Sustainability of sawn timber supply in Tanzania

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SUMMARY

Timber is an important commodity in African towns. This paper reports the findings from research into the supply of timber to Dar es Salaam and Mwanza (Tanzania). Tanzania has reserves of hardwood timber in the natural forest and softwood timber in plantations. Information gathered from consumers, producers and traders was used to estimate consumption, analyse changing patterns of supply and assess sustainability. Analysis of the hardwood supply system (presented as a sub-sector diagram) found it to be ‘slippery’, evolving in response to diminishing resources and a cumbersome and ineffective regulatory regime. With the advent of pit-sawing and other changes, control over the cutting of timber in the natural forest has been lost. Regaining control is unlikely unless effective local community participation can be established. Sustainable management in the plantations is achievable and offers the best chance of ensuring a supply of timber to meet future demands.

Keywords: Tanzania, timber, pit-sawing, sustainability, regulation

INTRODUCTION

In sub-Saharan Africa, urban growth is putting new pressures on forest resources. While the dependence of urban households upon wood for cooking is now widely recognized, and there has been considerable research into the flows of fuel-wood and charcoal into the towns (e.g. Leach and Mearns 1998, Ribot 1998) the supply of other wood products (sawn timber and/or poles) to urban markets has received little attention to date.1 This is a serious omission. Research by the authors in several countries in East and West Africa suggests that wood, whether roughly hewn or sawn, is one of the most important commodities in African towns (Wells et al. 1998, Wells and Wall 2003). Research revealed that the majority of poor households depend upon it to meet their requirements for shelter (roofing, doors, windows, scaffolding) and basic household furniture. At the same time, many people find work in the forest and wood products industries in both urban and rural areas. An official estimate of employment in the forest sector in Tanzania is 730 000.2 In addition, the national informal sector survey (URT 1991) found 157 168 people working in the wood products sector, 116,634 in rural areas and 40 534 in the towns. A survey of employment in small-scale forest products businesses in six southern African countries (Arnold and Townsend 1998) found employment in wood products to be growing at 30% a year. Ensuring an adequate supply of timber is therefore a key factor in sustaining livelihoods and containing poverty.

This paper presents findings from research into the networks supplying sawn timber from the forest and plantations in Tanzania to the primary city, Dar es Salaam and the second largest city, Mwanza. The research reported here was part of a bigger project investigating the flows of a variety of wood products to urban users in four towns in Kenya and Tanzania. The aim was to identify policies that would facilitate a sustainable supply of wood, so as to provide for current and future needs. Underlying this objective is a „people centred” approach to natural resource use, which gives priority to the sustainability of the flow of goods (timber) from the forest to support urban and rural livelihoods while recognising that adaptations may be needed to balance trade offs with environmental protection and conservation.

The broad strategy adopted for the research is what Blaikie (1993) terms ‘abductive’, meaning that it seeks to produce accounts of social life which draw on the concepts and meanings used by social actors and the activities in which they engage. This approach was adopted because the dearth of relevant and credible secondary material, including statistical

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1 Notable exceptions are Dewees and Saxena (1995) who examine the markets for black wattle in Kenya and eucalyptus in India, Marshall and Jenkins (1994) who investigate the trade in Kenya’s indigenous timber and Wall et al. (1998) who trace the flow of wood to the town of Mopti, Mali.

2 The estimate is from the Ministry of Natural Resources: http://www.tanzania.co.tz/naturalresources.html
data, meant the research was heavily reliant on obtaining good quality information from people working within the wood supply systems. Semi-structured interviews were chosen as the main method for data gathering, rather than structured interviews or questionnaire surveys. We considered this likely to produce information of greater accuracy because it allows the respondents to explain their work in the way in which they understand it.

Field work was undertaken between 1997 and 1999 by a multi-disciplinary team. Interviewing commenced in the towns with a randomly selected sample of wood retailers, drawn from a ‘population’ roughly enumerated in a visual survey of the towns and stratified according to location and size. The respondents identified their ‘forward linkages’ to users of timber. From this information the main groups of timber users (furniture makers, house builders and building users of timber) were identified and a sample selected for interview as above. Retailers and users also explained their ‘backward linkages’ to suppliers of timber and the areas from which it was obtained. The sources of wood were roughly defined in this way.

Research then moved to the supply areas and to the major staging posts within the source to urban supply chain, where interviews were conducted with traders and producers of timber. At these locations random selection of respondents was impracticable because information about the identity, location and number of people involved in the timber business was unavailable without extensive primary research. We therefore sought interviews with those most likely to provide an overview of the system or of their own business activities within the system. Informants were also sought who could verify key pieces of information provided by others.

Tanzania is a vast country with substantial indigenous forest resources in national parks, game reserves, forest reserves and on public land, as well as a number of industrial forest plantations with reserves of mature timber. While the indigenous forests contain mostly broad leaved hardwoods, most of the plantations have been stocked with exotic softwoods, conifers mostly pine and cypress. The interviews in Dar es Salaam and Mwanza revealed that both softwoods from the plantations and hardwoods from the indigenous forests are used in the towns but softwood has been substituted for hardwood as the latter has become more expensive. The process of substitution began in the 1980s with temporary uses of wood (formwork, scaffolding) in the construction industry and progressed in the 1990s to housing and furniture for low income households. Interviews were therefore conducted with producers, traders and forest officers in both the natural forest and the plantations. The composition of the sample of respondents in urban and rural areas is shown in Table 1.

| TABLE 1 Composition of the interviewing set |
|-----------------------------------------|------------------|
| Urban Respondents | Dar | Mwanza |
| Timber retailers | 101 | 17 |
| Furniture makers | 46 | 14 |
| House builders | 19 | 4 |
| Building contractors | 4 | 4 |
| TOTAL | 170 | 39 |
| Rural respondents | Hardwood | Softwood |
| Traders | 14 | 7 |
| Sawmillers | 7 | 19 |
| Pit-sawyers | 18 | 3 |
| Forest officers | 11 | 13 |
| Tree farmers | 0 | 5 |
| TOTAL | 50 | 47 |

The large sample of retailers selected for interview in Dar es Salaam was primarily because we were attempting to quantify the flow of wood traded through retailers in the town. In the absence of any reliable official data on the quantities of timber produced or consumed in Tanzania, the information provided by respondents was the main source of data from which an estimate of the total quantities of timber and the balance between hardwood and softwood could be derived. However this proved extremely difficult as the majority of enterprises selling timber are small, do not keep records and have no idea of the quantities of timber traded. We did produce a rough estimate of timber traded through retailers but concentrated efforts on developing estimates of timber demand. These were checked for overall consistency against estimates from the supply side. The results are presented in the following section.

The information provided by all respondents in urban and rural areas was used to build a picture of the systems supplying timber to Dar es Salaam and Mwanza. The approach adopted to understand the structure of the supply networks is based on sub-sector analysis, as outlined by Boomgard et al. (1992). Sub-sector analysis is a systems approach to economic activity, emphasising the interdependence of economic units involved in the production and distribution of a commodity. The following concepts are borrowed from the sub-sector approach: the existence of alternative vertical production/distribution channels for a commodity, the competitive position of economic units within these alternative supply channels, the extent of vertical coordination within channels, and the possibility of obtaining ‘leverage’ through ‘system nodes’ (the point where large quantities pass through a few hands or restricted geographic space). Further explanations
from the sub-sector approach are presented in the paper.

The following section presents the estimates of hardwood and softwood timber consumption in the two towns together with a summary of the methods used to prepare them. This is followed by our analysis of the supply of hardwood timber from the natural forest, which is the main focus of the paper. The sources of timber are identified and recent changes highlighted. Explanations are offered for the structure of the network, noting in particular the effects of diminishing resources and attempts at regulation. Attention then turns to the supply of plantation softwood. The final section assesses sustainability and discusses the policy options.

TABLE 2

<table>
<thead>
<tr>
<th>QUANTITIES OF TIMBER CONSUMED IN DAR ES SALAAM AND MWANZA</th>
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<table>
<thead>
<tr>
<th>DAR ES SALAAM</th>
<th>MWANZA</th>
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<tbody>
<tr>
<td></td>
<td>Softwood</td>
</tr>
<tr>
<td>Household demand for furniture</td>
<td>24 000</td>
</tr>
<tr>
<td>Household demand for housing</td>
<td>15 060</td>
</tr>
<tr>
<td>Construction industry demand</td>
<td>64 000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>103 060</td>
</tr>
</tbody>
</table>

The quantity of wood used by households in 1998 to meet their demand for furniture was calculated from data on household expenditure on furniture in the Household Budget Survey (URT 1992) adjusted for population growth and inflation. Assistance was provided by furniture makers who also advised on the relative quantities of hardwood and softwood used to make common pieces. To estimate the quantity of timber required to house the additional population in the towns each year we used detailed calculations of quantities of timber in various common house types and various assumptions about the distribution of house types, rate of population growth (4.5%) and median living space (4.5 m² per person). Adding the household consumption of timber for house building and furniture making and dividing by population gave a total consumption of timber per 1 000 population of 37.4 m³ in Dar es Salaam and 60.8 m³ in Mwanza. The latter figure is consistent with the estimated consumption of 56 m³ of timber by households in Arusha in 1988 (Ngaga and Kowero 1988). The lower figure for Dar es Salaam is explained by the finding in various household budget surveys that households in the capital do in fact spend much less on furniture than households in the other municipalities.

In addition to household demand, the construction industry uses large quantities of sawn timber for joinery (doors and windows) for roof structures and for formwork in reinforced concrete construction. In 1998 hardwood was still used for joinery but had been replaced by softwood in roof construction and formwork. Detailed analysis of softwood timber requirements in buildings under construction in Dar es Salaam and Mwanza in 1999 yielded minimum and maximum estimates from which we took the average.

The figures in Table 2 are broadly consistent with estimates from other sources. As explained in a later section, Dar es Salaam imports most of its softwood timber from the Sao Hill plantation in the southern highlands, from where it is transported by both road and rail. Data supplied by TAZARA showed shipments of 46 000 m³ of sawn timber offloaded in Dar es Salaam in 1998. Equal quantities were estimated to be coming by road, with a further 15 000 m³ from the northern plantations, giving a total estimate of 107 000 m³. However, our estimate of quantities of timber sold in an average year by the sampled retailers in Dar es Salaam produced rather different figures, 83 500 m³ of softwood and 23 300 m³ hardwood. The difference between these figures and those shown above could be because some of the building contractors do not get their softwood supplies from retailers but more directly from the source. Furniture makers may also bypass retailers in obtaining raw material transported into town in the form of semi-finished furniture, a point which we shall return to later.

In Mwanza we found two sources of data on timber supplies to the town. In a monitoring exercise for the World Bank, Chang (1998) estimated 10 550 m³ of hardwood entering the town in 1998. This is less than our estimate presented in Table 2. On the other hand, the supply of softwood (calculated from harvesting data in the two plantations supplying the town) would seem to be considerably more than our estimate, at around 50 000 m³. These discrepancies could be due to the fact that household furniture in Mwanza contains a higher proportion of softwood than hardwood. An additional factor that could account for the higher than expected quantities of softwood entering the town is that Mwanza is a centre for the production of cheap softwood furniture for the surrounding villages.

Sustainability of sawn timber supply in Tanzania | 334
THE SUPPLY OF HARDWOOD TIMBER

Sources of timber

Information provided by traders and users of timber in the towns indicated that the main supply areas for hardwood timber at the time of the field research were (i) the miombo woodlands in Tabora and Rukwa regions (ii) pockets of forest in Morogoro and Tanga and (iii) the coastal forest in Kilwa and Lindi regions. The first source supplied Mwanza and Dar es Salaam and the second and third supplied Dar es Salaam. Timber was transported to the towns from the cutting areas by road and along the two railway lines: the central line through Tabora operated by the Tanzania Railway Corporation (TRC) and the newer line to Zambia operated by the Tanzania Zambia Railway Authority (TAZARA), as indicated in Figure 1.

FIGURE 1 Hardwood supply routes to Dar es Salam

Evidence provided by respondents revealed that the sourcing of timber is constantly shifting, depending on the ease and cost of extraction. When easily extractable preferred species and sizes are gone from one forest area, extraction shifts to another area. This process is in practice unregulated: our respondents did not describe any practices motivated by environmental protection or sustainable extraction. The causes and implications of the absence of regulation over cutting are considered later in the paper.

Mninga (Pterocarpus angolensis) is the preferred species of timber in Tanzania. There is clear evidence to suggest that the centre of mninga extraction has been moving outwards from the towns at a rapid rate. In the 1970s-1980s Morogoro Region was the source of much of the hardwood timber going to the Dar es Salaam market, as new areas were opened up by the TAZARA railway line. The construction of the TAZARA line by the Chinese in fact led to heavy felling of indigenous timber for use as sleepers and as building materials. The railway, once completed, was used to export timber.

In the early 1990s the centre of mninga production shifted to the Tabora region. By the late 1990s it had shifted further west to Rukwa Region. Data collected from the TRC on timber shipments from the various stations along the railway line, while seriously underestimating quantities, shows this ‘retreat’ of the preferred hard wood species, mninga. From 1995 there was a marked decrease in shipments from Tabora and an increase in shipments from Mpanda and Katumba to the south west. This finding was supported by pit-sawyers in Tabora who complained that few suitable trees were left in the area and many had stopped working because of a lack of wood. At the time of the research pit-sawyers were reported to be moving towards Mpanda, but some estimated that the mninga in Mpanda would be depleted within five years.

This picture of increasing scarcity of mninga in the miombo woodlands was confirmed by forest officials in Tabora, Kigoma, Uwinza and Mpanda. However, the completion of the bridge across the Rufiji river has since facilitated the exploitation of considerable reserves in the more remote regions of southern Tanzania. More recent research found many of the pit-sawyers previously working in Tabora had moved to Lindi region, which is now the centre of timber production (Shayo 2003).

As mninga has become more difficult to find, the price has risen. At the time of writing there is still a substantial demand from urban centres, mainly for furniture making. However, rising prices and decreasing availability of the larger sizes have led consumers to turn to other species of hardwood, particularly mtundu (Brachystegia speciformis) and mkora (Afzelia quanzensis) as well as to plantation softwood. Areas that have been logged for mninga are now being logged again for second and third preference species. Evidence from the field suggests that the selective felling or ‘creaming’ of indigenous trees for timber occurs in waves. The first wave consists of large scale felling of relatively dense stands of mninga. This is followed by a second wave of cutting of smaller trees and trees in more remote locations, and by a third wave when trees other than mninga are cut. Hence the cutting areas are shifting both outwards from the towns and, at residual forests, inwards towards more remote areas of the forest.

Pit-sawing

Respondents confirmed that most of the timber extracted from Tanzania’s natural forests today is pit-sawn. Pit-sawing is a logging system which involves the felling of trees and sawing into planks by human labour alone. Usually the tree is felled and positioned over a pit (alternatively it may be raised above the ground on a timber scaffold) and is sawn into planks by two men (there are no women involved) using a two-handed saw, one standing in the pit and the other on the log above. Once cut the timber is carried out of the forest on foot, by bicycle or (if access allows) truck or tractor. Of the eighteen producers of pit-sawn timber interviewed, ten were organizers of pit-sawyers (whom we have called ‘pit-sawing contractors’), six were pit-sawyers, one was a supervisor...
of pit-sawyers and one was a bicycle transporter who had previously been a pit-sawyer.

The reasons for pit-sawing are not hard to find. Up until the 1980s nearly all timber was supplied from sawmills, mainly Government owned, and many set up with foreign aid to export timber and sleepers for the railways. Economic difficulties in the 1980s, notably shortages of foreign exchange to buy spare parts, overvalued exchange rates and inefficient management in government owned mills, led to a decline in the output of sawn hardwood timber and a dramatic fall in exports (Kowero 1991). Pit-sawing, although long practised in Tanzania, seems to have expanded dramatically as a result of these difficulties. Policies associated with structural adjustment and economic liberalisation facilitated this expansion.

A second and probably more significant factor behind the closure of sawmills and expansion of pit-sawing is the continuing decline in the availability of the most favoured species. Already in 1980 it was reported that logging distances to sawmills in the natural forest had increased to economically questionable proportions (100-150 kilometres) given the poor condition of the roads and inadequate equipment (Kowero 1991, Havnevik 1980). Evidence from field research indicates that increasing distances to the raw material resource and declining quantities have simply rendered saw milling of hardwood from the natural forest uneconomic.

The supply network for hardwood

Figure 2 shows a sub-sector diagram, developed from interview data, for the production and distribution of sawn hardwood timber from pit-sawyers in the forest to users in Dar es Salaam. Following Boomgard et al. (1992) seven main functions, or steps in the transformation and distribution of the product, are identified and shown in the rows of the matrix. Linkages between the functions are achieved either through a hierarchical system within one enterprise (vertical integration) which is shown on the diagram by a horizontal dotted line between the cells, or by sales between enterprises shown by arrows. Sales may be on spot markets (solid arrows) or through forward contracts (dotted arrows). Missed functions within an integrated enterprise are shown by vertical dotted lines. The conventions used in the diagram follow those of Boomgard et al. (1992) with the exception of the dotted arrows indicating forward contracts which is a new departure.

The diagram shows five main channels, or chains of transaction, through which timber passes from extraction to end use, with some movement between channels. The extent of integration of functions is the primary distinguishing characteristic of the channels, with integration increasing as we move from channel 1 to channel 6. Integration in this context refers to several different functions coming under the direction of a single business entity. It does not mean that the business entity performs each function internally: some functions, such as transport, may be contracted out.

The main characteristics of the five channels are outlined below:

- In channel 1, pit-sawyers working independently and in pairs go to the forest and cut timber. In channel IA, the pit-sawyers carry the sawn timber out of the forest themselves. In channel IB they sell the wood in the forest to 'bicycle transporters' who transport it out (usually with three pieces on each side of the bicycle frame). In both cases the timber is sold to furniture makers or dealers in local markets who sell it on to others who transport it to the city as timber or semi-finished furniture.
- In channel 2 the production of timber is co-ordinated and partially financed by an intermediary or pit-sawing contractor. The contractor provides transport, equipment, food and medicines (costs which are later
doubted from wages) and hires pit-sawyers to go to the forest and cut trees, thus serving as a link between the pit-sawyers and the dealers who buy and sell timber. The pit-sawing contractor may sell timber on a spot basis to local dealers (channel 2), but many are working on contract for known buyers who advance cash. These are generally dealers (2A) or retailers from the city (2B).

- In channel 3 the pit-sawing contractor is also a dealer, selling in the local market to other detailers or retailers who come out from the city to buy timber
- In channel 4 the pit-sawing contractor/dealer transports the sawn timber to the city (in his own or hired transport) where it is sold on a spot or contract basis to retailers (channel 2) or secondary processors/users (channel 4A).
- In channel 5: the pit-sawing contractor is also a retailer in the city. He organises the cutting of timber and transports it to the city where he sells it to secondary processors/users.
- Channel 6 is the fully integrated channel, whereby the timber user (a large furniture maker or builder) organises and controls the production of timber for his own use.

The sub-sector diagram for timber supply to Dar es Salaam is especially complex because some of the timber making its way to the city is traded in intermediate markets in secondary towns. An intermediate market for sawn timber developed in Tabora in the 1990s. Dealers and contractors brought timber from resource areas to Tabora where they sold it to other dealers who transported it to Dar es Salaam. However, in the more integrated channels this function of intermediate trading is missing. The retail function may also be missing, for example in channels 1, 6, 4A.

It was not possible to estimate the proportions of timber passing through the various distribution channels into the town. However a number of observations are in order. First, we found few fully integrated businesses (channel 6) with the production, transport and use of timber under the control of a single enterprise. We did find some large city retailers who also controlled the production of timber (channel 5). But most of the timber destined for household use was supplied through the less integrated channels (channels 1-3) either by pit-sawing contractors (channels 2 and 3) or independent pit-sawyers (channel 1). The balance between these two methods is difficult to assess. It is clear that the scale of operation within the control of an enterprise can jump dramatically when pit-sawing contractors become involved. Contractors we interviewed organised a maximum of twenty saws, but there were reports of others with as many as 200. Pit-sawing contractors also sometimes arrange activities so that casual labourers perform ancillary tasks (tree felling, pit digging and transporting timber). In this way they mobilise resources to meet big orders. However, this does not necessarily mean that the greatest volume of wood is produced by contractors, as the majority of the dealers and contractors interviewed also buy on a spot basis from the independent pit-sawyers, both in the forest and in local markets. Evidence provided by a pit-sawyer in Tabora indicated that there may have been twice as many pit-sawyers working independently in the region as are working for contractors. Diminishing resources could be a part of the explanation. Independent pit-sawyers can find trees where others can’t because they are operating on a smaller scale and possibly content to saw smaller trees and/or go deeper into the forest on foot. Regulation is also a factor.

**Regulation**

Anyone wishing to harvest forest products from the indigenous forest (forest reserve or public land) in Tanzania must first be registered and pay a fee. At the time of the research the registration fee for pit-sawyers was Tanzanian shillings (Tsh) 100 000 per annum, which was the equivalent of the earnings from fifty days work. After registering, a license is required to fell trees and royalty has to be paid on the standing volume. The royalty on mninga and other fine hardwood is very high, at Tsh 25 000 per cubic metre of standing timber. Most of the contractors and dealers interviewed were registered and had taken out a license ‘from time to time’. However all of those interviewed confessed to always cutting much more than the license permitted.

On the other hand, none of the independent pit-sawyers was registered and none had ever taken out a license. Forestry officials and others confirmed that small independent pit-sawyers everywhere operate entirely illegally. Buying from these independent pit-sawyers enables contractors and dealers to expand the volume of timber that they handle. It also enables them to expand the volume of timber for which no royalty has been paid. In this way, most of what they cut and sell is not paid for. The proportion of hardwood timber that is felled illegally was estimated by district forestry officers as 75% to 80%. The Director of Forestry in Dar es Salaam gave a figure of 95%.

Regulation issues may also lie behind the fact that a significant quantity of wood seemed to be entering Dar es Salaam as semi-finished furniture (channel 1). Evidence of the importance of this channel was found in the large number of furniture makers in towns in the wood supply areas. We found forty furniture makers in one village in Morogoro region and eight in another in an area with a total population of only 4000. One furniture maker estimated that 75% of the furniture and joinery items made there were destined for Dar es Salaam.

The transport of wood into the city in the form of semi-finished furniture could be because timber and/or labour are cheaper in the wood supply areas. But it is more likely due to the fact that it is easier to evade regulation in this way. Trees felled under license are supposed to be measured and hammer-marked by a forest officer before any pit-sawing

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1 In 1999 US$1 was approximately equal to Tsh 750. At the time of writing US$1 equals Tsh1100
or removal from the forest can take place. Once sawn, the timber should be measured again and the volume verified against the volume of logs. A ‘transit pass’ is then issued to transport the timber. The transit pass is issued free so long as the royalty has been paid. Respondents reported that dealing in timber without hammer marks is unproblematic, but transporting it without the necessary paperwork can be difficult. They evade regulation by passing wood through different channels, and also by switching from one transport ‘route’ to another, for example from rail to road, or vice versa. The absence of a ‘system node’ on the sub-sector map where timber passes through a few hands or where channels converge geographically such as in a wholesale market could also be to avoid regulation. Retailers are supplied directly by dealers, or their agents, so there is no wholesale function. As we have seen, the retail function is also missing in channels 1 and 6.

It is concluded that the complexity of the hardwood supply network is, in part, a response to the regulatory system. The network has evolved the way it has partly to avoid regulation (particularly the high royalty on mining) and in this it has been most successful. The current system of regulation of tree felling in the natural forest is clearly not working. Most of the timber that is cut is not paid for, there are no management plans, no supervision of felling and no effective control over the location of felling, or the size and quantity of trees felled. A project funded by the World Bank and aimed at regaining control over resources and increasing revenue collection in Tabora region has had little success, collecting only around 8% of the estimated potential revenues due. The project was funded by a loan. With no additional revenues collected, repayment of the loan will only add to Tanzania’s debt burden.

There are strong grounds for believing that the current system of regulation is actually unworkable. The central problem is a mismatch between the regulatory regime and the system it is to regulate on the ground. The regime was devised for an industrialised timber production system, dominated by the public sector, where a few large capacity, stationary sawmills formed the backbone of production. Regulation of this type of production system is relatively straightforward. The production units are easily traceable and production volumes easily monitored. The hardwood production system operating now is very different. The bulk of production is from a large number of small units operating over a very wide expanse of territory. Forest officers cannot regulate the extraction of timber because of insufficient resources. The costs of proper monitoring of the felling of trees would be enormous and far outweigh the benefits.

In addition, we have shown that the supply systems are flexible, so that agents can quickly switch channels and routes on tightening of regulation. One could say that the wood supply system is ‘slippery’. It is difficult to get hold of for regulation purposes. What looks like a good intervention point for regulation of the dispersed, multi-channel and complex system, ‘slips away’ as the regulation is applied. But as well as cheating by the pit-sawyers and dealers there is also corruption in the forest service, on the railways and in the police force. Many of the people in a position to apprehend and convict those trading without licenses can be ‘easily silenced with a bribe’, a fact openly acknowledged by all respondents.

THE SUPPLY OF SOFTWOOD TIMBER

Tanzania has around 80 000 hectares of industrial forest plantations, mostly established in the 1970s. The plantations are located in the northern and southern highlands with smaller pockets in the north-west. More than half of the total planted area is in the Sao Hill plantation in the southern highlands.

Interviews with saw-millers, forest officer and forestry managers revealed that the plantations, almost without exception, have been poorly managed. Evidence of poor management was manifest in the absence of up-to-date plans or maps, limited pruning and thinning, frequent forest fires, high dependence on a single species, uneven age-class distribution and limited replanting. As a result cutting has been unsustainable and several of the smaller plantations are exhausted.

Mwanza used to be supplied with pine from the Rubya plantation on Ukerewe island but in the late 1990s this source was almost exhausted and two thirds of its timber was coming from Buhindi plantation, 200 kms to the west. Dar es Salaam is situated roughly midway between the plantations in the northern and southern highlands. It has traditionally been supplied with cypress from the north and pine from the south. In the late 1990s the smaller plantations were still supplying some pine and cypress but supplies were limited. The main source of softwood timber for Dar es Salaam is now the giant Sao Hill plantation in the southern highlands, which supplies only pine. There is still plenty of wood in the Sao Hill plantation. Assuming modest growth the available cut is estimated at 600 000m³ which is far in excess of demand.

Sawmilling capacity has moved in line with timber availability. The main movement has been away from smaller plantations where supply is under pressure to Sao Hill. Older stationary mills, unable to move or adapt, have closed and new entrants, mainly local businessmen with limited capital have entered the market. They are using more flexible and simple technology, such as mobile saws and pit-sawing. Although first introduced to salvage timber from fire damaged stands in Sao Hill, pit-sawing of plantation softwood has been increasing. During the field research a high proportion of softwood consumed by householders in both Dar es Salaam and Mwanza was found to have been pit-sawn.

The supply network for plantation softwood, whether hand or machine sawn, is very much simpler than that of hardwood from the natural forest, with greater integration between functions, a more concentrated source and absence of intermediate trading. This, together with a clearly demarcated and densely distributed tree resource, makes the regulation of harvesting and collection of fees much more straightforward.
in plantations than in the natural forest.\footnote{The basic regulatory requirements for softwood extraction are the same as for hardwood. Agents have to be registered and licensed, the license fee being proportional to the standing volume of the trees extracted. In the northern plantations additional fees are levied for road maintenance and silviculture. Other regulations are the same as for hardwood.} However, the forest department estimated that the revenues collected from the sale of wood in the plantations in 1998/99 still amounted to only around 45% of what they should have been. Low revenue collection is partly responsible for the lack of replanting. But a further problem is that responsibility is split between central government, which retains 70% of the royalty revenues and the regions which have to implement the replanting. Forest officers in the regions point to the retention as a major cause of regional under-funding and some argue convincingly that if they were able to retain a greater proportion of revenues, replanting would occur and harvesting would be better managed.

**POLICY AND CONTROL OPTIONS**

The aim of the research was to identify policies that would facilitate a sustainable supply of wood so as to provide for the needs of poor households and safeguard the livelihoods of those involved in the wood products sector. Sustainable supply in this context is interpreted broadly to mean that trees cut are replaced either by the same or different species so that the total supply (from whatever source) is not diminished over time and may in fact increase in line with market demand. This interpretation accommodates a shift in the balance of wood coming from different sources. This is considered inevitable in Tanzania due to the declining area of natural forest resulting from conversion of forest land to agriculture and on-going reservation of large areas for water catchment and biodiversity conservation.

The research has in fact found a massive shift taking place in consumer demand, away from indigenous hardwoods which are increasingly scarce and expensive, towards lower cost softwoods. Consequently, the role of the plantations in supplying wood to the towns has increased dramatically, while the role of the natural forest has diminished. Maintaining the supply of wood from the plantations is of critical importance for the provision or affordable timber to urban households, as well as for the attainment of other development objectives such as relieving pressure on the indigenous forest and supplying raw materials for the development of wood industries.

**Plantations**

Tanzania is in the fortunate position of having a large area (80 000 hectares) under plantation forestry or set aside to be planted. While the Sao Hill plantation alone is large enough to meet the domestic demand for sawn softwood in the foreseeable future, the maintenance of the smaller plantations is very important as each serves a significant local market and decentralised production will reduce transport costs and create local employment. The replanting of Rubya plantation (serving Mwanza) and the northern plantations (serving Arusha, Moshi, Tanga as well as Dar es Salaam) is of particular importance as competition for resources is already intense.

To maintain or increase the supply of plantation softwood the collection of revenue from the sale of logs must be improved and more of the revenue retained at project level to finance replanting. Increased local autonomy, more devolved finance and accountability and incentives for regional forestry staff would increase their motivation and the performance of plantation management, particularly in replanting. The proposal to set up the plantations as executive agencies (autonomous bodies in the public sector to be run as commercial entities) is a positive step. Privatisation of the management of plantations, or sections of plantations, on the basis of a long lease is a possible alternative. However, care must be taken that the delegation of forest management to private interests does not lead to the exclusion of low cost producers, specifically the pit-sawyers.

**Natural forest**

The research has shown that the current system of regulation of the harvesting of wood from the natural forest is unworkable. It requires control at the point of harvesting, but this is not possible due to lack of resources in the forest service, the wide dispersion of cutting activities, the flexibility of the supply systems, corruption and lack of political support for law enforcement, all of which make it relatively easy for dealers to cheat. Perpetuating the present system is not a sensible option as the costs far outweigh the benefits.

An efficient and low cost system of taxing timber dealers (who make large profits from exploiting the natural forest) is needed. While recognising the potential benefit of levying royalty on the standing timber so as to exert some control over cutting, if this is not practicable or too costly to implement then a ‘second best’ option has to be considered. Given the diversity of supply and the large quantities transported into the towns, the research suggests that a system of collecting revenue at the market end of the supply chain might be more effective. In principle this could be done by mounting permanent check points for commercial vehicles on the roads into the towns and tightening controls on the railways. It is important to stress that the tax on timber transported to market should be simple and not require any measurement beyond an estimate of the quantity and it should be paid by all, irrespective of whether or not other taxes have been paid. A recent attempt to impose taxes on timber impounded at Dar es Salaam port was thwarted by the inability of the forest service to verify whether or not taxes had already been paid at source. If this could be made to work (an experience to date suggests it will not be easy) an added advantage could be the collection of some basic data on the quantities of timber harvested each year from the natural forest.

The question remains as to what, if anything, can be
done to promote more sustainable management of timber resources in the natural forest. The new forest policy (URT 1998) proposes that management be devolved to district level with a movement in the direction of greater community involvement. It suggests that village communities will be more fully involved through ‘Joint Forest Management’ in the forest reserve and that villages will have sole authority for management of the forests on public land through the creation of ‘village forest reserves’. Community ownership of forests or involvement in the management of forests could bring many benefits. However, it remains to be seen whether this will lead to effective regulation of cutting and more sustainable management of resources.

In this regard it is important to recognise that investment in time and effort is needed to manage forest resources effectively and when the resource is extensive the investment is considerable (Sodeik 1998/99, Dondeyne et al. 1997). Experience in Tanzania and elsewhere suggests that the active management of natural resources by local communities may be easier to achieve where local resources are already degraded and the community perceive this to be a problem (Wily and Monela 1999, Ostrom 1999). The depletion of one or two timber species may not, on its own, be seen by the local community as a sufficient problem to warrant the investment required.

Furthermore, management of forest resources by the community involves bringing together all of the users of the resource. Our research has shown that many people have an interest in using the forest. ‘Stakeholders’ include local villagers who use the forest for subsistence needs, but also those who use it to generate income which includes the pit-sawyers, pit-sawing contractors and timber dealers. The theoretical construct of Ostrom (1990) which seeks to identify characteristics associated with regimes of sustainable exploitation of natural resources notes that such regimes are most likely where communities are stable and relatively homogeneous and committed to maintaining their existing way of life. Achieving agreement over the use of resources amongst people with diverse interests is highly problematic (Ostrom 1990). Our findings in the Morogoro, Tabora and Rukwa regions provide evidence of temporary and permanent inward and outward movement of people, as well as heterogeneity within communities. Thus, by rough application of Ostrom’s criteria, communities are unlikely to have the capabilities or the disposition to work together to manage natural resources in a sustainable way.

Even if users are able to reach agreement on the rules for forest management and cooperate in monitoring compliance, they may well choose to exploit rather than to conserve the timber resources. Given the prevailing poverty in Tanzania, exploiting timber resources for short term gain may the preferred strategy for many. It may even be rational for poverty stricken communities to decide to exploit their prized species to extinction and invest the proceeds in other income generating activities or in education for their children. For conservation to attain a higher priority in a devolved setting, ways of making it pay for local people have to be found.

In this context it may be wise to adopt a pragmatic view and assume that the exploitation of preferred species from lands outside of national parks and game reserves cannot be controlled. It is important to note that while mining is under pressure it is not in danger of extinction. There are large stands in some of the parks and reserves as well as in the giant Selous game reserve. The government is able to exercise some control in these areas by calling them ‘special attention zones’ and obtaining funds from aid agencies (Barraclough and Ghimere 1995). Pit-sawyers interviewed confirmed that cutting in national parks and game reserves is more difficult. In this approach the parks and reserves could be seen as a means of preserving tree species, with tree conservation integrated with ecosystem and habitat preservation. The forest service could then devote its attention to the management of the plantations.

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