



KENYA FORESTRY: ECONOMIC AND FINANCIAL VIABILITY
WORLD BANK/PROFOR DISCUSSION PAPER

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TABLE OF CONTENTS

Topic	Page
Overview	3
The Background and Situation	4
The Overall Problem	5
Some Necessary Corrections	7
Potential Financial Returns to Forest Plantations	7
Some Alternative Forest Ownership and Operation Models	8
A Possible Model for Kenya : Long Term Forest Plantation Concessions	10
Other Considerations	12
Alternative Arrangements	13
Royalty Rates	13
Conclusions	14
Appendix A : Some Preliminary Results of a Financial Analysis of forest plantations in Kenya	16

Overview

1. There is good news and bad news for Kenya's plantation forests. The good news is that the biological conditions for plantation forestry are superb, matched only in a few places in the world. Additionally, the costs of delivering pulpwood to the mill are among the lowest in the world according to Jaako Poyry (2001). If managed properly, plantation forestry in Kenya can generate generous financial rates of return. The bad news is that plantation forest regeneration in Kenya has been very poor for a number of years resulting in a declining and aging forest stock. Kenya today faces a wood fiber shortage.

2. Industrial forest plantations are created for three principal purposes in Kenya: a) to provide a permanent flow of wood for useful products, b) to generate a permanent flow of net revenues for the government, and c) to provide an alternative to the expenditure of foreign exchange on the import of forest products. Currently, the industrial plantations are doing neither of the first two purposes well. The plantation forest estate in Kenya is in a sad condition as demonstrated below.

3. A major problem is the absence of the adequate forest regeneration after harvest. This has led to a deterioration of the plantation forest stock, a skewed age distribution of the forest and to the current serious shortage of industrial wood in the Kenyan economy.

4. Another major problem is the choice of species, which while suitable for many sites in Kenya, do not provide Kenya with the optimal species regarding growth, rotation and financial return. While pine and cypress do well in Kenya, eucalyptus performs exceptionally and should be planted in much greater abundance.

5. A general long-term solution to this situation is: 1) to insure adequate regeneration and thereby increase forest plantation growth and productivity by shifting the responsibility for forest management and regeneration more completely with the user of the resource, and 2) to encourage the planting for short rotation very fast growing species, which will increase the overall wood production potential of the Kenyan plantation system.

6. The short-term solution will require the timely introduction of more short-rotation fast growing species (eucalyptus) to provide the near term wood fiber required by Kenya's only pulp mill Pan African Paper Mills (PPM) to meet the wood shortage gap that will occur between now and 2015.. Abundant pulpwood will allow for more integrated harvesting that will allow mature sawtimber to be directed back into the sawmilling industry where it has higher value and meets Kenya's needs for solidwood products. These activities should be undertaken while insuring that the country of Kenya is properly compensated directly for the use of its land and that local peoples are provided livelihoods and participation.

The Background and Situation

7. Kenya's forests cover some 1.7 million ha in area. Of this some 160 thousand ha had been designated as plantation forest, although this area has been reduced to nearer 120 thousand ha due to the excisement of significant portions of the original area to private ownership shift and conversion to agricultural uses. Almost all the excisements happened prior to 2002.

8. Given the high population density and low income levels in much of the plantation region, local pressures on the some of the plantation lands in the form of encroachment are often severe and can be expected to increase since much of this land is suitable for cropping and grazing.

9. The original forest management system, the "shamba" system, involved local farmers occupying the land temporarily during which time they would plant trees, and provide weeding and seedling protection in return for the right to use the land for agriculture production until the trees dominated the site thereby precluding further agricultural use of the land. This system, however, created the unfortunate incentive for farmers to retard tree development, thereby allowing some farmers to extend their stay and use of the land.

10. The "shamba" system was discontinued in the 1990s and replaced by the current arrangement, which calls for the plantations to be maintained, protected and regenerated by the government through its Forest Department (FD). Unfortunately, it is estimated that 80% of the areas planted in the 1990s under this system failed due to lack of adequate maintenance. Current policy is to shift management responsibility to local communities, forest industrial companies and the private sector.

11. Under the FD the silvicultural and management systems for the plantation sites are designated for the production of either pulpwood or sawtimber. Almost all of the plantings are of one of three tree types: pine (*Pinus patula*), cypress (*Cupressus Lusitanica*) and eucalyptus (a small number of species of eucalyptus are used). Currently about 60% of the plantations are in cypress, 35% in pine, and 5% in eucalyptus. The FD management rules are quite inflexible and involve a prescribed number of prunings, thinnings, weedings, etc., depending upon the species and selected regime. After harvests, the rules require regeneration and are almost always of the same species as harvested.

12. The forest industry in Kenya consists of several hundred sawmills, of various sizes as well as plywood and composite board mills and a pulp and paper mill. Harvesting of pine and cypress is designated for one purpose, either the production of either pulpwood or sawtimber (for pine and cypress), and the wood use is efficiently integrated across purposes, although residues are sometimes used for fuelwood. Eucalyptus is managed exclusively for pulpwood.

13. In addition to plantation management, the FD is responsible for the allocation of harvest rights for the individual sites to the various users. The users in turn are

responsible for harvesting the site and making a royalty payment to the government. The payment is based on the royalty fee (per m³) and timber volume for the single designated use, e.g., sawtimber (including peeler logs), or pulp.

14. Royalty rates for sawlogs are in the range of KS 1000 –KS 1,400/m³The royalty for pulpwood was recently raised from about KS 350/m³ to KS 700/m³ (roughly \$9/m³). Note that pulpwood prices in the U.S. South have been between \$5 and \$12 per ton over the last 10 years with prices in recent years generally reported in the lower part of that range at around \$5-\$6/ton. The relationship between a m³ and a ton of wood vary by species and age, but in Kenya the relationship is treated essentially as 1 to 1.

15. After harvest, the FD is responsible for regeneration and protection until the next harvest. However, for various reasons discussed elsewhere in this report, the FD has not been successful in adequately regenerating many of the sites. In recent years some firms in the processing industry, e.g. Raiply and PanAfrican Paper Mills, have been involved in financing and/or in undertaking directly some activities required for the establishment of new plantations on harvested sites.

16. Regeneration activities undertaken by the larger processing companies, e.g., pulp and plywood, commonly provide financing for the first year of regenerate and sometimes for activities beyond the first year, e.g., weeding and mortality replacement. In recent years the annual area regenerated by Raiply and PPM has been two or more times the area harvested by the company in that year. These activities involve additional costs to the company and, if viewed as an additional cost of stumpage, are estimated at roughly KS 140/m³ harvested, thereby bring the effective stumpage rates up to roughly KS 840 and KS 1540 respectively for pulpwood and sawnwood. One way to adjust for these additional costs would be to lower the stumpage royalty fees by an equivalent amount.

The Overall Problem

17. Kenya is facing a current and future wood shortage. This is due in part to the contraction of the plantation forest estate in Kenya. As noted above, although the plantation area was designated at about 160 thousand ha, the current area is closer to 120 thousand ha, the reduction being the result of the “excisement” of forest land that was provided other ownership and largely converted to agriculture and other uses.

18. Additionally, the basic Kenyan plantation regeneration system has not worked well under either the prior “shamba” system or under the current system that calls for the FD to be responsible for planting, tending, undertaking the requisite silvicultural practices, and protecting the forest. The poor functioning of these systems has resulted in poor overall regeneration so that the forest stock reductions caused by harvesting have not been adequately replaced by successful planting and regeneration.

10. Evidence that reforestation of harvested sites is often poor include the facts that:

- Although some areas have been properly reestablished, the FD estimates that up to 80% have not been adequately regenerated.
- After harvest many plantation areas experience a long delay before reforestation activities are even begun.
- When planted the result is often inadequate reforested due to high mortality among the seedlings due to a number of factors including external disturbances, such as grazing and other human interventions.
- The allocation of harvesting rights is generating problems with mature sawtimber being allocated for pulpwood due to the absence of appropriate aged pulpwood stands.
- There has been a moratorium on harvesting awards to sawmills for a number of years.
- Also, the PPM contract has expired and not yet renewed. The mill is receiving harvesting rights only on a last minute basis. These features make reliable planning by the mill impossible and also generate economy-wide wood use inefficiencies.

20. In addition to the problems faced by the FD the Kenya Forestry Research Institute (KEFRI) seed center, which Center has substantial technical expertise and is the source for almost all tree seed in Kenya, has been criticized by a number of users, including forest firms and other sections within the FD, for failing to meet its contractual agreements to provide seed in a timely manner, thereby making efficient management difficult.

21. A major reason for the poor performance throughout the FD and KEFRI has been the chronic lack of adequate funding by the government. Without proper funding the FD cannot reasonably be expected to perform effectively its responsibilities. .

22. The government, in turn, is pressed for resources and since funding for forestry can easily be delayed, resources are diverted to other uses viewed by the government as more critical or more politically useful.

23. These various difficulties have resulted in Kenya finding itself with a serious current wood shortage that is likely to persist and worsen unless appropriate changes are implemented quickly.

24. In summary, the essence of Kenya's plantation wood shortage harvest reflects both the contraction of plantation forest area, the poor regeneration performance indicated above, and the choice of species that are non optimal for Kenya given its biology and other conditions. A problem has been a disconnection between the wood supplier, the government, and the wood user, which is the forest industry. The funding and

performance of reforestation activities, which is the responsibility of the government and the FD, has clearly been inadequate over many years. Furthermore, the responsibilities of the FD are several and sometimes in conflict. The FD is to be the producer, regulator, and seller of the forest resource. These functions often come into direct conflict.

Some Necessary Corrections

25. Kenya must find a way to insure adequate regeneration of harvested forests over both the near and long term. A new system for plantation regeneration must be developed.

26. Although the continued planting of some pine or cypress is desirable, their relatively long rotations will not provide adequate pulpwood in a timely manner to meet wood requirements of the next one and one-half decades. A substantial shift to the establishment of relatively large areas of plantation eucalyptus is required.

27. Large capital intensive wood processing operations must have sufficient control over their wood resource to allow long-term management and planning.

A Forest Bill currently being considered by Parliament will, if ratified, shift the emphasis for management of part of the industrial plantation estate to the private sector. A Forest Department Forest Reform Document recommends that the government should introduce pilot scale schemes for the commercialization of about 25,000 hectares of government plantations and Participatory Management based approaches in a further 15,000 hectares. A Forest Investment Workshop hosted by the World Bank and PROFOR in November of 2004 identified several possible local community/ forest industry partnership based approaches that could be suitable for pilot scale testing.

Current government policy gives strong emphasis of to securing private sector investment for the establishment of new plantation resources.

Potential Financial Returns to Forest Plantations

28. Earlier work by Jaako Poyry indicated that Kenya has among the lowest delivered pulpwood costs in the world. While this situation has changed due to the new higher royalty rates and world exchange rate adjustments, Kenya delivered wood costs are still competitive by world wide standards.

29. Preliminary calculations of financial returns to forest plantation investments suggest that favorable market rates of return can be obtained in Kenya if proper management practices are followed. The details of this analysis are found in the appendix to this report

30. Financial returns are estimated for a number of representative alternative types of species and forest management regimes (Appendices A and B). Real (inflation free) internal rates of return (IRR) for a well managed plantation regimes were estimated and

are reported in table 1. The analyses assumed conservative biological growth rates for the plantations and used current royalty rates as an estimation of future harvest prices. In the pine regimes a zero land rent was assumed reflecting the government's designation of an area for exclusive forest plantation use. Under these conditions the IRR are about 10% for both pine pulpwood and sawtimber. While the rates of return for cypress were not calculated directly, the returns will be essentially the same since management regimes, growth rates, rotations and royalty prices are very similar and often identical for cypress as for pine. Note that while cypress logs provide a modest premium in the sawnwood market (but not the royalty payment), growth rates are slightly lower.

Table 1: IRRs on Selected Species and Regimes

Species/regime	MAI m ³ /ha/yr	rotation period years	Stumpage price KS/m ³	IRR
Pine/pulpwood	15	19	700	9.9%
Pine/sawtimber	15	25	1400	10.2%
Eucalyptus/pulp	50	6	700	27%

See appendix A for details.

Note: \$1 = KS80

31. Financial returns for a well managed a eucalyptus pulpwood management regime are spectacular and are also presented in the table. The 18 year regime examined consists of an initial planting followed by two coppice post harvest regenerations. Three harvests are undertaken from the initial root system at years 6, 12, and 18. The MAI is 50 m³/ha/yr and the stumpage price set at the current royalty rate of KS 700/m³. In this case the IRR without a rental payment was estimated as 27%.

32. Alternatively, this regime was estimated to generate NPV of KS125,000/ha, with a discount rate of 10%. Note that price of a recent sale of agricultural land suitable for conversion to forestry was KS 135,000/ha. Thus, the calculation indicates that properly managed eucalyptus plantations are capable of generating an economic rent (or discounted present value) that competes quite favorably with agricultural uses of this land.

33. The above returns would generally be viewed in the forest products industry as more than adequate to financially justify undertaking the types of plantation investments examined. Furthermore, they could be improved with integrated management whereby wood use was allocated to its highest use.

Some Alternative Forest Ownership and Operation Models

34. Forest ownership and responsibility for management take a number of forms around the world. In some countries forests and the forest industry are largely privately owned and privately managed, e.g., Finland, France, albeit often with some environmental constraints. In these countries prices are typically determined in relatively unregulated markets. In other countries the forests are owned and operated by the government, e.g., centrally planned economies and Russia today. Other countries, such as the US, have a

mix of government and provide ownership. However, in most countries the wood processing industry is private.

35. In a number of countries forests and forestlands are owned by the government, but the management and harvest rights are transferred, for specified periods, to private “concessionaires.” Countries as diverse as New Zealand, Canada, Indonesia and Malaysia, give long term concessions management responsibilities and harvesting rights to private entities. Under this system the government typically derives revenues by charging the concession, in some fashion, for the use and productivity of the land. In New Zealand, for example, a concession of 99 years was provided to concessionaires on the basis of a bidding procedure for the concession rights. The proceeds from the bidding typically are collected by the government.

36. In Canada, by contrast, the concessionaire has harvest rights and reestablishment responsibilities with a royalty payment to the government based on the harvest level. There the concessionaire has a rolling 20 year concession privilege whereby his performance is evaluated every five years and if acceptable, the life of the concession is extended another 5 years. Thus, for acceptable performance, the concession period is periodically updated to provide a more or less continuous 20 year working period.

37. In the draft Forest Bill and Policy three models of commercialization of industrial forest plantation in Kenya are considered (as stated in the “Brief to World Bank Team” provided by the FD, Monday, November 1, 2004):

- Lease Agreement: The lease or license would provide exclusive rights to the lessee for the use of the land for a specific period of time in return for a specific payment.

- Contract Agreement: The FD would retain ownership rights, while the contractor controls resources and provides management systems under agreed terms.

- Joint Management Agreement: The FD would enter into Management Agreements with appropriate parties for joint management of a particular forest area. The Agreement would specify a number of features including the duration of the agreement, terms and conditions, the management plan, payment charges, etc.

For all of the three models the government maintains ownership but the degree of direct government control varies with the direct involvement in day to day operations. Government control is least for the Lease Agreement and greatest for the Joint Management Plan. The Contract Agreement could be similar or even identical to the Lease Agreement, depending upon the “agreed terms.”

38. Note that countries as diverse as New Zealand, Canada, Indonesia and Malaysia, give long term concessions management responsibilities and harvesting rights to private

entities. While these country specific systems all have some unique customized features and conditions, they each fit most closely to the Lease Agreement model under consideration in the proposal law since they allow the lessee management responsibilities within the specified conditions.

A Possible Model for Kenya: Long Term Forest Plantation Concessions

39. The model proposed below fits most closely into the Lease Agreement category.

40. The essence of Kenya's plantation wood shortage harvest reflects a disconnect between supplier, the GOK, and the user, the forest industry. Funding and performance of reforestation activities, which is the responsibility of the government and the FD, has clearly been inadequate over many years. Also, the responsibilities of the FD are several and sometimes in conflict since the FD has responsibilities as producer, regulator, and seller of the forest resource.

41. An approach would be the rationalization of the Kenyan plantation forest production, regulation and selling systems. A potentially attractive alternative national forest plantation model for Kenya is a concession system, such as suggested below, that would have the following features.

- The management of the plantation forest be shifted from the FD to wood users (e.g. forest industrial companies), or wood producing intermediates (newly created private forest management companies) through a concession system that would create a number of well defined largely contiguous forest parcels (5,000 to 20,000 ha) from the existing plantation forestry areas. These would be made available to private entities as forest plantation concessions that would have long-term (e.g., 99 year) responsibilities for planting, managing and harvesting the wood. This would also allow companies to choose which species to plant. For example, PPM can substitute a large amount of eucalyptus for cypress in its pulp production process. Control of its wood sources would allow very fast growing short rotation (5-7 years) eucalyptus to replace slower growing longer rotation (15-19 years) cypress.

- The concessions would provide payments for the use of the land to the GOK. This could be through a number of methods, e.g., the payment of an annual land rent, the payment of a portion of the selling price as a stumpage royalty at harvest, some combination of both, or another method that would insure a fair payment to the government. A portion of these rent payments could be directed to the local community.

- The specific concession terms would be determined by the GOK and concessionaire either through negotiations and/or competitive bidding for the concession rights.

- The government would have the right to periodically assess the performance of the concession to insure that the agreed specifications were met. (Or, the government might choose to have a third party audit assessment, e.g., by FSC, or some other recognized forest auditor, to determine that agreed environmental standards were maintained.) A procedure would be negotiated whereby the concession rights could be withdrawn (or transferred).

-Within the broad concession system two somewhat different types of concession systems might be appropriate in Kenya: a) a market oriented sawtimber system, and b) a less market oriented pulpwood system, reflecting the fact that there is only one pulpwood buyer in the country.

-A number of sawtimber concessions could be considered thereby providing a degree of competition on the wood selling side.

-The market conditions in Kenya (with over 300 sawmills and some larger solidwood users) are such that the harvest price and allocation for solidwood can be determined through a market system with well advertised bidding.

-For pulpwood, however, conditions are inadequate for a well functioning market, there being only one pulpmill in Kenya. Furthermore, forest management for pulpwood is generally different, e.g., shorter rotations, mass bioproduction, minimal thinning regimes. Thus, the pulpmill would require its own pulpwood concession, with the payment to government made wholly through the payments of land use rents for the area under its concession.

-The concessionaires would be required to involve local communities in plantation establishment, protection, maintenance and harvesting. Payments might also be made directly to the communities reflecting the traditional rights the communities had over the lands and the opportunity costs to the communities of not being allowed to utilize this land for other purposes, e.g., grazing or cropping.

-Subcontractual arrangements with small holders and local communities would be encouraged.

-Finally, the concessionaire should be given wide latitude to adjust management, including species selection, silvicultural practices and harvesting rotation, to fit individual concession needs. Additionally, the sale or transfer of the harvests or parts of harvest by the concessionaire should be unrestricted. Thus, for example, the pulpwood concessionaire should be allowed to sell as poles and sawlogs any portion of his harvest that is appropriate and also to purchase requisite wood from other concessions as needed at the market determined price.

42. There are a large number of ways that the various details of a concession system could be addressed. The important features are that the responsibility for regeneration and management, as well as the costs, be shifted to the concessionaires, while the

government received appropriate compensation for the provision of Kenyan land and the environmental standards of the forest are maintained. The concessionaires could be either direct industrial wood uses, or forest management specialists who would be managing the plantations to make a profit by selling their final product, wood, to interested buyers.

Other Considerations

43. The development of viable wood markets in Kenyan is very desirable. Such markets could provide signals as to the economic value of various types of wood and promote their more efficient distribution and utilization.

44. There appears to be greater potential for utilizing wood wastes as inputs into production, as with pulpwood, or as a fuel in the plant's operation. Systems could be developed involving integrated wood use for sawmills and pulp mills.

45. There may be substantial potential for the production of fuelwood as a final product.

46. There is general agreement that it would be desirable for forest farms to plant industrial trees in so far as it is economically sensible. In addition to plantation forestry, there appears to be substantial potential for tree planting among farmers and farms. Tree planting could be encouraged by the development of viable markets for sawlogs, pulpwood and fuelwood. The wood could be traded in the same markets as wood from the plantations discussed above.

47. To the extent that the stock of forest on the plantation lands is increased, there may be potential for carbon sequestration payments through the CDM of the Kyoto Protocol.

48. One difficulty for forestry on larger farms that have already established modest sized areas of pulpwood forests, is that of harvesting. While planting has been encouraged, harvesting is another matter. As understood, the existing procedures for permitting tree harvesting from private forest farms are complicated and tedious. Harvesting is said to require approval by two different agencies: the FD and an environmental agency. In addition, transport of logs requires a further government permit. This set of procedures is said to constitute a formidable obstacle to harvesting from farm forests and, not surprisingly discourage farmers from planting trees for commercial use. We should note that very occasional logging does not seem to be seriously effected, as the requisite procedures are largely ignored. Larger harvests, however, which might involve a number of ha, are negatively impacted. PPM, for example, has stated that it has been unable to arrange harvests from willing farm stumpage sources due to the prohibitive nature of the required procedures.

49. A recommendation is that the harvesting regulation on private farms be largely abolished, including transport impediments. The preharvest environmental inspection by both the FD and the environmental agency is almost certainly largely unnecessary since

these trees have been planted on agricultural sites that were earlier without trees. An exception might be made for forests on sites that exceed a certain slope or that are in certain riparian zones, where an acceptable harvest plan might require approval.

50. An issue in Kenya is that of which mechanisms and institutions are most suitable to provide wood to the one domestic pulpmill (PPM). Under the existing arrangement the government has made a long-term commitment to provide adequate timber through to certain firms, e.g., PPM, in return for a royalty (stumpage) payment. The Kenyan government, however, mandates the level of the stumpage royalty rate. The FD is in charge of planting, managing and protecting the forest. The harvesting rights to a portion of the forest are contracted to the pulp company (PPM) and the company is responsible for harvesting and transport back to the mill. As noted earlier in this report, the contract between PPM and the government has expired some time ago and has not yet been renewed. Wood is now being allocated on a short-term ad hoc basis, in part due to the scarcity of appropriate harvest age classes for pulpwood. However, for the company to plan and operate efficiently, it needs greater certainty about its wood sources and the timing of their availability.

Alternative Arrangements

51. One proposal, consistent with some of the discussion regarding the proposed new forestry law, is that PPM be given a long term concession to the management and use of the government's land for forest plantations. Under this condition PPM would be responsible for the both the funding and the actual implementation of the forest management including reforestation. Management responsibilities, from planting to harvesting and regeneration, would be transferred to the firm. Sufficient area needs to be transferred to allow PPM an efficient "working circle."

52. Such a circumstance would not be a radical change from the present situation where PPM already bears most of the costs of much of the plantation establishment. However, PPM would benefit from have increased control over the various phases of management, including the choice of species, and more direct control of wood flows to the mill. This arrangement would allow for sensible long-term planning.

Royalty Rates

53. If such an arrangement were made, however, the question will still arise as to what would be the appropriate stumpage (royalty). As noted, currently the Kenyan the government mandates the stumpage rate. In much of the world stumpage rates are determined by markets.

54. Various methods are proposed to determine the appropriate stumpage price. These include:

- the local market rate,

- a rate similar to that found in other countries, e.g., an average global stumpage rate, and

- a rate that would generate an acceptable rate of return to an investor in that the timber returns equal to the returns to other land investments in the economy.

55. The Local Market Rate: As noted, a functioning market for stumpage does not currently exist in Kenya, although, as argued above, we believe conditions are such that a viable market for sawtimber stumpage could exist under the right institutional conditions. If wood markets in Kenya were active, the rate could simply be that given in the market. In fact, under those circumstances the harvest rights (or perhaps the concession rights) might simply be auctioned off to the highest bidder, with the bid price the de facto royalty stumpage fee.

56. A Global Stumpage Rate: Data exist for stumpage rates in many forest producing countries of the world. See the Jakko Pory Report (2000). However, stumpage rates vary considerably across countries. Furthermore, they are subject to change. For example, some of the stumpage rates for the year 2000 cited in JP are likely very out of date since the prices are in US dollars and many dollar exchange rates have changed substantially. Nevertheless, a comparison of the Kenyan royalty rate with some stumpage rates is useful in establishing the general reasonableness of any royalty scheme.

57. Acceptable rate of return: An alternative approach might involve an estimate of the rate required to provide a reasonable return on the investment costs associated with an investment in a plantation in the region. Alternatively stated, what return would provide the prudent investor with a reasonable rate of return on this type of investment? That is, if privately owned what would an owner need to receive in payment for his stumpage in order to justify using the land in plantation forestry for pulp?

58. Our estimates of potential IRR to timber investments, suggest that the existing royalty rates (stumpage prices) are sufficient to provide a reasonable rate of return to timber.

59. Under the present system, however, the de facto stumpage rates are substantially higher than the official royalty rate, at least to some wood users. This is true because some wood users, e.g., large processors, also are involved in substantial regeneration expenditures. These expenditures have been estimated by the consultant to add roughly KS140/m³, roughly the equivalent of the first years' establishment costs on two ha for every one ha harvested. This results in a de facto royalty rate of KS 840 per m³ for pulpwood and KS1540 for sawtimber stumpage. These costs should be viewed as a harvest tax over and above the royalty payment.

Conclusions

60. Kenya is facing a serious industrial wood shortage despite the fact that it has the biological potential to readily meet its domestic industrial wood needs. The problems are

multiple. The forest plantation estate is in poor condition with the designated area of forest plantations having been substantially reduced through excisement. Furthermore, regeneration of the remaining plantation forest has been compromised due primarily to inadequate regeneration management and protection.

61. Neither the current situation in which the FD is responsible for regeneration and protection of the plantation forests nor its predecessor arrangement with the “shamba” system has worked well and neither gives promise for the future.

62. In the absence of dramatic changes in the forest sector, Kenya will almost certainly be forced to rely increasingly on imported industrial and process wood products.

63. While private farm forests have the potential to provide some additional industrial wood and this production can ameliorate the wood shortage to some extent, that potential is limited by virtue of the dense populations and the high productivity of much of the private land in agriculture.

64. Although determining the appropriate royalty rate is important, and the fees must be such that the industry can afford to bear the costs of purchasing the wood at a cost where the wood can then be processed and sold at a reasonable profit, this is not sufficient for a viable industry.

65. The critical element to long-term forestry success in Kenya is to provide an institutional setting and system that will insure rapid regeneration in appropriate species, including short rotation rapidly growing species such as eucalyptus.

66. For Kenya to have a viable forest industry it must radically restructure the way it plants, protects and manages plantation forests and forest lands. One suggestion is to modify the system to allow for long-term concession arrangement where the government is compensated for the use of the land through either rental payments or royalty fees or some combination of both. Within this restructuring, provisions must be made for some of the benefits of the forest to be captured by local peoples both through employment and perhaps through a portion of rental payments being directed to local communities.

Appendix A: Some preliminary results of a financial analysis of forest plantations in Kenya

Regime: Pine Pulpwood Plantation:

Specifics: 19 year rotation,
MAI 15 m³/ha/yr,
No thinning,
One pruning,
Stumpage price = KS700/m³,
No rental payments,
DF establishment costs
IRR almost 10%.

Regime: Pine Sawtimber Rotation:

Specifics: 25 year rotation,
MAI 15 m³/ha/yr,
Two thinning,
Three pruning,
Stumpage price=KS1400/m³,
No rental payments,
DF establishment costs
IRR about 10%

Regime: Eucalyptus Pulpwood:

Specifics: One planting, two coppice port harvest regenerations
3 harvests yr 6, yr 12, yr 18,
MAI 50 m³/ha/yr,
No thinning or pruning,
Stumpage price = KS7000,
Establishment cost those of the Tea Industry,
NPV KS125,000 at a 10% discount rate.
(Note: Market price of agricultural land suitable for conversion to forestry estimated at KS 135,000/ha)

Appendix B: Plantation Financial Returns

19YEAR PINE PULPWOOD PLANTATION

	cost KS	PVcost	benefit	Pvben	disc rate	0.099	OPERATIONS
0			0	0	0		
1	19437	17604.92	0	0	0		planting, weeding
2	8000	6562.959	0	0	0		weeding
3	3682	2735.888	0	0	0		weeding
4	2717	1828.559	0	0	0		pruning thinning, marking protectio n
5	350	213.3498	0	0	0		
6	350	193.24	0	0	0		
7	350	175.0258	0	0	0		
8	350	158.5283	0	0	0		
9	350	143.5859	0	0	0		
10	350	130.0518	0	0	0		
11	350	117.7935	0	0	0		
12	350	106.6906	0	0	0		
13	350	96.63424	0	0	0		
14	350	87.52576	0	0	0		
15	350	79.27582	0	0	0		
16	350	71.8035	0	0	0		
17	350	65.03549	0	0	0		
18	350	58.90542	0	0	0		
19	350	53.35316	199500	30411.3	0		harvest
total		30483.13		30411.3	NPV	-71.8266	

19YEAR PINE PULPWOOD
PLANTATION
wood
price KS700/m3
harvest volume 285m3

9.9% IRR assuming land opportunity costs = zero

26 YEAR PINE SAWTIMBER ROTATION

	cost	PVcost	benefit	PV benef	disc rate	0.1021	OPERATIONS
0	19437	19437	0	0			planting
1	8000	7223.514	0	0			weeding
2	3682	3001.932	0	0			pruning 1
3	2727	2007.524	0	0			thinning 1
4	350	232.6495	0	0			
5	350	210.0684	0	0			
6	350	189.679	0	0			
7	2717	1329.534	0	0			thinning 2
8	3135	1385.179	0	0			pruning 2
9	350	139.6352	0	0			
10	350	126.0821	0	0			
11	350	113.8445	0	0			
12	2299	675.2139	0	0			pruning 3
13	350	92.81731	0	0			
14	2717	650.5926	0	0			thinning 3
15	350	75.67389	0	0			
16	350	68.32892	0	0			
17	350	61.69687	0	0			
18	350	55.70852	0	0			
19	350	50.30141					
20	4180	542.4341					thinning 4
21	4180	489.785					pruning 4
22	350	37.03018					
23	350	33.436					
24	350	30.19068					
25	350	27.26035	0	0			
26	350	24.61444	546000	38398.52			
total		38311.73	546000	38398.52	NPV	-86.797	

26 YEAR PINE SAWTIMBER ROTATION

Wood Price KS 1400/m3 Wood volume = 285m3
 IRR = 10.21%

18YEAR EUCALYPTUS PULPWOOD PLANTATION

cost	PVcost	benefit	Pvben	disc rate	0.1 OPERATIONS
0	43888	43888	0	0	planting
1	4310	3899.849	0	0	pruning weeding
2	5394	4416.234	0	0	guarding, supervision
3	1003	743.0407	0	0	
4	1002	671.6607	0	0	
5	750	454.898	175700	106567.4	harvest
6	10000	5488.116	0	0	coppicing weeding
7	4310	2140.283	0	0	weeding
8	5394	2423.68	0	0	
9	1003	407.7894	0	0	
10	1003	368.9831	0	0	
11	750	249.6533	175700	58485.45	harvest
12	10000	3011.942	0	0	coppicing weeding
13	4310	1174.612	0	0	weeding
14	5394	1330.144	0	0	
15	1003	223.7996	0	0	
16	1003	202.5022	0	0	
17	750	137.0126	175700	32097.5	harvest

total 71232.2 197150.4 125918.2 NPV

18YEAR EUCALYPTUS PULPWOOD PLANTATION

wood price KS700/m3

vol 300m3/rotation

27.3% return assuming land opportunity cost=0

or

10% IRR

with a

NPV =

125918.2