



4.7 Chainsaw milling in Kenya

GEORGE M. MUTHIKE, DOUGLAS SHITANDA, CHRISTOPHER L. KANALI and FRED N. MUISU

Kenya's forest resources

Kenya is internationally considered to have low forest cover since less than 10% of its 569,250-km² land area is classified as forest area (MENR 2005). Nevertheless, the forest sector provides forest-related goods and services and is a vital part of the livelihoods of the Kenyan people. The forest's most significant contributions are energy for domestic and industrial processes, timber for construction and environmental services such as regulation of water flows, regulation of local climate conditions and provision of carbon reservoirs and sinks. It is estimated that 80% 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% of the nation's tree species, 40% of larger mammals and 30% of birds. Indigenous forests also contain some endemic and threatened species. In addition, they serve as cultural, ceremonial and recreational sites and provide a variety of non-timber products.

Most closed canopy forests are gazetted forest reserves managed by the newly established Kenya Forest Service (KFS). A few gazetted areas are national parks or game reserves managed by the Kenya Wildlife Service (KWS). An estimated 100,000 ha of forests are managed by county councils, which hold the land in trust on behalf of the local people. Forest exploitation in these trust land areas is often not well managed. In some cases, total deforestation has taken place due to a lack of capacity in the councils to manage these forests. An unknown area of indigenous forest is privately owned. Although these holdings tend to be small, they are considered important for water catchments and environmental conservation. Their exploitation is also difficult to control.



THE HIGH DEMAND
FOR TIMBER IN
KENYA AND THE
BAN ON LOGGING

OPERATIONS IN FOREST PLANTATIONS
DRIVE ON-FARM TIMBER PROCESSING.

George M. Muthike works for the Kenya Forestry Research Institute; **Douglas Shitanda** and **Christopher L. Kanali** work for the Jomo Kenyatta University of Agriculture and Technology; and **Fred N. Muisu** works for the Department of Forestry and Wood Science, Moi University.

The sawmill industry: processors of the wood

The first sawmill in Kenya was set up in 1913 (Table 1). The number of sawmills increased steadily, to about ten in 1920. The second notable increase in the number of sawmills took place during World War 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 occurred 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 resulted in a sharp decrease in the number of sawmills due to uncertainties about the future of the country. Many British sawmill owners left the country at this time.

The sawmill industry experienced its greatest growth between 1965 and 1970, due to the establishment of the Africanization programme and 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. The rebate on royalties for export timber was also highest (50%) during this period, which encouraged many sawmillers to export timber, especially hardwoods.

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

year	number of sawmills			remarks
	inside forest	outside 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
1945–50	60	—	60	during and after World War II
1960–64	34	—	34	Mau Mau rebellion and independence struggle
1970	200	150	350	Africanization programme
1980–85	220	150	370	ban on exports of all indigenous timber (1985)
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

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

With the availability of softwood timber in gazetted plantations, the number of sawmills increased further. Due to the over-exploitation of the forests and a low replanting rate, however, the government again imposed a ban on operations from gazetted forests by all timber processors. The ban, which is still in force, caused most sawmills to close due to a lack of raw materials.

The emergence of chainsaw milling

Before 1999, chainsaw milling (CSM) was insignificant, since sawmills were able to meet the demand for sawn timber. The ban on wood harvesting from government plantations, however, resulted in an acute shortage of timber. This prompted increased imports from neighbouring countries and cross-border timber trade, both legal and illegal (Samuel, Pasiecznik and Fehr 2007). Trees on farms became the principal alternative, and quickly made up a significant proportion of all traded timber.



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

processed on-farm trees, although this became uneconomical as distances to the tree source increased. Consequently, portable mills and tractor-mounted circular saws were used to harvest on-farm trees (Muthike, Githiomi and Onchieku 2006).

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

On-farm timber value chain

Unlike natural and plantation forests, which belong to the government and are managed through KFS, trees growing on farms belong to the farmers, who either planted or inherited them. Most farmers sell standing trees, which generates little if any added value. Negotiations over price depend on the urgency of the farmer's need for cash, 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 see little of this revenue.

Farmers are approached by several types of buyers:

- private individuals, who require timber for a project — they hire a chainsaw operator or a chainsaw and bench saw in combination to saw the trees into the desired dimensions; this category also includes some larger corporate users such as tea factories, schools and hospitals, which mainly fell trees for fuelwood (valuable timber trees are commonly felled for fuelwood);
- timber dealers, who buy standing trees —they either saw them on-site with their own bench saw and/or chainsaw or take the logs to a sawmill; the dealers sell the sawn timber to other dealers or end users;
- timber brokers, who buy standing trees from farmers and sell them to processors, making a profit without any physical effort — brokers usually offer the lowest prices to farmers; and
- 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, with the amount depending on the number of trees found and the price negotiated.

Institutional and legal framework

Since independence, many constraints have hampered the development of the forest sector. A weak legal framework prevented the private sector or communities from participating in forest management, and the Forest Department (FD) from managing resources outside gazetted forests. The *Forest Act 2005* put in place the reforms necessary to revitalize the sector. They provide for the participation of more stakeholders in the management and conservation of forests.

Under the old *Forest Act*, the FD was characterized by centralized 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 service is charged with forest administration, policy development, forest regulation, training, extension and protection of natural forests. It 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.



Policy and legislation

Before the 1999 ban on wood harvesting from government plantations, timber dealers who bought trees from plantations used CSM to convert them into beams for ease of transport. CSM was also used to convert illegally acquired timber from both government indigenous and plantation forests. Its use has since extended to timber of commercial sizes, especially on farms.

Today, CSM is a source of major legal challenges due to frequent misuse. Chainsaws are legal in Kenya and can be used by operators without restrictions. Currently, no licences or levies are imposed on chainsaw operators; therefore, it is difficult to know how many chainsaws are in use. While it is assumed that most of the traded timber comes from farms, substantial amounts are illegally sourced from government plantations, especially in areas bordering natural forests (Samuel, Pasiecznik and Fehr 2007). To minimize illegal practices, two requirements have been put in place by the government:

- a certificate of tree origin is required by farmers who intend to sell standing trees on their farms —it is obtained from the local chief's office before felling and affirms that the trees are from individually owned farms; and
- a loading and transportation permit from the local district forest office certifies that the timber is from the trees identified by the chief and shown in the certificate of origin and is authorized for transportation.

Although these documents are considered essential to minimize 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, 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 store it in one place. Illegally obtained materials are difficult to differentiate from legal timber and can easily find a legal way to 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 timber lorries 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 tree price) and the timber consumer (in terms of increased timber price).

Other steps to reduce illegal timber trade in Kenya include meeting the demand for timber by increasing timber-deficient regions' capacity for timber production and processing. With natural forests protected and plantations having to compete with agriculture, growing timber trees outside forests is increasingly being seen as a way forward (World Agroforestry Centre 2004). Farm forestry has shown an enormous 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 chainsaw milling

Three on-farm sawing methods are commonly used: chainsaws, mobile bench saws and pit saws (Muthike 2004). CSM is preferred because it is faster than pit sawing, it requires only one operator and at most an assistant, and it is cheaper and less limited by terrain than tractor-pulled bench saws (Oksanen, Pajari and Tuomasjukka 2002). When operated free-hand, however, CSM has a low mean recovery rate (Holding, Njuguna and Gatundu 2001), due to the wide chain kerf, machine vibration and to some extent to the lack of operator skills (Table 2). A large amount of wood is lost in form of sawdust (Muthike 2004). Free-hand milling also results in a poor surface finish.

Table 2. Mean comparison results for sawing methods and training

sawing method	mean recovery, untrained operators	mean recovery, trained operators
chainsaw	23.30	30.20
mobile bench saw	27.40	35.05

Source: Muthike 2004

Unlike large-scale industrial harvesting and processing techniques, on-farm methods are often inefficient. Chainsawn timber is generally of poor quality. Users have to purchase larger dimensions 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.

Chainsaw milling has a number of social and economic benefits, however. The main social impacts include local employment opportunities 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 CSM 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 tree growing is promoted and demand for timber is rising.

Chainsaw ownership and benefit-sharing

CSM in Kenya is a lucrative business in areas with trees on farms and near forests. A variety of ownership structures exist:

- In most cases, people purchase chainsaws and employ operators. When a sawing job is found, the chainsaw owner buys fuel and lubricant and pays 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 their own chainsaws. In this case, the sawing charges are paid directly to them and they employ assistants only when a job is found. The assistants are paid based on the length of time they work.
- In a few cases machine owners rent their machines to operators for a given period of time. In this case, payments to the machine owner are worked out per day irrespective of whether the machine is used or not. In such cases, the operator has to be aggressive in finding work for the machine.

Improved on-farm timber processing

The current research focus is on inexpensive portable sawing systems that can greatly increase the value of on-farm trees as sawn timber. KEFRI began studies on chainsaw frames in 2006 with the objective of improving timber recovery rates.



Frames guide the operator in sawing timber with consistent size, relatively smooth surface and improve timber recovery. They require a special ripping chain, which makes the technology more difficult to acquire. KEFRI has, however, been able to modify standard felling chains. Results show that the technology recovers more timber than freehand milling and results in improved surface quality (Muthike et al. 2008). It also greatly improves the operator's safety. The technology has been demonstrated and training conducted in various parts of the country, and the frames

have been successfully modified and fabricated locally. It is expected that such efforts will generate strong incentives for the farmers to grow more trees on their farms, increasing tree cover and reducing their dependence on natural and plantation forest stands.

Conclusions and recommendations

Conclusions

Chainsaw milling is illegal in prohibited government gazetted forests. It is legal on farms as long as the appropriate permits are obtained. Chainsaws are more commonly used than tractor-pulled bench saws. The high demand for timber in Kenya and the ban on logging operations in forest plantations drive on-farm timber processing.

Currently, farmers have little knowledge of tree growing, log and milling characteristics or market requirements. The labour capacity is limited and most people are unskilled or semi-skilled. This results in a low recovery rate. Training of logging crews on general safety, chainsaw maintenance and timber recovery at various stages of log processing is still infrequent and poorly organized.

Recommendations

These changes would improve the productivity and capacity of on-farm CSM activities:

- training of farmers in silvicultural treatments and management through simple on-farm tree inventory and valuation, timber marketing and utilization to improve tree prices;
- training of millers to improve on-farm timber processing through the use of appropriate machinery in harvesting and conversion, machinery and equipment maintenance and safety measures and timber quality, marketing and utilization specifications;
- improving CSM techniques by reducing kerf, weight and level of vibration to enhance timber quality and increase recovery; and
- 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 the development of policies incorporated in forestry law.

References

Holding C., P. Njuguna and C. Gatundu. 2001. *Farm sourced timber: the restructuring of the timber industry in Kenya. Opportunities and challenges*. Forest Extension, IUFRO, Vienna, Austria.

Luvanda, A.M. and G.M. Muthike. 2008. *Impact Assessment among the Small-scale On-farm Timber Processors using Improved Skills in Kenya*. Kenya Forestry Research Institute, Nairobi, Kenya, 8 pp.

MENR (Ministry of Environment and Natural Resources). 2005. *The Forest Act 2005*. Nairobi: MENR.

MENR (Ministry of Environment and Natural Resources). 1972. *Forest Department Annual Report*. Nairobi: MENR.

Muthike, G.M. 2004. Evaluating the impact of skill improvement in small-scale on-farm timber processing in Kenya. In M.N. Muchiri, B. Kamondo, P. Tuwei and J. Wanjiku (eds.) *Recent Advances in Forestry Research and Technology Development for Sustainable Forest Management*. Proceedings of the second KEFRI scientific conference, Muguga, Kenya, November 1–4, 2004.

Muthike, G.M., J.K. Githiomi and J.M. Onchieku. 2006. *Sawing guidelines for small-scale timber processing, specially developed for chain saw, mobile saw bench and pit saw operators in Kenya*. Forest Products Research Centre, KEFRI, Nairobi, Kenya.

Muthike, G.M., D. Shitanda, C.L. Kanali and F.N. Muisu. 2008. The potential of chainsaw frame mills in on-farm timber processing in Kenya: recent advances in forestry research for environmental conservation, improved livelihood and economic development. In Proceedings of the fourth KEFRI Scientific Conference, October 6–9, 2008, Nairobi, Kenya.

Oksanen, T., B. Pajari and T. Tuomasjukka (eds.). 2002. Forests in Poverty Reduction Strategies: Capturing the Potential. *Proceedings No. 47*. Proceedings of a workshop in Tuusula, Finland, October 1–2, 2002, 206 pp.

Samuel J.H., N.M. Pasiecznik and C. Fehr. 2007. *The Potential of Chainsaw Milling Outside Forests: Summary report with economic and policy case studies from East Africa*. HDRA, Coventry, UK. 66 pp. <http://chainsawgwork.org>.

World Agroforestry Centre. 2004. Small-holder Timber Workshop Notes. Small-holder Timber Workshop, November 29–December 1, 2004, World Agroforestry Centre, Nairobi, Kenya. CD-ROM.