



## SUSTAINING INDUSTRIAL FOREST PLANTATIONS BEYOND THE FIRST ROTATION CROP IN UGANDA

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### ABSTRACT

This paper is based on a study conducted in three government industrial plantations namely Katugo, Mafuga and Mwenge, being harvested by concessionaires, where the Forest Department imposed a condition to replant an area equal to that harvested. The aim of the study was to contribute to the general understanding of the constraints to replanting rate in relation to harvesting rate: access the local people's perception of ownership of the replanted industrial forest plantations; and identify socio-economic and institutional factors that affect the sustenance of timber supply from forestry administered questionnaires and semi-structured interviews were used to collect data, which were analysed using SPSS statistical package. The results indicated that the average annual harvesting rate was 16.2 ha., and the replanting rate was 0.3 ha. By December 1998, replanting percentage over the area harvested by the concessionaires was 6.1%. Only 28% of the concessionaires had established tree nurseries and only 24% had attempted to replant the areas harvested. Concessionaires were not willing to carry out the replanting although, each miller was willing to make a monthly contribution of Ugandan shilling (Ug shs) 193,750 (US\$ 143) to the Forest Department towards the replanting of the area (1.35 ha) they harvested monthly. Yet, the cost of replanting 1 ha by the Forest Department was about Ug. Shs. 400,000 (US\$ 300). Local people prefer government ownership of the second rotation plantation to other forms of ownership; the replanting rate is far below the replanting rate. Therefore, the current level of management of industrial forest plantations in Uganda by the Forest Department is unsustainable.

### INTRODUCTION

Forest management and management of forest industries are usually considered as integrated activities. The principle assumption is that production of raw materials determines the expansion of the forest sector. When considering alternative investment opportunities, the ability of forestry to achieve the overall objective of development has to be taken into consideration by any investor. Usually, the justification for funding the forest sector is found in the indirect role forestry is expected to play in the development process. This subject has been debated in detail for example, Westoby 1962 and 1987), Algvare 1969, Haley *et al.* 1976, Olawoye 1976, King 1980, Riihinen 1981). For this reason, most investments in forestry in developing countries are public. The forest sector is acknowledged to have a strong forward demand (by the forest sector from other sectors) (Westoby 1962).

With a per capita income of less than US \$ 400, Uganda is categorized as low income country by the World Bank. Investment in and management of forest resources are carried out in the context of economic restructuring aimed at promoting the rural economy and maximizing human welfare (Akade 1991). The implication is to maximize the total output per unit input. Haley *et al.* (1976) recognized the primary purpose of any investment as capital formation. A country like Uganda, characterized by shortages of investable



funds in relation to the investment opportunities, requires that the returns to inputs be the primary basis for choosing between investment opportunities. Investments in the Ugandan forest sector intensified following the timber shortage forecast in 1960s, and the desire for import substitution of forest products. This has continued with the objective of strengthening and improving the capacity of the sector to generate revenue and create employment, thus fulfilling its role in the development process of the country. This arrangement worked well when management of the forest resource was bestowed on the government. There were several socio-economic reasons for this type of arrangement, such as the length of production period of forest products; complexity of the forest products; land tenure; equity between and across generations. Currently, through its privatisation programme the government is encouraging private individuals to invest in various sectors such as the forest sector. But for adequate knowledge in the areas of the necessary inputs, good management constituted by sound silviculture, domestic demand of the products, and costs and prices in order to determine profits/losses by investments.

The pressure on Uganda's natural forests to supply various products especially timber is enormous due to the increasing demand resulting from the country's growing population at an annual rate of 2.6%, and an urbanization rate of 5.4% (Ministry of Finance, 2000). Forest plantations with higher biomass productivity than natural forests (Mather, 1990), were identified as having the potential of reducing the high demand for timber from natural forests. Trials of pines and cypress crops were established in various parts of the country from 1946, and large scale planting was undertaken by the Forest Department (FD) in the 1960s with assistance of the Norwegian Agency for development Cooperation (NORAD). However, the

planting programme ended in the 1970s, when NORAD withdrew its support to the then military government, with about 15,000 ha coniferous crop already established. The main species planted were *Pinus patula* and *Cupressus lusitanica*, in the highlands areas and *Pinus caribaea*, in the lowlands. Large-scale harvesting by concessionaires of the over mature coniferous crop started in 1992 and currently, there are about 50 concessionaires (millers) with a total of 80 sawmills which are highly mobile. On average, each sawmill utilizes about 35m<sup>3</sup> of round wood per week.

### Problem analysis

Unlike natural forests, the biomass productivity and management impacts of plantations are relatively easy to predict. Forest plantations can be structured to provide certain additional social, biological and environmental benefits to natural forests. The industrial plantations are a resource base for the development of wood using industries and may represent a new resource or a replacement of diminishing or less productive natural forests. On the other hand, the economic rationale for industrial plantation establishment may be one of import substitution or generation of export income (Sargent and Bass 1992).

Industrial plantations are associated with high wood productivity ranging from 5-50m<sup>3</sup>/ha (Poore, 1989). It has been shown that the move towards forest plantations in the tropics has been stimulated by the increasing scarcity and value of timber to the point where investment in growing trees has become a realistic option (Sargent & Bass 1992). Since these plantations are of uniform species, there are some advantages in the management because, spacing thinning, rotation length and inter-cultivation practices can be easily carried out (Sivananthawerl 1996).



Medium-rotation (15-20 years) forest plantations offer both opportunities and problems (environmental and management). The problems are related to the high rates of production and with corresponding increases in site impacts due to frequent silvicultural interventions such as intensive soil management, weed control, improvement of soil fertility and thinning during establishment and throughout the rotation. The opportunities include improved genetic stock through selective breeding programmes (Nambiar & Brown 1997) among others.

The economic viability of industrial forest plantations depends on the stand establishment, subsequent silvicultural costs, biological growth rates, rotation length, protection and regeneration, and stumpage prices. Much of the economic costs of establishing a forest plantation are incurred in the early stages of the investment, while the returns in the form of the stumpage prices at harvest are realized much later or toward the end of the rotation. With a positive discount rate, current returns are preferred to future returns of the same size, hence medium rotation plantations have an advantage over longer rotation plantations (Sedjo 1984, Ffolliott *et al.* 1995).

However, there are some negative aspects linked to industrial forest plantations, such as, replacement of local populations, opportunity costs due to benefits of natural forests forgone, environmental risks caused by monoculture situations, and market situations characterized by the same raw forests materials (FAO 1991). For example, certain commonly grown trees such as *Pinus* spp., have high levels of organic acids in their discarded needles which inhibit the activity of and limit the variety of soil micro-organisms.

The higher rates of production per unit area, intensive management and land use that characterize plantation management

result into increased demands on the soil. Low nutrient reserves, poor nutrient retention ability and susceptibility to drought have been identified as the major limitations to using tropical soils for short rotation tree crops (Tairks *et al.* 1998) in addition to socio-economic constraints.

### **Management dilemma in plantation forestry**

As indicated earlier, capital resources available to many developing countries for investment are scarce, yet there are several competing alternative areas for investment. Therefore, there is a need to allocate funds to alternatives that are more likely to maximize the sum of the stream of all future benefits from the investments undertaken. Timber growing has distinctive characteristics that differentiate it from other productive sectors. For example, the periods of production are too long the extent that many of potential investors are discouraged. Since the time period during which resources are committed are so long, making a decision between current and future consumption has to be based on information, through investment analysis. Investment analysis was employed by Kingston (1970) to determine the profitability of Uganda's softwood afforestation project, whereby various planting sites were ranked according to their profitability to demonstrate their capacity to recoup the invested capital. Akode (1991) used it to determine the profitability of silvicultural operations in *Cupressus lusitanica* plantations in Uganda, while Gombya-Ssembajjwe (1999) employed the same tool to determine the profitability of *Eucalyptus* growing in Uganda.

Since inception, the establishment and management of industrial forest plantations in Uganda, has been solely done by FD. However, there was heavy dependence on foreign aid for their establishment and management. To complicate the



management of industrial forest plantations further, the World Bank (WB) and International Monetary Fund's (IMF) Structural Adjustment Programme (SAP) has led to a reduction in public spending on social services by the government. Thus investments like those in forestry which require long period before returns investment can be realised have been hard hit (FAO 1991). Therefore, SAP policies of privatisation of public investments, retrenchment and limitation on recruitment of public servants have adversely affected the operations of the FD. Since large-scale harvesting started, mp serious replanting has been carried out. Therefore, the study on which this paper is based sought to find out why the concessionaires have not fully complied with the replanting condition set by the FD. The FD set this condition in order to achieve sustainable industrial forest plantation. The aim of the paper is to contribute to an understanding of the constraints to forest replanting by concessionaires. The specific objectives of the study were:

To establish the annual replanting rate in relation to the harvesting rate; to assess local people's perception of ownership of government industrial forest plantations ownership and their involvement in such management, and; to identify socio-economic and institutional factors that might hinder replanting by concessionaires.

## METHODOLOGY

### Data collection

Both quantitative and qualitative methods were used to collect data from Mafuga working plant area (WPA), consisting of Mafuga, Kirima and Muko plantations located in Kabale/Rukungiri Districts; Mwenge WPA, consisting of Oruha,

Kyehara, Kikumiro and Kagorra plantations situated in Kabarole District and Katugo plantation in Nakasongola District. The Respondent groups chosen for the study were millers, FD staff, and local people.

Sawmillers are concessionaires licensed by the FD to install and operate sawmills for utilization of found wood timber from productive forests. A total of 26 millers operating 40 sawmills were interviewed. FD staff (civil servants) are charged with the role of managing forest resources. Only those charged with activities in industrial plantations were interviewed, thus a total of 24 staff was involved the study. Local people were considered to be those living in villages surrounding the industrial plantations. A total of 97 household heads were interviewed during the study. The number of sawmills visited and respondents are as given in Table 1.

### Data analysis

In order to achieve a sustained yield of industrial plantations, the area replanted in the following year by the concessionaires should be equal to the area harvested in the previous year. Therefore the total area expected to be replanted by millers to date can be expressed as:

$$\text{Total replanted area} = (N - 1) \times \text{AAH}$$

Where:

N is the number of years a concessionaire has carried out harvesting operation

AAH is the average annual harvested area.

This model was used the used to find out whether sustainable exploitation of plantations by the millers has been achieved (Tugumisirize 1999).



Table 1: Number of sawmills and people interviewed

Plantation	No of sawmills	Local people	Sawmillers	FD staff	Total
Mafuga	13	53	11	11	75
Mwenge	15	30	7	6	43
Katugo	12	14	8	7	29
<b>Total</b>	<b>40</b>	<b>97</b>	<b>26</b>	<b>24</b>	<b>147</b>

Data were analysed using regression to establish the relationship between areas harvested and areas planted.

## RESULTS

### Local people's perception of forest plantation ownership

Four ownership scenarios (government, private, communal and co-ownership) were presented to the local concerning ownership of the second rotation crop of government industrial plantations, and the responses are presented in Table 2. Government ownership meant that the status quo is maintained as in the first rotation; private ownership meant that companies carrying out harvesting and replanting will own the second rotation crop; while communal ownership meant that local surrounding communities should own the second rotation crop after participating in replanting of harvested areas. Co-ownership meant that both the government and the millers own the second rotation crop jointly.

Most of the local people (63%) prefer government ownership for the second crop plantation to other forms of ownership. The reasons for this preference were related to the appropriation of resources products and not investment decisions. The local people obtained several benefits from the

industrial plantations (Table 3). With government ownership of the plantations the local people have guaranteed access to the resource and supply of the same benefits. The main benefit to the local people was in the form of firewood as indicated by 84.5% of the respondents followed by timber and poles. This implies that if the plantations were not owned by the government, strict control measures would be put in place to exclude the local people from enjoying above benefits.

### Harvesting of the first crop and re-establishment of the second rotation crop

Out of 25 millers, 7 (28%) had attempted to replant the area harvested. Six (24%) had planting stock for the April-May 1999 planting season. Ishasha millers, operating in Muko plantation, Mafuga, with 40 ha (26.3%) of harvested area replanted had the highest rate of replanting. The National Agricultural Research Organization-Forestry Resource Research Institute (NORO-FORRI) a government organisation operating a mill in Katugo plantation had only 4 ha (3.8%) of the harvested area replanted, the lowest rate by December 1998. Between 1992 when harvesting by millers started and December 1998, a total of 1540 ha had been harvested at a rate of 226.7 ha per year.

Table 2: Local people's preferences for ownership of second-generation plantations in Uganda

Type of ownership	(N =
Government	63(65.0%)
Private	8(8.5%)
Communal	2(2.1%)
Co-ownership	9(9.3%)
Undecided	15(15.5%)





Table 3. Benefits local people get from industrial plantations

Study area	Employment	Firewood	Poles	Timber	Vegetables	Others
Mafuga	19(35.9%)	49(92.5%)	36(67.9%)	36(67.9%)	23(43.4%)	25(47.2%)
Mwenge	3(10%)	20(67.7%)	19(63.3%)	14(46.7%)	0	14(46.7%)
Katugo	3(21.4%)	13(92.9%)	1(7.1%)	9(64.3%)	0	5(35.7%)
Totals (N=97)	25(25.8%)	82(84.5%)	56(57.7%)	59(60.8%)	23(23.7%)	44(45.4%)

According to the model for achieving sustainable management of plantations (Tugamisirize 1999), 1103.2 ha, at a rate of 17.9 ha per year should had been replanted. The study revealed that only 97 ha, at a rate of 157.6 ha per year have been replanted. This represented 6.1% of the harvested area and 8.8% of the area expected to have been replanted. The planting deficit was therefore 1037.8 ha. The nursery stock are equivalent was 67.3 ha and only four millers out of 25 had operated for less than 1 year, that could possibly not justify failure to plant the area harvested.

The regression analysis of the area replanted and harvested (ha) versus duration of operation (months) produced the following regression equations:  
 Area replanted =  $-1.89 + 0.123$  harvest duration; and Area harvested =  $20.6 + 0.914$

harvest duration. The relationship between the areas replanted and period of operation was weak ( $R^2 = 29.6\%$ ,  $p = 0.005$ ); whereas the relationship between area harvested and duration of operation was strong (high  $R^2 = 61.4\%$ ,  $p = 0.005$ ). This means millers have been concentrating on harvesting more than planting, as indicated in Figure 1(a) and (b).

If a miller has been in operation for less than one year, the area expected to have been planted (with a minus sign) is the nursery stock area equivalent. This means, there should be an equivalent quantity of plants being raised in the nursery that year adequate to replanted the expected area harvested by the end of that year during the following year (assuming a constant rate of harvest up to the end of the year).

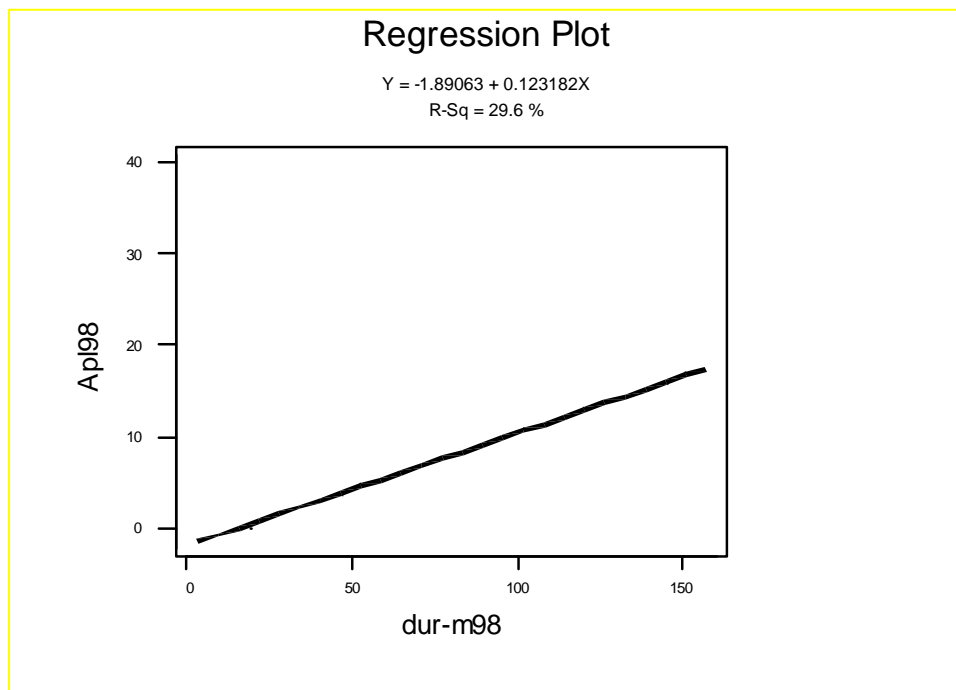


Figure 1(a) Regression of areas replanted (Ap 198) versus duration of harvest operation in months

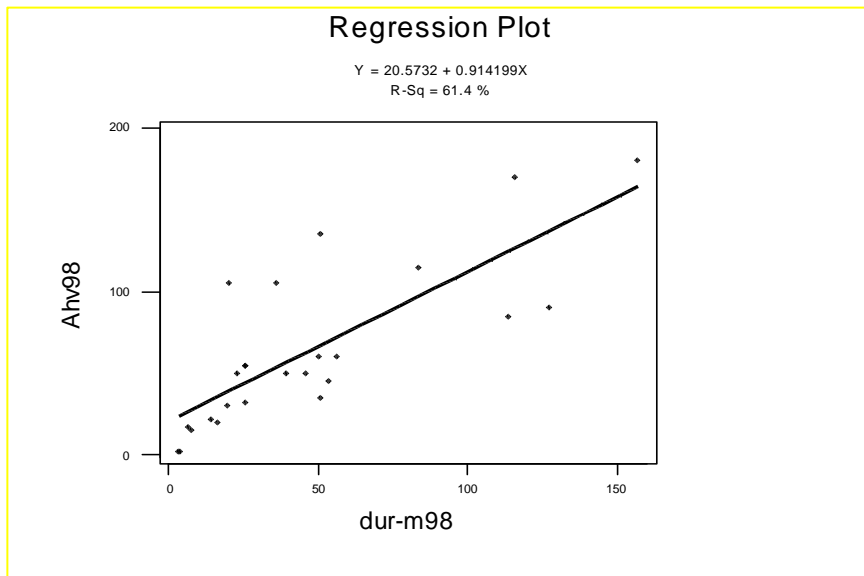


Figure 1(b). Area harvested (Ahv98) versus duration in months (dur-m98).

### **Institutional capacity for achieving sustained yields of industrial plantations**

There were no significant differences between staff disposition in the three study area ( $R^2 = 4.621$ ,  $p = 0.59$ ). In addition to plantation management some of the staff have other duties (66.7%) for all the study areas and 54.6% for Mafuga, 50% for Mwenge and 42.9% for Katugo. Inadequate funding (average annual budget was about US\$ 14,000 per WPA) was singled out by FD staff as the major constraint to replanting by the department. These findings concur with those from a similar study in Costa Rica, where the general forestry directorate is frequently so underfunded that it cannot afford gasoline for its vehicles to move through the forest (Ascher 1993 cited in Ascher 1995).

### **Constraints to replanting**

In order to replant one ha of pine plantation, it costs the FD US\$ 300. The concessionaires, who were willing on average to contribute only US\$ 125, considered the figure of US\$ 300 too prohibitive. The concessionaires (50%)

considered high costs as one of the reasons for failure or low rate of replanting. Other reasons advanced were; lack of assurance for exploitation and ownership of replanted crop (56%), and lack of technical assistance from FD (39%).

### **DISCUSSION**

The study of the sustainability of industrial plantations beyond the first rotation in Uganda considered economic as well as social aspects of forestry plantation production. To ensure sustained timber supply from plantations the FD demanded that areas harvested by each concessionaire be planted.

The replanting condition was set without consulting the concessionaires. Compliance with this condition is very low, as exhibited by the very low rate of replanting. The concessionaires gave various reasons for the low rates of replanting, which included high costs of replanting, the rights to the replanted crop, and the quality of the second rotation crop.



All the same time, the production period of 15 to 20 years is too long for investments being made using borrowed money at a rate 23% (current commercial banks borrowing rates), to be profitable. Investments in replanting of industrial forest plantations, at that rate would yield negative net present values of US\$ 279, at a rotation of 20 years. According to study of the profitability of industrial forest plantations in Uganda by Akode (1991) the rate, Internal Rate of Return (IRR), at which the discounted returns would be just zero was 18.7%. the high discount rates do not favour investments with high early costs and late revenues. Price (1989) urged that even at a discount of 3% returns from investments in natural forest in Continental Europe and Indian Subcontinent failed to justify the early costs.

The right of the concessionaires to the second generation crop remain unsolved and is more complicated because as a result of decentralization policy implemented by the government of Uganda since 1993, revenues from forest resources under local government is shared with the central government at a ratio of 4:6 respectively. Although, the local governments are expected to use the revenue for forestry development two within their areas of jurisdiction, this is not the case on the ground. Once received, the money is spent on other priorities by the district councils. Normally, forestry activities are not among those priorities. The implication is that if millers do replant and co-own the plantations, they would be required to share the revenues and not costs with local governments. This is not acceptable in private investments.

The condition requiring millers to replant the areas they harvest has failed. The failure was as a result of not consulting the concessionaires when the condition was being formulated. It was a top – bottom approach, which does not work under the current development planning process.

Hence the millers have not shown interest in investing in a long-term expensive and highly risky project like forestry. This calls for effective legal institutions to formulate and implement forest policies in order to achieve sustainable and continuous improvement of forest plantations. Enforcement is a key factor in the implementation of forest policies, but limited institutional capacity is a major obstacle to enforcement of forest regulations in Uganda forest management (Banana & Gombya-Ssembajjwe 2000, Semesi *et al.* 1998).

The local people do not see the forest plantations as theirs especially when outsiders are involved in the harvest. The responsibility of resource protection should lie with those involved in the exploitation. The condition that requires millers to replant an area equal to the harvested one has not yielded any positive results and therefore it should be revisited.

## CONCLUSION

The harvesting rate of 226.7 ha per year far exceeded the replanting rate of 17.9 ha per year, indicating that production from industrial forest plantation is unlikely to be sustained. The assumed high costs of replanting and the issue of ownership rights over the trees of the second rotation were the major constraints to millers to participate in replanting programme. In terms of ownership of industrial forest plantations, the majority (65%) of the local people preferred government ownership to private ownership. We recommend that the FD manages the industrial forest plantations as a business venture, with profit maximization being the overriding principle.





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