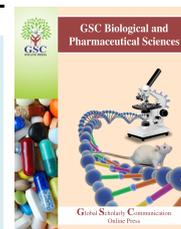


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(RESEARCH ARTICLE)



Evaluation of the uses of *Eucalyptus* species in Makurdi Local Government Area of Benue State, Nigeria

Ekhuemelo David *, Onah Gabriel and Wuam Luther

Department of Forest Production and Products, University of Agriculture Makurdi, Benue State, Nigeria.

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Abstract

The study was aimed at assessing uses of *Eucalyptus* species in Makurdi metropolis, Benue State, Nigeria. Snowball sampling technique was employed to select places where *Eucalyptus* trees were planted in Makurdi. Consequently, five out of these locations were randomly chosen. Target population for this study includes locations where *Eucalyptus* species were planted, Timber Sheds and stakeholders of forestry in Makurdi. Sum of sixty copies of semi structured questionnaire and personal interview were used for data collection. Results of this present study showed that 72% of respondents were male while 28% were female. Three species of *Eucalyptus* such as *Eucalyptus camaldulensis* (75%), *Eucalyptus globulus* (15%) and *Eucalyptus torelliana* (10%) were identified in the study area. The results revealed that *Eucalyptus* species were mostly used for windbreak (28.40%) followed by firewood (26.70%), aesthetics purpose (21.70%), landscaping (16.70%), electric poles (6.70%) and 0% for timber and furniture, respectively. Leave and bark of *Eucalyptus* species were reported to be used for medicinal purposes with *E. camaldulensis* most utilized. It was also observed that the stakeholders of forestry in Makurdi had neither *Eucalyptus* nursery nor plantation. Based on the findings, it is recommended that forestry stakeholders and government should embark sensitization of timber users to initiate *Eucalyptus* plantation to supplement the ever increasing demand of wood and wood products in Makurdi. Also, timber dealers should explore the *Eucalyptus* species for timber purposes and business.

Keywords: Eucalyptus; Forestry stakeholders; Timber; Medicinal; Aesthetic; Landscaping

1. Introduction

There is rapid consumption of wood for construction and furniture in northern Nigeria which is growing day by the day [1]. Constantly increasing population and the corresponding increase in demand for wood and wood based products has heightened wood consumption in Nigeria. As a result of this, the common timber species are getting depleted. Consequently, wood supply is obviously declining and its price becoming increasingly costly. Above all, the rates of growth of the indigenous savanna tree species are generally low and hence cannot meet the ever increasing demand of the people for wood and products [2].

With the help of considerable vegetation by various State forestry establishments across the savanna zones, very low productive forests have since been converted into productive plantation of fast growing exotics such as *Pinus spp.*, *Eucalyptus spp.*, *Tectona grandis*, *Gmelina arborea*, *Acacia spp.*, *Azadirachta indica* etc [1, 3]. The declining availability of the most important economic species in timber market has commenced the exploration of lesser-used species [4]. Oluwadare and Egbewole carried out a study on the quality of *Sterculia setigera* wood species to ascertain its suitability pulp and paper production. This suggests the need to explore wood species other than the native ones with a view to finding an alternative supply [5].

*Corresponding author

E-mail address: davidekhuemelo@gmail.com

It is probing on trend of events that this study seeks to explore the utilization potentials of *Eucalyptus* species, an indigenized exotic species whose drought tolerance and adaptability have made it particularly suitable for the semi-arid regions. *Eucalyptus* species (family-Myrtaceae) are known for rapid growth. Some of the species in their natural habitat attain very large sizes and are among the tallest trees in the world.

Eucalyptus species are local to Australia yet become broadly worldwide as short turn hardwoods for a range of products and as ornamentals. They have been fruitful as exotics due to their ability for fast growth and tolerance of harsh environments involving many effective adaptations which include indeterminate growth, coppicing, lignotubers, fire, soil acidity, low fertility, drought and insect resistance [6]. According to FAO estimates, *Eucalyptus* species are highly valuable and extensively planted hardwood in the world [7]. *Eucalyptus* species are grown mostly as exotic plantation species in tropical and subtropical regions throughout Africa, South America, Asia and Australia and, in more temperate regions of Europe, Australia, South and North America.

Eucalyptus species grows very fast and rotate per five years. About 80% of the total *Eucalyptus* plantation worldwide was occupied by four species and their hybrids from this subgenus namely *E. grandis*, *E. urophylla*, *E. camaldulensis* and *E. globules* [6]. Some authors reported that *Eucalyptus* species were raised in the practice of community forestry so as to meet up with timber supply as a result of rise in demand. However, this situation has changed because of its promising economic benefits to the land users [8-9]. Kebebew reported that growing of *Eucalyptus* species increased the annual income of rural farmers [10]. In addition, *Eucalyptus* species are utilized globally for a large array of product including essential oil, honey, tannin, pulp for high quality paper, lumber, plywood, veneer, solid and engineered flooring, fiber board, wood cement, composite, mine props, poles, firewood, charcoal, wind brakes and landscape mulch as well as for shade. It is also useful for phytoremediation [11-16].

In view of the previously mentioned background, it is thought here that if another wood species that are locally accessible are tapped, they could supplement or even replace with the accessible exhausted rainforest species. That could solve some of the problems of wood shortages that are being experienced currently. Therefore, the aim of this study was to assess the potential uses of *Eucalyptus* species in Makurdi.

2. Material and methods

2.1. Study Area

The study was carried out within Makurdi metropolis, Benue State. Makurdi as the Benue state capital is one of the LGAs in Benue North senatorial District. Makurdi town is located at Latitudes 7° 47' and 10° 00' N and longitudes 6° 25' and 8° 8' E of the equator. It is bounded by Guma LGA to the North, Gwer LGA to the south, Gwer -west LGA to the south-west and Doma LGA of Nasarawa State to the North-west. It is situated in the valley on the bank of River Benue [17].

2.2. Climate and vegetation of Makurdi LGA

The climate of Makurdi town is the tropical wet and dry type, Koppens AW classification, with double maxima [18]. The rainy season lasts from April to October with 5 months of dry season (November to march). Annual rainfall in Makurdi town is constantly high with an average annual total of approximately 1173 mm [19]. Temperature in Makurdi is however, generally high in the year with February and March as the hottest months. The highest and lowest mean monthly temperatures of 31 °C and 26 °C occurred in March/April and December [20].

The vegetation of Makurdi is guinea savanna type which has been adversely affected by human activities leading to the clear-cutting of trees cover in many parts of the town. This artificial vegetation has replaced the natural secondary vegetation [21].

2.3. Population and economic activities of Makurdi people

Makurdi town is inherited by many tribes with a population of 297, 398 to 157, 295 males and 140, 103 females [22]. These tribes include the Tivs, Igedes, Idomas, Etilos, Jukuns, Housas, Yorubas, Ibos and others. The Tivs are the dominant tribe. Makurdi town is made up people largely engaged in civil service, commercial activities and agrarian peasantry. The town is a built up area with highest concentration of people in High level, Wadata and Northbank. Dense population also exists in some low-lying parts of the town such as Wurukum.

2.4. Experimental design

Three main target groups which include locations where *Eucalyptus* species are planted, Timber Sheds and Stakeholders of Forestry in Makurdi were used for this study as shown in Table 1. Snowball sampling technique was employed to select places where *Eucalyptus* trees are planted in Makurdi. Five out the *Eucalyptus* trees sites were randomly selected. Secondly, four main Timber Sheds were purposively chosen. These timber sheds are shown in Table 1.

2.5. Data collection technique

A total of sixty copies of semi structured questionnaire were administered to the chosen target groups in the study area. The questionnaires were administered as showed in table 1. In each of the five *Eucalyptus* plantation locations selected, two copies of questionnaire were purposely administered to owners and residents of the sites, giving a total of ten questionnaires. In each office of the six Forestry stakeholders, five copies were purposively allocated to Senior Officers. While five copies each were randomly administered to Timber Traders in the four Timber Sheds sampled for the study. These summed up to 20 copies of questionnaire for the Timber Sheds. Personal interview was also used to sample information on *Eucalyptus* species found in the study area.

Table 1 Administration of semi structural questionnaire to target groups

Sr. No.	Target Groups	Selected units of target group	Sampled number	No. of questionnaire per Location	Total No. of Questionnaire
1	Forestry Stakeholders in Makurdi	Federal University of Agriculture Makurdi Federal Ministry of environment Makurdi Federal Department of Forestry Makurdi State Ministry of environment Makurdi State Department of Forestry, Makurdi Forestry Association of Nigeria, Makurdi	6	5	30
2	Eucalyptus location plantation in Makurdi	Tilley Gardo secondary School, Northbank Nigerian Union of Journalist (NUJ), Naka Road Padopas Harmony Secondary School, High level Lower Benue Federal Housing Estate, Northbank	5	2	10
3	Timber Sheds in Makurdi	Old bridge Timber Shed, North bank New bridge Timber Shed Wurukum Industrial Layout Timber Shed Naka Road SRS junction Timber Shed (SRSJTS)	4	5	20
Total	3	15	15	60	60

2.6. Data analysis

Descriptive statistics such as percentage, bar chart and pie chart were used to analyze collected data.

3. Results

Data on demographic characteristics of respondents are presented in table 2. The result shows that 72% of respondents were male while 28% were female. Most (35%) of the respondents were within the ages of 30-39 years while 66.06% were married with 33% of them involved timber trade as the occupation. The higher number of respondents was in civil service (55%) and had tertiary education.

Table 2 Demographic characteristics of respondents

Variables	Frequency	Percentage (%)
Sex		
Male	43	71.66
Female	17	28.30
Total	60	100.0
Age		
20-29	18	30.00
30-39	21	35.00
40-49	16	26.00
50 and above	5	8.33
Total	60	100.0
Marital Status		
Single	18	30.00
Married	40	66.06
Divorced	2	3.33
Widow	0	0.00
Total	60	100.0
Occupation		
Civil service	33	55.00
Student	4	6.66
Timber Trading	20	33.33
Trading	1	1.66
Farming	2	3.33
Total	60	100.0
Education		
Informal	3	5.00
Primary	9	15.00
Secondary	15	25.00
Tertiary	33	55.00
Total	60	100.0

Table 3, shows identified *Eucalyptus* species in Makurdi. This study revealed that *E. camaldulensis* (75%) was mostly common followed by *E. globulus* (15%) and the least was *E. torreliana* (10%).

Table 3 *Eucalyptus* species found in Makurdi

Sr. No.	Scientific name	Common Name	Frequency	Percentage (%)
1	<i>E. camaldulensis</i>	Red gum/River Gum	45	75
2	<i>E. globulus</i>	Blue Gum	9	15
3	<i>E. Torreliana</i>	Cadagi Gum	6	10
	Total		60	100

Table 4, indicates the uses of *Eucalyptus* species in Makurdi. It was observed that the highest (28%) use of *Eucalyptus* species grown in Makurdi was for the purpose of windbreak. This was closely followed by firewood (26.70%). Aesthetics uses of *Eucalyptus* species was 21.70%. While its use for landscaping and electric poles purposes were 16.70% and 6.70%, respectively. There was no record of *Eucalyptus* species use for timber, furniture/carpentry, plywood and particle board in Makurdi.

Table 4 Uses of *Eucalyptus* species in Makurdi

Sr. No.	Uses	Frequency	Percentage (%)
1	Timber	0	0.00
2	Fire wood	16	26.70
3	Furniture/carpentry	0	0.00
4	Plywood/particle board	0	0.00
5	Electric poles	4	6.70
6	Landscaping	10	16.70
7	Aesthetics purpose	13	21.70
8	Windbreak	17	28.30
	Total	60	100.0

3.1. Uses of *Eucalyptus* species on health matters in Makurdi

Table 5, indicates traditional uses of *Eucalyptus* species by respondents for medicinal purpose in Makurdi. From the result, 37% respondents used *E. camaldulensis* leaves for the treatment of typhoid fever, 27% used it for treatment of malaria fever and stomach upset, while 25% used it for cough suppression. Also, 13% and 10% used the leaves for ulcer and muscle/joint pains reliever, respectively. *E. camaldulensis* leaves and bark were noted for the treatment of fungi infection (22%), blood sugar control (7%) and treatment of skin diseases (5%). Whereas 15% respondents used *E. torrelliana* leaves for wound treatment, 28% and 8% used *E. globulus* leaves for cold reliever and treatment of respiratory ailment, respectively.

Table 5 Traditional uses of *Eucalyptus* species for medicinal purpose

Sr. No.	Species	Part Used	Uses	Frequency	Percentage (%)
1	<i>E. camaldulensis</i>	Leaves	Use for the treatment of typhoid fever	22	37
		Leaves	Treatment of malaria fever	16	27
		Leaves/bark	For the treatment of skin disease	3	5
		Leaves	Cough suppression	15	25
		Leaves	Treatment of stomach upset	16	27
		Leaves	Muscle/joint pain reliever	6	10
		Leaves/bark	Treatment of fungi infection	13	22
		Leaves/bark	Blood sugar control	4	7
		Oil	Hair nourishment	7	12
		Leaves	Treatment of ulcer	8	13
2	<i>E. torrelliana</i>	Leaves	Wound treatment	9	15
3	<i>E. globulus</i>	Leaves	As cold reliever	17	28
		leaves	Treatment of respiratory ailment	5	8
Total				60	100

3.2. Presence of *Eucalyptus* plantation and nursery in Makurdi

Results on establishment of *Eucalyptus* nursery/plantation in Makurdi is presented in table 6. From the result, 100% of the respondents did not have *Eucalyptus* nursery and plantation.

Table 6 Establishment of *Eucalyptus* nursery/plantation in Makurdi

Sr. No.	Sampled Areas	<i>Eucalyptus</i> Nursery/Plantation			
		Yes		No	
		Frequency	Percentage (%)	Frequency	Percentage (%)
1	Forestry Association of Nigeria, Makurdi	0	0	5	8.30
2	Federal Ministry of Environment, Makurdi	0	0	5	8.30
3	Federal Department of Forestry, Makurdi	0	0	5	8.30
4	Location <i>Eucalyptus</i> were grown	0	0	10	16.70
5	State Ministry of Environment, Makurdi	0	0	5	8.30
6	State Department of Forestry, Makurdi	0	0	5	8.30
7	Timber Shades	0	0	20	33.30
8	Federal University of Agriculture Makurdi	0	0	5	8.30
Total				60	100.0

3.3. Locations where *Eucalyptus* species were grown in Makurdi

The information presented in Table 7, shows the three species of *Eucalyptus* and various locations where they are grown in Makurdi and the reasons why they were grown. In lower Benue, *E. camaldulensis* were grown for windbreak, aesthetic purpose and landscaping. In Federal University of Agriculture, Makurdi, it was reportedly grown for shade, aesthetic purpose and landscaping. Nigerian Union of Journalist (NUJ) environs raised the species for aesthetic purpose, windbreak and landscaping. Whereas, in Federal Housing at North Bank, Makurdi, *E. camaldulensis* were said to be grown for aesthetic purpose and shade. In Tilley Gado College, *E. camaldulensis* were grown mainly for shades, aesthetic purpose and landscaping.

Table 7 Locations where *Eucalyptus* species are grown in Makurdi

Sr. No.	<i>Eucalyptus</i> species	Location grown	Reasons for grown
1	<i>E. camaldulensis</i>	Lower Benue	Windbreak, aesthetic purpose, landscaping
		University of Agriculture	Shades, aesthetic purpose, landscaping
		Nigeria Union of Journalist	Aesthetic purpose, windbreak, landscaping
		Federal Housing, North Bank	Aesthetic purpose and shade
		Tilley Gado College, North Bank	Shade, aesthetic purpose, landscaping
2	<i>E. globulus</i>	Federal University of Agriculture	Shade, landscaping and aesthetic purpose
3	<i>E. torelliana</i>	Federal University of Agriculture	Shade, aesthetic purpose and landscaping

Figure 1, shows interest of respondents in massive plantation establishment of *Eucalyptus* species in Makurdi. According to result, 24% of Stakeholders supported massive plantation of *Eucalyptus* species, 11% Timber Shed owners advocated for massive growth while 6% from different places where *Eucalyptus* species were grown also supported the massive plantation of *Eucalyptus* species in Makurdi. Figure 2, shows *Eucalyptus* stands planted for

beautification in Federal University of Agriculture Makurdi. The species were grown for landscaping, shade and aesthetic purposes.

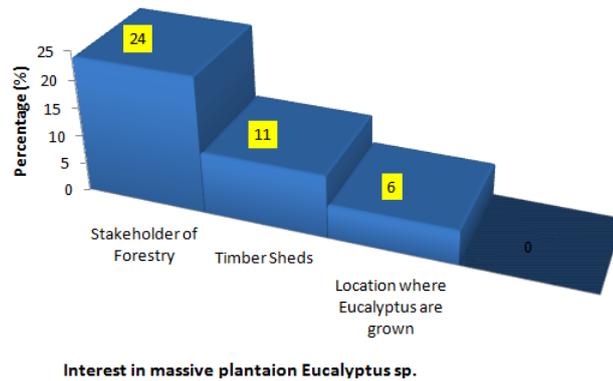


Figure 1 Percentage interest in massive plantation of *Eucalyptus* species in Makurdi



Figure 2 (A) *E. torelliana* in South Core, FUAM, (B) *E. camaldulensis* in South Core, FUAM, (C) *E. globulus* in South Core, FUAM

4. Discussion

In this study, the number of male respondents surpassed their female counterparts. The low number of female respondents may be because forestry and wood business require physical strength found more in men than women. This finding is similar to Rongo and Leon and Ekhuemelo et al., who reported that males are dominant in wood working processes [23-24].

The study revealed that *E. camaldulensis*, *E. globulus* and *E. torrelliana* were found in Makurdi with *E. camaldulensis* as the most dominate of the three. This may be because it is the fastest growing and tolerable species among the three species. This confirm the findings of Rockwood et al. who stated that that *E. camaldulensis* was successful as exotics because of their capacity for fast growth and tolerance of harsh environments involving many effective adaptations which include indeterminate growth, coppicing, lignotubers, , fire, tolerance of soil acidity and low fertility, drought and insect resistance [6].

The study further revealed that *Eucalyptus* species within Makurdi were used mainly for windbreak firewood, aesthetics purpose and electric poles. There respondents were not aware that they can be used for timber purposes. This finding is at variance with Babatola and Abubarkar, who reported that *Eucalyptus* species were grown extensively worldwide as short rotation hardwoods for a variety of products and as ornamentals [1]. The rate of wood consumption for construction and for furniture in northern Nigeria is growing by the day. As a result *Eucalyptus* species should be massively grown in Makurdi to meet the ever increasing demands for wood for construction purposes. It was reported that *Eucalyptus* species under community forestry was to meet timber supply due to rise in the demand of wood [8-9]. *Eucalyptus* species are utilized globally for a large array of product including essential oil, honey, tannin, pulp for high quality paper, lumber, plywood, veneer, solid and engineered flooring, fiber board, wood

cement, composite, mine props, poles, firewood, charcoal, wind brakes and landscape mulch as well as for shade. It is also useful for phytoremediation [11-16].

Babatola and Abubarkar reported that large density values recorded from their research on density and bending strength characteristics of north western Nigerian grown *E. camaldulensis* in relation to utilization as timber placed the wood at an elevated position of suitability in the wood to compete favorably with some commercially available timber species in Nigeria [1]. They further asserted that the bending strength and modulus of elasticity values compared favorably and even superior to some of the species currently used in Nigeria.

Eucalyptus has been used traditionally for medications and has been used for the treatment of diseases for a very long time [25]. The findings this study reveals that *Eucalyptus* species were used for the treatment of several diseases such as typhoid fever, ulcer, malarial fever cough, stomach upset, blood sugar skin infection in the study area. This result supports the finding of Adeniyi et al. who reported that essential oils of the leaves of *E. camaldulensis* were used in the treatment of lung diseases, while the volatile oils were used as expectorants [26]. Ointments from *Eucalyptus* oil have been reportedly used in customary indigenous medicines to treat injuries and fungal diseases. *Eucalyptus* oil obtained by steam distillation and rectification of the fresh leaves has Eucalyptol (1, 8-cineole) as its active ingredient and this is responsible for its various pharmacological actions [27]. The antimicrobial activities of the methanolic extracts of *E. camaldulensis* have also been reported [28]. The emergence of bacterial resistance to the currently available antimicrobial drugs necessitates further research in the discovery of new safe and effective antibacterial agents [29]. EMA reported that *Eucalyptus* leaves of *E. globulus* were often marketed as a combination with other herbal substances/preparations for the treatment of cough associated with cold [30].

The study further reveals that there was no *Eucalyptus* nursery and plantation in Makurdi except for beautification. This result is at variance with findings of Jacobs who reported that, *Eucalyptus* has been extensively planted in Australia, Asia, South America, and Africa, with plantations established in the U.S. starting in the mid-1800s [31]. The result is also at variance with Rockwood et al. who claimed that *Eucalyptus* species was grown extensively worldwide as short rotation hardwoods for a variety of products and as ornamentals [6]. Rockwood et al. further asserted that *Eucalyptus* species have been flourishing as exotics because of their capacity for fast growth and tolerance of harsh environments involving many effective adaptations [6]. Most respondents advocated support for massive establishment of *Eucalyptus* species in the area may be as a result of the enlightenment they got in exposure to this study.

5. Conclusion

This study revealed three species of *Eucalyptus* species such as *E. camaldulensis*, *E. globulus* and *E. torelliana* found in Makurdi. *Eucalyptus* species found within Makurdi were used for firewood, landscaping, aesthetic and windbreak purposes, while the bark, leaves, oil from seeds and the root were used for medically for treatment of typhoid fever, malarial fever, skin infection, cough, stomach upset, fungi infection, blood sugar, hair nourishment, ulcer, wound, cold and respiratory ailment. *Eucalyptus* wood was no sold as timber in any Timber Sheds or any parts of Makurdi and also, no *Eucalyptus* plantations or nursery was established in Makurdi for commercial purposes for timber production because dearth of information on the species. Finally, the level of awareness on the uses of *Eucalyptus* was very low. Based on the findings of the study, we recommend that Forestry Stakeholders and government should embark on sensitization of timber users. This would help to initiate *Eucalyptus* plantation establishment to supplement the ever increasing demand of wood and wood products in Makurdi. Timber dealers should explore the *Eucalyptus* species for timber purposes and business.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest.

References

- [1] Babatola O and Abubarkar M. (2011). Density and bending strength characteristics of North Western Nigerian grown *E. camaldulensis* in relation to utilization as timber. *Research Journal of Forestry*, 5, 107-114.
- [2] Otegbeye GO. (2004). Drought and desertification: Challenges for afforestation in Nigerian arid and semi-arid regions. *Savanna*, 19, 1-11.
- [3] Momodu AB, Otegbeye GO and Igbuanugo AB. (1997). The priority multipurpose tree species (MPTS) of the arid and semi arid areas of Nigeria: Identification, distribution and ethnobotanic values. Seminar paper delivered at the Forestry Research Institute of Nigeria Conference Hall, Ibadan, on June.
- [4] Oluwafemi OA and Adegbeniga SO. (2007). Preliminary report on utilization potential of *Gliricidia sepium* (Jacq.) steud for timber. *Research Journal of Forestry*, 1, 80-85.
- [5] Oluwadare AO and Egbewole ZT. (2008). Wood quality studies in plantation-grown *sterculia (Sterculia setigera Del.)* in the Guinea Savanna, Nigeria. *Research Journal of Forestry*, 2, 22-33.
- [6] Rockwood DL, Rudie AW, Ralph SA, Zhu JY and Winandy JE. (2008). Energy product options for *Eucalyptus* species grown as short rotation woody crops. *International Journal of Molecular Science*, 9, 1361-1378.
- [7] FAO (2005). Global forestry resource, assessment. 2005 main reports, FAO forestry paper.
- [8] Meknonnen A. (2000). Variation of community forestry in Ethiopia: A contingent valuation study of rural households. *Environment and Development Economics*, 5, 289-308.
- [9] Liu H and Li J. (2010). The study of ecological problems of *Eucalyptus* plantation and sustainable development in the Maoming Xiaoliang. *Journal of sustainable Development*, 3, 1997-2001.
- [10] Kebebew Z. (2010). *Eucalyptus* in rural livelihood safety net strategy in coffee growing area: Case study around Jimma, South Western Ethiopia. *Research Journal of Forestry*, 42, 202-207.
- [11] Tournier V, Grat S, Marque C, El-Kayal W and Penchel R. (2003). An efficient procedure to stably introduce genes into an economically important pulp tree (*Eucalyptus grandis* x *Eucalyptus urophylla*). *Transgenic Research*, 12, 403-411.
- [12] Gorrini B, Poblete H, Hernandez G and Dunn, F. (2004). Particle board and MDF using *Eucalyptus nitens*: Industrial scale experiments. *Bosque*, 25, 89-97.
- [13] Krzysik AM, Muehl JH, Youngquist JA and Franca FS. (2000). Medium density fiberboard made from *Eucalyptus saligna*. *Forest Products Journal*, 51, 47-50.
- [14] Foley, W. J. and Lassak, E. V. (2004). The potential of bioactive constituents of *Eucalyptus* foliage as non-wood products from plantations. Rural Industries Research and Development Corporation, Australia.
- [15] Coutts RSP. (2005). A review of Australian research into natural fibre cement composites. *Cement Concrete Composites*, 27, 518-526.
- [16] Barton A. (2007). Industrial uses of *Eucalyptus* oil white paper. (www.oilmallee.com.au/docs/BARTON.doc).
- [17] Gyang EO. (1997). Students information handbook (1996-1998). University of Agriculture, Makurdi, 1-3.
- [18] Ayoade JO. (1983). Introduction to climatology for the tropics. Chichester: John Wiley and Sons.
- [19] Abah RC. (2012). Causes of seasonal flooding in flood plains: a case of Makurdi, Northern Nigeria. *International Journal of Environmental Studies*, 69(6), 904-912.
- [20] Tyubee BT. (2010). An assessment of vulnerability to climate change risks in Makurdi, Nigeria. ACCFP Final Technical Report.
- [21] Ologunorisa ET and Tor T. (2002). The changing rainfall pattern and its implication for flood frequency in Makurdi, Northern Nigeria. *Journal of Applied Science Environmental Management*, 10 (3), 97 – 102.
- [22] FGN (2007). Details of the breakdown of the national and state provisional population totals of 2006 census. Federal Government of Nigeria Official Gazette, 94(24), 175-198.
- [23] Rongo LMB, and Leon B. (2005). Qualitative method for assessing dust exposure in small-scale wood industries in the informal sector. *East African Journal of Public Health*, 2(1), 32-38.

- [24] Ekhuemelo DO, Iorpenda MA and Tembe ET. (2017). Analysis of wood- based enterprise in Gboko local government area of Benue State, Nigeria. *Asian Research Journal of Agriculture*, 4(1), 1-10.
 - [25] Jaswant R, Pankaj G and Bipin KA. (2015). Approach of *Eucalyptus globulus* plant parts for human health safety and toxicological aspects. *British Open Journal of Plant Science* 1(1), 1-10.
 - [26] Adeniyi BA, Lawal TO and Olaleye SB. (2006). Antimicrobial and gastroprotective activities of *E. camaldulensis* (Myrtaceae) crude extracts. *Journal of Biological Sciences*, 6(6), 1141-1145.
 - [27] Trivedi NA and Hotchandani SC. (2004). A study of the antimicrobial activity of the oil of *Eucalyptus*. *Indian Journal of Pharmacology*, 36, 93-94.
 - [28] Akin-Osanaiye BC, Agbaji AS and Dakare MA. (2007). Antimicrobial activity of oils and extracts of *Cymbopogon citrates*, *Eucalyptus citriodora* and *Eucalyptus camaldulensis*. *Journal of Medical Sciences*, 7(4), 694-697.
 - [29] Lokhande PD, Gawai KR, Kodam KM, Kuchekar BS, Chabukswar AR and Jagdale SC. (2007). Antibacterial activity of isolated constituents and extract of roots of *Inula racemosa*. *Resource Journal of Medical Plant*, 1(1), 7-12.
 - [30] Europeans Medicines Agency (EMA) (2012). Assessment report on *Eucalyptus globulus* Labill., folium. EMA/HMPC/892615/2011 Committee on Herbal Medicinal Products (HMPC), 16d (1).
 - [31] Jacobs MR. (1979). *Eucalypts for Planting*; FAO Forestry Series No. 11; Food and Agriculture Organization of the United Nations: Rome, Italy, p. 677.
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