

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Tropical AgriSciences

Department of Crop Sciences and Agroforestry



Forest Resources in Angola – history, present state and perspectives

Bachelor thesis

Elaborated by: Vasco Valério Chassusso Chiteculo

Thesis supervisor: doc. Ing. Bohdan Lojka, Ph.D.

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Declaration

I hereby declare truly that this thesis is my own work and quoted only according to the references listed within. However, contributions of others are involved, especially under the guidance of doc. Ing. Bohdan Lojka, Ph.D.

Prague, May 2013.

Vasco Valério Chassusso Chiteculo

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Abstract

Forest resources provide useful raw materials for livelihood and economic development. Before any source of income, natural forests were always the first source of survival for Angolan citizens. This thesis reviews the history and present state of forestry in Angola. It highlights historical and present causes of deforestation issues with special focus on charcoal production in Bié. The deforestation rate of 0.2% for Angola when compared with others official sources does not show lucidity. The questionnaire survey done in Bié province (Angola) proved that charcoal and firewood production affect the rate of deforestation. About 60 to 80% of Angolan population relies on charcoal to meet their residential energy needs. The price of charcoal depends on the distance from where it's produced, with risk of error below 10% (9.8% and 8.3%). It is higher in Kuito (province of Bié), where the maximum price was about 13 USD per bag. The actual size of forest surface in Angola will only be possible to estimate with a conclusion of the national forest inventory.

Key words: Bié province, deforestation, investment, firewood, charcoal, small farmers, miombo.

Abstract (Portuguese)

Os recursos florestais proporcionam matéria prima para o sustento e desenvolvimento económico das populações. Antes de qualquer outra fonte de renda, as florestas naturais sempre foram consideradas como principal a fonte de sobrevivência para as populações Angolanas. Esta tese analisa a história e o estado actual das florestas em Angola. Ela sublinha o histórico e as presentes causas de desflorestação, com foco especial na produção do carvão na Província do Bié. A taxa de desflorestação de 0.2%, quando comparada com outros dados oficiais, não mostra coerência. Os dados obtidos durante a pesquisa feita em forma de questionário no Bié (Província a sul de Angola), mostra que a produção de lenha e carvão afecta o tempo de desflorestação. Cerca de 60 a 80 % da população angolana depende do carvão para satisfazer as suas necessidades energéticas. Existe uma relação entre o preço do carvão e a distância onde este é produzido, isto é, com a

probabilidade de erros abaixo de 10% (9.8% e 8.3%). O preço do carvão no município do Kuito (Provincia do Bié) é alto, onde o preço máximo ronda aos 13 USD por saco. A actual superficie ocupada por florestas em Angola, será possivelmente estimada com a conclusao do inventario florestal nacional.

Palavras chaves: Provincia do Bié, desflorestação, investimento, lenha, carvão, pequenos camponeses, miombo.

Abstrakt (Czech)

Lesní zdroje poskytují užitečné suroviny k existenci a ekonomickému rozvoji lidstva. Než-li jako zdroj příjmu, byly vždy lesy prvním zdrojem k přežití místních obyvatel v Angole. Tato práce zkoumá historii a současný stav lesních zdrojů v Angole. Zaměřuje se na vyzdvihnutí problému deforestrace v závislosti na výrobě dřevěného uhlí. Odlesňovací sazba 0,2 procent, porovnááme-li ji s ostatními oficiálními daty, nedává jasný smysl. Průzkum uskutečněný v Provincii Bié ověřil, že produkce dřevěného uhlí a palivového dříví ovlivňuje sazbu deforestrace. Kolem 60ti až 80ti procent obyvatel Angoly je závislých na dřevěném uhlí, a to k uspokojení svých základních potřeb k bydlení. Cena uhlí souvisí s vzdáleností odkud se dováží, a to pouze s rizikem omylu menší než 10% (9,8% a 8,3%). Cena uhlí je dražší v Kuito (Provincie Bié), kde se maximalní cena pohybuje kolem 13 dolarů za pytel. Dokud nebude dokončen národní lesnický inventář, nebude možné odhadnout aktuální lesní plochu v Angole.

Klíčova slov: Provincie Bié, deforestrace, investice, palivové dříví, dřevěné uhlí, malé zemědělce, miombo.

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1. INTRODUCTION

After the several years of civil war, economic development of Angola has depended on natural resources (Oil, diamante, etc.) available. In the world of today, we are worried that natural resources may become scarce in the future. In developing countries like Angola, the situation is more complicated because of the lack of trusted statistics data which can show the actual use of natural resources (BUZA et al. 2006). There is a widely held perception that forest has been destroyed, but information on what exactly is happening, on where and how fast it is happening is unknown.

In Angola, very few studies have been done concerning forestry. That is due to lack of qualified people and an economic problem that has narrowed the progress (FAO 1995). The 27 year of civil war that last in 2002, made people understand the importance of forests, as this is where was found the means of survival in periods that people could not work in farms. In Angola, almost 70% of people depend on agriculture to survive. It is very difficult to imagine life without forest resources. People use forest as a source of living. The importance of forest resources is known, but the actions of handling and structuring takes a long time to be arranged. There are not secondary schools or high institutions in Angola that deals with forests issues.

The deforestation in Angola tends to be critical, the forests have been explored without any management plan concerning on why and when to cut down the trees. The wood industries which transformed the raw materials into finished materials are paralysed and abandoned. During and after the war, the forest resources in Angola were uncontrolled. It has been argued that forestry products contribute poorly to the Gross Domestic Product (GDP) of the country. Today the Government of Angola is trying to organize, provide projects which can suggest better forest management and a good utilisation of forest resources which can increase possibility of jobs, a reduction of deforestation and develop an alternative to change the actual use of forest resources. The purpose of this study is to review the history of forestry in Angola, concentrating mainly on charcoal and firewood production that highly affects the deforestation rate in Bié Province. The data about forestry in Angola are almost inexistent (FAO 2008). For this reason, it has been difficult to realise studies in this area. This study wants to focus especially on Bié province that was much damaged by the long civil war.

2. OBJECTIVE OF THE THESIS

The principle objective of this study is to review the actual situation of forestry in Angola particularly in the province of Bié. The specific objectives focus on the review of the history of forestry, deforestation rate and their possible causes, potential of forest resources as well as identification of the possible changes in utilisation of forestry resources before and after the independence of Angola.

This work will contribute in enriching the information of forestry in Angola by bringing good ideas, like what and how to invert the precarious situation involving the governor to realise that spending money in the forestry sector is not a cost but rather an investment. Assuming a hypothesis that charcoal and firewood production affect the deforestation rate in Bié Province, a questionnaire survey was used to understand the driving forces of charcoal production which, is one of the causes of deforestation in the area.

3. METHODOLOGY

3.1 Methodology of the literature review

A literature review was conducted to find out information concerning forestry in Angola both the historical and present situation. Secondary reliable data were collected from online databases sources from July to September 2012. There have been few and essential documents that were used as a pillar of this thesis (Cabral A.I.R. et al (2010); Diniz A.C. 1996; FAO 1996; FAO-Forest Resources Assessment 2000; FAO-Forest Resources Assessment 2010; FAO-Forest Outlook Study for Africa 2000; Jirků and Petrželková (2008); USAIDA (2008), and Institute for Forest Development-IDF Reports 2007; 2008; 2009; 2010; and 2011. The essential articles were found through database search in Science direct (<http://www.sciencedirect.com>), Web of knowledge (<http://apps.webofknowledge.com>), FAO, (<http://www.fao.org>) , World Bank databases, Minister of Agriculture in Angola (<http://www.minagri.gov.ao/>), Institute for Forest Development in Angola (www.idf.co.ao) and other internet websites. The same secondary data were then analysed and framed according to the titles into a definite form comparing them with scientific published works for some others organizations (i.e. FAO, NEPAD, and SADC) that deal with forestry issues in Angola.

3.2 Survey of charcoal production

A questionnaire survey focussing on forest resources exploitation mainly the charcoal production was done in province of Bié (Angola) (**Figure 1**) specifically in municipalities of Kamacupa, Katabola and Kuito.

The data were collected through administrative collection channels (IDF and agricultural cooperatives from Adventist Development and Relief Agency-ADRA). The survey was administrated by two students from Faculty of agricultural - University Agostinho Neto in Angola. Questionnaires were divided into two target groups with different questions: One directed to Institute for Forest Development – IDF, another to the local population who deal with forestry mainly the farmers who sells charcoal or firewood. The semi-structured questionnaire (**Appendix 2**) with 23 questions written in Portuguese language was prepared

and distributed among local charcoal producers (mainly farmers) and also governmental officials. At some point the questions had to be translated into the local language “Umbundu” to facilitate the comprehension between the farmers. From 37 questionnaires received, 27 respondents are farmers and 10 workers from IDF (two in Bié and eight in Huambo Province). The survey questions included the age, locality from where charcoal has been produced, the distance from where the charcoal has been produced, types of forest species used for charcoal production, non forest products, the price of charcoal or firewood and also questions concerning deforestation.

3.3 Data analysis

Due to the focus and scope of the respondents, the data were especially suitable for qualitative analysis of individual cases. However, six samples of respondents were evaluated quantitatively. In the calculations process, instead of taking the interval, we took just the average. On the other hand, the incomplete answers were omitted. There was concentration on the age of the respondents concerning the production for trade or domestic uses.

For data processing, was used the Excel and STATISTICA program. Excel provides tools for classical two-sample tests (based on the Student distribution). Using these methods, require assumptions of normality random variables, or the conformity of variances. The program STATISTICA contains nonparametric methods that were preferable in our case. In the presented data, the two-side Wilcox test (calculation was done by hand) was used and its variant Mann-Whitney test (Using the STATISTICA program). Finally, there was an effort to find out if there is any correlation between the price, amount of charcoal and distances from where it's transported. Then again (Besides not too suitable Pearson correlation coefficient) we use nonparametric test using Spearman correlation coefficient. Then was used also Kendall correlation.

4. LITERATURE REVIEW

4.1 Definition of the term forest

For many years the definition of the term forest has not been clear and compressive. There are a lot of misunderstandings among countries. According to Helms (2002), these misunderstandings are due to the changes in knowledge, forest use, increased needs for clarity and precision in communication. There are more than 100 definitions of forest (Lund 2002); these definitions do not include rubber wood, palm oil, bamboo and nut trees as forest trees. However, FAO (2000) reported 650 definitions of forest assembled from 132 countries. These definitions contrary to the first one include rubber wood, bamboo, palm oil and other plantations.

Helms (2002), understood that language is never static, words and terms change with use over time. There are a lot of questions which need to be clarified, for example a forest after being burned by wildfire and regenerated, is it still a forest? Or must it reach some threshold stage of development before warranting that designation? If someone mentioned the concept of a forest, does another person have the same understanding what exactly is being discussed?

In some African countries, the forests have a bigger importance than can be imagine. Each change of the forest definition should affect the normal life of many rural populations. In Cameron for example the tree symbolises the forest, which houses the body of God. It is believed that it has a vehicle through which people communicate with God. In Central African Republic, the tree is for a newborn child. If the tree stops growing, people fear for the health of the child, if a tree bears fruit, it is a time for a child to marry (Lund 2002). All of these beliefs and misunderstandings have influenced to have a clear definition. As a consequence of having different definitions for one term with different meanings and ideology, until now 21st century it is not known what a forest is.

Lund (2002) defines a forest as a land on which vegetations is dominated by trees, with more than 25% of canopy cover. Does it necessarily have to be covered by 25% of canopy to be a forest? The current definition used under the Kyoto Protocol in (Cadman 2008) define a

forest as a minimum area of 0.05 hectares with tree crown cover of at least 10% of canopy and minimum height of 5 metres at maturity in situ, including fruit tree plantations.

Note for example how forest definition has changed over time: In Forest Resources Assessment report (FRA) 1980 and FRA 1990, the 10 % of canopy cover were used for developing countries only and the 20 % for industrialised countries (FAO 2000). Rubber plantations were not included into the definition in FRA 1990 (Mather 2005). FAO in Forest Resources Assessment (1990) estimated the world forest area to be about 3.4 billion hectares; however, after 10 years the reports estimated it to be 3.9 billion hectares. This difference does not mean that the extension of the world forest have increased, it results from new information and changes in forest definition (FAO 2001). Updated definition of forest in FRA 2010, mentioned almost the same definition, however, clearer and accompanied by explanatory notes to justify the definition. However, variation in definitions, even so minor, increases the risk of inconsistency in reporting over time (FAO 2010).

On the other hand, the attempt to develop a clear national and international agreement of a standard definition of forest, may cause win-lose situations. The solution should now be based more on political implications than on technical criteria (Helms 2002).

However, the definitions from Kyoto Protocol without inclusion of 10% canopy cover and fruit orchards or tree plantations should be included for Angola. Until now Angola does not have a clear definition for their forestry, so we do believe that the international standard established by FAO (2010) should be more convenient in the actual situation.

4.2 Review of the Angola country

Angola is located on the western coast of southern Africa (**Figure 1**) with an equivalent area of 1,246,700 square kilometers from which 43.3% covers the forest surface (IDF 2011). The population is estimated to be 19.6 million (World Bank 2011). The capital city is Luanda and Portuguese is the official language. The coastal zone of Angola is characterized by lack of vegetation cover even with the presence of indifferent trees species (**Figure 2**) such as *Brachystegia*, *Julbernardia* and *Isoberlinia* usually found in the plateau (FAO-FOSA 2001). Generally Angola has only two seasons: Dry season (called cacimbo) and rain season. The rainy season is longer in the Provinces of north. In these areas, are found

bigger and dense rainforests of Angola (Maiombe forest and Yona forest). Savannahs and miombo cover occupy more than 80 % of Angola's surface (USAID 2008).

The climate varies considerably from the coast to the central plateau and divided into three big climate zones: Humid tropical climate, zone that cover the region north, hot desert climate in south region, it goes from tropical desert of Namibe to tropical dry zone of Cunene (World Food Programme 2005) and dry tropical climate covering the plateau zone of Angola.

Bié Province where this study was done is located in centre of the country between 10°34'' – 14°18'' South latitude and 15°42'' – 19°13'' East longitudes. The area surface is estimated to be 70, 314 square kilometres with 2 million of people approximately. About 790, 000 of them live in the capital city – Kuito (Ministério da Administração do Território 2012). Bié was part of the traditional Ovimbundu kingdom before colonised by Portuguese.

The general characteristic of Bié forest is an open forest or miombo forest; several types of vegetation are distributed in the area of alto kwanza. The dense forests are found in the municipalities of Chitembo, Kamacupa, Andulo and Cuemba. The agriculture activities depend on small's farmers, who in average use 1.5 hectares of land to produce agricultural goods (Chaloupkova et al. 2009). The possibility of a mechanised agriculture at now is not available due financial problems, outstanding extensive agriculture of subsistence. Some people use animal mechanisation but mainly, agriculture activities are done manually. According to MINADER (Ministério da Agricultura e Desenvolvimento Rural 2006) about 70% of Angolan population is involved in Agricultural activities. The mainly products grew are; maize in combination with beans, sweet potatoes, potatoes, rice soya and cassava. In Bié province, agricultural activities are still dependent on external assistance concerning knowledge, skills and agricultural inputs supply (Mazancova et al. 2007).

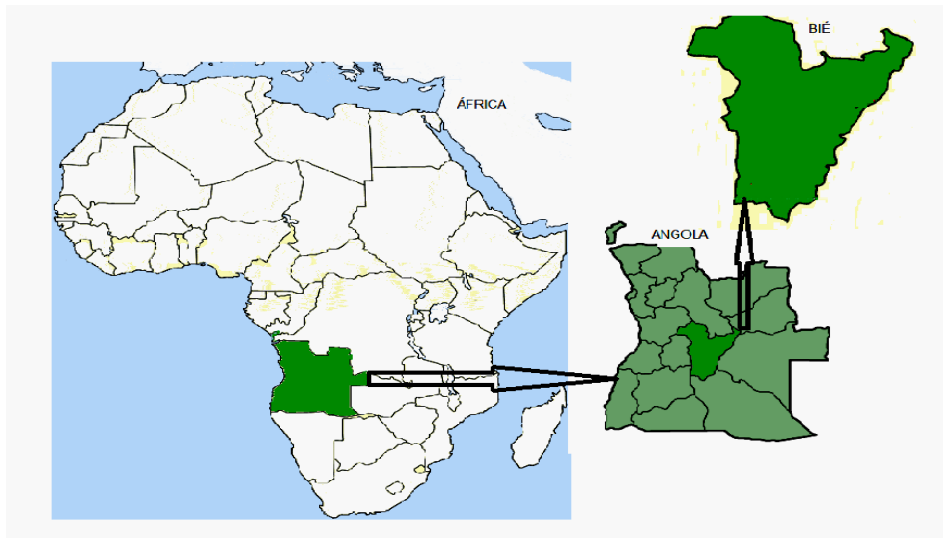


Figure 1: Geographic location of Angola, Bié

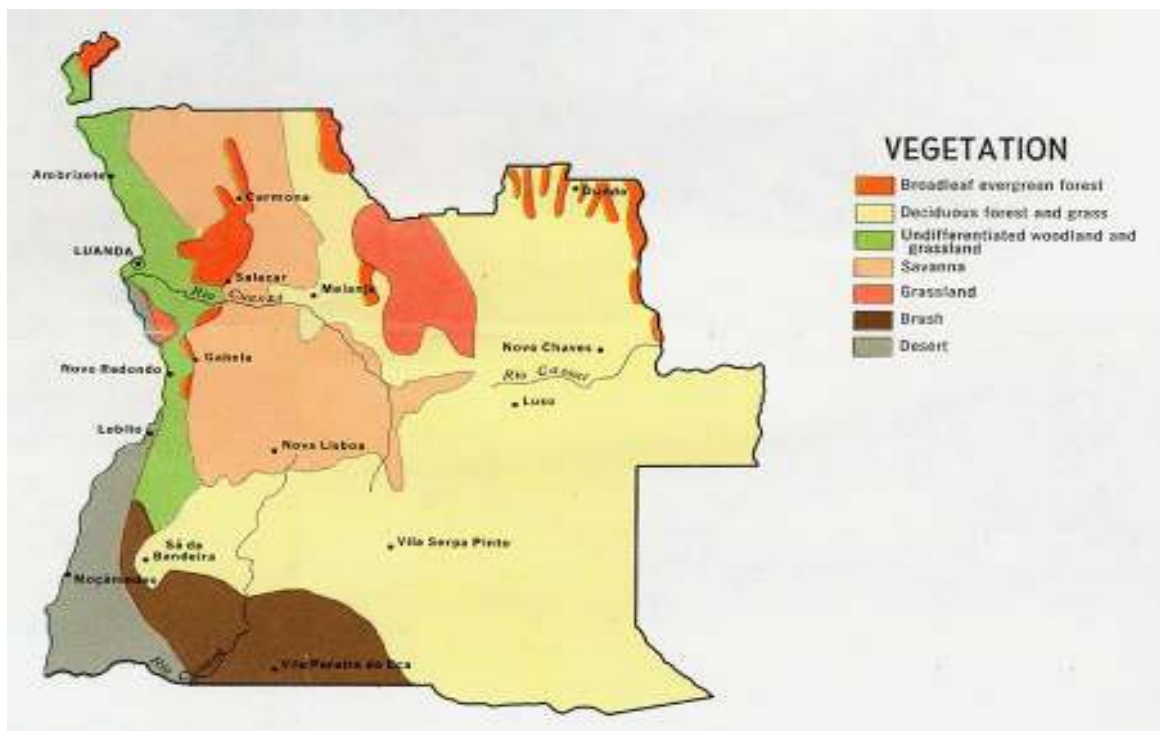


Figure 2: Vegetation map of Angola (<http://maps.nationmaster.com/country/ao/>)

4.3 History of forestry in Angola

According to Jirků and Petrželková (2008), the history of African forests began 8 million years ago, when the climate became humid and started to develop flowering plants. The actual climatic zones in Africa were formed 5 million years ago. The first global cooling occurred in our planet about 2.5 million years; this caused that big part of Europe, North America and Asia to be covered by ice. That was the beginning of the first glacial epoch (ice age). After many years, glacial and interglacial periods started to alternate and these cycles were repeated in intervals of about 40,000 to 80,000 years. As consequences the glacial epoch stretched, while interglacial epoch reduced and therefore, increased the difference between temperature and humidity.

In Africa, with the alternance of the glacial epochs, the temperature and humidity decreased, that brought an enlargement of the dry regions and a reduction of the humid regions and as a consequence the forests were damaged. Practically, during the glacial period the forests disappeared from the African continent and were replaced by savannah. Moreover, when the temperature and humidity increased, new good conditions reappeared for reestablishment of new forests. Most of the African countries, were not glaciated during the last glacial maximum and escaped from drastic vegetation extinctions that affected so much the continent especially in temperate parts of the northern hemisphere (Burgoyne et al. 2005). Today it is possible to find regions where the forests are maintained regularly even during the dry seasons. These regions are called *Pleistocene forest refuges*. Within these refuges are found the older forests of Africa and endemmic plants (Jirků and Petrželková 2008).

Angola was always characterized by natural forests as densely populated since antiquity. These forests had always served as a place to seek sustenance. With the arrival of the Portuguese in Angola, an intensive exploitation of forest resources began. This was due to the high demand of timber at that time. With time, the Portuguese colonists found out that the natural forests do not provide the quality of wood required and it had a long vegetative period, hence came the need to introduce new species such as eucalyptus, cedar, pine, grevilha etc, which were planted in very large areas (IDF 2009). When the first European settler came, they

faced difficulties to establish their colonies; the timber was not enough to satisfy the needs of those times (Britton 2006). The settlers were not only depleting the forest, but also the surrounding fynbos of woody shrubs for the insatiable demand for firewood (IDF/Bié 2008).

The major problems faced by Angolan institutions that are responsible for the forest resources, was always the lack in organisation capacity of data collection (Zola 1999). For example what happened with forests during the first war against the Portugal settlers? There was a shortage of timber and the price boomed due to the demand of national timber market. German settlers, who cultivated sisal in the area of Benguela, started also to plant eucalypts and others species. Documents of what happened with these plantations are inexistent.

4.4 Natural forests in Angola

Natural forests are considered as a symbol for hope to many African countries. Angolan population has natural forest as part of their history linked with their antecessors lives. Moreover, before any other sources of income, natural forests are the first sources of survival (IDF 2011). Barbosa (1970) reported that natural formations in Angola can be aggraded into seven groups according to their forest composition and geographic localisation. Here we are going to characterise only five of them;

4.4.1 Dense humid forest

The humid forest of Angola has high productivity and represents 2% of the total forest area, which is about 2.4 million hectares (IDF 2008). It is localised on the north of the country (**Figure 3**), from Cabinda province up to Balombo river, forming a triangle with Uíge, Bengo and Kwanza-Norte provinces (IDF 2011).

There are (Cabinda, Uíge, Cuanza Norte) the main centres of timber explorations, with 0.4 m³/year of average growth which makes an annual production of 960, 000 m³ of timber. The more common species within Angolan humid forest are: *Entandrophragma*, *Chlorophora excelsa* locally called “Câmbala”, *Pterocarpus tinctorius* “tacula”, *Mitragyne macrophylla* “m’vuco”, *Millettia versicolor* “m’bota”, *Combretodendron africanum* “pau rosa”, *Staudtia gabonensis* “memenga”, *Sarcocephalus diderichii* “ungulo”, *Mamea Africana* “m’boza”, *Pycnatus angolensis* and *Millettia uersicolor* (Dinz 1998; IDF 2011).

4.4.2 Guinean forest savanna mosaic

Guinean forest savanna mosaic is estimated to be 673,600 square kilometers of African surface. It lies between western lowland and rain forest ecoregions (white 1983). According to IDF (2011) the vegetations of Guinean savanna occupy 20% of Angolan natural forest. It is located in the northern part of the country mainly in humid zones (**Figure 2**). In these areas dominate species are; *Nauclea latifolia*, *Hymenocordia acida*, *Annona arenaria*, *Maprouena Africa*, *Psorospermum febrifugum* and *piliostigma thonningii*.

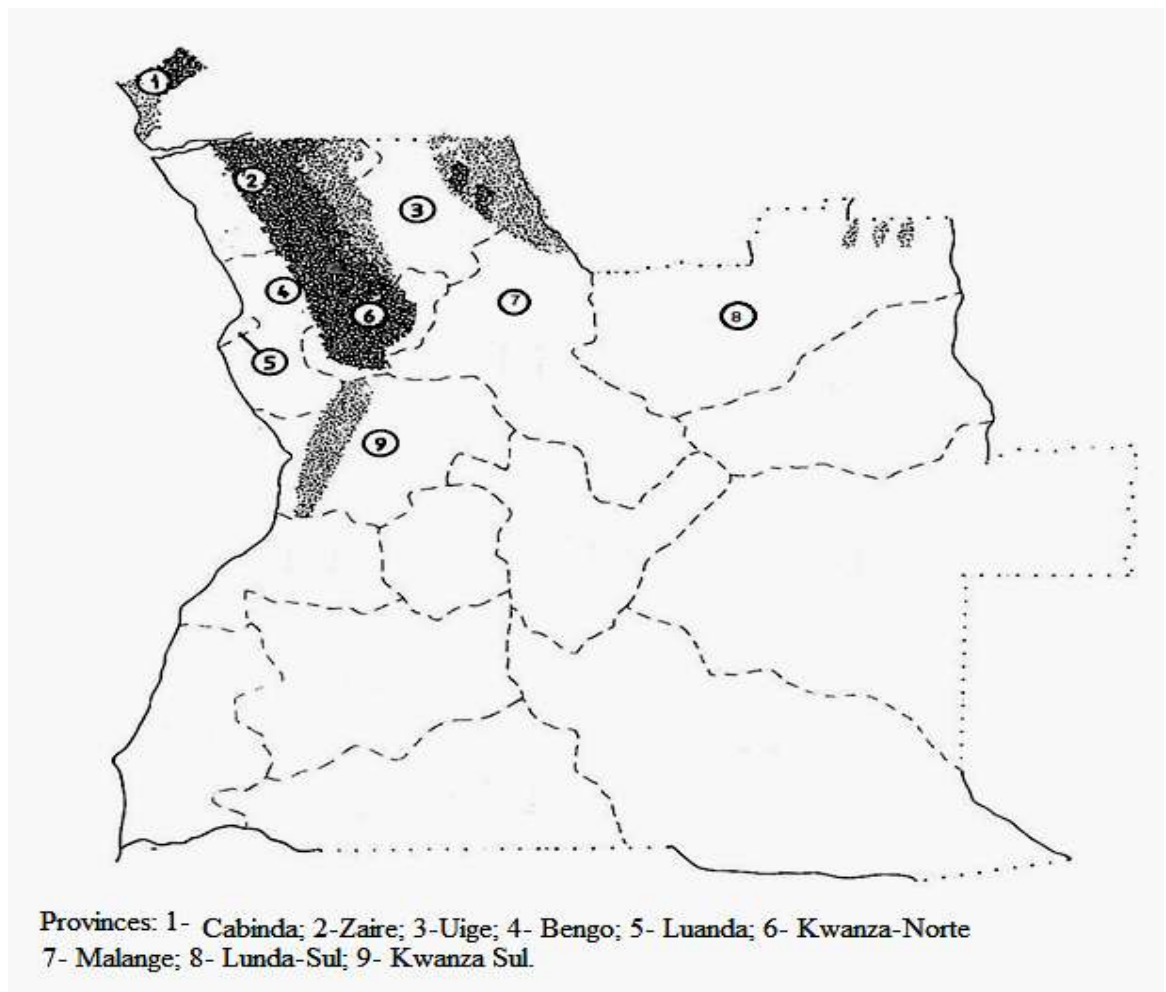


Figure 3: Zones with dense humid forest in Angola

Source: (Diniz 1998).



Figure 4: Dry savanna in Uíge province (Angola) with its typical vegetation.

4.4.3 Dry savanna

In these areas predominate trees or shrubs (**Figure 4**), occupy approximately 24.2% of total Angolan natural forest. It is a kind of forest with low productivity in terms of timber market (IDF 2011). The dry savannas are located mainly in coastal provinces. The importance of these areas is that, they provide fuel wood, construction materials and medicinal products to people around. However, it can be also denominated as dry forest because of its lower rainfall (Duerr 1993).

4.4.4 Mangroves

The mangroves in Angola represent 0.3%, that is concretely 1, 250 km² (IDF 2011). There are located almost at the mouths of all large rivers. There are found Species like *Rhizophora racemosa* and *Rhizophora mangle*. In the estuary of the Lubinda River, Cabinda and the estuary of the Zaire are located the most extensive stands of mangroves in Angola. Mangrove flora of Cabinda Province appears to be the richest. Unfortunately the number of species has declined. In south of Benguela Province it seems to disappear completely (FAO 2006). FAO (2006) reported that mangroves in Angola have been severely disturbed by firewood collection. In Cabinda province the disturbance has been caused by oil exploration.

The oil spilled on water and salinity in the water circulating through the mangrove forest may have killed the mangroves (Sanders 2004).

The United State oil companies refuse to accept the allegation that the oil spilled on the water is the main cause of disappearance of mangroves in Cabinda. Hughes, in Sanders (2004) reported about a significant oil spills on water. This gives reasons to finger point at the oil companies operating in Angola. The resolutions of this issue require involvement of political implications between United State oil companies and Angolan government.

However, some mangroves will survive and perhaps even thrive with the predicted changes in climate (Alongi 2007). For Angola, the answer to this issue will depend mostly to the interest of USA oil companies than on Angolan government.

4.4.5 Miombo or open forests

The miombo forest is situated in south sub-humid tropical zone of Africa (**Figure 5**) with 2.7 million square kilometers. It covers countries as Angola, Malawi, Mozambique, Zambia, Zimbabwe, Tanzania and south part of the Democratic Republic of Congo (Campbell et al. 1996). The term miombo originated from Bantu languages (muombo), it is commonly used in Shona language (Zimbabwe) and Bemba language (Zambia). This term has been used by ecologists in Africa, to refer those trees of the genus *Brachystegia*, *Julbernardia* and *Isoberlina* (FAO 2012).

The vegetation types with similar form have similar ecological performance, whereas those with contrasting physiognomies functions (Campbell et al. 1996). On these grounds White (1983) suggested that the use of the term savannah should be discontinued for miombo; the reason is that the term savannah has been defined in so many different ways that is no longer possible to use it in a precise classificatory sense. There have been a problem to define the term Miombo; is it a savannah, woodland or forest (Huntley 1982; Frost et al. 1986; white 1983)? Physiognomically, it is a closed deciduous woodland within the spectrum of savannah ecosystems (Huntley 1982), grading into seasonal dry forest at above 1,200 mm mean of annual precipitation. Most of the miombo trees and shrubs flourish in the same period immediately after the rains.

In regions like Angola mainly in the north part, where are higher rates of rainfalls, miombo gives way to evergreen forest. In Angola, miombo occupies around 45.2% of total natural forest (IDF 2011). There are found high quality timber and endemic species. Species like *Pterocarpus angolensis* “girassonde”, *Guibourtia coleosperma* “mussibi”, *Azelia cuanzensis* “ovala or muvala”, *Brachystegia spiciformi* “Omanda”, *Julbernardia panoculata*, *Copaifera baumiana* and *Marquesia macroura* “muvuca” (Diniz 1998; Huntley1974) are common in Angolan miombo and have great economic value especially for carpentry work and handicrafts (IDF 2011).

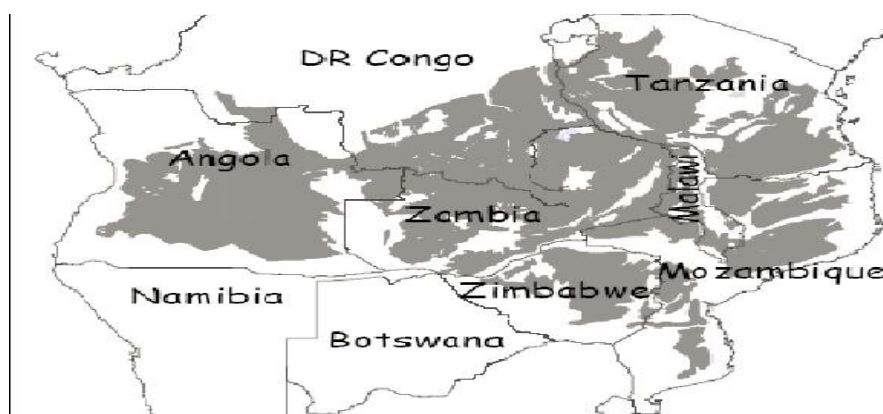


Figure 5: Representation of miombo forests in Africa (Campbell et al. 1996) based on White 1983.



Figure 6: Miombo forest in Huambo Province (Angola)

The resources of miombo woodlands are the central livelihood of millions of rural populations (Campbell et al. 1996; Lawton 1982). Unfortunately there are very few “good news stories” in the region about miombo in Angola. The problem of deforestation is associated to poverty that ravages those areas.

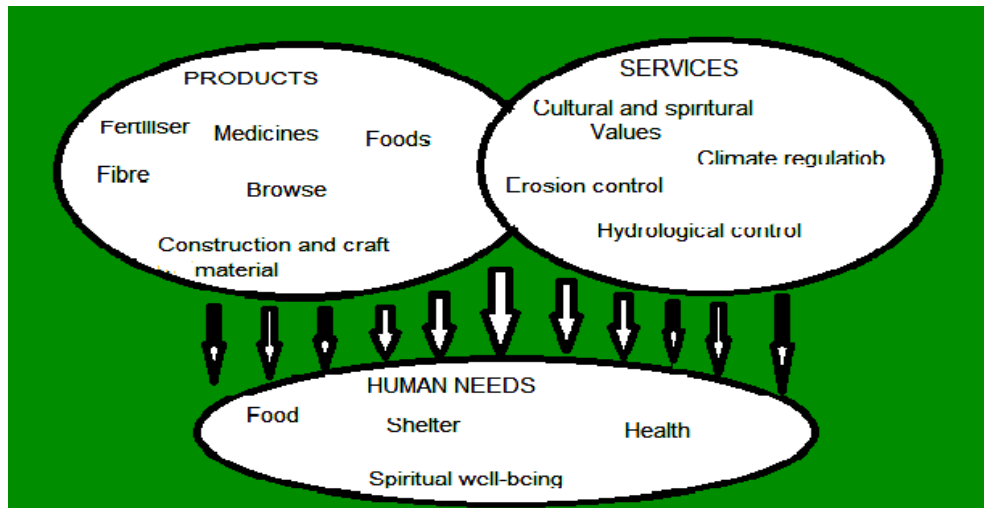


Figure 7: Goods and services provided by miombo forests

The miombo forest plays an important paper in livelihood strategies of rural population. The **figure 7** summarises all aspects concerning the importance of miombo forest in Angola. Miombo forests are more than just a source of material goods; they constitute the central of the spiritual needs of people, it is a sacred groves associated with spirits of the dead (Campbell et al. 1996; Morris, (1995). The conservation of some specific trees is done for cultural reason. The demand for cultivation land is one of the major causes of deforestation in miombo countries.

4.5 Eucalypts plantations in Angola

Generally, the plantations species were introduced in Angola during the colonial period. The species introduced were *Eucalyptus sp*, *Cupressos lusitanica*, *Calitriss calcarata*, *Pinus patula*, *Grevilha robusta* and *Cassuarina equisetifolia* (FAO 2000). Old documents with informations about how and what happen with forestry sector durand and after the 1975 are unkwon. They may exist some where in Portugal.

The demand of timber motivated the settlers to grow more plantations in Angola. They planted more than 20,000 ha of trees mainly *Eucalyptus*, *Pinus patula*, *Pinus elliotii* and *Cupressus lusitanica*. What happens after that? No one knows. No studies have been done concerning these plantations. By the time of independence in 1975, more than 100,000 ha of eucalypts were established in Angola. Eucalypts was the major genus planted for timber, fuel wood and pulp (Matas and Pukkala 2011). It was introduced to Angola in 1930. They were established by private sector with the purpose of pulpwood and wood fuel production for locomotive machines (FAO –FOSA 2001). From 148,000 ha of the actual total forest plantation, 128,000 ha consist of eucalypts, 16,000 ha pines and 4,000 ha of *Cupressus* (IDF 2011). Majority of these plantation belong to private companies like CCPA (Celulose and paper company of Angola) and CFB (Caminho de Ferro de Benguela). The *Eucalyptus* and *Pinus* trees were planted along the railway and the favourite specie was *Eucalyptus camaldulensis* (IDF 2011).

It was distributed in highlands, central plateau concretely in provinces of Benguela (Ganda, Babaiera, and Alto Catumbela), Huambo (Kuima, Sanguengue, Ukuma and Tchinjenje), Bié and Huila (Bunjei) as it is shown on **(Figure 8)**.

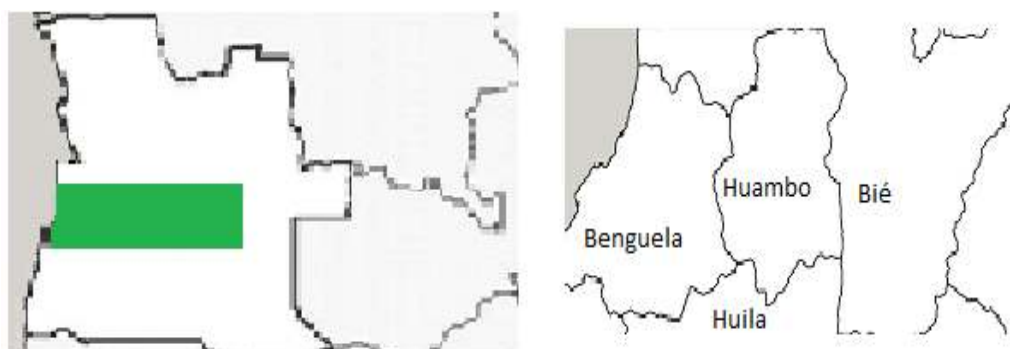


Figure 8: Central angolan highlands with Eucalyptus species

Source: (Matas and Pukkala 2011).

Huambo province has the highest rate of eucalypts plantations, planted during the colonial period. The visual study undertaken by FOSA-FAO (2001) in some plantations had shown that 40 to 50 % of Angolan plantations are in advanced critical state of degradation

caused by illegal cutting of trees by neighbouring populations and the lack of silviculture treatment or management.

The history of Angolan forests was linked with the presence of Portuguese settlers in the territory. The Angolan population knew very little about their forest resources so it was much easier for the settlers to dominate the resources. Today, a new history is in the making; the surface of the planted forest area after independence is about 650 hectares (IDF 2011) furthermore, the Government is negotiating with FAO to revitalise the forest sector and potential of Angolan natural forests.

4.6 Deforestation in Angola

Deforestation is not a new issue in our planet. The Mediterranean was already deforested before the fifth century (Thomas 1956); Europe also had series cases of deforestation in 16th century (Trirgood 1981). A lot of authors already wrote much on the topic, others even mentioned some specific cases; Rainforest of Haiti was deforested by the end of 19th century (Coffey 1985). Other authors have associated the deforestation rate of African countries to their sluggish economic growth (Diarrassouba and Boubacar 2009). The modern history of sub-Saharan Africa is linked with deforestation (Marques dos Santos 2009). To estimate deforestation in Africa is a challenge due to the lack of information, maps, satellite and images (Cabral 2010).

To work on deforestation topic is important to agree which definition may be used, so that hypotheses concerning on it can be tested (Rock 1996). According to Angolan forest law, deforestation is a devastation or indiscriminate cutting of trees without proper replacement (IDF 2011). Not many studies have been done to clarify the state of deforestation in Angola. Forests in Angola have been explored to obtain fuel, firewood and charcoal for domestic uses (Agency of International Energy 2006). Many authoritative sources like Commission on Environment and Development (1987); World Bank (1989); and IMF (1993), have attributed deforestation problem in Angola to the actions of the rural population. There is a certain tendency to blame the problem of environmental degradation onto the poor people. The deforestation rate depends on the combination of many factors, such as development of the country, conservation programs, fragility of ecosystems, the economy of rural population and employment opportunities (FAO 2000).

The deforestation rate for Angola has been inadequately estimated. According to FAO (2000) and IDF (2011) it is about 0.2%. USAID (2008) reported it to be 0.9 – 1.0 % annually. Recent studies by Cabral (2010) found the annual deforestation rate to be 2.66% to 6.9%. There is no coherence on the data of deforestation. The more critical areas are those with open forests. The highest levels of deforestation are found in provinces of Luanda, Benguela, Kwanza Sul, Cunene, Huila, Huambo and Bié (**Figure 8**). In Bié Province, it has been hard to talk about deforestation. The activity of charcoal and firewood production is exactly what conducts the rapid deforestation. Data about forestry are unknown at all. In 2008, the Director of IDF (Province Bié) said: *“the only thing we know is that the trees have been cut brutally by charcoal and firewood producers, a fact which can lead to deforestation. We know that deforestation exist in Bié; we can observe it even within some “protected” areas.*

Conversely, the study by USAID (2006) in Cuando Cubango province did not find much obvious human impact on the landscape as it was expected. Due to decades of war, a lot of places were completely inaccessible for security reasons (FAO 2000). Palo and Mery (1996) believe that the main conception of economic development and deforestation is that “a higher per capital GNP provides more options to avoid deforestation”.

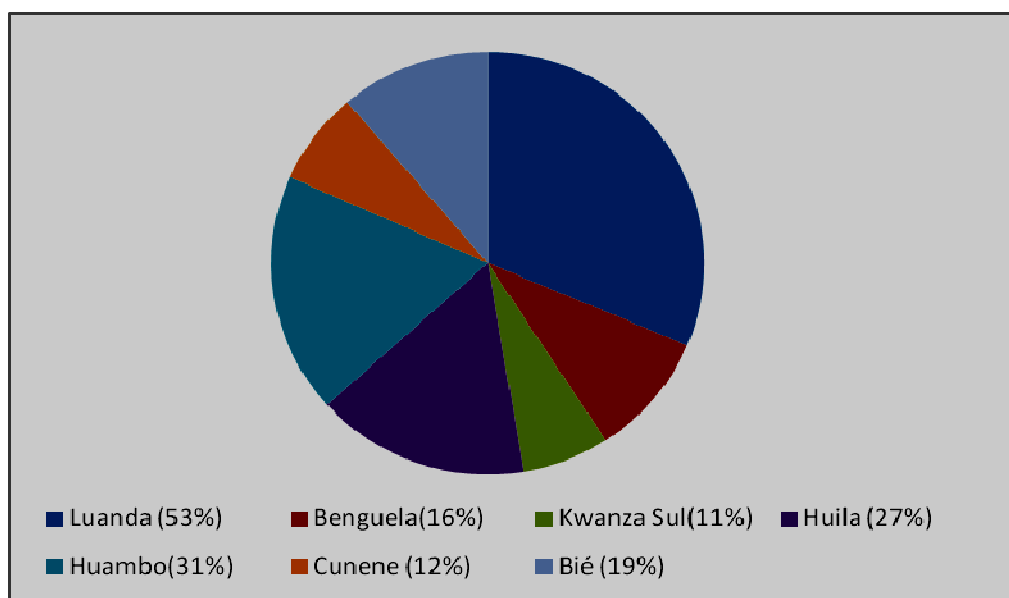


Figure 9: Provinces with higher deforestation rate

Source: (IDF 2007).

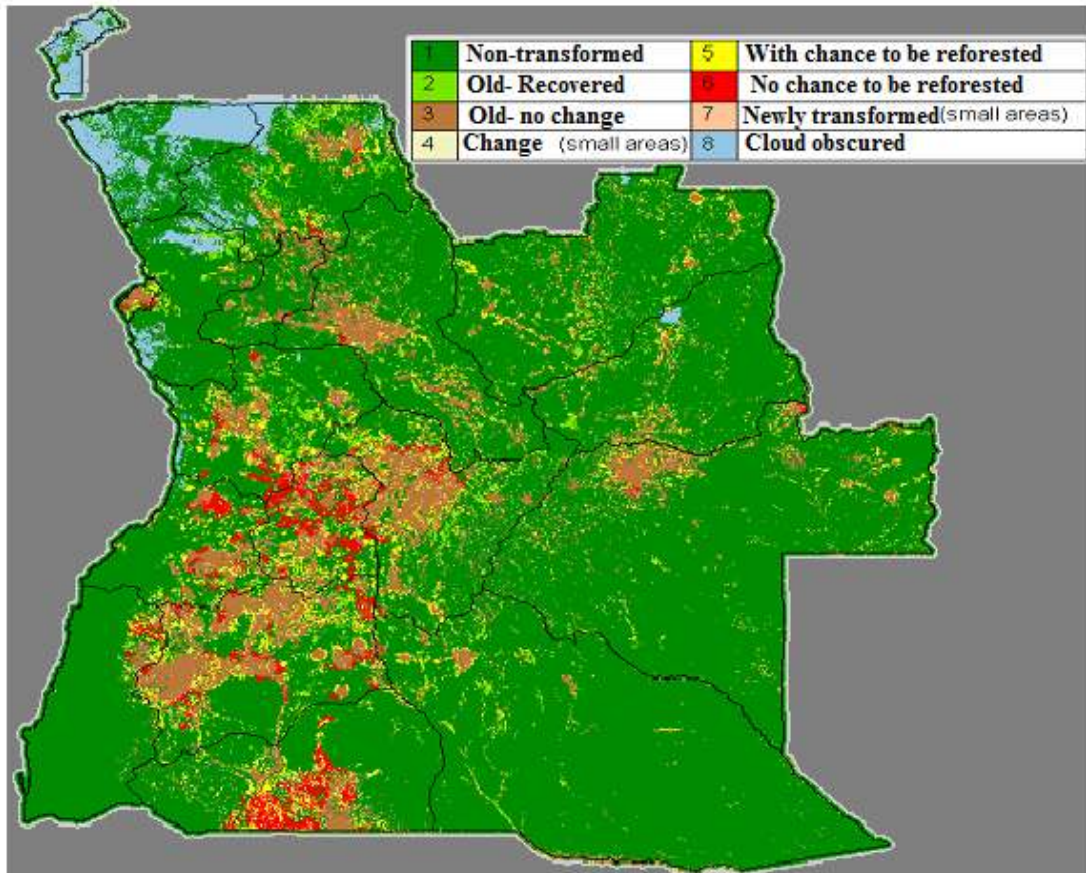


Figure 10: Map of Angola representing the deforested areas (IDF 2007)

The **Figure 10** shows the more deforested areas in Angola. The places coloured yellow indicate the areas with critical level of deforestation but they still have chances to be reforested. In the areas coloured red, the level of deforestation is very critical and the chances to reforest it are small and doubted. The forests have been transformed to agricultural land and grazing fields for livestock. The brown colour represents places with old vegetations that did not change over time. Places with slightly green colour, forests are in recovering processes.

Generally, the causes of deforestation are grouped in two; direct causes and indirect causes. Direct causes are the most visible and easily to identify. The indirect causes are driven by less visible forces like socioeconomic forces, fiscal and development Policies. However, Palo and Mery (1996), divided deforestation into two types: (1) Natural deforestation, caused by climatic changes and (2) deforestation of subsistence caused by the need of new agricultural land, charcoal and firewood production (FAO 2000).

Firewood and charcoal production constitute one of the major causes of deforestation in Angola. The absence of controls in the protected areas, have given also space to these activities (USAID 2008). There are a lot of professional charcoal-makers, locally called “Carvoeiros”, working under contracts or licenses which are provided and signed within IDF. These “Carvoeiros” explore large quantities of charcoal for trade. According to a recent survey concerning consumption of charcoal in Angola, about 60% of people use charcoal to cook their food (Journal of Angola 2012), a fact which justifies the demand of charcoal in the country.

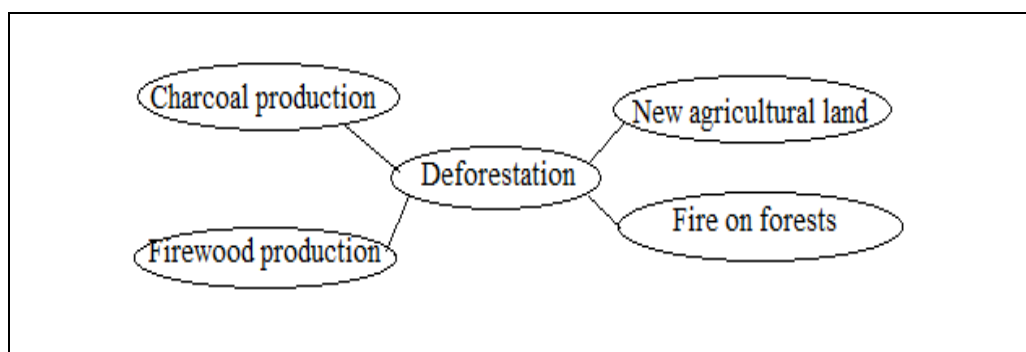


Figure 11: The main causes of deforestation in Angola.

4.7 The use of forest resources in Angola

Forest resources provide useful and important raw materials for livelihood and economic development. Commonly, people living in remote areas are dependent on resources available within the area (Yeo-Chang 2009). Good contributions of these resources to the welfare of rural population have been regularly mentioned in poverty surveys (Cavendish, 2000). Today, there is an increasing interest concerning on how natural forest contribute to the local rural employment and income (Arnold and Townson 1998). However, in Angola, forest resources represent timber, firewood, charcoal, collection of fruits, medicinal products, honey, fibber, and tannin (FAO 2008). There are no records in this area.

4.7.1 Timber exploitation

In Angola, the harvest of forest resources is usually done without management plan. Timber exploitation and other forest products are based on an annual license system which is given by Institute for Forest Development - IDF. Even the logging companies operating in Angola do not undertake any inventory before timber exploitation. According to the current regulation in Angola, the explorations of forest resources fall under two following regime:

- **The exploration based on simple license;** consists on exploitation of 500 m³ of timber. This license is valid during 12 months and can be renewed. It is exclusively for national companies and local community. At the current situation, the simple license is the suitable way used to explore forest resources as firewood, timber and charcoal in Angola. In 2011, about 264 licenses were allowed to explore timber, 454 for charcoal production and 64 for firewood (IDF 2011). The requests for licenses must include the following information: a descriptions of the technical and financial resources of the individual or company making the request, the company name, a description of the type of vegetation cover which should be verified by a IDF local authority, a map of the area to be licensed, including number and technical level of its employers (FAO 1995), and also indicate the utilisation of the finished or unfinished product.
- **The exploration based on contracts;** consists on multiannual concepts, in the sense that the products explored are used to supply forest industries. Unfortunately it's no longer used because the forest sector does not currently know the availability of forest resources and their localisation (Ministério do Urbanismo e Ambiente 2006). However, experiences from other countries (e.g. Ethiopia) have shown that this kind of exploration based on contracts and licenses may stress the forests and lead to an extinction of certain species (FAO 2008).

4.7.2 Timber production in Angola

The annual worldwide consumption of forest products increase yearly e.g. 1.5% of sawn wood, 3.3% for wood-based panels and 3% for paper (FAO 2009). The country has a capacity to produce 326, 000 m³/ year of timber from natural forests (FAO, 2000) and 850,

000 m³ from plantations (IDF report 2008). The actual production of timber is estimated to be 77, 000 m³ (IDF 2011). The consumer per capital is assessed to be 0.03 – 0.05 m³ of timber per person yearly (Ministério do Urbanismo e Ambiente - MINUA 2006). To supply the actual demand of timber, the country needs about 500,000 m³ of timber. However, in the actual level of timber production, Angola has a deficit of 423, 000 m³ of timber. The centres of timber exploration are located in the region of Maiombe (Cabinda) and Dembos (Bengo and Cuanza Norte), Uíge, Moxico, Cuando Cubango, Lunda Sul and Lunda Norte (**Figure 3**).

The average price of selling timber is being about USD 80 to 200, per m³ ranged according to the species. In particular case of Cabinda province, the prices become higher due to high port fees paid for transportation. It is reported by the MINUA (2006) that 1 m³ is being sold at 130, USD plus 70, USD of port fees making a total of 200, USD.

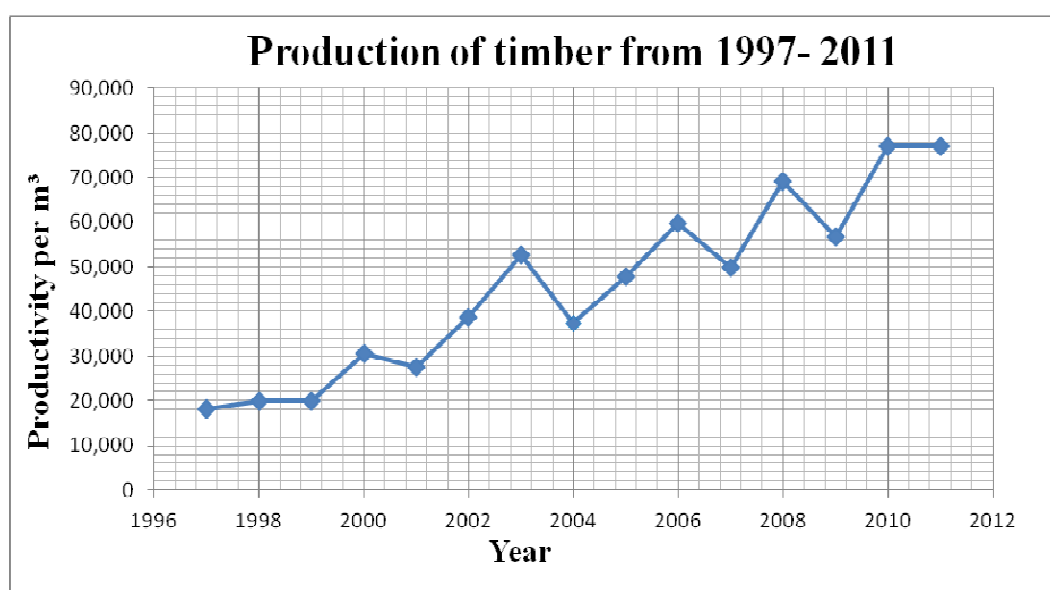


Figure 12: Productivity of timber per year in Angola

Source: (IDF 2007).

The quantities of timber exploration have had a lot of fluctuations. On **Figure 12** it is seen that from the year 1997 to 2000, timber production increased while a decrease of almost 8,000 m³ was recorded in 2001. Generally, there has been an increase in productivity per m³ of

timber production. The Cabinda province is the main productive area in the country (Diniz 1998).

In particular case of Bié province, the timber exploration is low and insufficient to supply the province demands. Legally there is only one company (Carpintaria Lumenye) authorised in timber exploration, others are illegal. According to IDF/Bié (2008), the main problem constitutes the illegal's ones, because it is not known where, which species and how much they are able to explore per day. The main areas of timber exploration in Bié province are;

- **Ceilunga**- This area has been in existence since 1949. It was property of Portuguese settlers. It occupies about 380 hectares, mainly of eucalypts, Pines and cedar
- **Trumba**- It was established in 1960. A property of Portuguese settlers as well, consisting about 150 hectares of eucalypts
- **Caminho -de- ferro** (railway) - There exist mainly eucalypts which was used as fuel for Trans. It occupies about 200-205 hectares
- **Chitembo and Cuemba**- The forest in this area exist as natural forest but unfortunately are unexplored because of security reasons. These regions are very dense with presence of wild animals that prevent the exploration. According to old data Fritz Horesten (1983), Bié province does not have potential areas for an intensive wood exploration. It is calculated that the province is able to produce 3, 000 m³of timber per year what means approximately 1, 800 hectares.

The main natural species for timber production are: *Pterocarpus angolensis* (Girassonde), *Pterocarpus tinctorius* (Takula), *Afxelia cuazensis* (Uvala), *Guibourtia coleosperma* (Musibi), *Faurea sp* (Jungue), *Pricopsis angolensis* (Maku), *Albizia adianthifolia* (Mukasa), *Erythrophleum africanum* (Mucoso), *Dialium angloranum* (Musala), *Brachystegia spiciformis* (Omanda), *Brachystegia sp* (Samba), *Marquesia macroura* (Mukuvo), *Isobernardia angolensis* (moné), and *Julbernardia paniculata* (Fritz Horesten 1983).

4.7.3 Non-wood forest products (NWFP) in Angola

It is recognised that a non-wood forest product is linked with natural life of rural population. Plant products like mushrooms, fruits, leaves, tubers, roots, nuts and medicinal plants are the most important non-wood forest products in Angola (FAO 1991). It includes, honey, bush meat, fodder and edible animals. Non-wood forest products have a large impact in traditional medicine especially there, where the access to modern treatment and medicine is limited. The data in control are generally limited and almost irrelevant for the single fact that Non-Wood Forest Products are not taken into the statistics data and have not been counted into the economy of the country (Zola 1999).

For example, in other countries (Brazil, Senegal, India etc.) medicine plants and other NWFPs are considered as one of the biggest source of seasonal employment (Agustino et al. 2011). In India, the leaf of the tendu tree (*Diospyrus melanoxylon*) produces approximately USD 200 million per year (FAO 1994). In Senegal, Non-wood forest products contribute with about 14% to the GDP of the country (Dabiré 2003). In South Africa the wild plant resources contribute with an income of USD 194 to USD 1,114 per household (Agustino et al. 2011). These comparisons are just to illustrate how much Angola is losing for not exploring the non-wood forest products.

It has been reported that Angola has approximately 200 species of medicinal plants, from which some are endemics (MINUA 2006) and are in danger of extinctions due their medicinal value. *Cochlospermum angolensis*, *Myrothamus flabellifolus*, *Lannea antiscorbutica*, *Pteroxylum obliquum* and *Clerodendron* are in risk of extinction. These species are used for malaria, tuberculosis and hepatitis treatments (FAO 1996).

Honey production in Angola has not yet gained a proper tradition concerning trade production. The industry sector which produced honey and wax for commercial purposes collapsed after the independence of Angola. Considering the great potential of Angolan indigenous forests and large plantation of eucalypts, it should be a great opportunity to develop beekeeping activities in Angola (FAO 1999). Beekeeping activities today are done mainly by small's farmers for subsistence production. The centres of beekeeping activities are found in localities of Mazozo (Bengo), Chitembo (Bié), Kuima (Huambo), Menongue

(Cuando Cubango), Kangandala (Malange), Quipungo (Huila) and Luena (Moxico) (FAO 1999; IDF 2007).

4.7.4 Charcoal and firewood production in Angola

Charcoal is a fuel produced by carbonisation of biomass (Chidumayo and Gumbo 2012). It is extensively used for various purposes. In sub-Saharan Africa is used mainly as cooking fuel mainly in urban areas. In the western part of the world, charcoal is used in metallurgical industry as well as barbecue fuel (Reumerman and Frederiks 2002).

The consumption of charcoal in the world is estimated to be 40.5 million tonnes per year, from where Africa has about 19.8 million. The charcoal and firewood production have been reported since 1980 in Southern African Development Cooperation (SADC), where Angola is a state member as well. It has far reaching impacts extending across a range of social and environmental issues of the Angolan rural population. It is estimated that 80% (International Energy Agency-IEA 2006) or 60% (Jornal de Angola 2012) of Angolan population rely on charcoal and firewood to meet their residential energy needs. The charcoal has been produced in rural areas and sold along the roads (**Figure 13**). The charcoal production in Angola is evaluated to be 253, 104 tonnes yearly in average (IDF 2011). The government of Angola through Institute of Forest Development estimates that, to produce the 100 kg bags of charcoal, requires 10 to 15 wood sticks with a diameter of 25 – 30 cm (IEA 2006). To produce the whole amount of charcoal would require the use of roughly 130, 000 hectares of forest.

Due the type of technology used in cutting trees process, (axes and slashes) the charcoal makers called “*Carvoeiros*” are not able to cut large trees with more than 30cm of diameter. They just cut trees with smalls diameters which have high energetic value (FAO 2008). The charcoal and firewood production continue to dominate household in Angola due to the current demand on these resources in Angolan markets.

Biomass Technology Group BV (BTG 2010) suggested that since charcoal production cannot be easily replaced by alternative energy sources affordable, it is important to develop policy measures that aim at charcoal production an utilisation of more sustainable ways, avoiding higher prices of the product.

In 2010 the reduction of charcoal and firewood production (**Figure 14** and **15**) was due to reduction on issuance of licenses concerning exploration of charcoal and firewood. It has been reported that the widespread use of firewood and charcoal scarcity of local supplies in Angola, have forced people usually women and children (**Figure 16**) to carry up 40 kilograms of firewood and walk an average of five kilometres every day. These activities force them to spend seven hours every day, which reduces their time to devote to other activities, such as farming and education (International Energy Agency 2006).



Figure 13: Sale of charcoal along the road- Bié province



Figure 14: Average of firewood production per year

Source: (IDF 2011).

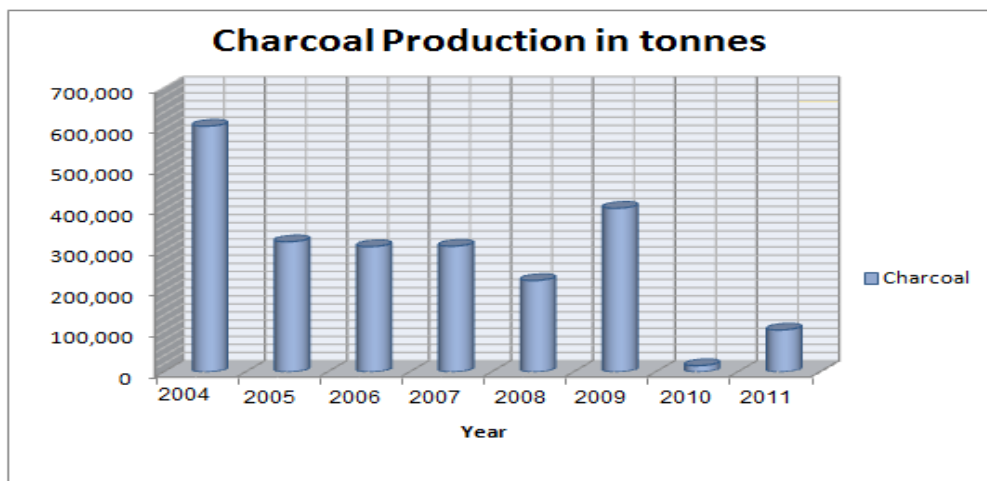


Figure 15: Average of charcoal production per year

Source: (IDF 2011).

The charcoal production is still an important source of income for many families in Angola. In Bié province, there are regions where the many activity of rural population is charcoal a firewood production (e.g. Chinguar, Andulo, and Kunhinga). That explains the higher levels of charcoal production as seen on **figure 17**. The annual average is estimated to be 5, 325 tonnes per year (IDF/Bié 2011).



Figure 16: Children collecting firewood in Angola

Photo: (Barry Ferguson)

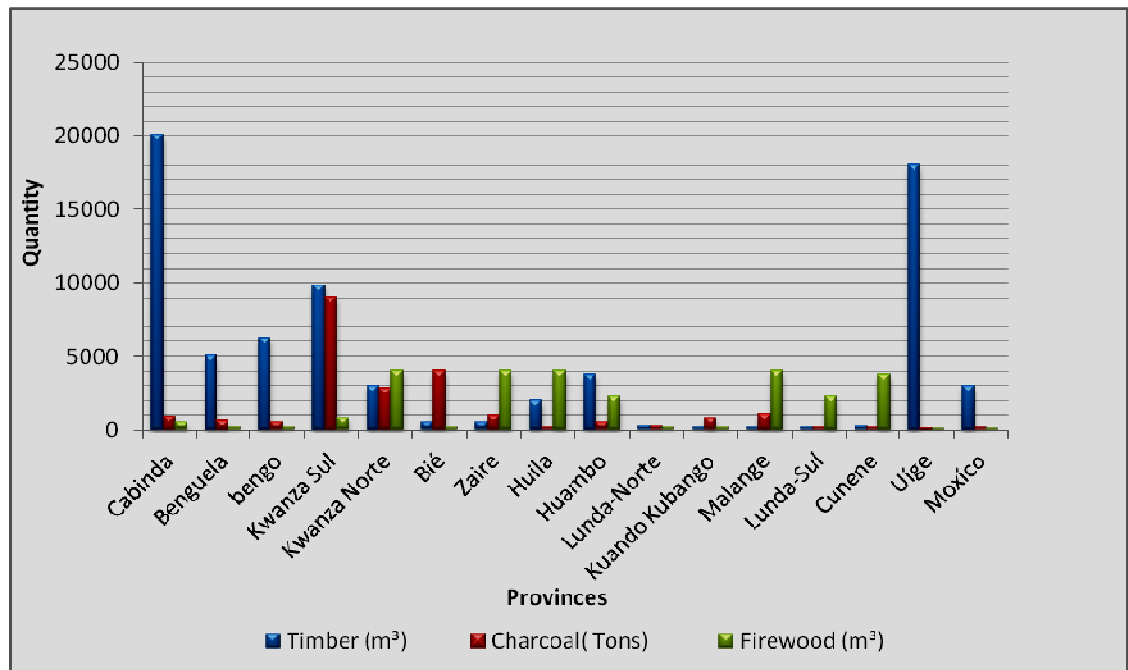


Figure 17: Production of forest products by provinces (IDF 2009).

4.8 Potential of forest resources

Angola has approximately 8,000 species of plants, from which 1,260 are endemic; 275 species of mammals from which 20 are endemic amphibians and 847 species of bird (FAO-FOSA 2001; MINUA 2006). The forest species with high economic value in Angola are; *Entandrophragma*, *Chorophora excelsa*, *Pterocarpus tinctorius*, *Combretodendrom africanum*, *Sarcocephalus diderichii*, *Millettia laurentii*, *Gossweilerodendron balsamiferum*, *Terminalia superba*, *Pterygopodium oxyphyllum*, *Albizia ssp*, *Celtis*, *Melia dubia*, *Pterocarpus angolensis*, *Guibourtia coleosperma*, *Entandrophragma ekebergioides*, *Brachystegia spiciformis* locally called “onduko”, *Brachystegia hockii* locally called “omanda”, (Diniz 1996; Gonçalves 2009).

Rodendron calsamiferum, *Terminalia superba* and mahogany are considered as the most important species for timber. By 1948 from 33,000 m³ of the total Angolan timber exports, 21,000 m³ were *Rodendron calsamiferum* and 8,000 m³ were *Terminalia superba* (FAO 1996 in Marçal 1972). Today these two species are considered as extinct.

Forestry industries which transformed raw timber into final products are closed and abandoned (FOSA 2001). They had played great importance in the economy of the country until 1974. Angola had about 104 sawmills, from which 27 were under the control of the Ministry of agriculture, the rest were controlled by the government and private sectors. They had been operating from 1976 to 1986 (FAO 2000) or up to 1992 (IDF 2011). There were also two (2) manufacturing units for plywood, one (1) manufacturing unit of matches, three (3) units of parquet production and one (1) paper industry.

People in general have some dependence on forests or forestry industry products such as timber and paper, yet other people rely heavily on forests for their livelihoods (FAO 1997). The capacity of forest industries to transform forest products into other forms is low.

The production of saw wood decreased from 10,045 m³ to 5,372 m³ per year (FAO-FOSA 2001). The two manufacturing units for plywood located in Luanda and Cabinda province had a productive capacity of 5,000 m³ of lumbers and 30 - 40 m³ of sawn wood. The paper industry located at Alto Catumbela in the central zone of Benguela had a production

capacity of 15,000 tons of paper per year. It controlled about 82,500 hectares from which 78,000 ha are *Eucalyptus saligma* and 4,500 of *Pinus sp.* It is paralysed since 1985 (FAO-FOSA 2001) or 1994 (IDF 2011).

Today, there exists only 20 sawmills including the new ones (IDF 2011). The annual wood production is under 20% of its annual extraction capacity, which makes 350-400 m³ per day. That is due to lack of wood and old equipments of exploration (FOSA 2001).

Angola considers also that all plants genetics resources are valuable. Another important tool to consider is the conservation of genes forest resources to avoid backward situations with regards situations like of many other developing countries that find their Plants Genetics Resources in foreign countries' genebanks where they have rights (FAO 1996).

4.9 The current state of forest in Angola

The 27 year of civil war in Angola left the forestry sector in almost complete disarray and with very many difficulties to the government to stabilise efforts to maintain the resources under control. Official statistics reported that Angola has between 23 million and 53 million hectares of forest corresponding to 18.5% or 43.3% (IDF 2006) of Angola surface. The discrepancy of statistical data is due to lack of knowledge concerning forest surface. Documents and reports that explain the actual state of forest do not make sense sometime; the same information has been used for over 30 year and has been inconsistent (Barbosa 1970; Diniz, 1998; FAO 2008; IDF 2008; IDF 2011). One figure has been used to describe the same situation in a different way. The data about the actual state of the Angolan forest size have been guessed (FAO 2008). The actual size of the forest is unknown. It is difficult to accept the actual data of how much forest exist and what happened over 30 year of war.

Angola lacks proper information about forestry resources. There is a need to know when and where it went wrong or went well with the forestry over the last 30 years. There is a scarcity of all kind of resources such administrative and personnel (FOSA 2001). The responsibility of forestry at Government level lies within the Institute for Forestry Development and the National Directorate of agriculture, livestock and forestry, both under the Ministry of Agriculture (FAO 2008). Actually the Angolan Government through the Ministry of agriculture with the support of New Partnership for African's Development

(NEPAD) and FAO initiated a project in 2006 to revitalise Angola's forestry sector, including a preparation of a national inventory of forests (FAO 2005; ANGOP 2010).

It's known that the war had very large impact on forest degradation as seen around Angolan forest. It is also evident that in other areas, forest may be kept untouched due to inaccessibility (FAO 2008). Angolan foresters have suggested that, the relevance of war impact on forests needs to be documented, specifically with researches that can truly show the specific areas where the war had bigger or less impact. Food Agriculture Organization of the United Nations (2008) believes that there are unsuitable conditions to characterise the actual state of forestry resources in Angola until the national Inventory will be done.

4.9.1 Management of forests in Angola

Forest management may probably be defined as the conservation and regeneration of the ecological resources of a forest while maintaining its productivity. The success of forest management depends primarily on the sustainability of timber productions (Brienen and Zuidema 2006). Forests are managed for multiple objectives; production of goods, soil protection, conservation of biodiversity, security of forest ecosystems, contribution to poverty alleviation and livelihood support (FAO 2010). It involves also the integration of the biological, social and economical aspects of the forest resource (FAO 2005). Sustainable management systems for tropical region require information on tree growth (Boot and Gullison 1995).

The history of forest management and silviculture in Angola as well as in other Africa countries was linked with European colonisation in late nineteenth century. It altered the face of the great Central African forests. European settlers developed the cultivation of many plantations as oil palm, rubber, and eucalypts, which required management. The African forestry policy orientations and concerns sometimes tend to converge, especially for issues of environmental protection and forest conservation (FAO 2002).

Generally, in Angola, the national law stipulates that all natural forest, private or owned belongs to the state (IDF, 2011) but also in common view the same forests are properties of the members of various tribal lineages. Usually the responsibility of management and forestry administration is up to the state. Angola has been considered as the only country

in sub-Saharan regions that still lacks a forest law and an appropriate legal framework (FAO 2002). According to Angolan legislation promulgated in 1992 (Law 21-c/92, the land law), natural forest cannot be held privately, except for small designated as agricultural and pastoral areas. Most of Angola's environmental policies and forestry law were adapted from other countries and based on colonial-era legislation (Russo et al. 2003). FAO (1996) reported that conservation and management of forest ecosystems in Angola is a moral responsibility to future generations. The forestry sector in Angola does not have at now a clear policy for forest management. Neither does it have financial and human resources for their maintenance and rehabilitation. This is not only an Angolan problem but the all miombo regions.

4.10 Economic aspects of forestry in Angola

The forestry sector in Angola has a mandate to satisfy the basic needs of the population in terms of wood, forest products and services which contribute to the socio-economic life of the nation (FOSA 2001). The socio-economic aspects of forest products in Angola (e.g. medicines plants, wild fruits, mushroom, honey, tannin etc.) are almost unknown (FAO 2008). It is reported that the contribution of the forest sector to the economy of the country is low. The indirect contributions in terms of services provided by IDF (i.e. soil, water conservation and water quality and biodiversity conservation) are not easy to measure. The forestry sector in Angola is totally dependent on the government. All programs concerning forest management, natural resources and investments are decided by the Government through intermediate of IDF.

Government capacity to support all investment in forestry sector is limited because of other emergency programs. Now the only way that remains for the Government, is to create incentives to attract the foreign investors to invest in Angola (Cavallo and Daude 2011). Nevertheless the difficult business environment, corruption and underdeveloped financial system within the country interfere in all investments (Rosenn 1997; Nascimento 2012; US Dept. of State 2010).

Angola exports timber, log wood, wood veneer and plywood to various countries such as: Portugal, Italy, France, USA, China, Bahamas, Slovenia, German, India, Namibia, Hong-Kong, Turkey, Netherland, Spain, Thailand, South Africa and Holland (IDF reports 2007 - 2010). The annual average of exported timber is about 12,000 m³. The Cabinda sawmills has

an annual export capacity of 10,000 m³ with the possibilities to enlarge to 20 – 30,000 m³ of timber (FOSA 2001). A quarter of Angolan exports are shipped to China, half to the United States of America and about 20% to European Union percent (Manyoni 2008).

On the import side, Angola buys almost all goods from abroad, even things that the country has a potential comparative advantage in itself production (DTIS 2005). Angola imports wood and forest products from Europe, China and other African neighbours' countries like Namibia and South Africa. Portugal was leading the trade import in Angola, however in the last period it seems like China is taking over the control of all imports (Manyoni 2008).

5. RESULTS

5.1 Historic and present data of forestry resources in Angola

The attempt to review the definition of the term forest, found that it has been actually defined as a minimum area of 0.05 ha with trees cover of at least 10% of canopy and 5 metres high minimum (Cadman 2008; FAO 2010). There was found 650 definitions of forest which include plantations (rubber, bamboo, palm, etc.) and 100 definitions with exclusion of plantations. The international standards to define forest into Kyoto protocol do not satisfy the expectations of other countries, it causes win and loses situations. For some African countries (Cameron and Central African Republic) changes of forest definition affect the normal life of rural population due to their cultural reasons. Angola defines its forest according the standards established in FAO parameters.

The history of natural forest in Angola has not been reported since 1975. There are few documents found concerning the history of forest in Angola. These documents refer only to plantations of *Eucalyptus* and *Pinus* (**Table 1**) which were introduced in 1930 by Portuguese settlers for pulpwood purposes and wood fuel for locomotive machines.

Table 1: Properties and surface of forest plantations

Species	Owner	Surface (ha)
<i>Eucalyptus sp.</i>	CCB, CCPA, State	128, 000
<i>Pinus patula</i>	CCPA, State	18, 000
<i>Cupressus sp.</i>	CCPA, State	4, 000

Keys: CCB- Benguela Railway Company; CCPA- Cellulose and Paper Angolan Company.

The natural forests have been divided into seven categories from which, the major surface is covered by miombo (45.2% of forest surface) **Figure 18**. The typical and important species in that habit are *Guibourtia coleosperma* locally called “mussibi”, *Azelia cuanzensis* “ovala or muvala”, *Brachystegia spiciformi* “Omanda”, *Julbernardia panoculata*, *Copaifera baumiana* and *Marquesia macroura* “muvuca” (FAO 1996). In the other hand the surface of

mangroves in Angola is estimated to be 1, 250 km² and are located in the estuary of the Lubinda River, Cabinda and estuary of Zaire. The common species are *Rhizophora racemosa* and *Rhizophora mangle* which are in state of extinction due to the oil that has been spilled on the water by Oil Companies operating in Angola

Table 2: Extension of forests in Angola

Variable	Surface (ha)	Source
Natural forests	28-53 million	Barbosa 1970; IDF 2006
Forest plantations	148, 000	FAO 2002

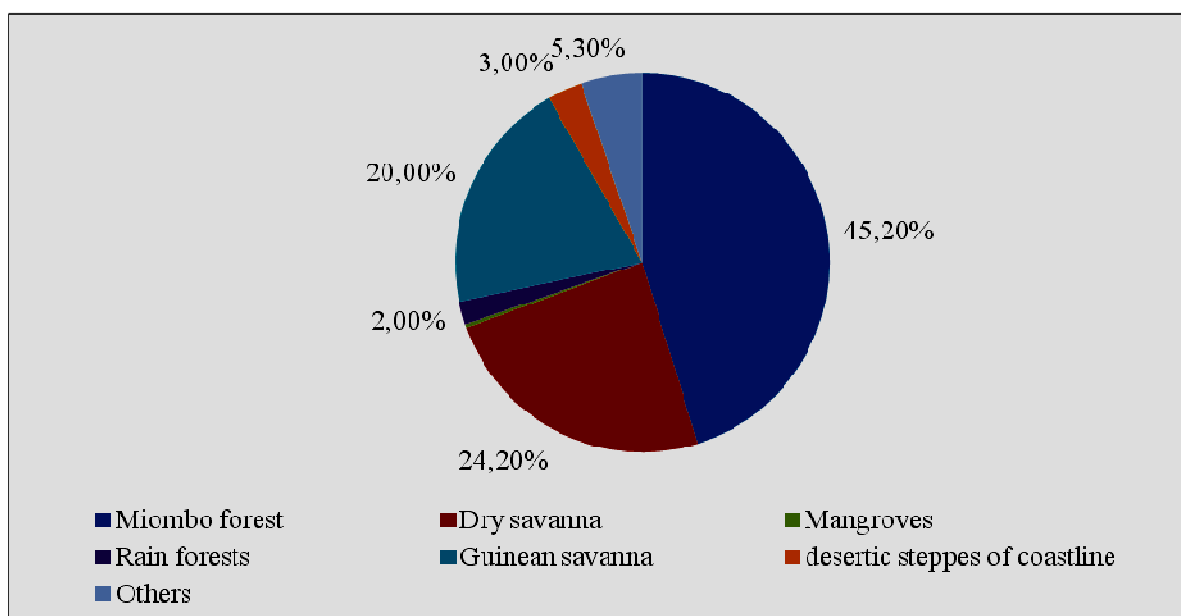


Figure 18: Displays distribution of natural forests according to IDF (2011), regarding to total area of forest surface in Angola.

The flora of Angola is rich in natural resources. There are found important species (Table 3) like *Commobretodendron africanun* (used for timber production) and *Ceiba pentane* (used for boat construction).

Table 3: Forest species with economic value in Angola

Scientific name	Local name	Use	Source
<i>Commobretodendron africanun</i>	Pau rosa	T.p	Diniz 1996
<i>Brachystegia hockii</i>	Omanda	Ch.p and fi.p.	Gonsalves 2009
<i>Ceiba pentana</i>	Mussibi	T.p-boat	
<i>Bombax angolense</i>		T.p	
<i>Dalbergia sp.</i>		Ch.p	
<i>Erythropheum africanum</i>		Ch.p	
<i>Afxelia cuazensis</i>	Uvala/muvale	Sap.	Fritz Horeste 1983
<i>Pterocarpus angolensis</i>	Mako	T.p	
<i>Rodendrom calsamiferum</i>		T.p	FAO 1996
<i>Terminalia superba</i>		T.p	
<i>Hyphaema luandenis</i>		Basket and mat weaving	

Keys; T.p – Timber production; Ch.p – Charcoal production; fi.p. – Firewood production; Sap. – Saponification.

The research found that, Angola has a capacity to produce 326,000 m³ of timber per year from Angolan natural forests and 850,000 m³ from forest plantations (IDF 2011; FAO 2000). Anyhow, the actual timber production is low and estimated to be 77,126 m³ per year. The center of timber production in the country is dominated by the provinces of North part (Cabinda, Kwanza Norte, Bengo and Uíge). The price of timber in the market varies from Province to Province. In Cabinda province it was found around 80 to 200 USD per m³ due to higher port fees paid for transportation.

The wood industries which transform raw material into final products work limitedly. From 104 sawmills only 20 sawmills are operating, with an annual production under 20% of its capacity. Others are paralysed since 1992.

Since 1975, the timber has been poorly extracted due to the lack of technology for its exploration. Species like *Rodendrom calsamiferum*, *Terminalia superba* and mahogany were intensively explored before the independence of Angola due to the wood quality and demand

of these species in that period. The timber exploitation was a rentable activity in that period; it constituted the major activity for export. Actually timber the export was estimated to be 12,000 m³ per year. Before the independence of Angola, just the specie *Rodendron calsamiferum* constituted around 21,000 m³ of exports and 8,000 m³ were *Terminalia superba* (FAO 1996).

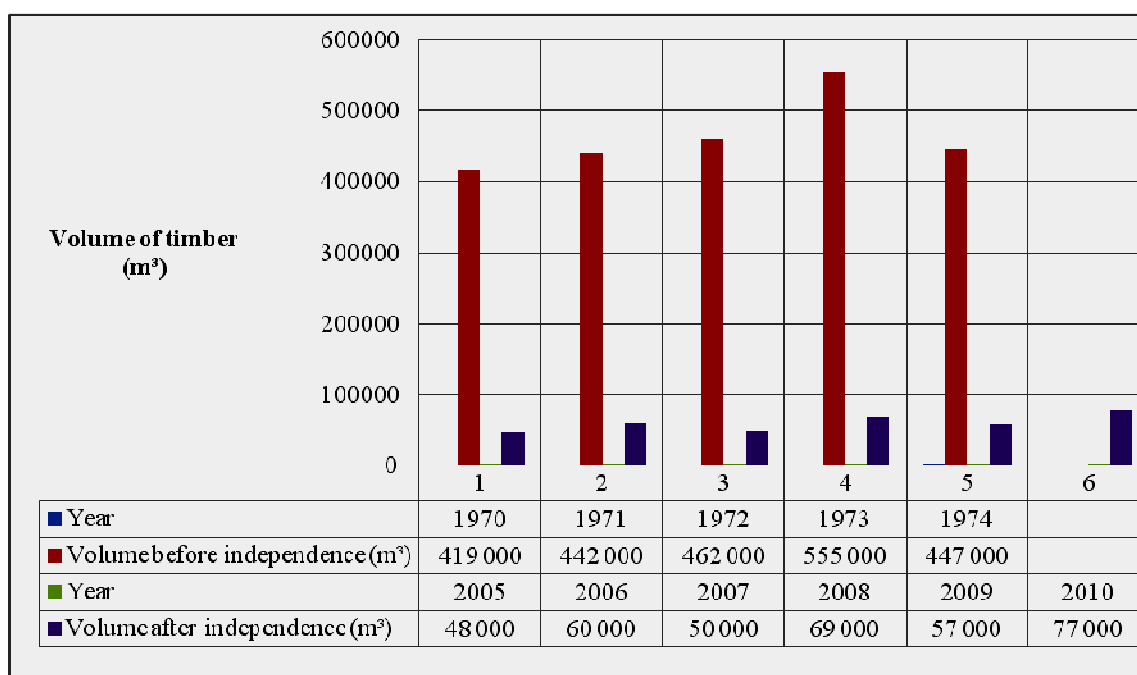


Figure 19: Comparison of timber production before and after the independence of Angola

5.2 Rate of deforestation in Angola with regard to charcoal production

Actually the charcoal, constitute the major forest product exploited in Angola. This activity has increased the tempo of deforestation in the country. Moreover, there was not found any study done to determine how much charcoal production affects the deforestation.

The deforestation rate of Angolan woodland is badly estimated. The deforestation rate in Angola grows with the enlargement of charcoal and firewood production since 1975. It has been produced around 253,104 tones of charcoal and 50,180 bundles (**1 tone of charcoal= 7 bundles**) of firewood yearly (IDF 2011). Provinces like Luanda, Benguela, Kwanza Sul, Huila, Huambo, Cunene and Bié were found with higher levels of deforestation.

Table 4: Deforestation rate regarding to the year of estimation

Deforestation rate (%)	Year of estimation	Source
0.2	1990 – 2000	FAO-FRA 2000; IDF 2011
0.21	2000 – 2005	FAO-FRA 2006
0.4	-*	MINADER 2011
2.6 – 6.9	-*	Cabral at all 2010

(-*) It was not mentioned the year it was done

Before the independence of Angola, the charcoal production was not considered as a business activity. The charcoal produced in that period was used only for domestic purposes. Today the amount of charcoal produced is about three 10 – 11 times higher (**Figure 20**).

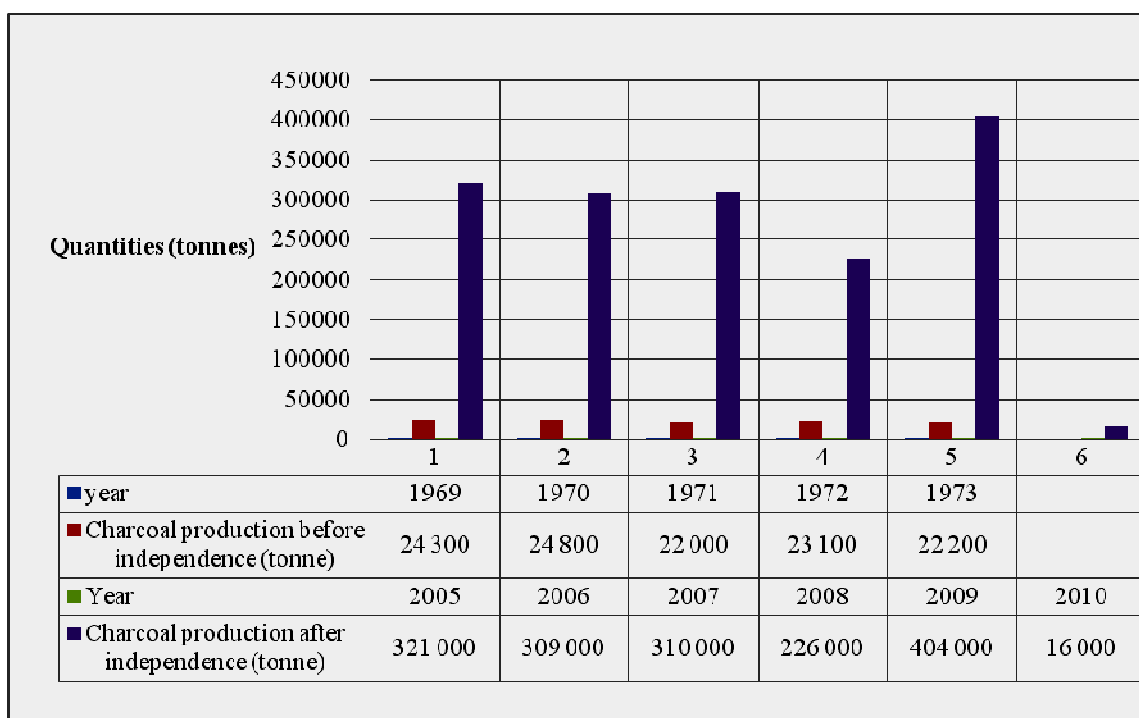


Figure 20: Comparison of charcoal production before and after the independence of Angola.

The increase and decrease of charcoal or timber production, relate to the number of licenses issued each year. The reduction of them can reduce the production of charcoal as it was showed in 2010 (**Figure 21**).

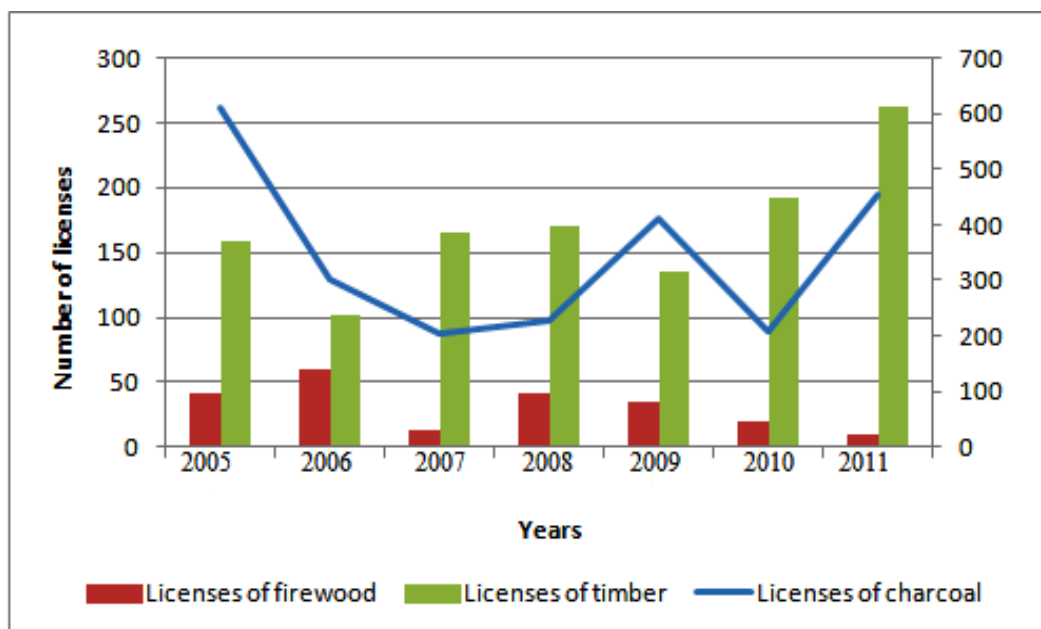


Figure 21: Licenses for exploring forest resources

5.3 Survey results

The survey was conducted in Bie province with the objective to find out if the charcoal production affect the speed of deforestation. We found that majority of respondents (71%) rely on charcoal to satisfy their basic energy needs. They produce charcoal for two purposes: 68.75% for household (to cook their food) and 31.25% for trade (a specific people called “Carvoeiros” engaged in selling charcoal).

The charcoal and firewood production in Bié province is not related to a specific age or gender. Even children are working on its production. The general average age of the respondents was 45 years old and 47 for those who produce charcoal specifically for trade.

The attempt of survey to find if there is a relationship between the age of respondents and quantity; of charcoal produced did not permit to show significant differences on the results (**Table 5**). The risk of error (probability of type I error) was always considerably higher than 0.05% (it was 46.6% for age, 28.7% for quantity and 79.2% for the distance). The quantity of charcoal and the distance from where it’s produced, do not relate whether charcoal is produced for household or business. Using the program STATISTICA (Wilcox test) to process the same data presented, similar results concerning the age, distance and quantity were found (the risk of error was 32.5% for age, 44.5% for quantity and 81.7% for the distance). Only the price showed significant relationship on distance in both calculations with risk of error below 10 % (9.8% and 8.3%) and not with a risk of 5% as is common in statistical surveys.

However, there was a significant difference between the amounts of charcoal produced with regards to the purposes. Around 9 to 10 bags is the amount average that one producer “Carvoeiros” can produce per week. This represents only the amount produced for trade. In the other the results of Kendal and spearman correlation (**Table 5**) show the tendency that the prices of charcoal increase with the distance.

Table 5: Correlation between price of charcoal and distance

Variable	Kendal correlation (τ)	Spearman correlation (r)	Mann-Whitney U test
Price and distance	0.161	0.229	0.031

Note: (1) Kendall's coefficient τ (0.161) the degree of a relationship tends to decrease; (2) Spearman r (0.229) weak linear relationship (based on Buxton 2008).

The survey identify that the price of charcoal and firewood are higher in the capital city (Kuito) of Bié Province where the maximum was estimated to be 1,300 Kwanzas (13 USD), per bag for charcoal and 1,200 Kwanzas (12 USD) per bundle for firewood. Majority of respondents who sell charcoal in the market (Chisindo) in province of Bié do not produce it. They buy it from the charcoal makers called “Carvoeiros” and then resale it at higher prices.

The difference of the prices of charcoal, timber and firewood in capital city (Kuito) are twice expensive compared to other localities (**Table 6**).

Table 6: Differences on average prices of forest products regarding localities

Locality	Price of charcoal (Kwanzas ¹ per bag ²)	Price of firewood (Kwanza per bundle)	Price of timber (Kwanza per plank ³)
Kuito	1,185	625	1,195
Kamacupa	750	275	325
Katabola	595	165	250
General average	1,028	546	930

(1) 1 USD = 95.9 Kwanzas¹; (2); 1 Bag of charcoal measure 30-35 kg; (3); 1 Plank has 3 metre high and 60-65 cm diameter.

On average, the charcoal production for both group (for business and household) was 6 bags per week. It is transported by bicycles. The bicycles are the more used means for charcoal transportation (**Appendix 3**). On one bicycle the producers are able to carry 4 to 5

¹ http://pt.coinmill.com/AOA_USD.html 06.04.2013)

bags (of about 180 kg in total) and walk 4 to 6 hour in average to get the town. Just minor group of respondent (14.5 %) mentioned the possibility to hire a car to help them with transportation. In other cases they preferable to sale it along the road than to spend a lot of time using bicycles.

Independently of the distance where the charcoal is produced, the respondents certify that *Brachystegia* sp is the more preferred species for charcoal production (**Figure 22**). However, *Eucalyptus*, *Pinus* and *Grevillha* are used for timber and firewood. Either rain or dry seasons do not have influence on charcoal production. Charcoal has been produced in any season of the year. Evidences of deforestation were found in the areas where the charcoal has been produced with more regards in areas closer to the capital city (Kuito). However this phenomenon differs from forest to forest. Today it is no possible to find natural forests with trees of more than 3 meters high in the regions closer to the capital.

There was also a problem concerning the species used for charcoal production. In some areas (Katabola) population are used also fruit trees to produce charcoal due to shortage of the *Brachystegias* sp.

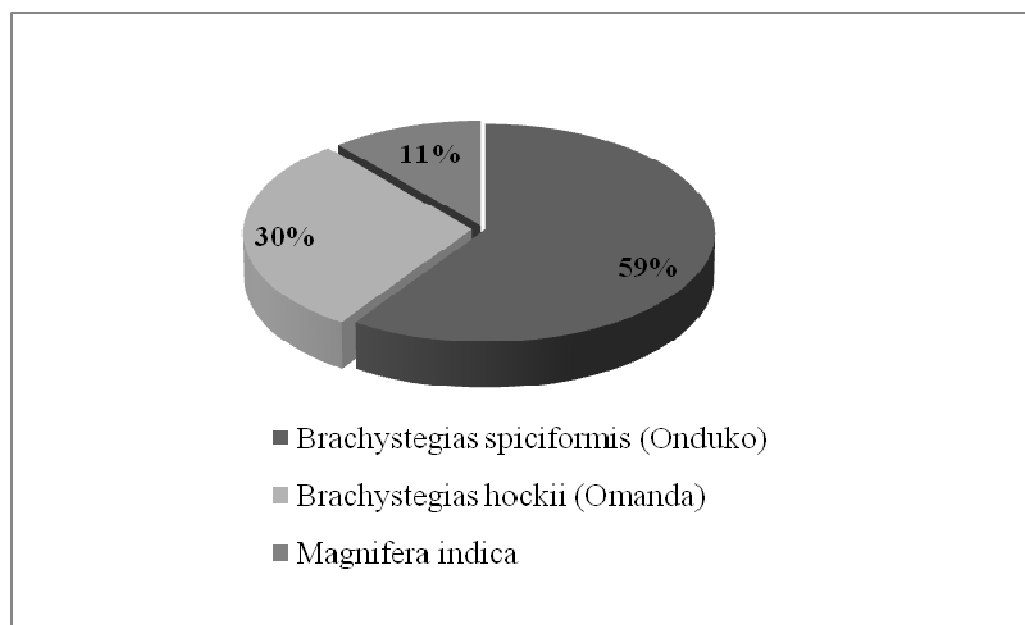


Figure 22: Forest species used for charcoal production in Bie

6. DISCUSSION

While other nations world wide seized opportunity upon national independence and self-determination as appropriate tool to control their natural resources, Angola decided to explore it without any management since 1975. After the independence of Angola the forestry sector was forgotten. No studies have been conducted in this area. Historic reports concerning forest resources started to be documented in 1930, when eucalypts and other plantations were introduced in the country (Matas and Pukalala 2011). These documents or reports are not in disposition of Angolan institutions.

The few historic data available, when compared with the actual ones do not illustrate a clear perception and does not show coherence at all. One image (**Figure 2**) or map has been used for over 30 years to illustrate different characteristics of Angolan vegetations. The institute responsible for forestry at government level created in 1986 (MINUA 2006) lacks organisation capacity on data collection (Zola 1999) of what happened before and after the independence.

For example, comparison of how forest resources were explored before and after the independence of Angola, showed interesting perception. In the period before the independence of Angola, the production of timber was an extremely lucrative business. The amount of timber produced was about 500,000 m³ (**Figure 19**) and part of it was exported to Portugal and other countries. Actually, the amount of timber produced in Angola is about 77,126 m³ (IDF 2011) which makes a deficit of 422,874 m³ if compared with the period before independence. Today the imports of timber are superior to exports in the country. If the country has a deficit of 422,874 m³ of timber production, how come it is still exporting 12,000 m³ of timber yearly (IDF 2010)? According to a classic opinion of economics, a country should only export the products they produce in enough quantity and import those products that the country cannot or produce in insufficient quantity.

On the other hand, the charcoal production increased after the independence (**Figure 20**) due to the increase of the population rate. It is important to remember that one of the hypotheses of this paper was to find out the changes on utilisation and exploration of forest

resources before and after the independence. It is clearly seen from the **figure 19** that charcoal production was not a business activity before the independence if compared with the actual situation.

Charcoal production is an important activity which generates income for about 80% (IEA 2006) or 60 % (IDF 2011) of rural population. It also speeds up the rate deforestation in Angola. The actual amount of charcoal (253,104 tonnes per year) produced does not illustrate the actual situation concerning charcoal production. There is no control of charcoal production in the country. Majority of charcoal makers “Carvoeiros” explore illegally so they do not report the production to anyone.

Assuming that the deforestation rate of Angola has to be 0.2% per year; it means that yearly Angola loses about 106,000 ha of forest surface. If this amount is multiplied by 30 years, meaning from the period between 1970 when the first forestry inventory was done and up to 2000 when the 0.2% was reported, Angola should have 49,820,000 ha of forest surface and not 53,000,000 ha as it has been reported.

With the objective of comparing the value obtained in **table 4**, the study found a mess on estimation of deforestation rate in Angola. The statistics data available do not illustrate a clear understanding. Certainly, the difference between the data is due to the specific criteria used in the estimation process. For example the data concerning deforestation from FAO are obtained from information provided by each country and different sources like: forest inventory, national surveys (the 0.2% for Angola was obtained from a national survey done in 1983 (Cabral 2010)) and expert opinions. On the other hand, the deforestation rate (2.66 – 6.9 %) estimated by Cabral (2010) was obtained from the sequence of global land cover maps which, correspond to areas with a tree cover greater than 10%. However, it is also inappropriate to accept that the higher level of 2.66 – 6.9 is true, because some forests remained untouched during the war period. It is believed that the statistics may be right but from the way the data have been reported, it is difficult to find coherence on them.

In opposition, the tendency of reforestation should compensate the forest degradation. The causes of deforestation in Angola are various. There is a tendency to mention the war and poverty as causes of deforestation. However there is no particular study done to prove the

impact of the war on forest degradation. War and poverty are just a stage that forces people to explore forest resources to meet their energy needs.

People living around miombo forests depend on the forest resources available. Miombo and savannah are the main vegetation types in Angola which together constitute about 80 % of Angolan forest surface (**Figure 18**). In these regions people found the source of survival during the conflict period. They collected medicine plants, honey, bush meat, mushroom, firewood and charcoal. Today the major problem of these Angolan woodlands is a lack of management and a need of new agricultural land which lead people to cut and burn forests to acquire cultivation land.

Forestry as a science in Bié province (Angola) has been ignored. Local population thinks that natural forests may grow itself without any management. The charcoal production constitutes an activity which moves children, women and men to the forest. The actual amount of charcoal production in that Province is estimated to be 5,325 tonnes (IDF/Bié 2011). People spend a lot of hours on this activity; some do it for trade, other just to meet their energy needs. It diminishes their time to devote to other activities like education.

The reason we conducted a survey in Bié province was to find out if the charcoal production relate with the high percentage of deforested areas. The survey covered the collection of other forest products like timber and firewood including the non forest products. This was of particular importance because no study has been done concerning deforestation in that region of Angola. It offers an overview of the ins and outs of forestry in Bié. The commercialisation of charcoal in Bié depends on the distance from where charcoal has been produced. The distance from Kuito to Katabola (Bié province) is about 60 km and the difference on price between these two municipalities is about 589 Kwanzas (**Table 6**) which is approximately 6 USD per bag.

Our finding that majority of people who sell charcoal in the market do not produce it, proved that the charcoal makers who have to carry 4 to 5 bag of charcoal on bicycles are not getting benefit from charcoal production. Those who resell charcoal in the market are the ones getting benefit from it. The money they (charcoal makers) got from charcoal is spent buying goods like cooking oil, rice, salt and soap to sustain their families. Then they go back to their

villages with less money or empty pockets. By the end of the day, charcoal production is not a rentable activity that people wish to do; however, they only do it because of poverty.

The result of this study does not estimate the rate of deforested area in Bié due to a limited questionnaire survey used. Nevertheless it reflects the evidence of deforestation in that region. Our study compared with Cabral at all (2010) done in Huambo Province but with different criteria used, found a similar component concerning the species (*Brachystegia sp*) preferred for charcoal production. It has also found similarity with the study of Trefil (2003) done in Nequilo village (Kuito/ Bié), on issues concerning transport and commercialisation of charcoal in Chissindo market.

The demand for charcoal production in Bié is higher and the government cannot manage strategies to stop it, until alternatives sources are found to supply the actual energy needs. The local authority are preoccupied because larges hectares of forests disappear every day. The worry is about the increase of deforestation rate than its causes. The causes of deforestation are well known but actions to stop or reduce it, takes a lot of time to be dedicated.

Our findings suggest that the impact of charcoal production on environment should be studied and calculated because in the last 5 year, the rhythm of deforestation has increased due to charcoal production. In Bié, no matter in which direction you use when going out of the town, large deforested areas are seen along the road.

The actual methods at government level to prevent the charcoal production in Angola do not appear to work. The government through IDF, authorise licenses for charcoal production and others forest products. These licenses are renewable each year. However, the reduction of these licenses can relatively reduce the charcoal production in the country as it was seen in 2010 (**figure 20 and 21**). Contrarily the authorisation to explore a certain product for market concern may increase the demand of this product on the international market (Barth 2010) and open the vision of the charcoal makers “Carvoeiros” to get more money from selling charcoal.

7. CONCLUSION

Information concerning forest resources in Angola is difficult to be found or almost nonexistent. The few available sources are found in foreigner countries and written in foreigner languages (English, French, German, Czech, Slovak and Russian) which Angolan population do not understand or have no access.

This work does not bring the solution of the problems reviewed in this thesis. However, it gives the overview of the main problem of deforestation and show possible way for its solution. It contributes in enriching the information of forestry resources particularly in Bié Province.

The weakest point concerning forestry resources in Angola is the lack of qualified foresters. There is no training institution or high schools delivering forest education. Without well qualified people, who can apply better management, the forests may become little more than a bush or agriculture land. If higher paying careers continue to attract the best students, there will not only be a shortage of forest resources, but the teachers and students available will not have proper qualifications. This means that Angola will be forced to import forestry products in which they have potential advantage and the future generation will suffer

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9. ANNEXES

Appendix 1: Questionnaire directed to farmers and sellers of charcoal

Locality _____

Nome _____

Age _____

Sex _____

1. Except of you being farmer, do you collect also charcoal and charcoal?

Yes

Not

Sometime

Other _____

2. What are the products do you usually get from forests?

Charcoal

Firewood

Mushroom

Others _____

3. How far do you go to collect charcoal and firewood?

1-3 hours

3-5 hours

5-7 hours

Others _____

4. Why do you collect charcoal and firewood?

Cooking food

For sale

Construction of house

Others _____

5. How much do you sale the firewood (kg, m³)?

6. How much do you sale the charcoal (kg, tons)?

7. What are the species do explore for firewood and charcoal production?

8. Did you ever note any signal of deforestation in the area where you produce charcoal?

- Yes
- Not
- Sometime
- Others _____

9. Do you cut fruit trees for charcoal production?

- Yes
- Not
- Sometime
- Other _____

10. What are the means of transport do you use for charcoal and firewood collection?

- Car
- Motorcycle
- Bicycle
- Others _____

11. How much of firewood can you sale per day or per week

12. How often do you collect firewood?

- Once per week
- Twice per week
- Once per month
- Twice per week
- Others _____

13. Which season is more profitable for firewood and charcoal production?

- Rain season
- Dry season
- Both
- Others _____

14. How much of charcoal can you see per day/week/month?

15. How much do you sale the timber?

16. Who the forest belong to?

- State
- Farmers
- Village
- Others _____

17. What species were forbidden to explore during the colonial period?

18. How often do you sale the charcoal?

- Every day
- Every day expect Saturday
- Twice per week
- Others _____

19. What are the species more explored for firewood?

- Eucalypt
- Cedar
- Grevilha
- Others _____

20. What are the species do you normally explore today?

21. Do you collect also medicinal plants from the forest?

- Yes
- Not
- Sometime
- Other _____

a) If yes. What are them?

22. What are the zones of timber exploration in Bié?

23. Where do you collect or explore firewood and charcoal?

Appendix 2: Questionnaire directed to the Institute for Forest Development

Locality _____

Date _____

Gender _____

1. Does the IDF have some data of how many hectares of natural forest exist in Bié?

2. How much of timber the Province is able to produce per year?

3. How many hectares of the following species the Province has?

- Eucalyptus _____
 - Pinus _____
 - Grevilha _____
 - Others _____
-

4. What are the explored forest resources?

- Wood
 - Firewood
 - Charcoal
 - Othes _____
-

5. Is there a plan to explore forest products

- Yes
 - Not
 - Maybe
 - Othes _____
-

6. Who is dedicating more on charcoal and firewood production?

- Woman
 - Man
 - Child
 - Others _____
-

7. How the local government die with timber and charcoal production?

8. How many company explore timber in Bié

9. How do you estimate the rate of deforestation?

10. How many forestry Engineer the IDF has actually?



Appendix 3: Transport of charcoal in Bié Province (Angola)

Photo: (Trefil 2003)



Appendix 4: Timber exploration in Uíge Province (Angola)

Photo: (IDF. http://idf.co.ao/Ver_Foto.aspx?id=8)