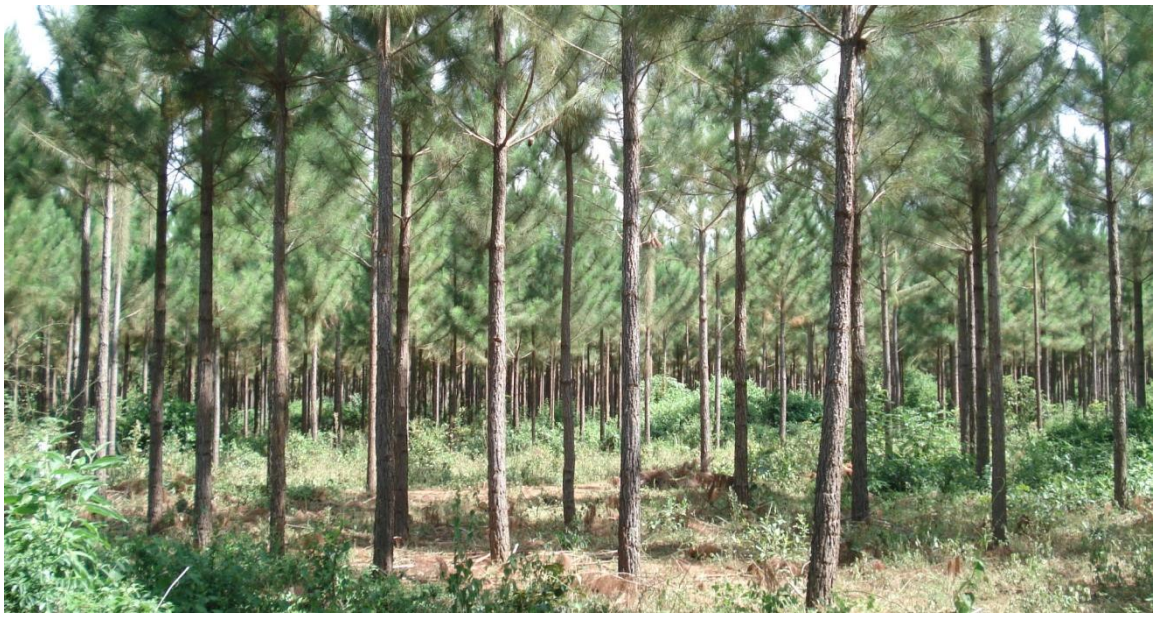
DEVELOPING A MARKET FOR 1ST THINNINGS FROM PLANTATIONS IN UGANDA



Study Commissioned by Sawlog Production Grant Scheme

by

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EXECUTIVE SUMMARY

SPGS clients have been very successful in their endeavours to establish well-stocked stands of pines, with the objective of producing sawlogs when the plantations mature. However, in order to produce trees that will yield a high proportion of logs suitable for sawing requires thinning of the stands. Guided by the proposed SPGS thinning regime, of reducing the pine stands to 700 trees per hectare when the trees reach an age of between 4 and 6 years, a volume of 250 000 m^3 of small logs is expected to come onto the local market from the plantings of SPGS growers in the next 5 years, with some 120 000 m^3 of this in 2012. Being an essential silvicultural process it is not really possible to delay the thinning process without having a detrimental effect on the final sawtimber crop.

Most of the timber from first thinnings will be produced from the Albertine, Central and Mubende clusters which are located some distance from the main markets and processing facilities of Kampala and Jinja. In order to minimise the cost of transport and maximise the return to the growers and processors, it is proposed that integrated processing hubs are established at strategic locations within the clusters.

Further recommended actions for SPGS to take are aimed at stimulating and developing a sustainable and viable market for small logs from first thinnings, and include the following:

1. Institute an inventory system
2. Research alternative thinning regimes
3. Explore and identify the properties of the wood from first thinnings and its possible uses. An outcome from this would be a log and lumber grading system.
4. Inform prospective investors and processors of the opportunities associated with this new source of pine timber
5. Equip SPGS staff with the necessary skills and knowledge to provide guidance to processors - along the same lines as has been done for plantation development.

ABBREVIATIONS

kg	kilogram - 1000 grams
kW	kilowatt - 1000 watts
MJ	Mega Joule - 10 000 joules
NFA	National Forest Authority
OSB	Orientated Strand Board
PSP	Permanent Sample Plot
SPGS	Sawlog Production Grant Scheme

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1 INTRODUCTION

SPGS clients have been very successful in their endeavours to establish well-stocked stands of pines with the objective of producing sawlogs when the plantations mature. However, in order to produce trees that will yield a high proportion of logs suitable for sawing requires thinning of the stands.

Thinning is the process whereby the number of trees in the stand is reduced through a process of harvesting the smaller trees and those of poor form. SPGS recommends undertaking the first thinning down to 700 trees per hectare when the trees reach an age of between 4 and 6 years. (Jacovelli, et al, 2009). At the these ages the trees that will be removed in the thinning process (smaller, weaker trees) will be very small, of relatively poor form and wood quality, the latter as a result of the high percentage of juvenile wood in the thinned trees. It is the marketing of this timber that is of current concern and the subject of this study.

Thinning is an essential silvicultural operation required to produce high quality sawlogs within an acceptable period time by concentrating the growth of the stand on the remaining trees after those of poorer quality have been removed. This has the effect of stimulating the diameter increment on the better trees and thereby increasing the value of the stand. Good quality trees are those that have a rapid rate of growth, have healthy crowns and are of good form, i.e., trees that are straight, have a single leader and small branches with a wide angle of attachment to the tree. The yield of saleable timber in the process of thinning should be viewed as a means of offsetting the cost of the operation and not as a real source of income, especially in the case of the first thinning.

2 THE WOOD FROM FIRST THINNINGS

The primary concern is that of the timber that will become available from thinnings from SPGS growers, although cognisance is taken that these are not the only source of small-dimension logs as there would also be some volume from the plantations managed by the National Forestry Authority (NFA) from both thinnings and clearfellings.

In order to address the marketing of the timber from first thinning it is necessary to have some insight into the volume of timber and its location. At this stage the emphasis is on the timber that will become available in the next 5 to 10 years as this is of immediate concern and the marketing options discussed in this report are likely to differ from that of the longer term, as the latter products will be largely high-quality sawlogs for which there will be a ready market. However, a market for small, low quality logs will always be required as these will be produced from thinnings on an on-going basis together with the tops of the trees from clearfellings in the future.

Unique – The Forestry Consultants, modelled the future yields of logs from the SPGS clusters, (Held and Techel, 2010) based on the following:

- Growth models developed by Dennis Alder in 2003,
- Information pertaining to the areas planted by the SPGS growers
- The recommended thinning regime proposed by SPGS.

Although, the modelled information is the best available information it is likely that the actual yields will differ significantly due to the following factors:

- Estimates of the volume of timber from first thinnings is inherantly inaccurate due to the high degree of variability of the harvested trees. All the timber will be from first thinnings
- Growers will decide when to thin and the actual timing of the thinning may not coincide with the modelled time.
- There has been very limited measurement of stand volumes and the models are based on a relatively small sample of trees at a young age.
- Very little thinning has taken place and thus the accuracy of the models to predict thinning yields has not been tested and the models adjusted.

However, the Unique estimates do provide a useful starting point for understanding the location and volume of the timber that will potentially come onto the market from the early plantings of SPGS Growers.

2.1 AREAS AND VOLUMES

Figure 1 shows the area of plantations that will yield thinnings in the next 10 years. The year to year variance in area reflects the establishment programmes and very little can be done to “smooth the area” (i.e. reduce the year to year variance) as it is essential to carry out the thinnings when they are due and not to delay the operations. There may be some merit in trying to reduce the volume peaks by prioritizing thinnings according to growth performance but this aspect should only be considered once far more is known about the growth of the trees and the impact of thinning on stand development.

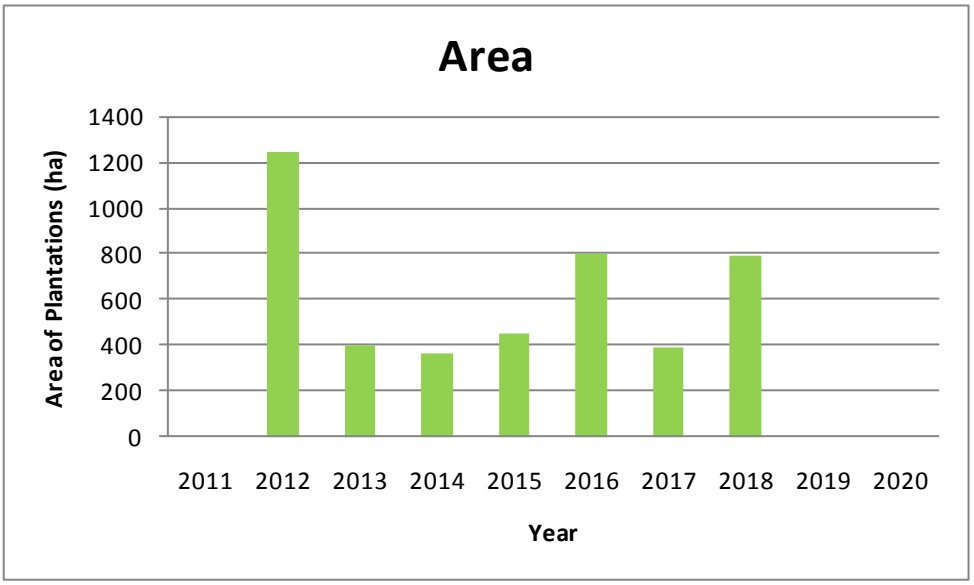


Figure 1. Extent of SPGS growers' plantations that will yield thinnings

As expected, the timber yields are closely correlated to the area that will be thinned and the volume yields for each year are shown in Figure 3. The Unique modelling did consider 3 site qualities and associated yield performance levels and the projected yields thus reflect site qualities as well as the extent of the plantations.

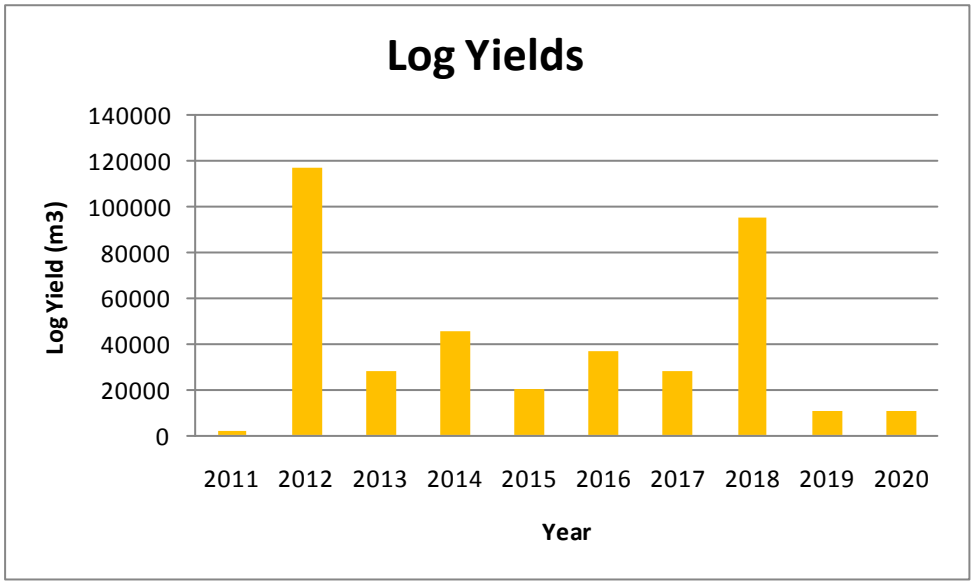
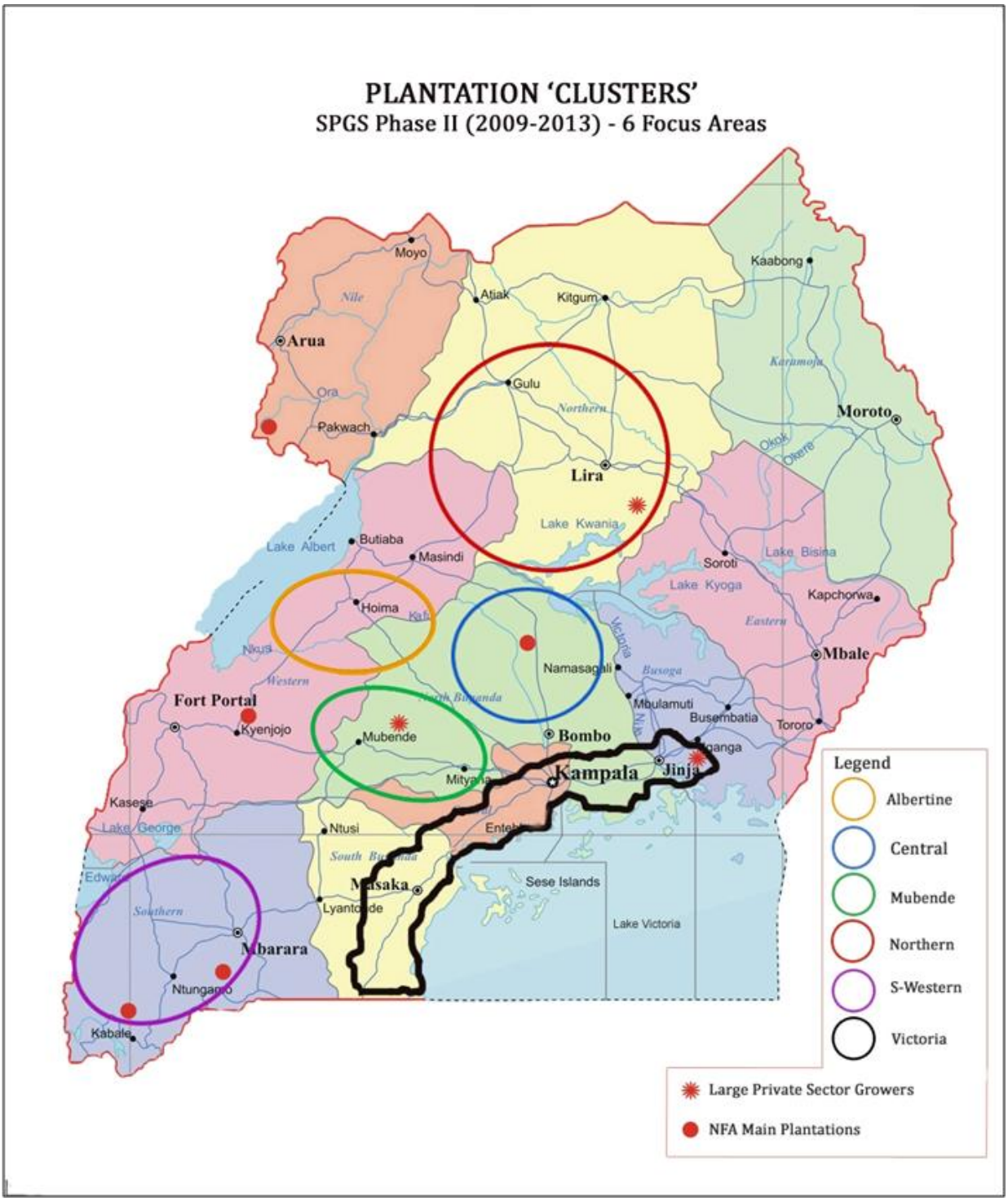


Figure 2. Log yields from SPGS plantations

2.2 GEOGRAPHICAL LOCATION OF YIELDS

A study undertaken by Unique – The Forestry Consultants in November 2010 (Held, *et al*, 2010) indicated the location of the SPGS timber growing zones and these are shown in Figure 3



Source: SPGS

Figure 3. Map showing the location of the SPGS plantation clusters

The SPGS plantations are, as would be expected, located in the rural areas some distance away from the main centres of Kampala and Jinja. It is in these cities where the demand for timber is highest as a result of the number of people that live there and where most of the primary timber processing, manufacturing capacity, and use of wood-based products takes place.

The timber yields from thinning operations in the various plantation clusters over the next 5 years are shown in Table 1. It can be seen from the table that a volume of some 250 000 m^3 can be expected over the next 5 years with a relatively high variance in the volumes from year to year. This year to year variance makes it particularly difficult to develop a market for the timber as processing plants typically require a constant and minimum supply each year. There is considerably less variability when the total volume of timber from all the different clusters is considered. Most of the timber (95%) is produced from the Albertine, Central and Mubende clusters, with a percentage volume range from 25% to 36% amoung these clusters over the next 5 years.

Table 1. <u>Expected log yields from the SPGS plantation clusters</u>

Plantation Cluster	Timber Yields (m^3) in Respective Years						TOTAL	% of Total
	2011	2012	2013	2014	2015	2016		
Albertine	0	79 700	0	5 926	0	0	85 626	34%
Central	1 169	19 633	17 015	20 217	10 773	22 119	90 926	36%
Mubende	525	17 597	10 764	16 485	5 209	10 975	61 554	25%
North	0	0	0	0	0	0	0	0%
Other	511	406	0	0	4 354	3 723	8 995	4%
Southwest	0	0	0	0	0	0	0	0%
Victoria	0	0	0	3 298	0	0	3 298	1%
Total	2 205	117 337	27 779	45 926	20 335	36 817	250 399	100%

From the above it is apparent that the focus of marketing efforts should be in the towns of Hoima, Nakasongala and Mubende, which are central to the Albertine, Central and Mubende clusters respectively. Kampala is the closest city to these clusters. Timber from these clusters destined for Jinja would need to negotiate the traffic congestion of Kampala, making Jinja a less attractive market from a logistics point of view.

2.3 Wood Properties and Uses

Wood properties are typically correlated to species, the genetic make-up of the individual and maturity (age) of the tree. Wood properties within the tree vary with the distance from the centre of the tree, with the pith having the poorest qualities and improving towards the outside of the tree, i.e., the wood that is laid down in later years being of better quality. The difference in the wood properties of the centre pith and that of the outside of the log can be clearly seen in the cross-section of the log in the photo on the left

Cross section of a log showing pith

The wood of trees from first thinnings is likely to have the following characteristics based on experience of pines grown elsewhere in plantations, namely South Africa and Zimbabwe and literature from Australia and Nigeria (Harding and Copley, 2000; Oluwafemi, 2007)

- High proportion of juvenile wood which is characterised by tracheids with large vacuoles and thin walls.
- Low basic density of about 400 kg/m^3 with a range of 330 to 450 kg/m^3
- Short fibre length
- Low strength properties both in terms of compressive and tensile strength
- Instability, with the wood tending to twist, cup and bow depending on its origin in the tree.
- High number of knots which should all be live knots if pruning has been carried out according to SPGS standards
- High degree of radial shrinkage and some longitudinal shrinkage when dried
- Relatively high resin content
- Low proportion of bark - the bark of young trees being relatively thin

Plank sawn through a longitudinal section of a young tree –>

The wood properties of young pines limits the use of the timber to applications where high strength is not required. The wood is thus not suitable for structural purposes but could be used for all the following:

- Panelling
- Laminated facia boards
- Composite boards such as blockboard, chipboard and orientated strand board (OSB)
- Shavings for animal litter and packaging
- Fencing poles and slats
- Fuel pellets
- Smelter poles, for example in the smelting of silicon
- Fuel wood for heating and gasification – see Text Box 2 for further detail.

A range of composite boards

3 MARKETS FOR FIRST THINNINGS

3.1 EXISTING TIMBER MARKETS

Although the market for sawn timber is large and well distributed (See Text Box 1) with the local demand being very high for structural and furniture timber there is currently very limited processing capacity for low-grade, small, pine logs. However, relatively low-grade pine planks fetch very good prices in the markets in Kampala due to the workability of pine compared to most of the indigenous hardwoods but this is unlikely to be maintained

An informal mill designed for large logs

as the supply of pine timber becomes more readily available. There are a number of informal sawmills in the forestry areas which produce sawtimber, most of these being

Text Box 1. <u>Timber Markets in Kampala and Jinja</u>

There are a number of well-established timber markets in Kampala which focus on the sale of a range of species and dimensions of lumber. In addition, timber traders have established themselves along the main routes leading into the city and provide their customers with ready access to timber in the course of commuting in and out of the city. A similar set-up is found in Jinja.

A vibrant secondary processing sector, manufacturing a range of furniture and other wood-based items such as doors and window frames, has established itself either within the market area or in close proximity to where sawn timber is sold. This has created a number of timber forest product centres where customers can source the wood that they are looking for and have it made up into an item of furniture or a door, according to their requirements. Timber that is not suitable to be used as "appearance grade" is used in the manufacture of fully upholstered furniture where the less attractive timber is hidden from view.




Pine lumber, turned bedposts and upholstered furniture in the local markets

designed to process large logs and when used to process small logs the recovery of sawn boards is very low due to the thick kerfs of the saws and the inflexibility of the sawing systems to accommodate variable log sizes. These sawmills are not suited to processing logs from first thinnings.

The Nileply mill situated in Jinja is the only chipboard manufacturing facility in Uganda and its distance from the plantation clusters will negatively impact on the price that Nileply could pay for first thinnings. However, the management of the Nileply plant have indicated that they would be interested in purchasing logs from first thinnings as the mill at Jinja is running below capacity and the regional demand for chipboard exceeds their supply capabilities. The price that Nileply could pay for the logs has not been calculated but the company has indicted that they would facilitate the transport of logs to their plant using either their own trucks or those of a contractor. Once the economic procurement catchment has been determined by Nileply, the price that growers could expect to receive for their wood could be calculated. It is likely that the procurement catchment will be of the order of 50 to 100 km from the Nileply Jinja mill.

Blockboard produced by Nileply

3.2 INTEGRATED PROCESSING FACILITY

In order to maximise returns from the logs attention will need to focus on maximising the recovery of saleable products. A common technique employed to maximise recovery is to manufacture a suite of primary products from the logs and then to ensure that all the waste or by-products, are gainfully utilised. This requires the integration of a number of processing operations at a centralised facility, although all the processing operations need not be owned by a single entity. The concept of a processing hub is discussed in the next section. A key element of such an integrated processing facility is accurate grading of the logs to ensure that the largest, straightest logs with limited defects are utilised for solidwood products while the smaller logs and those with defects are used for fibre-based products such as shavings, chips, pellets or fuelwood. The differentiation of the grades depends on the following:

- The processing machinery and its capacities,

- The prices that are achieved for the processed products
- The value of the by-products such as sawdust, slabs and offcuts.

An integrated processing facility would be one that has the capacity to undertake a range of complementary wood processing activities and the following is provided as an example of the activities that would need to take place in such a processing plant for small logs from first thinnings:.

- Logs are graded according to dimension and quality criteria.
- Better quality logs are processed in the wet mill into planks ranging in widths of 50 to 100mm and thicknesses of 25 to 38 mm
- The planks are kiln dried and remanufactured into end products such as tongue-and-groove panelling, skirting boards or laminated together to make facia boards and shelving
- Some of the waste from the manufacturing process is used in the boiler to create steam which is used to cure the timber in the drying kilns while the balance is used to fuel a gasifier to produce electricity. The electricity is used to run the saws, lighting and other processing machinery.
- Excess electricity is sold to neighbours for domestic use
- A schematic of the process flows and systems of an integrated wood processing facility is shown in Figure 4

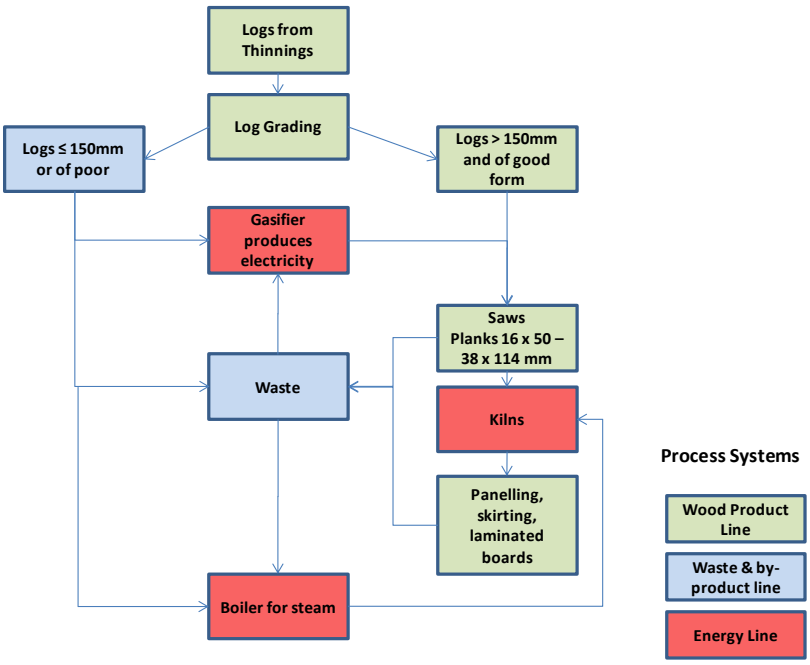


Figure 4. <u>Process flows of a typical integrated wood processing facility</u>

Text Box 2. <u>a gasifier plant producing electricity from sawmill waste</u>

A neat example of the use of waste wood from a sawmill to generate electricity is to be found near the town of Alice in the Eastern Cape, South Africa. A biomass gasification plant has been set up at Melani village in partnership with Eskom, the South African electricity utility. The plant makes use of waste wood (offcuts and shavings) from Schenk's sawmill to produce electricity for a self-contained bakery adjoining the gasifier plant.

Gasification is the process whereby biomass (wood) is converted into energy-rich producer gas which can be used to power an internal combustion engine which in turn powers an electricity generator. Producer gas comprises a mixture of carbon monoxide, carbon dioxide, hydrogen, methane, nitrogen and water vapour and has a thermal energy of approximately 6 MJ/kg.

The gasification plant at Melani produces 4800 kWh of electricity and consumes about 150 kg of wood per hour running a 200 –kW generator at 75% capacity. This is sufficient electricity to power a village bakery and more, with the balance being available for other uses.

The gasifier plant with the bakery in the modified shipping container

3.3 DEVELOPMENT OF INTEGRATED PROCESSING HUBS

Considering that it is unlikely that it will be economical to transport all the logs from first thinnings to the Nileply processing plant at Jinja, especially from the clusters that are situated further away, consideration should be given to developing local markets for the logs in order to minimize transport costs and maximise the revenues to the growers. It is proposed that a number of processing hubs are established at strategically located places in the various plantation clusters. A processing hub would typically comprise a number of interdependent and complementary processing facilities under the control of one or more business entities. The concept of a processing hub is based on leveraging the efficiencies of larger economies of scale and the sharing of logistical and skills resources. Processing hubs will also tend to attract secondary processors and manufacturers of end products.

4 RECOMMENDATIONS

The development of a market for first thinnings is likely to require an external intervention to overcome the inertia associated with the newness of the opportunity and general lack of knowledge of the resources, the processing options and the products that could be manufactured. In order to develop a viable and sustainable market for first thinnings it is proposed that the following actions are taken:

4.1 INSTITUTE AN INVENTORY SYSTEM

Institute an inventory system whereby plantations are regularly measured by either the growers or specialist contractors. It is recommended that SPGS provide their growers with the necessary training to undertake the inventories and data capture and that SPGS process and analyse the growers data as a service to the latter. This could effectively be combined with a GIS-based mapping service much like that offered to their members by some of the larger timber cooperatives in other countries. This would allow SPGS to play a coordinating role in the marketing of timber and would facilitate the bringing together of buyers and sellers of logs. SPGS could charge the growers a small commission on the volume of timber sold to offset the costs of providing the service.

Many years ago, a system of undertaking an inventory of a compartment to check the quality of marking for thinning was very effective in improving the quality of thinning operations and a similar system could be considered for SPGS growers.

It is also essential to carry out an inventory to identify the volumes, qualities and location of logs that could become available from first thinnings. Although the Yield and

Economic Models developed by Held and Techel (2010) provide an indication of the magnitude and location of the volumes that could become available, more detailed geographical information and scheduling is required to stimulate the development of expensive processing facilities. In addition, there is very little information on sources of wood from plantations other than those of the SPGS growers, which, depending on the extent of these other plantations, would be of importance to prospective processing plant investors. Information on the existing road and timber processing infrastructure in the various plantation clusters would also be very useful. The inventory information could be fed into an annual report on the timber resources of Uganda which would be of value to planners and potential investors in the timber processing sector. Standardised and systematic inventories would contribute substantially to the accuracy of such an annual report.

4.2 Research Thinning Regimes

Determine the trade-offs between the silvicultural benefits of early thinning and the financial implications of harvesting and processing very small logs. For example, it may be feasible to reduce the initial establishment stand density to something of the order of 800 trees per ha and to carry out a first thinning at a later age when the trees are more marketable. Although this research action could be undertaken at a desk top level using various modelling techniques, it is essential that a series of thinning and pruning trials are established to calibrate the models in due course. An intermediate step would be to establish some strategically located permanent sample plots (PSPs) which could also be used to refine the growth models, while providing insight into the effects of thinning across a range of site qualities. This could lead to a more sophisticated thinning regime being implemented based on the basal area development of the stand as opposed to only the age of the trees being the primary thinning decision criterion.

4.3 Explore and Identify Wood Properties for a Grading System

Commission an assessment of the wood properties of logs from first thinnings to facilitate the development of a log grading system that is aligned to the processing constraints and end products that could be manufactured. At this early stage the mechanical and energy properties of the wood would be most important. The capabilities of small-log processing machinery would need to be considered as part of such a study. In general there is an urgent need to develop a log and timber grading system to differentiate qualities of logs and lumber, and not only for smallwood from thinnings. There are a number of timber

grading systems in use in various countries and selecting a system to base the SPGS grading system on, would depend on the familiarity of customers with a particular system.

4.4 Inform Prospective Processors of the Opportunities

Publicise the opportunities associated with the processing of logs from first thinnings and encourage entrepreneurs to participate in the establishment of processing hubs. The SPGS Timber Market Report series is well suited to doing this and could be expanded to include information on primary and secondary markets for forest products.

4.5 Equip Staff with the Necessary Skills and Knowldge

In order to offer sound advice and guidance to prospective processors and to assist those who invest in timber processing facilities, SPGS will need to develop some in-house timber processing knowledge and skills, much the same as has been done for the plantation operations. This will effectively require some vertical integration of the SPGS skills and knowledge base.

Should entrepreneurs not be forthcoming, it may be necessary to initiate the physical establishment of a model processing hub in order to demonstrate the viability of the concept. This could be done by partnering with an existing and experienced timber processor and facilitating discussion among growers, prospective processors, local government and financing institutions.

5 CONCLUSION

The timber market has developed over many years and the introduction of a new grade of timber such as that from the first thinnings of pine compartments will take some time to become known and understood. Cognisance should be taken of the effectiveness of the advertising industry in creating demand for products in general as people only ask for, and buy, what they know to exist. In this regard, it is essential, in order to fast-track the development of the market for first thinnings, to inform as many prospective processors and users of the wood products of the opportunities that exist. There is some urgency as almost 120 000 m^3 of timber from first thinnings could come onto the market in 2012.

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