S.Moore)
Hyedua	Daniellia	<i>Daniellia ogea</i> (Harms) Rolfe ex Holland
Esa	Natal white stinkwood	<i>Celtis mildbraedii</i> (Engl.)
Onyamedua	Stool wood	<i>Alstonia boonei</i> (De Wild.)
Odum	African teak	<i>Milicia excelsa</i> (Welw.) C.C. Berg
Mansonia	Mansonia	<i>Mansonia altissima</i> (A.Chev.)
Asamfena	Aningeria	<i>Aningeria altissima</i> (Aubrev. et Pellegr.)
Dahoma	Piptadenia	<i>Piptadeniastrum africanum</i> (Hook.f.) Brenan

Table A2. Some common bushmeats (FGD1).

Local/Twi Name	Name of Bushmeat	Binomial Name
Otwe	Grey rhebok	<i>Pelea capreolus</i> (Forster)
Akrantee	Grasscutter	<i>Thryonomys swinderianus</i> (Temminck)
Aprawa	Ground pangolin	<i>Smutsia temminckii</i> (Smuts)
Nwansane	Bushbuck	<i>Tragelaphus scriptus</i> (Pallas)
Kwakuo	Mangabey monkey	<i>Cercocebus atys</i> (Audebert)
Osanka	African hog	<i>Hylochoerus meinertzhageni</i> (Thomas)
Adowa	Antelope/Dik-dik	<i>Antilope saltiana</i> (Desmarest)

Table A3. Names and uses of some medicinal plants (FDG2).

Local/Twi Name	Plant Name (Botanical Name)	Medicinal Uses
Tuoantini	<i>Paullinia</i> (<i>Paullinia pinnata</i>)	Waist pain, rheumatism, ulcer, sexual weakness, piles, impotency, bone fracture, fatigue, fever, stroke, HIV / AIDS
Kakapenpen	<i>Mahogany</i> (<i>Khaya ivorensis</i>)	Cough, anaemia, fever, wounds, ulcers, and tumours, rheumatic symptoms, sores, lumbago.
Nim dua	<i>African Neem</i> (<i>Azadirachta indica</i>)	Tuberculosis, cancer, malaria, wounds, worm infections
Moringa	<i>Moringa</i> (<i>Moringa oleifera</i>)	Ulcer, hypertension, fever, malaria, blood tonic, typhoid, urine retention, diarrhoea, bilharzia
Mmpampro	<i>Schrad</i> (<i>Bambusa vulgaris</i>)	Hypertension, malaria, cancer
Ahomakyem	<i>Planch</i> (<i>adenia cissampeloides</i>)	fever, wounds, numbness, gastro-intestinal disease, hypertension, wound, malaria
Awobe or Abe aduro	<i>(Phyllanthus floribundus)</i> <i>Monkey fruit</i> (<i>Myrianthus arboreus</i>)	Wounds, inflammation, menstrual disorders, pains, fevers
Nyankama		Reproduction, kidney pain, diabetes
Wisa	<i>Black pepper</i> (<i>Piper nigrum</i>)	cancers, malaria, excipient
Hwenetia	<i>Ethiopian pepper</i> (<i>Xylopia aethiopica</i>)	Stomach ache, chickenpox, bladder trouble, leprosy, diabetes mellitus, strengthening pregnancy, asthma, mental illness, convulsions, arthritis, inflammation

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