

## Harvesting, Trade and Impact of Logging *Pterocarpus Erinaceous* in Bali LGA of Taraba State, Nigeria

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### Abstract

This study investigated the harvesting, trade and impact of logging *Pterocarpus erinaceous* in Bali local government area of Taraba State, Nigeria. Two study sites selected were: Mai-Labari in Garba Chede and Bayan Dutse in Bali town all in Bali LGA. The study was carried out to: identify reasons for the harvest of *Pterocarpus erinaceous* K, examine the environmental effect and impact of logging *Pterocarpus erinaceous* in the study area. Data was generated through research questionnaire, interview, and physical observations of the major sites and key informants who were fully involved in the logging and trading of *Pterocarpus erinaceous*. The findings showed that, the high exploitation of *Pterocarpus erinaceous* K is like a 'rush for gold' because harvesting of the log wood provides employment opportunities to the unemployed youths in the area; environmental effects, illegal logging has been identified as the main driver of degradation and loss of forests in the area. Also high incidence of absconding of bees from their beehives was observed. This was attributed to noise pollution from chainsaw activities and felling of shade and foraging trees. Residual waste left by loggers served as ready fuel for the wild fires during the dry season. Despite the enactment of the act forbidding indiscriminate tree felling in State, harvesting and trading of *Pterocarpus erinaceous* is still ongoing in the interior areas. Finding also showed that, Artificial intelligence has made monitoring illegal activities in the forest easier. With drones, aerial survey and snapshots of hundreds of acres of forests within few hours is feasible.

**Keywords:** Harvesting, Trade, Logging, *Pterocarpus erinaceous*, Bali LGA

### Introduction

There have been several reports from different countries of West Africa highlighting the persistent flow of illegal forest products especially *Pterocarpus erinaceous* from the region (Bosu, 2013). Nigeria leads in the trade of rosewood as from 2011 to date. Despite the existence of forestry regulation and its implementation in the country, there is a rise in the illegal exploitation and large scale trading of the *Pterocarpus erinaceous* in Nigeria.

The recent discovery and exploitation of rosewood (*Pterocarpus erinaceous*) in the sub humid Savanna lands of Taraba state has generated a lot of concern. The high rate of harvesting of forest tree species and the large traffic flow of this wood timber across the State is a source of concern because of its likely consequence on the environment (Bosu, 2013). This has also led to extremely serious harmful consequences for the species of tree in the environment, most especially where it is grown and pressure from increasing human populations.

The logging of rosewood (*Pterocarpus erinaceous*) tree is on the increase daily even though it is a protected species in Taraba State (CITES, 2013). These phenomena have been observed in different countries of West Africa. In the rouse of this development, many countries in the region have adopted and implemented at an early stage, regulatory measures to protect the species (through total bans on harvesting and export, or very strict control of them). Unfortunately, it is clear that these national measures often remained inadequate and failed to address regional and intercontinental drivers of illegal and unsustainable exploitation of the species (Bosu, 2013).

Despite the fact that logging activities in the area are mostly through informal operations, permit and conveyance arrangements, study has not being carry out in Taraba State in order to understand the dynamics in harvesting, logging and trading as well as environmental affects as a result of indiscriminate felling activities. This study attempts to fill this knowledge gap.

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The primary focus is to provide a good understanding of the driving force behind the increase in harvesting, trading of rosewood and the impacts of logging as its affect the environment.

## Materials and Methods

### The Study Area

The study sites were Mai-Labari and Bayan-Dutse all in Bali local government. Mai-Labari is located between latitude  $08^{\circ} 21' 22.4''$  N and longitude  $011^{\circ} 11' 28.2''$  E, about 10 kilometer to eastern part of Garba Chede central area. The site (Mai-Labari) is located on the top of the mountain where human activities like grazing and logging take place. While “Bayan-Dutse” in Hausa, which means “Behind the mountain”, the site is located behind Bali main Mountain which is between latitude  $07^{\circ} 46' 27.3''$  N and longitude  $010^{\circ} 58' 05.2''$  E., about 8 kilometer from Bali central area. Human activities in the area include grazing and logging. Local government area has annual mean temperature of  $27^{\circ}\text{C}$ - $28^{\circ}\text{C}$  with annual maximum and minimum temperatures of  $32$ - $34^{\circ}\text{C}$  and  $22$ - $24^{\circ}\text{C}$  and annual rainfall of  $1000$ - $1200\text{mm}$  (NIPOST, 2009).

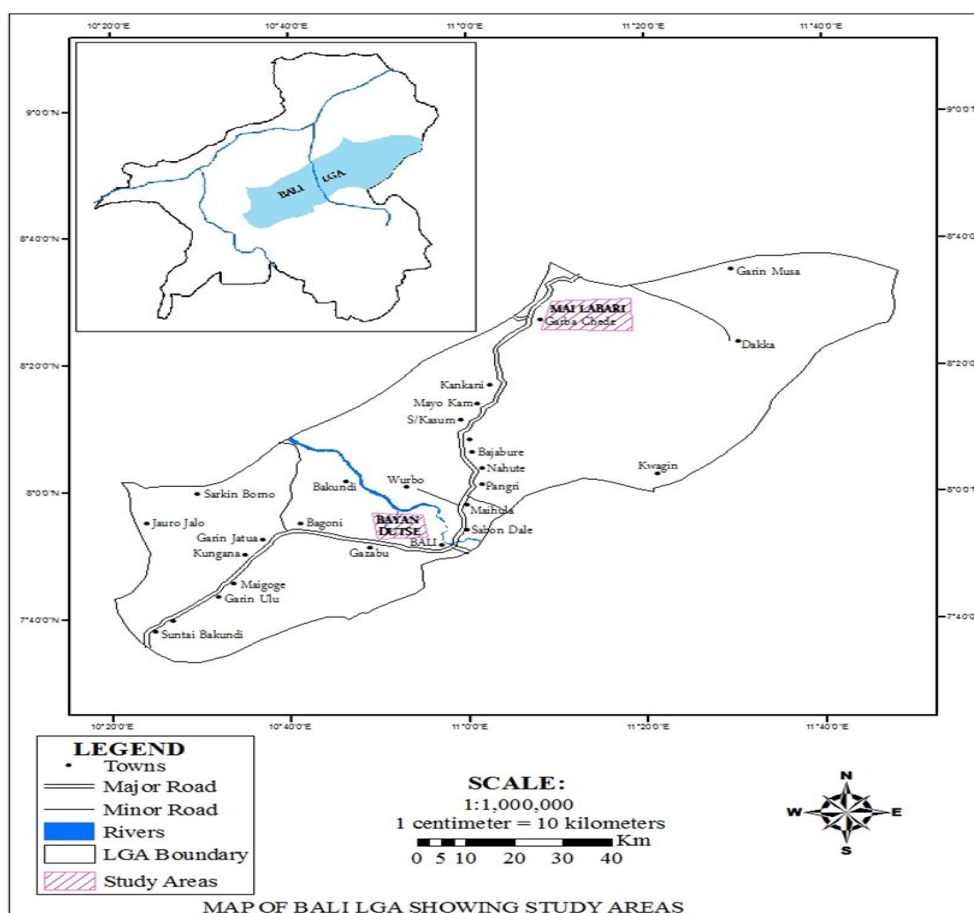


Figure 1: Showing Taraba State including study sites.

### Sampling

Both purposive and random sampling techniques were employed to ensure good spread of the respondents for the study. In the first stage of the sampling procedure two (2) wards namely: Garba-Chede and Bali were selected because of prominence in logging activities. Mailabari and Bayan Dutse out of the two wards were purposively selected for data collection. This is because the wards have abundant forests and logging is ongoing on daily basis (Ahmed, et al., 2016).

Sixty (60) household heads were randomly selected to avoid bias from each of the two (2) rural communities making a total of one hundred and twenty (120) household heads. The survey design was adopted in this study (OECD, 2012).

### Data collection

Data was collected from both primary and secondary sources. The primary data was obtained by the use of structured questionnaire. The research questionnaire was structured to obtain information on the harvesting, trading, environmental effect and impact of logging of *Pterocarpus erinaceus* in the study area.

Discussions and oral interview were held with community members in the areas where these activities are ongoing. Information on chainsaw operations mode and means of transport as well as the transportation routes were gathered from remote surveillance and monitoring and confirmed with discussions with respondents who are directly engaged in the trade.

### Data analysis

Data on respondent's demographic were analyzed using descriptive statistics such as the trend analysis, ratios, percentage, graphical depictions and frequency counts.

## Results and Discussion

### Harvesting of *Pterocarpus erinaceus*: Felling Activities

Result revealed that chainsaws is the main machine used for the harvesting of *Pterocarpus erinaceus*. In some cases, local axe were available just in case the chainsaw failed. The use of such modern machine gave rise to faster felling, hence more tree are being harvested indiscriminately. As a result, fast money is made in the business which empowered individuals to acquired their personal chainsaws and use them without licenses. Some local community members acquire their own chainsaw while others hire it for operation and cutting down of *Pterocarpus erinaceus* for the buyers. Felling activities were randomly carried out at any location of accessibility.

**Table 1: Number of *Pterocarpus erinaceus* trees harvested daily (per individual)**

Number of Tree(s)	Frequency	Percentage (%)
1 – 3 Trees	92	76.7
1 – 4 Trees	28	23.3
1 – 5 Trees	0	0.0
<b>Total</b>	<b>120</b>	<b>100.0</b>

Source: Field Survey, 2019

The results further showed that, an individual cuts down an average of 3 trees stands of *P. erinaceus* daily and this gives an estimates of 15 trees weekly, 60 trees monthly and 720 stand yearly per individual (Table 1). This implies that, the logging activity is at an alarming rate. Most of the *Pterocarpus erinaceus* trees are found on hilltops, which is discovered to be of high quality in terms of market value while low quality trees, were found at the lower ground level. Normal standard cutting is 7ft and a diameter is 80cm (31.49 inch). The trees are cut and rolled down the hill.

### Impact of Logging

On the impact of logging of *Pterocarpus erinaceus*, it was found that about 3 tree stands of *P. erinaceus* is been cut daily by an individual and this gives an estimates of 15 trees weekly, 60 trees monthly and 720 trees yearly. Logging the target using the chainsaw, likely affects many species of trees around it. It was observed that the trees felled on others, breaking their branches, covering their leaves and also hindering them from having direct access to sunlight. At the lower ground level, grasses were seen to be exposed to sunlight intensity leading to loss of nutrients, exposure to erosion through much surface run off and this also can lead to loss of soil microorganisms. The logging activities have also left behind a lot of residual waste because the merchants are only interested in just about 7ft log of wood and this residual waste was observed to serve as ready fuel for the fires during the dry season.



Pic. Remnant of *Pterocarpus erinaceus* on grasses. The pieces and logs seen in the picture are remnant of *P. erinaceus* which is abandoned because is not useful according to dealer's prescription. Source: (Fieldwork Research, 2019).

## Trading

### Cost Determination of *Pterocarpus erinaceus* and Logging

The result in Table 6 revealed that (60.8%) of the respondents collected a sum of ₦350 – ₦400 for loading each log into a trailer, followed by 23.3% at ₦250-300 and the least, 15.8% at cost of ₦450-500. The cost of rolling down a log of *Pterocarpus erinaceus* from the mountain top as revealed by (55.0%) respondents was ₦1650 – 2000, followed by (45%) at ₦1250-1600. While, those that cut down the tree charge ₦350-400 naira per stand (97.5%) compared to those who fell it at the rate of ₦450-500 (2.5%).

**Table 2: Revenue generated for Exploitation of *Pterocarpus erinaceus* (per trailer)**

Type of fees Paid	Amount
Taraba State Government	₦400,000 (USD 1,000)
Bali Local Government Treasury/Council	₦45,000 (USD 112.5)
National Association of Road Transport Owners	₦20,000 (USD 50)
Timber Contractor's Bali Gate	₦20,000 (USD 50)
National Union of Road Transport Workers	₦12,000 (USD 30)
National Youth Council of Nigeria(NYCN)	₦10,000 (USD 25)
Royal Palace (Kaigama Development Levy)	₦5,000 (USD 12.5)
Buyer's License	₦5,000 (USD 12.5)
Depot fee	₦5,000 (USD 12.5)
Timber Contractor's Pass	₦5,000 (USD 12.5)
Soldiers check point	₦4,000 (USD 10)
Haulage	₦3,000 (USD 7.5)
Transporters Tax	₦3,000 (USD 7.5)
Police check point	₦2,000 (USD 5)
<b>Total</b>	<b>₦542,000 (USD 1363.75)</b>

Exchange Rate at 1 USD= N400

Source: Field Survey, 2019

### Revenue Generated and Value of *Pterocarpus erinaceus* Exploitation

Finding on revenue generated from exploitation of *Pterocarpus erinaceus* revealed that, the Taraba State Government and members of the community benefits from the proceeds of the sale of *Pterocarpus erinaceus*. Information at the field from dealers and contractors showed that revenue is generated from *Pterocarpus erinaceus* by Taraba State Government, Bali Local Government, other associations and individuals involved in the business on daily basis on trade of *Pterocarpus erinaceus*.

Apart from the ₦400, 000 (USD 1,000) which is the mandatory revenue given to the state Government per fully loaded trailer of *Pterocarpus erinaceus*, the rest of the revenue gets dissipated in the hands of buyers, chainsaw operators, dumping and loading boys, middle men, front men in the communities, opinion leaders, community leaders and Chiefs, Forestry officers, police and military officers at various check points in the country amounting to ₦542,000 per fully loaded trailer (Table 2). The result does not agree with the findings of Bosu (2013) who reported that the amount of revenue generated from Bole, Northern region of Ghana on the dynamic of harvesting and trade in *Pterocarpus erinaceus* amounted to ₦741,007.17 (GHC 10,000) as Government Revenue per trailer (as against ₦400,000(USD 1,363.75) from Taraba State, Nigeria.

There are many sites where production and loading are taking place simultaneously. These revenues being collected by the Government gives the dealers the legitimate right to carry out logging activities and this explains why logging activities persists despite the existing forest regulations. At each security check point, the police collects ₦2,000 (USD 5), while the soldiers collect ₦4,000 (USD 10); a sum of ₦60,000 (USD 150) is realized by the police and 120,000 (USD 300) by the soldiers daily from the 30 trailers going out of Bali Local Government which is estimated numbers in Mai-Labari with Fifteen (15) trailers and Bayan Dutse Fifteen (15) trailers respectively. Comparatively, the same activities was on in Ghana as reported by Bosu, (2013) as based on figures of number of truckloads of rosewood obtained from key informants and examination of formal revenue records, a conservative estimate \$ 1.6 Million has accrued to both the formal and informal sector.

### Transportation systems, dumping and packing *Pterocarpus erinaceus*

Findings on transportation systems, dumping and packing of *Pterocarpus erinaceus* revealed that several means of transportation employed in moving the logs of *Pterocarpus erinaceus* from their stumpage point in the forest to their dumping areas or collection centres for onward movement to the major trading points in Lagos.



Bali, Garba Chede and Mayo Kam have a central collection centre which is seen as the main market for *Pterocarpus erinaceus*.

Open tipper trucks were used for transporting logs from their stumpage points to the collection centres. An illegal act commonly observed is that the harvested *Pterocarpus erinaceus* logs are often harvested and transported at night in order to evade several forestry check points which is in line with findings of Bosu (2013) who reported that since the activities of logging became rampant, illegal merchants invaded the system, transporting these logs at night.



Transporting and Loading logs of *P. erinaceus* in an open tipper @ Garba Chede, Bali

## Discussion

### Demographic characteristics of respondents

The respondent's sex in this research revealed that logging the wood of *Pterocarpus erinaceus* is mainly done by men or the exercise is carried out by men. A hundred per cent of people involved in logging were men. Men are seen to be the major partakers in the job and business of logging which ranges from cutting down *Pterocarpus erinaceus* in the forest, rolling the logs down the mountain top, transporting the logs from the forest on motorcycles to collection centres, and loading the logs into trailers. The reason is probably due to the nature of the job; it is extremely physical and labour intensive and above all risky. The result agrees with the findings of Manfre and Rubin (2012); they reported that men contribute more to household income than women because their forest activities are income generating whereas women are more involved in subsistence activities. The result also agrees with the findings of ILO(2016) who reported that In the United States, only 6.3% of women worked in male-dominated occupations in 2016 and only 3.2% are involve in logging.

Age between 31-40 years had the highest per cent of 45.8, meaning they are the ones who are actively involved in the business of cutting and selling of *Pterocarpus erinaceus*. The reason may be that youths are agile/active; logging involves much energy, strength and endurance. This result agrees with the findings of David (2016) whose report confirmed that logging business is mostly done by agile youths who should be in school, but by reason of poverty are forced to indulge in this business.

The married were more involved in this business than singles, widowers and divorce. The reason may be linked to responsibility issue; married people are more conscious of the needs of their family therefore more were involved in the logging activities. This result corresponds with the findings of Omolehin *et al.* (2007); they reported that married farmers are more conscious of the need to get better yields so that they could meet their family food needs.

Business men were actively involved in the business even though most of them were farmers, traders, and politicians before now because of the cash flow reaped in *Pterocarpus erinaceus* business most of them decided to divert their business into it. Most of the dealers come from Lagos, Kaduna, Niger, Port Harcourt, Adamawa, Imo, Gombe and Jalingo.

At the field, those whose responsibility is cutting, rolling logs down the mountain top, loading and offloading were mostly those having no formal education, primary education and secondary education, and from observation they embarked on it basically because of the monetary aspect; they have no idea about the effects and dangers of logging and deforestation to the environment. The result agrees with the results of Tindan (2013) who reported on the causes of and impact from deforestation on local level sustainable forest management in a survey of Dwease and Praaso communities in the Ashanti region Ghana. The research findings point out that most of the respondents involved in logging have had some level of formal education, for those with formal education, 76 respondents (69.1%) have attained basic level education and this comprises of primary, middle school and junior high school leavers.

Respondent's ethnicity revealed that the major tribe involved in the logging activities that is cutting, rolling logs down the mountain top, loading and offloading of *Pterocarpus erinaceus* are Jibawa; probably because Jibawas are the majority in the logging business when compared to other tribes; Jibawa are the main indigene of Bali Local Government and they also lay claims to most of these forest areas as nature's gift to their parents of which they are heirs and more over they know the terrain of the forest better than anyone coming into the area. The result agrees with findings of Harper (2006) who says that the most important ethnic groups in the Local Government area are the Jibawa, Ichen and Hausa Fulani.

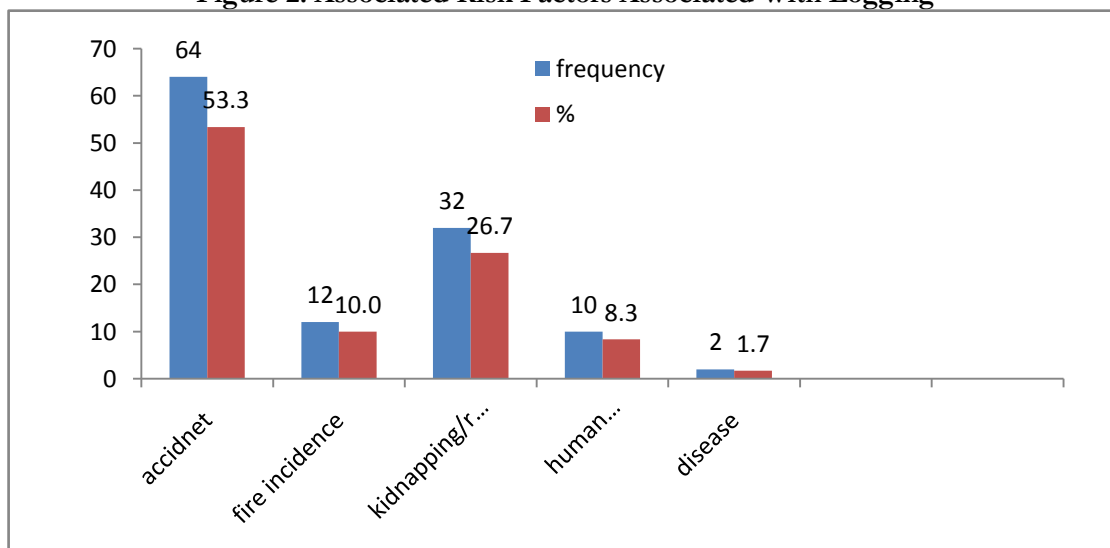
### The effect of logging and trading of *Pterocarpus erinaceus* to the environment

The physical observations from the study area revealed that the major effects of logging *Pterocarpus erinaceus* are as follows: while logging the target tree using the chainsaw, many species of trees like *Khaya senegalensis*, *Parkia clappertoniana*, *Butyrospermum paradoxium* are affected. What was observed was that, the tree do fall on them breaking their branches, covering their leaves from having direct access to sunlight and at the lower ground level, grasses were seen to be exposed to much sun intensity which could lead to loss of nutrients, exposure to erosion through surface run off and this can also lead to loss of soil microorganisms. Considering the practices involved in the activities of logging *P. erinaceus*, the result revealed an uncontrolled felling and destruction of *P. erinaceus* in the area which have adverse effect on plants and animal species.

This study is in line with the findings of Diaz (2006) who reported that logging causes destruction of natural habitat of wild animals, destruction of vegetable species, fruit trees, and trees of medicinal importance as well as the disruption of essential microbial ecosystems. This condition leads to the loss of biodiversity, degrade the soil and it also encourages soil erosion as heavily deforested areas due to logging are left bare at the expense of runoffs during rainfall. This study agrees with the findings of Knox and Marston (1998) who explained that when trees are cut, the forest no longer supports the same wildlife as effectively as it did before and this may place its inhabitants at risk.

The noise from chainsaw activities, felling of shade and foraging trees contributes to scaring the animals away. According to some informants in the study area, where most people are engaged in bee keeping, they have observed a high incidence of absconding of bees from their hives. This was attributed to the noise from chainsaw activities, felling of shade and foraging trees. Some hives have also been destroyed by the impact of falling trees.

Figure 2: Associated Risk Factors Associated With Logging



The results of the study shows that an individual cuts down 3 trees stands of *P. erinaceus* daily and this gives an estimates of 15 trees weekly, 60 trees monthly and 720 stand yearly per individual. The logging activity is at an alarming rate. This result is in line with the findings of FAO (2006) which stated that Nigeria was considered the highest deforested country from 1990 to 2010; Nigeria has lost 55.7% of its primary forest with an average yearly loss rate of 409,700 hectares due to logging.

Logging activities has also left behind a lot of residual waste as the merchants are only interested in 7ft length of the tree considering the fact that very tall tree branch reach heights of 10 meters or even less. This residual waste will serve as ready fuel for bush fire during the dry season. The result is in line with the findings of Hanson (2000) who reported that removal of larger trees was found to be the primary cause of forest fires, logging makes forests susceptible to both fire and disease and relentless clearing of forests left huge areas largely devoid of the cooling shade of trees, replacing moist natural forest microclimates with the hotter, drier conditions characterized by stump fields.

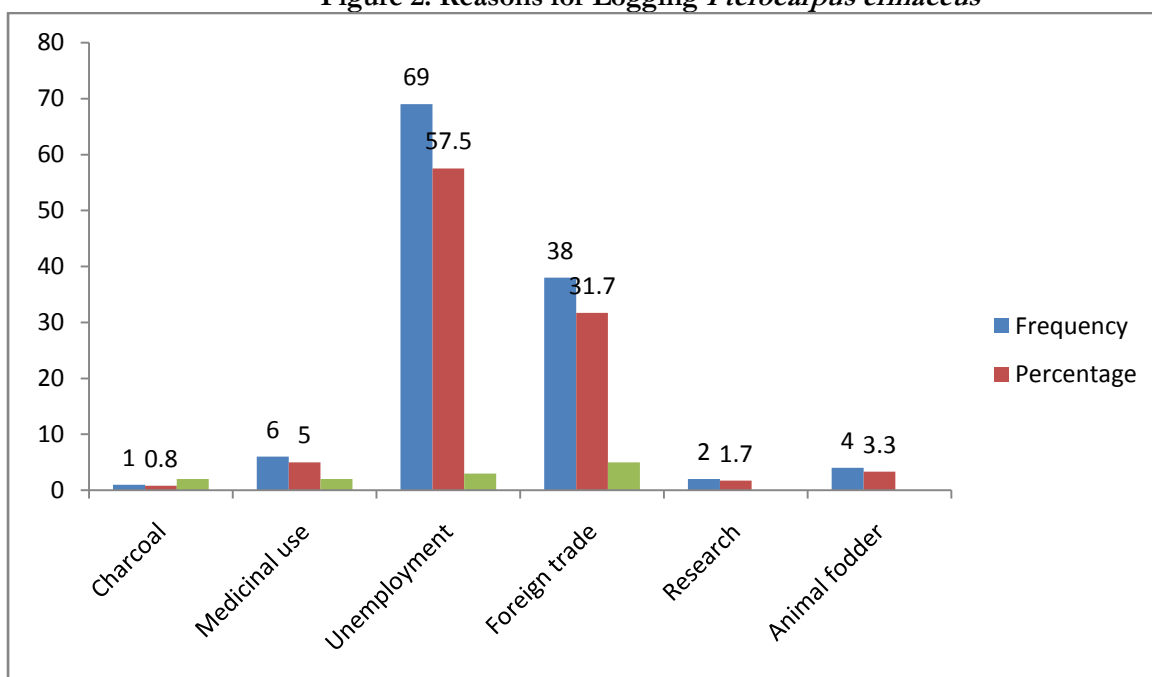
The major dealers are mostly those with tertiary education who have full knowledge of the effects and dangers of logging but yet are involved in the business because of the monetary aspect and profit got there in.

Assessing on why People Engaged in Logging of *Pterocarpus erinaceus*? The findings revealed that unemployment was described as the most significant reason why people engage or venture into logging of *Pterocarpus erinaceus* with 57.5% of respondents attesting to this fact that is a money paying business. Also foreign trade is another factor which must be addressed especially the presence of Chinese company.

Unemployment is a menace because idle youths indulge into indiscriminate felling of trees for money, drugs addictions; politicians used them as thugs during elections and predominant issues of kidnapping, arm robbery and banditry were perpetrated by the youths in their opinions that there is no employment them that is why they looked for fastest and easiest means of livelihood as such the issue of unemployment must be addressed in order to reduce the rate of deforestation. The outcome of the finding is in line with the findings of Adebayo (2010) who said that poor living conditions, unemployment and illiteracy are the causes as well as consequences of environmental degradation. The work also is in line with the findings of Angelson and Kaimowitz (1999) who said logging is the only option available for the livelihood of farmers living in forest areas since it provides employment for them.

Etuonovba (2009) report also is in line with this result. He reported that foreign business trade, that is logging, is one of man’s activities that causes deforestation both in protected and unreserved forest in Nigeria brought about by foreign timber dealers, China pricesly. The work also is in line with the findings of Angelson and Kaimowitz (1999) who says logging is the only option available for the livelihood of farmers living in forest areas, since it provides employment for them. Therefore poverty as a result of unemployment is well considered to be an important underlying cause of deforestation by farmers and naturally people living in forest dense areas are frequently associated with high level of poverty and unemployment (Chomitz, 1999).

**Figure 2: Reasons for Logging *Pterocarpus erinaceus***



## Artificial Intelligence in Forest Management

Managing forests and oversees activities such as timber harvesting and day to day management of protected areas and other duties which include providing advice to forestry companies on forest fires and sustainable harvesting practices are some of the responsibilities of a forestry expert to do only daily basis.

The expert spends a large time out of the office in the forest, determining the type of trees to be planted, perform inspection of forests and assessing inventory for valuation. Even at this point only few works can be done. The rest of the forest survey must be left for future inspections or extrapolated based on a small sample set of data. This is a big worry for experts in this field. The fear is that important details may be missing out in some part of the forest that will cause problems later.

With Artificial Intelligence (AI), activities in the forests are redefining and make works easier and more effective. Today, time spent in the thick of the forests is drastically reduced. Large tracks of Forest can be surveyed from the comfort of the forest expert's office seat. Thanks to the drones. This flying piece of metal/plastic is now able to survey and take pictures of hundreds of acres of forests in a few hours.

Using all the information collected by the drone, one can perform the following analysis:

1. Research into the health of the forest enabling a targeted response
2. Estimate forest cover
3. Monitor illegal activities
4. Rapid response to environmental impact events – e.g. assess fire damage

Applications like this are typical of the new wave of artificial intelligence (AI) in forestry. Forestry companies are now not only focused on increasing their timber holdings but also increasing their quantitative and qualitative (ex. timber stiffness, stem straightness, tree diameter) yield per acre.

Data generated by drones, sensors in the forests and other records produce a wealth of information about the soil, quality of wood and costs of fertilizing the trees. Internet of things technologies and advanced analytics help foresters to analyse real time data like weather, temperature and moisture help foresters to predict likelihood of forest fires. This information can also be used to predict disease hot-spots. Real-time info about current prices and predictions for future prices can help loggers to decide which tree to fell and when.

AI can also play important role in inventory monitoring and control. Models are being developed to increase production forecast accuracy, reduce inventory level and predict customer needs. Reinforcement learning algorithms increase packing efficiency in freights and tankers for exports which reduces transportation costs. All this can lead to reduced prices for customers.

Habib (2018) said AI is not a job stealer, it is a job enabler, but does this mean AI will have an impact on jobs in forestry. Will all foresters be out of a job subsequently? Absolutely not! AI is an enabler not a replacer. It enhances the human ability to process and achieve tasks. AI is designed to augment our own knowledge. We will still need forest experts to perform all of the duties of a forest manager, yet their jobs will be transformed. They will spend less time on the boring and menial tasks of their jobs and will be able to focus on discovering ways of improving business processes.

The advent of AI presents a golden opportunity to reduce costs and increase profits in an industry which is undergoing enormous change as consumption patterns evolve.

## Conclusions

Although, there are benefits such as the provision of employment, poverty alleviation and revenue generation by government, the activities have resulted in the depletion of rosewood species in the early sites and shifts to other parts of the State. This has resulted in loss of biodiversity, animal fodder and important timber resources in the State. The depletion of rosewood and loss of biodiversity have been attributed to the highly syndicated nature of the logging, weak enforcement of the forestry legislation and illegal exports of the rosewood.

## Recommendations

Based on the findings of the study, the following recommendations are proposed:

1. Government in its effort to generating revenue should also consider the conservation of this biodiversity so that the future generation to come can also benefit from the natural resources in the area. Harvesting should be done sustainably
2. Government and the custodians involved in the logging should device a means of regulating the particular size of *Pterocarpus erinaceus* tree to be logged.



3. Chinese companies processing *Pterocarpus erinaceus* wood can be encouraged to establish in Nigeria. This is to promote value addition and job creation locally.
4. State Governments should increase the number of protected areas in their domain in order to protect this highly valued species.
5. Government should empower the youths especially unemployed with job opportunities that will Fetch them money and means of sustaining life.
6. Government should emphasis more on skill acquisition and entrepreneurship that will provide permanent jobs for the unemployed youths who are mostly involved in logging.
7. Application of Artificial Intelligence in forest management should be encourage for easy and effective monitory of large forest area.

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