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## **The Impact of Urbanization on the Vegetation of Yaounde, (Cameroon)**

**Dr. Clement Anguh Nkwemoh**

Senior Lecturer, Department of Geography, University of Yaounde, Cameroon

**Mesmin Tchindjang**

Associate Professor, Department of Geography, University of Yaounde, Cameroon

**Dr. Roland Ngwatung Afungang**

Natural Hazard Researcher, University of Porto, Portugal

### **Abstract:**

*The Yaounde agglomeration epitomizes the rapidly expanding settlements at the pinnacle of the tropical evergreen forest of Central Africa. The repercussions of this rapid expansion have resulted in untold environmental stresses and other problems to City dwellers and Managers. This study stood to canvass the particular impact of urban expansion on the vegetation cover in a bid to contribute to solutions that would enhance a lucid/sound urban environmental system.*

*The research methodology that has been adapted to establish this article combines both classical and empirical approaches. These entailed the use of topographical maps, Aerial Figuregraphs and Satellite images. Other information was canvassed by way of questionnaires, interviews and Focus Group Discussions.*

*The results reveal that there has been a rapid expansion in settlement types in the Yaounde Metropolis and as sprawl develops, there has been an increased depletion of the flora of the area. The results also reveal that the degradation of forest vegetation is due to the need of materials for the construction of homes, the use of fuel wood or charcoal, wood works as well as the quest of space for urban agriculture amongst an array of other forcings.*

*The measures that have been proposed are those that are ecologically sound, socially just, adaptable and flexible and even economically viable. They include the elaboration of urban forestry/fuel wood plantation and agroforestry with reference to home gardens, rotational/intercropping and alley/strip cropping. All of these would be integrated in the urban planning system in an effort towards achieving a sustainable or Bio/ Eco-city.*

**Keywords:** *Urbanization, population growth, deforestation, fuelwood, charcoal, Woodwork, urban forestry*

### **1. Introduction**

An urban ecological system is said to be in resilience if it has the capacity or ability to absorb a certain amount of disturbance without either a change or rupture in its structure and composition. This is its ability to resist damage or degradation and to recover quickly from stochastic disturbances such as urban floods, pollution and other anthropic disturbances. The urban ecosystem and the biotic components; (plants, fauna and man) and abiotic components, (soil, water, geology and air) suffer from degradation as man struggles to enhance urban development. These ecosystem components are thus subject to stress as man struggle to look for more space for settlement, material for the construction of houses and for the cultivation of food. These stressors are aspects of the urban environment that when exacerbated, can in turn affect the living conditions for man, plants, and animals in the city. The issues on urbanization and the implication on environment has been vied variously by Gleave (1992a) (1992b) (2001), Goudie, (1986) Letouzey (1968) Martin, (1985), Bopda, A. (1985), Nkwemoh (2011)

The main problem of this study centers on the precarious situation of the vegetation of the area due to the rapid population growth in the city. The objective of this article is thus to analyze urban development which has led to the disappearance of vegetal cover and the urban Green Belts

### **2. Empirical Realities of the Area**

Yaounde (Figure 1) is part of the western sector of the Southern Cameroon Plateau. The area is characterized by gentle rolling chains of hills, and numerous valleys and wetlands. This varied physical landscape permits a combination of streams, hydromorphic soils and a great variety of plants and Fauna.

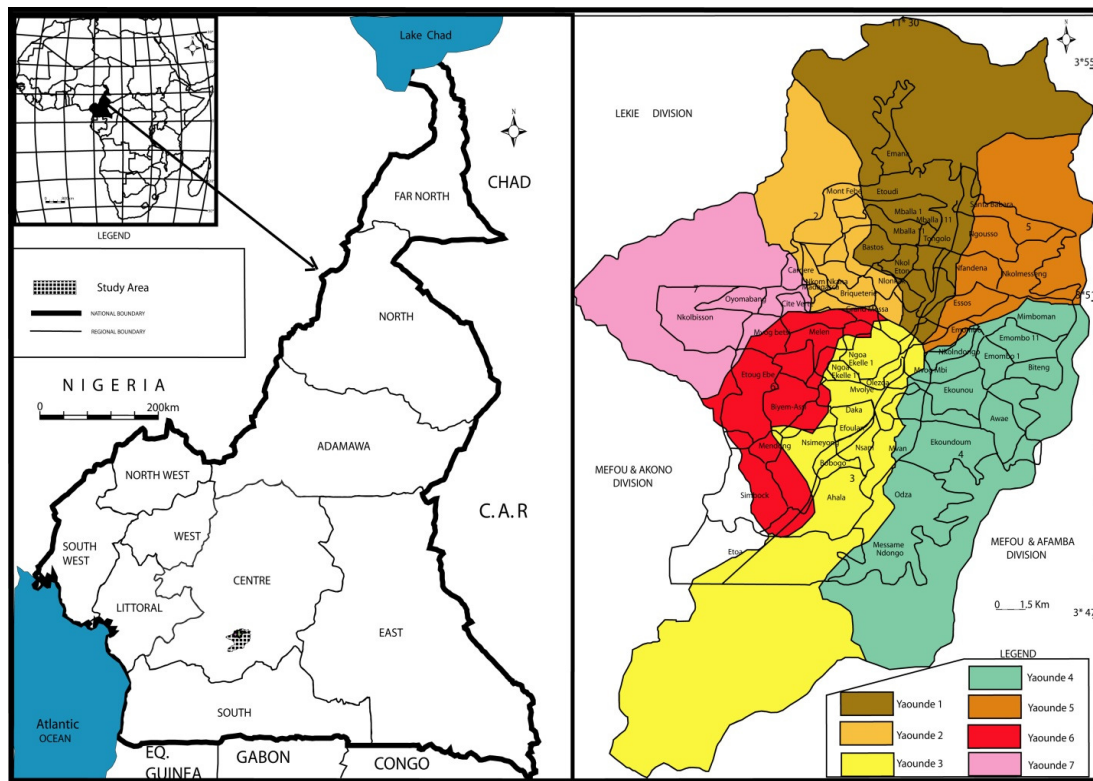


Figure 1: Location of Yaounde

This area is found in the heart of the Equatorial evergreen forest where forest vegetation is supposed to cover every square meter of the domain. The area is also in a tropical domain where the sun is constantly overhead and with high atmospheric humidity.

Just like many Bantu countries in Africa, the aborigines of Yaounde were Pygmies. These Pygmies were pushed out by the invading Ewondo. Similar to the Fang (Beti, Bulu, and Fang) where they constitute a major part, the Ewondo came from Northern Sanaga to seek refuge in the hills of the South. They were escaping from the Foulbe in the North who constituted their main threat of the Century. They formed the Mvog who are found distributed on the hills that constitute the present Yaounde town. Yaounde, was founded in 1888 by the German Colonial Administration. It became the capital of the French territory under the League of Nations in 1922. During the 2<sup>nd</sup> World War, it was temporarily shifted as the capital of the former East Cameroon Province. With the independence of the Country in 1960, the city has remained the political capital. The Yaounde metropolis plays double administrative roles. It is currently the Regional and National capital.

Yaounde is the Political Capital of both the Centre Region and Cameroon and has a population of over 1.800.000 (BUCREP, 2010)

### 3. Materials and Methods

The methodology that has been adapted entailed deductive and inductive approaches. Data was collected from secondary sources via main Libraries of the University of Yaounde, the World Bank, the Ministries of Environment, Forest and Fauna and the Yaounde Urban Councils. Topographic sheets of Yaounde 3b, 3d and 4c (Oveng, Nkolbisson etc.) at the scales 1:50.000), Aerial Figures and Landsat and Spot satellite images (LANDSAT 1988, Spot 2002 and Google earth 2008) have been utilized for location and mapping of specific sites. We collected numerical census data (1933, 1957, 1976, 1987) and estimate projection of population of Yaounde in 1990, 2000 and 2010 that we computed using EXCEL.

Field observation was enhanced by the use of 350 questionnaires to households. The 7 districts of the metropolis permitted the administration of 50 questionnaires to randomly selected households. The cartographic part of this work was realized by the use of computer assisted drawing and GIS programs such as Adobe Illustrator 9.0 and MapInfo 7.5 softwares. A simple evolution rate has been made with this equation:  $P2 - P1 / P1 \times 100$  Data analyses were realized by the use of the S.P.S.S (Statistical Package for Social Science).

The cartographic part of this work was realized by the use of Computer Assisted Drawing and GIS programs such as Adobe Illustrator and ArcGIS and Quantum GIS. Data analyses were then realized by the use of the S.P.S.S (Statistical Package for Social Science) and EXCEL. Data on the Findings of the research has been presented in the form of tables, figures, Graphs and synoptic charts

### 4. Results and Analyses

The continuous increase in the population has brought about an increase in the need for space for settlement. The expansion of the city is clearly reflected by the growing extension of houses in the outskirts of the city. The remnants of forest around these areas are also being rapidly destroyed.

4.1. A Rapid Rate of Population Increase

	Year	Population
1	1933	7000
2	1957	58099
3	1963	100000
4	1976	313000
5	1987	649252
6	2000*	1538192
7	2010	1.800.000

Table 1: BUCREP, 2010 and \*Estimates

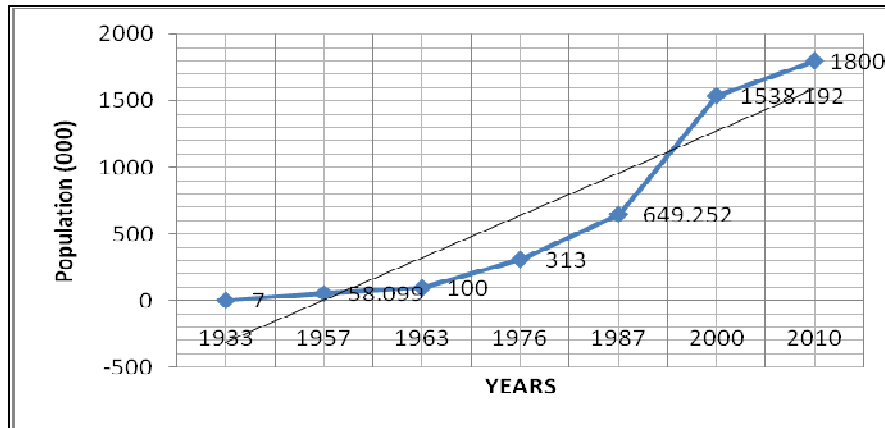


Figure 2: Evolution of the population of Yaounde  
Source: BUCREP, 2010 and \*Estimates

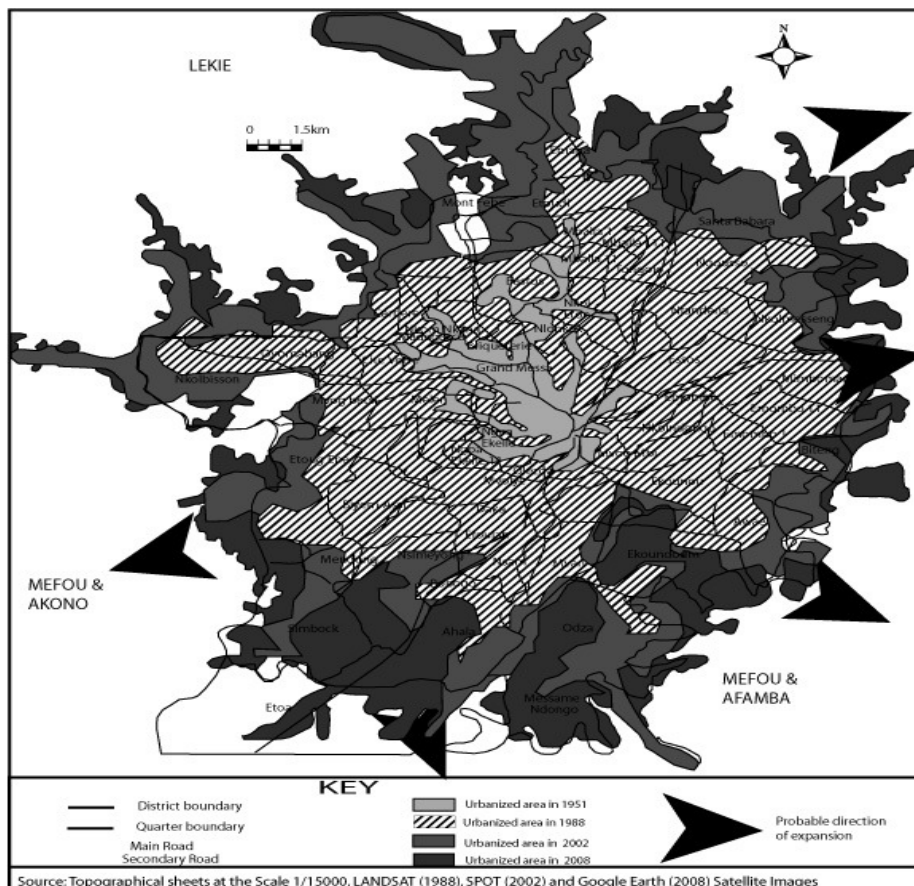


Figure 3: The Evolution of the Yaounde Metropolis

4.2. *The Need of Constructions and Materials used*

Apart of the space that is taken up for construction after clearing the forest, forest also provides building materials. During the early settlements around 1888, the small population of city dwellers used mostly mud and sticks or bamboos. This was extracted from the immediate surrounding and so because of this small population size, there was no real stress on the environment. But the increasing population in recent times has caused an increase in the materials needed for construction. The result from a sampled household population in Yaounde in 2010 to determine the material used for construction is presented in Table 1.

Material	Mud & bamboo/sticks	Bricks	Wooden board (Planks)	Cement blocks	others	Total
Number	61	90	40	153	4	348
(%)	17.5	25.8	11.5	44	1	100

*Table 1: Sampled Households According to Materials Used for Construction.*  
 Source: Fieldwork

It is seen in Table 5.1 that, even-though the use of modern material like cement blocks with 44% and Bricks with 25.8% is predominant, the use of bamboo and sticks (17.5%) as well as planks (11.5%) for construction still takes a reasonable proportion. Tchotsoua (1993) noted that a minimum of 250 of sticks per perch (a unit of area equal to 25.3m<sup>2</sup> /301/4 sqyd) are needed for a house of 10m x 8m. Each stick has a diameter of approximately 8-10cm. The material for construction and roofing comes from the forest in and around the metropolis. In such areas today, it is still common to find traditional and modern structures existing alongside each other.

(Figure 4 and Figure 5)



*Figure 4: A Traditional dwelling at Nsimeyong (Yaounde 111)*  
 04/02/10 09:36 NKwemoh C.A.

-The use of sticks, planks and bamboos to erect the frame of a traditional dwelling is evident. The empty spaces are filled with mud (poto-poto)

-Here old corrugated iron sheets have been used to replace mat of palm fronts in a pure traditional system



*Figure 5: Ultra- modern structures along the 20<sup>th</sup> May Boulevard*  
 02/04/10 08:59 NKwemoh C.A.

-At the foreground, the surface is tarred; this is the 20<sup>th</sup> May Boulevard.

-At the rear (background), towards the left is Hilton hotel, part of the Ministry of finance, and the Bank of Central African States. This necessitates the engulfment of space that was occupied by forest for settlement (Figure 6).



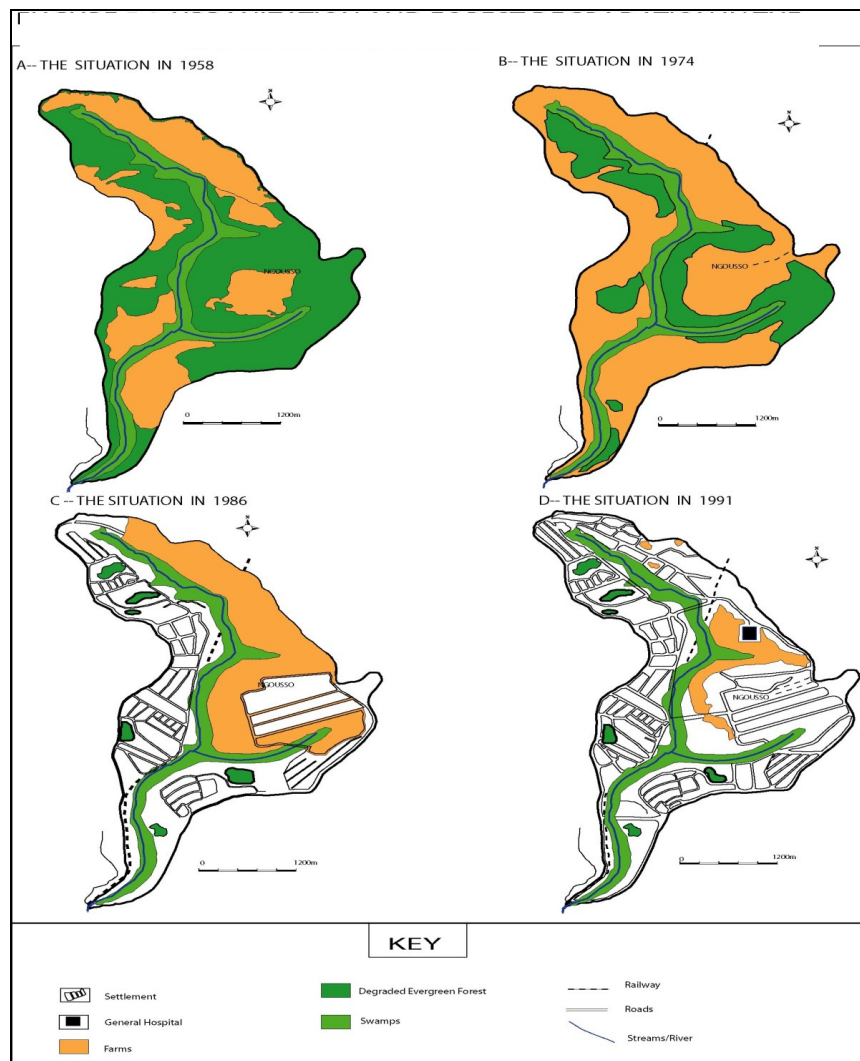


Figure 6: Urbanization and forest Degradation in the NTEM Basin in Yaounde  
Source: Tchotsoua (1993)

No forest management method that would match that rate of settlement is laid down. If it was, at least some patches of natural forest niches would still be traced in the city. In areas around the fringes of the city centre, it is realized that the mere need of land for construction is forcing inhabitants to strip off remnants of forest as seen in the Figures 7 & 8



Figure 7: Relicts of Evergreen forest at Simbock  
15/02/10 13:19 Nkwemoh C.A.

-At the foreground around the middle, the corrugated iron sheet roofs of houses can be spotted and are responsible for the scanty plant growth.  
-At the background, emergent trees can be seen and this clearly gives the impression of the tropical evergreen forest



Figure 8: Gradual decimation of Rain forest at the out skirt of Yaounde towards Mbankomo  
15/02/10 14:15NKwemoh C.A.

- At the foreground, there is a gradual invasion of forest vegetation by settlement.
- The dense evergreen forest behind these houses show only traces of remnants of the equatorial evergreen forest.

This juxtaposition indicates a gradual fading away of the traditional construction material in favour of other materials according to a changing financial strength. In a nutshell, there is a gradual evolution from old - non-conventional methods to modern conventional methods of construction. This necessitates the engulfment of space that was occupied by forest for settlement. No forest management method that would match that rate of settlement is laid down. If it was, at least some patches of natural forest niches would still be traced in the city. In areas around the fringes of the city centre, it is realized that the mere need of land for construction is forcing inhabitants to strip off remnants of the forest.

The replacement of forest by houses can be seen around Mvan, MessameNdongo and Odza, in the south-eastern sector of the metropolis; Mimboman11, Essos, Ngouso, Mfandena and Santa Barbara in the east and north eastern sectors as well as Obobogo in the north-western part. The situation shows that emphasis is being laid on the construction of roads and houses. This is obviously at the detriment of natural forests which is not protected.

Looking at the nature and planning of the landscape from aerial and topographical views, it is realized that towards the centre of the city almost no space is left (Figures 5.9a & 5.9b showing Briqueterie and Emombo). The buildings are dense with just no space for natural vegetation. Meanwhile, towards the outskirts (peripheries), patches of surviving natural forests are being stripped-off for construction but still with much space (figures 5.9c & 5.9.d showing Ahala and Oyomabang). From the outlook of housing in Ahala and Oyomabang, it is realized that even though there is still space for natural forest, the increasing population needs space. Most plots here are currently being purchased very fast. This indicates that current construction of houses is at the detriment of natural forest. The impact of the clearing of forest and the need for forest products for construction in forest degradation is aggravated by the need for fuel wood.

4.3. Fuelwood/charcoal

Another reason for the disappearance of the forest in the metropolis is the need for firewood and charcoal for cooking. An analysis of questionnaires after a field survey of households in the metropolis indicates the percentage in the use of felled trees in the area. Fuel wood accounts for 54%, furniture, 29% and others, 16.3%. The other uses of felled trees that were enlisted include; sculpturing/carving of mortars, pestles and material for artisan works.

It is realized that a greater part of the felled trees was used as fuel wood. From observation, loads of wood are transferred on a daily and weekly basis from the outskirts of the city with patches of forest and beyond. The uses of trees have also been computed from sampled households in the various Districts (Figure 3). In Figure 3, it is realized that Yaounde 3 is the district with the highest uses. This is followed by Yaounde 1 and then Yaounde 7. These figures are explained by the presence of carpentry workshops and the frequency of use of firewood and charcoal.

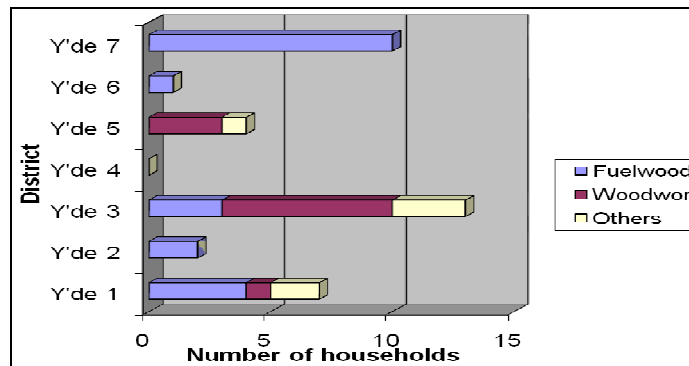


Figure 9: Proportion of uses of felled trees by sampled households according to districts in Yaounde.

Figure 10 shows results of sampled households on the sources of cooking energy. Although charcoal does not occupy a predominant position as a source of energy in Yaounde, it is very instrumental in the degradation of the forest in and around the area. In the evenings and nights in the metropolis, charcoal serves for braising and cooking

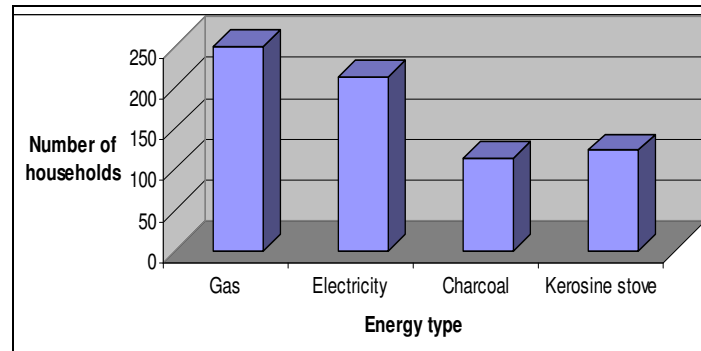


Figure 10: Alternative Energy Sources based on sampled households in the Yaounde Metropolis

Considering that cooking is done on a daily basis and intensified during weekends, the number of trees felled to extract charcoal is equally on the rise. It is thus realized that even where there are relicts of natural forests that survived urbanization, the need of fuel is a perpetuating factor in degradation. Meanwhile, this is measured for the survival/subsistence of urban dwellers.

Charcoal that is utilized in Yaounde is produced by charcoal burners in the outskirts of the metropolis. The main areas include Nkolbisson, Simbock- Mbankomo, Okola, and Mfou as well as timber saw mills in the city that produce waste to be utilized. Charcoal also comes from Mbalmayo, Akonolinga, Ayos and Bertoua in the Southern and Eastern Regions amongst others. The charcoal that is used in the metropolis can be classified into two categories. These are the heavy and light weight charcoals. The heavy weight produces very hot flames and burns for a longer period. The light charcoal produces flames with less heat and burns for a comparatively shorter period. The quality therefore determines the quantity to be supplied and the price. The charcoal is usually put into large bags that are plated and transported to the city as shown in Plate 7.10. Charcoal is delivered to wholesalers who then retail it. The large bags cost between 3000-4000 Frs CFA. This is then sold for cost prices that range from 100, 200, 500 to 1000F CFA respectively. Charcoal is sold in all the markets in the metropolis but the main markets are Mokolo, Mfoundi, Mvog-Mbi, Mvog-Ada and Essos amongst others. It is realized that this activity is not well organized to permit quantification of the amount that is consumed by city dwellers. It is however easy to judge from the increasing population and increase in the need of fuel wood and charcoal that the adverse impact is on forest.



Figure 11: Charcoal on sale at the Mokolo market in Yaounde  
Source: Nkwemoh C.A. 17/08/10

#### 4.4. Woodworks

A great factor that has contributed to the disappearance of trees in the area is woodworks. This is the second factor of wood consumption after fuel wood. Presently, it is realized that settlements are furnished with diverse household equipment like furniture. The need for these items has skyrocketed with the rapid population growth. These furnitures are derived from wood transformed into planks in and around the metropolis.

Carpenters or woodwork specialists and sculptors have actually invaded most areas of the city and are increasingly making their impact felt. They are responsible for the purchase of wood for the production of specific designs of furniture and other wooden materials for sale. Woodwork is a real expanding activity in the metropolis today. This sector has greatly evolved from the spotted carpentry workshops to complex furniture shops today. The initial wood comes from timber around the Centre, South and East Regions, with specific reference to Ebolowa, Akolnolinga, Sangmelima, Bertoua, and patches of tropical evergreen forests at the outskirts of the metropolis. The timber is taken to saw mills but the principal collection points of wood by woodworkers are Messa, Nkolbisson and Mvan, LaverieAwae and Nkomo. Wood workshops are found in all the main quarters in the metropolis but renowned

clusters include the area from Olezoa to Vallee de la Mort, Elig-Efa, Kondongo, Mvog-Ada, Mvog-Mbi, Essos, Etoudi and Emana areas.

There are varieties of woods that are highly solicited and have been classified according to the most suitable use as shown in Table 2. From inquiries, it was realized that there is a steady increase in the demand for furniture due to the increase in urban population and expansion.

Type of wood	Scientific Names	Rank in terms of quality	Most suitable uses (furniture)
Ewenge, Eben	<i>Milletialaurentia</i> <i>Diospirossp</i>	1 <sup>st</sup>	Upholstery chairs and couches, Dinning sets, Beds, Cupboards etc.
Bubinga	<i>Guiboutiatessmannii</i>	2 <sup>nd</sup>	All types of furniture
Sapelli	<i>Entandrophragma cylindricum</i>	3 <sup>rd</sup>	Upholstery chairs and beds
Maobi	<i>Baollonellatoxisperma</i>	4 <sup>th</sup>	Bed, Wardrobe, cupboards
Bibolo	<i>Lovoatrichilioides</i>	5 <sup>th</sup>	Upholstery chairs and Beds, Cupboards
Iroko	<i>Milletiaexcelsa</i>	6 <sup>th</sup>	Bed and construction materials
Mouvingi	<i>Destemonanthusbenthamianus</i>	7 <sup>th</sup>	Beds, Cupboards, Chairs and tables
Mbete	<i>Mansoniaaltissima</i>	8 <sup>th</sup>	Dinning sets and Cupboards
Elande, Pache	<i>Afzeliapachyloba</i>	9 <sup>th</sup>	Couches, Cupboards and TV-stands.
Ayous	<i>Triplochitonscleroxylon</i>	10 <sup>th</sup>	Upholstery chairs and cupboards after treatment

Table 2: Quality of Wood and Most Suitable Uses  
Source: Fieldwork, 2010

Exact figures in the growth rate of the demand and sale of furniture could not be obtained because of the informal and poorly organized nature of the activity in the metropolis. It was also found out that there are peak periods for the demand of furniture. The August-September period is the first peak period because of purchase of beds, table and chairs as schools re-open. Another peak period is the November-December period when urban dwellers purchase furniture (Upholstery chairs, Cupboards and Dinning sets) to upgrade or improve on the aesthetics of the house for Christmas and New Year festivities. Table 3 shows the most frequently purchased furniture and their prices. One hundred percent of the wood that are used for the fabrication of the furniture listed in Table 3 are derived from timber. The timber comes from the evergreen forests of the southern sector of Cameroon. The need for furniture is also responsible for the disappearance of forests in the Yaounde metropolis. It is obvious that even though the urban space has been expanding, the exploitation of timber together with charcoal and fuel wood needs are contributory factors in the forest degradation process. It is worthwhile noting that the increase in the need of forest products has been imposed by the ever-increasing population numbers in the metropolis. On the contrary, there are no appropriate management methods to protect the original forest in the area today. Even the patches of evergreen forest at the outskirts are facing increasing pressure and would thus be exterminated if nothing is done to ensure conservation or sustainable development.

Type of Furniture	Price Range (FCFA)
Simple bed, bunk beds, king sized beds	15.000 – 400.000
Cupboard	150.000 – 350.000
Upholstery/chairs	150.000 – 900.000 – 1.500.000 on command
Dinning sets (depending on seats and materials)	90.000 – 400.000
Wardrobe	80.000 – 150.000
TV- Stand	25.000 – 50.000
Computer – Stand	30.000 – 60.000

Table 3: Types of Furniture and Their Price Range  
Source: Fieldwork.

The high demand of items for urban consumption has been responsible for the degradation of forests in parts of the city that were still forested in the 1970s and 1980s. Such areas include the stretch of land around Mt Fébé, the summits around Carrières, Oyomabang and Nkolbisson amongst others.

## 5. Recommendations

### 5.1. Forest Protection and Management

The Forest Regulation Law of 1994 adopted by the Ministry of Environment and Forestry has put in place very specific felling modalities to be respected by forest exploiters. This is respected in reserved areas and is a good idea in protecting and managing the



forest. This law should be applicable also to specific areas of the Yaounde city with natural forest. These areas include the forested summits and slopes from Mendong-Etoug-Ebe ridges, Mvog-Betsi-Nkolbisson and Oyomabang, Mont Febe, and Nkolondom in the north-western part of the metropolis. They also include the patches of natural forest around Simbock, Mbankomo and Odza from the south eastern to south western sector of the metropolis.

Forests provide habitat for a variety of plants and animals and perform many other important functions that affect humans. Figure synthesis is the chemical process in the leaves that uses sunlight and carbon dioxide to produce energy-supplying sugars for the tree. In this process, the foliage gives off pure oxygen for breathing. The forest canopy and root systems provide natural filters for the water we use from lakes and rivers. When it rains the forest canopy intercepts and re-distributes precipitation that can cause flooding and erosion of topsoil. Some of the precipitation flows down the trunks as stem flow; the rest percolates through the branches and foliage as through fall. The canopy is also able to capture fog, which it distributes into the vegetation and soil. Forests also increase the ability of the land to store water. The forest floor can hold as much as five times its weight in water and a tree contains water in its roots, trunk, stems, and leaves. Because of all this stored moisture, forests help to maintain an even flow of water in rivers and streams in times of flood or drought. The roots of the trees and other vegetation hold the soil in place and control erosion from wind and rain, preventing flooding and clouding of streams and rivers. It is because of these of forest vegetation functions that forest regeneration is recommended in the metropolis.

With regards to forest management, the first step here concerns the farmers. Since subsistence farmers in these areas still cut trees to open up space for farms, they should be advised on how to go about things in a sustainable way by the Forestry unit of the Delegations of Forestry. such exchanges should either be through forums like workshops or momentary visits of forest technicians. The farmers who already own established plots should then be encouraged to practice permanent farming system as in agro forestry discussed earlier

The choices of resource management range from one extreme to another; between present and future generations, between private and public welfare, between conservation and maximum production and between economic efficiency and societal acceptability. All of this supposes extremes but extreme solutions are rarely solutions, they are escapes (Peter, Sun 1990). The forestry service and planners should bear this in mind while sorting the most appropriate strategy. West and Brachin (1990) and Machlis (1992) hold that it is not easy to reconcile the needs of conservation and those of the local people. It is against this backdrop that farmers should be encouraged to co-operate with the forestry services of Mfoundi. This would permit the city dwellers to become responsible and treat the relict of forest as their belonging.

The type of system recommended here is the taungya system. According to Enabor and Adepoju (1975), Nkwemoh (1999), this system is a variant of agro forestry. Farmers provide free labour for land clearing and tending of forest crops while cultivating food crop. This system has been successful in Asia, Latin America and other parts of Equatorial Africa.

Another method concerns the search for fuel wood. Considering that those who fetch, collect and use firewood are the local population and who still constitute mostly the farmers and some firewood dealers, they should be allowed occasional access by the forestry unit to these forests. They are not allowed to fell trees but can only harvest twigs or branches and trees that have deteriorated on their own. Fogwe (1997) noted that a way trees could be utilized without destroying the landscape is by gathering small wood and barks hanging off. The above measures would then be accompanied by the creation and management of family, community fuel wood plantations as explained in the next section.

### 5.2. Forest Regeneration/Urban Forestry and Fuelwood Plantation

The right of regeneration of forest all over the country and Yaounde in particular has been confided to ONADEF. This institution has however regenerated forests in some areas in the 80s but today, it is no more carrying out the function. Rather, this institution is more engaged in the sales of seedlings to those who intend to plants trees. This however notwithstanding, the Yaounde Urban Council is effectively carrying out some measures. This is recognition of the fact that the environment of the metropolis needs to be revamped by a combined effort of the Government and city-dwellers. This entails the proposals on the establishment of green spaces (table 4)

No.	SITE	SURFACE AREA
1	The park of Olezoa-Mvolye Valley	290 ha
2	The leisure park of Mont Febe	400 ha
3	The park of two Rivers Ngousso	215 ha
4	The Airport Park	150 ha
5	The Nsimeyong--Biyem-Assi Park	100 ha

*Table 4: Proposed Sites for Recreational Parks  
Source: Divisional Delegation of Forest and Fauna (2010)*

These are leisure parks whose greenery somehow distorts the predominantly brown landscape otherwise called the urban scape. This measure is reinforced by the creation of public Gardens (Table 5)

	Garden Site	Characteristics
1	The Garden at Hotel de Ville	Flower beds, Ornamental trees and lawn
2	The Central Square -- Djoungolo Valley	
3	The Garden of the Sports complex park and Fouda zone	Flower beds, Ornamental trees and lawn
4	The Garden of Nkol-Ewe	
5	The Garden around the Charles Atangana Monument	Eucalyptus, Lawn and hedges
6	The Garden at the View point of Atemengue Plateau	Flower beds, and lawn
7	The restructured garden of the Messa Valley	On-going
8	The Garden of the Mosque and Congress Hall	Flower beds, Ornamental trees and lawn
9	The Garden of the Sector of the Present Presidency	Flower beds, Ornamental trees and lawn
10	The Garden of Ngouso	Flower beds, hedges (ornamental) and lawn

Table 5: Main Gardens in the Yaounde Metropolis  
Source: Yaounde City Council – VoirieMunicipale (2010)

The other proposed sites should however be made operational by the State and Yaounde city Council. Meanwhile, some additional valleys should be managed. These measures would obviously improve on the ecological and social status of the city. In the long-run when all of this is achieved, there would have been a reasonable step towards the creation of a “sustainable city”. A true type as recommended by the Stockholm Convention. These measures are already indicating attempts at producing an acceptable urban ecology. This would however be complemented by urban forestry.

The Yaounde metropolis falls under ecological zone of the humid lowlands of western and central Africa (ICRAF 1998). This zone supports a broad variety of multipurpose tree species. These local and exotic species would also do well in urban forestry which is a measure that has been recommended here.

An example of the recommended tree planting exercise was already started in the Mfoundi by the Municipal Council in 2008 when 23000 trees were planted followed by 8000 trees in 2009. The principal species include *Canarium sp.*, Mbete, Padoula, Assamela, Framire, Frake, Wenge, *Eucalyptus sp.*, *Cypress* and *Terminalia sp.* Planting took place below the ENAM campus, the stretch of land behind the National Assembly to Vallee de la Mortand Mont Febe.

There are already some prerequisites that can enhance the initiative to plant trees in the Yaounde metropolis. They include the presence of plant nurseries such as the one managed by IRAD in Nkolbisson. Trees for urban forestry can be purchased at giveaway prices as indicated in table 6. Considering the fact that there is an increasing use of firewood and charcoal in the metropolis, fuel wood plantations should be created by the Yaounde city Council.

Scientific Name	Local Name	Method of Propagation	Price (Francs CFA)
<i>Accassiasp</i>	N.A.	Seedlings	1000
<i>Afrostiralepidolus</i>	Country onion		1000
<i>Alamblakia</i>	Oil for cosmetics	Still under research	
<i>Baobab</i>	N.A	seedlings	1000
<i>Biollinellatoxisperma</i>	Moabi	Seedlings	1000
<i>Canariumschweintifütii</i>	Black tree	Seedlings	1500
<i>Diospirosalata</i>	Eben	Seedlings	1000-2500
<i>Entandrophragma</i>	Bibolo	Seedlings	1500
<i>Garcinia kola</i>	Bitter cola	Grafting	1500-2500
<i>Garcinialucida</i>	(for fermenting palm w).	Seedlings	1000
<i>Giboutiatesmanii</i>	Essingang/bubiga	Seedlings	1500
<i>Gnetumafricana</i>	Eru (Kok)	Cutting	600-2000
<i>Iribromaoblona</i>	Eyon	Seedlings	1500
<i>Irvingiagabonensis</i>	Bush mango	Cutting/marcot/grafting	2000-4000
<i>Jatrophercureas</i>	For biofuel	Seedlings	1000
<i>Kola nitida</i>	Cola	Seedlings	2500
<i>Lophiraalata</i>	Azobe (hard wood)	Seedling	1500
<i>Melitiaexcelsa</i>	Bilinga	Seedlings	1500
<i>Melitialaurentine</i>	Wenge		2500
<i>Militia excelsa</i>	Iroko	Seedlings	1500
<i>Moloingaoloifera</i>	Medicinal		1000
<i>Monodoramiristica</i>	Ndong (spices)	Cuttings	2000
<i>Polysciasfulva</i>	(for carving, xylophone, Etc)	Seedlings	1000
<i>Posinistalliyoyimbe</i>		Cuttings	2000
<i>Prunusaficana</i>			1000
<i>Recinodendronheudelloti</i>	Njangsa	Grafting/cutting /marcot or airlayering	2000-2500

<i>Spathodeacampanulata</i>	N.A	seedlings	1500
<i>Spondiamoubine</i>	N.A.	Seedlings	1500
<i>Tectonagrandis</i>	N.A.		1500
<i>Terminaliasuperba</i>	N.A.		1500
<i>Triplochitonscleroxylon</i>	Ayous	Seedlings	1000
<i>Voacangaafricana</i>	Quinine	Seedlings	1000

Table 6: Some Urban-Agro Forestry Species And Prices

Source: Information obtained from ICRAF, ONADEF and ANAFOR plant nurseries 2010

Other sites can be chosen around Nfandena in the north east, Mimboman and Ekounou in the east and Ahala and Simbock in the south and south western sector of the metropolis. These are areas with less population concentrations and availability of land that can be exploited for this purpose.

Another method entails the planting of woody perennials along streets or roadsides. Good examples of the ornamental species whose dead branches can serve as authorized wood are here presented in table 7. This would take the extra weight that is felt by the natural forest both in the outskirts and beyond. Possible locations for these plantations include the summits around the Meva hills of Carrière where the population had been relocated to other areas because of recurrent landslides.

Scientific Name	Local Name	Method of Propagation	PRICE (Francs CFA)
<i>Bauhimia</i>		Seedlings	1500
<i>Calistinnon</i>	Bottle brush tree	Seedlings	1000
<i>Cassia siamea</i>		Seedlings	1000
<i>Catapaterminalia</i>		Seedlings	1000
<i>Cypress</i>	Christmas tree	Seedlings	8000-20.000
<i>Eucalyptus</i>		Seedlings	600
<i>Ficus sp. **</i>		Cuttings/ Seedlings	1500-2000
<i>Flambouyang</i>		Seedlings	1000
<i>Frangipanier</i>		Seedlings	1000-5000
<i>Gestroema</i>		Seedlings	1000
<i>Jakarada **</i>		Seedlings	1000
<i>Lorie</i>	Small shrubs	Seedlings/cuttings	1000-8000
<i>MelitiaLautentia</i>	Wenge	Seedlings	1000
<i>Neem</i>		Cuttings/ Seedlings	1000
Palms (Ornamental)		Seedlings	15000-50 000
<i>Solpleureur</i>		Seedlings	1500-15 000
<i>Terminaliamantali **</i>		Seedlings	500
<i>Whistling pine</i>		Seedlings	1500

Table 7: Some Species of Ornamental Trees For Urban Forestry

\*\* plants with poor rooting system that is not good when very close to public infrastructures.

Source: Information obtained from ICRAF, ONAREF, ANAFOR and Pacific Garden Plant nurseries (2010).

Ex-situ conservation is also a good approach of protecting and conserving forests and species diversity. According to Hoyt (1988) this is an important way of protecting forest/biodiversity through seed banks (germplasm, zoo-botanical garden). This effort needs to be encouraged and there should be an increase in the density of species. There is enough space around Mbankomo, Simbock, Mimboman and Nfandena. These areas should be converted and reserved for this purpose. MINFOF should encourage this while city dwellers should be encouraged to practice urban forestry.

Past studies have shown that the younger generation of urban dwellers with a higher education and active urban forest users prefer more ecologically oriented management when compared with older residents (60+ years) with less education (Tyrväinen et al 2003). This is why the high literacy level in the metropolis is responsible for a higher percentage of affirmation to conservation. Managing existing urban forest includes thinning, under storey management, the leaving of dead snags and decaying ground wood. The role of urban residents in the up keep of these domains is important. This is so as to make sure that the areas do not become true hideout for criminals.

Experience shows that evaluation has a close link with the important emotion-related psycho-physiological responses (Ulrich et al., 1991). More so, environmental preferences are viewed as having a substantial genetic evolutionary basis (Kaplan & Kaplan 1989, Tyrväinen, 2003). These approaches suggest that environmental preferences may depend more on effective reactions than on any knowledge-based logical operations (Daniel, 2001a cited in Tyrväinen, 2003). In the pursuit of urban forestry in the Yaounde metropolis, the primordial aspects in mind are ecology, sustainability and most importantly aesthetics

The creation of MINEF and the MINFOF with all the Delegations had been a recognition of the fact that forest preservation is an issue. Decree No. 03-169 of April 1982 laid down forestry regulations which had a provision for forest regeneration all over the territory. Initially forestry reforms were realized by CENADEFOR and later ONAREF (Office Nationale pour Le Développement de Forest). This institution should be revamped. Their efforts should be supported by other Agencies and NGOs like CARPE, CEW, GEF and CRESA.

Urban residents in the area concerned should be invited to participate in issues related decision on management of forest. Tyrvaiven and Löfström (1998) hold that active participation in forest planning may increase the participants' ecological and/or silvicultural knowledge, and thus may change their preferences towards forest management options

### 5.3. Encouraging Agroforestry

It would be very appropriate if Homegardens, Intercropping and Alley farming are practiced in and around the metropolis. The practice where trees are planted sequentially or simultaneously with crops is a practice that has proved to be the most sustainable system in degraded lands. The combination of trees and crops leads to an ideal situation. This practice which is referred to as agro forestry has evolved from simple planting of trees and crops to a careful selection of plants and crops according to their mutual give and take needs. This implies that the choice of the type of agroforestry will depend on the will of farmers and Agricultural extension workers in the area.

## 6. Conclusion

The above investigation has permitted us to draw some conclusions. Firstly, that there has been a rapid increase in the population of the Yaounde metropolis. Secondly, that the increase in population implies the increase need for space to accommodate the growing numbers of city dwellers. This also means the increase need for agricultural land to cultivate in order to feed more mouths. The implication of all the above is clearing of vegetation on areas that had not been occupied by construction.

It was equally realized that construction of houses by both traditional and conventional methods need forest products in the building and roofing processes. This impact on forest vegetation has been exacerbated by the need of Fuel wood/Charcoal for domestic cooking. The situation of forest cover has even become more precarious with the need of a wide variety of wood for woodworks/furniture especially needing in the increasing number of households.

The investigation crowns it all with some recommendation on the urban planning and forestry policies on forest protection and Management. The measures also include Forest regeneration, Urban Forestry, fuel wood plantation and agroforestry with reference to Homegardens, Intercropping and Alley farming

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