



A PLATFORM FOR STAKEHOLDERS IN AFRICAN FORESTRY

POSITIONING FORESTRY AS ENTRY-POINT AND PATHWAY FOR GREEN ECONOMY DEVELOPMENT IN WEST AFRICA



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Positioning forestry as an entry point and pathway for green economy development in West Africa

Martin Nganje

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Acronyms and Abbreviations

AFF	African Forest Forum
AfDB	African Development Bank
AFOLU	Agriculture, Forestry and Other Land Uses
BCR	Benefit Cost Ratio
C	Carbon
CDM	Clean Development Mechanism
C&I	Criteria & Indicators
CNEDD	National Council on Environment and Sustainable Development (Niger)
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organisation of the United Nations
FCP	Forest Convergence Plan
FIP	Forest Investment Programme
GDP	Gross Domestic Product
IBRD	International Bank for Reconstruction and Development
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature / UICN in French
LULUCF	Land Use and Land Use Changes and Forestry
MAPs	Medicinal and Aromatic Plants
MRV	Monitoring Reporting and Verification
NAPA	National Climate Change Adaptation Plan of Action
NFAP	National Forestry Action Programme
NP	National Park
NTFPs	Non-Timber Forest Products
OECD	Organization for Economic Cooperation and Development
PHAs	Polyhydroxy-alkanoates
RBO	River Basin Organization
REDD+	Reducing Emissions from Deforestation and Forest Degradation
REP	Renewable Energy Policy
ROAM	Restoration Opportunities Assessment Methodology
SDGs	Sustainable Development Goals
SFM	Sustainable Forest Management
SMEs	Small and Medium-sized Enterprises
UNEP	United Nations Environmental Programme
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
UNESCO	United Nations Educational Scientific and Cultural Organization
VAT	Value Added Tax
WTO	World Trade Organization

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EXECUTIVE SUMMARY

This report presents the harmonized and expanded results of studies carried out in 2016 by two teams of researchers on the potential of forests for green economy development in West Africa: the Anglophone study in three sample countries namely: Nigeria, Ghana and The Gambia, and the Francophone study in another three West and Central African countries namely: Niger, Benin and Gabon. The current study also benefits from information obtained from grey sources and the researcher's experience in West African societies.

Although variously defined, United Nations Environment Programme (UNEP) describes green economy as low carbon (C), resource-efficient and socially inclusive economy. Forests meanwhile were placed at the center of green economy development in 2009 during the United Nations Economic Commission for Europe /Food and Agriculture Organization (UNECE/FAO) Conference in Geneva, titled "Forest sector in the green economy". The conference consensually concluded that there was a key role for forests in the transition towards green economy and a more sustainable society. The current study upholds the preceding assertion and proposes to generate verifiable information necessary to increase awareness of policy makers and other actors in West Africa on the role and contribution of forests to the development of a green economy in the sub-region. The study focuses on forests as biological capital for wealth creation, elimination of poverty and stimulation of economic activity.

The study identified key elements and proposed how they may be explored to ensure forests' contribution to green economy development without risking sustainable forest management (SFM). With respect to food security and development: rational exploitation of edible forest commodities; systematic reforestation and rational exploitation of floodplains for enhanced fisheries; planned greening and sustainable use of agricultural production schemes including agroforestry; and planned enrichment of pastures with fodder tree species for enhanced livestock husbandry. With respect to forest assets for economic and social development: planned expansion and intensification of forest biomass stock; sustainable bio-trade in forest foods, bio-medicines and cottage industry products; sustainable development of industrial wood markets, biomass-based energy, and improved energy efficiency; and sustainable exploitation of ecological tourism and intangible heritage assets. As regards forests for environmental stability and security: conservative management of biodiversity; sustainable management of watersheds; rational exploitation of climate related development processes; and the greening and sustainable use of urban spaces for recreation, leisure and development.

Four groups of actors expected to support engagement of forests in green economy development were identified at the individual, private sector, supervisory authority, and policy levels. They include: biomass producers; forest commodity processors; forest services' promoters and processors; and marketing and cross-cutting service providers. Their capacity requirements range from knowledge and skills to implement field level operations, to appropriate policy development and planning capacity to institute provisions expected to facilitate the leadership role of forests in green economy development.

The study assessed several national sector policies in connection with their adequacy for positioning forestry on a green economy pathway, and underscored the following points with suggestions:

- With respect to forestry, water, and environmental policies and legal frameworks; the study noted that very few have articulated the legal, regulatory, fiscal or corresponding institutional provisions expected to address the main forest tenets of a green economy, such as the production of forest foods, biofuels, biomedicines, watershed enterprises, forest biodiversity conservation businesses, forest carbon development assets etc., and suggests that these areas be included when updating current policies.
- Agriculture and land policies were assessed in terms of their capacity to embrace forestry through i.e. agroforestry schemes, and their supportive or inhibitive objectives to the use of low carbon, less toxic, and ecologically friendly agricultural inputs characteristic of a green economy. With the exception of a few policies, these aspects were inadequately covered. The study suggests their inclusion when updating current policies.
- National energy policies examined in connection with plans for novel green economy commodities such as biofuels were for the most part silent on the subject. This is understandable as most of the policies were developed during the height of the debate on the potential impact of biofuels on food production. The study suggests that this situation be revisited at national level.
- Policies on animal husbandry and pastures were investigated for the existence of plans advocating the greening of pastures with fodder tree species and strategies against wildfires in the context of facilitating a green economy. Most were found to be deficient in these areas. The study suggests the inclusion of these aspects when updating current policies.
- Industrialization and trade policies were examined in connection with incentives offered for trade in forest commodities and related services in a potentially green economy context. With the exception of timber, most policies were found to be silent, and

especially so, on forest services. The study suggests consideration of these aspects when updating current policies.

- National climate change adaptation, forest investment programmes, and Reducing Emissions from Deforestation and Forest Degradation (REDD+) proposals were assessed in connection with commitments towards the production, ownership, management and commercialization of forest carbon as a green economy forest ecosystem service. Though variously mentioned, there was little information on how to process forest carbon as an ecosystem service and asset. The study suggests provision of guidance on incorporating forest carbon in basic policy documents.

In addition to the preceding suggestions, the study noted that national policies were inadequate in certain cross-sectorial aspects considered pertinent for positioning forestry in a green economy pathway and proposed measures for their eventual inclusion when updating such policies and programmes. They include to:

1. Expand and develop national forestry policies into programmes and projects in continuation of the National Forestry Action Programme (NFAP) process as forerunner to the greening process.
2. Ensure political adoption of criteria and indicators (C&I) of SFM and certification as the main policy instruments for operationalizing the concept of SFM.
3. Pursue decentralization in forest management and associate its implementation with the capacity building of all actors, including government institutional and legislative level actors.
4. Provide clear roles for rural youth and women in policies as a precursory measure to initiate transformation of the informal forest sector and check unnecessary migration.
5. Provide clear measures to transform and streamline informal forest activities to the mainstream forest sector for economic competitiveness, efficiency and development at all levels.
6. Indicate clear strategies to reduce total dependence on fossil fuel derivatives, toxic and harmful chemicals in the agricultural, livestock husbandry, industrial and health sectors.
7. Institute forest governance frameworks to coordinate different sector level interventions on the forest landscape as a measure of minimizing conflicts and unnecessary duplication of effort.
8. Define, reinforce and incentivize, where necessary, the private sector's involvement in forest research, forest production and industry.

9. Develop strategies and administrative frameworks starting at the Economic Community of West African States (ECOWAS) regional level for collaboration in comprehensive management of forest and tree pests and diseases.
10. Develop strategies and administrative networks starting at the ECOWAS regional level for collaboration in the development of tree germplasm programmes to support the forest rehabilitation and restoration effort.

1. INTRODUCTION

The Economic Community of West African States (ECOWAS) has 15 countries, covering an area of 5,112,830 km² (UN, 2013) and a forest expanse in 2015 of 71,234,000 hectares (ha) (FAO, 2015). The sub-region had a human population of 327,374,979 in 2012 (UN 2013), expected to increase by approximately 1.4 times around 2025 and more than double by 2050 (Mallon et al., 2015). West Africa's forests are one of the most diverse types on our planet, spanning south to north, from the mangroves of the Gulf of Guinea through the Guinea Moist Forests known as the cocoa belt, to the mountain forests of the Nimba and Gola, and further north to the Sudan-Sahel rangelands and Acacia parklands.

Recent assessments confirm the economic importance of West Africa's forests, which in 2011, were responsible for the formal and informal employment of 6,930,000 people, representing 5.9% of the sub-region's labour force, and a sub-regional Gross Domestic Product (GDP) of 1.3% compared to the sector's Africa-wide GDP of 0.9% in the same period (FAO 2014a). In a general manner, ECOWAS describes the sub-region's forest as relatively stable over the last 20 years, with a net annual surface area change that is inferior to 0.5% (ECOWAS, 2012).

The legal codes, administrative and institutional frameworks, including those of the forestry sector, are different among West African countries and are based on colonial heritage from the British, French and Portuguese systems. However, through the convergence effort of ECOWAS, these fundamental differences are increasingly minimized through the harmonization of policy formats and streamlining of their contents.

1.1 Background

Like forests of other African regions and continents, West Africa's forests have the capacity to address development challenges related to food security, pest and disease control, environmental sustainability, renewable energy supply, water purification and protection, biodiversity production and conservation, climate regulation and stabilization, climate adaptation, fight against desertification, control of land degradation, disaster risk reduction (UN-TST, 2014; Popoola et al., 2016). These are in addition to educational, cultural and recreational roles, with their industrial uses extending beyond biochemical, textile and computer products. There is little doubt therefore that the sub-region's forests are suited to lead national and regional efforts towards green economy development.

"The green economy concept was first used in 1989 by a group of leading environmental economists in a United Kingdom report (Pearce et al., 1989). The authors in their book: *Blueprint for a Green Economy*, argued that because today's economies are biased towards depleting natural capital to secure growth, sustainable

development is unachievable. The aim was to advise the United Kingdom government to focus on the implications of sustainable development through the measurement of economic progress and the appraisal of projects and policies. In 1991 and 1994 the authors released sequels of reports titled, *Blueprint 2: Greening the World Economy*, and *Blueprint 3: Measuring Sustainable Development* respectively (Allen and Clouth, 2012). The first *Blueprint* reported on the necessity of the economy to support environmental policy while the sequels extended this message to the problems of the global economy, climate change, ozone depletion, tropical deforestation, and resource loss in the developing world (Allen and Clouth, 2012). In response to the multiple global crises in 2008, the United Nations Environment Programme (UNEP) championed the idea of "green stimulus packages" and identified specific areas where large-scale public investments could kick-start a "green economy" (Atkisson, 2012). The UNEP vision inspired several governments to implement significant "green stimulus" packages as part of their economic recovery efforts. Therefore, the concept of green economy is discussed in national and international debates in the context of policy responses to multiple global crises".

(Vodouhe and Assogbadjo, 2016)

"The concept of green economy has been variously defined by different authors. The UNEP defines it as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP 2010). It entails essentially a low carbon, resource-efficient and socially-inclusive economy. Green economy requires the transformation of production and consumption lifestyles towards economic activities that enhance and preserve environmental quality, while using energy, water and natural resources more efficiently, and reducing social inequalities. At the operational level, in a green economy, growth in income and employment is driven by investments that reduce carbon emissions and pollution; enhance energy and resource efficiency; prevent loss of biodiversity and ecosystem services; and reduce unemployment and poverty, especially among the poorest segments of society (UNEP, 2011)".

(Popoola et al., 2016)

The Policy Forum on "Forest sector in the green economy" organized by the United Nations Economic Commission for Europe (UNECE) and the Food and Agriculture Organization of the United Nations (FAO) in Geneva in October 2009 was the first international meeting to deliberate on forests and green economy. The forum which included participants from governments, industry, trade associations, and academics, arrived at an overriding consensus that there is a key role for forests in the transition towards green economy and a more sustainable society (UNECE, 2010). Key aspects worth considering as forests' contribution to green economy development include: managing natural capital by

developing, restoring and maintaining forests for the full range of their provisionary and functional ecological services; engaging resource use efficiency by producing more with less, using forest-related technological and management innovations; and engaging sustainable consumption by harnessing the power of demand and supply of forest commodities and services to drive improvements (Grieg-Gran et al., 2015). Generally, forest related investments for a green economy need to be catalyzed and supported by targeted public expenditure, policy reforms and regulation changes geared towards maintaining, enhancing, and rebuilding natural capital as a critical economic asset and source of public benefits (Gueye, 2011). Also, if a more sustainable society is to be achieved, there is need to re-focus the global economy towards investments in natural infrastructures and renewable sources of energy through green industries and technologies (UNECE, 2010). Given the natural resource dependence of most African economies, capitalizing on the continent's natural capital will play a critical part in its transition to a green economy. (Gueye, 2011).

Some countries recognized as most advanced in greening their economies used forests as building-blocks for the process. Examples include South Korea which operationalized its national forest programmes to achieve the country's strategy on low carbon and green growth through sustainable forest management (SFM). South Korea invested decisively in reforestation, passing from an area of 63,995,000 ha of growing forest stock in 1960 to 800,025,000 ha in 2010 – a twelve-fold increase in the area of growing forest stock during the 50 years period. During the same period, the volume of growing forest stock per ha increased from a meager 9.6 m³ per ha to a huge 125.6 m³ per ha – another twelve-fold increase (Lee, 2012). This was not without difficulties as South Korea became, at that time, the 13th largest economy in the world by GDP (IMF, 2011); given that it was a poor country in the 1950s and 1960s. Overseas assistance such as an International Bank for Reconstruction and Development (IBRD) loan and support from the German Government, in particular for the establishment of the Forest Works Training Centre, contributed to the successful implementation of reforestation projects (Lee, 2012). Generally, most developing countries do not have the potential and capacity to invest in the expansion of their forestry sectors (Gunatilleke, 2015).

Going green should not be perceived as a cheap process. Some industrialized countries are resisting going green or at best their governments chose to impose taxes as a means of getting the private sector to fund the greening process. Even then, some private sector industrialists resist for fear that the higher costs for producing in a “green environment” (in their contexts), will make their products costly to compete (Chipeta, 2011). Challenges of engaging forestry as driver of green economy development in Africa include: low inherent productivity of local forests despite diverse forest product types, elite and external actors' capture of values and benefits, restrictive regulations and high transactional costs of producers and traders, limited support by the private sector for forest enterprise

development, and lack of strong local organization to demonstrate volumes and engagement (Campbell et al., 2007). Other challenges include: failure to legitimize forest benefits due to inadequate legal instruments manifested by difficulties to access revenue from forest services such as forest carbon trading; problems of forest resource ownership where trees and forests have the same status as petroleum, gold or bauxite and are therefore owned by the State; tendency to value forest products in terms of quantity and not quality, which does not emphasize value addition, thereby rendering competitive commodity pricing unattractive and consequently resulting in low economic benefits (Nyirenda et al., 2011).

This study draws from and expands information received from two previous studies conducted in 2016 by the African Forest Forum (AFF) in five West African countries, namely; Benin, Niger, Gambia, Nigeria and Ghana, as well as Gabon in Central Africa. The studies titled respectively: “Forest sector potential for green economy and land use, land use change and forestry (LULUCF) in Anglophone West African countries”, and “Review of land use, land use change and forest sector potential for green economy in Francophone West and Central African countries” recommended: the reorientation of forest governance and policies; review of extant forestry laws, adoption of new forestry technologies and training, proper staffing of forestry institutions and agencies, building of networks with stakeholders including cross-sector forum engagements, consistent and robust forestry input in national planning, fill knowledge gaps related to forest conservation mechanisms, provide wide sensitisation on interests and benefits for involvement in REDD+, and develop strategies to involve field forest workers in green economy development. These recommendations have been internalized in this report.

In addition to information generated by the referred studies, this report draws from the literature in scientific journals, resolutions from regional and international workshops, technical papers, books and project reports, as well as the researcher’s extensive field experience in West African communities and nations. The report uses the words “forests” and “forestry” as appropriate, based on the context. It is presented in five sections in conformity with the areas under focus indicated in section 1.3.

1.2 Objective

The overall objective of the study was to generate verifiable information necessary to increase awareness of policy makers in West Africa on the contribution of forests to the development of a green economy and to sustain human livelihoods by focusing on natural capital-forests- as an essential basis for wealth creation, poverty reduction and stimulation of economic activity.

It must be emphasized that although forests are proposed as pathway for green economy development, their management on the landscape cuts across the interventions of different government ministerial departments and a plethora of stakeholders. It will be inconsiderate to undertake any planning without engaging such stakeholders and partners. This is in conformity with the African Development Bank's (AfDB) principle that an entry point for green economy is upstream diagnostics which emphasizes cross-sector linkages (AfDB, 2014a).

1.3 Focus of the study

The study focused on the following:

- Identification of key elements within the forestry sector that have the potential to contribute to a green economy;
- Analyses of how the preceding key elements can be made to contribute to a green economy pathway, while not jeopardizing attainment of SFM;
- Identification of the key players and their capacity requirements for undertaking the preceding elements;
- Assessment of the adequacy of existing policy and legal frameworks that could guide the positioning of forestry activities on a green economy pathway and suggestion of ways to improve the same;
- Documentation of the added benefits realized by putting the forestry sector in green economy development.

1.4 Methodology

As stated earlier, this report is the product of a desk review based on primary data from two field studies undertaken in 2016 by two teams of researchers in West and Central African countries namely: Nigeria, Ghana and Gambia on the one hand, and Niger, Benin and Gabon on the other hand. The primary studies consisted of extensive surveys of, and in-depth discussions with individuals and institutions involved in activities, projects and programmes with potential for green business and green development opportunities in those countries (Popoola 2016). Key contact persons were selected based on their knowledge and their institution's potential role in greening the forest sector. In each country, questionnaires were addressed to such key contacts, and appointments arranged followed by face to face interviews (Assogbadjo and Vodouhe 2016).

In addition to data obtained from the referred specific studies, the current review further benefited from a large number of sources, including the West Africa expert knowledge of the researcher, towards an output more generalizable to West African countries. The countries visited are indicated on Figure 1.



Figure 1: Six countries, with red star visited during the preliminary studies

NB: From left to right: The Gambia, Ghana, Benin, Niger, Nigeria and Gabon.

Source : <http://mapofafricanew.blogspot.com/2017/05/west-central-africa-map.html>

2. KEY ELEMENTS OF THE FOREST SECTOR WITH POTENTIAL TO CONTRIBUTE TO GREEN ECONOMY

This section identifies and provides justification for engaging value elements of forests and forest ecosystems in developing a green economy. Three groups of elements are broached: forest commodities, value-based forest ecological services and valuable forest-related social services.

2.1. Forest commodities

Forest commodities in this report are primary value goods produced by trees and in forest ecosystems. They are characterized by low energy input for their production, different from cash crops whose basic production is dependent on high energy inputs such as fertilizers, pesticides and other energy intensive processes and practices. Forest commodities may be forest foods, forest or biomass-based fuel, forest or biomass-based fiber and forest or biomass-based medicinal and aromatic products. These are described in the following sections within the West Africa context.

2.1.1 *Forest foods*

According to IPCC (2014), the agricultural sector is responsible for 24% of global greenhouse gas emissions of which 75% comes from the livestock sector. While West Africa's contribution to such emissions may be close to insignificant i.e. lower than 4%, the impact of agricultural inputs where applied in the sub-region can have far-reaching negative effects. According to an AFF study undertaken in 2015 (Nganje, 2016), referring to AGRIFOR Consult (2006), the author narrates that:

“In Côte d'Ivoire, areas producing pineapple, banana and cocoa without exception present traces of several pesticides while the soil of cocoa farms is contaminated mainly by Lindane. In banana areas, there are still traces of old organochlorides (Aldrine, Dieldrine and Endrine) with higher concentrations in the deeper soil layers. These substances have a negative effect on human life through the contamination of domestic water sources with a consequent negative effect on the quality of labour for the production of food.”

The preceding assessment is similar in most West African countries with conventional cash crop plantations of oil palm, coffee, cocoa, banana, cotton and vegetables.

Forest foods are edible tree and forest products i.e. fruits, seeds, inflorescence, leaves, gums, oils and foods naturally found in the forest environment such as honey, snails, edible caterpillars, authorized bush-meat and wild-fish, as well as crops or livestock produced or reared under a silvicultural scheme (Fig. 1). The production of forest foods is characterized by relatively low energy and little or no chemical input usually associated with higher levels of greenhouse gas emissions and pollution. Under an increasing population scenario likely to challenge food security in West Africa on the one hand, and in pursuit of good human health, poverty reduction and ecosystem resilience on the other hand, investment in the production of forest foods can be a commendable outcome of West Africa's green economy model. This can be pursued as replacement of some percentage of conventional food production or as a 'renewed' source of food with investments to fulfill food security objectives of West Africa's increasing population.

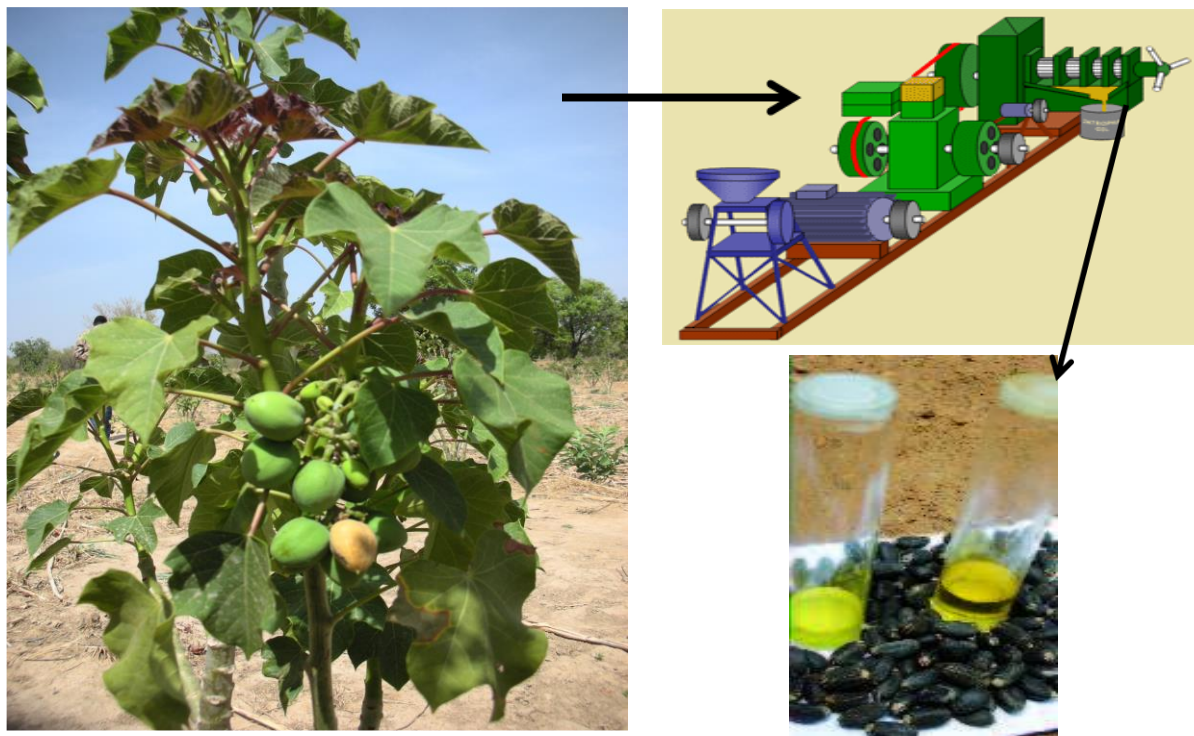


Figure 2: The dried seed of the Jatropha plant (*Jatropha curcas*) milled and pressed to produce bio-oil – above

Source: Martin Nganje.

2.1.2 Biomass fuel including liquid and gaseous biofuels

According to Canadell and Raupach (2009), Africa's fossil fuel emissions between 2000 and 2005 stood at 260 Tg C y⁻¹ above that of the continent's land use change for the same period (240 Tg C y⁻¹), representing 3.7% of global fossil fuel emissions in the above period. Although emissions from fossil fuel use in Africa are relatively low, complete dependence on fossil fuel in the continent generally, and West Africa in particular, where only a few countries produce the commodity can have far reaching negative effects. For example, the Ghana Energy Commission reported that "crude oil imports accounted for approximately 80% of the country's trade deficit in 2001, with the cost of crude oil imports rising from US\$ 280 million in 2000 to over US\$ 500 million in 2004. Also, the annual tax revenue on petroleum product sales was equivalent to about 39% of the cost of crude oil imports in 2000 and almost 60% in 2004" (Ghana Energy Commission 2006). Even under this traumatic scenario, the Ghana Energy Commission projected an increase in national petroleum demand from 1.6 million tons in 2000 to above 3 million tons in 2015 and 4.5 million tons by 2020. As petroleum resources dwindle, there is a need to identify and exploit biological sources, which have the added value of checking the negative effects of fossil fuel emissions and rising cost impacts.

Biomass energy sources such as fuel-wood and charcoal have always been used in West Africa. They will continue to be essential commodities based on the use of improved production and processing techniques. According to FAO (2014b), approximately 232,243,000 people in West Africa use wood-fuel to cook, representing 75.2% of the sub-region's population. The large-scale use of liquid and gaseous biofuels however is relatively recent and is only starting to make inroads in the sub-region.

Liquid biofuels are produced from plant parts and animal oils. Bio-oils are extracted mainly from oily plant seeds and nuts such as *Jatropha* seeds (Fig. 2), palm oil nuts and others, while bio-ethanol is produced by fermenting biomass followed by distillation. Bio-oils can be burnt directly to generate heat or refined into biodiesel which has similar physical and chemical properties with petroleum diesel, allowing it to be blended with petroleum diesel and used as an automotive fuel. Bio-ethanol meanwhile, when blended with petroleum gasoline, produces gasohol, also usable as an automotive fuel. The production of biofuels is characterized by relatively low energy inputs and limited transportation, otherwise associated with the production of high levels of greenhouse gas emissions and fatalities on the accident-prone roads of West Africa's land-locked countries. The production of biofuels can therefore be pursued to replace some percentage of conventional petroleum products or as a 'new' source of fuel especially for low energy automotive units such as mills, crushers and adapted forms of power generators. As such, they constitute a commendable outcome of West Africa's green economy model.

2.1.3 Forest fiber for industrial and cottage sectors

Since their discovery between the 1950s and 1960s, man-made petroleum fibers notably: nylon, polypropylene and polyester have increasingly inundated the textile sector. For example, polyester, the most popular among the synthetic fibers is increasingly used in the manufacture of construction materials, upholstery and other textile products. According to Pattie and Leigh Anne, polyester is also used in the manufacture of most types of clothing and sportswear including diapers, sanitary pads, mattresses, curtains and carpets. Meanwhile, the manufacture of polyester includes reactions between ethylene glycol and terephthalic acid, with pathway derivatives that are poisonous, flammable and carcinogenous, at least likely to be of concern to future generations (Leigh and Leigh, 2011). Also, according to Aiama et al. (2016), the energy input for the production of polyester revolves around 125 MJ/kg compared to 100 MJ/kg for viscose (natural cellulose-based fiber). With a population of more than 300 million West African inhabitants, a large proportion of synthetic fiber products end their life-cycle in countries of the sub-region. For example, in Burkina Faso, household waste which includes abandoned clothes, carpets and other textile products occupy the third place in greenhouse gas emissions - 4%, after agriculture - 88%, and energy - 6% (SP-CONEDD, 2010).

Meanwhile, increasing West Africa's contribution of natural fibers from wood, cotton, natural rubber, flax, and others, to the construction, upholstery and textile industries has the potential to create green jobs, generate additional income, and reduce environmental pollution and soil toxicity. Replacement of some proportion of synthetic products in the aforementioned industries may be facilitated by producing natural substitutes to petrochemicals capable of enhancing strength and pliability in textiles and clothes. Bio-chemicals with such characteristics include Polyhydroxy-alkanoates (PHAs), which can be bio-refined from bio-oils, bio-ethanol or directly from plants to enhance the strength and pliability of natural fibers. PHAs are biodegradable elastomers, applicable in large scale commodity products such as containers, bottles and fiber (Philip et al., 2007; Langeveld et al., 2010). They can substitute plastics in consumer products (van Beilen and Poirier, 2008; Langeveld et al., 2010) constituting a commendable outcome for a green economy approach.

Meanwhile, the importance of West Africa's wood industry remains outstanding, responsible for an export value of US\$ 538,000,000 and 3% of the sub-region's GDP in 2011 (FAO 2014a). Other forest fibers of particular interest include: rattans, canes, and bamboos, which together with other non-timber forest products accounted for 168,000 direct employments in 2011 (FAO 2014a). Moreover, according to FAO (2014b), about 35,078,000 people in West Africa live in homes made partly from forest products, representing 11.4% of the sub-region's population.

2.1.4 Forest-based bio-medicinal and aromatic elements

The health care industry specialized especially in the production and distribution of pharmaceutical products and the disposal of their waste is increasingly under pressure to take account of its carbon footprint (Chung and Meltzer, 2009). Although carbon emissions data from this industry is still rare, United States scientists have established that the American health care industry accounts for 8% of the country's total carbon dioxide emissions (Chung and Meltzer, 2009). Attention has now turned to the global pharmaceutical industry whose drugs are increasingly produced from laboratory chemicals most of which contain petroleum derivatives. Although West African countries are not producers of conventional medicines as a community of nations, they can choose suppliers who adhere to their green economy model. AGRIFOR Consult (2006) notes that:

“Management plans for hazardous medical waste in Côte d'Ivoire are non-existent. Production of medical waste from public health structures was estimated at 3,200 tons per year (AGRIFOR Consult, 2006). Wastes rarely undergo selective sorting at source, except occasionally for syringes, placentas and large surgical derivatives. While some centers practiced ditch burning and small-scale incineration, most final disposals are done in wild unprotected pits. These allow leaching to the water table with potential for proliferation of insect and rodent vectors, and development of diseases such as tetanus, typhoid, diarrhoea, hepatitis B, and substances toxic to humans, wildlife and the environment such as cyanides, dioxins, furans and heavy metals, i.e. mercury and lead.”

The preceding assessment is common in most West African countries. Meanwhile, forests of the sub-region contain highly efficient medicinal species of equal economic importance (Fig. 3). For example, making an economic case for West Africa's medicinal species, Liberia's Land Rights and Community Forestry Programme (USAID, 2009) reported that the gross revenue for country spice (*Xylopia aethiopica*) traders was US\$ 7,800/trader/year and that for black pepper (*Piper nigrum*, *P. guineensis*) was US\$ 5,000/trader/year, constituting incomes which could be improved in the advent of pursuing a green economy vision.

Also, West Africa contains institutions with the capacity and experience in synthesizing medicinal bio-chemicals from plants and trees. Examples include the Mampong-Akuapem Centre for Scientific Research into Plant Medicine in Ghana, the 'Applied Biomedical Sciences Institute' in Benin and others. Pursuit of a green economy vision may include advocacy for locally produced bio-chemical elements to replace some of the toxic medicinal compounds in lab-based medicines, as well as supply environmentally sensitive pharmaceutical companies with bio-stocks for the manufacture of medicines that meet the green economy aspirations of the sub-region.



Figure 3: Baobab leaves (high in vitamin A) or the fruits (high in vitamin C) ground into powder and packaged as pharmaceutical products or tablets - above.

Source: <https://en.wikipedia.org/wiki/Adansonia>

2.2 Value based forest ecological services

Forests provide multiple services including: water retention and supply, soil conservation, carbon sequestration, habitat for fauna and flora, resource for human recreation including cultural and spiritual values, etc. The importance and ranking of these services are different for each forest, depending on the site, forest type, accessibility, etc. Some services are functional only from large connected areas such as in watershed conservation and wildlife protection, while others can be provided by small patches such as in botanic gardens for rare plants or insects. Some services can be localized easily, such as soil conservation, while others may not, such as for wildlife. Some depend on invariable aspects such as topographic features for soil conservation, while others are based on variable aspects such as requirements of human communities in the form of cultural and spiritual needs etc. (Dhital and Schindele, 1996). The major services are described in the following sections within the green economy development context of West Africa.

2.2.1 Watershed conservation and development

A watershed is an area that receives rainfall and other forms of precipitation and then channels these downwards, along slopes to surface or underground water bodies i.e. streams, rivers, lakes, reservoirs, etc. The area generally includes riparian zones occurring along riverbanks, streams, and around lakes and wetlands. It also includes the water body as well as areas subject to periodic flooding and immediate adjacent uplands (Dhital and Schindele, 1996). Watersheds contain the highest plant and animal diversity and some of the most valued forest resources on the forest landscape, providing critical habitat and

travel corridors for mammals, reptiles, birds and other species, and maintaining ecologically important vertical and horizontal linkages on the forest landscape. Valuation calculations have revealed that the benefits of multiple watershed services tend to range between US\$ 200 and US\$ 1,000 per ha per year (European Communities, 2008), constituting relevant information to be factored in green economy related decision making.

Some of the major moist and dry forest watersheds in West Africa include: the Fouta Djallon Highlands, Niger River Basin, Senegal River Basin, Gambia River Basin, Volta River Basin, Komadugu Yobé Basin, Lake Chad Basin, and several others. Because of the precarious soil fertility associated with exceptional levels of biological wealth concentrated on watersheds within forest landscapes, their management should be planned with sustainability in view. Without compromising water yield, areas identified for human intervention as opposed to areas for state of the art conservation can be exploited as production hubs for biological or climate smart agriculture, such as using invasive watercourse species in compost making, biological livestock husbandry, biological horticulture, commercial floriculture and enrichment with valuable native tree species. Where the results of environmental and social impact assessment are favourable, water resources in the forest landscape may be exploited for electricity generation and irrigation. This visionary green economy approach is already under exploitation in some localities of the West Africa sub-region under the supervision of regional water basin organisations such as the Niger River Basin Authority, the Senegal River Basin Authority and the Volta River Basin Authority.

2.2.2 Biodiversity conservation and development

"Biodiversity can be defined as the diversity of plants, animals and other living organisms in all their forms and level of organization including genes, species, ecosystems and the evolutionary and functional processes that link them. Biodiversity does not entail merely the preservation of a few rare, endangered or interesting species, but rather the protection and conservation of the diversity of species, genetic materials, biophysical processes and ecosystem structures that together determine biological productivity and stability" (Dick and Yonten, 1996; Dhital and Schindele, 1996). The main tool for administering biodiversity conservation is the Protected Area Model, of which the major ones in West Africa include: the Taï and Comoé National Parks (NPs) in Côte d'Ivoire; Ankassa, Kakum and Molé NPs in Ghana; Sapo NP in Liberia; Gola and Outamba-Kilimi NPs in Sierra Leone; Mt. Nimba and Zياما NPs in Guinea; Cross River, Gashaga-Gumpti, Okomu and Lake Chad NPs in Nigeria; the W-Arly-Pendjari shared between Niger, Burkina Faso and Benin; Aïr et Ténéré in Niger; Saloum Delta NP in Senegal, and others. Protected Areas are classified in 6 management categories from 1a i.e. Strict Nature Reserve, to category VI i.e. Protected Areas with Sustainable use of Natural Resources. Their management is administered through 4 governance types namely: governance by government, shared governance,

private governance, and governance by indigenous peoples and local communities (IUCN/WCPA, 2015).

The development aspect of biodiversity conservation includes the promotion of biodiversity businesses, described as “commercial enterprises which generate profits through activities that conserve and use biological resources sustainably, and share the benefits arising from this use equitably” (IUCN, 2009). The overarching goal is to portray biodiversity conservation as a worthy and sustainable business model different from the negative perception characterizing it as a bottomless pit of investments which should otherwise finance direct social and economic development. Tested biodiversity businesses at the local conservation area include: collection and export of wildflowers, rearing and export of butterfly pupae to exhibitors abroad, wildlife cropping of simple species which attain excess carrying capacity levels, wildlife rearing including ex-situ planting of valuable wild tree species, etc. At the national or trans-boundary levels, business opportunities likely to promote the green economy vision include: the creation of Conservation Trust Funds, the practice of biodiversity offsets in which biodiversity or ecosystem degraders/defaulters pay for the restoration or rehabilitation of the degraded biodiversity or ecosystems, and payment for field research in conservation areas including for the collection of plant or animal samples for scientific purposes.

2.2.3 Carbon sequestration and development

Sequestration of carbon involves removing carbon dioxide from the atmosphere, where according to the United Nations Framework Convention on Climate Change (UNFCCC), 3.67 tons of carbon dioxide is equivalent to 1 ton of immobilized carbon. The UNFCCC's Kyoto Protocol's Clean Development Mechanism (CDM) advocates carbon sequestration by forests as a process that mitigates global warming. Carbon is also the central product in the determination of REDD+' benefits. Moreover, based on calculations from FAO (2015), forests of West African countries lost a total of 1,740,000,000 Tons of standing forest carbon in the 25 years period between 1990 and 2015, representing 29.6% of the sub-region's standing forest carbon stock in 2015. With the exception of Côte d'Ivoire, Gambia and Cape Verde which added net standing forest carbon gains of 26 million Tons, 3 million Tons and 1 million Tons respectively during the above period, all other countries of the sub-region experienced deficits, revealing insufficient investments to benefit from global carbon processes such as the Kyoto Protocol's CDM, REDD+ and others. Forest carbon is sequestered essentially by wild growing trees, domesticated tree species, afforestation or reforestation and through inclusive tree-based schemes with agriculture or livestock husbandry, referred as Agriculture, Forestry and Other Land Uses (AFOLU).

Forest carbon immobilization within the green economy context can generate benefits through market-based approaches and carbon price-based mechanisms such as: carbon offset schemes, carbon emissions trading schemes, scaled-up crediting schemes, and

carbon taxes (Bryan et al. 2008). The most common among these are carbon offset schemes, implemented either through 'Allowance-Based Transactions' or 'Project-Based Transactions'. In the case of Allowance-Based Transactions, carbon regulators create, allocate or auction emission allowances under cap-and-trade regimes, which are then bought by buyers. In the case of Project-Based Transactions, buyers pay for emission credits from projects that can prove that they effectively acquired greenhouse gas emission reductions compared to the level of emissions that would have been produced without the project (Bryan et al. 2008).

Project types in this category include: Improved Forest Management, REDD+, Afforestation and Reforestation, and Agroforestry under AFOLU. Both 'Allowance-Based Transactions' and 'Project-Based Transactions' can be funded under compliance schemes of the Kyoto Protocol's CDM, or Voluntary/Non-Compliance Schemes under the CDM and other schemes such as the Voluntary Carbon Standard. Voluntary schemes are characterized by less onerous technical procedures and include systems such as the Plan Vivo Scheme currently involved in a number of emissions reduction projects in Africa.

Meanwhile, the private sector is increasingly sought to engage especially in forest restoration. For example, in Ghana, where there are large tracts of highly degraded, publicly managed forest reserve land that will be difficult to recover using improved silviculture and natural regeneration, the government is actively exploring the possibility for some of such land to be used to attract private sector investments in commercial plantations (IUCN and WRI, 2014). Based on its restoration opportunities assessment methodology (ROAM), IUCN and WRI (2014) propose that private sector investments in forest restoration should be approached in a pedagogic manner, that is starting with a comprehensive evaluation to assess: the role and entry point for additional private sector investment, the extent to which barriers to private investment exist in the country and how they might be addressed in order to promote such investment opportunities; the investment potential of the restoration interventions emerging from the assessment so far; and sources of funds and risk mitigation instruments available for restoration in the country (IUCN and WRI, 2014).

2.3 Valuable forest related social services

According to FAO's FRA 2005, forest social services include: recreation, tourism, education as well as aspects related to cultural or spiritual importance (FAO, 2006). Also, according to Principle 2b of the Forest Principle's (previously titled The non-legally binding authoritative statement of principles for a global consensus on the management, conservation and sustainable development of all types of forests) Chapter 11 of Agenda 21 of UNCED, "Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations." (UN,

1992) The major social services provided by forests are described in the following sections within the green economy development context of West Africa.

2.3.1 Traditional ecological practices /intangible heritage assets and development

A comprehensive elaboration of traditional methods used in exploiting forest resources is beyond the scope of this section. The focus of this section is limited to the social or cultural services offered by forests and forest ecosystems. As such, traditional ecological practices or forest-based intangible heritage assets within the West Africa forest context include biodiversity festivals such as celebrations related to the birth of a revered forest species i.e. chimpanzee or naming of the new-born of a rare species i.e. forest elephant. They also include ritual festivals during initiation ceremonies in reserved forest areas, as well as celebrations during the seasonal communal collection of cherished forest species or specific products such as edible forest caterpillars.

Totem rallies as well as annual memorials celebrating certain forest related totems also fall within traditional ecological practices. Memorials can include festive periods when communities recall and celebrate spectacular relationships with particular forest fauna, flora or specific places of the forest related to their history or ancestry. Such memorials are mirrored at national and international levels by events such as the 'UN World Forest/Tree Day', 'UN World Biodiversity Day', 'UN Environment Day' etc. One characteristic common to these manifestations, especially those at forest-edge communities, is their potential to attract audiences seeking recreation, constituting an opportunity to generate income as contribution towards attainment of a green economy vision.

Forest related cultural events as narrated above are also described as cultural ecotourism and should necessarily be captured in forest and biodiversity conservation and management plans and publicized to attract visitors and consequently revenue for forest dependent communities. In addition to generating revenue, the preceding approaches constitute an opportunity for States and governments to create intangible biodiversity conservation assets for listing in the new United Nations Educational, Scientific and Cultural Organization (UNESCO) Intangible Heritage Register. When registered, these assets create a global window for international cultural ecotourism. Also, as a green economy venture, forest culture enterprises can include the manufacture and sale of communities' forest related totem gadgets, totem stickers, totem emblems etc. This is mirrored in the flags or seals of States and gadgets of emblematic species promoted by some international conservation organizations.

2.3.2 Ecological tourism and development

The International Union for Conservation of Nature (IUCN) defines ecotourism as: environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature and any accompanying cultural features (including

intangible cultural heritage) that promotes conservation, has low negative visitor impact, and provides for beneficially active socio-economic involvement of local populations (Vodenska, 2003). Some of West Africa's humid forest landscapes likely to attract forest ecological tourists include: Nigeria's Cross River and Yankari landscapes for their emblematic Cross River Gorillas; Guinea's Badair, N'Dama and Zياما; Côte d'Ivoire/ Liberia's Taï and Grebo; Liberia's Sapo; Sierra Leone/Liberia's Gola, Lofa and Mano; Guinea/Côte d'Ivoire/Liberia's Nimba and Ghana's Kakum and Ankassa landscapes for their relatively intelligent chimpanzees, forest elephants, pygmy hippos and duikers.

Some of the dry forest landscapes likely to attract ecological tourists include: the Niger/Burkina Faso/Benin' WAP landscape for its savanna elephants, big cats and West African giraffe (Niger), Sierra Leone/Guinea's Outamba-Kilimi/Madina-Oula landscape; Ghana/Burkina Faso's Molé/Nazinga/Kaboré Tambi and Côte d'Ivoire's Comoë landscapes for their forest-savanna elephants, chimpanzees, baboons, duikers, monkeys, and others. Ecotourism is yet to be developed in West Africa, currently handicapped by inadequate facilities, especially as reflected by poor road infrastructure. Consequently, West Africa occupies the last but one position among Africa's 5 sub-regions in so far as ecotourism is concerned. According to IUCN (2010), ecotourism in West Africa represents only 5% of the tourism sector of the sub-region.



Figure 4: Canopy walkway - Kakum National Park, Ghana.
(Facilities that promote forest-based ecological tourism)
Source: Musa Abu-Juam/Martin Nganje

Notwithstanding the challenges, there exists considerable potential for forest ecotourism business in West Africa. Opportunities around forest conservation areas include: (a) ecological lodges and related facilities to accommodate visitors; (b) shops for handicrafts made from local forest products; (c) visitor centers for student groups, researchers and

others; (d) sale shops for unique forest products such as spectacular tree pods and others; (e) forest wildlife sightings from tree canopy platforms (Fig 4); (f) visits to ex-situ plant and tree collections in botanic gardens and arboretums; (g) forest walks through popular sites i.e. waterfalls, sacred forests, spectacular trees, historic sites, spectacular archeological areas, and others. Generally, eco-tourists prefer clear wildlife landscapes, where they can watch “animal” wildlife.

In order for forest societies (where animal wildlife is usually less visible) to benefit more consistently from eco-tourism, the private tourism sector, may need to ‘bundle’ wildlife-rich forest landscapes with destinations of forest-savannah wild-lands that are usually richer in animal wildlife. Such an approach has the potential to include forest communities in income generation thereby contributing towards achievement of a green economy vision.

3. HOW FOREST ELEMENTS CAN CONTRIBUTE TO GREEN ECONOMY WITHOUT JEOPARDIZING SUSTAINABLE FOREST MANAGEMENT

Although progress is underway, most forest management activities in West African countries are still pursued in an opportunistic and sporadic fashion, without clearly stated objectives to guide assessment of success. As revealed in section 2.2.3 above, there is continuous loss of forest carbon and other productive functions of West Africa's forest ecosystems leading to concerns about the livelihood of societies and welfare of nations most dependent on these resources. The following sections describe how the functions of these forests can be maintained without endangering their productive capacity.

3.1 Food security and sustainable forest management

3.1.1 Conservative exploitation of edible forest commodities

Forest or wild food commodities characterized by relatively low energy and little or no chemical inputs for their production have been mentioned in section 2.1.1 of this report. In addition to fulfilling food security objectives, forest food sources are more resilient to climate change. Consequently, they constitute safety-nets for livelihood and human survival when drought scorches rangelands and locusts ravage agricultural fields, when floods and fires devastate landscapes, and when people are displaced by civil conflict, all resulting in widespread poverty. Though not limited to such conditions, the poverty level in West Africa induces human communities to frequently revert to these food sources. Despite their importance in food security and in providing employment, forest food commodities receive little or no strategic attention due, amongst others, to inadequate information on: their geographical distribution, wild resource stocks, disease impacts, regeneration capacity and productivity, market potential, networks and channels for their production, processing, storage, etc.

Notwithstanding these weaknesses, a project undertaken in Senegal between 1998 and 2004 code-named VALEURS "Promoting species for the sustainable use of wildlife resources", investigated the value of mostly wild food commodities at the national level and revealed that: the total annual value added from the harvest of non-timber, non-fuel forest products in Senegal ranged between FCFA 3.5 billion (US\$ 6.25 million) and FCFA 11

billion (US\$ 19.7 million), with a median of FCFA 4.5 billion (US\$ 8 million) or 14% of the reported output of Senegal's forestry sector in 2000 (Ba et al., 2006). Such exhaustive national level assessments are rare due to their high capacity requirements. It is however evident from Senegal's economic case for wild foods that such products are likely to contribute more than 10% of the forestry sector's total revenue in West African countries and therefore require active planning for their sustainable management, especially when adjusting towards greening the economies of the West Africa sub-region.

The process of issuing licences to individuals to collect forest foods from extractive reserves and national forests has not been effective in discouraging the use of irrational and destructive collection methods of these commodities in West Africa's forests. This is partly because adjacent forest communities would also collect such products without permits anyway. Sustainable management of forest food sources within a green economy context would require collectors to form extractive cooperatives followed by their incorporation, registration, and eventual training in enterprise development and management. It is such cooperatives that are expected to sign resource management contracts with governments, and local conventions with other wild food stakeholders. Contracts with governments may include responsibility by cooperative groups to monitor and report illegal collectors and poachers. The wild foods sub-sector still needs research to inform policy and consequently development of the appropriate legal framework for related activities. It should however be noted that institutions have been created in some West African countries to pursue this function. Examples include: the 'Centre d'Etudes, de Recherches et de Formation Forestières established in Benin in 2010, with the mandate, amongst others, to conduct Non-Timber Forest Products (NTFPs) census/inventory and research on the valorisation of NTFPs (Assogbadjo and Vodouhe, 2016). Such specialized institutions are needed in other West African countries to generate forest food related information that could support policy development and for other purposes.

3.1.2 Systematic reforestation and rational use of floodplains for enhanced fisheries

The native landscapes of virtually all deltas and lakes in West Africa include adapted indigenous tree species and forest stands. These flood forests have dwindled over time as a result of climate change, drought and anthropogenic pressure manifested by excessive exploitation for domestic use. The case of the Inner Niger Delta of Mali (35,000 km²) is compelling as it lost more than 90% of its indigenous stands of *Acacia kirki* flood forests before and during the drought of 1982/83 from overharvesting for domestic use. The Delta itself is characterized by seasonal floods corresponding with the height of the fishing season, and low tides corresponding with the height of the grazing, swamp rice and vegetable cultivation season (Nganje, 2014). It was only at the end of the drought in the late 1980s' and full return of floods accompanied by persistent poor fisheries, poor soils for horticulture and poor pastures for livestock that studies linked poor yields to the absence of

hundreds of thousands of migratory birds which used the flood forests as roosting and brooding site (Fig 5).

When the forests were restored in the 1990s', the birds returned and the effect of their massive droppings on fisheries, soil fertility for horticulture and pastures for cattle once more led to improved yields of the different sectors (Nganje, 2014). According to Yafong et al. (2009) and Nganje (2014), the area once more thrives with fishermen, horticulturists, cattle grazers and tourists. In addition to the importance of birds, fish consume the foliage of flood forests as fodder. This case reveals that even the modest forest function of roosting site for birds, when it is underestimated and whole forests removed, can set in motion a spiral of poverty and hunger in neighbouring communities and townships. SFM principles require that reforestation in flood plains be undertaken mainly with native flood forest species.



Figure 5: Cattle Egret birds on Acacia kirki trees during high tide on the Inner Niger Delta of Mali. (The droppings of migratory birds from flood forests have been associated with rich fisheries, rich pastures and highly productive horticulture)

Source: Martin Nganje

3.1.3 Planned greening and sustainable use of agricultural systems including agroforestry

The importance of trees and forests in agricultural production systems has been recognized by several West African countries. In Ghana for example, a National Agroforestry Policy was developed as early as 1986 (Asare, 2004). This led to the institution of an Agroforestry Unit in the Crops Services Department of the country's Ministry of Food and Agriculture, a National Agroforestry Committee, an Agroforestry Technical Sub-Committee and Regional and District Agroforestry Committees. According to Asare (2004), despite the comparative superiority of agroforestry yields in several research and adaptive research settings in Ghana, the schemes' "impact in reducing deforestation, land degradation, and improving small-holder farmers' livelihoods is yet to be fully realized".

This observation is true of many West African moist forest countries, and is explained as largely due to insufficient capacity of government agricultural and/or forestry extension agents to provide adequate advice on schemes still awaiting adapted research results for different agro-ecological zones. The challenge of collaboration between agriculture and forestry government services also appeared to constitute a challenge. It should be mentioned that agroforestry has been successful in Sahelian countries, where for example as revealed by an AFF study in 2015 (Nganje, 2016), technological adaptations and adoption of processes such as hedgerows, windbreaks and fodder banks in parklands and alley cropping farms as well as tree and crop rotations, coppicing, enrichment planting produced better agricultural crop yields (MEDD – Burkina Faso, 2011; Nganje, 2016).

Another form of agroforestry known as 'Modified Taungya' has been advocated as an organized intercropping system that combines woody tree species with food crops in the early years of forest plantation development by communities, usually undertaken on government land (Nganje, 2014). Community members lacking arable land enter a convention with government forestry officials to plant their annual crops (and trees for government) on fertile national land to be vacated when the tree canopy starts shading light off the annual crop.

In all accounts, crop yields in properly managed agroforestry schemes have mostly been superior to those from pure agricultural schemes, even when supplemented with inorganic fertilizers. For example, Popoola et al. (2016), reported that the benefit cost ratio (BCR) for cassava in an agroforestry alley-cropping scheme undertaken in 1993 in some plots in Nigeria was 4.5 while production of the same in other fields and with inorganic fertilizer plots yielded a BCR of 4.1; and production of same in other fields without fertilizer yielded a BCR of 3.2. Similar superior performance was observed for maize produced in alley-cropped plots that yielded a BCR 2.06 against a BCR of 1.93 for production of the same in other fields supplemented with inorganic fertilizer; and for other fields that did not receive inorganic fertilizer the BCR was 1.67 (Popoola and Enabor 1993; Popoola et al. 2016).

Considering the preceding analyses, greening agricultural production schemes, including through climate smart agriculture, as a pathway towards green economy should: (a) ensure collaboration and joint planning between government agriculture and forestry departments, (b) capitalize and document all agroforestry experiences with support from the relevant research organizations. This should include development and distribution of technical and descriptive information on the different agroforestry schemes and techniques for their wide uptake, (c) update the job descriptions of agricultural and forestry extension agents and ensure their adequate training, including training of trainers, in agroforestry development, and (d) develop and implement a strategy for production and multiplication/upscaling of the relevant agroforestry tree species for the different agro-ecological zones.

3.1.4 Planned greening of rangelands and pastoral schemes for enhanced livestock husbandry

Fodder shrubs can easily be grown, they require relatively less land, labour and capital for their production and generate numerous by-products often ready to be used as cattle feed within a year from planting (Franzel et al., 2013). The bigger fodder trees meanwhile develop roots that tap water from the deeper soil layers with some, such as *Faidherbia albida*, staying green during the dry season and therefore capable of providing cattle fodder in the drought-prone rangelands of the Sahel. During such droughts however, West Africa's pastoralists indulge in the age-old tradition of transhumance, i.e. moving livestock across national internal and external frontiers in search of greener pastures. This has become a strongly cultural phenomenon.

In their study on: "Fodder trees for improving livestock productivity and smallholder livelihoods in Africa", Franzel et al. (2013), noted that pastoralists in southern and eastern Africa, as well as the horn of Africa, purposely plant trees and shrubs to produce fodder for cattle. The authors cite Boffa (1999), who reports that cattle breeders of the West Africa Sahel do not purposely plant trees for cattle fodder, preferring instead to harvest from naturally growing stock. While the situation may be changing gradually, there appears to be a cultural challenge to overcome in West Africa's cattle breeding communities as the sub-region organizes around the pursuit of a green economy vision.

Recent discoveries in the propagation of fodder tree species need to be adopted or adapted in West Africa's cattle breeding communities. As an illustration, in Dan Saga communities in Niger, farmers no longer over-plough their land, a process which included cutting-back sprouting roots of trees burnt several decades ago. They indulge instead in minimum tillage which encourages root sprouts of trees, a process which keeps the soil surface firm against wind erosion, to which they had consistently lost crop seeds. Seedlings from root sprouts are hitherto selectively managed on the agricultural landscape. While this may be good news for farming communities, cattle rearing communities are still plagued by cultural challenges, such as the perception of trees as propagators of tsetse flies. In order to resolve

challenges of rarity of cattle feed due to over-cutting and over-browsing of fodder trees, Ky-Dembele et al. (2016) conducted experiments to identify the most appropriate multiplication methods for some species used as fodder in the Sahel. The researchers experimented with stem-cuttings of the most browsed and cut fodder species and discovered that the most responsive to vegetative propagation by stem cuttings were: *Pterocarpus santalinoides*, with a stem rooting percentage of $88\pm3\%$, *Pterocarpus erinaceus* ($37\pm4\%$), *Pterocarpus lucens* ($31\pm5\%$) and *Balanites aegyptiaca* ($26\pm6\%$). Deep planting of large diameter (15-20 mm) stem cuttings of *Commiphora africana* also gave a high rooting rate of $78.3\pm4.4\%$ (Ky-Dembele et al. 2016). While more research is needed, there is enough information to start propagating fodder species as a green economy pathway in cattle rearing communities of West African countries.

3.2. Sustainable exploitation of forest assets for economic and social development

3.2.1 Sustainable use and bio-trade in forest-foods, biomedicines and cottage products

According to UNEP (2013) in Popoola et al. (2016), trade in biodiversity-based businesses or bio-trade refers to those activities of collection, production, transformation and commercialization of goods and services derived from native biodiversity under the criteria of environmental, social and economic sustainability. In West Africa generally, the collection of forest foods, biomedicines and forest cottage products is characterized by unsustainable methods. For example, a 2013 field study in Liberia, (Nganje, 2013) noted that “collectors of black pepper (*Piper guineensis*, *P. nigrum*), and country spice (*Xylopia aethiopica*) frequently cut down vines and fell trees respectively, to facilitate and maximize their harvests”. These species meanwhile, are prominent bio-medicines. For example, country spice is anti-microbial and anti-fungal and is used in the treatment of coughs and other infections (Nganje, 2013). Also from the Liberian study there was noted increasing trade between local producers and especially business people from Asia in species such as: black pepper, grains of paradise, country spice, *Aframomum melegueta*, *Thaumatococcus daniellii*, and *Voacanga africana*.

The resource sustainability challenges of this sub-sector, common to several West African countries, include: (a) elusiveness and informality characterizing transactions in the forest foods, bio-medicines and cottage industry domains, (b) inadequate policy environment, (c) unsustainable harvesting due to inadequate capacity of collectors, (d) poor organization of producers, (e) near absence and incapacity of forestry extension services to provide guidance, (f) inadequate processing facilities, and (g) product demands originating from environmentally insensitive markets.

Organized bio-trade in forest-foods and bio-medicinal commodities has the potential to achieve both SFM and development goals by increasing the value of forest resources to local communities (Angelsen and Wunder, 2003; Popoola et al., 2016). Popoola et al. (2016), notes that there are no programmes on sustainable harvesting of forest foods, medicinal and cottage industry commodities except in parts of northern Nigeria for Gum Arabic from *Acacia senegal* trees. Achieving sustainable management and development at the resource collection level may involve: (a.i) organization of collectors into collector-cooperatives. This may require registration with the appropriate government ministerial departments, (a.ii) training of collectors in harvesting techniques through projects or by the appropriate forestry or agricultural extension services, and (a.iii) zoning and scheduling of collection frequency. The sustainable production level of the referred commodities may include: (b.i) decentralization in natural resource management and institution of adequate land and tree tenure processes, (b.ii) establishment of sustainable extractive reserves based on simple management plans for the referred species, (b.iii) domestication of major forest food, bio-medicinal and cottage industry species, (b.iv) establishment of equitable benefit sharing processes, (b.v) establishment of product certification arrangements, and more. Sustainable transformation of products from forest food, bio-medicinal and cottage industry species may involve: (c. i) using appropriate equipment in the hands of well-trained persons, (c.ii) organizing and using cooperative infrastructure to cut down costs, and (c.iii) collecting waste and recycling into agricultural or livestock inputs, amongst others. Sustainable commercialization of the byproducts of forest-foods, bio-medicines and forest cottage species may require: (d. i) organizing producers into business enterprises, (d.ii) using fiscal measures to promote business with environmentally sensitive market outlets, and (d.iii) using market intelligence i.e. mechanisms to ensure that market prices are freely circulated to inform decision making.

3.2.2 Sustainable exploitation and development of industrial wood markets

According to Gondo (2012), there is little evidence over the last 60 years that proceeds from the industrial wood sector have lifted rural populations out of poverty or contributed significantly and sustainably to local development in sub-Saharan Africa. This is attributed to a number of factors including: (a) illegal activities and corruption, (b) inadequate governance systems, (c) low levels of transformation, (d) low wages, (e) marginalization of rural communities, and (f) low forest investments leading to declining revenue. In Côte d'Ivoire for example, with an annual production of 5 million cubic meters (m³) in the 1970s, timber was the second export earner after coffee in the country. By 2000 however, timber production in the country had dropped to 1.8 million m³ per year (AGRIFOR Consult, 2006). Forest production in the country continued to decline even as other industrial sectors expanded, and by 2008, timber was down to sixth place (5%) among the country's industrial sectors behind agro-industries (33%), chemicals (28,5%), electric energy (8,9%), water (8%) and metals – 5,3% (Fonds Monétaire International, 2009). In Ghana, the timber industry is plagued by overcapacity i.e. under-supply of primary wood products. Its

operational capacity is believed to be in excess of 2.5 million m³ of wood on an annual basis compared to the abysmally low present annual cut of 1.1 million m³. Consequently, many timber companies are operating below maximum capacity leading to inefficiency, a situation compounded, amongst others, by low forest investments and high levels of waste (TIDD, 2011; Tufuor, 2012).

Results of related AFF studies carried out in 2016 to identify the contribution of forests to a West Africa green economy vision, Popoola et al. (2016) and Assogbadjo and Vodouhe. (2016) acknowledged a number of industrial wood sector interventions favourable for SFM. They include: (a) using trained and experienced personnel in all field operations, (b) improving efficiency in wood harvesting by using reduced impact logging techniques such as, (b.i) cutting-off lianas from target trees to avoid them pulling down untargeted trees, (b.ii) collecting cut boles and main branches from the forest rather than taking out only the boles, (b.iii) avoiding principal seed trees including special species e.g. *Tieghemella heckilii* and *Klainedoxa gabonensis* whose fruits constitute feed for emblematic species such as elephants also disseminated by these animal species, (b.iv) avoiding felling trees on slopes greater than 25° and along waterways, and (b.v) use of appropriate cutting and log hauling equipment. Specifications in forest management plans and operational cutting schedules should however be respected, (c) improving efficiency of wood processing by (c. i) using appropriate equipment in the hands of trained and experienced experts, and (c.ii) avoiding waste by reusing residues such as wood off-cuts, sawdust, wood shavings and discarded logs. According to Popoola et al. (2016), such wastes can be transformed into marketable briquettes, flooring parquets, broomsticks, mirror frames, toys and reconstituted wood products such as chipboard, block boards and others. The application of finger-jointing and value-adding technologies to wood residues would enhance their efficient utilization, create new jobs and generate revenue which can be reinvested in forest management to advance the green economy vision. Resource sustainability and good governance in the industrial wood sector will also be achieved by (d) engaging forest and forest product certification, and (e) involvement of the press and media, including through press conferences, to systematically inform the public on activities of the sector thereby ensuring accountability and governance.

3.2.3 Sustainable fuel-wood exploitation and improved energy efficiency

According to various studies, fuelwood and charcoal constitute an insatiable market, remaining by far the first energy source of households and representing approximately 80% of the energy use in sub-Saharan African countries (Bonkougou and Yao-Gnabeli, 2010). As an example, results of a preceding AFF study undertaken in 2016 within the West Africa green economy context revealed that fuel-wood and charcoal account for about 60 % of Gambia's energy supply and more than 90 % of the country's household energy consumption (Jarju ,2008; Popoola et al., 2016). In 2005, the technical potential for sustainable fuel-wood production in Gambia was estimated at 209,000 tons/year for an

aggregated demand of 734,400 tons/ year, resulting in a considerable gap of 525,400 tons/year (Jarju, 2008; Popoola et al., 2016). This led to overexploitation of native forests and charcoal imports from Senegal. In Ghana, the bulk of energy consumption is based on fuelwood, of which 90% is obtained directly from natural forests, constituting a major driver of forest degradation (UNEP, 2013; Popoola et al., 2016). Ghana's Energy Commission (2006) reported that the nation's consumers spent between US\$400 – 600 million on fuelwood between 2000 and 2004, implying an annual average of US\$ 125,000,000 during the referred period. This assessment is mirrored in all West African countries.

Cutting trees for the supply of domestic energy in West African countries is currently inevitable. The increasing demand by urban households for firewood and charcoal has given rise to organized, but mostly informal, networks for the production, transport, commercialization and distribution of these products. In countries where such networks are officially recognized, such as the 'rural wood markets' of Niger, local communities form cooperatives, procure wood from forest concessions under management plans and sell to urban centers. Such an approach which cuts off unscrupulous middlemen reportedly contributes to alleviate poverty in a green economy context.

However, the problem of inefficiency in the fuelwood sector arises from: (a) the wasteful use of fuelwood, and (b) the inappropriate transformation of wood to charcoal. The wasteful use of fuelwood is tackled by: (i) improved wood cooking stoves, (ii) putting off fires immediately after cooking, and (c) using wood-ash remains in biological agriculture; while inappropriate transformation of wood to charcoal is tackled by (i): use of improved kilns, and (ii) adequate training and improved capacity of processors. According to a study commissioned by the AFF in 2015 (Nganje, 2016) showed that:

“Traditional carbonization kilns that burn wood underneath mounds of thatch and soil only account for a wood to charcoal transformation efficiency rate of about 18% , i.e., 5.5 kg of wood yielding 1 kg of charcoal (Sow, 1990; Nganje, 2016). Brick kilns, common in dry forest countries of West Africa, have a conversion rate of up to 50%. The Mekko kiln, made of metal casing, has the ability to conserve most wood byproducts during combustion, with a wood to charcoal conversion ratio of upwards of 75%”.

(Kalenda et al., no date; Nganje, 2016).

Irrespective of the proficiency in fuelwood use and efficiency of kilns, firewood and charcoal production must be based on long-term forest management plans that are guided by rotation cycles; where short to mid-term cutting operations are based on actual needs, and plantings are based on expected demand in future years.

3.2.4 Sustainable exploitation of intangible heritage assets and ecological tourism

Traditional ecological practices (forest-based intangible heritage assets) may be beneficial for SFM, such as through their regulatory processes which translate as restrictions in the use of revered species and prohibition from harming or consuming them. Examples include sacred forests containing revered species such as in Côte d'Ivoire's Kolodio-Tabagne sacred forest and several others (Gomé, 1998). Such landscapes, in addition to forest related cultural practices mentioned in section 2.3.1 of this report, can be exploited in cultural ecotourism to generate revenue for communities and governments. However, traditional ecological practices may also contribute towards unsustainable forest management such as through the use of ritual, where for example, fire may be used to burn small or large forest landscapes as an offering to a deity. Similarly, while ecological tourism is sought and promoted for its potential to generate revenue that can serve in the promotion of biodiversity conservation, SFM and community livelihood sustenance, it is also associated with forest and natural resource stress and trauma. Traumas are instigated when visitors abandon litter in forests, inappropriately collect tree parts for research or as trophies, or indulge in excessive noise which traumatizes forest wildlife likely to affect their reproductive ability.

Research on streamlining traditional ecological practices in conventional forest conservation undertaken in Ghana revealed that under increasing population and globalization, conventional forest conservation initiatives alone will be unable to achieve long-term success in sustainable forest and biodiversity management of adjacent community areas, even as conservation-friendly traditional ecological practices alone will not succeed without conventional forest management initiatives (Nganje, 2012). This suggests the need to conjugate conservation-based traditional practices and conventional forest conservation efforts for successful long-term management of forests, especially the adjacent community areas. Success is based on the principle of "selective attention," which postulates that people will take responsibility for issues that support their values, group attitudes and decisions (Worchel et al., 2000).

Taking into account community values in forest planning and management has the potential to commit communities to such plans and in their execution. Nganje (2012) also informed that the reason favourable traditional forest conservation practices are not included in forest management plans is because of the limited knowledge and skills of forest management planners in handling the 'ecological technology' of communities.

The way forward in advocacy for a green economy approach is to build the capacity of conventional forest managers in handling favourable traditional forest management practices using task analysis. The approach consists of breaking down traditional conservation practices into tasks, similar to criteria and indicators (C&I), for inclusion in operational forest plans. With respect to the negative practices of ecological tourism on

SFM, these should be contained through legislation, implemented through organized sensitization on the impacts of forest litter, inappropriate forest collections, pollution, noise and other unplanned activities on forest habitats and species.

3.3 Sustainable development of forests for environmental stability and security

3.3.1 Rational exploitation and conservative management of forest biodiversity

Forests are biotic communities characterized by trees operating in complex functional ecological settings. They constitute the world's largest and most important terrestrial ecosystems, with the largest reservoir of plants and animals on land (Loo, 2011). The survival of biodiversity in forests is facilitated by ecological processes that include: micro and macro climate regulation, water supply of acceptable quality and quantity, good soil water percolation and erosion control, soil nutrient cycling, plant pollination and dispersal of reproductive plant parts, pest and disease buffer, and genetic information storage.

West Africa's forests are one of the most diverse on this planet, ranging from the low-lying mangroves on the Gulf of Guinea through the Guinean Moist Forests known as the cocoa belt, to the montane forests of the Nimba and Gola, and upwards to the Acacia forests of the Sahel. These forests host an important variety of endemic biodiversity such as the spectacular West African Giraffe, the exclusively endemic pygmy hippo, highly threatened species such as the Jentink's duiker, relics such as the Mount Nimba lesser otter shrew, and flagships such as forest/savannah elephants, chimpanzees and more. Moreover, biological assessments carried out in 1999 for the West Africa forest, revealed that the level of endemism attained by mammals, vertebrates, birds, plants, reptiles and amphibians of these forests is exceptional (Conservation International, 1999). It is around swaths of these forests, set aside as biodiversity conservation landscapes, that biodiversity businesses expected to contribute towards a forest-based green economy narrated in Section 2.2.2, thrive or are expected to flourish.

According to data from FAO (2011) by Popoola (2016), the area of forests designated primarily for biodiversity conservation in West Africa rose from 14,672,000 ha in 1990 to 14,972,000 ha in 2000 and to 15,328,000 ha in 2010. This represents annual increases of 30,000 ha for the period between 1990 and 2000 and 36,000 ha for the period between 2001 and 2010. These positive changes are usually the result of advocacy campaigns by conservation organizations. Generally, after the successful advocacy leading to new conservation legislation and the gazettelement of new biodiversity conservation areas, the advocacy ends, leading to the proliferation of "Paper Parks". It is essential to obtain sustainable funding for gazetted forest landscapes, by for example, creating the appropriate environment for financial mechanisms such as conservation trust funds.

Meanwhile, an AFF study undertaken in 2017 (Nganje, 2018) identified threats to the sustainable management of trans-boundary moist and dry forest landscapes prioritized by stakeholders, relevant to this section, as follows: (a) incursions for wood harvesting and improper removals of NTFPs, (b) wildlife related crime and poaching, (c) incursions for artisanal mining and quarries, (d) invasion by refugees or internal migrants, (e) encroachment by expanding local settlements, (f) encroachment by traditional agriculture, (g) poor management due to inadequate capacity and outdated or inexistent management plans, (h) wildfires, (i) encroachment by transhumance and excessive grazing, (j) invasive species, forest or wildlife diseases and pests, and (k) land-use conflicts and problems of tenure. Nganje (2018) proposed, among others, that: ‘forest biodiversity management initiatives’ should design strategies where possible, to convert threat enablers into SFM advocates. The author described detailed proposals in this regard that are expected to expand sustainable forest biodiversity management partnerships.

3.3.2 Sustainable management of watersheds

The role of forests in the protection of water resources is complex, with some research revealing that forests are net water consumers on the landscape, responsible for reduced water yield in headwaters and watersheds (Scott et al., 2005, in Bonell and Bruijnzeel, 2005). Planting trees with the objective of protecting water resources is now known to be effective only on landscapes with little or no vegetation and limited water infiltration capacity, i.e. more than 40% runoff in which case the forest stand will enhance water infiltration, or on steep slopes where the forest stand has the capacity to check sedimentation and siltation in water bodies downhill (Scott et al., 2005). Based on the preceding conditions, forest functions on watersheds can be summed as: regulation of water flow into rivers and lakes, control of sediment yield, maintenance of water quality, and reduction of the risks of floods (FAO, 2006).

Conserved water has marketable demand for human consumption, irrigation for agriculture, livestock production, generation of hydroelectric power and multiple uses by first and second level industries. All of these functions can generate revenue with a significant potential to contribute towards a green economy. Consumers of water resources protected by forest watersheds should contribute in the sustainable management of such watersheds, most of which are currently facing different types of challenges. Some of these include: chemical and/or organic pollution of surface and /or underground water, reduction in water-flow, drying-up of water courses, ponds, marshes and lakes, etc.

According to data from FAO (2011) by Popoola (2016), the area of forests designated primarily for water and soil protection in West Africa dropped from 2,529,000 ha in 2000 to 2,417,000 ha in 2010 implying a loss of 112,000 ha in the referred period. As indicated in the preceding paragraphs, undertaking forest restoration on watersheds without scientific

considerations may leave such landscapes with permanently reduced levels of water in their aquifers and reduced stream discharges.

As advocated in the 1992 Rio Earth Conventions, sustainable management of forest watersheds must not be sectorial but involve all stakeholders on the landscape through an 'integrated water resources management approach (GIRE – in French)'. Decisions are necessarily based on assessments of the impacts of water related issues on the landscape through the 'Water Resources Issues Assessment Method (MERQUIRE – in French)'. Examples include, for each problem: assess its extent and magnitude of its impact, i.e. its permanence or temporal nature, its reversibility or irreversibility and whether it is cumulative or not, etc. Based on results of scientific assessments, multipurpose species such as *Faidherbia albida* whose stand transpiration represents only about 5% of the annual rainfall (Roupsard et al., 1999) and fire resistance capability could be promoted for restoration on denuded dry forest slopes. The problem of wildfires on West Africa's major watersheds could be tackled, amongst others, through legislation that promotes sensitization and voluntary community-based fire-fighting squads.

3.3.3 Rational exploitation of climate related processes

According to the UNFCCC, greenhouse gases, especially carbon dioxide, accumulating in the earth's atmosphere are the cause of rising global temperatures and consequently climate change. The faster and more these gases accumulate in the atmosphere, the more rapid global climate change will be experienced with increasingly negative than positive consequences on all life forms on earth.

According to FAO (2010), 1/5 of all greenhouse gases released into the atmosphere come from deforestation and forest degradation. Notwithstanding, forests have a significant ability to remove carbon dioxide from the atmosphere, and they contain more carbon than the entire atmosphere, assessed at 650 billion tons, of which 44% is immobilized in biomass, 11% in dead wood and litter and 45% in the soil (FAO, 2010). While climate change has the potential to negatively affect forests, afforestation and reforestation have the potential to remove carbon dioxide from the atmosphere and consequently mitigate climate change. In West Africa, where the frequency and intensity of wildfires is increasing, river discharges declining and droughts more frequent, the impacts of climate change, whether biophysical, social or otherwise constitute a source of concern.

A funding scheme initiated during the climate Conference of Parties in Montreal in 2005 and specified by the Bali Plan of Action in 2007 to compensate individuals, communities, projects and nations for reducing greenhouse gas emissions related to forests, through avoided deforestation and degradation in developing countries is the REDD+ mechanism. It expands the limited funding scope of the Kyoto Protocol's CDM mechanism which did not include avoided forest degradation. REDD+ therefore presents an excellent funding

opportunity for countries in West Africa to protect forests and ensure their contribution to a green economy (Popoola et al, 2016).

Major forest management challenges related to the REDD+ mechanism include: (a) leakage, which is essentially the displacement of deforestation and/or forest degradation from the project to a site elsewhere in order to accommodate the REDD+ project. Solutions include ecological safeguards such as creating additional forest carbon sinks above what is envisaged for the REDD+ scheme. Generally, reliable baselines would be necessary to monitor for leakage and REDD+ initiatives should be able to reveal measures to predict, avoid, reduce, mitigate, measure and monitor leakage, (b) additionality, which ensures that the REDD+ scheme sequesters forest carbon above and beyond what would have happened under the business as usual scenario. Examples include forest regeneration after felling or protection of a wetland already programmed as fulfilment of a national, regional or international legislative commitment, (c) permanence, which essentially deals with the potential for carbon loss from the REDD+ scheme due to fire, pests and diseases and other vices. Solutions include mixing diverse forest species in the REDD+ scheme, using fire tolerant species and fire control regimes advocated by the REDD+ scheme, (d) monitoring-reporting-verification (MRV), which essentially concerns challenges in the adequate measurement of carbon sequestered by the REDD+ scheme.

As narrated in the preceding sections of this report, negative anthropological activities in forest environments alongside climate change constitute threats to forests. Adaptive measures to enhance forest and forest ecosystem resilience to such threats include: maintaining sufficiently large forest blocks and ensuring connectivity between blocks, avoiding forest fragmentation and high intensity forestry, identifying keystone species in forest blocks and undertaking special protective measures to keep them in ecologically optimal populations (Noss ,2003), and maintaining natural fire regimes and diverse gene pools.

3.3.4 Planned greening and use of urban spaces for recreation, leisure and development

The main schemes targeted for greening in this section include: urban parks and new botanic gardens for the possibility that they offer in generating revenue from access fees and sale of forest biodiversity gadgets. In an AFF study undertaken in 2015, (Nganje, 2016) identified secondary schemes that could be greened for improved mental and physical health. They include: floral sanctuaries, traditional cultural centers and related spaces, and along avenues and roads in township centers. In addition to health benefits, parks, gardens and the secondary schemes were justified for serving the purposes of research and education, recreation and tourism, scenic beauty, shade, windbreaks, cultural and spiritual purposes, and for the provision of NTFPs through their fruits and seeds. The choice of tree species depends on the desired objective of each scheme (Nganje, 2016).

While greened urban parks and botanic gardens can create additional green jobs and provide net financial profits, the challenges are enormous, with each scheme requiring highly trained and experienced landscaping architects for its conception and rollout. Their management, usually the responsibility of municipal agencies, is intensive with work undertaken on an hourly basis, such as: getting rid of litter from visitors and general cleaning services, up-keep of lawns, providing public relations, information and guidance services. Such facilities exist in some countries of West Africa such as the Aburi Botanic Garden in Ghana, the Bangr-weogo urban park in Ouagadougou – Burkina Faso, and others. Pursuing a green economy vision should include developing such facilities in the major towns and cities of West African countries as well as in smaller towns and villages with the potential for ecological tourism.

4. KEY PLAYERS AND CAPACITY NEEDS TO FACILITATE CONTRIBUTION OF FORESTS TO GREEN ECONOMY

The Organization for Economic Cooperation and Development (OECD) defines capacity as “the ability of people, organizations and society as a whole, to manage their affairs successfully” (OECD 2012). It is acquired at three levels, namely: the individual, the organizational and the enabling environment levels. Most forestry policies of West African countries have either prepared the environment for stakeholder involvement and/or proposed their roles and responsibilities for policy implementation. For example, the Benin forestry policy states that after institutional diagnosis, it will be necessary to reflect on the division of roles among different actors to ensure improved forest resource management and governance. The policy notes that within each category of actors, the required institutions will have to be created, restructured and/or reorganized taking into account, on the one hand, their ability to implement the critical roles of SFM, and on the other hand, fulfilling new functions associated with the devolution of powers for decentralized forest management. This is pertinent taking into account the disengagement of government from activities of production, processing, transport and marketing of forest products, to focus on its statutory functions of definition of policies and standards, formulation of strategies, and control, monitoring and evaluation, forward planning and guidance, and stakeholder support and supervision (Assogbadjo and Vodouhe, 2016).

An example worth emulating is that of the Niger government, which has identified local communities in their various groupings as the fundamental actors in the implementation of its forestry policy. They are variously described as:

“Farmers, agro-pastoralists, pastoralists, men, women, young, sedentary, transhumant or nomadic villagers, whose incomes are directly related to or affected by the local production, conservation and marketing of natural resources. In practice they include all those who live in or around rural riparian forests or are directly concerned by the management of such resources. Beyond individuals and families, there are traditional organizations like the traditional chieftaincy, which sways authority in land allocation and related decisions in natural resource management. There are also formal or informal professional organizations established by development projects initiated around economic or social activities. They evolve according to current policies and prevalent situations and include: village associations, local natural resource management structures, cooperatives, user

groups, natural resource management committees, various professional associations, federation of unions, rural producer unions, tontines, and local mutual savings and credit unions”.

(Ministère de l’Hydraulique et de l’Environnement du Niger, 2012)

The following section describes four fundamental groups of actors expected to directly support engagement of forests in green economy development. They include (a) biomass producers, (b) forest commodity processors, (c) forest services’ promoters and processors, and (d) marketing and cross-cutting service providers. The basic capacity requirements for each of these groups as well as that of their fundamental supervisory authorities are variously described.

4.1 Forest biomass producers and capacity requirements

Primary biomass producers targeted for capacity enhancements include: (a) individual and private sector afforestation and reforestation biomass producers as well as their supervisory authorities, namely: the departments of forestry, municipal authorities, parliament and the departments of finance, (b) individual and private sector agroforestry scheme producers as well as their supervisory authorities, namely: forestry departments, agricultural departments, and municipal bodies, (c) individual and private sector tree and forest livestock fodder producers and their supervisory authorities, namely: the departments of livestock, pastures and animal industries, and (d) individual and private sector forest commodity collectors as well as their supervisory authorities, namely: forestry departments and municipal bodies. The challenges, capacity needs at the personal and private sector levels as well as at the organizational level for supervisory authorities is reported under Annex 1 of this report.

4.2 Forest commodity processors and capacity requirements

Forest commodity processors targeted for capacity enhancements include: (a) individual and private sector forest food processors as well as their supervisory authorities, namely: forestry departments and the departments of industry and commerce, (b) individual and private sector charcoal and firewood processors as well as their supervisory authorities, namely: forestry departments, the departments of industry and commerce, municipal bodies and the departments of finance, (c) individual, small and medium-sized enterprises (SMEs) and industrial level timber processors as well as their supervisory authorities, namely: forestry departments, departments of SMEs, municipal bodies and departments of finance, and (d) individual and private sector forest medicinal and aromatic products processors as well as their supervisory authorities, namely: forestry departments, departments of public health and the departments of industry and commerce. The challenges, capacity needs at

the personal and private sector levels as well as at the organizational level for supervisory authorities is reported under Annex 2 of this report.

4.3 Forest services' promoters and processors and basic capacity requirements

Promoters and processors of forest services targeted for capacity enhancement include: (a) forest biodiversity conservation promoters i.e. conservation managers and their supervisory authorities, namely: the departments of wildlife and nature protection, departments of forestry, departments of finance, and parliament, (b) forest watershed protection promoters such as community leaders and project managers as well as their supervisory authorities, namely: departments of water and hydraulics, departments of forestry and municipal bodies, (c) individual and private sector forest carbon sink promoters and their supervisory authorities, namely: the departments of forestry, industry and commerce, and parliament, (d) individual and private sector ecological tourism entrepreneurs and their supervisory authorities, namely: the departments of tourism, wildlife and forestry as well as municipal authorities and the departments of roads and public infrastructure, (e) individual and private sector intangible heritage promoters, and their supervisory authorities, namely: the departments of tourism, wildlife and forestry as well as municipal authorities and the departments of roads and public infrastructure. The challenges, capacity needs at the personal and private sector levels as well as at the organizational level for supervisory authorities is reported under Annex 3 of this report.

4.4 Marketing and cross-cutting service providers and basic capacity requirements

Marketing and cross-cutting service providers targeted for capacity enhancement include: (a) individual extension and advisory services workers and their supervisory authorities, namely: the departments of forestry, agriculture and livestock, (b) individual researchers and their supervisory authorities, namely: the departments of forestry research, agricultural research and livestock and pastures research, (c) individual and private sector market services providers and promoters including their supervisory authorities, namely: the departments of commerce and trade, the departments of finance and parliament. The challenges, capacity needs at the personal and private sector levels as well as at the organizational level for supervisory authorities is reported under Annex 4 of this report.

5. ADEQUACY OF POLICIES FOR POSITIONING FORESTRY ACTIVITIES ON A GREEN ECONOMY PATHWAY

5.1 Assessment of national policies and legal frameworks for adequacy

5.1.1 Forestry, water and environmental policies

Although several West African countries have updated their natural resource policies i.e. forestry: Benin (2012), Nigeria (2006), Ghana (2011), Niger (2012), and Gambia (2010); water: Niger (2005), Ghana (2007), Nigeria (2004); and environment: Nigeria (2008), etc., very few have articulated the legal, regulatory, fiscal or corresponding institutional provisions expected to address the main forest tenets of a green economy such as the production of forest foods, biofuel production, production of biomedicines, watershed enterprises, forest biodiversity conservation businesses, forest carbon development assets, etc.

A policy that has indicated inclination towards a green economy pertaining to forest biomass production, and worthy to be emulated in this regard, is Benin's forestry policy, whose vision is "a Green Benin where forest, wildlife and natural resources are managed sustainably for the ecological, economic and socio-cultural needs of populations and to contribute to poverty reduction, food security and the fight against climate change". The policy identifies tree biomass as a commodity and proposes establishment of institutional and regulatory frameworks to encourage municipalities, communities, farmers and private operators grouped together or individually to invest in reforestation. To achieve this challenge, the policy proposes to implement tax incentives and seek cooperation support from national banks for the establishment of financing mechanisms favourable for forest plantation entrepreneurship.

Another policy initiative worth emulating is the identification of watershed protection as a value-based service by the Nigeria water policy. The policy identified 8 hydrological areas in the country and proposed the creation of a river basin organization (RBO) for each hydrological area to coordinate competing interests over water use and to collect abstraction fees. Community based organizations, as water user associations, are expected to be involved in the activities of RBOs through committees to address water allocation issues. Legal, regulatory and institutional decisions are expected to be made based on the

results of forums with and among stakeholder agencies on all water resources matters in order to harmonize administrative tools and eradicate conflict and duplication of effort.

5.1.2 Agriculture and land policies

Agriculture and land policies were assessed in terms of their embrace of agroforestry planning and their supportive or inhibitive objectives to the use of low carbon, less toxic and ecologically friendly inputs for production, characteristic of a green economy. In terms of tackling inhibiting factors however, an objective worth emulating is captured in Benin's 2025 agricultural strategic plan related to the disproportionate use of chemical pesticides for cotton production, vegetable gardens and in food-crop farms with negative consequences on wildlife, forests and humans. The policy describes the uneducated use of agricultural chemicals as equally detrimental for the agricultural sector where they lead to soil toxicity and potential sterility. This discrepancy is also captured in Nigeria's 2015 agricultural policy, as well as the country's 2008 environmental policy, where the impacts of agricultural chemicals, almost all of which are imported, are described as responsible for ecosystem degradation and pollution. Both the Benin and Nigeria policies propose strategies for regulating the importation and use of agricultural chemicals. For example, section 4.7 of the Nigeria environmental policy proposes to regulate the production, use, storage, transportation, marketing, sale and disposal of agricultural chemicals based on results from monitoring pesticide and agro-chemical residue levels in the air, soil, water, sediments, flora, fauna and humans to determine the fate of such chemicals. Under its section 4.19, the policy requires industries to use chemicals with minimal toxic or polluting components in their production processes (e.g.tanneries to use butane instead of pentachlorophenol).

In terms of supportive policies worth emulating, sections 4.4 (l) and 4.5 (b) of Ghana's land policy of 1999 proposes that construction projects in urban areas should be careful to ensure provision and maintenance of adequate tree cover to protect the environment, and that no planted tree plantation shall be cleared for the purposes of establishing a mining activity. The Benin agricultural policy is also supportive of forest commodity production through agroforestry. For example, its section 3.1.3 advocates support for production systems that limit greenhouse gas emissions and promote organic and ecological farming activities with a focus on agroforestry and the promotion of organic and ecological agriculture.

5.1.3 National energy policies

National energy policies examined in connection with plans for novel green economy commodities such as biofuels were for the most part silent on the subject. This is understandable as most of the policies were developed between 2000 and 2010, during the height of the debate on the potential negative impact of biofuels on food crop production and food prices. Notwithstanding, a policy worth emulating is Ghana's 2010 energy policy. Section 4.4 of the policy specifically proposes to seek a balance between biofuel

development and food security. It proposes to support development of the indigenous alternative transportation fuel industry based on biofuel resources by instituting appropriate mechanisms and legislation to support private sector investments expected to facilitate the cultivation of biofuel feedstock, extraction of the bio-oil and refining of bio-oil into secondary products.

As expected, most of the policies have extensive plans for biomass-based energy sources. One of such policies worth emulating is Nigeria's 2003 energy policy. It proposes to develop sawdust, biogas, smokeless coal and other energy technological outputs as alternatives to fuelwood; encourage establishment of private and community woodlots for the supply of fuelwood; establish micro-credit facilities for entrepreneurs especially women groups for development and operation of commercial fuel-woodlots and production of renewable energy devices and systems; establish demonstration and pilot projects on biomass, biogas, wind, solar energy and other renewable energy resources to ensure their adoption and market penetration; provide adequate incentives to producers, developers and suppliers of biomass, solar and wind energy products and services; establish appropriate fiscal measures as incentives for the utilization of solar, wind and other renewable energy systems, and propose regulations and guidelines to promote and sustain the local biomass, solar and other renewable energy industries. The preceding policy planning needs to be emulated and expanded as West African countries evolve towards greening their economies.

5.1.4 Livestock and pastures policies

Policies on animal husbandry and pastures were investigated for the existence of plans advocating the greening of pastures with fodder tree species and strategies against wildfires in the context of facilitating a green economy. Most of the policies were found to be grossly deficient in these areas. This is understandable in the case of fodder trees on pastures as there is no tree planting culture among West African pastoralists, most of whom do not have permanent ownership of land. The deficiency in wildfire policy planning could also be understood as due to the strictly sectorial set-up of wildfire management, with government ministerial departments responsible for agriculture, forests, and livestock entertaining separate uncoordinated wildfire policies. In some cases, a policy document alludes to wildfire and refers its planning to another sector policy where it is only scantily covered. A policy that attempts to resolve the challenge of fodder trees and wildfires is Ghana's 2016 livestock development policy and strategy. The policy acknowledges the high protein content of fodder from fodder trees (12%) and proposes the establishment of community and government supported fodder banks and reserves for organized grazing during pasture deficient periods. The policy also proposes the development of community bye-laws for wildfire management to be implemented by voluntary community wildfire brigades. The policy however notes that in pasture heartlands, wildfires are usually set by pastoralists as a management instrument against livestock pests as well as to create space and appropriate

conditions for new pasture sprouts cherished by livestock. Irrespective of the conflicting objectives, wildfire has no boundaries. Its management therefore requires effective coordination with and among all stakeholders of the forest and pastoral landscape. This is of paramount importance for the survival of forest-based commodities and sustainability of the value-based services that they offer.

5.1.5 Industrialization, export strategies and trade policies

Industrialization and trade policies were examined in this section in connection with privileges that they offer for trade in forest commodities and related services in a green economy perspective. In these regards, Ghana's 2015 national trade policy is worth emulating. It commits to facilitate access to export credit and provide support such as cash payments, tax rebates and effective World Trade Organization (WTO) compliant subsidies; to ensure efficient and effective duty drawback and Value Added Tax (VAT) refund on all imported inputs for export production; to exempt key imported inputs from VAT, thus improving competitiveness of producers for both the domestic and international markets; to enable quick and effective movement of imported inputs and finished exports through the ports, combined with additional fiscal incentives to lower costs and support efficient logistics for exporting; and to provide a system of inward processing under bond to enable producers obtain up-front duty and VAT-exempt imported inputs in which case producers would only pay duty and VAT due on that proportion of inputs to production sold on the local market. Pertaining to the crucial challenge of access to land, among other commitments, the policy proposes to establish a land clearing-house system to facilitate the identification and acquisition of land for productive investments. This is expected to simplify procedures and assure investors of security of land tenure in order to encourage investments, a measure expected to be implemented through the national land policy.

Other obstacles to industrial development in Africa have been reported in a recent study by Totouom (2017) and include: low levels of infrastructure in African countries, especially transport infrastructure, energy and telecommunications; lack of political vision; political instability; small size of the market; and difficulties in accessing funds. It should be indicated that the International Trade Centre, a joint agency of the WTO and the United Nations Conference on Trade and Development, when requested, provides technical assistance and supporting tools in the design, implementation and management of national, sector level and regional export strategies.

5.1.6 Biodiversity and wildlife management policies

Policies on biodiversity and wildlife management were investigated for governments' commitments and orientations related to the sustainable management of forest-based commodities and bio-trade in a green economy perspective. While commitments and procedures for the sustainable management and trade in timber products are adequately presented in forestry and some biodiversity policies, similar commitments for other forest

commodities and services are rare. The importance of planning for these assets is underscored in Benin's 2011 national biodiversity strategy and action plan in which the government commits to support stakeholders, especially communities, to identify and sustainably exploit new niche markets, namely: organic products, fair trade, ecotourism, and to promote a green economy. The policy advocates the creation of labels as an asset to encourage actors to invest in the adoption and expansion of biodiversity-friendly practices.

Meanwhile, worth emulating is Nigeria's 2016 national biodiversity strategy and action plan which commits to improve knowledge on available stocks of useful biodiversity through a national biodiversity survey aimed at identifying habitats of high biodiversity and ecosystem services value and priorities for ecosystem restoration alongside their valuation through a special programme for the valuation of biodiversity; identify and mainstream payments for ecosystem commodities and services into the national budget; establish and implement a national procedure to guide payment for ecosystem services; enhance private sector investment and corporate social support to the country's biodiversity protection; designate appropriate structures of protected areas for sustainable harvesting of NTFPs by local communities to guarantee protection of such resources; and strengthen implementation of guidelines for community-based sustainable use of biodiversity. Also worthy of the mention, is the necessity to develop memorandums of understanding between national forestry agencies and national environmental protection agencies in order to reduce unnecessary duplication of effort.

5.1.7 Climate change programmes, REDD readiness, and forest investment programmes

National climate change adaptation and forest investment programmes, as well as REDD readiness preparation proposals, were assessed in connection with governments' commitments towards the production, ownership, management and commercialization of carbon as a green economy forest ecosystem service. While carbon is variously mentioned in the climate change NAPAs, Readiness Preparation Plans and Forest Investment Programmes (FIPs), there is little information on how to process the service. This inadequacy is reflected in Ghana's 2012 FIP document which proposes to implement pilots to test the effectiveness of intended tree tenure, benefit sharing, and carbon rights for REDD+ on the ground, including mechanisms for farmers to own existing trees and plant new ones. It should be indicated that the driving notion behind REDD+ is to place a market value on the carbon sequestration service of forests to be taken into account in the quantification of carbon credits and therefore facilitate policy and field level decision making on land-use options. Based on results of the Ghana pilots, the country's FIP proposes to develop legislation in order to clarify carbon rights, carbon benefit sharing arrangements, and tree tenure.

Nigeria's 2011 NAPA meanwhile, commits to support private sector organizations desiring to explore opportunities to obtain carbon credits for adaptation practices such as improved agroforestry, noting that the sale of carbon credits could reduce the cost of some adaptation measures. Key basic weaknesses of the currently evolving legal and policy frameworks for carbon and REDD+ include the lack of clarity and clarification surrounding carbon definitions, ownership and benefit-sharing mechanisms, the problem of forest stewardship and governance-- including weakly implemented and conflicting laws, perverse policy incentives originating from state ownership of naturally occurring trees such as useful timber species on cocoa and coffee farms, as well as land tenure challenges and conflicts which prejudice social equity and increase transaction costs (Forest Trends, 2010). In addition to the preceding carbon and REDD+ related policy challenges, national policies are also lacking in regulations on: MRV standards and procedures; statutory references of national satellite imagery depicting analyses of forest cover change; and statutory national carbon maps (Forest Trends, 2010).

5.2 Assessment of relevant regional policies

5.2.1 ECOWAS forest policy

The ECOWAS (2012) forest convergence plan (ECOWAS-FCP) as an emanation of its 2007 forest policy, provides direction concerning two major challenges related to the greening West African economies. They include (a) improved knowledge of the forest resource (forest commodities and valuable ecological services), and (b) improved economic valuation and valorization of forest resources (forest commodities and valuable ecological services). Pertaining to improved knowledge of forest resources, the ECOWAS-FCP notes that for the purposes of planning, it is important to know among others: the surface areas occupied by useful plant formations, volumes of wood, existing species including their annual increases and off-takes, as well as ecotourism potential. The Plan notes that comparisons of successive results of inventories and surveys are necessary, to guide definition and application of management techniques and methods. At the regional level, the ECOWAS-FCP proposes to support improved knowledge of forest resources amongst others, through: complementary biological and related socioeconomic studies and surveys, inventory of intangible heritage assets and publication of such assets, and research on NTFPs.

With respect to valuation and valorization of forest resources, the ECOWAS-FCP notes that few countries carry out preliminary transformation of their forest products before export. The Plan attributes this insufficiency, among others, to lack of exchanges on good practices, and proposes to support valuation and valorization of forest resources at the regional West Africa level, among others, by: promoting ecotourism and intangible heritage assets as strategic areas for valuing protected areas and the knowledge and practices of neighboring protected area communities, promoting forest product certification and traceability,

establishing an appropriate forest commodity valuation system in line with current market trends and supported by a market information system, and combating illegal exploitation of forest resources and poaching.

With regard to forests as a major green economy pathway in West African countries, the ECOWAS-FCP proposes among others to: create green jobs by establishing tree nurseries of NTFPs and biofuel species with high technological value and high production potential; develop a directory describing the different professions and businesses of the forestry sector in West Africa; promote payments for carbon services and related innovative mechanisms such as REDD+ as strategies to support agroforestry and SFM; improve mastery in the use and promotion of renewable energy sources; and promote professional associations, wood production and processing industries, and related exporters/importers for the benefit of the timber sector and national economy as a whole.

A major weakness of the ECOWAS-FCP is its silence on forest and tree pests, diseases and invasive species. For example, crabs i.e., the *Goniopsis pelii* species, are known to cut and feed on mangrove seedlings (*Rhizophora* and *Avicennia* species) thereby thwarting natural regeneration or assisted restoration efforts (Nganje, 2018). Others include Iroko (*Milecia excelsa*/M. regia) attacked by the insect gall maker - *Pytolyma* spp., throughout West Africa (Gichora et al., 2017); the African Mahogany (*Khaya* and *Entandrophragma*) attacked by the Mahogany shoot borer - *Hypsophyla robusta* in Côte d'Ivoire, Ghana, Togo, Nigeria; the *Fromosia* tree (*Pericopsis elata*) attacked by the insect pest - *Lamprosema lateritalis*.

Also absent in the ECOWAS-FCP, are any arrangements for regional collaboration in the development of viable tree germ-plasm programmes to support the forest restoration effort. Clear arrangements are needed in these areas if forests must succeed in their green economy leadership role in West Africa.

5.2.2 ECOWAS renewable energy policy

The 2015 ECOWAS renewable energy policy (ECOWAS-REP) observed to be comprehensive, provides regional direction and commitments that address two green economy challenges confronted by West African countries, namely: (a) technology for the sustainable use of wood-fuels (firewood and charcoal), and (b) biofuel technology related investments and markets.

With regard to wood-fuels, the policy notes that based on increasing demand by the West African population (327,374,979) in 2012 (UN 2013), requirements for wood-fuel by 2030 will exceed 215 million tons per year, that is 241% above the current supply of 89 million tons per year. It warns that withdrawals beyond the current 89 million tons per year will lead to severe, and possibly irreversible deforestation in the sub-region. In order to address the exponential growing pressure on the sub-region's woodlands, the policy advocates the use

of more efficient kilns (60% to 100% conversion rate from wood to charcoal) and improved cook-stoves with carbonization efficiency from 14% in 2010, to 20% by 2020 and 25% by 2030 or in terms of production, 75% efficient charcoal burning by 2020 and 100% by 2030. The ECOWAS-REP proposes to ban inefficient stoves by 2020 as charcoal, by virtue of its light weight and ease of transportation, replaces firewood in West African cities by 2030.

With respect to biofuels, the policy notes that the general attitude towards biofuels in the sub-region is 'cautious', as biofuel production is generally considered for national demand and as energy for motive power in rural areas. The ECOWAS-REP observes that the purpose of developing biofuels is both economical i.e. cutting importation of 5% to 10% gasoline at the 2020/2030 horizon, and social i.e. bringing development, added value and motive power to rural areas through the local production of raw vegetable oil or biodiesel. The policy considers two options: (a) production of ethanol to be mixed in gasoline (5 to 15% blending), and (b) production of raw vegetable oil (e.g. *Jatropha*) to be used directly or as biodiesel in diesel motors for local electricity production, milling or pumping. It commits to: (a) ethanol production, corresponding to 5% of the ECOWAS gasoline consumption in 2020 and 15% in 2030, to reduce carbon dioxide emissions of 5 to 10% for light traffic in 2020/30 and (b) raw vegetal oil/biodiesel production corresponding to 5% of the ECOWAS diesel oil/distillate diesel oil/fuel oil consumption in 2020 and 10% in 2030.

5.3 Preliminary areas to be addressed in national and regional policy frameworks

5.3.1 Decentralization in forest management

This section on decentralization is inspired by an AFF study on trans-boundary forest resources in West and Central Africa undertaken in 2017 (Nganje, 2018). Decentralization is an act by which a central government formally relinquishes powers to stakeholders and institutions at lower levels in a political-administrative and territorial hierarchy of government (Murombedzi et al., 2016). It is divided into democratic decentralization and de-concentration. Democratic decentralization in the management of natural resources is a governance strategy that seeks to ensure transparency, poverty reduction and economic development for those residing close to such resources (Agrawal and Ribot, 2012; Murombedzi et al., 2016). Although most forestry policies in West African countries have been modified to enshrine decentralization in forest management, effective devolution of forest management powers to democratically elected bodies remain generally ineffective. The following must be overcome to render the process effective:

- Institutions and entities to be empowered are essentially legal and democratic with clearly defined geographical jurisdictions. While geographical jurisdictions between regions, divisions, municipalities and communities within the same country may be known on paper, persisting conflicts on tenure at the local level such as between

community farmlands, grazing lands, national forests and other land uses must be resolved.

- Reforms are necessary to support the decentralization process, especially with respect to public finances and macroeconomic sectors abiding on taxes, subsidies, incentives, etc. Experience reveals that resource-wealthy entities usually resist sharing their natural wealth with poorer entities. Such reform requires clear knowledge of the extent and value of forest resources of the units to be empowered as well as appropriate models and scenarios to guide the transfer of especially financial resources to such jurisdictions. Provisions are necessary to build required planning capacity and the managerial skills of empowered bodies.
- Another issue of contention is elite capture, which explores insufficient knowledge and lack of capacity and skills of decentralized units to take personal control of land and forest resources. Appropriate measures must be developed to discourage elite capture (Nganje, 2018).

5.3.2 Private sector involvement in forest production and industry

Private sector is broadly defined to include commercial enterprises of any size, sometimes referred as a 'business' an 'enterprise', a 'company' or a 'firm'. Private sector also includes both legally registered (formal) and unregistered (informal) enterprises such as family business units, small-scale trade and industry, industrial associations, consumer and investor groups or labour unions (UNDESA, 2011). While several forestry policies of West African countries mention the role of the private sector in forest management, rarely do any define the private sector. This is of utmost importance in the promotion of forestry as a pathway to national green economy since active entities will necessarily include community-based organizations such as: producer cooperative associations, buy-and-sell cooperative unions, business-oriented user-groups, and others. These must be legally defined as private sector, civil society or simply as self-help community groups.

For example, the Benin forestry policy of 2012 describes the role of the private sector as basically involved in the exploitation, processing, marketing of wood and NTFPs, as well as in the creation of private plantations and breeding of wildlife. In addition, as active operators, the private sector is invited to: participate in the diagnosis of forestry challenges; sensitization, support, organization, training, extension, development and implementation of forest and riparian land management plans; investment in the sector for promotion of value chains and the mobilization of funding for technical activities, as well as in the protection and management of natural resources generally. The preceding extensive role accorded the private sector calls for forestry policies not only to carefully define the private sector but also to cautiously determine the role given to this particular stakeholder, cognizant of the different types of actors expected to be involved following effective decentralization in forest management and in pursuit of a green economy.

5.3.3 Involvement of youth and women

The use of forests generally considered a remote resource, as entry point for a green economy, constitutes an opportunity to build necessary social infrastructure and engage rural youth and women in this novel initiative. This is because by their nature, youth are experimental, seek challenges and get uninterested where there are none. Engaging forests as a green economy pathway provides the prospect of retaining the attention of rural youth by virtue of the challenges that it generates at the community level. Moreover, as expected, youth are the stable and long-term contributors who will guide forests and green economy development at community level. This is because they represent a vast and often untapped resource for immediate and long-term community development efforts. Through their collaboration with adults and existing organizations, they achieve skill enhancement, confidence building, and leadership development (Barnett and Brennan, 2006). Also, “not only will young people provide more labour, but crucially they will infuse (forestry) agriculture with innovation and entrepreneurial impetus that will realize the transformation of the sector” (Anyidoho et al., 2011). Although most West African national forestry policies mention gender (---read women), rarely are women or youth attributed roles as particular groups of actors in the implementation of these policies.

A policy worth emulating is Nigeria’s 2006 forestry policy which has attributed roles separately for women and for youth in its implementation. The policy notes that vulnerable groups including women, youth, the aged and the poor will constitute beneficiaries in the development of the forest sector in recognition of the fact that they are often marginalized in development processes, even as they mostly depend on forest resources for their livelihood. The policy additionally notes that the problem of youth in the country is acute in rural areas where they are frustrated by material disadvantages and deprivations as well as limited horizons and opportunities. Specifically pertaining to women, the policy proposes to: create awareness in order to enable women appreciate the benefits derivable from their involvement in forest resources management, involve women in agroforestry practices, build capacity of the technical implementers on gender, develop grass-root women group promoters’ capacity to motivate and empower women on their rights to forest resources management vis-a-vis other development opportunities, promote an environment for visibility and credibility of women group promoters as development agents to create local development associations and consequently gain power for advocacy, and cultivate a learning and sharing culture by linking up grassroots level learning and challenges to national and international forums. With regard to the youth, although the policy is inadequate in terms of measures to build the necessary social infrastructure for the engagement of rural youth, it however proposes to: promote awareness campaigns and education programmes in schools, colleges, etc. on sustainable management practices to stimulate and sustain interest of the youth, promote and sustain foresters’ clubs in schools, and enhance the employment of youth in forestry income generating activities.

5.3.4 Institution of governance frameworks to coordinate different sector interventions

The problem of conflicting objectives and duplication of effort between government departments whose activities affect forests and forest ecosystems exist in all West African countries. To alleviate this challenge, francophone countries, that are most evolved in democratic decentralization of forest management, have adopted super-structures or inter-ministerial frameworks to coordinate the forest management effort. In Niger for example, the coordinating structure is the National Council on Environment and Sustainable Development (CNEDD). The CNEDD is an “Environmental Policy Council” placed under the chairmanship of the Director of Cabinet at the Prime Minister’s office. It is made of representatives of all government ministerial departments whose interventions are impacted by forests and the environment. At the operational level however, the Ministry of Hydraulics and Environment is responsible for the implementation of forestry policies with the collaboration of related agencies and partners within the CNEDD. More specifically, the role of the environmental policy council (CNEDD) is to promote co-operation among line ministries, local authorities, the private sector, non-governmental organizations, key centers of excellence, representatives of the council of traditional leaders, religious organizations, women, the youth and others engaged in forest and environmental management programmes. Ultimately the Council ensures that the development effort of government ministerial departments is guided by sustainable forest and environmental management standards.

With the exception of a few West African Anglophone countries, whose forestry policies take account of the Council approach such as Liberia, most contend with the challenge of coordination of forest management in more or less coherent ways. For example, the Nigeria 2006 forestry policy notes that the forest sector cuts across many traditional management boundaries, including: energy, agriculture, water, industry, tourism, education and economic development planning, and that the division of responsibilities and artificial sectorial boundaries have created a number potential and actual conflicts. The policy proposes to reduce such conflicts by: increasing inter-sectorial discussions and exchange of information, support and sustain collaboration with other land using stakeholders, evolve appropriate mechanisms for the valuation of sectorial contributions to the national economy, and establish effective mechanisms for mediation and early response to crisis situations.

5.3.5 Political adoption of principles, criteria and indicators of SFM

The International Tropical Timber Organization (ITTO) describes C&I for SFM as the most important and innovative policy instrument for operationalizing the concept of SFM. Criteria depict the essential components of SFM, and indicators are ways to measure each component. When monitored over time, C&I reveal changes and trends in the biophysical, socio-economic and policy conditions relevant for SFM at the national, subnational and forest management unit levels (ITTO /ITTC, 2012).

C&I are also used as a framework for planning, developing and approving forest programmes or comparable strategies as well as a framework for regulating and developing guidelines for forest use and management practices at various levels. Examples include: as a code of practice for harvesting forest products based on inventory and harvesting requirements and related guidelines as well as to guide development of forest management plans. C&I also provide the required basis for forest management certification or ecological certification schemes and other performance standards. Other uses include: as guidelines of the quality of the watershed protection function of forests; capacity to address climate change adaptation and mitigation, desertification, forest and land degradation; and forest biodiversity and soil and water conservation. In these regards, C&I are applicable for REDD+ and carbon accounting through indicators on forest area and type, growing stock, age structure, annual planting input and removals, and consequently estimations of the amount of carbon stored in forest stands. C&I also serve in assessing and monitoring forest governance through their inclusion on the state of application of laws and policies, land tenure, taxation, transparent and participatory decision-making, capacity of forest institutions to implement programmes and enforce regulations (ITTO /ITTC, 2012).

“C&I can equally serve as an early warning system and help to identify gaps in and threats to SFM, which should be addressed in forest policy. Moreover, enabling forestry sector contributions to green economy implies creating a context in which economic activity within the sector increases human well-being and social equity, and significantly reduces environmental risks and ecological scarcities. Changing the economic environment in this way is an ambitious undertaking which requires a holistic set of policies to overcome a broad range of barriers across the investment landscape. This entails a critical role for governments to correct the currently unsustainable forestry practices and to alter investment landscapes in the short to medium-term within the sector (Popoola, 2016)”. It should be indicated that forestry policy documents are preliminary guidelines, not expected to be detailed and voluminous texts. However, they should contain the “principles” of SFM who’s C&I, after field tests, are adopted and circulated in secondary directive documents in the form of administrative decisions or decrees of application of SFM.

5.3.6 Expansion of forestry policy into programmes and projects

The FAO has supported several countries in the development of their NFAPs based on existing forestry policies starting as early as the 1990s. Such programmes are still necessary and should be updated taking account the new spate of forestry policies in West African countries, most of which look up to forests to lead green economy development in the sub-region. The development process of NFAPs is necessarily participative, involving all actors on the forest landscape likely to be impacted and therefore required to contribute in the conception of projects constituting inherent parts of the programme. Such projects usually forerun the green economy development process. An example of such a project that can be emulated by other countries is the Community Forestry Management Project in

Ghana. Operational between 2004 and 2010, the project restored degraded forest reserves while increasing the productive potential of agricultural, wood and non-wood forest products in five Ghanaian districts (AfDB, 2014b). Based on green growth related assessments, the AfDB which funded the project, notes that the following project achievements are relevant to green growth: a total of 14,814 ha of Teak plantations were established in 5 selected forest reserves in the country, representing a significant carbon sequestration potential; a total of 6,800 farmers were supported in agricultural activities and livelihoods investments, half of whom were women, thereby successfully reducing poverty; another 184 direct livelihood investments to build social capital and cooperative support were established; 4 post-graduate courses were sponsored benefiting both project staff and community area residents; 7 short courses, amongst which 4 external and 3 in-country, were supported; and refresher courses for 100 support staff were realized (AfDB, 2014b). Other cross-sector projects and measures undertaken by the government alongside the preceding project include: carrying out a Strategic Environmental Assessment to inform decision-making in all sectors of the national economy; reducing the environmental impacts of mineral extraction; expanding the Protected Area System; promoting regulatory or economic incentives and improving institutional policy reforms for the sustainable management of forests, wastes and other natural resources; and promoting low-carbon growth to reduce emissions and mitigate climate change, in particular through energy efficiency improvements, and enhancement of public transport services and related facilities.

6. ADDED VALUE FOR ENGAGING THE FORESTRY SECTOR IN GREEN ECONOMY DEVELOPMENT

6.1 Broad-based distribution of opportunities, wealth, and reduced migration

The use of forests as the driver of green economy essentially entails extensive investment in forest resources by governments, businesses, knowledge-based stakeholders and others, in order to secure the sustainable production of associated commodities, ecological functions and services. This places pressure and dependence on forest resources, forest ecosystems and their functional ecological processes to provide alternatives to the current wasteful, expensive, inefficient and environmentally degrading production processes. More investment will therefore be required in green transformative knowledge and skills, ecologically friendly energy methods and processes, recycling technology, use of natural products and processes, cheaper packaging and storage technology, and more.

There is little doubt that the preceding processes and methods are broad in terms of their scope and outreach with the potential to engage the poorest among the poor in society. For example, poor collectors of a particular forest commodity could become part of an international supply chain for a green product. Similarly, poor communities residing on an important watershed or close to a pertinent forest carbon sink could become beneficiaries of international financial mechanisms. According to UN (2013), the search for employment is at the top of the list among causes of migration from developing to developed countries. Investment in forests and forest resources as drivers for greening West African economies has the potential to provide extensive work opportunities for the unemployed and therefore check migration and poverty.

6.2 Improved resilience of forest landscapes and human societies

Forest ecosystem resilience is the forest's relative capacity to absorb or accommodate disturbance or stress without changing to a fundamentally different state, coupled with its relative ability to recover its composition, structure, and function following disturbance (Noss, 2003). The increased resilience of forests and forest ecosystems to disturbance and stress under green economy is based on the improved management that they will receive

under such as a scheme. As forests become a focus of the economy and generate additional benefits for societies, beneficiaries will seek ways to perpetuate their existence by instituting mechanisms for their sustainable management.

With regard to individuals and communities, they are resilient and therefore capable of surviving stresses and hardships when their economic and social needs are fulfilled. Forests as driver of green economy and as narrated in this report, advocate establishment of formal and informal groups, cooperatives and related institutions around the production, processing, trade of forest commodities and related services. Such groups, cooperatives and institutions are storehouses of knowledge, which provide information and create opportunities for income generation and social learning. “People’s adaptability and resilience in changing circumstances can be influenced by rural local institutions. Interactions between local and higher-level institutions can affect the capacity of a community to respond to change. The linkage of these institutions with other formal local and external institutions facilitates exchange of knowledge and resources that can foster resilience (Brown and Sonwa, 2015)”.

6.3 Increased restoration, productivity and security of forest ecosystems

United Nations Sustainable Development Goal (SDG) No 15, target 15.2 states that by 2020: to promote implementation of the sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally (UNDP, 2015; Antwi-Agyei et al., 2018). “In spite of international (obligations such as those of SDG No. 15.2) and intentions such as those of the Ministerial Bonn Challenge on ecosystem restoration, efforts to restore damaged ecosystems continue to fall short of stated goals..... It is known from experience, the immense power that the business sector has as a driver of new partnerships and schemes. A scenario in which business and investors enter partnerships with science and other stakeholders thus holds the promise of effectively restoring degraded forest ecosystem functions to a state in which they can support a balanced socio-economy based on ecological functions (Ferwerda, 2012)”. Because of the business perspective of engaging forests in a green economy, the private sector will undoubtedly be a strategic partner. Calculations by the economy of ecosystems and biodiversity reveal that while the cost of restoring one ha of tropical forest is US\$ 3,450 ha⁻¹, the annual benefits ha⁻¹ is US\$ 7,000 ha⁻¹, and the net present value over 40 years is US\$ 148,700 ha⁻¹ (Ferwerda, 2012: 43).

Under a forest-led green economy, large scale forest restoration efforts will essentially be public-private-community partnerships with communities engaging local brigades and byelaws for the protection of restored forest landscapes. Involvement of communities in such ventures therefore helps protect forests from threats such as wildfires, that could eventually lead to less interrupted forest production and better security outcomes.

6.4 Better adaptation to and mitigation of climate change

The impacts of climate change, whether biophysical, social or otherwise, constitute a source of concern in West Africa where there is no doubt that the phenomenon is effectively taking place. In a GIZ funded study that was undertaken by the Forestry Research Network for Sub Saharan Africa (FORNESSA) thematic group on forests and climate change in selected ecosystems in Africa in 2011, the researchers noted a trend of increasing mean annual temperatures and reducing annual rainfall in the Affinso District of Ghana for a period of more than 30 years (Foli and Addo-Danso in IUFRO-FORNESSA, 2012). The impacts included: forest loss due to increasing occurrence of wildfire, and declining availability of potable water, among others. The world's response to climate change – in terms of adaptation and mitigation should focus more on forests. This was underscored at the Paris Climate Agreement in 2015, where it was expressly indicated that forests and trees play a crucial role in determining the accumulation of greenhouse gases in the atmosphere and therefore have the potential to check global warming and consequently climate change. As carbon sinks, forests absorb the equivalent of approximately 2 billion tons of carbon dioxide each year (FAO, 2018).

Focusing on forests as the driver of green economy development has the potential to expand and intensify the propagation of trees and forests from rural settings to urban green spaces with positive ripple effects, in addition to climate change adaptation and mitigation. For example, recent assessments have revealed that nature-based tourism is growing three times faster than the tourism industry as a whole, and now accounts for approximately 20% of the global tourism market (FAO, 2018). There is no better means of improving the climate change adaptation potential manifested by ecological tourism than investing in forests and nature-based resources.

6.5 Reduced dependence on risk-prone fossil fuel derivatives

Reduced dependence on fossil fuels partly implies increased production and use of biofuels. A major handicap however, is the potential for habitual food crop producers to shift to biofuel production with potential negative impacts on food prices. In this respect, there may be a need to engage an integrated approach whereby bio-fuel initiatives serve multiple functions such as in soil protection, watershed conservation, carbon credits, windshields, and boundary markers.

Their development will therefore require: use of adequate tools to assess environmental, social, ecological impacts and food security, as well as guidelines to mitigate adverse impacts; adoption of an adequate environmental policy to promote participation of small producers taking into account land tenure challenges, financial means, and institutional

support to build capacity of small scale cooperatives; establishment of participatory direct or indirect incentives, as well as tax policies differentiated based on company or smallholder; development of tools to support high quality production and commerce of bio-fuels, such as codes of conduct including norms and protocols, certification procedures, and framework agreements; establishment of monitoring mechanisms for local production, processing and consumption with a view to facilitating quality control and the implementation of a national tax policy; and development and implementation of collaborative agreements between West African countries to share experiences in bio-fuel production for poverty reduction.

The production of biofuels will necessarily require engagement of the private sector through public private partnerships, and in some cases through public-private-community partnerships. Some tools for encouraging engagement of the private sector include: feed-in tariffs i.e. a guaranteed minimum price per unit of power in kilowatt/hour (kWh) or megawatt/hour (MWh) over a stated fixed-term period sold and fed into the grid; tax credits, tax reductions, or production payments; public investment, and loans or grants (UNECA, 2016). Notwithstanding, dependence on scientifically determined baselines require that the best conditions for biofuel production be determined by studies on land tenure systems, tree planting approaches, regulatory aspects, equity and gender issues, supply, marketing channels, networks and price determination mechanisms.

6.6 Opportunity to transform and valorize the informal forest sector

The informal forest sector is renowned for its relatively low levels of productivity due to the use of inadequate methods, wasteful techniques and obsolete equipment and inappropriate materials. It is also characterized by lost opportunities to governments and the public generally, due to forgone tax revenue, which would otherwise contribute in the development of public services and related infrastructure. Moreover, it also constitutes a missed opportunity for those involved, as they cannot benefit from added-value opportunities provided by formal institutions such as banks or the extension services of government ministerial departments, with the result of unending vulnerability and precarious livelihoods.

In developing countries, the informal forest sector is often much larger than the formal one and is crucial to unlocking development opportunities (FAO, 2018). It has been suggested, based on estimation factors that the number of people working in the informal forest sector is at the very least 1.63 times the number in the formal sector (Shackleton et al., 2011). This gives an idea of the large missed opportunity for development in sub-Saharan African countries, and especially in West Africa where the poorest countries of the continent are located. Of particular concern is the fact that women and rural youth are key architects of the informal forest sector. Various studies reveal the entrepreneurial role that women exert, especially in the informal forest sector, as well as their leadership functions in community and participatory forest management. Also, the enterprise and energy of rural youth are vital

for the future of the sector. Investing in the informal forest sector starting by giving it a particular status of formality has the tendency to bring wider economic, social and environmental benefits, improve employment conditions and foster a more sustainable approach to forest management, all with positive impacts stretching from the forest through agroforestry schemes to the green city and ultimately ending hunger and poverty (FAO, 2018). It is obvious that quantifying and addressing informal sectors in forestry can yield a very positive impact, among others, by increasing the availability of decent work where it is needed most.

6.7 Improved public infrastructure, services and related facilities

Several studies have shown that one of the main obstacles to the industrial development of Africa is insufficient and low quality of infrastructure, especially transport infrastructure (Totouom, 2017). The current study also acknowledged the poor road infrastructure in West African countries (section 2.3.2 further above), as a handicap for travels to ecological and cultural tourism sites and locations – constituting missed opportunities in terms of foregone revenue for poor forest-edge communities. As the large and wasteful informal forest sector is brought under regulation, starts benefitting from training, technical and financial support from formal institutions, and accesses new markets and improved economic opportunities, it will pay new taxes and duties to government. These new taxes will integrate the national economy and become available for the development of public infrastructure, related facilities and services. Also, new skills in social learning, networking and collaboration with external partners acquired within the green economy context will transform the previously isolated stakeholders of the informal forest sector to beneficiaries of opportunities offered by globalization. More jobs will be created, and more revenue generated, some of which will considerably strengthen the economies of West African countries.

As a matter of fact, in the long term, opportunities for new and additional sources of revenue within a forest led green economy context are numerous, and include: REDD+ funds; an expanded ecotourism sector; funds released from reduced costs of production and revenue gains from improved quality of produced and processed commodities; funds released from improvements in economic efficiency; funds released from the reduced need for energy imports; reduced economic costs associated with pollution, soil toxicity and health related expenses (BMZ, 2015), bio-trade in previously non-conventional and unknown products, and more. This new and additional revenue will strengthen the national economy and contribute to the development of highly needed public infrastructure, services and facilities.

7. CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

This study demonstrates that forests can effectively lead green economy development in West Africa, with project level case examples already under implementation in countries such as Ghana. However, most forestry, environment and water policies and regulatory frameworks were noted to be insufficient in the legal, regulatory, fiscal and related institutional provisions that are expected to address the main forest tenets of green economy development, such as: production of forest foods, biofuels, biomedicines, watershed enterprises, forest biodiversity conservation businesses, forest carbon development assets, and others. Also, agriculture and land policies were found to be deficient in several ways and should be revised to take account of low carbon development pathway, less toxic and ecologically friendly agricultural inputs that are characteristic of a green economy. Energy policies were observed to be insufficient in biofuel development planning. Further, animal husbandry and pastures policies were lacking in planning for the greening of pastures with fodder tree species. With the exception of timber, industrialization and trade policies were found to be deficient in planning and advocating for other forest products and related services. Also, climate change and related policies were found to be deficient in basic information on carbon as an ecosystem service and asset. The study suggests the inclusion of these measures when updating the current policies and regulatory frameworks.

7.2 Recommendations

In addition to the preceding suggestion, the study proposes the following recommendations:

- Ensure political adoption of C&I of SFM and certification as the main policy instrument for operationalizing the concept of SFM.
- Define, reinforce and incentivize, where necessary, the private sector's involvement in forest research, forest production and industry.
- Expand and develop national forestry policies into programmes and projects in continuation of the NFAP process as forerunner to the greening process.
- Pursue decentralization in forest management and associate its implementation with the capacity building of all actors, including government institutional and legislative level actors.

- Provide clear measures to transform and streamline informal forest activities to the mainstream forest sector for economic competitiveness, efficiency and development at all levels.
- Provide clear roles for rural youth and women in policies as a precursory measure to initiate transformation of the informal forest sector and to check unnecessary migration.
- Institute forest governance frameworks to coordinate different sector level interventions on the forest landscape as a measure of minimizing conflicts and unnecessary duplication of effort.
- Indicate clear strategies to reduce total dependence on fossil fuel derivatives, toxic and harmful chemicals in the agricultural, livestock husbandry, industrial and health sectors.
- Develop strategies and administrative frameworks, starting at the ECOWAS regional level, for collaboration in comprehensive management of forest and tree pests and diseases.
- Develop strategies and administrative networks, starting at the ECOWAS regional level, for collaboration in the development of tree germ-plasm programmes to support the forest rehabilitation and restoration effort.

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