Role of Forestry in the Realization of the Vision 2030, Au Agenda 2063, SDGs and Bottom up Economic Transformation Agenda (Beta) on High Priority Agenda in Kenya

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Abstract

The current paper provides in-depth case study the role of forest in Kenya in achieving vision 2030, AU Agenda 2063, SDGs and bottom up economic model. The forestry sector in Kenya including farm forestry, agroforestry and natural forests contribute immensely to the realization of these development goals in Kenya. Food is achieved through various forest trees whose fruits and roots form food for local community members. Forest trees also provide traditional medicine leading to exploitation in pharmaceutical industries. The energy from fuelwood and building materials from forests also support majority of people in rural areas. Natural roles of forest as sources of water catchment and climate change regulators including in carbon trading have also received fair coverage in Kenya. However, in Kenya, the contribution of forestry still lag behind because of low cover compared to some developed countries such as Japan where these benefits are maximal. Furthermore, the realization of these opportunities depends on the governance of the forest industry, the ways in which forests are managed, and the need for increased local value addition to primary forest products. There is also an urgent need to incorporate private sector into financing of forestry sector to enable them achieve much in terms of the high priority agenda for Kenya. There is need to incorporate the county government into the forest value chain through promotion of value addition to forest products, encouraging agroforestry for food and biomass energy, promotion of industrial plantations and promotion of sustainable forest management.

Key words: *Kenya vision 2030, AU Agenda 2063, SDGs, Forestry, sustainable livelihood, Kenya.*

1. INTRODUCTION

Kenya's path to economic development is now anchored on fulfilling several interrelated national and international conventions. First, The chapter on the Bill of Rights in the Kenyan Constitution, 2010 provides for enjoyment of economic and Social rights under Article 43(1). a-f on health, adequate food and of acceptable quality, housing, clean and safe water, social security and education. Some of these right are also captured in the international conventions which include the Sustainable Development goals (SDGs) (Hák *et al.*, 2016; Warchold *et al.*, 2022) and the African Union Agenda 2063 (Ufomba, 2020), as well as in the national convention such as the Kenya's Vision 2030 (Kigunda, 2018) and the Kenya government's Bottom Up Economic Transformation (BETA) model launched in 2022 by the current president of Kenya Hon. William Ruto. Upon a scrutiny of these documents, one is tempted to identify where there is differences, synergies and convergence of the goals and pillars. The pillars that seem to converge are all relevant to the social, political, environmental and human development and form the basis for high priority agenda. The SDGs has 17 agenda designed to monitor progress for human well-being, environmental protection and partnerships (Omisore, 2018; Botchway and Bradley, 2023). The SDGs goals are amalgamated into major blocks the first block are 6 goals namely: 1: End poverty in all its forms, 2: Zero Hunger, 3: Health, 4: Education, 5: Gender equality and women's empowerment and 6: Water and Sanitation. The second block of goals is: 7: Energy, 8: Economic Growth, 9: Infrastructure, industrialization 10: Inequality, 11: Cities, 12: Sustainable consumption and production. The final block goals include: 13: Climate Action, 14: Oceans, 15: Biodiversity, forests, desertification, 16: Peace, justice and strong institutions, and finally 17: Partnerships for the goals. The African Union (AU) has defined a set of development Goals targeted for the continent in a longer time frame through the formulation of the African Agenda 2063 in 2013 (Mhangara *et al.*, 2019; Muigua,

2019). The AU Agenda 2063 has more goals and pillars summarized as: high standard of living, well-educated citizens, skills revolution underpinned by Science, Technology and Innovation (STI), health, poverty reduction, transformed economies, modern agriculture for increased productivity and production, blue/ocean economy for accelerated economic growth, climate resilient economies, continental financial and monetary institutions, infrastructure, democratic values, capable institutions, peace security, stable and peaceful Africa, gender equality, among others. The slogan '*The Africa we want*' encapsulates Agenda 2063 – a shared ambitious vision for inclusive growth and sustainable development for Africa (Ufomba, 2020; Boaheng, 2022).

The Kenyans vision 2030 was launched by the then President Mwai Kibaki in 2008 as a vehicle to accelerate transformation of Kenya into a rapidly industrializing middle-income nation by the year 2030. The Vision 2030 was guided by economic, social and political pillars anchored on macroeconomic stability; continuity in governance reforms; enhanced equity and wealth creation opportunities for the poor (Fourie, 2014). The main emphasis of the vision 2030 was infrastructure, food security, health, energy, poverty reduction through human resources development, climate action, affordable housing, security; and public sector reforms (Ndung'u *et al.*, 2011). The Bottom-Up Economic Transformation Agenda (2022-2027) is designed to tap the comparative advantages of Kenya and relieve the key binding constraints to the country's development as articulated in the Kenya's National Productive Capacities Gap Assessment (NPCGA). It is also tailored to support the delivery of "The Bottom-Up Economic Transformation Agenda (BETA) 2022-2027". The Holistic Programme's priority areas for policy interventions are captured in five main pillars, namely: Agricultural Transformation; Micro, Small and Medium Enterprise (MSME); Housing and Settlement; Healthcare; Digital Superhighway and Creative Industry. The key enablers: Infrastructure; Manufacturing; Blue Economy; the Services Economy, Environment and Climate Change; Education and Training; Women Agenda; Youth Empowerment and Development Agenda; Social Protection; Sports, Culture and Arts; and Governance. When broken down, BETA aims at achieving: food security through agricultural transformation, micro- and small enterprises, affordable Housing, digital and creative economy, health. Based on extensive scrutiny of these policy documents, the key synergistic and convergence of the SDGs, AU Agenda 2063, Vision 2030, and BETA can be summarized as high 7 priority areas including: food security, energy, health, poverty reduction, water, climate action and housing. In meeting these high priority agenda areas, there is increasing scrutiny of the role of forestry sector in achievement of these ambitious plans and agenda. However, how forestry contributes to the development and realization of all these high 5s priorities is rather neglected in research undertakings especially in Kenya. This paper provides some factors on the issue and tackles some opportunities and challenges.

2. A SCRUTINY OF THE KENYA FOREST COVER

In Kenya, Forests cover an area of about 5.226,191 million ha. which translates to 8.83% forest cover (Kenya Forest Service, 2021). This area is composed of 1.756,715 ha. (33.61%) dense forest, 1,648,860 ha. (31.55%) moderate forests and 1,820,617 ha. (34.54%) open forests. There are also large number of landmass with farms, settlement and urban lands which have trees which do not qualify to be classified under natural forest but are key forest resources. The current improvement in land cover is due to a lot of interventions by the KFS and gazettement of additional lands as forest land between 2000 and 2018. The breakdown of the results showing area under forest in 2021 is shown in Fig 1.
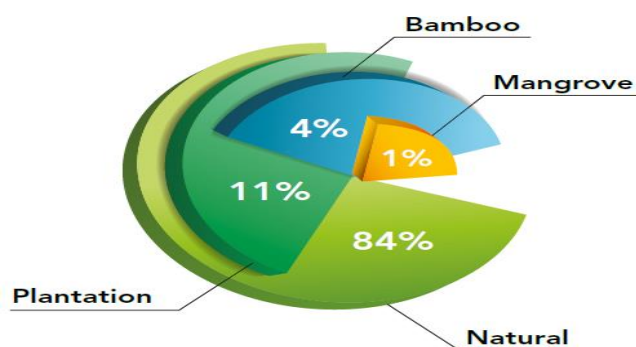

Figure 1. *Area under different forest uses 2021 (Kenya Forest Service, 2021).*

3. 3. ROLE OF FOREST SECTOR IN THE 7 PRIORITY AREAS

The central focus of forestry sector has been on the realization of the economic, social and environmental benefits, as prescribed by sustainable forest management principles. These tenets are well-aligned with the High 7 priorities being identified in various conventions and meetings including: food security, energy needs, industrial growth and development in Africa, and poverty reduction in Kenya.

3.1 Forest in food security

The increase in population against constant food production and increasing prices has made food security a major issue in the Kenyan development agenda (Korir *et al.*, 2020). These effects are exacerbated by climate change (Kogo *et al.*, 2021). With rising food prices and insufficient improvements in food production technologies and agricultural policies, food security is rapidly emerging as a key factor in Kenya's social and economic agenda. The interactions between forest and trees, on one hand, and food security, on the other, may not be immediately clear to most people, unless they witness clearance of forest land for food production.

Forest foods are of particular nutritional to indigenous communities. At the global front, there indigenous community can access 120 different forms of wild foods from the forests (Baldi *et al.*, 2022). In some communities that consume high levels of forest food, wild forest foods alone are sufficient to meet minimum dietary requirements. In Kenya, approximately 850,000 households live within 5 km of the natural forests and therefore depend to some extent on wild foods within such forests. Most of these food are largely classified as game meat, edible insects, fruits, edible plant products, mushrooms, fish and honey from the forests. Unfortunately there is very little studies that have attempted to quantify the percentage contribution of these food items to the national food consumption aggregated demand. Therefore in the current paper most of the quantity and value are based on estimates from several reports and studies. The estimated quantities of these wild food items from the natural forests are provided in Table 1.

Table 1. *Estimated quantities of wild food items from the forests*

Food item type	Estimated quantity metric tones)	Estimated total value (USD per ear
Game meat[*]	650 mt	500,000
Edible insects	450 mt	9,500,000
Fruits	250 mt	7,500,000
Edible plant products (Roots and tubers)	1,200 mt	8,500,00
Wild edible mushrooms	456,100	35,00,000
Wild edible vegetables	82,500	15,000,000
Fish	16,500	45,000,00
Honey	4,500	65,500,000

[*]Illegal in Kenyan forests but some forest adjacent communities still engage in the activities. Limited game meat at the moment due to decline and conservation efforts

Wild, game or bush meat, here defined as non-domesticated terrestrial mammals and birds harvested in the wild for food, is the main source of animal protein in many tropical forest regions including Kenya. A significant proportion of the wildlife biomass hunted by humans for food, especially large-bodied primates, ungulates and rodents (average weight greater than 1 kg), is found in Kenya, with ungulates and sometimes rodents dominating the biomass in more open habitats. The hunting and trade for bush meat from forests is illegal in Kenya but the practice is still ongoing because bush meat is cheaper than domesticated animals. Nevertheless there is very little documentation in the practice in Kenyan forests. Insects are often considered a nuisance to human beings and mere pests for crops and animals. Yet insects provide food at low environmental cost, contribute positively to livelihoods, and play a fundamental role in nature. However, these benefits are largely unknown to the public. Edible insects collected from the forests are also important elements in the diet in many in Kenya (Kinyuru *et al.*, 2018). Insects have a long history as a part the diets of several ethnic groups in Kenya. Traditionally, the consumption of insects has mainly taken place in the western provinces of the country and has included primarily grasshoppers, termites, lake flies and crickets (Raheem *et al.*, 2019). However, the exact number of edible insect species in Kenyan forests is unknown. A recent survey identified

approximately 17 main insect species of edible insects in Kenya forests ecosystem (Table 2, Münke-Svendsen *et al.*, 2016). The highest diversity of edible insect species is as follows: moths and flies, crickets, termites, honey beers, grasshoppers and Beetles.

Table 2. *Common insect species consumed as food or used as animal feed in Kenya Source:(Münke-Svendsen et al., 2016)*

Common name	Scientific name	Local name(Kiswahili)	Local name(kikuyu)	Local name(Luo)
Desert locust	Schistocerca gergaria	N/A	Gitono/gitarariki	Bonyo
Longhom grasshopper	Ruspolia differens	Senene	Ndahi	Senene
Grasshopper	R.Nitidula	Senene	Ndahi	Senene
Two-spotted cricket	Gryllus bimaculatus	Nyenje	Ngiria	Onjiri
House cricket	|Acheta domesticus	Nyenje	Ngiria	Onjiri
Termite	Macrotermes bellicosus	Kumbi kumbi	Nguya	Ng'wen Agoro
Termite	Macrotermes subhyalinus	Kumbi kumbi	Nguya	Ng'wen Sisi
Honey bee	Apis mellifera	Nyuki	Njuki	Kich
Black ant	Carebara vidua	N/A	Thigiriri	Onyoso
Moth	Bunea alcinoe	Nondo	Kihuruta	N/A
Black soldier fly(only feed)	Hemetia illucens	N/A	Kigunyu/wakaguku	Luang'ni

Source: Münke-Svendsen et al., 2016

There is large number of fruits available from the forests in Kenya (Kehlenbeck *et al.*, 2013). These wild fruits contain high vitamin and mineral contents, with the potential to contribute year-round to the micronutrient supply of local communities, even during seasons of food shortages. The most common wild fruits from forests are fruits of *Adansonia adansonia*, *Vitex doniana*, *Azanza garckeana*, *Tamarindus indica*, *Psidiuim guajava*, *Terminalia brownie, Berchemia discolor* and *Vangueria madagascariensis* (Nyongesa and Vacik, 2019). In addition to micronutrients, the high sugar content of fruits such as tamarind (*Tamarindus indica*) and baobab (*Adansonia digitata*) make them important sources of energy. *Adansonia digitata* produces a powdery fruit pulp rich in vitamin C and B2, used in Ukambani, Kenya. Wild edible roots and tubers serve as sources of carbohydrate. Root and tuber crops in Kenya are important food crops that have gained increased importance due to their role in food security, ability to withstand drought (Rajat *et al.*, 2017). The roots used as food in Kenya include *Cordia sinensi*, *Commiphora africana*, *Commiphora schimperi*, *Cyphia glandulifera*, *Eriosema shirense Maerua decumbens*, *Thilachium africanum*. There are wild potatoes such as *Ipomoea lapathifolia* Forests in Kenya also provide diverse options for leafy vegetables (Muthoni *et al.*, 2010). Wild vegetables from the leaves from trees and shrubs are consumed forest products. They serve as a rich source of protein and micronutrients, including vitamin A, calcium and iron, which are often lacking in the diets of nutritionally vulnerable communities. These wild leafy vegetables include *Commelina africana*, *C. benghalensis*, *Amaranthus graecizans*, *Solanum americanum*, *Oxygonium sinuatum*, and *Cleome gynandra* (Mutie *et al.*, 2020). The leaves are a good source of protein, vitamins A, B and C, and calcium and iron. Mushrooms are an important source of food for a substantial proportion of people. In Kenya, use of mushrooms from forests for food is rare except in the Pokot, Turkana, Luo, Luhya and coastal (especially Giriama) communities (Onyango *et al.*, 2016). Mushrooms also used as a lactating agent for breast-feeding mothers. Forests and trees outside forests also support food availability by providing fodder for livestock. Fodder thus contributes to food availability in two ways: livestock are a source of meat and milk, and they support agricultural production by providing draught power and manure, which can increase farm productivity. Beekeeping as a forestry-related

activity is not very well developed in forestry. Otherwise, the Apiculture and Emerging Livestock Division of the Ministry of Agriculture and Rural Development has officers up to the divisional level who are charged with the duty of promoting bee-keeping activities all over the republic. According to the 2020 annual report of the Apiculture and Emerging Livestock Division of MoA&RD, the country has 192,750 beehives in close proximity to forests. The amount of honey produced from these hives totals about 4,538,498 kg with a monetary value of Ksh.46,555,012. These figures should, however, be taken with caution, as not all district reports are included in the national report due to non-submission.

3.2 Role of forest in provision of energy

According to the International Energy Agency (IEA), 1.2 million people in Kenya use significantly less electricity in a year than the global average (Asongu and Odhiambo, 2021). The development and use of wood biomass has received adequate attention compared to other energy sources (Khan *et al.*, 2022). This is because wood biomass is the dominant source of energy for Kenya, where biomass energy provides 68% of Kenya's national energy requirements and it is expected to remain the main source of energy for the foreseeable future (Takase *et al.*, 2021). In 2020, Kenya was reported to use 64.3 mmt of biomass for fuel from forests which 35.1 mmt was in form of fuelwood while 36.5 million tonnes was wood for charcoal. Charcoal industry is estimated at more than US$ 500 million in 2020, with more than 4 million people dependent on the sector for their livelihood. Predictions are that the economic value of the charcoal industry in Kenya may exceed US$4 billion by 2030. The scenario on the demand for wood fuel forecast is shown below.

Table 2. *Projected demand for wood fuel (mmt)*

Year	Charcoal	Firewood	Total fuelwood demand
2000	0.97	11.18	17.96
2005	1.17	12.90	20.77
2010	1.40	14.75	23.79
2015	1.65	16.67	26.91
2020	1.92	18.65	30.10

The charcoal industry in Kenya represents an estimated annual market value of over US$ 427 million (Ksh 32 billion). It employs over 700,000 people along the whole value chain supporting a population of 2.8 million people (Njenga *et al.*, 2013; Kiruki *et al.*, 2020). In order to produce the volume of wood needed, for charcoal alone, 496,000 jobs would be created at the rate of two jobs for each hectare of wood. Making of efficient stoves, charcoal processing kilns and biogas equipment also generate jobs both in rural and urban areas. However, data is not available and has to be generated to guide investment in the same.

3.3. Forest and health of society

In Kenya, about 80% of the local population meets their Primary Health Care (PHC) needs through herbal medicines (Gebreyohannes, 2013; Ondicho *et al.*, 2016). In rural areas where about 20% of the medical services are realized, people are treated largely by use of traditional medicines. This is mainly due to inadequate supply of modern medicines, shortage of qualified medical staff, increased population and high poverty levels. IN Kenyan forests, there are studies that have document many plants that are useful for medicinal purposes (Table 3) (Otieno and Analo, 2012; Kipkore *et al.*, 2014; Mbuni *et al.*, 2020).

Table 3. *Plants identified that have medicinal properties in Kenyan forest*

Sn. No.	Botanical Name	Common Name
1	*Acanthus eminens* C.B.Cl.	Bear's breeches
2	*Achyranthes aspera* L.	Devil's horsewhip
3	*Afrocrania volkensii* (Harms.) Hutch.	Dogwood
4	*Albizia anthelmintica* (A.Rich) Brongn.	Goat weed
5	*Aloe tweediae* Christian	Chinese aloe
6	*Azadirachta indica*	Neem
7	*Berberis holstii* Engl.	Barberry
8	*Bidens pilosa* L.	Blackjack
9	*Calotropis procera* (Aiton) W.T. Aiton	Rubber bush
10	*Carrisa edulis* Vahl.	Simple-spined num-num
11	*Chenopodium opulifolium* Koch & Ziz	Grey goosefoot

12	*Clematis simensis* Fresen.	Pine hyacinth
13	*Cleome gynandra* L.	Stinkweed, Spiderwisp
14	*Crateva adansonii* DC.	Garlic Pear
15	*Croton macrostachyus* Hochst. ex Delile.	Broad-leaved croton
16	*Cyperus esculentus* L.	Nutsedge
17	*Dodonaea angustifolia* L.f.	Sand olive, Hop bush
18	*Dombeya torrida* (J.F. Gmel.)Bamps	Forest dombeya
19	*Dovyalis abyssinica* (A. Rich.) Warb	Ceylon gooseberry
20	*Dryopteris inaequalis* (Schltdl.) Kuntze	Woodfern
21	*Euclea divinorum* Hiern.	Towerghwarrie
22	*Euphorbia candelabrum* Kotschy	Candelabra euphorbia
23	*Faidherbia albida* (Delile) A.Chev.	Apple-ring acacia
24	*Ficus natalensis* Hochst	Back-cloth fig
25	*Flacourtia indica* (Burm. f.) Merr.	Governor's plum
26	*Garcinia livingstonei* T. Anderson.	African mangosteen
27	*Gardenia volkensii* K. Schum.	Common gardenia
28	*Hagenia abyssinica* Willd.	African redwood
29	*Jasminum abyssinicum* N.E.Br.	Forest jasmine
30	*Juniperus procera* Hochst. Ex Endl.	African pencil cedar
31	*Justicia flava* Vahl	Willowleaf justicia
32	*Kigelia africana* (Lam.) Benth.	Sausage tree
33	*Lannea schweinfurthii* (Engl.) Engl	False Valley floor
34	*Lonchocarpus eriocalyx* Harms.	Broad lance-pod
35	*Maesa lanceolata* Forsk.	False Assegai
36	*Momordica foetida* Schum. & Thonn	Bad smell melon
37	*Nuxia congesta* R.Br. ex Fresen.	Brittlewood
38	*Olea europaea* L.	Olive tree
39	*Ozoroa insignis* Delile	Tar berry
40	*Pittosporum viridiflorum* Sims	Cheesewood
41	*Plectranthus barbatus* Andrews.	Indian coleus
42	*Podocarpus gracilior* (Pilg.) C.N. Page	Weeping Podocarpus
43	*Prunus africana* (Hook.f.) Kalkman	Red stinkwood
44	*Rhus natalensis* Berhn. Ex Krauss.	Natal rhus
45	*Ricinus communis* L.	Castor-oil plant
46	*Rotheca myricoides* (Hochst.)Steane & Mabb.	Butterfly Bush
47	*Rubus steudneri* Schweinf.	Forest bramble
48	*Salvadora persica* L	Toothbrush tree
49	*Schefflera volkensii* (Harms) Harms	Cabbage tree
50	*Sida cuneifolia* Roxb	Common wireweed
51	*Solanum incanum* L.	Sodom apple
52	*Solanum nigrum* L.	Black nightshade

3.4 Forest in poverty reduction

Traditional forest dwellers, and the forest adjacent communities depend on forests for their subsistence needs hence escaping the biting poverty in many regions of Kenya (Musyoka Victoria *et al.*, 2020). This people use various resources from the forest and hence are protected from immense poverty. Eco-tourism has potential to generate income and ensure sustainable management of forest. The wide areas of foods, timber, poles and other forest products when sold fetch good price for the households hence preventing poverty (Okumu and Muchapondwa, 2020). A recent valuation of the off-take of these multiple products from the forest was conservatively estimated at US$1.7 million per year. By introducing alternative, sustainable income-generating activities, the local people will be more eager to preserve the forest. These activities include apiculture, sericulture, silk moth-culture, butterfly farming, harvesting of medicinal plants etc.

3.5 Role of forest in access to water

Natural forests play a very significant role in environmental conservation and water catchment protection as most of the water sources in the country originate from these areas. It should however be noted that most of Kenya's electric energy needs are met from hydro-electric sources which are intricately linked to forest management. In Kenya all the river systems originate from forests. The main

river systems in the country are: Tana River System whose source is Mt. Kenya and The Aberdares Forest ecosystems. Athi River system whose source is the Aberdares and Ngong Hills ecosystems. Ewaso Nyiro river system whose source is Mt. Kenya and Aberdares forest ecosystems. Lake Victoria basin river system whose source is Mt. Elgon, Cherangani Hills, Mau Forest and Nandi Hills forest ecosystems. The Turkwel gorge river basin whose source is Mt. Elgon forest reserve and Cherangani Hills

3.6 Forest and climate action

There is renewed interest in curbing the adverse impacts of climate change though climate action. This has even seen the African Climate Conference being held in Nairobi in 2023 and attended by various African and other world leaders (Akol, 2023). Forests play an important role in regulating the earth's global climatic system. They capture carbon dioxide, including emissions from anthropogenic sources, and from the atmosphere and convert it, through photosynthesis into living biomass: tree trunks, roots, branches and leaves. Actions to increase or maintain forest cover sustainably not only have important carbon benefits, but adaptation benefits as well. Other benefits from forests include preventing flooding and landslides, reducing erosion and sediment discharge into rivers, which in turn also prevents sequestered carbon from being released into the atmosphere. Recognizing the need for climate action, the Kenyan Government has also committed to international climate action initiatives (mitigation and adaptation), as outlined in Table

Table 4. *Commitments by the GOK for the forestry sector*

Agreement/Strategy	Commitment	Target year
The Paris Agreement	Kenya is a signatory to the Paris Agreement, and has committed to a GHG emissions abatement target of 32% by 2030 relative to the BAU scenario of 143 $MtCO_2$ eq.	2030
Africa 100Initiative	To restore 5.1 million ha of deforested and degraded lands (in line with its 10% tree cover target. In 2019 the Government announced plans to ratchet up this ambition to achieve the 10% tree cover by 2022	2022
The Constitution of Kenya, 2010	The Government committed to increase tree cover to 10% countrywide. The target date has now been reduced, as per a Presidential Directive in 2019, to achieve this target sooner	2030
United Nations Agenda 2030	The Government of Kenya has shown a commitment to achieving the United Nations Sustainable Development Goals (SDGs). This includes SDG 13 which calls for urgent action to combat climate change, SDG 14 (life under water) Kenya is championing sustainable blue economy that include rehabilitation, conservation, and sustainable utilization of mangrove resources. and SDG 15 that looks to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.	2030
Climate Change Action Plan (NCCAP)10 2018-2022	he NCCAP 2018 – 2022 is made up of seven Climate change priority objectives; the fourth of these is focussed on forests with the target of "increasing forest cover/tree cover to 10% of total land area, and rehabilitate degraded lands, including rangelands. Actions have been outlined in the plan that include (but are not limited to) afforestation and reforestation projects, restoring degraded landscapes, and promoting sustainable timber production. The Government has set a forestry sector target of reducing GHG emissions of 10.4 $MtCO_2$ eq by 2023 through forest restoration, afforestation, reforestation and reduction of deforestation. The Government has also identified a technical maximum abatement potential of 40.2 $MtCO_2$ per year by 2030 in the forestry sector	2030

NDC (2020)	Kenya will reduce its greenhouse gas (GHG) emissions by 32% by 2030 relative to a business as usual scenario of 143 $MtCO_2$. The forestry sector to support achieves these reductions. Implementation in the forestry sector to support achieving the NDC will include attempting to achieve tree cover of at least 10% of the land area in Kenya, providing better access to clean energy and improving energy efficiency and, promoting climate-smart agriculture to reduce deforestation while improving productivity	2030

Source: (AECOM, 2021)

Kenyan forests affect the net carbon change in the country. Consequently, changes in land use from forest to other uses may result to imbalance in the carbon cycle resulting in accumulation of excess carbon dioxide in the atmosphere. Given this important role, it is therefore necessary that increase in forest cover be stepped up.

3.7 Forest and housing

The latest forest inventory in the indigenous natural forests in Kenya estimated the total standing volume in Kenya's forests (i.e. sum of timber, pole wood and fuel wood) at 200 million m^3. The timber volume alone was estimated at 47 million m^3. Besides the species composition, also the timber volume per forest region shows some difference: The coastal forest region contains the lowest mean standing volume per ha. The mean timber volume in the closed canopy forest is estimated at under 4 m^3/ha. Within the dry forest, the timber volume per ha is estimated to average 47 m³/ha. Within the western rainforest region, the standing volume is estimated at 230 m^3/ha and the mean timber volume at 78 m³/ha. The total sustainable yield from the natural forests is estimated at 1.5 million m³. These figures do not take into consideration the areas falling within nature reserves, national parks and other forest areas currently or which may in future be zoned as protected areas where no harvesting is allowed.

With proper controls and sound exploitation based on sustained yield management with strict annual allowable cuts from each forest area, there are great prospects for modest utilization of the timber, fuel wood and pole wood resources from these natural forests on a sustainable basis as inventory studies have shown that the sustainable volume of hardwood that could be extracted from Kenya's natural indigenous forests is considerably higher than the present amount used by the wood industry in Kenya today.

As already mentioned, it is estimated that about 3 million forest-adjacent people who live directly adjacent to forest boundaries derive wood from the forests. The estimated value of the wood demand part of which is used for housing is shown in Table 5.

Table 5. *Estimated Value of Projected Wood Demand (Ksh '000)*

Wood Use/Year	2000	2005	2010	2015	2020
Fuelwood	1,676,290	2,132,361	2,696,200	3,372,720	4,414,630
Poles	21,525	28,713	37,791	49,035	62,928
Industrial Wood	2,591,600	3,563,700	4,570,100	5,872,200	7,578,400
Total	4,289,415	5,724,774	7,304,091	9,293,955	12,055,958

The prices are the average for the commercial species (highest and lowest), Cypress, Pines, *Grevillea* and *Eucalyptus*. Industrial wood (Ksh.1900), Fuelwood (Ksh.70) and poles (Ksh.15). A 10% increase is used in prices for the projected demand for each period.

4. CONCLUSIONS

There is clear demonstration that forestry sector in Kenya including farm forestry, agroforestry and natural forests contribute immensely to the realization of priority development goals in Kenya. Food is achieved through various forest trees whose fruits and roots form food for local community members. There is massive application of forest trees for traditional medicine and many trees are now being commercially exploited in pharmaceutical industries. The energy from fuelwood and building materials from forests also support majority of people in rural areas. There are numerous cases of tree planting

and selling as a strategy for poverty reduction in Kenya. Natural roles of forest as sources of water catchment and climate change regulators including in carbon trading have also received fair coverage in Kenya. However, in Kenya, the contribution of forestry still lag behind because of low cover compared to some developed countries such as Japan where these benefits are maximal.

The importance of ensuring that policy decisions are backed by data (trends, magnitudes, trade flows in volume and values and by product categories), cannot be emphasized enough for the promotion the forestry sector. Such decisions can lead to improving the wood based industry, and a better understanding of illegalities in the sector and how to contain them. It can help remove barriers to trade, and impact many other decisions that, cumulatively, will contribute to creating a continental economy that will strengthen each country and create a prosperous and industrialized Africa. This would be in line with the developmental aspirations of the African Union Agenda 2063.

5. RECOMMENDATIONS

The above discussion and statistics on the forestry sector in Kenya suggest a high level of dependence of the people of Africa on forests. Development programmes in Kenya, therefore, have to look at food security, household wellbeing and income generation from not just traditional agriculture but in combination with forest products that are important for household nutrition, health, income generation and employment opportunities. A major prerequisite though will require recognition by policy-makers of the importance of the forest-product value chains in Kenya's development. As it conducts operations in its regional member countries, the Kenya's development priority agenda should intensify policy analysis, knowledge generation and support for forest-product value chains. Leveraging forestry in implementing the High 7 priorities is a strategic investment that will lead to sound development outcomes.

Policy initiatives could include the following actions:

- Encourage value addition to forest products, notably wood and non-wood forest products.

- Promote biomass energy.

- Urge the use of industrial plantations of desirable tree species.

- Integrate forestry and agriculture for climate change resilient productive systems and agroforestry.

- Promote intra-African trade in forest products and related commodities.

- Encourage good governance and better institutional arrangements.

The increasing demand for forest products, as a result of the increasing population, has lead to a major shift to agroforestry. Currently research and development activities are geared towards this area of forestry. This is seen as the direction in the next decade as the land area of plantation and indigenous forests diminishes. This will cause a realization of social benefits in the form of food security, poverty alleviation and employment as well as environmental benefits.

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