SOME GUIDELINES FOR REDUCED IMPACT TIMBER HARVESTING PRACTICES IN MIOMBO WOODLANDS

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ABSTRACT

The Miombo woodlands are one of the largest dry forest types in Africa, covering over 2.7 million km^{-2} in eastern, central and southern Africa; including Angola, Democratic Republic of Congo, Malawi, Mozambique, Tanzania, Zambia and Zimbabwe. Over 20 percent of the people in Sub-Saharan Africa depend on the Miombo woodlands for their livelihood in terms of food, direct revenues, employment, forage for animals, tourism, fuel, timber and non-timber forest products. Miombo woodlands which occupy over 60 million hectares of land in Zambia and Tanzania contribute to the economies of these countries in terms of direct revenues, tourism, employment, raw materials for building and mining industries, energy and non wood products. Unfortunately, indiscriminate exploitation for timber, charcoal and other products, frequent destructive woodland fires and expansion of agricultural activities have of recent contributed to eroding the environmental importance and ecological diversity of this type of forest. With fast growing populations around these forests, this is likely to increase pressure even further on these forests. Proper management and utilization of these forests are therefore important if they are to sustained future uses. This paper outlines the current harvesting principles and documents procedures to follow in order to improve the existing harvesting practices in Miombo woodlands in southern and eastern Africa using Tanzania and Zambia as case studies. The document recommends improved procedures and techniques, which if adopted will lead to improved productivity, improved environmental value, health status of the residual forest and improved socio-economic benefits at local and national levels. The paper is intended to be used by policy makers, forest departments logging managers, field supervisors, communities and other stakeholders involved in timber harvesting with an objective to promote harvesting practices that improve productivity sustainable and efficient resource utilization while minimizing negative environmental impacts.

Keywords: Reduced impact logging miombo woodlands - pre-harvest planning – platform sawing - post harvest impact assessment

INTRODUCTION

Miombo woodland is one of the extensive dry forest vegetation types in Africa occurring in seven countries in eastern, central and southern Africa namely; Angola, Malawi, Mozambique, Tanzania, Zambia, Democratic Republic of Congo and Zimbabwe. They occupy an area of about 2.7 million square kilometres, almost equal to combined land area of Mozambique, Malawi, Zimbabwe, Tanzania and Zambia (Kowero, 2003). The Miombo woodlands cover over 60 million hectares of the land in Tanzania and Zambia and is dominated by the legume family Caesalpiniaceae, with *Brachystegia, Julbernadia, Isoberlinia, Afzelia, Dalbergia and Pterocarpus angolensis* being the dominant tree species (Frost 1996). They contribute substantially to the economies of not only these two countries, but also the other countries in eastern and southern Africa which have Miombo woodlands. The Miombo benefits these countries in terms of direct revenues, employment, raw materials for wood, wood for mining industries, energy, building materials, forage for grazing and browsing animals, tourism (game viewing and

hunting) and various Non-Timber Forest Products (NTFP). The potential for these woodlands in socio-economic development of these countries has not been extensively exploited and yet the woodlands are rapidly being lost through (Kowero, 2003);

- Agricultural expansion, the leading cause of deforestation,
- Overgrazing that reduces the quality of woodlands,
- Fuel-wood collection that impairs the quality of the woodlands and has resulted into massive deforestation especially in areas where charcoal production prevails,
- Over-exploitation of important trees and animal species and
- Uncontrolled burning that is increasingly becoming a common feature of woodlands.

If the contribution of Miombo woodlands to national economies in the region is to be increased and sustained, management of these forests have to be improved. In the course of implementing sustainable management of Miombo woodlands, precautions should however be taken to ensure that timber harvesting practices do not compromise their ecological value. Experience has shown that uncontrolled mechanised harvesting can result in severe damage to forest structure, composition, and regeneration capacity. Therefore, minimising the negative impact associated with timber harvesting activities is one of the main aims associated with achieving sustainable forest management in the Miombo woodlands. Inappropriate timber harvesting practices, including over-harvesting and poor logging techniques, have been cited as important causes of deforestation and forest degradation (FAO, 1996).

To reduce negative impacts associated with timber harvesting operations, a number of international initiatives and actions have been in place, primarily trying to set regulations or guidelines designed to help foresters, forest agencies, and forest enterprises to select sustainable management practices to be followed. Such initiatives and actions include, Dykstra and Heinrich (1992, 1996); Fiji Ministry of Forests (1990); Ghana Forestry Department (1992) and the Asia Pacific Forestry Commission (APFC 1999, 2000). As the basis for sustainable management of the Miombo woodlands, implementation of reduced impact logging or timber harvesting practices is necessary. This entails appropriate planning and implementation of timber harvesting activities to ensure that the future trees and other Non Timber Forest Products (NTFP) values are conserved, waterways and soils are protected, scenic beauty and recreational opportunities are enhanced, and that the forest itself is perpetuated (Abeli and Dykstra 1981; Applegate and Andrewartha 1999 and APFC 2000).

Purpose

The purpose of preparing these guidelines is to provide a minimum set of standards for improved timber harvesting practices that will promote productivity, improve the well being of timber workers, improve timber quality and wood utilization, improve the social-economic status of the surrounding communities and reduce negative environmental impacts to the residual trees and stands. These guidelines if implemented will assist the Miombo woodlands to be sustained for future generations and improve the economic and social contributions made by the woodlands to the sustainable development. Specifically, the purpose of these improved practices for harvesting the Miombo woodlands are to:

- Provide guidelines and procedures that if used or followed will lead towards sustainable use of the woodlands;
- Promote and improve forest productivity in Miombo woodlands;
- Improve the health and safety of forest workers;

- Support economic returns and environmental values ;
- Promote forest regenerative functions and species diversity.

Scope and coverage

The improved timber harvesting standards and practices outlined in this paper are designed to balance commercial considerations with conservation and/or protection of environment and social values. If followed, these guidelines will allow the miombo woodlands to be harvested with minimal adverse impact on the environment and will help ensure that important resources and values to communities, industry, and to the nations are realised and protected during timber harvesting operations. The improved timber harvesting practices provide minimum standards that are feasible, within the limited resources available in many countries and are designed to be flexible and reviewed as institutional capacity increases, and new information and technologies become available.

While it is acknowledged that during the initial stages many of the guidelines and standards will not be able to be implemented immediately by many timber harvesters, or forest owners, in principle, they are intended to provide a "benchmark" which all timber harvesting practices in the miombo woodlands should aim to achieve. The recommended practices focus mainly on timber harvesting activities in Miombo woodlands, as this is the component of industrial forestry that is most often criticised for causing environmental damages during forest operations. The guidelines include specifications for pre-harvest planning, timber harvesting operations, (cutting, skidding, loading and hauling), forest workers health and safety and post-harvest operations.

Although it is an important aspect to consider when addressing improved timber harvesting practices in Miombo woodlands, no attempt has been made in this document to address specific wildlife habitat requirements.

Recommended Reduced Impact Timber Harvesting Practices

This set of recommended timber harvesting practices provide minimum standards and principles which concentrate on "what should be done" rather than "how to do the timber harvesting" in order to reduce negative environmental impacts in the woodlands.

The appropriate practices should be overseen or monitored by the Forest Departments and/or leadership/management of the Community-based forests while the implementation should be undertaken by logging companies or communities using contractors in Miombo woodlands by ensuring the following:

- Effective management and security of the resource;
- Maintain future and sustainable resource use options;
- Maintain bio-diversity and promote regeneration;
- Ensure maximum economic returns while protecting social and environmental values;
- Training of forest managers, supervisors and key stake holders on how timber harvesting operations should be undertaken;
- Enforcing appropriate legislation and harvesting practices, monitoring and evaluation of harvesting operations.

2.1 Woodland Management Planning

Woodland management planning is required to develop comprehensive strategic and operational mechanisms which ensure that the forest values are managed sustainably. It also provides responsible use of land and woodland resources for the maximum benefit of all stakeholders by taking account of the socio-economic and environmental impacts on the area. This approach assists in the provision of efficient, cost effective

and environmentally sensitive means of harvesting timber. One objective of this part of planning is to develop comprehensive timber harvesting plans before any harvesting activities commence. Knowledge of the terrain and characteristics of the woodland resource, its timber and infrastructure is central to the development of plans and the subsequent efficient harvesting of the woodland.

2.2 Pre-harvest Planning and Operations

Woodland harvesting planning is required to develop comprehensive operational document that will outline appropriate harvesting practices and at the same time protect forest values.

Harvesting plans have to be developed before harvesting operations commence. In developing these plans, knowledge on the terrain conditions, distribution of timber to be harvested, type of workforce available, condition of logging tools and equipment available and the existing road network have to be known in advance. This knowledge will assist in planning harvesting operations so that they are carried out in a systematic, cost effective and efficient manner.

2.2.1 Woodland Harvesting Plan

A woodland harvesting plan should be prepared in order to reduce logging damage to both harvested and residual trees, soils and regeneration. The main objective should be to improve operational efficiency, increase productivity, reduce logging costs and environmental impact, improve worker's health, safety and their socio-economic well-being.

A woodland harvesting plan aims to:

- improve operational efficiency and productivity,
- reduce logging costs,
- improve forest workers health, safety, and economic well being,
- attain a maximum tree felling intensity of 8 trees per hectare in order to reduce potential environmental damages,
- minimise tree felling in areas that are ecologically sensitive or on slopes greater than 40%.

In order to be able to estimate the total volume of timber to be harvested and its distribution over the area to be harvested, a detailed inventory and stock map of the area is required. Inventory information and stock maps are intended to provide detailed locations of trees to be harvested and those for retention as seed trees or as future crop trees. Harvesting plans should also include stock maps which are normally in the scale of 1:10 000, and should show important topographic features (e.g. sensitive areas, stream crossings, steep slopes to be excluded from logging in order to minimise environmental impacts). This information assists in designing the skid trails, log landings and in planning hauling tracks.

The woodland harvesting plan should therefore include:

- forest inventory details,
- a felling plan which should indicate the felling units, methods and equipment to be used,
- silvicultural prescriptions to be adopted,
- a map showing;
  - tree stocking on the area, with location of trees to be harvested,
  - streams and rivers,
  - exclusion zones (stream buffers, swampy areas, rocky areas and steep areas),
  - skid trail, landings and road network (current and proposed) and stream crossings (current and proposed),
- copy of the contract agreement which specifies what regulations the company has to comply,
- forest worker's health and safety plan, which specifies nature of safety clothing and equipment to be provided.

2.2.2 Woodland Inventory

A pre-harvest inventory should be carried out to assess the type of the terrain and provide estimates of the number of harvestable trees and merchantable volume

per unit area of the woodland expected to be harvested. This inventory which can be carried out with the assistance of geographical information system (GIS) should further identify areas that may need special harvesting treatment to minimise deleterious physical and social environmental impacts associated with harvesting operations.

In principle, a pre-harvest inventory should be carried out to:

- assess the nature of the terrain,
- provide estimates of the number of harvestable trees and merchantable volume per unit area,
- identify areas that may need special harvesting treatment in order to minimise deleterious environmental impacts and other types of damages associated with harvesting operations.

Detailed topographic maps for the area to be harvested are required. The topographic maps should show important topographic features (e.g. sensitive areas, stream crossings, steep slopes to be excluded from logging in order to minimise environmental impacts). These topographic maps should form the basis of the map for the timber harvesting plan.

Plate 1: Typical Miombo Woodland during dry season

2.2.3 Tree Marking and Direction of Fall

Tree marking is carried out in order to ensure that only the trees that meet the specifications outlined on sales contracts are harvested, in a manner that will help to maintain a vigorous residual forest. Commercial trees to be felled should be marked with a record number and a vertical paint blaze indicating the intended direction of fall. The trees should be marked with at least two "X" to assist the feller to identify the trees to be harvested. Decisions about felling direction should be based on;

- feller's safety,
- ease of skidding,
- degree of lean of the tree,
- avoidance of damage to harvested tree and future crop trees, and
- impacts on buffer zones.

2.2.4 Skid Trail Layout

Main skid trails that are planned and marked on the stock maps and harvesting plan should be located in the field prior to tree felling and extraction. The topography of the Miombo woodland is relatively flat and the rainfall generally low (<1000 mm/year). However, if steep slopes are encountered, skid trails should be located on ridges and slopes greater than 40% should be avoided. In principle, Skid trails should:

- be planned and established to facilitate uphill skidding (up-hill skidding is preferred to down hill skidding),
- not exceed 3 m wide and be marked in the field with paint or tape along the proposed extraction or hauling route,
- not be located on slopes steeper than 30%, with skid trails angled across the slope rather than running straight up and down,
- avoid stream crossings if possible,
- be kept as straight as possible, curving only where necessary to reach trees marked for cutting or to avoid wet or unstable soils and steep hillsides,
- be kept out of streamside buffers,
- have end points clearly marked in the field with paint or tape.

For optimal skidding production, average skidding distances with Farm tractors should be less than 150 m.

2.2.5 Log Landings

Landings are important for log storage prior to transportation to the processing facility. Log landings should be located:

- within the area being harvested, but not in the buffer zone, beside a stream crossing, or on steeply sloping terrain,
- at sites appropriate for the designated skidding patterns and directions,
- in areas that are easy to drain (i.e. areas that have slightly sloping ground),
- on ridges to promote uphill skidding and to disperse runoff into surrounding vegetation,
- beside roads whenever possible to reduce construction of additional landings and to reduce impact on woodland,
- so as not to occupy or exceed 400 m^2 in area,
- in conjunction with planning of skid trails.

2.2.6 Road layout and Construction

Locating and constructing hauling roads in the Miombo woodlands is relatively less complicated than in some other parts of the tropics. Much of the land occupied by the Miombo is relatively flat topography with few physical obstacles encountered. However, roads have to be planned in such a way that they cover most of the area being harvested and minimise skidding costs. Due to low stocking density, low volume of logs harvested per unit area and the general terrain conditions rarely are hauling roads constructed by disturbing or excavating the subsoil. Rather, truck roads are cleared of shrubs, trees and other obstacles and the first truck normally form and determine where the roadway shall be.

In many parts of the Miombo, the concession periods or harvesting contracts given to logging contractors are short. This doesn't encourage them to invest in permanent roads as it is not worth the investment. By lengthening the concession periods and introducing rebate systems for each road constructed, it could probably encourage logging companies to construct high standard hauling roads, which would reduce hauling time and save on regular maintenance of both roads and machines.

Although roads are essential for transporting logs and providing access for forest management and monitoring, the same roads also cause soil and gully erosion especially if not properly designed, constructed and maintained. Roads therefore have to be designed and properly laid in the field in order to minimise soil disturbance and avoid stream crossings. Where it is necessary to layout and construct hauling roads in

Miombo woodland, harvesting roads should be planned on maps at the appropriate scale and located;

- on high ground to facilitate drainage,
- in areas which do not require large cuttings and fills in order to reduce soil erosion and sedimentation of streams,
- away from the stream buffer zones, swampy areas and saddle areas
- on slopes less than 30%,
- by taking advantage of the natural drainage for installing cross drainage structures,
- so as to minimize loss of productive forest land, total length of roads in an area should be minimized,
- so as to minimise stream crossings in order to avoid stream pollution,
- to avoid wet and unstable areas in order to minimise land slides and soil compaction.

Properly designed and constructed roads are important for sound forest management. Well constructed roads should have the following features:

- the right road formation width with the appropriate camber or crown,
- shoulders and v shaped side ditches to collect water from both sides,
- clear sight distance by clearing the 'right of way' to an appropriate width,
- adequate cross drains e.g., culverts, bridges and water bars,
- catch drains dug on the catchment or watercourse areas in order to direct water to cross drains without causing soil erosion on batters and out-slopes on the side of the road,
- culverts with well constructed head walls, outlet or wing walls and sediment traps.

These drainage structures should be constructed and used by truck operators during the trucking operations. Trucks should remain on designated roads at all times unless permission is granted by the supervisor or Forest Officer/Community based forest manager. Such exceptions should be noted and explained in field record books.

In many regions, roads will be constructed by organisations other than the timber harvester or Forest Departments or communities. It is for this reason that detailed road standards are necessary. Detailed specifications for tropical forest roads can be found in the following publications: Applegate, G. B. (1997), Asia-Pacific Forestry Commission (1999), Department of Forestry and Wildlife (1999), Dykstra and Heinrich,(1996), Fiji Ministry of Forestry (1990), South Pacific Commission (1994).

3.0 Timber Harvesting Operations

Timber cutting and extraction operations should aim to maximise recovered log volume and value, and ensure minimum damage to residual trees and regeneration. Timber harvesting operations should also adopt safe working practices.

The general guidelines for timber harvesting operations include specifications for general supervision of operations, tree cutting (directional felling, limbing and bucking), log extraction by skidding, log storage at landings, loading, hauling and unloading operations aimed at reducing the impact of harvesting on the environment.

3.1 Supervision of Operations

All timber harvesting operations should be supervised to reduce unwanted site disturbances and improve efficiency of the operations. Supervisors who are trained in reduced impact timber harvesting practices should oversee the harvesting operations regularly and monitor production methods in order to ensure that they conform to the woodland management and woodland harvesting plan. Forest Department staff or community representatives should inspect each operation and check whether there is compliance with contract specifications, the right logging tools or equipment are being used and the right working

techniques/methods are being applied. Non-compliance with the agreed practices should be acted or rectified immediately. Forest Officers or logging supervisors should institute complete closure of logging operations during extreme rainy seasons when there is heightened risk of damage to roads, soil/ground damage and breakdown of machinery.

3.2 Tree Felling

During felling operation, it is important that the felling crews are trained on the proper felling techniques and are provided with the right working gear in order to increase productivity, avoid accidents and minimise wood waste. Improper training will lead to high accident rates, damage to equipment, soils and residual trees, stream pollution, high extraction cost, low tree utilisation and low log quality.

Tree felling equipment/tools should be properly selected and used in order to improve felling production, safety and log value. During felling operation;

- Felling/cutting tools must be sharpened regularly for safety and efficiency
- Handles of felling hand tools should be smooth and well designed
- Felling auxiliary such as wedges, levers, tongs and cant hooks should be used
- Felling crews should be provided with protective gear

During felling operation, it should be conducted in a manner that;

- trees are felled by trained personnel in the direction indicated (it is recommended that either a two-man raker-toothed crosscut saws or chainsaws are used to make scarf-cut and back-cuts. Axes may be used for making notch cuts when felling with crosscut saw while auxiliary tools such as wedges, felling levers could be used in case of directional felling,
- it causes minimum damage to trees harvested, residual trees and regeneration,
- all tree hang-ups during the felling operation are brought down,
- it facilitates log extraction and other operations/activities,
- it avoids disturbance to areas not planned to be harvested,
- only trees marked for felling are harvested and seed trees are left standing,
- climbers are cut ahead of actual felling operation so that they are dry already during felling operation,
- it causes minimum hazards to the felling crews by providing them with protective gear,
- safety precautions are taken when felling trees close to public roads by putting warning signs,
- trees should be cut low to leave stumps of less than 30 cm high,
- escape routes near the tree to be felled are prepared by clearing shrubs and other obstacles.

3.3 Tree limbing

Rarely are trees in the Miombo woodlands limbed or de-branched as the first branch normally sets the merchantable bole length. Where trees have to be limbed, trees have to be de-branched as follows:

- use axes and/or chainsaws for limbing felled trees,
- limbing trees on very steep slopes should be avoided in order to minimize accidents,
- limbed branches and logging slash should not be deposited in streams neither on the planned skid trails and truck roads,
- branches should be removed so that the limbed tree lies flat on the ground to facilitate next operations,
- limbing should be accomplished on time in order to allow or facilitate next operations.
- Limbing should be done to ensure that the final log is smooth with no short branches,

3.4 Tree Bucking

In many of the Miombo harvesting operations, the first branch sets the maximum length of merchantable timber and rarely is two or more logs bucked from a single tree. In most trees, only one log of length 3 – 6 m is bucked while the rest of the tree remains as waste in the forest. This results to only 30-40% of the tree being used as merchantable timber and the rest wasted in the forest. This practice needs to be discouraged by introducing incentives and changes to the current stumpage pricing policies. The current practice of paying for only volume of logs taken out the forest should be reviewed and fees be based on the actual standing tree volume.

In order to improve bucking efficiency, bucking should be undertaken as follows:

- bucking should be done using crosscut saws or chainsaws. Axes should not be used for bucking trees as they cause excessive wood waste,
- bucking crews should be trained in appropriate scaling and bucking procedures in order to maximise tree utilisation, and reduce log waste. Training can increase tree utilisation by about 20% and log value by about 15%,
- bucking should also consider the minimum mill and market specifications in order to avoid timber waste,
- bucking tools must be kept in good cutting /working order in order to reduce stress and wood wastes.
- Unlike in the past, due to scarcity of logs, large branches and/or short logs of valuable tree species previously left in the forest to rot are nowadays salvaged and bucked before being utilized for furniture purposes. This is a step in the right direction as it increases the percentage of tree utilization.

3.5 Log Extraction (Skidding)

Log extraction is the process of moving logs from the stump sites to landings or roadsides before being transported to the mill by trucks. Ground skidding is the most common skidding system used in the Miombo woodlands. There are a number of different types of skidding equipment that are appropriate for the Miombo woodland. These include farm tractors, skidders and crawler tractors. Whichever type of skidding equipment is used, it is important that machines to be used for skidding have the following;

- A two –drum winch which is mounted so as to raise the butt of the log off the ground during the skidding operation
- These two winches are able to be fitted with 30m of wire rope,
- Log chokers should be used in order to minimise choking time and enhance also the life of the winch wire rope.

When undertaking skidding operation, it is important to ensure that;

- the operation causes minimum damage to residual trees and environment in general,
- machines remain on designated skid trails marked prior to tree cutting,
- as far as possible, only crawler tractors, skidders or farm tractors fitted with or without winches are used in log extraction,
- that skidding should not be undertaken in designated exclusion zones,
- tractors use winches (with one or two drums) to winch logs from stump sites directly to tractors on skid trails in order to minimize environmental damage (winches to be fitted to tractors should have the capacity to hold 30 m 15-30 mm diameter wire rope),
- the butt section of logs are raised off the ground during skidding operations,
- log extraction machines are kept out of streambeds and away from the riverbanks,
- skidding on steep slopes (> 30°) and on sensitive wet soils (low trafficability due to high water content) is avoided where feasible,

- skidding uphill rather than downhill should be preferred,
- that skidding on steep slopes and on easily compacted soils is carried out during the dry season,
- skidding logs on roads or across roads is discouraged,
- skidding is undertaken by appropriately trained crews,
- improper skidding besides leading to soil damage and soil compaction, stream and residual tree `damages, will also cause accidents, low productivity, high production cost and poor quality of logs.

Plate 3: Skidding Logs in Miombo woodlands

3.6 Log Landings

Landings are established along the roadsides or on open areas that are easily accessible by the log trucks by clearing of all standing trees and shrubs. They are constructed as temporary storage centres for logs awaiting further transport to the mills. In other words, from these landings, logs are loaded either manually or mechanically into hauling trucks. In order to minimise long skidding distances, many small landings are established within the woodlands. As a matter of principle, these landings should be big enough to hold at least one truck load and should be easily accessible and well drained. During heavy rains, such landings are closed in order to avoid excessive damage to the soil and the environment in general.

Plate 4 Log loading in one of the landings in the Miombo woodlands

3.7 Log Transportation

Logs are usually transported to the mill site from the log landings by 7-10 tonne flat bed trucks and sometimes by semi and full trailer trucks. In principle, transportation of logs out of the woodlands should adhere to the following guidelines:

- loading of logs onto trucks should be done manually using A- frames or with the use of mechanical loaders depending on the volume of logs to be loaded per area/site.,
- log transportation should be planned in advance so that log trucks use pre-planned roads,
- planned and constructed truck roads should be able to accommodate different types and sizes of vehicles,
- trucks must not be loaded in excess of their design capacity and neither should they be under loaded in order to carry other types of load on the way.
- logs being transported must be secured tightly with wire ropes, chains or load binders (load binders that are of sufficient strength to prevent logs from falling off the truck if the load should shift during transit),
- loaded trucks should be checked prior to departure and regularly when en-route to ensure that binders are securely fastened, that the load is well positioned on the vehicle and that tyres and brakes are in good working condition,
- truck drivers must hold appropriate driving licences and should be adequately trained and instructed to follow the marked and pre-designated truck road to avoid damage to residual trees and the soil,
- trucks have to conform to public highway regulations, have to be unsured and have up to date road licences.
- prior to unloading, and removing log binders, side stanchions should be checked to ensure that they are secure,
- as far as possible, try to minimise transportation cost as this is the most expensive timber part of the harvesting operation (accounts to 50-70% of the total timber harvesting cost),
- stop log transportation operation during the rainy season in order to minimise ground damage and potential accidents.

Plate 5: Transportation of logs in Miombo woodlands

3.8 Pit/platform hand sawing

Pit or platform hand sawing is the process of converting logs into sawn timber on-site using special two man cross cut saws. The sawn planks are then carried manually to the roadsides before being transported to market by trucks. Studies have shown that pit/platform hand sawing is ecologically less destructive than other timber harvesting systems especially on steep and remote areas with low stocking density.

This system is practically appropriate in Miombo woodlands where stock density is low and most logging areas are in inaccessible terrain or environmentally sensitive areas. There are two forms of hand sawing; pit and platform methods. The platform method is more preferred as it causes less soil disturbances although it tends to destroy young timber trees in the neighbourhood. Pit sawing on the other hand involves digging at least 1.5m deep pit by 1.0m wide and 2.5m length which is time consuming, costly and environmentally not acceptable.

Despite its low investment and less environmental impact, the problem with pit/platform hand sawing is that it often leads to over utilisation of resources around the pit or platform, poor tree utilisation (low recovery) and is less easily monitored. Employment of well motivated forest officers or communities would probably minimise the problem of uncontrolled and over utilisation of particular tree species in the forest.

Plate 6 Platform hand sawing method in Miombo woodlands

4.0 Post-Harvest Operations

Post-harvest operations are designed to encourage woodland regeneration and improve environmental services and values. They are also meant to protect water pollution, soil erosion and downstream sedimentation. The Forest Department staff should systematically check the logging areas and evaluate adherence to the practices and levels of logging damage before making recommendations on measures to take or rectify the situation.

4.1 Field Activities

Post-harvest activities which need to be undertaken include:

- closing roads using ditches or billboards to restrict access,
- cleaning the drains and culverts on all roads of debris before and after the rains,
- draining landings and skid trails using cross drains placed at 10 degrees to the trail and emptying into the undisturbed woodland,
- carrying out burning of the forest in the early part of the dry season. It may be necessary to return to the site to ensure the burn is conducted at the appropriate time,
- closing and removing camps after harvesting is completed and to leave the area clean and tidy. All refuse should be removed or buried.

4.2 Harvesting Impact Assessment

The aim of undertaking a post-harvest impact assessment is to provide feedback about the quality of forest harvesting operations undertaken. This is usually undertaken 8-12 months after the harvest operations. The operation should involve a systematic check in order to determine the degree to which a harvesting operation has been carried out according to timber harvesting plan and the extent to which it has met its stated objectives. Communities (if woodlands are on Community Land) with assistance from Forest Department staff should carry out harvesting impact assessment immediately after every timber harvesting operation has been completed on an area.

The harvesting impact assessment is undertaken to:

- compare the actual location of roads, landings and skid trails with the location indicated on the harvest plan and any discrepancies should be explained,
- determine whether the sampled stumps heights comply with what is stated in the guidelines,
- identify and keep record of trees that were marked for felling but not felled and charge the contractor accordingly,
- assess the extent of ground and soil damage caused by harvesting operation,
- assess harvesting intensity by sampling,
- assess the percentage of woodland disturbed by truck roads, skid trails and log landings.,
- assess damaged trees/hectare and volume of timber remaining as waste in the woodland,
- assess tree mortality or residual trees damaged due to timber harvesting,
- assess the amount of harvesting debris deposited in streams or rivers,
- assess whether exclusion zones have been logged, and whether potential crop trees have been killed or damaged,
- assess the condition of the working tools/equipment and assess whether they conform with the safety regulations.
- assess whether the safety gear was used by workers and the level or extent of accidents with or without safety gear.
- prepare a Completion Report to communicate the results of the harvest impact assessment to the Forest Department, Community Based Forest Management Committee and Contractor.

5.0 FOREST LABOUR FORCE

Among the areas that need to be improved in woodland management in order to improve operational efficiency, productivity and reduce accidents of forest workers include worker health, safety and competence (Andrewartha *et al.* 1998). This can be achieved by improving the work place condition, nutrition and health status of workers and above all, training of forest workers (Abeli, 2000).

5.1 Work place condition

Work places should be properly designed so as to minimize unnecessary delays and accidents, activities should appropriately be scheduled so that they allow other activities to be undertaken simultaneously or concurrently while appropriate working techniques using properly designed tools/equipment should whenever possible be introduced and adopted in the woodlands. For workers living far from workplaces, transport to and from work should be arranged and for unskilled labour force, it is better to employ local people so that besides creating employment, they appreciate and value the woodlands. For those workers living in logging camps, both basic health and social facilities have to be provided by the employer/contractor.

5.2 Worker's Health, and Safety

For the good health and safety of the forest workers, it is important that the following are observed;

- adequate, and nutritional balanced meals made up of either maize, beans, rice, meat, fish and/or vegetables should be provided at the harvesting sites,
- basic ergonomic principles should be considered and applied during harvesting, and these should include;
  - proper design and handling of felling/bucking tools,
  - proper working techniques,
  - proper apportioning of working time and rest patterns,
- provision of adequate social welfare and services by employers (e.g. basic medical care and other social services) at or near campsites,
- fair wages should be negotiated with worker's representatives and if possible stable or permanent employment should be encouraged, with priority given to members of local communities surrounding the forests,
- supervisors should be trained and provided with First Aid kits in order to

attend injured or sick workers in the forest,
- accidents causing injury to workers or damage to equipment should be reported in standard prepared forms,
- serious accidents should be investigated immediately and preventive measures taken to avoid similar accidents in future.

5.3 Protective Clothing and Safety Equipment

The objective of providing appropriate safety equipment, training and a safe working environment is to reduce the number of accidents occurring during timber harvesting operations. Personal protective equipment should be provided to workers and they should be taught how to use and maintain them. During timber harvesting operations, harvesting crews should be provided with the following protective clothing and equipment:
- steel capped logging boots or shoes,
- safety helmets,
- high visibility suits or jackets (red or orange colour),
- eye and ear protection devices for chainsaw and machinery operators,
- gloves for chainsaw operators, loading crews and workshop workers,
- auxiliary felling tools (wedges),
- sharpening tools (whetstone, files),
- adequate rest breaks during harvesting operation with long rests during loading and felling activities ,
- health services medical insurance and compensation for accidents occurring during harvesting operations,
- first-aid kit and anti-snake bite kit provided and carried by the crews in the field,
- safe working guidelines, regulations and security of employment to be provided and explained to all employees and contractors.

5.4 Training and Competency Requirements

Forest work force need to be trained in order to make them competent in the use and maintenance of equipment and can carry out the assigned tasks more efficiently. This will in addition motivate them to work with confidence and safety. Training is also necessary to ensure that people responsible for particular tasks understand the need requirements of those tasks.

Prior to the implementation of the improved harvesting practices, skills and training needs assessment is necessary as it will develop the minimum competency standards for forest harvesting operations to be undertaken. Properly trained staff or workers with the necessary competencies for undertaking forest harvesting and associated activities work more safely and effectively. This leads to more efficient work practices with less downtime due to injury and machinery breakdowns.

Training should therefore involve the following:
- development of competencies, levels and standards for timber harvesting in Miombo,
- competency-based training programmes developed and implemented as;
  - train-the-trainer,
  - chain saw (tree fellers) and machinery operators and field workers,
  - field supervisors, and logging managers
- study tours and executive style training and information and awareness to policy makers and senior executives,
- training and awareness training for middle level managers.

To ensure that all staff engaged in harvesting operations are able to carry out their assigned tasks effectively and efficiently, training of forest workers must be undertaken (Abeli, 2000)

Logging managers and logging supervisors should be adequately trained to undertake inventories while machine operators should undergo training and skill testing before being employed. Tree fellers should be trained in safe working practices, determination of log lengths tree and log marking requirements. Forest Officers in-charge of logging, logging managers, logging contractors and logging crews should be trained on reduced-impact logging and provided with logging guidelines.
Workers should undergo basic first-aid training and whenever possible transport should be made available at work site for quick transportation of sick or injured workers.

6.0 CONCLUSION

Both timber and non-timber resources and environmental values can be sustained in the Miombo woodlands in Africa by implementing the guidelines for improved timber harvesting practices. These techniques require relatively minor modifications to many of the current practices, and in many cases they can be implemented with only a small increase in current operating costs.

To ensure that these improved timber harvesting practices are adopted widely, government policies must be revised with a view to promoting improved management of timber concessions and timber harvesting agreements and to ensure appropriate incentives for sustainable practices through taxation and other fiscal measures and to improve the training of Forest Officers, Communities and company personnel. All of these stakeholders require more resources and assistance from trained foresters to enable them to take responsibility for managing the land under their jurisdiction and a greater control over timber harvesting operations.

It is anticipated that through implementation of improved harvesting practices and supervision in the Miombo woodlands, the following gains could be made:

- improved sustainable management of the woodland resources,
- reduced disturbance and impacts to soil and residual future tree crops,
- conservation of biodiversity and non-timber forest products,
- increased revenues for communities and governments,
- reduction in actual harvesting costs to contractors, governments and communities, with higher levels of productivity, efficiency, and timber utilisation.

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