Overview of the Forest Sector in Kenya

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Kenya is located in East Africa bordered by Tanzania (S), Uganda (W), South Sudan (NW), Ethiopia (N) and Somalia (NE). The capital city is Nairobi with a population of about 3.5 million people (Fig. 1). The country has a population of approximately 45 million people and an area of 581,309 km^2 (224,445 mi^2). The official languages are English (official) and Swahili (national). More than 42 ethnic groups live in Kenya and the literacy rate is estimated to be 78 percent. Gross domestic product (GDP) growth rate has averaged 5 percent over the past 6 years. In 2015, the major contributions to GDP are industry (14.8%), agriculture, including forestry (24.2%), and services (62.5%).

Kenya's major exports are coffee, tea, and horticultural crops. The country is one of the world's most popular tourist destinations where a myriad of big game mammals can be seen including the ''Big Five''— African elephant, black rhinoceros, cape buffalo, African lion, and the African leopard. There are many national parks and game reserves (e.g., Amboseli, Maasai Mara, Tvavo, and Nairobi).

The importance of forests to Kenya has been acknowledged by the colonial government as early as the 1900s. In 1902, the first forestry department was established with the arrival of Mr. C. F. Elliot who became the first conservator of forests. By 1908, most of the major forest blocks as we know them today had been reserved as forest area through gazettement. It was not, however, until 1957 that the first comprehensive forest policy was developed. The policy primarily outlined the protection of the forest estate and the sustainable exploitation of forests. It also included plans for afforestation, conservation of forests, and the management of privately owned forests for public amenities, recreation, and as a habitat for wildlife (Kenya Forest Service [KFS] 2016).

With the growth of the population and resulting diminishing settlement land, the forest policy was revised in 1968. Chief among the modifications was the introduction of the Shamba system meant to help in reforestation and further support forest management. The system was also intended to allow communities bordering forests to have forest access for cultivation. Other modifications included the designation of local forest authorities and the promotion of forestry research and education. However, this period was more characterized by forest mismanagement through illegal allocation of forestlands and political interference in the management of forest affairs. This situation led industry stakeholders to prepare the Kenya Forest Master Plan of 1994 (Ministry of Environment and Natural Resources [MENR] 1994), a new forest program centered on community involvement, conservation and protection, decentralization, and cost-benefit sharing.

In 2005, the KFS, a state corporation was established under the Forest Act of 2005. Commencing its operations in February 2007, the Service's expressed mandate is to enhance development, conservation, and management of Kenya's forest resources base in all public forests, and to assist County Governments to develop and manage forest resources (KFS 2017).

Kenya's Forests

Kenya's forests are broadly categorized as natural forests and intensively managed plantation forests (Table 1). These are further categorized by forest type and subtype. Figure 2 shows the distribution of forest types. Trees planted on farms or agricultural land, although not forests per se, are also considered in the wood supply analysis, as they currently provide a substantial amount of wood and are projected to be a key source of wood in the future in rural communities. Forests are further classified into three groups based on their ownership and management characteristics as public forests, community forests, and trees on farmlands (Ministry of Environment, Water and Natural Resources [MEWNR] 2013).

Public forests are government owned and are managed to provide goods and services such as water from natural forests and commercial and subsistence requirements of wood products from plantations. Because of an increased demand of environmental benefits, management of natural forests on government lands does not include production of wood—this takes place only on plantations. Management of

Figure 1.—Map of Kenya including major preserves and national parks.

plantations is guided by management plans that include forest treatments and harvest schedules. Management includes input from different stakeholders such as communities, government forestry agencies, university forestry professionals, and wood products manufacturers (MEWNR 2013). Plantation management dates back to the early 1900s during the colonial period when most of the major forest blocks were reserved as forest areas.

Forest cover has since declined due to deforestation and conversion of forestland to farmland. The country's forest cover is currently estimated at 7 percent of the total land area with government efforts targeting at least 10 percent forest cover by the year 2030 (MEWNR 2014). In spite of plantation initiatives, the country still faces numerous challenges in the management and conservation of its forest resources as outlined in the Kenya forest policy of 2014.

Forests provide a wide range of ecosystem goods and services that support growth of Kenya's economy. In particular, montane forests regulate more than 75 percent of the country's renewable water resources, which is critical for sustainable development of many sectors such as agriculture, forestry, fisheries, electricity, water, hotels and other tourist accommodations, public administration, and defense (KFS 2013). They also prevent soil erosion and provide habitat for many plant and animal species. In addition, they supply fuelwood that generates over 75 percent of Kenya's overall energy requirements. Over the last two decades, the KFS has tried to enhance these benefits by improving management of state-owned industrial plantations and by encouraging private investment in plantation management to increase production to

meet domestic demand for wood products. Although much has been accomplished, established targets are yet to be achieved.

Natural Forests

Natural forests are diverse and comprise a wide range of forest ecosystems that are categorized into montane forests, western rainforests, coastal forests, and dryland forests. Montane forests are located in the central and western highlands and on mountains along the Ugandan border, rainforests are located in western Kenya, and coastal forests and dryland forests are located in the coastal region, and in the arid and semi-arid regions of the country, respectively. These forest types are further subcategorized (Table 1).

Table 1.—Forest types and areas in Kenya in 2012.[a]

Forest type	Forest subtype	Area (ha)	% of forest area
Natural forests			
Montane forests	Mixed indigenous forests	1,359,860	32.1
	Bamboo	85,693	2.0
Western rainforests	Mixed indigenous forests	144,615	3.4
Coastal forests	Mixed indigenous forests	295,871	7.0
	Mangroves	48,522	1.1
Dryland forests	Mixed indigenous forests	1,875,316	44.3
	Riverine forests	135,231	3.2
Plantation forests	Indigenous and exotic trees	286,716	6.8
Total area		4,231,824	100

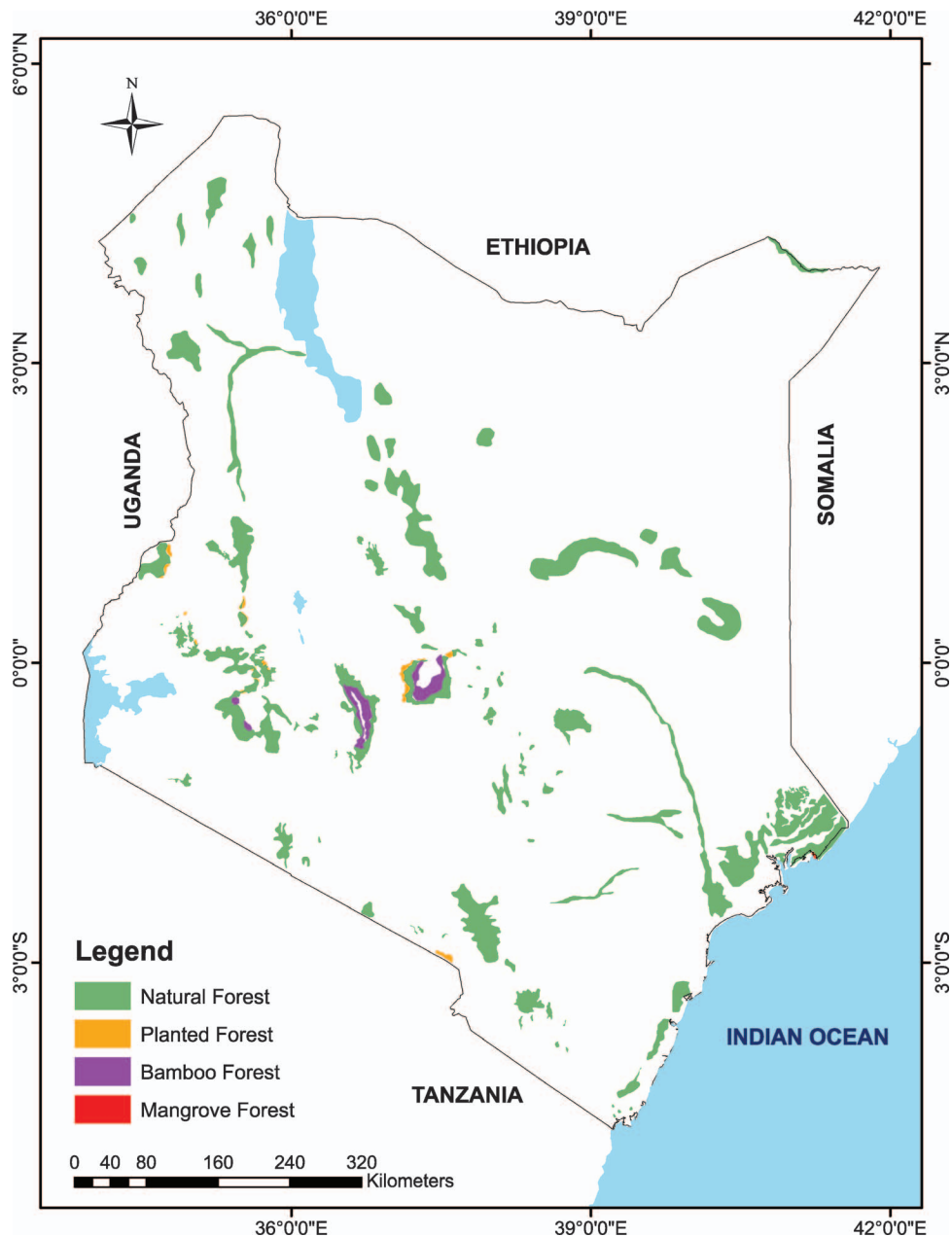[a] Source: Kenya Forest Service 2013.

Figure 2.—Kenya forest types and distribution. (Source: National Forest Program Secretariat 2015.)

Natural forests, forming the majority of Kenya's closed canopy forest area, are biologically rich and contain a high concentration of endemic plant and animal species. They are managed by KFS, with some areas managed as national parks and game reserves by the Kenya Wildlife Service (KWS), while a smaller area falls under the authority of local governments (GATSBY Charitable Foundation 2014).

Montane forests are the most critical in providing clean water to Kenya. Mount Kenya, Aberdare Range, Mau Forest Complex, Mount Elgon, and Cherangani Hills (MENR 2016) are the primary montane types and are popularly known as the "Five Water Towers." They are dominated by two major subtypes, mixed indigenous forests and bamboo-dominated forests. The main tree species in the mixed indigenous type are *Syzygium guineense, Macaranga capensis, Juniperous procera, Podocarpus* spp., *Ocotea*

usambarensis, Olea capensis, and *Vitex keniensis* (MENR 2016). Higher altitude areas in montane forest regions are dominated by continuous stands of highland bamboo (*Yushania alpina*).

The five montane forests form the upper catchment areas for all major rivers in Kenya (except the Tsavo River), and as such, are the main sources of water for agriculture, industrial processes, and hydro-power generation (GATSBY Charitable Foundation 2014). Conservation of these areas remains a strategic priority aligned to Kenya's Vision 2030, a long-term policy framework formed in 2008 that outlines the country's developmental goals and targets. Furthermore, areas surrounding these forests have high potential for intensive agriculture and human settlement due to an abundance of water, and for this reason, they are characterized by high population density. Consequently,

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A natural forest in Kaptagat in western Kenya.

high population growth and poorly planned settlements in these areas present the greatest threat to the conservation of natural forest resources. To date, encroachment, conversion of forestland to farmland, and illegal extraction of timber and charcoal are the primary drivers of deforestation and degradation of the natural forests.

Efforts by KFS between 2005 and 2007 slowed forest loss and degradation from these areas through improved conservation and rehabilitation, implementation of forest management plans, and formation of Community Forest Associations (CFAs) as a means of improving benefit sharing between government agencies and forest-adjacent communities (GATSBY Charitable Foundation 2014). KFS works with CFAs to design harvesting, management, and monitoring plans for indigenous forests owned by the state. However, the role of CFAs is limited in terms of their participation in determining harvest times and regulating harvest levels.

The second type of natural forest is the western rainforest, which is in the Kakamega and Nandi forest reserves in western Kenya. The main tree species in this forest type are *Croton megalocarpus, Bosqueia phoberos, Celtis durandii, Aningeria altissima, Funtumia elastica, Antiaris toxicaria, Craibia brownie,* and *Olea capensis* (MENR 2016). Logging is prohibited in these forest reserves. However, forest neighboring communities are allowed to extract other forest products such as firewood, fodder, and they may graze their livestock at a fee.

The third type is the coastal forest which are made up of two forest subtypes. The first is a narrow strip of mixed indigenous forests about 30 km from the coastline while the second is mangroves that form a transitional zone between the coastal marine and the mixed indigenous forests (MENR 2016). Harvesting is prohibited in the mixed indigenous forests, whereas mangrove harvest is permitted based on management plans developed by the KFS.

The last type of natural forest is the dryland forests which is predominantly found in the Arid and Semi-Arid Lands (ASALs) of Kenya. They cover approximately 2,050,000 hectares and account for more than 80 percent of the country's eco-tourism interests and a large proportion of the

wildlife population (GATSBY Charitable Foundation 2014). These forests also provide important climatic and water catchment functions. They are managed by a combination of the KFS, KWS, private land owners, and community-based associations.

The greatest driver of degradation of dryland forests is charcoal production, owing to high demand for charcoal in rural and urban settlements across the country. Charcoal producers target specific high-density species, such as *Balanites, Acacia,* and *Terminalia*, which have low regeneration capacity (GATSBY Charitable Foundation 2014). In efforts to stop this degradation, KFS has developed strict regulations that govern harvesting, production, and sale of charcoal. United Nations Environment Program (UNEP 2012) estimated that in 2009 dryland forests provided 11.6 million m^3 of wood products, the majority of these being charcoal and wood fuel. This production is substantial but may not be sustainable in the long run given the low annual productivity of dryland forests.

Forest Plantations

Forest plantations are categorized as state-owned plantations or private forest plantations. State-owned plantations cover an approximate area of 136,000 hectares. The predominant species are Pines and Cypress (86%), Eucalyptus (10%), and the rest are indigenous hardwood and softwood plantations (Food and Agriculture Organization of the United Nations [FAO] 2015). They are managed by KFS for the production of sawlogs, pulpwood, and transmission poles and in total, they produce about 2,181,400 m^3 of wood products annually.

Following unsustainable harvesting of these plantations and a projected roundwood deficit by the Kenya Forestry Master Plan (MENR 1994), the government imposed a logging ban in 1999 to curb uncontrolled clear-cutting of plantations. Although this was meant to improve management, the ban interrupted regeneration and harvesting regimes, leading to backlogs in harvesting, replanting, and carrying out of silvicultural operations such as thinning and

A young Cupressus lusitanica *plantation in Kaptagat Forest in western Kenya.*

pruning. Furthermore, many wood processing companies, mainly saw mills, were closed following the ban leading to job loss in the sector and a distortion of prices in wood product markets.

The logging ban lasted about 10 years and when lifted, strict harvesting plans to improve plantation management were implemented. In addition, KFS introduced the Plantation Establishment and Livelihood Improvement Scheme (PELIS), a form of non-residential mixed cropping system for plantation establishment, which has since improved restocking of harvested forest plantations. By 2014, about 30,000 hectares of an estimated 41,000 hectares had been replanted (GATSBY Charitable Foundation 2014). Plantations remain the main source of raw material for wood processing industries in particular, sawmills, plywood mills, and the country's single pulp and paper mill.

Private forest plantations are estimated to cover about 100,000 hectares spread across the country. They are predominately fast-growing Eucalyptus species grown to provide posts, transmission and building poles, sawn timber, fuelwood, and charcoal. The tea and tobacco industries are among the leading investors in fuelwood plantations to dry their products. These companies also contract farmers to supply them with fuelwood under an arrangement known as out-grower schemes. In addition, as previously mentioned, state-owned (federal level) plantations account for about 136,000 hectares. In addition, other publicly owned (e.g., local governments, municipalities) plantations account for an additional 86,000 hectares.

Commercial growers of Eucalyptus trees also target the supply of transmission poles as their primary market, with thinnings and other secondary products serving as building poles and wood-fuel products. Besides Eucalyptus, other exotic species grown by private investors for sawn timber include *Cypressus lusitanica, Pinus patula,* and *Grevillea robusta.* Indigenous species such as *Prunus africana, Melia volkensi, Podocarpus falcatus,* and *Juniperus procera* are grown but on a smaller scale (GATSBY Charitable Foundation 2014).

Investment in private plantation forestry faces some key challenges, which include limited access to extension services on establishing, managing, and harvesting of forest plantation, lack of quality planting seedlings from local tree nurseries, lack of organization and information systems related to end markets, and the requirement that independent growers obtain licenses to harvest trees on their land and to transport tree products between administrative areas. KFS has tried to address these barriers to promote private plantation forestry as an effective economic activity for both small-scale and large-scale growers.

Forest Products

Wood-based industries in Kenya consist of about 450 sawmills, two integrated panel mills that manufacture plywood, particleboard, and hardboard (one of which also manufacturers sawnwood), and one pulp and paper mill which has not been operational since 2009, but is now scheduled to start production following current government interventions. Most of these mills procure their raw materials from government plantation forests for which harvesting and utilization levels are established by KFS. Farmlands and woodlands outside state forests supply the bulk of wood for transmission poles, wood fuel, and sawlogs for small-scale sawmills spread across many regions in the country (MEWNR 2013).

Table 2.—Supply and demand of forest products in Kenya in 2012.[a]

	Wood product (m³)				
	Timber	Poles	Firewood	Charcoal	Total
National supply	7,363,414	3,028,907	13,654,022	7,358,717	31,372,531
National demand	5,262,624	1,409,482	18,702,748	16,325,810	41,700,664
Net balance	2,100,791	1,619,424	−5,048,726	−8,967,093	−10,328,134

[a] Source: Ministry of Environment, Water and Natural Resources 2013.

Kenya's annual supply and consumption of its main wood products in 2012 are shown in Table 2. Not much has changed since 2012 with a decline in mature harvestable plantation trees. Timber in the table includes all roundwood for production of lumber, wood panel products, and pulp and paper. There is a sufficient supply of poles and timber but a deficit of fuelwood. Supplies must increase to meet demand for wood fuel (charcoal and firewood), which already has a deficit of more than 14 million tons. This is a significant challenge given that wood fuel is currently the main source of energy for heating and cooking for the majority of households in Kenya.

Roundwood consumption by wood industries from 2005 to 2015 is shown in Figure 3. Pulpwood supply declined due to the closure of Pan African Paper Mills, which was the largest consumer of pulpwood. The supply of sawlogs and veneer logs had a slight decline over the same period due to restricted harvesting regimes by KFS. Sawmills in Kenya have an annual log intake capacity of about 700,000 m^3, producing about 200,000 m^3 of lumber annually. If recovery rates improve above 30 percent, output will increase substantially to minimize the current supply deficit.

Figure 4 shows the quantity of roundwood imports and exports between 2005 and 2015. Roundwood imports were more than exports, to cover the deficit from industrial plantations. Owing to the shortage, the country will continue importing more roundwood to meet the supply deficit as
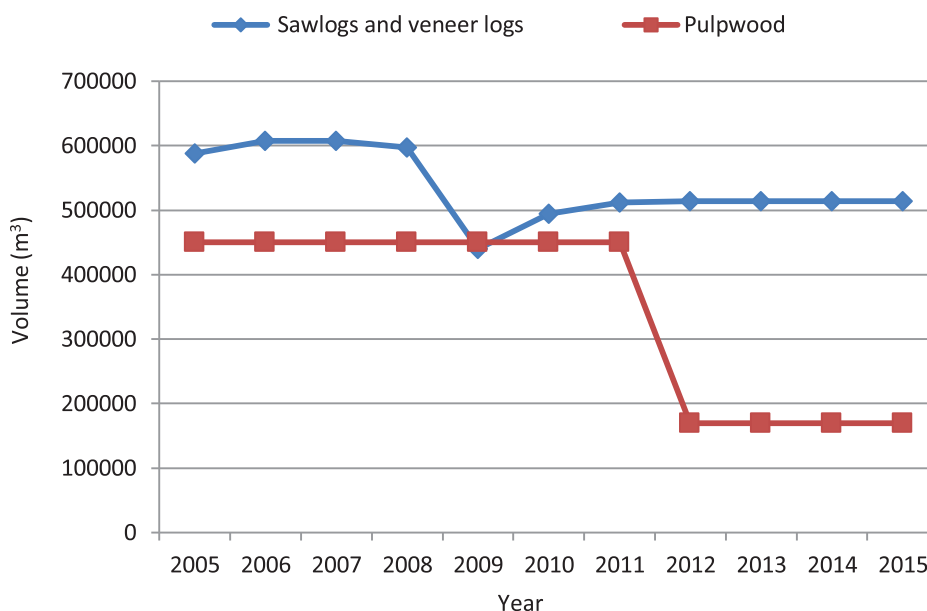

Figure 3.—Kenya industrial wood production, 2005 to 2015. (Source: FAOSTAT 2016.)

Debarked logs in RaiPly Company in Eldoret, Kenya.

A truck transporting logs to RaiPly sawmill in western Kenya.

efforts are made to improve production from industrial forest plantations. Most of the imports are high-value hardwood sawlogs, particularly the African mahogany from the Democratic Republic of Congo through Uganda. Some sawlogs and lumber are also imported from Tanzania and Uganda.

Table 3 shows the quantity of panel wood products produced in Kenya between 2005 and 2015. Plywood production remained constant at 66,000 m^3 over the period with an increase in imports to cover the domestic supply deficit. Hardboard and particleboard production also remained steady at 93,000 and 7,700 m^3, respectively, over the same period.

The value of paper imports between 2005 and 2015 is shown of Figure 5. The quantities included were for newsprint and writing paper. Imports were exceedingly higher than exports because there was no production from the country's pulp and paper mill over the period.

Challenges and Opportunities

Although efforts have been made to sustainably manage Kenya's remaining natural forests and develop a plantation-based supply for wood products manufacturers, many challenges remain. The first challenge is the low utilization efficiency of roundwood by sawmills which is estimated to average 28 percent. In contrast, the country's only large-scale integrated mill that produces lumber, plywood, particleboard, and hardboard achieves about 80 percent recovery. The mill utilizes waste material for combined heat and power to fuel its operations. However, most other sawmills in the country have smaller capacities and produce single products—mainly lumber—using inefficient technologies that result in low recovery rates. This remains a key
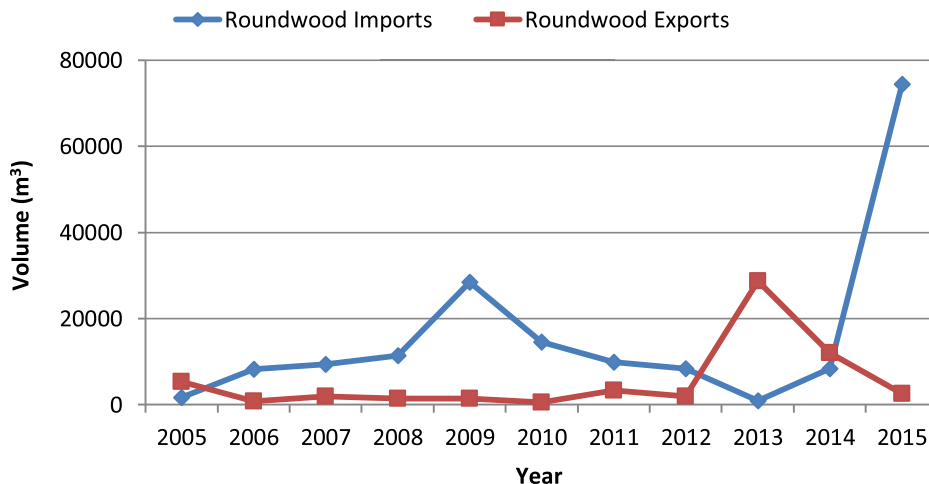

Figure 4.—Kenya industrial roundwood imports and exports, 2005 to 2015. (Source: FAOSTAT 2016.)

Year	Panel products (m^3)			
	Production	Exports	Imports	Consumption
Plywood				
2005	66,000	2,280	2,737	66,457
2006	66,000	2,188	3,552	60,260
2007	66,000	3,134	4,156	58,710
2008	66,000	5,023	4,893	56,084
2009	66,000	5,023	6,396	54,581
2010	66,000	6,857	6,801	52,342
2011	66,000	2,922	10,776	52,302
2012	66,000	2,384	7,663	55,953
2013	66,000	2,855	11,768	51,377
2014	66,000	787	20,025	45,188
2015	66,000	569	19,502	45,929
Hardboard				
2005	9,300	1,323	1,869	9,846
2006	9,300	722	1,146	9,724
2007	9,300	2,194	293	7,399
2008	9,300	61	534	9,773
2009	9,300	61	350	9,589
2010	9,300	265	656	9,691
2011	9,300	265	995	10,030
2012	9,300	749	10,689	19,240
2013	9,300	3,079	486	6,707
2014	9,300	3,411	326	6,215
2015	9,300	2,294	507	7,513
Particleboard				
2005	7,700	7,433	1,891	2,158
2006	7,700	1,783	518	6,435
2007	7,700	3,205	1,310	5,805
2008	7,700	7,112	2,327	2,915
2009	7,700	7,112	10,604	11,192
2010	7,700	4,597	9,858	12,961
2011	7,700	1,753	11,814	17,761
2012	7,700	1,088	5,176	11,788
2013	7,700	3,827	14,236	18,109
2014	7,700	71	584	8,213
2015	7,700	29	531	8,202

challenge in the utilization of available roundwood resources in the country.

The second challenge facing Kenya's forest sector is overcoming a supply deficit of industrial raw materials as a result of unsustainable management of its forests in the last three decades. Restocking of harvested industrial plantations by KFS has been lagging behind schedule with an estimated 3,000 hectares being replanted verses more than 6,000 hectares of mature plantations harvested annually (FAO 2015).

A related issue is a lack of labor following the discontinuation of the Shamba system by the government in 1986, a form of shifting cultivation by forest neighboring communities that provided cheap labor for plantation establishment. The backlog in restocking has had a negative impact on overall plantation management and is likely to contribute to future deficits in industrial wood for raw materials.

KFS must develop enforceable strategies to overcome these challenges. Although this will take some time, efforts should include encouraging private investment in forest production by bringing more land under forest production and by providing extension/outreach services and by planting fast growing high yield tree species.

Finally, increasing population pressure and associated demand for agricultural land and wood products poses a great challenge to the forestry sector in Kenya. Efforts to conserve natural forests and to ensure sustainable provision of goods and services from the forests requires partnerships between local communities and KFS. In addition, this requires provision of incentives to make communities less dependent on forests for their livelihoods in order to ease pressure on forest resources.

Opportunities exist to improve output and returns from forestry investments. Foremost, management of forest plantations should be market-oriented. Given that Kenya's forest plantations are managed to produce multiple wood products, an integrated harvesting system from the forest to the consumer would increase efficiency and output and result in higher revenues (Ototo and Ogweno 2006).

Another opportunity to improve output is to encourage the use more-efficient cook stoves in households, which would consume less firewood and charcoal. It is estimated that this could lead to savings of up to 960,000 m^3 of wood fuel per year (UNEP 2016). This is substantial and can help to decrease the current fuelwood deficit in the country.

Figure 5.—Kenya paper import and export value, 2005 to 2015. (Source: FAOSTAT 2016.)

Despite the challenges, the forestry sector continues to play an important role in Kenya and has great potential to grow. There is a sizable local market for forest products as well as in the greater East African and global markets. Efforts should be tailored toward increasing forest production and improving conversion recoveries at wood processing facilities. At the end of the day, adoption of innovation throughout the forest supply chain coupled with strong enforceable government policy will move Kenya's forest sector forward.

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