

Sawmilling in Kenya

The timber shortage has shifted attention to trees on farms despite inefficient sawing systems

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Kenya is internationally considered to have low forest cover since less than 10 per cent of its 569,250-km² land area is classified as forest (MENR, 2005). Nevertheless, the forest sector, by providing forest-related goods and services, is a vital part of the livelihoods of the Kenyan people. Forests provide energy for domestic and industrial processes, timber for construction and environmental concerns such as regulation of water flows, regulation of local climate conditions and provision of carbon reservoirs and sinks. It is estimated that 80 per cent of the population uses biomass wood for energy while urban people rely heavily on hydro-electric power (Luvanda and Muthike, 2008).

The forests contain 50 per cent of the nation's tree species, 40 per cent of larger mammals and 30 per cent of birds. Indigenous forests also host some endemic and threatened species. In addition, they serve as cultural, ceremonial and recreational sites and provide a variety of non-timber products. In recent years, more people have been engaged in the production and processing of non-timber forest products, especially in the dry areas, where forests are scarce.

Most closed canopy forests are gazetted forest reserves managed by the Kenya Forest Service (KFS). Other gazetted areas are national parks or game reserves managed by the Kenya

Table 1: Number of sawmills in Kenya, 1913–94

Year	Number of sawmills			Remarks
	Inside the forest	Outside the forest	Total	
1913–15	1	-	1	Operating under special concessions
1920	<10	-	<10	Initial growth of the sector
1930	>10	-	>10	Mainly providing timber for consumption of local settlers
1940	>20	-	>20	Timber export markets open up
1945- 1950	60	-	60	During and after the World War II
1960- 1964	34	-	34	Mau Mau rebellion and independence struggle
1970	200	150	350	Africanisation Programme
1980	220	150	370	
1985				Ban on exports of all indigenous timber
1990	-	361	361	Government regulation to remove sawmills from inside the forests
1994	-	450	450	
1999	-	450	450	Ban on all operations on state plantations

Source: MNR Annual Reports, 1964–99

Wildlife Service (KWS). An estimated 100,000 ha of forests are managed by county councils, which hold the land in trust for the local people. Forests in the Trust Lands are often not well managed, with total deforestation taking place in some cases due to lack of capacity or interest by the councils to manage these forests.

An unknown portion of indigenous forest is privately owned. Although these holdings tend to be small, they are considered important especially for

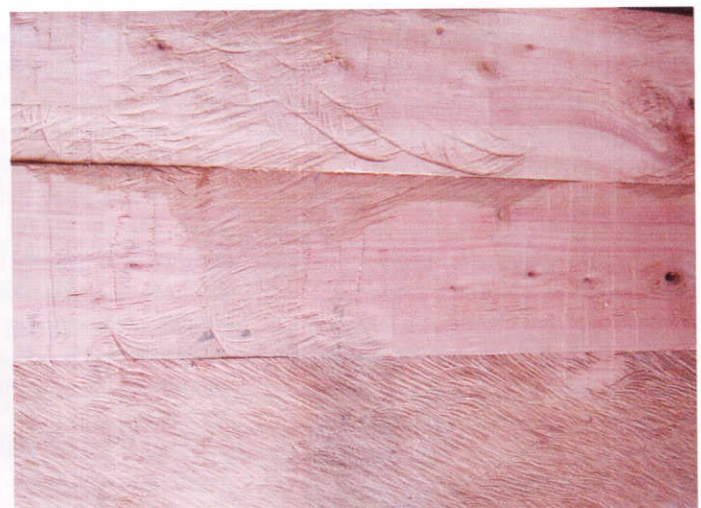
water catchments and environmental conservation. Their exploitation is also difficult to control. In the dry lands, farm forestry initiatives are becoming a major contributor to improved forest cover.

The sawmilling industry

The first sawmill in Kenya was set up in 1913 (Table 1) and the number of sawmills increased steadily to about ten in 1920. The second notable increase took place during World War



Freehand chain sawing is a common practice on farms. It is also called "splitting". (Photo: KEFRI)



Chain sawn timber surface: This timber was sawn by a chainsaw. One can clearly see its marks, translating in more loss of timber after planing. (Photo KEFRI)

II (1939–45), and was attributed to the high demand for timber for the construction of army barracks and railway sleepers for both local and export markets (MENR 1972). Another increase happened just after the war, mainly to produce timber for reconstruction work.

The Mau Mau rebellion of 1952–60 and the years before independence in 1963 however resulted in a sharp decrease in the number of sawmills due to the uncertainties about the future of the country, with many British sawmill owners leaving the country.

The sawmilling industry experienced its highest growth between 1965 and 1970, due to the establishment of the Investment Credit Development Corporation (ICDC) by the government shortly after independence. ICDC financed the purchase of existing sawmills and the start-up of new ones with African participation under the Africanisation programme. The rebate on royalties for export timber was also highest (50 per cent) during this period, which encouraged many saw millers to export timber, especially hardwoods.

This growth was again negatively affected by the 1982 order to stop the exploitation of camphor wood (*Ocotea usambarensis*) and by the 1984 presidential ban on the export of indigenous timber. In 1985, this ban was extended to cover all timbers unless one obtained special clearance from the Office of the President. Consequently, most sawmills turned to processing plantation grown softwood for local markets and some limited export.

With the availability of softwood timber in gazetted plantations, the number of sawmills increased further. However, this increase was not accompanied by efficiency of sawing systems and some of the sawmills recorded conversion factors from logs into timber as low as 30 per cent or even lower (Muthike and Mbaabu, 1994).

This was mainly caused by:

- Use of very thick circular blades
- Poor saw maintenance practices due to lack of adequate training of the saw doctors
- Lack of adequate sawing skills and record keeping.

This in part contributed to overexploitation of the forest resources, which in addition to low replanting rates and abusive practices in the timber sales, forced the government to impose a ban on operations in gazetted forests by all timber processors in 1999. The ban saw most sawmills close due to lack of raw materials.

Table 2: Recovery rates per sawing method

Sawing method	Chain saw	Mobile bench saw	Pit saw	Circular saw	Band saw
Timber recovery (%)	27.0	29.8	39.9	30.1	46.1

Source: Muthike, 2003.

The emergence of on-farm timber processing

Before 1999, on-farm timber sawing was insignificant, since sawmills were able to meet the demand for sawn timber. However, the ban on wood harvesting from government plantations resulted in an acute shortage of timber, prompting increased imports from neighbouring countries and cross-border timber trade, both legal and illegal (Samuel et al, 2007). Trees on farms became the principal alternative, and quickly made up a significant proportion of all traded timber despite lack of efficient sawing systems.

A substantial amount of *Grevillea robusta* was planted on farmlands in the 1980s. *Grevillea* and eucalyptus species were also promoted for shade in coffee and tea plantations. Many indigenous species are also found on farms, remnants of natural forests. The few sawmills still operating used on-farm trees, although this became uneconomical as distances to the tree sources increased. Consequently, portable mills and tractor-mounted circular saws were used to harvest on-farm trees (Muthike et al, 2006).

Farm forestry continued to receive support from the government and development partners in the last decade. Several initiatives promote on-farm tree growing in the drylands. The government, through the Kenya Forestry Research Institute (KEFRI), also dedicated a large portion of its research grants to farm forestry and on-farm timber processing technology development initiatives.

On-farm timber value chain

Unlike the natural and plantation forests, which belong to the government and are managed through KFS, trees growing on farms belong to farmers, who either planted or inherited them. Most farmers sell standing trees, which generate little, if any, value. Price depends on how urgently a farmer needs money, tree quality, accessibility and the farmer's knowledge of the tree's value. At present, timber prices are relatively high due to a shortage of supply, although farmers receive little of this revenue.

Farmers are approached by one of several types of buyers:

- Private individuals who require timber for a project. Individuals hire sawing machines and operators to saw the trees

into the desired dimensions. This category includes some larger corporate users such as tea factories, schools and hospitals, which mainly fell trees for fuel wood. In the process, valuable timber trees are commonly felled for fuel wood.

- Timber dealers who buy standing trees. These dealers saw the trees on-site with either bench saws and/or chainsaws or take the logs to a static sawmill. The dealers sell the sawn timber to end-users or other dealers.
- Timber brokers who buy standing trees from farmers and sell them to processors, making a profit without any physical effort. Brokers often offer the lowest prices to farmers.
- Tree finders who are hired by any of the three groups above to locate suitable trees and negotiate the cheapest price. They are paid a commission by the processors/brokers, depending on the number of trees found and the price negotiated.

Institutional and legal framework

Since independence, the forest sector has faced many constraints that have hampered its development. A weak legal framework did not allow the private sector or communities to participate in forest management, or permit the then Forest Department (FD) to manage resources outside gazetted forests. The Forest Act 2005 provides for the participation of more stakeholders in the management and conservation of forests.

Under the old Forest Act, the FD was characterised by centralised decision-making and inadequate financing. This resulted in ineffective management, best illustrated by the poor condition of industrial plantations and the degradation of indigenous forests. Under the new Act, sustainable forest management is being carried out by KFS. The parastatal is charged with forest administration, policy development, forest regulation, training, extension and protection of natural forests.

The Act also promotes commercial tree growing by the private sector, farmers and communities by providing incentives for forest development. In addition, KFS works closely with various sectors such as agriculture, water, land, energy and tourism. And in the area of



Framed chainsaw: A frame is attached to the chainsaw so that timber is sawn in a regular way, into planks of equal thickness. (Photo KEFRI)

research, the Kenya Forestry Research Institute (KEFRI) plays an important role of generating and disseminating the necessary information and technologies for development, management and utilisation of forests and forest products.

Policy and legislation

Before the 1999 ban on wood harvesting from government plantations, timber dealers who bought trees from plantations used chain saws to convert them into beams for ease of transport. Chain saws were also used to convert illegally acquired timber from both indigenous and plantation forests. Their use has since extended to timber of commercial sizes, especially on farms. Mobile saw benches are also used but are quickly being substituted by the inexpensive, easier to operate and faster chain saw systems.

Today, chain saws present the major legal challenges due to frequent misuse. The saws are legal in Kenya and can be used by operators without restrictions. Currently, no registration, licences or levies are imposed on chainsaw operators, so it is difficult to know how many chainsaws are operating in a particular area. Therefore, while it is assumed that most of the traded timber comes from farms, substantial quantities are illegally sourced from government plantations, especially in areas bordering natural and plantation forests (Samuel, Pasiecznik and Fehr 2007).

To minimise illegal practices, two requirements have been put in place by the government:

- Farmers who intend to sell standing trees on their farms require certificates of tree

origin. These are obtained from the local chief before felling and affirm that the trees are from individually owned farms.

- Loading and transportation permits from the local district forest office certify that the timber is from the trees identified by the chief and shown in the certificate of origin and are authorised for transportation.

Although these documents are considered essential to minimise illegal trade in timber products, enforcing them is a challenge. Since there is no supervision during harvest operations, unscrupulous traders can acquire a certificate of origin from the local administration officer for a few trees, use it to steal and process wood from a nearby plantation as well and obtain a transportation permit for the mixed timber.

Although the transport permit is supposed to be signed after a forest officer has supervised the loading of the timber from the sawing site, some traders process timber from different sites and gather it in one place. Illegally obtained materials are difficult to differentiate from legal timber and can easily find a way to the market.

Abuse of the legal requirements - e.g. bribes given to administrative officers to release certificates of origin or transport permits - have been reported (Luvanda and Muthike, 2008), as have cases where security officers at roadblocks delayed lorries carrying timber to extort bribes. This abuse increases the costs of providing timber to the market. In most cases, these costs are passed on to the farmer (in terms of reduced



Framed chainsawn timber: This timber is produced by a framed chainsaw, and it is regular and smooth on the surface. (Photo KEFRI)

tree prices) and the timber consumer (in terms of increased timber prices).

Other steps to reduce illegal timber trade in Kenya include meeting the demand for timber by increasing the timber production and processing capacity of timber-deficient regions. With natural forests protected and plantations having to compete with agriculture, growing timber trees outside forests is increasingly being seen as the way forward. Farm forestry has shown huge potential to meet the demand for more wood, and Kenya's vast drylands are slowly being turned into productive agro-forests, supported by appropriate skills and tools.

Drivers and impacts of on-farm timber processing

Three on-farm sawing methods are commonly used. These are chainsaws, mobile bench saws and pit saws. The chain saw is preferred because it is faster than the pit saw, it requires only one operator and at most an assistant, it is cheaper and less limited by terrain than the tractor-pulled bench saws (Oksanen, Pajari and Tuomasjukka 2002).

When operated freehand, however, the chain saw system has the lowest mean timber recovery due to the wide chain kerf, machine vibration and to some extent, the operators' skills. Freehand milling causes poor surface finish and a low

recovery rate, as large quantities of wood are lost in the form of sawdust.

Unlike large-scale industrial harvesting and processing techniques, on-farm methods are often inefficient. Chain sawn timber is generally of poor quality. Users have to buy more than required to allow for the excessive planing needed to obtain a consistent thickness and acceptable finish. This is partly because chainsaw operators are unskilled, inexperienced, or drink alcohol to overcome fatigue while sawing.

However, chainsaw milling has a number of social and economic benefits. The main social impact is local employment and business opportunities, provision of building materials and adding value to farm trees. With improved sawing systems and training, the social and economic impacts of the systems could be increased to include:

- improved timber recovery,
- high-quality timber,
- operator safety, and
- improved income.

On-farm timber processing is likely to continue as farm tree growing is promoted and demand for timber keeps rising.

On-farm timber sawing systems

On-farm timber processing in Kenya is a lucrative business in areas with trees on farms and near forests. A variety of ownership structures exists:

- In most cases, people purchase chainsaws and employ operators. When a sawing job is found, the chainsaw owner buys fuel and lubricants and charges the tree owner, based on either running foot of timber or amount of fuel used. The payment is shared in three equal parts - to the machine owner as profit; to repay the cost of fuel and maintenance of the chainsaw; and split by the operator and the assistant at a ratio of 2:1.
- Some operators own chainsaws. In this case, the sawing charges are directly paid to them and they only employ assistants when a job is found. The assistants are paid based on how long they work.
- In a few cases, machine owners hire out their machines to operators for a given period. In such cases, payments to the machine owner are worked out per day, irrespective of whether or not the machine is used. The operator has thus to be aggressive in finding work for the machine.

Improved on-farm timber processing

Table 3: Performance of the on-farm timber processing systems

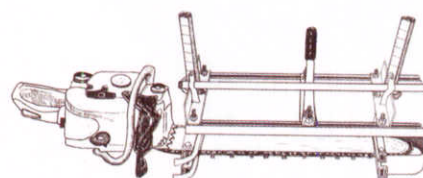
Sawing method	Freehand chain saw	Framed chainsaw	Mobile bench saw	Pit saw
Estimated initial investment cost (Ksh)	60,000 (Chainsaw only)	75,000 (Chainsaw and locally fabricated frame)	1,500,000 (Used tractor and locally fabricated bench)	25,000 (Blade only)
Production (m ³ /8hrs)	0.531	0.494	1.321	0.125
Production cost (Ksh/m ³ of sawn timber)	2,315	3,275	3,875	4,518
Timber recovery (%)	27.0	56.3	29.8	39.9

Source: Muthike, 2003; Muthike et al, 2008; Marfo, 2010

The current research focus is on inexpensive portable sawing systems that can increase the value of on-farm trees as sawn timber. Such systems should be eco-efficient and protected by law. KEFRI began studies on chainsaw frames with the objective of improving timber recovery rates. Frames guides for the chain saws have been developed. They help the operator in sawing timber to a consistent size with a relatively smooth surface and improve timber recovery; but they require a special ripping chain, which makes

in Kenya and the ban on logging operations in forest plantations drive farm timber processing.

Farmers are becoming more knowledgeable on tree growing, log and milling characteristics and market requirements. However, the processing labour capacity is limited and most people are unskilled or semi-skilled. This results in low timber recovery rates. Sawing systems operating crews have limited knowledge on general safety, chainsaw maintenance and timber recovery at various stages of log processing.



the technology difficult to acquire.

Figure 1. Chainsaw framed guide

However, KEFRI is in the process of modifying the standard felling chains to make them adoptable to work with the framed system. Interim results based on the performance of the system show that it recovers more timber (Table 2), with improved surface quality than freehand milling. It also greatly improves the operators' safety.

The technology has been demonstrated and training conducted in various parts of the country. The frames have been successfully modified and fabricated locally. It is expected that such efforts will generate strong incentives for farmers to grow more trees on their farms, increasing tree cover and reducing overdependence on the natural and plantation forest stands.

Conclusions

Chainsaw milling is illegal and prohibited in government gazetted forests. It is legal on farms as long as one obtains the appropriate permits. The system is more commonly used than the tractor-pulled bench saw. The high demand for timber

Recommendations

The following changes would improve the productivity and capacity of the timber value chains from on-farm activities:

- Training of farmers in silviculture treatments and management through simple on-farm tree inventory and valuation, timber marketing and utilisation to improve tree prices.
- Training of processors to improve on-farm timber processing using appropriate machinery in harvesting and conversion, machinery and equipment maintenance and safety measures and timber quality, marketing and utilisation specifications.
- Improving chainsaw techniques by reducing the kerfs, weight and level of vibration to enhance timber quality and increase recovery.
- Promoting the use of chainsaw guide frames and encouraging chainsaw operators to invest in technology to enhance timber recovery and surface quality. This could be aided by development of policies incorporated in forestry law.

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