Abstract To analyze the traditional methods of smoking bushmeat in a rural Congolese environment, a survey and physical measurements have been conducted within the Conkouati-Douli National Park (PNCD), Department of Kouilou. The study involved two parts: a survey of 52 hunters selected in a random in a village in this protected area, and physical measurements associated with smoking process. The results indicate that the operations before the game smoking trimming were cutting, skinning and flushing. Smoking was affected by way of a metal drum containing a hurdle and a fireplace. The amount of wood used was an average of 8.6 kg, quantity varied according to species. The average duration of smoking was about 6 hours 30 minutes per day. The air temperature differed as measured on the gate and the hurdle. However, the minima temperatures were recorded at the end of cooking; however, the maxima were found between one hour and two hours of smoking. In conclusion, processes of transformation of bushmeat fresh in meat smoke in forest Congolese are still rudimentary, thus calling for the completion of the work of technological innovation.

Keywords Bushmeat; Smoking; Traditional technologies; Adorn practices; Congo (Brazzaville)

Background In sub-Saharan Africa smoking is the main traditional process of transformation and conservation of the bush meat in forest environment. Used to get the product of wanted quality, it is sometimes associated to the salty in order to improve the conservation of the product (Atoukam and Nizesete, 2002). In any case, the final product is characterized by the specific qualities of flavor and color searched for according to the consumer's preferences.

To Congo (Brazzaville), demography constantly increasing and accelerated, associated to the economic exchange internationalization and the globalizazion of markets, shine by an increasing demand in wild animal proteins and a use of fauna products in its different forms: transformation, conservation and derivative product quality (Codja and Assogbadjo, 2003). To this effect, the animal protein consumption, dominated by the one of meats deep-frozen imported, is the more often supplied by the available bushmeat. The conservation of products transformed of meat presenting some acceptable hygienic qualities constitutes a primordial preoccupation of housewives then (Atoukam, 2004). It is why the seasonal character of the production of the bushmeat and the necessity to spread its consumption on return indispensable all year round its storage and its conservation on a long period. Otherwise, the transformation of the bushmeat in products smoked is to the origin commercial activity, which generates a big value added to the product (Eves, 1995). Besides, it contributes to a better distribution, even during periods where stores in bush meat prove to be difficult. However, the practice of the smoking of the bushmeat, as well as technologies of transformation and conservation there relative, were the object of rare specific studies nowadays in the Congolese basin forest (Makosso-Vheiye, 2010). It proves to be then indispensable to arrange some reliable data on the traditional technological knowledge of smoking of the bush meat and modes of conservation (Atoukam, 2004; Fargeot, 2004).
The present survey fixes several objectives. It is first about identifying, describing and characterizing types of the traditional processes of smoking and conservation of the bush meat in Congolese farming environment. Thereafter, stages and impacts of smoking are identified. Finally, the kinetics of the temperature at the time of the process of traditional smoking of the bushmeat is analyzed.

1 Results

1.1 Nature and Measurements of the Smoking Oven

The table 1 gives the dimensional features of the traditional smokehouse observed during the investigation. It was about a metallic barrel, of cylindrical shape. The lower basis of the smokehouse was open (gate), to act as home where burns a fire. The smokehouse was equipped, in its median part, of a hurdle constituted of the metallic bolsters or in wood on which rested a metal grating. This device prevented the direct contact of meat with fire. The eviscerated meat was put thus to smoke in the smokehouse, hollow in the bottom part and superior.

Table 1 Middle values, gaps-types and extreme values of measurements of the main elements of a metallic smokehouse

|                      | \( \bar{X} \pm G-T \) | \( X_{\text{min}} \) | \( X_{\text{max}} \) |
|----------------------|------------------------|------------------------|
| Barrel diameter (cm) | 51.0 ± 0.3             | 58                     | 60                     |
| Barrel height (cm)   | 72.4 ± 4.1             | 51                     | 83                     |
| Hurdle height (cm)   | 46.1 ± 5.3             | 34                     | 55                     |
| Smokehouse height (cm)| 35.6 ± 2.4            | 24                     | 41                     |
| Smokehouse width (cm)| 40.7 ± 0.5             | 33                     | 45                     |

1.2 Organization of Work

The animal to smoke or to dry is in most cases, is cut down by the hunter himself, after a cycle of hunt to the very short and regular rifle, but sometimes very variable (enters 3 and 12 months) or is captured by trapping (all 2 at 3 days).

Techniques of preparing the game use some current instruments (knife, machete). In the majority of cases the game of small size is not cut up before smoking.

1.3 Modes of Evisceration and Tear up a Game

The noted technological determinants, in the quasi-totality of cases observed, amounted to the evisceration and to tear up the game. Some either the fashion of transformation, the first operations are common and begin the freshly dejected game (to the rifle) captured either (to the net) and succeeds to the eviscerated game. From the eviscerated meat either decorated the other unit operations are specific to the considered final product type. The evisceration and the tear up are the cardinal operations of the first phase of transformation. The order of realization of the first unit operations is not variable. According to the species and the size of the game the carving of meat can make before or after the tear up; but the evisceration is always associated to the tear up. The rare variations met during the preparation are function of the nature of the animal. In the case of a game to hairs or prickles the animal is burnt on the inferno to inflame it either soaked in the hot water to weaken prickles in case of the African brush-tailed porcupine (. Atherurus africanus). For many small animals they are smoked directly with their hairs after evisceration.

The animal eviscerated by the ventral face is spit while quartering cutlets; it facilitates the internal penetration of the heat and the emptying of cooking exudates during smoking. The middle values and gap-types of the determining mains operations of the traditional treatments of smoking summaries in shops are brought back in the table 2. In most cases, the evisceration took place at the place of slaughtering for the thick games (to facilitate the transportation of the game) or close to the camp (case of long length hunt in forest), or at home. The evisceration had place in majority, in full air (contact with the sun), or in a few rare cases under the “m’bongui” (roof to palaver the chief of family or the village). The animal was spread out very well on a board, either on leaves of banana tree or palm, either again on branches or in short on a metallic sheet metal. In our case, the place the more used was dominated by the domicile (95% of cases). However, about an evisceration on 4 was achieved on places of capture (evisceration of the yellow-backed duiker). That it was about the evisceration in forest or at home, the game was the most often disposed on leaves of banana tree or palm (85% to 90% of cases) or on branches (10% to 15% of case).
Table 2 Averages and gap-types of variables associated to the traditional smoking process (case of African brush-tailed porcupine and blue duiker)

<table>
<thead>
<tr>
<th></th>
<th>African brush-tailed porcupine</th>
<th>Blue duiker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middleweight of the game before preparation / evisceration (kg)</td>
<td>4.70± 0.2</td>
<td>5.50 ± 0.200 a</td>
</tr>
<tr>
<td>Weight of the game eviscerated (kg)</td>
<td>3.30 ± 0.2</td>
<td>4.375 ± 0.500</td>
</tr>
<tr>
<td>Weight of the game after smoking (kg)</td>
<td>1.96 ± 0.2</td>
<td>2.325 ± 0.340</td>
</tr>
<tr>
<td>Lasted of the habiliment or tear up (min)</td>
<td>22.00 ± 4.0</td>
<td>14.40 ± 4.357</td>
</tr>
<tr>
<td>Middle quantity of woods clear soup (kg)</td>
<td>7.80 ± 3.1</td>
<td>9.400 ± 0.100</td>
</tr>
<tr>
<td>Middle quantity of wood (middle kg)/masse of meat smoke (kg)</td>
<td>2.40 ± 0.3</td>
<td>2.200± 0.100</td>
</tr>
<tr>
<td>Length average per day (h)</td>
<td>6.30 ± 1.4</td>
<td>6.400 ± 0.600</td>
</tr>
<tr>
<td>Percentage of middle loss of weight during smoking (%)</td>
<td>40.60 ± 4.2</td>
<td>46.800 ± 3.800</td>
</tr>
<tr>
<td>Output final means (in relation to the whole game) (%)</td>
<td>41.70± 1.7</td>
<td>42.300 ± 2.100</td>
</tr>
</tbody>
</table>

*: the time of evisceration of blue duiker doesn't take in account the time of tear up the skin

Percentage of weight losses = \( \frac{\text{Weight of the game after evisceration} - \text{Weight after smoking}}{\text{Weight of the game before evisceration}} \times 100\% 

Final output = \( \frac{\text{Weight after smoking}}{\text{Weight before evisceration}} \times 100\% \)

Weight of meat smoke bois = \( \frac{\text{Quantity of woods clear soup}}{\text{Weight of the game eviscerated}} \)

The either decorated finished games were arranged dorsally on a hurdle, either in iron (metal grating) for the metallic smokehouses above a smoky hot air.

1.4 Unit Operations

The smoking of the bushmeat takes place in several operations that drive to two types of finished products: weatherbeaten meat and "smoked" meat. Weatherbeaten meat; so-called is the result of a light and short smoking of only one fire in the Congolese popular jargon. This meat, no cooked again, is appreciably humid and little rare. On the other hand, meat considered like smoke is cooked well and dry, of hard texture. Fire is active (53.8% of cases; p<0.05), very quick to the departure of smoking to avoid the putrefaction of the game.

Some transforming estimate that the fire of the smoking beginning must be soft (17.4% of quotes) or moderate (26.9%) to allow the meat to cook slowly and to avoid to burn meat in surface without making cook the inside of muscles. During the operation of smoking the smokehouse is covered not only to contain the heat and smoke, but also to avoid the deposit of dusts that can infest meat. This cover encourages the cooking of meat and decrease the quantity of wood used during the smoking. The exhibition to the free air slows down the cooking of meat, which loses its flavor then, its flavor or even its taste (personal communication of a hunter). The gate of the smokehouse also participates in the regulation of the intensity of the heat. According to people investigated (100%), the smoking fat meat proves to be very delicate: it requires a sustained attention and an experience of the transformer. In this precise case, the fire of smoking must be soft and continuous, because greases falling on the inferno activate fire; what is susceptible to burn meat.

1.5 Kinetic of Temperatures of Air at the Level of the Gate and the Hurdle According to the Time

It is first right to rise that the hygrometric degree of the ambient air, during this period of follow-up of the technological processes of the smoking, varied 52 to 66% (average: (61.4±2.5)%). The Figure 1 illustrates the evolution of the temperature of the environment and the hurdle according to the time of the smoking in the case of the athèreure. The ambient temperature stayed lower to 40°C, with an average of 35.6°C (extreme: 32°C to 360min–39°C to 120min). As for the temperature on the hurdle varied meaningfully: +49°C in 150mins, reaching the maximal value of 126.3°C. Was a progressively decreasing phase observed then, until end of the smoking (θ=41.6°C), the slope of this decrease adjoining 67%.

Otherwise, the Figure 2 indicates the evolution of the temperature of the environment and the hurdle according to the time of smoking concerning the blue duiker.
Variations of the temperature of the ambient air proved to be meaningful, active of 21°C to 42.5°C, raised value to \( t=150 \) min. With regard to temperatures on the hurdle were they meaningfully increasing of \( t=0 \) (\( \theta=50^\circ \)C) to \( t=120 \) min (\( \theta=107^\circ \)C). Was the observed decrease thereafter, weaker (\( \Delta \theta=22^\circ \)C).

2 Discussion

The goal of this survey was to analyze the traditional processes of the smoking of the bush meat in Congolese farming environment. At the time of our investigation we raised already that alone 35% of hunters investigated achieve smoking with a smokehouse in metallic stock (table 1). On the other hand, 61.52% among them make it again with a smokehouse on pickets and more rarely in a smoky pit. Yet, the biggest innovation that appeared toward 1986 date (FAO, 2005) in the smoking of carnal products consists in the apparition of smokehouses or ovens improve "Chorkor" or "Altona". By their convenience of use (long length of conservation, easiness of mobilization and equipment), this smokehouse permits a good joint of the transformation (smoking-cooking) between the farming environment and the urban environment. It is the case of the smoking-cooking of certain foods of street ("coupe-coupe") or meat of beef braised, fish or chicken recovered nowadays in Congolese urban environment. The gotten data also put in evidence of numerous inherent constraints to the transformation of the bush meat in traditional products (table 2). However, most hunters consider that the pickup of wood is from afar the operation the most laborious follow-up of the fire surveillance. It is in this sense that one author underlines, in relation to changes of behaviour intervened in sub-Saharan Africa that followed itself of it of changes in life styles (Massamba, 2003). These last drove to an evolution of the set of asks it food urban, including the one relative to foods of basis. Practices of transformation and representation of foods are modified therefore considerably by the urbanization (Bricas, 1993; Riquier-Desjardin, 1989). In city, the recourse to the faraway stores makes necessary often to consolidate products to preserve them and to condition them to facilitate their transportation and their storage. Thus, conditions of urban life modify calendars of work, generate some new constrains. However, they open some new opportunities in particular for consumers and housewives (Muchnik, 1993; Nago et al., 1996).

Concerning features of the home and processes of smoking adopted it suits to signal first that at the time of the measure of a temperature above a hurdle or of a chimney, more the plan of measure is big; more the heterogeneities of temperature are strong. It was necessary to grid this plan then and to measure the temperature inside every slot and to determine a really representative middle temperature from the sum of
temperatures of every slot. Our observations and our data (Figure 1 and Figure 2) suggest that the smoking of the bush meat with the help of the fire of wood is associated to two types of heat transfer: a transfer of heat by radiance and a transfer of heat by convection. In what milked to the first fashion the equation used to value the energy radiated by the incandescent wood coals to dry or to smoke meat on the hurdle is: 

\[ H_r = e \sigma (T_2^4 - T_1^4) \]

where \( e \sigma \) is the energy radiated, \( T_2 \) and \( T_1 \) are the temperature of the home and the hurdle, respectively. \( T_1 \) is the temperature of the home and \( T_2 \), the temperature measured on the cut of meat put down on the metallic hurdle since the beginning of the operation. So, is its raised value to the thermocouple in this survey 20°C, either \( T_1 = 293 \) K.

The surface of the home is estimated to \( S_f = S_F - S_s \), where \( S_F \) is the surface of the stock, equal to \( \pi D^2/4 \approx 2042 \) cm² and \( S_s \) is the surface of the hole, equal to \( h_l \times t_l = 1449 \) cm². Therefore, the surface of the home is: \( S_f = 593 \) cm². According to opinions of people investigated on features of the smoking fire, the half of topics estimated that the intensity of fire was strong for a middle quantity of 7.8 kg wood (Figure 1). As for the firepower it relates to the middle power (in watts) during smoking to high power or low power (Bailis et al., 2007; Vita, 1985). It is given by the \( F_{pc} \) expression:

\[ F_{pc} = f_{cm} \times P_c \times 60 \times (t_{cf} - t_{ci}) \]

where \( f_{cm} \) is the equivalent of the coal clear soup and \( t_{cf} - t_{ci} \) the variation of temperature at the time of the operation of smoking. The calorific power (\( P_c \)) of the fuel (coal of wood) is the free energy quantity for every unit of mass (or of volume) burnt. Of the writing inventory one assigns fluently to the coal of wood a calorific power of about 25 000 kJ/kg to 26 750 kJ/kg, either 6 000 kcal/kg to 6 400 kcal/kg (Rossier and Micuta, 2005), or even 7 500 kcal/kg (Keita, 2007). However, considering an elevated enough relative humidity, we estimate that values of \( P_c \) can be lower. Can one therefore apply for a "valued fire power" to 2 000 W (\( H_r \)), for a coefficient of broadcast (\( e \)) of the coal of equal ardent wood to 0.95 (Kieffaber, 1982). Knowing that \( \sigma = 5.67 \times 10^{-8} \) W·m⁻²·K⁻⁴ (Rozis, 1995), it follows that the ~2 value of the home for such an intensity can be calculated from: 

\[ T_2^4 - T_1^4 = H_r + e \epsilon S \]

What gives, after calculations and simplification, a value of \( T_1 \) that adds up to \( 1.01 \times 10^3 \) K. The temperature of the home is therefore 1 000 K, either about 707°C, value that adjoins the one brought back by the FAO (2005). Of the stock, the hot air flux takes place inside of the home toward the hurdle by convection, in accordance with the equation: 

\[ H_{cv} = h S_f (T_2 - T_1) \]

where \( h \) is the coefficient of air convection, valued to 29 W·m⁻²·°C for a speed of the air of 2 m/s (middle value recorded by anemometric in our shops). In these conditions, if one relates to data of faces 2 and 3, the loss of heat by convection can be estimated on average, for a middle mass of bush meat eviscerated of 3.5 kg of African brush-tailed porcupine or blue duiker exposed above to 50 cm fire, to: \( H_{cv} = -272.2 \) W.

So, as smoking is achieved (in the first 3 hours), the temperature adjoins 1 100°C, value brought back by the literature (FAO, 2005), in relation with losses in grease contributing to revive fire. Had consideration to the convection, this temperature decreases the hurdle at the level. These evaluations seem to agree therefore with our data, as for the downward and decreasing phase of temperature curves (Figure 1 and Figure 2). Indeed, a reduction of the fire intensity is started after 3 at 4 o'clock in order to avoid the formation of crusts on meat. In relation with the operator’s cleverness, the regulating of fire, the restraint of the heat and smoke determines the quality of the bush meat otherwise, in end of smoked. However, changes of wind direction participate in the disruption of the working of the oven; what makes difficult the regulating of fire and the restraint of the heat.

If the height of the hurdle proves to be weak, it is necessary that fire is slightly back the product; what entails a bigger dwindle of heat and smoke. Besides, when it blows in the middle, the quality of the product is affected, especially if the smokehouse is not covered. To have a smoking uniform necessitate to return and to change the site of the product regularly. While taking opinions of transformers interrogated as a basis, two main factors contribute to the obtaining of a better quality of meat smoke. It is on the one hand preferentially about its coloration golden. On the other hand, another factor is the disposition of meat to smoke on hurdles superimposed on the oven or the smokehouse. The configuration of hurdles is effectively function of the measurement of the smokehouse (notably in relation
to the speed of air), of the manipulation. These factors make comfortable the process of smoking. Besides, interviews with them investigated revealed that hurdles in wood must be regularly treated to avoid the warping (distortion) in humid environment. Indeed, the cleanliness of hurdles and the use of the removable canvases are at a time a factor of hygiene; a frequent cleaning permits not to impair supports. In the case where several hurdles are superimposed transformers examine a hurdle in general, to the middle, then the two last. Thus, they judge the opportunity to proceed to the rotation of hurdles that is put down then on the floor or on a support in wood. One proceeds then to the turning of meat that himself hand-made, when it is about thick pieces, and by a translation of hurdles charged of meat toward the empty hurdles in the case of small size species.

As for the technical performances of shops of transformation of the bushmeat and its impacts on the quality, it appears that variants observed on the traditional smoking drift more of the endogenous innovations that appeared progressively with the progression of the evolution and the appropriation of the technology by hunters and local smokers.

It is in this context that among variants of smokehouses the more observed, and appeared under the pressure of the urban food demand, the case of the smokehouse in metallic stock in place and room of smokehouses on pickets or present a particular advantage in a trench or smoky pit; increasing the quantity of meat thus to smoke (or to cook) and improving the quality of products gotten.

3 Conclusion
Results of this work show that variations either observed in the preparation of the cool bush meat. Smoke especially concern the realization or no of some operations of rudimentary transformation before modes of cooking and the various shapes of consumption. The metallic stock, characterized by a home situated at the level of soil and a hurdle arranged to the middle height of (46.1±5.3)cm, is in majority the process the more used. The temperature of the home adjoins 1 000°C in the middle of smoking, and the one recorded at the level of the hurdle 120°C, that, whatever is the mass and the animal species. However, because of phenomena of transfer of heat and the appreciation subjective of the meat firmness thus smoke, the length of the operation is variable. These different processes must be improved however to guarantee the hygienic quality of the bush meat. In sum, the valorization of the bush smoke meat, in the Congolese forest farming surroundings, pass by a precise artisanal path knowledge that assures the main thing of the urban provision in products smoked either cool fleshed. These artisanal paths should constitute places where would develop of innovations in processes, tools and even products. However, nowadays the working of these paths, so much a social view point (new organization, distribution of tasks, etc.) that economic (system of prices), are again often under the influence of backers urban. In spite of these limiting factors the knowledge of the bush path meat must be submitted to new technology constraints (tools, processes and quality of products finished, etc.) and to a better preservation of the wild fauna, while encouraging and integrating innovations.

4 Materials and Methods
4.1 Type of Survey and Geographical Situation
The zone of survey concerned the Tié-tié village, situated to twelve km of the border with the Republic Gabonese, within the Conkouati-Douli National Park (CDNP), department of Kouilou (District of Nzambi), in the west part of the forest massif of the Mayombe (Figure 3). The park spreads between 3°23~4°18 and 11°06~11°43E (Hecketsweiler and Mokoko, 1991; UICN, 1989). It is limited to the north by the border of Gabon, to the East by savannas of Cotovindo and to the west by the Atlantic Ocean and to the South by the Conkouati lagoon and the Ngongo River (PNCD and WCS, 2005).

4.2 Animal Material
The choice of the animal material supported on the consumption of the game by the farming communities of which 76% of meat consumed were constituted of african brush-tailed porcupine (*Atherurus africanus*) and blue duiker (*Cephalophus monticola*) (Wilson and Wilson, 1991).

4.3 Type of Investigation and Sampling
An investigation of prospective type, with a poll to 2 degrees for the pull to the fate of numbering zones (ZD or village)
and has been achieved of September 2010 to November 2011 of units of transformation, by a population targets constituted of the transforming hunters of bushmeat. The only criterion of inclusion was the voluntary to participate in the survey. To the descended of this process the sample of the survey was 52 hunters. The investigation took a rest on an open questionnaire and the direct observations of technological follow-up. To the total, 10 traditional shops of smoking of the bushmeat have been kept by simple uncertain pull. This sample permitted to appreciate the technical data, types of ovens, the hardness and outputs of the traditional technologies of transformation of the bushmeat. Thereafter, an analysis of different technological treatment determinants has been done.

4.4 Construction and Validation of the Questionnaire
The maintenance guide was a questionnaire on the local ability in products finished containing four categories: the organization of work and provision of bushmeat; the assessment of the knowledge to make and of frequencies of transformation.

4.5 Feature of Technological Processes of Smoking
The technological follow-up has been achieved during the month of October 2010 by an investigator. The guide of observation, adapted to the one of Oates (1986), permitted to distinguish modes of provision in raw materials and the use of products finished.

For techniques of evaluation in the days of work and energizing expense calculation. The recorded lengths and quantities of games transformed have been taken in account. As for the technological follow-up of the traditional transformation of the bushmeat it amounted to the technical data of the oven and determinants of the traditional technological treatments of smoking (length of the habiliment and every unit operation; balance of mass). Balance matter has been appreciated by the slant of the mass measure and the qualitative appreciation of smoking, according to the species. The measure of masses permitted to determine reports of smoking and debits of products. The goal of measures of masses and lengths was to specify the degree of the drying; considered like satisfactory when the report masse measured was located in the norm equivalent to $1/3 - 1/4$ (Rozis, 1995). The ambient humidity, the temperature of the oven, the length of smoking or cooking (timed in every visited shop), report quantity/quality of woods clear soup by smoking (weighed of land in every visited shop) have been appreciated also. Finally, the evolution according to the time of the ambient temperature and the one recorded at the level of the hurdle has been appreciated at intervals of 30 min. This kinetics has been examined for an animal mass of 3.5 kg according to the species. The temperature has been measured with the help of a theromcouple nickel and nickel.
chromium-plates. The measure of the relative humidity of air has been achieved with the help of hygrometers to sensor capacity.

**Authors’ Contributions**
Makosso-Vheiye G. conceived the study, participated in the study design and data acquisition. Massamba A. participated in the study design, statistical analysis and reviewed the manuscript. Mananga V. participated in the data acquisition. Massamba J. and Silou T. reviewed the manuscript.

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**References**
Atoukam T.L.D., 2004, Transformation, conservation et commercialisation de la viande de brousse dans l’Adamou (Cameroun), pp.8
FAO, 2005, Evaluation des performances d’un foyer, WEN and CAM (Wood Energy Network of Cambodia)
Keita J.D., 2007, Bois ou charbon de bois: quel est le meilleur combustible? Les petites entreprises forestières. Archives des documents de la FAO; Département des forêts
Kieffaber L.M., 1982, Heat transfer in household energy, John Wiley and sons, New York, pp.192
Massamba J., 2003, Potentialités d’amélioration des modalités d’utilisation alimentaire des produits dérivés des racines de manioc au Congo Brazzaville, Dissertation for Ph.D., Faculté des Sciences, Université Marien Ngouabi, Brazzaville, Congo, pp.305
Muchnik J., 1993, Alimentation, Techniques et innovations dans les régions tropicales, pp.556
PNCD and WCS, 2005, Rapport sur les activités socio-économiques dans le Parc National de Conkouati-Douli, pp.22
Rossier G., and Micuta W., 2005, Le charbon de bois est-il un combustible satisfaisant, REDI
Vita 1985, Testing the efficiency of wood burning cook stoves: provisional internal standards, volunteers in technical assistance, Arlington, VA, pp.76