# UTILIZATION OF *DALBERGIA MELANOXYLON* (GUILL. & PERR.) IN TANZANIA: A CASE STUDY OF NACHINGWEA DISTRICT

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## ABSTRACT

A study was conducted to assess the current status and uses of *Dalbergia melanoxylon* (Guill. & Perr.) in Nachingwea district. Data collection was done using two methods; forest inventory and social survey. Forest inventory data were collected from a total of 44 sample plots, which were laid out on general land forest. Parameters determined included height, stems per hectare, basal area per hectare, volume per hectare and diameter classes. Social data were collected using Participatory Rural Appraisal (PRA) and questionnaires. Microsoft Excel was used to analyse inventory data while social data were analysed using Statistical Package for Social Sciences (SPSS). The study identified 103 tree species. The number of stems, basal area and volume per hectare for *D. melanoxylon* were found to be 20, 1.2 $m^2$ and 8.6 $m^3$ respectively. The stems were distributed in five diameter classes. The species contributed 8.3% by volume out of all tree species. The number of stems, basal area and volume per hectare for other tree species were 507, 14 $m^2$ and 103.7 $m^3$ respectively. It was found that in 1999 about 1,500 $m^3$ or 37% of harvested *D. melanoxylon* in the country was exported in the form of carvings and timber. Internationally, the main use of *D. melanoxylon* is for the manufacture of musical instruments. The remaining 63% were used locally as building poles, fuel wood, charcoal, for manufacturers of household utensils and carving. Seventy eight percent of people in Nachingwea district did not prefer *D. melanoxylon* for fuel wood or house construction. The study concluded that there was inadequate control of timber harvesting activities, lack of awareness of the value and importance of *D. melanoxylon* and lack of inventory on *D. melanoxylon.* It is recommended that forestry and environmental education programmes be provided to communities in Tanzania and national inventory for the species be carried out in order to know the existing stock and prescribe sustainable harvesting regimes.

## INTRODUCTION

*Dalbergia melanoxylon* (Guill. & Perr.) whose trade name is East African Blackwood belongs to the family *Fabaceae* subfamily *Papilionaceae.* It is locally known as "mpingo" in East Africa. The species has a wide range of occurrence, it occurs in at least 20 countries in sub-Saharan Africa (Figure1). In Tanzania, *D. melanoxylon* is widely distributed throughout the drier parts except desert scrubs. It is most frequently found in mixed deciduous forests and savannas of the coastal region. The species is less common in the western miombo woodlands where it is confined on upland sites with altitude approaching 1,000 m (Nshubemuki 1993).

Grant (1934) reported that *D. melanoxylon* was fairly plentiful in Tanzania in the 1930's, but recent studies indicate that the species is now scattered in occurrence. In the 1960's for instance, it was recorded as being rare due to intensive exploitation. Read (1993) further noted that tree population continued to decrease due to over exploitation and inadequate control of fires.

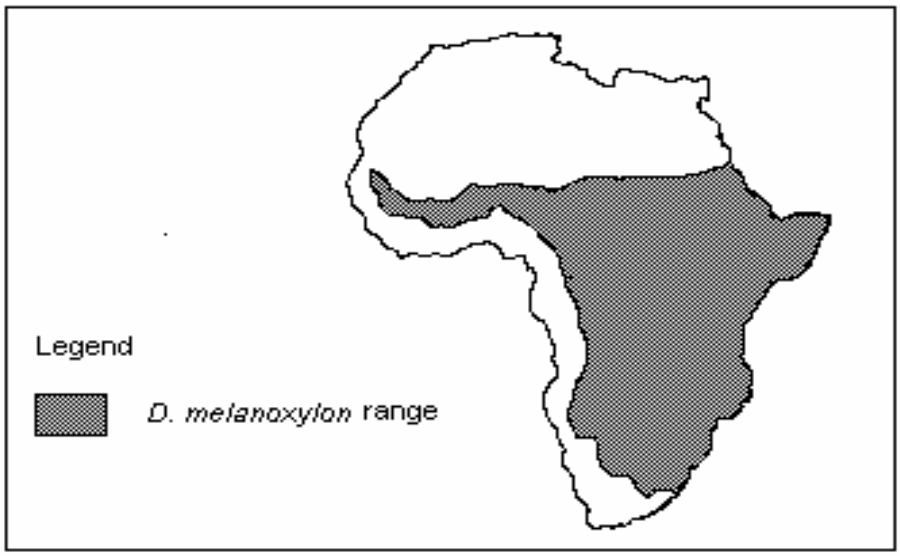


Figure1. Map of Africa showing the distribution of *D. melanoxylon* (source Marshall 1995).

To date, there is a threat of extinction of *D. melanoxylon* if the current trend continues unchecked. The main threat to *D. melanoxylon* in Tanzania is uncontrolled and or illegal harvesting. It is estimated that 20,000-30,000 *D. melanoxylon* trees per year are harvested for both international and local markets (BBC 1992). Another threat is expansion for agricultural land. About 130,000 ha of forests, mostly on general land, are cleared for agriculture every year (Ahblack 1992). In addition to that, lack of appreciation of the high value of *D. melanoxylon* by local people has normally resulted into its inefficient utilization. Although the species produces one of the most valuable woods, local people do not consider its economic value at the international market. For example, in the 1991 world market, sawn wood of *D. melanoxylon* fetched US$ 13,880/$m^3$ compared to only US$ 459/$m^3$ and 491/$m^3$ for *Pterocarpus angolensis* (mninga) and *Milicia excelsa* (mvule) respectively, the most famous wood species in Tanzania (Mugasha 1996).

Due to lack of funds, there is no large-scale inventory carried out for *D. melanoxylon* in Tanzania. Therefore, the exact stock of *D. melanoxylon* in the country is not known. Small patches of forests in Kilwa and Mikumi National Parks have been inventoried. Prescribing a sustainable harvesting regime for *D. melanoxylon* requires adequate information on the distribution, stand volume and growth rate.

The country is faced not only with decreasing forest cover but also a sharp decline of famous timber species, *D. melanoxylon* being one of them. This is caused by, among other factors utilizing few species. Tanzania has about 220 species, which can be utilized for timber and other efficient uses but only few species are utilized commercially. *D. melanoxylon* belongs to these few most utilized species. Therefore, immediate actions are urgently needed to reverse the trend.

The overall objective of this study was to assess the current status and uses of *D. melanoxylon* in Nachingwea district. The specific objectives were to estimate the total

volume of *D. melanoxylon* and other species in the study area, and also to find out the current end uses of *D. melanoxylon* in the study area.

## MATERIALS AND METHODS

### Study area

The study was conducted in Nachingwea district, which is one of the five districts of Lindi region. The district lies between longitude 38° to 39° E and latitudes 10° to 11° S, occupying an area of 642,266 hectares. It consists of five wards; Naipanga, Luponda, Lionja, Nambambo and Kilimarondo and a total of 65 villages. It is home to five ethnic groups namely; Mwera (the largest), Yao, Makua, Makonde and Magingo.

Nachingwea district has a population of 150,000 out of which 52% are women and 48% are men. The total cultivated land is 21,535 hectares equivalent (3.4 %), while forests cover 190,159 hectares, equivalent to 29.6% of the total area (URT 1997). The average farm size is three hectares although some houses have up to 15 hectares. Major food crops are cassava, maize, sorghum, rice and pigeon peas while major cash crop grown was sesame and cashew nuts. In many villages, wild animal meat constitutes an important source of protein. Average rainfall for the Nachingwea district ranges between 600 and 1100 mm per year. The highest temperature is 35.5°C and the lowest is 15°C taken for the last ten years.

### Data collection

Systematic sampling was adopted for obtaining forest inventory data. To cover the whole area, the forest was divided into transect lines crossing the forest from north to south. Plots were located at equal intervals of 1 km along the transect line. To avoid edge effect first plot was established 50 m inside the boundary of the forest. A total of 44 sample plots with radius of 15 m were established. Sampling Intensity of 0.7% in accordance to Synott (1979) was used with the plot area of 0.07 hectares for the case of tropical inventories. The estimated area for all forest covers was 5,500 hectares. Sample plots inventoried were equivalent to 3.08 hectares.

In each plot, all *D. melanoxylon* trees with DBH of 4 cm and above were measured. The measurements were taken from five diameter classes namely 0 - 10 cm, 10 - 20 cm, 20 - 30 cm, 30 - 40 cm and > 40 cm. Measurements for DBH were taken to the nearest 0.1 cm and those for total height to the nearest 0.1 m. Diameter of fluted trees was recorded as the average of two measurements taken at right angles. The height and diameter of all *D. melanoxylon* trees were measured in each plot.

Due to multiple stems and flutings, standard mensurational techniques were strictly followed to minimize measurement errors. For example, for a tree forking below 1.3 m from the ground, each stem was treated as an individual tree.

Social data was collected using questionnaire surveys and Participatory Rural Appraisal (PRA). For questionnaire survey, a multi-stage sampling procedure was employed. Four villages were purposely selected on the basis of closeness to the forest under general land and easy of communication. Five percent of households as recommended by Boyd *et al.* (1981) from each village were picked randomly for interviews. Interviews were done in 122 randomly selected households. Heads of households were interviewed and other members were allowed to participate to supplement information.

### Data analysis

Data from forest inventory were analyzed by using Microsoft excel-spreadsheet software and the parameters included

diameter classes of trees, total tree height, stems per hectare, basal area per hectare and volume per hectare.

Data collected by using PRA techniques in phase one were analysed with the help of the communities and the results were communicated back to them. This participatory approach involved continuous interaction between a researcher and the communities who were seen as equal partners in the research process. Data collected through questionnaires were analysed using both quantitative and qualitative methods. Statistical Package for Social Sciences (SPSS) was used to analyse quantitative data whereas Content and Structural-Functional Analysis were used to analyse qualitative data. The content of verbal discussion were analyzed in detail with the help of content analysis method. In this way, recorded dialogue with respondents was taken down into smallest meaningful units of information or themes and tendencies. This helped the researcher in ascertaining values and attitudes of respondents.

## RESULTS AND DISCUSSION

### Number of stems per hectare

The stocking of *D. melanoxylon* was found to be 20 stems per hectare. In most cases the stems were found in clusters that may indicates that the stems developed from disturbed roots. Among these, five stems were in diameter class one, five stems in diameter class two, four stems in diameter class three, four stems in diameter class four, and two stems in diameter class five. The information is summarized in Figure 2.

The number of stems of *D. melanoxylon* per hectare reported in this study contributed about 4 % of the total stems. The average number of stems per hectare for all other tree species was 507. This is similar to the findings of Malimbwi *et al.* (in press) for inland areas of southern Tanzania. Hawkins *et al.* (1995) reported a similar stocking of 20 stems per hectare in Mikumi National Park which contributed only 0.7 % of the total density. The distribution of the number of stems did not depict a true reversed J-shape as expected for natural forests. This might be caused by the controlled harvesting, which, have been imposed by the central government.

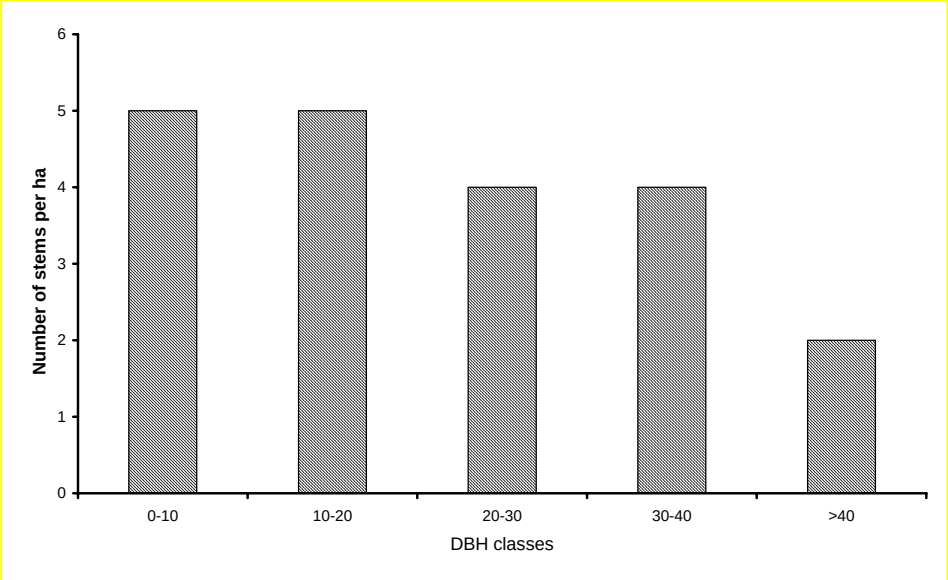


Figure 2. Distribution of number of stems for *D. melanoxylon*

In order to harvest *D. melanoxylon* tree one needs to get a permit from the District Forest Officer (DFO) who decides on the amount to be harvested. The government has classified *D. melanoxylon* as class 1A of the license system. It costs Tshs. 60,000 per $m^3$ to get a licence of harvesting *D melanoxylon*. This is the most expensive species according to this classification (URT 1996). This is one way of controlling harvesting of *D. melanoxylon* since ordinary people cannot afford the fee. Since there is prolific *D. melanoxylon* natural regeneration, the stocking difference between younger and older age might be attributed to ecological factors, fire and other growth conditions. The easy accessibility to general land, which enhances harvesting, may be another factor.

**Basal area per hectare**

The average basal area for *D. melanoxylon* was found to be 0.02 $m^2$ per hectare, distributed in five diameter classes (Figure 3). The average basal area per hectare for all other tree species growing in the study area was 14 $m^2$. The distribution of basal area per hectare depicted a J-shape common in natural forests. It can be observed in Figure 3 that basal area increases with DBH.

**Volume per hectare**

The average *D. melanoxylon* volume was found to be 8.6 $m^3$ per hectare, distributed in five diameter classes as shown in Figure 4. The average volume per hectare for all other tree species found in the study area was 103.7 $m^3$. The volume obtained from this study for *D. melanoxylon* was relatively greater than 7.5 $m^3$ per hectare reported by Malimbwi *et al.* (in press) for coastal and inland areas in southern Tanzania. CMP (1999) reported 1.03 $m^3$ per hectare of potentially harvestable logs in Kilwa district while in Cabo Delgado province in Mozambique, Macome (1996) reported a total overbark volume of 2.2 $m^3$ per hectare. Mills in Lindi region get most of their logs from Nachingwea and Ruangwa Districts, and a few from Mtwara and Masasi (CMP 1999). This is because most of *D. melanoxylon* in Nachingwea has brown coloured heartwood, which is mostly preferred by customers as it gives a good finishing.

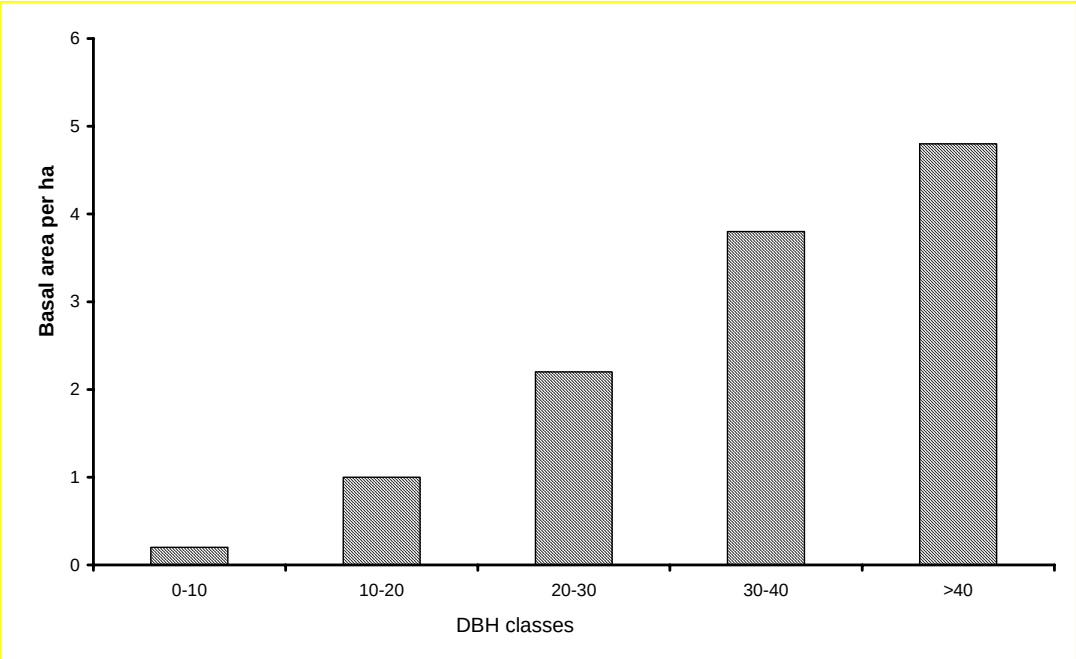


Figure 3. Distribution of basal area for *D. melanoxylon* in DBH classes.

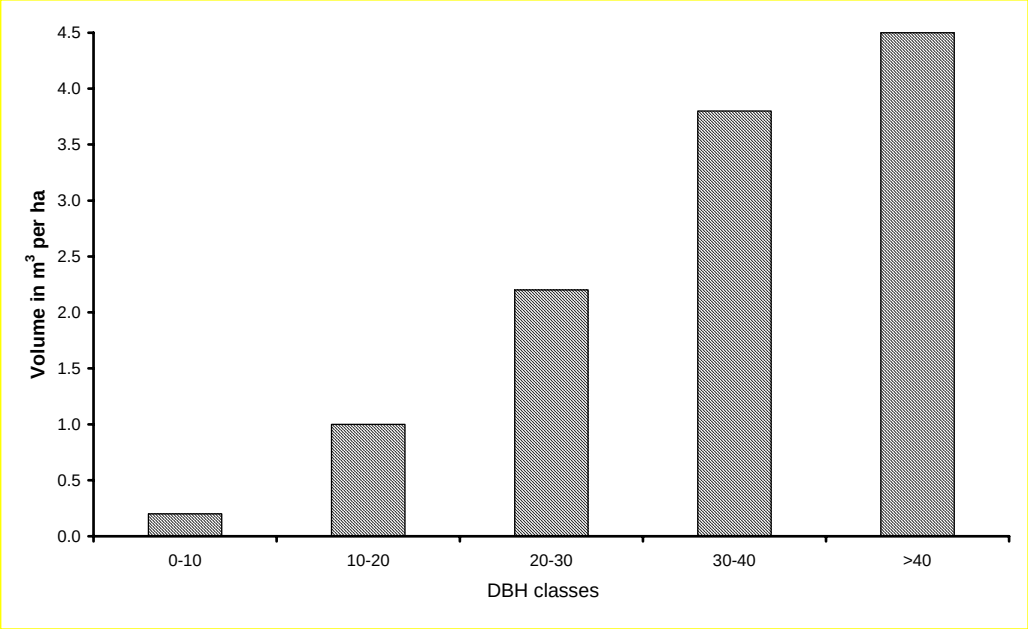


Figure 4. Distribution of volume for *D. melanoxylon.*

**Current end uses of *D. melanoxylon***

**Carvings and trade**

The study noted a consumption of 2-3 *D. melanoxylon* trees per carver per year. The number of carvers in Nachingwea district was estimated to be 60. Makonde carving is probably the best-known artwork in Nachingwea district. The Makonde people produce this art and their material of choice is *D. melanoxylon.* Their work is both traditional and contemporary, reflecting a tribal past as well as modern response to urban life. They utilize their tribal myths and stories as inspiration for the masterful work. One carver, for instance, specializes in ghost spirits and clouds. Animal statues and human and demon-faced ceremonial masks are common. Moore and Hall (1987) estimated that there are about 1,500 carvers in Tanzania and most of them use less than one cubic meter timber annually. The total harvest of *D. melanoxylon* in Tanzania per year is 4,054m$^3$ of which 37% goes to international markets while the remaining 63% is used locally.

**Household utensils**

Wood of *D. melanoxylon* was used to manufacture household utensils such as plates, stools, combs, cups, mortar and *chapati* rolling boards.

**Wood fuel**

It was observed in this study that 22 % of the respondents use *D. melanoxylon* as fuel wood. However, 78% of respondents did not prefer the wood for fuel, giving reasons shown in figure 5. Out of all respondents, 1.8% said *D. melanoxylon* would not be cut without permission from the relevant offices, 37.5% said that they couldn't prefer it for cooking because of soot and smoke the wood produces, 23.2% said that it has high calorific value such that it damages cooking utensils. In addition to that, 30.4% of the respondents said the species was found very far from the village and/or was


Figure 5 Reasons for not using *D. melanoxylon* for fuel

not easily available and 7.1% found it difficult to cut and very heavy to carry from the forest.

A similar study conducted in Lindi by CMP (1999) found that adult women did not prefer *D. melanoxylon* for fuel wood due to its thick stinging smoke. On the other hand, men (whose household responsibilities do not include cooking and firewood collection, unless living as bachelors) prefer wood from the species due to its strong flame.

**Medicine**

It was found in this study that *D. melanoxylon* had medicinal values. The species was used to treat a number of diseases and ailments such as headache, tooth pains, abdominal pains and diarrhoea. The species also treats women who have undergone long period without menstruation period to restore their normal cycle.

Also leaves of *D. melanoxylon* are pounded, mixed with water and given to babies to provide them with strength for growth. The findings are similar to those reported by Mbuya *et al.* (1994), Marshall (1995) and CMP (1999). Mbuya *et al.* (1994) and Marshall (1995) also reported that *D. melanoxylon* is used to treat worms and venereal diseases.

**Construction**

In a small-scale (19.5%), *D. melanoxylon* is used for interior support in house construction because of its resistance to termites and other biological agents. The species is not much preferred in construction because most of its poles are crooked. Respondents further pointed out that the wood requires too much energy to cut, and was found far away from village centres.

## CONCLUSION AND RECOMMENDATIONS

Based on this study it is concluded that the number of stems for *D. melanoxylon* was 20 stems per hectare with the basal area and volume of 1.2 $m^2$ and 8.6 $m^3$ per hectare respectively. The total harvest of *D. melanoxylon* in Tanzania per year is 4054 of which 37% is exported and 63% utilized locally. Traders given licence to harvest *D. melanoxylon* are not supervised as a result, they harvest more than the permitted amount. In addition to that, there is lack of inventory as well as awareness of the value of the species.

It is recommended that licensing of *D. melanoxylon* harvesting be based on estimates of the yield and not existing demand and penalties should be revised from time to time in order to deter illegal harvesting. On top of that, awareness should be created to the communities around the forest resources on the value of the resources as well as being involved in the ownership and resource management and protection. It is further recommended that a national inventory for the species be urgently carried out in order to know the existing stock so as to prescribe a sustainable harvesting regime.

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