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CHAPTER 5

CONTRIBUTION OF WOODFUEL TO MEET THE ENERGY NEEDS OF THE POPULATION OF CENTRAL AFRICA: PROSPECTS FOR SUSTAINABLE MANAGEMENT OF AVAILABLE RESOURCES

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Introduction

Fuelwood and charcoal represent 90 % of all wood removal from forests in Africa and a third of the global woodfuel production (FAO, 2011a). Woodfuel serves foremost as cooking energy for households in the absence of accessible and affordable alternative energies. While in the past, issues related to overharvesting of woodfuel have mostly been a concern to Saharan savanna forests, they now need to be assessed for humid areas, such as the Congo Basin forests, especially around urban areas with increasing demand (Marien, 2009).

Woodfuel and the associated sustainability issues have the potential to be perceived from two opposing viewpoints: woodfuel is a cause for deforestation and degradation, or it is a promising renewable energy source. The extent to which production causes negative impacts on the natural resource base depends on the quantities and types of wood that are being harvested, the type of ecosystem, production characteristics and the accessibility of the area (Sizer *et al.*, 2005; Arnold *et al.*, 2006). In Central Africa, the supply of fuelwood and charcoal is often linked to shifting agriculture by a producer or landowner to the point where high demand is attracting producers to cut fresh wood for the sole purpose of woodfuel production. In abundant forest areas, producers seek and select specific species that produce high quality charcoal. Other sources for woodfuel include tree-plantations and wastewood from timber processing companies, which is transformed into charcoal or wood chips. The woodfuel sector is associated with forest resource decrease and increasing prices in areas of high demand. Also, health problems, mainly respiratory diseases, frequently occur with women and children (Smith, 2006; Marien, 2009). On the positive side, the sector provides energy and income generating activities for a large number of people; an esti-



Photo 5.1: Charcoal being transported to market in Kinshasa

mated 83 % of the population in Sub-Sahara Africa uses woodfuel for cooking (Daurella & Foster, 2009). The access to alternative fuels, the prices of these fuels and household income can be determinant factors affecting the quantities of woodfuel consumed (Chambwera & Folmer, 2007; Ouédraogo, 2007). It is thus imperative to look at the driving forces of woodfuel exploitation and its impacts for households at both producer and consumer sites in order to take appropriate actions that can reconcile environmental and livelihood needs (Schure *et al.*, 2009).

This chapter provides an overview of the woodfuel sector in the Congo Basin countries, with a special emphasis on those areas where the exploitation of woodfuel poses threats to the sustainability of the resource base and to the livelihoods of those depending on it. With regard to the fact that little data exist, this chapter draws upon information from recent studies to present an overview of the knowledge base in 2010²⁸. It also provides a review of possible or already implemented management options and how these can help to resolve some of the problems associated with woodfuel production and consumption in the Congo Basin.

²⁸ FAO estimates about national woodfuel production were referred to for those countries with no other available data.
Wood density: 1 m³ = 0.725 tons (FAO, 2011b).

Status of wood energy in Congo Basin countries

There are large differences between the various Congo Basin countries when it comes to total woodfuel consumption (figure 5.1), from 138,000 tons in Equatorial Guinea to 54.7 million tons in the Democratic Republic of Congo (DRC). In Gabon, woodfuel only represents 24 % of all wood removal, whereas in DRC it

accounts for 94 % of total round wood production (figure 5.2). Variations between countries can in part be explained by the number of inhabitants and by the availability of alternative types of energy as shown in figure 5.3 for Cameroon, the Republic of Congo and Gabon.

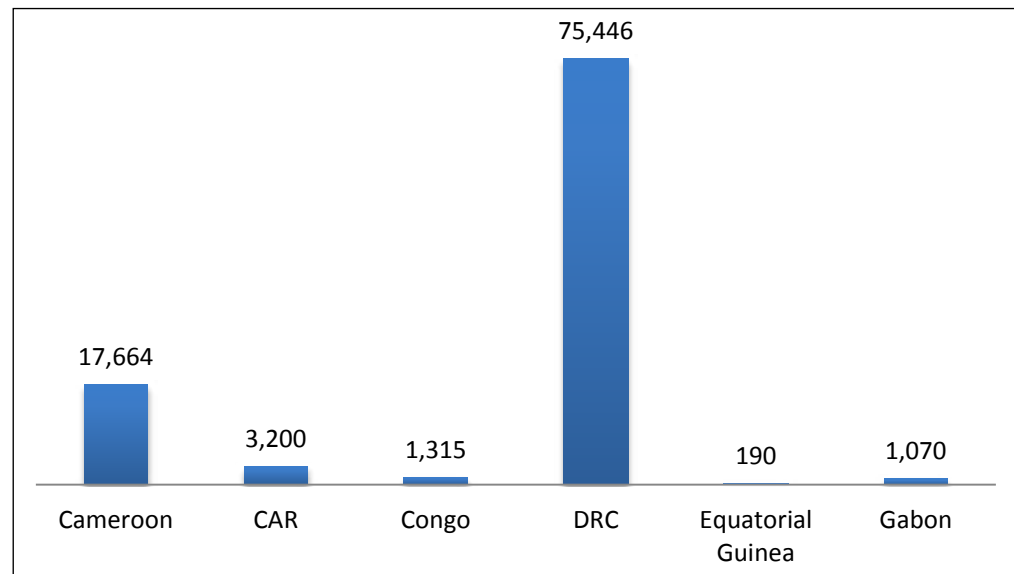


Figure 5.1: Woodfuel production in the Congo Basin countries in 2009 (thousands m³)

Sources: FAO, 2011b; Yuntewi, 2008; Drigo, 2009; Ministère de l'Énergie et de l'Eau, 2009-2010

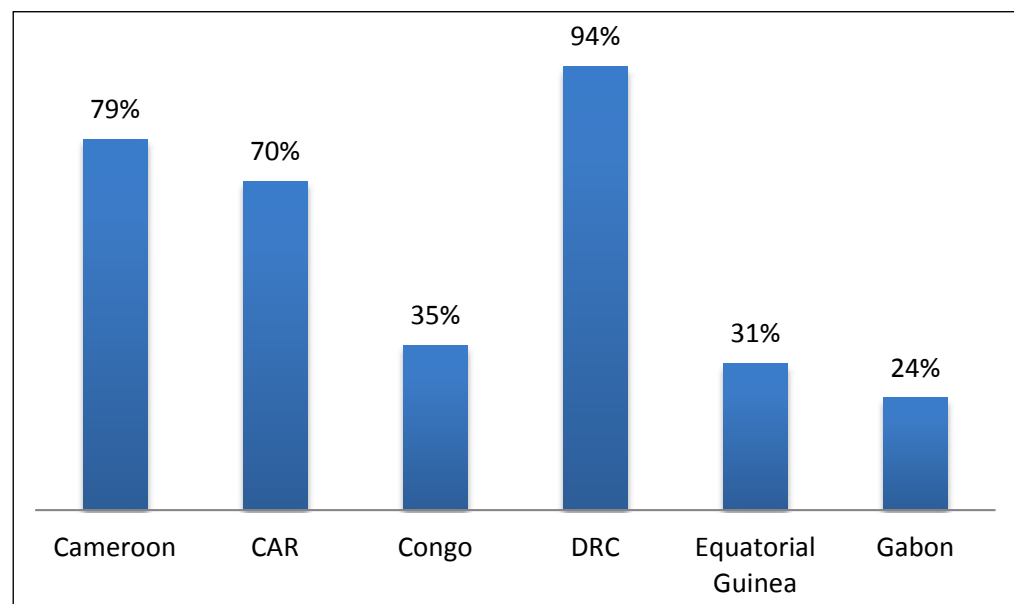


Figure 5.2: Woodfuel production out of total national round wood production in 2009 (%)

Source: FAO, 2011b

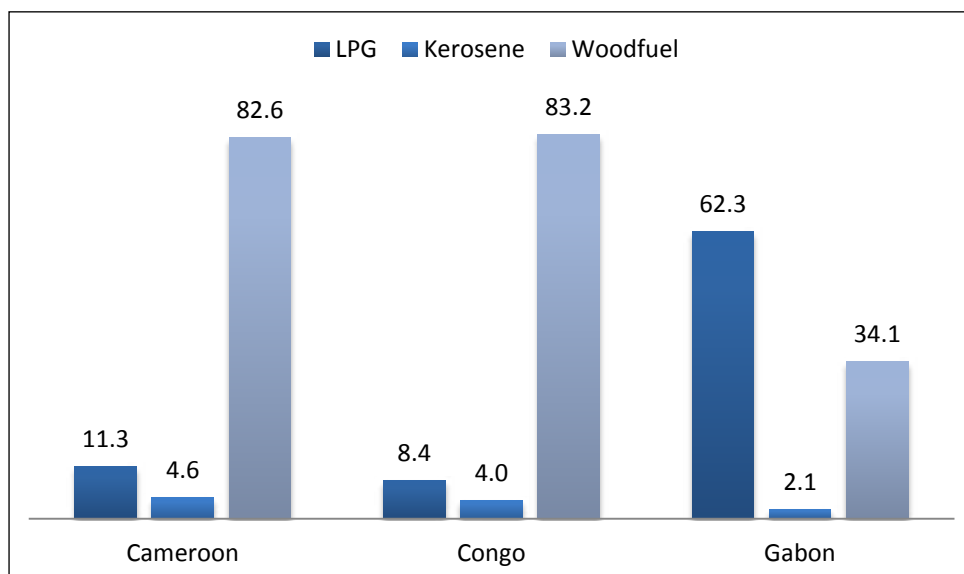


Figure 5.3: Part of the population using LPG, kerosene and woodfuel as their main cooking fuel in Cameroon, Congo and Gabon (%)

Source: Daurella & Foster, 2009

The following case studies provide further insights on the woodfuel sector, its production and consumption patterns as well as opportunities for

management of the sector, in five Congo Basin countries: Central African Republic (CAR), Cameroon, DRC, Gabon and Republic of Congo²⁹.

Central African Republic

In 2009, national consumption of woodfuel in the CAR totalled about 2.3 million tons of wood (3.2 million m³)³⁰. In Bangui, the capital city where 25 % of the total population of the country lives (i.e., roughly the 50 % of urban population), and its immediate surroundings, the estimated consumption in 2002 was above 430,000 tons per year (Drigo, 2009). It is estimated to have grown to over 520,000 tons (717,000 m³) by 2010.

The most common supply system in rural CAR is the direct daily or periodic collection of fuelwood by women and children in areas surrounding households, while the commercial fuelwood and charcoal production is limited to Bangui and a few other urban areas and goes largely unrecorded. The Ministry of Waters, Forests, Hunting and Fishing of CAR estimates that in the supply zone of Bangui the wood energy sector employs some 22,650 people (15,000 producers, 3,400 transporters and 4,250 retailers). Fuelwood is by far the most common woodfuel consumed in CAR: 97.2 % of people use woodfuel for cooking, 97 % as fuelwood and 3 % as charcoal. The use of charcoal is slowly increasing in cities, but it

is still marginal. In Bangui, for instance, fuelwood represents 91.7 % of the energy used for cooking while charcoal represents 5.5 % (Salbitano, 2009).

There is no evidence of the use of woodfuel in the industrial sector while it is a common source of energy for the commercial sector (food stalls, bakeries and restaurants). The “three stones” system (the traditional stove that consists of three stones or bricks holding a cooking pot) is still highly prevailing in rural areas. In urban areas, charcoal-specific and wood-specific improved stoves are becoming more popular and constitute a commercial niche for the craft sector. The Ministry of Waters, Forests, Hunting and Fishing has started some campaigns to introduce kerosene as alternative energy, but there is not a clear program of subsidies.

Largely informal and uncontrolled, woodfuel harvesting is often associated with land conversion of forest areas to farmland. In the landscape surrounding Bangui, the forest line recedes 0.3 km per year. This is primarily due to the rapid expansion of farmlands, while woodfuel production remains more a by-product of this process as



Photo 5.2: Fuelwood collection is often the responsibility of women and children

²⁹ Equatorial Guinea could not be included as a case study due to a lack of available information about the woodfuel sector in this country. However, in general it was found that although woodfuel is the main source of energy for households, the total amount remains relatively small and woodfuel production is not a driver of deforestation or degradation. The main sources of deforestation are shifting cultivation and logging. No movements of charcoal between Equatorial Guinea and neighboring countries have been recorded.

³⁰ Estimation for year 2009 based on a consumption rate of 0.54 air-dry tons per person per year (including fuelwood and charcoal). Derived from ESMAP 1992 and several national references (Yandji, 2007).

opposed to a direct cause (Drigo, 2009). According to the Woodfuel Integrated Supply/Demand Overview Mapping (WISDOM) method of analysis (Drigo *et al.*, 2002), CAR has abundant wood resources relative to its internal demand, but the lack of planning combined with farmland expansion creates fronts of unsustainable harvesting, especially around Bangui (Drigo, 2009).

Woodfuel has recently received a more prominent place in CAR's national policy. Where in the past only the industrial and formal timber production was given priority, the new forest law prepared in 2008 gives to woodfuel an important sectoral focus. Moreover, the Strategy on Urban and Peri-urban Forestry, a decision-making participatory document, which was published and accepted by the ministerial board in 2008, includes the woodfuel sector as a key policy objective. A legislative platform was also introduced to enforce policies oriented to optimize the wood

energy sector (Salbitano, 2009). Until 2008, there were no dedicated plantations for woodfuel, but the Strategy on Urban and Peri-urban Forestry introduced woodfuel-oriented forestry and agro-forestry practices, and resulted in plantations and agro-forestry initiatives.

A result of the recent analysis of Bangui's wood basin supply (i.e. the necessary sustainable supply zone), found that timber concessions within the wood basin supply now consider woodfuel production for Bangui market a specific management objective (also as a way to prevent uncontrolled harvesting).

NGOs play an active role in promoting best practices in the wood energy chain, including introducing improved stoves as a tool to reduce wood consumption and to lower costs and pollution. In order to ameliorate the commercial sector, formal and informal groups of associated producers, transporters and retailers are incentivized.

Cameroon

Cameroon produced an estimated 11.4 million tons of fuelwood, 214 thousand tons of charcoal and 301 thousand tons of sawdust and wood chips in 2009, representing a market value of over \$ 380 million (*Ministère de l'Énergie et de l'Eau*, 2009-2010).

The main consumers of woodfuel are households, of which 82.6 % use wood in the form of fuelwood, charcoal, sawdust or chips, as their primary cooking energy. Other forms of energy for cooking in Cameroon are Liquefied Petroleum Gas (LPG) (11.3 %) and kerosene (4.6 %) (Daurella & Foster, 2009). Various businesses also depend on woodfuel, such as for: grilling and smoking of meat or fish, cooking "beignets", ironing cloths, metal and aluminium forgers, and drying of cocoa (Pouna, 1999; Laird *et al.*, 2009).

Case studies from Garoua and Bamenda reveal that in these urban areas, most consumers use traditional stoves and more energy efficient improved stoves remain rare, contributing to overexploitation of the resource in these regions (Yuntewi, 2008; Ntsama Atangana, 2009). Low energy efficiency is common for charcoal producers who typically use traditional ovens covered with earth for carbonization of the wood (with an efficiency of 10 - 15 %). Some improved charcoal ovens made out of metal or bricks exist at wood processing companies that provide their waste wood for charcoal production.

Issues around sustainability have mainly been studied for the northern part of the country with a Sahelian climate, where population growth, woodfuel harvesting and bush fires put pressure on the remaining woodlands. Overexploitation of woodfuel has led to an expanding circle of deforestation around the cities of Maroua and Garoua leading to erosion and decrease of agriculture productivity (Madi *et al.*, 2003; Folefack & Abou, 2009). For the humid forest zone, around places of high demand such as Douala and Yaoundé, woodfuel harvesting leads to forest degradation. Of special concern is the wood collection from valuable mangrove forests for charcoal supply of Douala and export to Chad and Nigeria (Ndenecho, 2007; Feka & Manzano, 2008).

Management of the woodfuel sector is prescribed in the 1994 Cameroonian Forest Law. Non-commercial use of woodfuel falls under users' rights. Commercial production of woodfuel is regulated by the 1995 Decree on forest regime implementation modalities under two types of permits that define the place and quantities authorized: (i) the Permit for exploitation of special products (including charcoal); and (ii) the Permit for exploitation of fuelwood (Cerutti *et al.*, 2009). However, figures over the past years show that less than 1 % of the estimated charcoal production has been allocated under "special forestry product permits": 6 permits representing 1,140 tons of charcoal for 2009 (MINFOE, 2009a and 2009b)



Photo 5.3: Charcoal production oven, Cameroon

and 6 permits representing 1,800 tons for 2010. There are some examples of woodfuel production output under community forestry arrangements (Minang *et al.*, 2007). Regarding the energy sector, the national Energy Policy recognizes the role of biomass and renewable energy but leaves wood-

fuel largely out of its national strategy (*Ministère de l'Énergie et de l'Eau*, 2008). Further integration of Cameroon's number one household energy in the country's energy strategy would be a necessary step towards modernizing the woodfuel sector.

Democratic Republic of Congo³¹

DRC produced an estimated 54.7 million tons (75.4 million m³) of woodfuel in 2009, representing 94 % of its total round wood production (FAO, 2011b).

Use of woodfuel is growing in cities due to population growth, the lack of alternative energy sources, high unemployment, and the weak implementation of forest legislation, and becomes increasingly associated with forest degradation and deforestation. In Kinshasa, the country's capital city with around 8 million inhabitants, it is estimated that the total charcoal consumption in 2010 was around 500 thousand tons of charcoal with a market value of \$ 132 million. Woodfuel represents 87 % of households' cooking energy in the capital city. Various businesses, like bakeries, aluminium forgers, breweries, restaurants and brick makers also depend on woodfuel. Urban consumers prefer the use of charcoal over fuelwood (charcoal represents 75 % of cooking energy in Kinshasa and fuelwood 12 %) because charcoal does not produce as much smoke, does not affect the taste of food, and the cooking pot remains cleaner, compared to cooking on fuelwood. Only a small group of urban households (3.2 %) uses energy efficient stoves.

For DRC, unsustainable practices and deforestation are mainly observed in the peri-urban areas where an increasing demand and a lack of management of the woodfuel sector pose threats to the sustainability of the resource base. For the supply of Kinshasa most charcoal comes from within a distance of 200 km from the city, with an average distance of 135 km (figure 5.4). An

estimated 42 % comes from the eastern located Batéké Plateau, 34 % from the southern located Bas-Congo province and 24 % enters the province via the Congo River, which includes woodfuel supply from more distant provinces (Bandundu, Equateur and Orientale) up to 1,000 km away. Like in Cameroon, production of woodfuel is artisanal and charcoal producers use traditional ovens, covered with earth (with a low energy efficiency of 10 to 15 %), to carbonize the wood. Over half (52 %) of the woodfuel harvested for the market of Kinshasa comes from agricultural land, 29 % from uncultivated forests and 16 % from other sources such as (village) plantations. Kinshasa's peri-urban forests are rapidly depleting; it is estimated that in the production zones around Kinshasa, 60,000 ha are harvested each year for combined slash and burn agriculture and woodfuel production (Marien, 2009). On the Batéké Plateau (150 km from Kinshasa) a study of satellite images showed that between 1984 and 2010 only 14 % of the dense forest remained intact (Pennec *et al.*, 2010).

Besides the peri-urban zones (such as around Kinshasa, Mbuji Mai and Lubumbashi), the eastern part of DRC, where many refugees aggregate, is sensitive to overexploitation of woodfuel. Biodiversity-rich landscapes, such as Virunga National Park, suffer greatly from illegal charcoal exploitation. WWF has initiated the EcoMakala project (box 5.1) in this area that aims to simultaneously offer alternative sources of woodfuel and increase the use of energy efficient stoves (Bodson *et al.*, 2009).



Photo 5.4: Frontier forest lands near villages and roads are the primary sources for household energy

³¹Most data presented in this case study was provided by the Makala Project, to be published in more detail in a publication about the woodfuel sector of Kinshasa and Kisangani, DRC (Schure *et al.*, 2011). The Makala Project-Sustainable management of woodfuel in DRC - (2009-2013), is coordinated by CIRAD and realized with financial support of the European Union (<http://projets.cirad.fr/makala>).

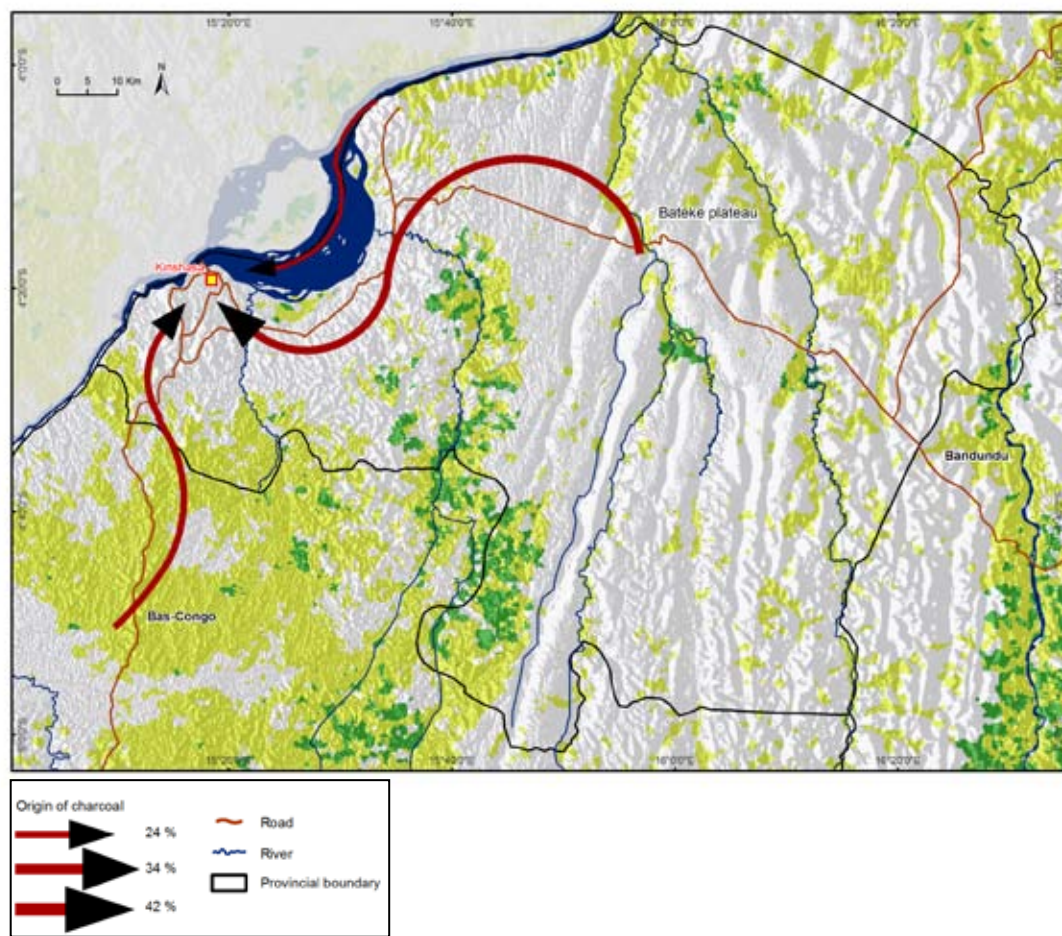


Figure 5.4: Charcoal supply zones of Kinshasa, DRC
Sources: Makala Project; OFAC



Photo 5.5: Fuelwood being readied for transport on the Congo River near Kisangani, DRC

Box 5.1: EcoMakala: Sustainable and alternative rural development to respond to deforestation

Thierry Lusenge and Bruno Hugel

WWF-PEVi

Goma, in the east of the Democratic Republic of Congo (DRC), is the provincial capital of North Kivu. Bordering on Rwanda and close to Virunga National Park (PNVi), it is a town of 800,000 inhabitants. For a long time, this region has had the highest population density in the DRC and timber resources outside PNVi no longer meet the needs of local communities. In 2007, Goma's annual timber consumption was 59,434 tons. 80 % of this came from the illegal and unsustainable logging of the PNVi's natural forests (Balolebwami *et al.*, 2008). The increase in the prices of charcoal in recent years (\$ 10-12 in 2006 to \$ 15-25 in 2010 depending on the quality) is also a heavy burden for households to bear.

In order to provide Goma with long-term supplies of charcoal, it is estimated that plantations of fast-growing species covering an area of 19,000 to 24,000 ha will be required. Financed mainly by the European Union, the EcoMakala project aims at developing plantations covering 5,500 ha that will primarily be undertaken by small land holders. The project is not seeking to meet the needs of Goma single-handedly but is instead trying to find solutions for the current obstacles to spontaneous reforestation by: (i) developing private forestry, (ii) involving, structuring and building capacity for local communities and associations for reforestation; (iii) developing a stable marketing framework with the help of planter networks; and (iv) carrying out on-site testing of the Kyoto Protocol Clean Development Mechanism as well as the future mechanism on Reducing Emissions from Deforestation and Forest Degradation (REDD+). This project is also linked to a project to provide improved stoves.

The EcoMakala project further seeks to develop an innovative model for long-term community reforestation which would bring rapid reforestation to an area that is facing a significant energy crisis, provide quality control of outcomes, more intensive technical support and the establishment of a capital rotation system that will allow activities to continue when the project finishes.

To achieve this, WWF and local associations responsible for reforestation sign contracts for each planting season (i.e. twice a year). Each association then identifies the potential participants in order to estimate the total area required for the number of plantations. Following validation by WWF, the associations and planters sign contracts. The associations and planters must respect a number of quality standards set out by the project (e.g., alignment, spacing, upkeep) in order to improve reforestation where land is under severe pressure, and ensure maximum profit for planters. Further contracts with associations and planters will depend on the results obtained.

Regulatory frameworks for the woodfuel sector exist in the forestry code and land tenure law. Possible legal options for managing woodfuel production are: (i) public plantations; (ii) private plantations; (iii) reforestation of agricultural parcels; (iv) woodfuel exploitation with a permit for woodfuel cutting and carbonization; and (v) community forestry (Assembe-Mvondo & Lescuyer, 2010).

In practice however, there are not many woodfuel plantations and most wood is sourced from (newly slashed) agricultural land and (degraded) forests. The Mampu project on the Batéké Plateau with production of charcoal from 8,000 ha of acacia trees (*Acacia auriculiformis*), the neighboring reforestation project *Ibi Village* with related charcoal production under the Clean Development Mechanism (CDM), and the EcoMakala project in North Kivu are among the few woodfuel plantations that currently exist. Furthermore, the concept of community forestry (see

chapter 11) is still in its infancy and reforestation only takes place on small scale. Despite the higher targets that were set by the National Forest Fund (10,000 ha (500 ha per year) between 1986 and 2006, recently raised to a target of 1,000 ha per year per province), only 4,787 ha have been planted during the period 1986 – 2006 by the Department of Reforestation and Horticulture (DRH, 2009). Individual efforts exist: 21 % of charcoal producers in the supply zone of Kinshasa have planted trees that could be used for woodfuel harvesting. However, most of the producers (79 %) are not involved in any replanting activities. The permit system for woodfuel is officially eligible for rural citizens but figures from the Environmental Department of the Urban Coordination (Kinshasa, Tshiangu), one of the few places that delivers permits, show its lack of implementation; only 19 permits, representing 910 tons of charcoal, were issued in 2009³².

³² *Division urbaine de l'Environnement, Coordination de Tshiangu, April 2010.*



Photo 5.6: Baskets of charcoal (makala) for sale at a market in Kisangani, DRC

While recognizing the current weak implementation of legal options for managing the woodfuel sector, it must also be noted that the producers around Kinshasa and Kisangani access their resources mainly under customary rules. Only 3.5 % of the producers are owner of an official forest concession. The common types of access to land are either customary land rights or renting of land or buying trees from the landowner or village chief. This shows the strong role of local authorities in granting access rights to producers, which needs to be taken into account in any woodfuel sector intervention.

Gabon³³

Gabonese woodfuel production in 2009 was estimated at 776,000 tons or 1.1 million m³. This represents 24 % of the country's total timber production and is the lowest percentage in terms of woodfuel production in the Congo Basin region (FAO, 2011b). The woodfuel sector in Gabon has two components: industrial and small scale. As this sector has not been widely researched, little precise data exists. Nevertheless, research organizations, forestry and mining companies, as well as other actors involved in environmental protection, are becoming increasingly interested in this sector.

The first component of the small scale woodfuel sector in Gabon relates to two activities: (i) deadwood is used by local populations for their own consumption (this is in total compliance with their right to exercise customary use as described in chapter VI of the Forestry Code); (ii) charcoal and deadwood (used as fuelwood) are produced and sold, mainly to supply the Libreville market. These products are consumed by households with modest incomes that cannot afford to buy gas. They are also used during gas shortages or for braising or smoking food, which is becoming increasingly popular.

The commercial production of woodfuel poses several problems in Gabon. First, it is not regulated apart from the Environmental Code which states that charcoal production should be subject to an environmental impact study³⁴.

This is not compatible with the small scale aspect and limited extent of this activity. To date, no impact studies for this activity have been submitted to the Environment Directorate-General. From an environmental perspective, this activity is sometimes undertaken in protected areas, notably in the Mondah Classified Forest, near Cap Esterias, and the area around the Akanda National Park, both of which are near Libreville. Furthermore, from a practical viewpoint, this type of activity tends to use small diameters of species that are typical to secondary forests, thereby posing problems for forest regeneration.

The final problem arising from this activity is human-related. People who produce charcoal rarely come from the production zone, or even from Gabon. This causes conflict with local populations and leads to social unrest.

Overall, the sector remains poorly developed, with Gabon's small population almost systematically using gas for household purposes (62.3 % of the population use it as their primary source for cooking notably in the towns (Daurella & Foster, 2009).

Alongside this sub-sector, another sector that is flourishing in Gabon is the industrial woodfuel sector. Whether they are in the forestry or mining sector, more and more operators are interested in this option, seeking an alternative to the coal they import to dry their products. Many forestry enterprises that are equipped with transformation

³³Data taken from a TERE (Terre Environnement Aménagement) survey of actors working in the Gabonese forestry and environmental domain.

³⁴ Decree 39/PR-MRSEPN on 10/01/1979, relating to industrial classification and identifying the factors that need to be taken into consideration in pollution assessments.

units currently use sawmill wood chips to alimnt their wood dryers. Some manufacturers are also leaning towards woodfuel options that would allow them to produce electricity using cogeneration boilers. However, in light of the large scale

investment that would be required, operators are not certain this would be economically viable, and the installation of such units remains delayed despite increases in hydrocarbon costs.

Republic of Congo

Over 80 % of the population in Congo uses fuelwood, charcoal or wood waste for cooking purposes. In 1994, the annual flows of woodfuel to the four main towns (Brazzaville, Pointe-Noire, Dolisie and Nkayi) were estimated to represent 213,880 tons of fuelwood and 25,461 tons of charcoal, which is 426,055 Teq³⁵ of fuelwood for a carbonization average yield of 12 %. This corresponds to an annual turnover of CFA 9 billion (Lamouroux & Boundzanga, 1994). Urban demand comprises primarily households which, in 1994, consumed 261 kg of fuelwood annually and 60.5 kg of charcoal per household. In 1998, a study carried out in Brazzaville revealed that, for various socio-cultural and economic reasons, substituting gas for woodfuel was highly unlikely (reasons for this include a traditional attachment to using wood, fire risks, and the high cost and inconsistency of gas supplies) (Andzouana, 1999).

In 2004, an assessment of woodfuel and wood derivatives consumption in Brazzaville and Nkayi found that: (i) following studies in 1990 and 1994, the public authorities had made no attempt to find an alternative solution; (ii) there was a growing movement in the energy sector for the substitution of fuelwood by charcoal; and (iii) the ecological situation of peri-urban natural forest spaces was critical (Boundzanga, 2004). In 2006, the country's urban woodfuel consumption was estimated to be 1,029,856 Teq of fuelwood (DFS, 2006). This consumption is unevenly distributed between Brazzaville (57 %), Pointe-Noire (35 %), Dolisie and Nkayi (4 % each). Between 1994 and 2006, consumption increased from 344,425 to 584,728 Teq of fuelwood for Brazzaville (70 % increase), from 244,758 to 364,387 Teq of fuelwood for Pointe-Noire (49 %), from 21,467 to 42,196 Teq of fuelwood for Dolisie (97 %) and from 15,525 to 38,545 Teq of fuelwood for Nkayi (148 %).

The average wholesale price for woodfuel is relatively even across the country's main urban markets and has practically doubled since 1994 - from CFA 20 to 39 per kilogram of fuelwood and from CFA 66 to 109 for charcoal. At the same time, if fuelwood remains the energy source used by poor households, charcoal continues to attract households of all sizes, socio-professional categories, education levels and income because its qualities are very similar to those of gas (e.g., faster cooking, cleaner cooking pots, very few fire risks, nearly always available, cost that can be adapted to all categories of household). The heavy urban demand, which is unlikely to decrease, constitutes an important sector of economic activity and a source of increased revenue for rural and urban populations. This should be weighed against the need to sustainably manage the environmental challenges involved. Finally, given the growing urbanization of the Congolese population, without increases in household revenues and lasting strategies for domestic energy in urban areas, it will be difficult for urban households to open up to alternative energy sources. Nevertheless, the implementation of the new National Afforestation Programme, that aims to promote and develop forestry for energy production, can be considered to represent a lasting alternative that could satisfy urban demand for woodfuel (see box 5.2).

³⁵Teq: Equivalent ton

Photo 5.7: Bags of charcoal ready for transport from the Batéké Plateau to urban markets in Kinshasa



Box 5.2: CRDPI: Eucalyptus plantations respond to the urban demand for woodfuel in Pointe-Noire, Republic of Congo

Méthode Nkoua

CRDPI

Pointe-Noire is the economic capital of Congo. It has a population of one million inhabitants and is surrounded by 42,000 ha of industrial clonal eucalyptus plantations that produce logs and paper wood chips for exportation. For two decades, the woodfuel sector has used the remains from eucalyptus exploitation to respond to a growing urban demand for fuelwood and charcoal. For Pointe-Noire, and its woodfuel basin supply, the eucalyptus plantations are facing challenges that are economic, social as well as environmental.

In terms of the economy, eucalyptus plantations represent 47 % of annual flows in woodfuel or 265,000 fuelwood equivalent tons per year in the rainy season (Nkoua *et al.*, 2010). This corresponds to an annual financial flow of CFA 5 billion. The fact that Pointe-Noire markets have a regular availability of eucalyptus fuelwood and charcoal has a regulatory effect on the prevailing prices that are affected seasonally by the availability of timber from natural formations.

From a social perspective, the eucalyptus woodfuel sector generates revenue for townspeople and villagers. In order to ensure woodfuel production, it mobilizes over 300 city operators and about twenty villages organized under an Economic Interest Grouping. Several hundred intermediaries working as transporters, wholesalers, yard managers and retailers depend on this sector to ensure the urban provision of woodfuel. Charcoal from eucalyptus and charcoal from natural forests respectively represent 45 % and 55 % of flows to Pointe-Noire; fuelwood from eucalyptus and fuelwood from natural forests respectively represent 75 % and 25 % (Nkoua *et al.*, 2010). Charcoal and fuelwood are essentially used by urban households; 96 % of these households use charcoal to cook their food (Marien, 2006).

On the environmental front, eucalyptus plantations help to reduce the pressure exerted on peri-urban natural forests by urban and village communities. Without eucalyptus plantations, over 1,000 ha of natural forests would suffer from deforestation each year in order to produce the woodfuel required by Pointe-Noire.

In order to better integrate the eucalyptus sector into the sustainable management of woodfuel basin supply for Pointe-Noire, a study is under way to analyze the effectiveness and territorial balance between natural forest and eucalyptus sectors.

Sustainable management of woodfuel in the Congo Basin

It is clear from the descriptions above that conditions differ between countries, and even within the same country. There is therefore no global or unique, miracle “recipe” for an economy based on the overexploitation of woodfuel to develop into an economy that can introduce and sustainably manage new and renewable resources.

Nevertheless, solutions do exist. Choosing one or rather a combination of several solutions should be based on the most far-reaching and

honest appraisal feasible in light of available information and forecasts for medium to long-term trends. It also needs to be recognized that woodfuel in Central Africa is a component of regional development and is usually closely interlinked with agricultural and rural activities. Strategic thinking is necessary to integrate the different components and provide significant incentives for local populations.

Pressure zones

The forest dynamics in the Congo Basin are generally sufficient to respond to the domestic needs of the population and therefore issues related to the sustainability and impacts of this sector have taken a long time to come to attention. Population growth and its concentration in urban areas have considerably changed the situation. Numerous pressure zones have recently appeared that significantly put the sustainability of timber resources into question. The situation is critical, for example, from a geographical perspective in terms of: (i) the accelerated degradation of peri-urban wooded areas around big towns and in protected areas; (ii) the degradation of dry zones (exploitation/logging of wooded savannas); and (iii) the degradation of forest fallows (shortening of cycles and soil impoverishment).

Other critical problems relate to specific aspects of the sector. The lack of organized transport and trade, land tenure, and problems associated with the allocation of the resource and profits represent greater challenges that touch upon governance issues and the role of the State (Arnold *et al.*, 2003; Arnold & Persson, 2003; Sizer *et al.*, 2005). Lastly, the main obstacles to bringing about a lasting improvement are without doubt the lack of research and possibilities for innovation, in addition to the difficulty of successfully and sustainably applying the few results that are available.

Resumed below are the various management options for the woodfuel sector. They are linked to agro-forestry, plantations and improved effectiveness in production and consumption levels.

□ *Promoting agro-forestry*

Recognizing the importance of trees in agricultural systems

Widespread areas, either former forested areas that are currently completely deforested (Bas-Congo in DRC), or savannas (Batéké Plateau in Congo), have been devoted to large scale temporary subsistence farming. The most noticeable aspects of this type of farming are: (i) accelerated depletion of soil nutrients; (ii) increased erosion; and (iii) decrease in productivity. Under these circumstances, the reintroduction of trees is a key element to bring about long-term improvement of the system. Trees provide a wide variety of goods and services, including woodfuel. Reintroducing trees can be undertaken through a classical agro-forestry system, or with the installation of hedgerows (where trees are installed as hedges around the fields and form territorial barriers).

Managing ecosystems of slash and burn agriculture and forest fallow

One of the most widespread anthropogenic landscapes in Central Africa centers on slash-and-burn agriculture and associated forest fallow areas. For a long time, this traditional system has been balanced, alternating one period (2 to 3 years) of crop rotation (cassava, maize, groundnuts, peanuts) with quite a long period (10 to 20 years) of forest fallow. Unfortunately, population growth (both rural and urban) and the resulting increase in the demand for food and wood products, has led to fallow periods being shortened, resulting in land and environmental degradation. In such a situation, using naturally assisted regeneration techniques can promote existing forest species. Seedlings, low forest and sprout forests are various examples of proliferation methods that can be adapted to these rotations. Among these forest species (many of which are specific to this system and not found in forests that are not degraded) some, such as *Pentacletra* spp., are highly regarded for the quality of the charcoal they produce.

Stabilizing frontiers

Human frontiers typically develop along communication routes, often in a disorganized way. Local populations or land holders often only have a very vague idea of the value of vegetation types in these areas. They are encouraged to sell out (often to foreign populations or to intermediaries) in order to gain a relatively low, immediate profit with no thought to long-term considerations. Some of the trees are cut down and transformed, either into planks or into charcoal, but most of the resource is burnt and abandoned onsite to make place for slash and burn agriculture. This is the case for example around Kisangani in DRC, and also on the outskirts of new informal village installations that have developed across the forest environment (notably in concessions or protected areas).

It is difficult to halt population growth along communication routes away from the concessions or the protected zones. However, with targeted information, the villagers and land holders would be able to better appreciate the real value of their heritage so that either they, itinerant loggers or farmers/cultivators could demand a better evaluation.

□ *Plantations*

Plantations in transition zones

Due to the high increase in local demand, the zones surrounding protected areas are often sources of unrestrained coal production. One solution to offset this would be to create a woodfuel source in degraded or deforested zones, for example by planting around villages. This has already been done in the periphery of Virunga National Park in the DRC and Conkouati Douli National Park in Congo. These plantations can be mixed (timber and fruit) which helps to increase their value and hence the effectiveness of their management. This solution furthermore encourages populations to settle in one place and limits encroachment into the central zones of protected area.



Photo 5.8: Burning grasslands facilitates the collection of timber stems

Create an agro-forestry resource for villages and/or agricultural communities

The lack of available timber resources is unfortunately already a reality in many areas of the Congo Basin. There are deforested zones as well as run-down grassy savannas or miombo (dry, dense forests), and wooded savanna areas that have been overexploited by densely-populated rural communities. In such cases, creating resources for villages and agricultural communities is an excellent way to improve living conditions and combat poverty (Marien & Mallet, 2004). Some countries in the sub-region are already implementing this option on a large scale. Creating agro-forestry plantations provides the guarantee for receiving long-term, diversified revenue. Different modalities exist for this: planting pure species, mixed species or a sequence of agricultural and timber products.

Create intensive industrial timber resources

In the Central African region, individuals and private investors alike dispose of significant financial income that they are ready to invest in economically viable opportunities. Industrial plantations designed for timber production offer interesting opportunities. These plantations require a well-defined strategy, long-term land and environment security, as well as significant inputs (both technical and capital). Woodfuel can constitute the principal product or one of the by-products of intensive biomass production, with the development of a sector that has the potential to be controlled by investors. Plans for large scale agro-industrial plantations are being discussed

and naturally raise a number of questions. Some of the main criticisms of large scale agro-industry relate to the export of products and profits. The woodfuel sector would not necessarily face the same issues and has the potential to become even more profitable if a carbon finance system is effectively put in place.

□ Improving the effectiveness of production and consumption

Use of wood waste

In natural forests, a significant amount of biomass, from non-marketable felled trees, is left on the ground. The exploitation required to make paths, develop means of access and harvest commercial timber leaves a significant amount of biomass (Simo & Siyam Siwe, 2000; Cooper & Laing, 2007). This abandoned biomass often represents an order of 70 % of harvested logs. In addition to biomass that has been left on the forest floor, sawmill residue can be found, notably scraps in the form of flitches (non-marketable short strips of varying sizes). The material yield marketable sawmill/logs is rarely more than 40 % which, in theory, offers considerable potential (Perry & Bediang, 2009). Mobilizing these raw materials poses substantial challenges in terms the mobilizing, conversion and transport costs, as well as the placement of processing units. Nevertheless, some sawmill units in forest concessions are exploiting the potential represented by these residues, using cogeneration system, or transforming waste into woodfuel (coal, sawdust, wood chips) to provide supplies for urban centers.

Developing energy efficiency

Since credible and viable alternatives to woodfuel are not easily available across the Congo Basin, it is absolutely necessary to improve energy efficiency in the near future. The conversion of timber to charcoal can be improved on several levels:

- Selecting species that give high-energy returns;
- Providing efficient technologies for both coal producers and consumers;
- Improving transport, storage and market capacities.

Ideally, the potential and techniques offered by improved stoves in developing countries would

allow a more sustainable exploitation and mitigate negative health implications for users. Numerous public and private projects have invested in this area. However, the effective adoption of improved stoves does not depend on financial aspects alone (cost of buying the stove), but also on complex factors such as: capital techniques, available information, starting costs and cultural barriers (Tucker, 1999; Kuteesakwe & Kuteesakwe, 2008). A better understanding of the reasons why consumers in the Congo Basin have or have not adopted the proposed technologies would help to identify more effective solutions.

Conclusion

Woodfuel is an essential source of energy throughout the entire Congo Basin region, although differences in its importance and utilization exist between the countries and sub-regions. In CAR, 97.2 % of all households depend on woodfuel, whereas in Gabon gas provides 62.3 % of households with an alternative cooking energy. In DRC, Congo and Cameroon there is a shift from use of fuelwood to charcoal in urban centers. In addition to households, various businesses also depend on wood energy for their daily operations, including bakeries, breweries, restaurants, brick makers and aluminium forgers. Moreover, large wood-processing and mining companies have shown increased interest in using waste wood for cogeneration or transformation in charcoal or chips for their energy supply. Overharvesting of wood is especially problematic in pre-

valent in large urban centers, savanna zones and around protected areas. Improved management of the woodfuel sector needs to be implemented without further delay as demand continues to increase and alternative energies will not be available at a level adequate to address demand in the short term. Management alternatives should take into consideration the fact that issues are often location specific and that wood energy production and trade remains primarily an informal sector. Policy and available data remain minimal, and increased collaboration between different sectors (energy, forest, land use planning) is necessary. Establishing sound agro-forestry and improving efficiency at the level of producers and consumers offer important opportunities to guarantee a future energy supply, while simultaneously maintaining the natural resource base.