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IMPACTS OF THE OPERATIONS OF DEMOLITION AND UNLOADING OF THE CONCESSION WOOD-KASSA, SUB-PREFECTURE OF LIRANGA, DEPARTMENT OF LIKOUALA, REPUBLIC OF CONGO

AYESSA LECKOUNDZOU[1,2,3,4], Pierre MBETE [1,2,3], Felix KOUBOUANA [1,2] and Tychique Junias TOPANOU

[1]Higher National school of Agronomy and Forestry (ENSAF),
[2]Marien Ngouabi University (UMNG) LP 69 Congo-Brazzaville.
[3]Laboratory of Ecology Applied and the Environment of the ENSAF.
[4]National Forest Research Institute (IRF)

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ABSTRACT

The present study proposed to evaluate the environmental impacts in Wood-Kassa company. Realized in 10 pieces adding up a surface of 500 ha in the Annual Plate of Cut 2020.In order to achieve these goals, wood was used like vegetable material for the harvest of the data. The method to reach that point was the take of measures to each place of impact. The results reveal that forest surface impacted by each operation rises to 7.65 ha for the demolition of the 155 feet and 16.82 ha for the unloading of the 287 barks.

The total loss in terms of surface per tree cut down rises to 497.10 ha, and the total number of the impacted stems is of 8 trees per cut down tree.It is thought that Wood-Kassa company should still provide a little effort so that the non-observance of the standards of management is considerable tiny room of way whereas the application of standards EFIR remains a major tool for a durable management of forests.

Keywords: Environmental Impacts, Demolition, Evaluation, Unloading, Stems with A Future, Surface.

1. INTRODUCTION

Opened on the coast Atlantic and crossed by the equator, Congo is indisputably the principal door of entry of central Africa.The river which gave its name "Congo" delimits a natural border with the Democratic Republic of Congo.It is also the greatest inland waterway of all Africa (Mavoungou, 2002).It forms integral part of the "forest basin of Congo" and extends on 342,000 km2 (Groutel, 2013).

Congo has a forest cover of 22 471 271 hectares is 1/10ème dense forests of Africa Centrale.65% of the national territory covered of forest of which 7 million is in the easily flooded zones, the remainder being on firm ground (IFO, 2005).The forest field congolais east divides into three principal solid masses of extent, of floristic composition and of the very different level of development, it is about:solid mass of Kouilou-Mayombe with 1.5 million hectares;solid mass of Chaillu with 3.5 million hectares, it is the second solid mass in term of surface;solid mass of Congo North with 15 million hectares (IFO, 2005).

This characteristic explains the importance of the forest vegetable cover repeted on the national territory, from where the economic development of the country remains tributary with forest

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(Etoka, 2005).Indeed wood constituted the principal resource of the country until 1974.It contributed up to 85% to the export earnings and approximately 10% to the GDP, before oil does not relegate it to the second plan.Currently, wood accounts for nothing any more but 9% of the export earnings and 2% of GDP (PNUE et al..2015).

After the conference of the United Nations on the environment and the development in Rio de Janeiro in June 1992, several countries became aware of the importance of the forests in their economic, social and environmental development (Barthod, 1993).The new context ecological and economic, social, cultural and the environmental protection made it possible Congo to adopt a new law N16-2000 of the 20/11/2000 bearing forest code and the N2002-437 decree of the 31/12/2002 fixing the conditions of management and use of the forests (Presidency of the republic of Congo, 2002).

Durable forest management required the introduction in wet tropical medium the methods "of forestry development to reduced impacts", usually called "EFIR" whose first stage of the EFIR consists of a precise planning of the operations, followed by their control, with in parallel a sensitizing and a formation of the labour, the second stage relates to the identification of the impacts generated by the forestry development (ATIBT, 2006).

In this context, forest managers are called to set up the procedures aiming at minimizing the impacts (OIBT, 2006).It is within this framework that we undertook this work on the evaluation of the environmental impacts in Wood-Kassa company in order to contribute a significant share in the improvement of the techniques of forestry development with an aim of reducing the impacts caused by the forestry development on the environment.

The problems of the practices of the mining methods forest in the tropical countries frequently result in the non-observance of the standards of forestry development to reduced impact (EFIR) of which forest administrations, owners forest, the academics and the researchers have more and more interest concerning durable management on the environment (ATIBT, 2006).The general objective of this study is to evaluate the direct impacts of the operations of forestry development on forest settlement in a forest concession.To achieve the goal concerned, the specific objectives of this work are:

- To evaluate the impact on the vegetation in particular on the residual settlement according to the physical state of the stem (E for the barked stems, D for the uprooted stems, and C for broken) according to classes' of diameter, more precisely on the gasolines with a future at the time of the operations of demolition and the unloading of the sawlog,
- To compare the correlations of the surface of perforated with that of the houppier of the three gasolines most cut down in this UFA, in particular Bubinga (*Guibourtia tessmanii*) (Harms) J Léornard, Azobé (*Lophira alata* Banks ex P. gaertn *Lophira alata* Banks ex P. gaertn) and the gasoline Iroko (*Milicia excelsa* (Welw.) C.C Berg) least representative,
- To determine the rate of impact of all these operations.

2.MATERIEL AND METHODS

2.1. Material used for the data-gathering

For the harvest of the data, the following material was used:

- One decametre ribbon to determine measurements;

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- A cord of 50 m;
- A GPS map 63 SC (standard Garmin) and two pairs of piles to locate the co-ordinates thanks to the satellite;
- A cable of remote loading;
- A telephone for the take of the photographs;
- A compass to indicate the orientation;
- A chart of the annual plate of cut;
- A machete.

2..2.Sampled vegetable material

In the present study, 155 feet of 11 cut down gasolines were useful like vegetable material for harvest of the data.

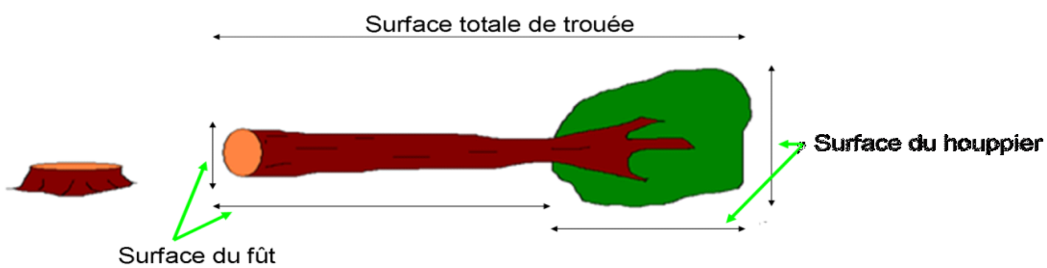
2.3.Methods of data-gathering

Choice of the sampled pieces

The experimental device of this study consisted of ten (10) units of sampled pieces (A1;A2;A3;A4;A5;B1;B2;B3;B4;B5) of 50 ha (1000 m X 500 m) each one of rectangular form selected according to their accessibility in the Annual Plate of Cut (AAC) 2020.

2.3.1.Method evaluation of the impact to demolition on the forest ecosystem

The data were collected primarily on 155 cut down feet of 11 gasolines.All the cut down trees met were the subject of a botanical identification and the surfaces of perforated were measured (Figure 1).



Appear I: Diagram of measurement of perforated demolition (Mbété, 2014)

Surface barrel = Length of the barrel x width of the barrel

To evaluate perforated demolition, we proceeded in the following way:

- To determine the surface of the barrel we multiplied the length of the barrel by the width of the barrel;
- To determine the surface of the houppier we multiplied the length of the houppier by the width of the houppier;
- Then we added two surfaces.

The average diameter of the cut down barrel and the length of the barrel enabled us thanks to the scale of cubage (CIRAD, 1995) to determine the volume of the barrel.

2.3.2.Evaluation on the residual forest settlement

In the present study, the types of damage of the stems impacted by demolition set out again as follows:uprooted, barked and broken.An inventory of these alive stems of diameter equal to or higher than 10 cm, measured with one decametre to height of the chest (1 m 30 height) was carried out (figure3).On these stems a vital evaluation was the object in order to determine the types of impacts or damage.

The damaged stems were divided into new (9) classes diameter and the classes of diameter correspond to the following figures: **I** for the class of diameter ranging between (10;19 cm); **II** for the class of diameter ranging between (20;29 cm); **III** for the class of diameter ranging between (30;39 cm); **IV** for the class of diameter ranging between (40;49 cm); etc.Figure 3 presents the catch of measurement of a barked stem.

Figure II: Measure diameter of a stem of Niové barked

2.3. 3.Method evaluation of the impact to the unloading on the forest ecosystem

The data were collected according to piece's retained for measurements.On a total of ten (10) pieces, the length of each track and its width was measured using a double decametre.At the entry, the medium and the end of each track, measurements of the width of the tracks were taken.The surface degraded by the unloading, is calculated by multiplying the average width of all the tracks opened by the overall length of all the tracks.

2.3.4.Evaluation of the impacted residual vegetation

All the stems damaged on the two sides of the tracks of unloading were recorded.With each time that a stem was damaged that was recorded.Only and of uprootings were observed and it is with these three types of damage that the evaluation was limited.

S = L X l

With S = surface;l = width;L = Length

Rate of impact

It is calculated by the following formula:

$$\mathbf{T(\%)} = \frac{Si}{Sp}\mathbf{X\ 100}$$

With

T:Rate of impact in %

Si**:** Impacted surface, it is given by the following formula:

S_i = a Number of cut down feet X average Surface impacted by tree

Sp: Surface of the sampled piece.

2.3.4. Processing of data

The data collected on the ground were seized in the software Excel, these data were analyzed through the statistical functionalities of the Excel software.Then we used the Word software for the seizure of the document.

3. PERSENTATION OF THE RESULTS

3.1. Estimate of the impacts of perforated demolition

Forest Unit of Installation (FUI) Wood-Kassa with a great floristic diversity since the zone had never undergone a forestry development since the colonial time, but the market demand shows a preference of wood selection.Table 1 illustrates the commercial, scientific names by family of the cut down trees.

Table 1: Distribution of the number of trees cut down essentially

Gasolines	**Scientific names**	**Family**	**A number of cut down trees**
Azobé	*Lophira alata* Banks ex P. gaertn	Ochnaceae	37
Bilinga	*Nauclea diderrichii* (De Wild.And T Durand Merr;	Rubiaceae	8
Worked clearly	*Guarea cedrata* (A. Chev.) Pellegr.	Meliaceae	10
Bubinga	*Guibourtia tessmanii* (Harms) J Léornard	Fabaceae-Caesalpinioideae	52
Essia	*Pertersianthus macrocarpum* (P. Beauv.)	Lecythidaceae	3
Iroko	*Milicia excelsa* (Welw.) C.C Berg	Moraceae	3
Limbali	*Gilbertiodendron dewevrei* (De Wild.) J.Léonard	Fabaceae-Caesalpinioideae	17
Niové	*Staudtia kamerunensis* Ward.VAr gabonensis Fouiloy	Myristicaceae	5
Oboto	*Mammea africana*	Clusiaceae	6
Sapelli	*Entandrophragma cylindricum* (Sprague) Sprague	Meliaceae	11
Tiama	*Entandrophragma angolensis* (Welw.) C.Cd..	Meliaceae	3
Total			**155**

Table 5 highlights the distribution of the number of trees cut down essentially. Bubinga constitutes the gasoline having more cut down feet followed by Azobé on the other hand Essia,

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Iroko and Tiama constitutes the gasolines having less feet cut down for a total volume of **2026,806m3**.

Table 6 presents the distribution of the trees cut down according to their length, their average diameter and their volume.

V = 0,7854 X D2m X L;
Vtotal = 2026,806 m3
With

π/ 4 = 0,7854;
DM = average Diameter measures some (**m**)
L = Length measures some (**m**)
V = Volume in cubic meter (**m3**).

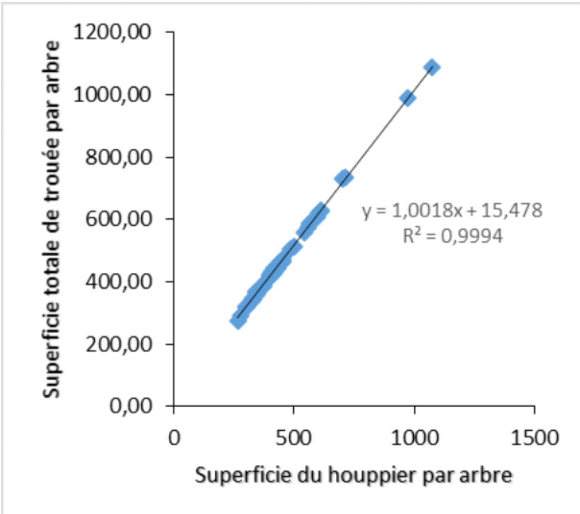
Table 2 presents a abstract of principal measurements of perforated barrels and houppiers by cut down trees.

Table 2: Average value of the principal surfaces of the barrels and houppiers by cut down trees

Gasolines	Manpower	Average surface of the trouées/fûts (m²)	Average surface of perforated/houppiers (m²)	Total surface of perforated (m²)	Average surface of perforated (m²)
Azobé	37	18.73	513.54	19693.99	532.27
Bilinga	8	18.74	496.58	4122.56	515.32
Bossé clair	10	17.27	422.16	4394.3	439.43
Bubinga	52	16.3	457.71	24648.52	474.01
Essia	3	13.58	382.78	1189.08	396.36
Iroko	3	17.2	570.12	1761.96	587.32
Limbali	17	17.36	377.02	6704.46	394.38
Niové	5	15.6	436.45	2260.25	452.05
Oboto	6	20.37	482.46	3016.98	502.83
Sapelli	11	22.22	622.8	7095.22	645.02
Tiama	3	25.11	504.01	1587.36	529.12
Total/Moyenne	**155**	**18.41**	**478.69**	**76474.68**	**497.10**

The reading of table 6 announces that the 155 cut down feet add up a total surface of perforated of 76474.68 m² (7.65ha).The average surface of perforated is of 497.10 m².In this table, one notices that the gasoline which impacts more in term of surface is Sapelli (645.02 m²), followed by Iroko (587.32 m²).Limbali impacts less with 394.38 m² compared to all the gasolines cut down in the sampled pieces.

Three gasolines were subjected to a comparison surfaces of perforated tree compared to perforated of the houppier and the results are illustrated on figures 4 to 8 in the case of Bubinga *Guibourtia tessmanii* (Harms) J Léornard, figures 9 to 13 for Azobé *Lophira alata* Banks ex P. gaertn and from 14 to 18 for the gasoline Iroko *Milicia excelsa* (Welw.) C.C Berg.



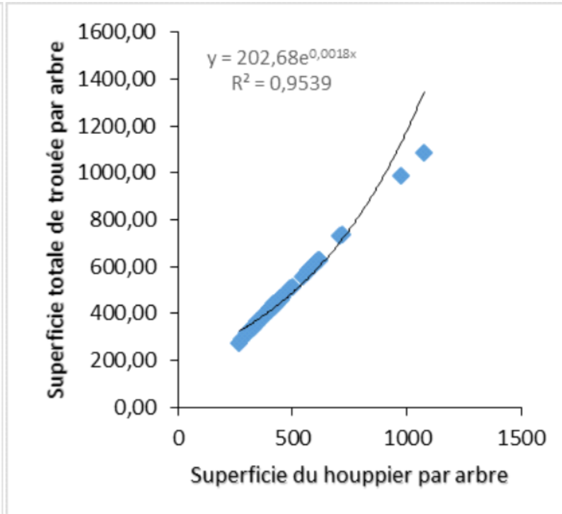
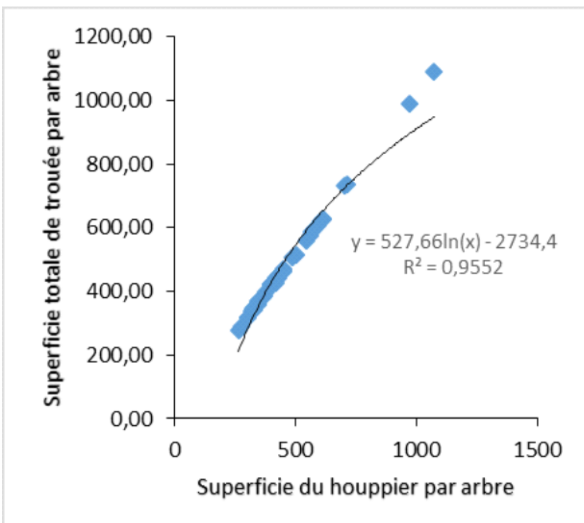
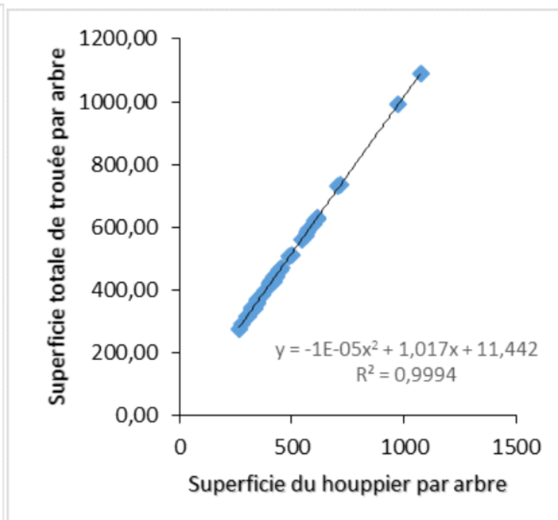


Figure III: Linear Equation **Figure IV:** Exponential equation





Appear V: Equation logarithmic curve **Figure VI:** Polynomial equation

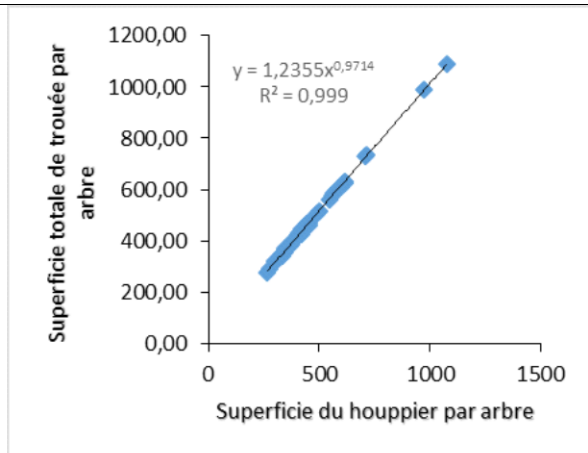
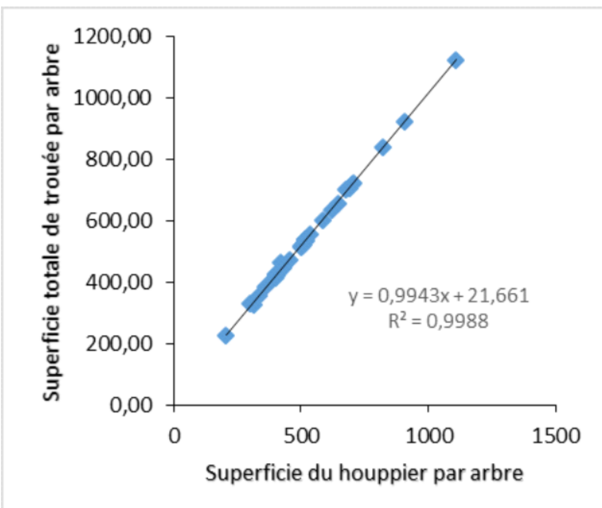


Figure VII: Equation power

Figures 8 to 12 show the correlation between the total surface of perforated compared to the houppier for the gasoline Azobé.



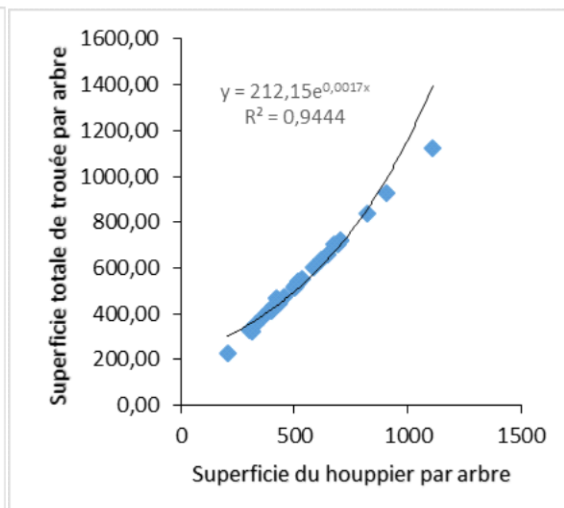


Figure VIII: Linear Equation **Figure IX:** Exponential equation

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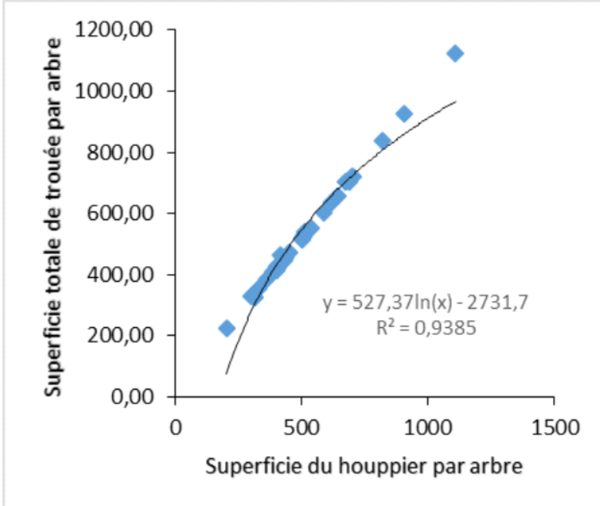
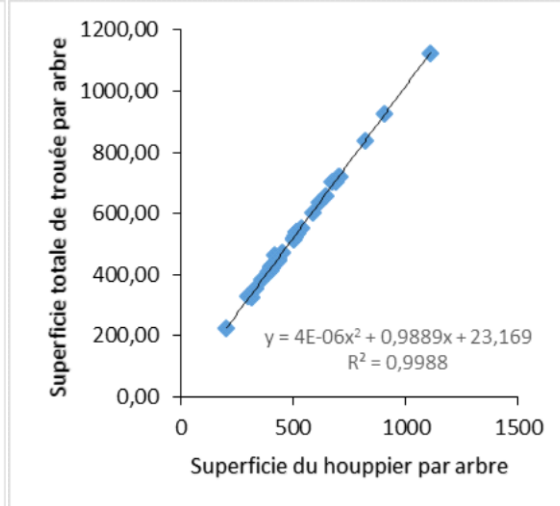




Appear X: Equation logarithmic curve **Figure XI:** Polynomial equation

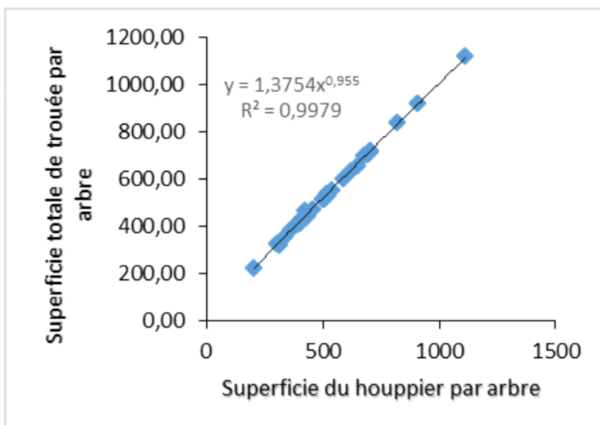
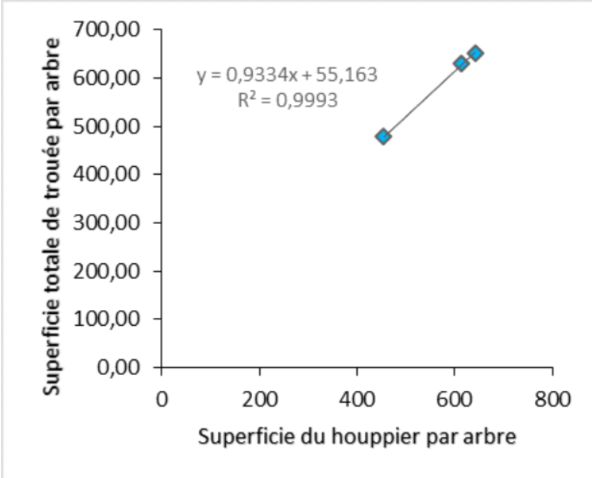


Figure XII: Equation power

Figures 13 to 17 show the correlation between the total surface of perforated with the houppier for Iroko



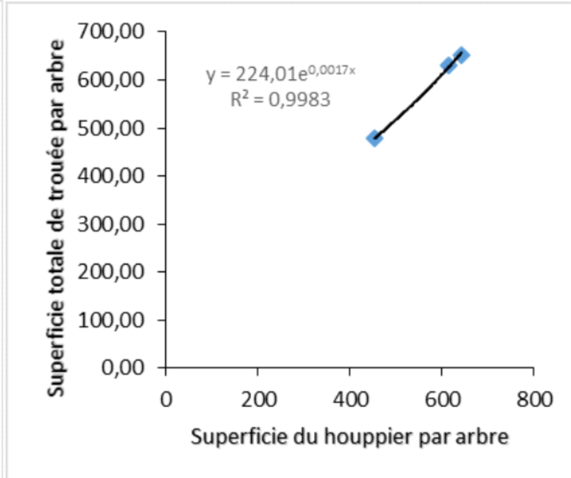
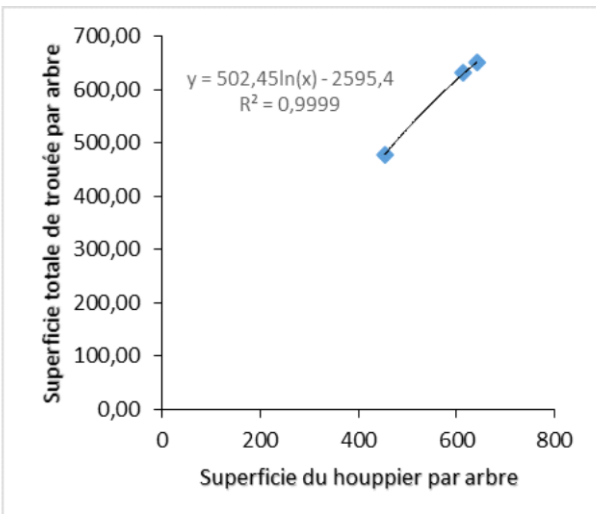


Figure XIII: Linear Equation **Figure XIV:** Exponential equation



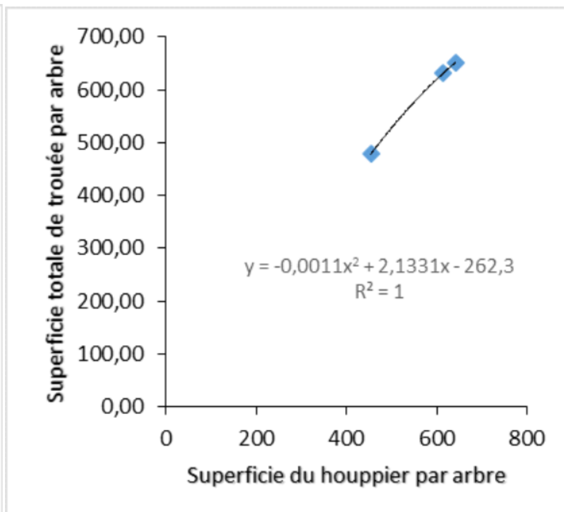


Figure XV: Equation logarithmic curve **Figure XVI:** Polynomial equation

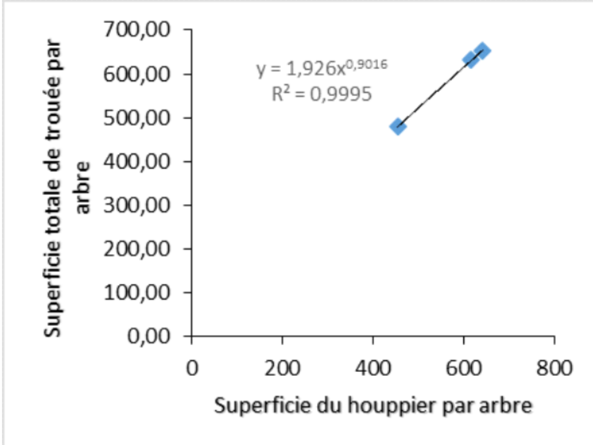


Figure XVII: Equation power

The examination of figures 3 to 17 watch that the shape of the cloud of all these figures is strictly linear, and nonexponential, logarithmic curve, polynomial or power.The model which is adjusted best with the data of total surface of perforated and of the houppiers is of type: **Y = ax + B**

Whatever the model used, the coefficients of R^2 determination vary between 0,938 and 1.This explains why it y' has a positive dependence between the two variables (total surface of perforated and surface of the houppiers) and the estimate of the correlation is indeed significant.Table 3 highlights the distribution of the rate of impact essentially cut down.

Table 3: Distribution of the rate of impact essentially cut down

Gasolines	A number of cut down trees	Rate of impact (%)
Azobé	37	0.39
Bilinga	8	0.08
Worked clearly	10	0.09
Bubinga	52	0.49
Essia	3	0.02
Iroko	3	0.04
Limbali	17	0.13
Niové	5	0.05
Oboto	6	0.06
Sapelli	11	0.14
Tiama	3	0.03
Total	**155**	**1.53**

The examination of table 3 shows that the rate of impact is 1.53 % compared to the sampled pieces.Bubinga has a rate of high impact of 0.49 % compared to other gasolines, follow-up of Azobé (0.39 %). As for Essia it has the lowest rate of the impact estimated at 0.02 %. to

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objectively explain the causes of the increase in the rate of impact, we established a correlation between the number of tree taken in the pieces sampled with the rate of impact essentially (figure 18).

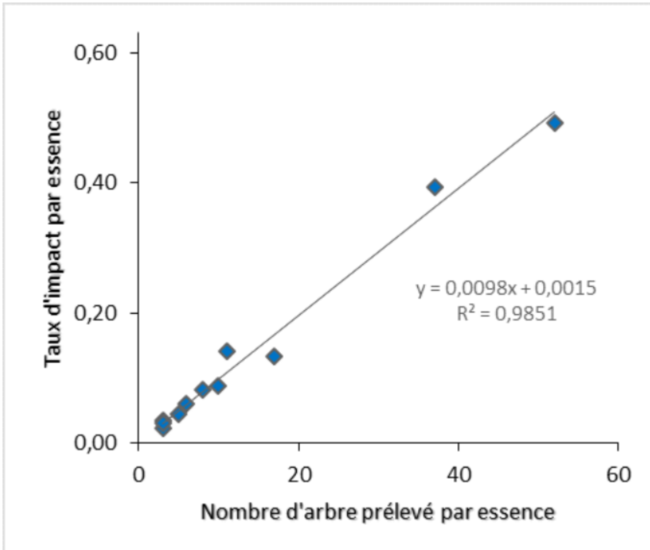

Figure XVIII: Evolution of the rate of impacts compared to the number of feet taken in the pieces sampled essentially

It comes out from this figure that the coefficient of determination between the number of feet taken essentially and the rate of impact is strong and positive (R^2=0,985).There is then a positive linear relation between these variables.That means that the more one increases the rate of taking away, the more the rate of impact is significant.Our results corroborate with those of (Luc DURRIEU OF MADRON et al. 2000 city by FAO, 2000-2003).

It arises that 1251 stems with a future were touched for 155 cut down feet.That is to say an average of 8 stems touched for a cut down exploitable tree.

To explain the number of stems with a future damaged during demolition a correlation is established between the number of damaged stems with a future and surfaces of perforated.Figure 19 has the results of this correlation.

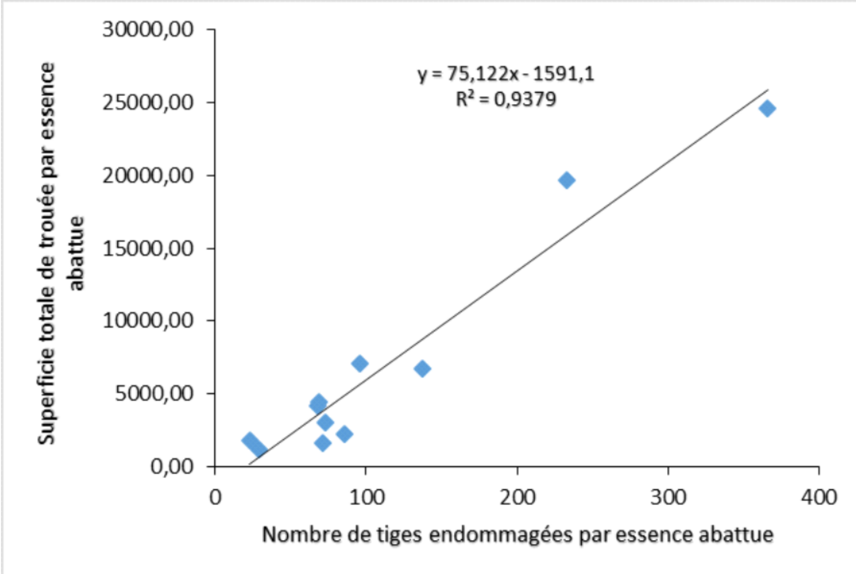

Figure XIX: Evolution of the number of stems with a future damaged compared to total surfaces of perforated cut down gasolines

It arises from figure 19 that the coefficient of determination between these two variables is very strong (R^2 = 0,9379).This means that when perforated is very large, the damage on the settlement is also enormous.Table 4 highlights the types of damage themselves compared to their class of diameter.

Table 4: A number of stems impacted by class of diameter

Classes of diameter (cm)	**Types of impacted stems**				**% percentage**			
	Barked	**Uprooted**	**Broken**	**Total**	**E**	**D**	**C**	**Total**
I	76	60	281	417	6.08	4.80	22.46	33.33
II	56	36	151	243	4.48	2.88	12.07	19.42
III	49	21	135	205	3.92	1.68	10.79	16.39
IV	27	10	85	122	2.16	0.80	6.79	9.75
V	32	7	37	76	2.56	0.56	2.96	6.08
VI	25	5	21	51	2.00	0.40	1.68	4.08
VII	17	3	31	51	1.36	0.24	2 .48	4 .08
VIII	27	4	22	53	2.16	0.32	1.76	4.24
IX	19	2	12	33	1.52	0.16	0.96	2.64
Total	**328**	**148**	**775**	**1251**	26.22	11.83	61.95	100.00
% percentage	26.22	11.83	61.95	100				

Table 4 presents the proportions of the types of in the following way impacted stems:26.22 % of the barked stems, 11.83 % of the uprooted stems and 61.95 % of the broken stems.

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The class of diameter I has the highest density of impacted stems (33.33 %), followed class II with 19.42 % of impacted stems.On the other hand class IX has the lowest density of the stems impacted (2.64 %). As regards the vital statu of the impacted stems figure 20 indicates it.

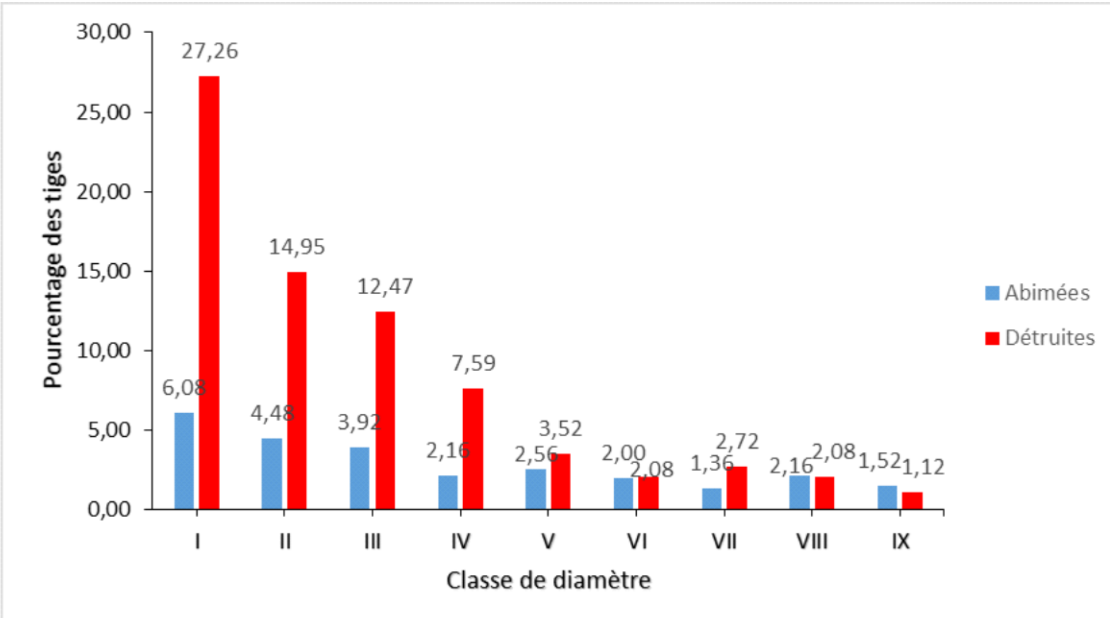

Figure XX: Vital statute of the stems impacted according to class of diameter

It arises from figure 20, that the first 8 classes of diameter I, II, III, IV, V, VI, VII, VIII (10 to 89 cm) have a strong density of destroyed stems On the other hand (73.78 %). the class of diameter which is followed from there (90 to 99 cm) has a high density of abimées stems (26.22 %).

2.2. Estimate of the surfaces damaged with the unloading

Table 5 has the surface degraded by the unloading according to the number of discharged trees and numbers it tracks.

Table 5: Distribution of the surface degraded by the unloading

Numbers total of track	**Total discharged barks (m) numbers**	**Overall length of the tracks of unloading (m)**	**Average width of the tracks of unloading**	**Total surface (ha)**	**% percentage**	**Average of a bark**
12	287	31435	5.35	16.82	0 .24	7.07

It arises from table 5 that out of 287 discharged barks, one noted an opening of the tracks of unloading of 31,435 m, when one multiplies this overall length of the tracks of unloading by the

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average width of the tracks of unloading, one finds 168177.25 m² or 16.82 ha are 0.24 % compared to the Annual Plate of Cut.Thus, the 16.82 ha represent the total surface touched by the opening of the tracks of unloading and table 6 fact of arising the number of stems impacted by class of diameter to the unloading

Table 6: Distribution of the number of stems impacted by class of diameter to the unloading

Classes of diameter (cm)	Types of impacted stems				% percentage			
	Barked	**Uprooted**	**Broken**	**Total**	**E**	**D**	**C**	**Total**
I	157	374	97	628	7.74	18.44	4.78	30.97
II	197	213	79	489	9.71	10.50	3.90	24.11
III	205	237	24	466	10.11	11.69	1.18	22.98
IV	54	128	2	184	2.66	6.31	0.10	9.07
V	39	6	1	46	1.92	0.30	0 .05	2.27
VI	69	1	0	70	3.40	0 .05	0.00	3.45
VII	90	1	0	91	4.44	0.05	0.00	4.49
VIII	44	0	0	44	2.17	0.00	0.00	2.17
IX	10	0	0	10	0.49	0.00	0.00	0.49
Total	**865**	**960**	**203**	**2028**	42.65	47.34	10.01	100
% percentage	42.65	47.34	10.01	100				

Table 6 presents the proportions of the types of the in the following way impacted stems:42.65 % of the barked stems, 47.34 % of the uprooted stems and 10.01 % of the broken stems.
The class of diameter I has the highest density of impacted stems (30.97 %), followed class II (24.11 %) of impacted stems.On the other hand class IX has the lowest density of the stems impacted (0.49 %). As regards the vital statu of the impacted stems figure 21 indicates it.

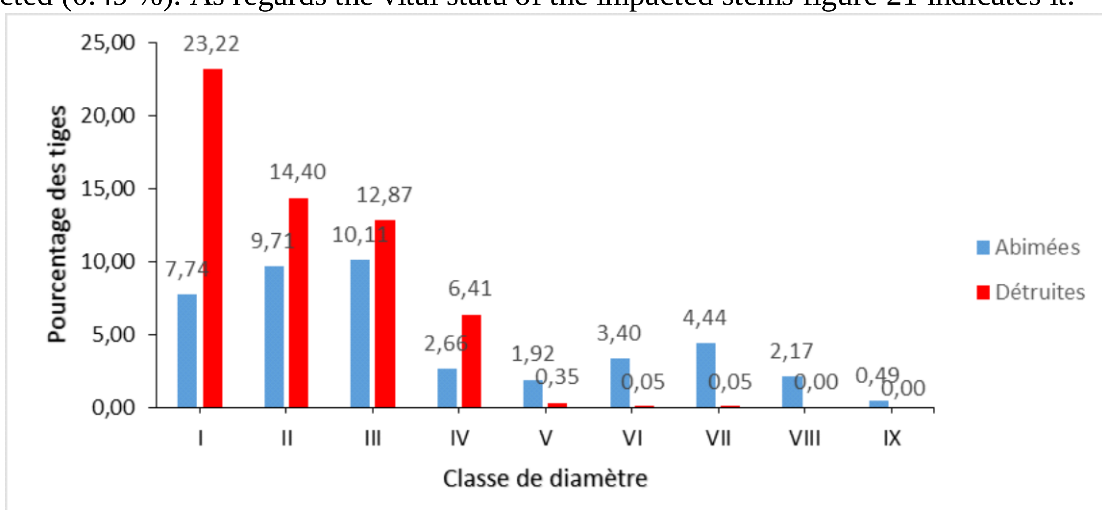

Figure XXI: Percentage of the damage caused on the residual population according to classes' of diameter

It arises from figure 21, that the first 4 classes of diameter I, II, III, IV (10 to 49 cm) have a strong density of destroyed stems On the other hand (57.35 %). the classes of diameter which are followed from there (50 to 99 cm) have a high density of abimées stems (42.65 %). It arises from the observations of ground that, on 75 opened parks, the destroyed total surface is of 139144.17m2 is 13.91 ha having a percentage of 0.19%.

4. DISCUSSION

4.1. Discussion related to the impacts of demolition on the forest ecosystem

The limitation of the maximum number of exploitable stems is directly responsible for the damage on the exploited settlement, it proves to be an effective measurement for the reduction of the damage and the durability of installation (Dupuy, 1998).The damage of demolition depends directly on the number of stems taken with the hectare and, generally of the size of the cut down tree.When the crowns of the trees are very large (up to 30-40 m in diameter), Jardin (1995) notes for a taking away of 0.35 tiges/ha the rate of damage is estimated at 1.6 % and the average surface of perforated demolition is of 523.90 m².

In the same way, Mbété (2014), finds the surface average of perforated demolition of 347.75 m² and the rate of impact on the remaining settlement rises to 2.30 %. In this same optics, Oreyila (2015) in the UFA Ngombe, reveal that with a taking away of 0,58 tiges/ha, a rate of impact of 2.90 % on the settlement was noted.Fosso (2013) reveal that, for a taking away of 1.72 tiges/ha, the rate of impact is 5.21 %.

In our study, for a taking away of 0.31 tiges/ha, the rate of impact is estimated at 1.53 % and the average surface of perforated demolition is of 497.10 m².It is noticed that the rate of impact is a function of the rate of taking away.In Central African Republic, for an exploitation of 3.7 tiges/ha in semi-décidue forest, the average surface of perforated demolition was of 350 m² per exploited foot, affecting 13 % of the forest (De Chaterlperron and Commerçon, 1986).The importance of the impacts due to the houppiers depends on the space volume of those, of the size as well as density of the surrounding trees being able to create the damage.

The gasolines which have the average surface of perforated largest are those which have a very spread out houppier.Mbété (2014) affirms that by a correlation between the average surfaces of perforated with the houppiers. This assumption was checked by correlations at the time of our study.The models used between the two variables (surface of perforated and the houppiers) made it possible to observe that, the coefficients of determination (R^2) are satisfactory.In the models tested, it appears that the linear model is that which could be advised with the various users.

Work of Bertault and Sist., (1995);of Durieu de Madron et al..(1998) also showed that, the surface of one perforated depends on the size of the houppier.The same observations were made by Pardé and Bouchon (1998).A study in Amazonia showed that the lianas connected each tree to the houppiers from three to nine other trees and that the tree felling rich in lianas generated perforated in canopée twice the larger than those created by the fall of trees without lianas.It is advisable to mean that the impact of demolition on the forest ecosystem depends on the number of stems taken with the hectare, of the size of the tree, the density of the feet in the zone but also of the other generating factors.

4.2. On the level of the residual forest settlement

The tree while falling, bark, uproot, and break a certain number of stems in the zone.The mortality of the stems indisputably touches all the classes of diameter (Durrieu de Madron, Eric Forni and Marcellin Mekok, 1998).The results of our study reveal that on 155 cut down feet 1251 stems with a future were touched, that is to say an average of 8 stems touched for an exploitable tree.Table 7 presents a comparative study of the impact of demolition on the residual forest settlement at other authors.

Table 7: Comparison of the impacts of demolition on the residual forest settlement

Sources	**A number of cut down feet**	**A number of damaged stems with a future**	**Average of stems with a future impacted by tree**	**Diameter of inventory of the impacted stems**
Garden, 1995	187	408	2.2	? 20 cm
OIBT, 2006	31	652	21	? 20 cm
Fosso, 2013	86	1273	14.8	? 10 cm
Nabienne, 2015	100	1026	10.26	? 10 cm
Makita, 2018	112	701	6.26	? 20 cm
Present study, 2020	155	1251	8	? 10 cm

The reading of table 7 indicates that, the study undertaken by OIBT (2006) emphasized significant impacts on the residual forest settlement (21 stems touched by cut down tree), followed study of Fosso (2013) which finds 14.8 stems touched by cut down tree, then the study of Nabienne (2015) which finds 10.26 stems impacted by cut down tree.On the other hand at the time of our study Topanou (2020), 8 stems were touched by cut down tree, follow-up of the study undertaken by Makita (2018) which finds 6.26 stems impacted by cut down tree, finally the study undertaken by Jardin (1995) reveals that 2.2 stems were impacted by cut down tree.

4.3. Discussion related to the impacts of the unloading on the forest ecosystem

The unloading is one of the significant operations of the forestry development, it causes a visible impact on the forest settlement, in particular on the stems with a future by creating openings (Mbété, 2014).The unloading is an operation which consists in extracting the barks from the place of cut in forest to the park with bark (Sist, 1998).Cette operation causes significant impacts on the forest ecosystem (ATIBT, 2014).

We have an average width of 5.35 m and the overall length of the tracks of unloading for 287 discharged barks is estimated at 31,435 Mr. the degraded total surface gave 16.82 ha, that is to say 0.24 %. Our results show that degraded surface is above that envisaged by standards EFIR.In addition it is recognized that the number of damaged stems vary according to degraded surface, it arises from it from work of (Mbété, 2014) that when surface is weak, the number of damaged stems is also weak

FAO (2003), recommends that the maximum width of the tracks of unloading should not exceed 4 m, i.e. the length of the shovel of a tractor.Just as Nkounkou (2011) in the UFA Mokabi had 3.85 m like average width of the tracks of unloading.This proves that the tracks of unloadings in the company Wood-Kassa do not obey to standards EFIR.

4.4. On the residual forest settlement on the level of the unloading

The unloading causes damage on the forest ecosystem by the destruction of the vegetation.This impact is all the more significant when the network of track of unloading is not optimized and is not planned and that the trees to be preserved are not marked.Reason for which Marn and Jonkers (1982) recommend good programming of the exploitation which goes hand in hand with an improvement of the profitability of the operations.Laurent and Maitre (1992) distinguish the damage due to the tracks from unloading according to whether it is carried out in a phase (directly foot exploited with the park with bark).

The track of unloading causes the opening of a band of forest, but contrary to the opening of the roads, the largest stems are saved (Durrieu de Madron et al..1998).

The results of our study reveal that on 287 discharged barks 2028 stems with a future were touched, that is to say an average of 7 stems touched for a discharged bark.According to Bertault and Sist (1995), Méoli (2005), the unloading causes the break of the stems of low diameter, in general between 10 and 20 cm, more rarely of the stems having a diameter higher than 50 cm.This thought confirms our results.

4.5. Estimate of the total impact of the exploitation on the residual settlement

A total of 3279 stems damaged by work of demolition and unloading.The table below presents a abstract of the total number of the stems damaged during work of demolition and unloading.

Table 8: Estimate of the damage total of the exploitation on the residual settlement compared to demolition and with the unloading

Operations of forestry development	**Numbers impacted stems**				**% percentage**			
	Barked	**Uprooted**	**Broken**	**Total**	**Barked**	**Uprooted**	**Broken**	**Total**
Demolition	328	148	775	1251	26.22	11.83	61.95	100
Unloading	865	960	203	2028	42.65	47.34	10.01	100
Total	1193	1108	978	3279	68.87	59.17	71.96	
% percentage	36.38	33.79	29.83	100				

It is deduced from this table which the number of the damaged stems is higher with the unloading (2028) that with demolition (1251).Our results are weak compared to those found by Mouélé (2012) which had a rate of impact of 58.8%.

6. CONCLUSION

Congo has immense forest resources.The rational exploitation of those presents one of the surest ways of its economic development.International requirements as regards durable management of the forests whose maintenance and improvement of the aptitude of the forest as well as possible to fill the unit of its ecological, economic and social functions, by preserving all its potentialities for the present generations and future will have to be imperatively observed.

The results of the study reveal that perforated demolition opened by the company Wood-Kassa caused on 155 cut down feet 7.65 ha of surface impacted with a rate of impact estimated at 1.53 % and the damage of demolition has affected 1251 stems with a future, that is to say a ratio of 8 stems touched by cut down tree.In the 1251 touched stems, 73.78 % of the stems are destroyed while 26.22 % of the stems are abimées what could disturb the forest ecosystem considerably, compared to its capacity of regeneration for the future exploitation.

The durable management of the forest resources is currently in the center of the concerns of many national, international and governmental organizations.Many forest companies became aware of the importance of the certification of their concession, whose economic impact on the international markets of wood is satisfactory.

REFERENCES

ATIBT, 2006, Training of forester amenagist and forest manager, Modulates 6:Forestry development with reduced impact.TEREA, FFEM, 53 p.

ATIBT, 2014, Etudes on the plan practises installation of the natural forests of production tropical African, Durable Volet 4 Management and recommendations for certification. Belgium.126 p.

Barthod C, 1993, the conference of the United Nations on the Environment, the development and the forest. Rev-For-XLV-1.75700. Paris, 25p.

Bertault J G and Sist P., 1995.Impacts of the natural exploitation. *Drink and Forests of the Tropics* 242: 5-20.

Cirad-drill, 1995. Scale of cubage, 7th edition, 86p.

De Chaterlperron G and Commerçon R., 1986. Introduction of the device of research in natural forest in the forests of Boukoko and Lolé in Central African Republic Project F.A.C. A.R.R.F.C.T.F.T., 58 p.

Dupuy B, 1998. Bases for a sylviculture in African wet tropical forest dense.Project FORAFRI, 328 p.

Durrieu de Madron L;Forni E;Karsenty A.;Loffeier E and Pierre J.M., 1998. The Pilot project of installation integrated of Dimako (Cameroun) (1992-1996).Project FORAFRI, 160 p.

Durrieu de Madron L;Forni E and Mekok Mr., 1998. Techniques of exploitation with weak impact in wet dense forest camerounaise.Series FORAFRI, document 17.CIRAD-forest, Montpellier, 28 p.

Etoka S.V., 2005. Approach technical for the maximization of output matter in the production facility of the company Wood-Kassa.Report/ratio of training course of end of formation for obtaining the diploma for the occupation of engineer of work of rural development, Option:Forest techniques.Institute of the rural development, University Marien NGOUABI, Brazzaville, pp 8-43.

FAO, 2000-2003. Regional code of forestry development to weak impact in the wet tropical dense forests of central Africa and the west.130 p.

Fosso C L, 2013. Evaluation of the damage caused by the forestry development on the stems with a futures:case of the UFA 10060, AAC 2-4 of the SCTB. Memory of end of study for obtaining the diploma for the occupation of engineer of Water, Forests and drives out.Faculty of agronomy and agricultural sciences, University of DSCHANG, Cameroun.101 p.

Groutel E, 2013. Forum of Brazzaville on the future of the forests of the basin of Congo.Un models creation of shared value.Program UE FAO FLEGT, Working paper 2, Rome. 52p.

IFO, 2005. Handbook of procedures of forestry development, 60 p.

Garden J L, 1995. Studies of the dégats of exploitation in forest sempervirente.Pilot project of installation integrated of Dimako. Douala-Cameroun.10 p.

Laurent D. and Maitre H.F., 1992.Destruction of the tropical forest resources:the exploitation is the cause?CTFT/FAO, Italy, 107 p.

Marn H. Mr., Jonkers W, 1982. Logging ramming in tropical high forest.In Tropical P.B.L. forests:source of energy through optimization and diversification.Reports of the international conference from the 11 to November 15, 1980 in Penerbit Universiti Pertanian, Serdang, Selangor, Malaysia.Srivastava et al..Eds:pp 27-38.

Mavoungou A.Y., 2002. Improvement of the outputs matters by the valorization of the wood losses in a building site of forestry development.Case of MAN Fai-tai.Report/ratio of training course of end of formation for obtaining the diploma for the occupation of engineer of work of rural development, Option:Forest techniques.IDR, UMNG, Brazzaville, pp 4-24.

Mbété P., 2014. Evaluation of the incidence of the operations of forestry development on the vegetation and fauna in the forest unit of installation of Mokabi.Single thesis of Doctorate.Technology and Faculty of Science.University Marien NGOUABI.Congo Brazzaville.217 p.

Méoli Mr., 2005. Impact of the exploitation on the forest ecosystem in the concessions of Congolaise industrial of wood (CIB).CIB, ITTO, GECOS.79 p.+ appendices

Mouélé A.G.P., 2012. Environmental incidence of the exploitation in theIndustrial one of Wood (CIB):case of the forest concession of Loundoungou-Toukoulaka, Department of Likouala, IDR, Memory of end of studies, 101 p.

Nabienne C J, 2015. Evaluation of the environmental impacts in the Annual Plate of Cut 2014 of the Forest Industry of Ouesso (IFO).Memory of end of formation for obtaining the diploma of professional Master in Sciences and Forest Technology, Higher National School of Agronomy and Forestry (ENSAF), University Marien NGOUABI (UMNG).Congo Brazzaville.92 p.

Nkounkou A., 2011. Evaluation of the environmental impacts related to the forestry development:case of the Annual Plate of Cut 2010 (Aac-2 of the UFP 1).UFA Mokabi-Dzanga, Department of Likouala, IDR, Memory of end of studies, 72 p.

OIBT, 2006. Regional project of forestry development to impact reduced in the countries of basin of Congo. Gabon.33 p.

ISSN: 2456-8643

Makita., 2018. Incidence of demolition on the space structure and the biodiversity of the Forest Unit of Installation (UFA) Jua-Ikie.Memory of end of formation for obtaining the diploma of Master research in Durable Management of the forests, Higher National School of Agronomy and Forestry (ENSAF), University Marien NGOUABI (UMNG).Congo Brazzaville.44 p.

Mouélé Mouko Alban Gys Pancrace., 2012.Environmental incidence of the exploitation forestiere in durable management with the industrial congolaise of wood (CIB):case of the concession forestiere of loundoungou-toukoulaka. Memory of end of formation for obtaining the diploma of Master research in Durable Management of the forests, Higher National School of Agronomy and Forestry (ENSAF), University Marien NGOUABI (UMNG).Congo Brazzaville.102p.

Oreyila Mr. R., 2015. Follow-up and evaluation of the impacts of the operations of forestry development in natural dense forest:case of the UFA NGOMBE, Memory of end of formation for obtaining the diploma of Licence in Sciences and Forest Technology, Higher National School of Agronomy and Forestry (ENSAF), University Marien NGOUABI (UMNG).Congo Brazzaville.66 p.

Pardé J and Bouchon J, 1998. Dendrometry.Nancy, France, E.N.G.R.E.F., 328 p.

PNUE., 2015. Strategy national and action plan on biological diversity, Brazzaville, 2p.

Sist P., 1998. Directives for the application of the techniques of exploitation to weak impact (EFI) to Gabon:objectives, principles and stakes, Seminar FORAFRI of Libreville - session 4:exploitation, installation, management, 26 p.

Topanou T J, 2020. Evaluation of the grumière production and the losses in the UFA Mobola-Mbondo.Memory of end of formation for obtaining the Agronomic diploma of Licence in Sciences, Forest and Environment, Higher National School of Agronomy and Forestry (ENSAF), University Marien NGOUABI (UMNG).Congo Brazzaville.58 p.