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Aerial Biomass and Carbon Stock in the Era-Congo Forestry Concession of the Mai-Ndombe Province, the Democratic Republic of Congo (DRC)

Kolokota Baelo Jean Pierre[1*], Mbokolo Mbaka Stéphin[2], Momba Ndombo Benteke Maggy[3], Kidikwadi Tango Eustache[4], Katusi Lomalisa Roger[5]

[1]Department of Environmental Sciences, Faculty of Sciences, the University of Mbandaka B.P 10 Mbandaka, Democratic Republic of Congo

[2]Searcher Environmentalist independent, Democratic Republic of Congo

[3]Department of Environmental Sciences, Faculty of Sciences, the University of Mbandaka, B.P 10 Mbandaka, Democratic Republic of Congo

[4]Systemic Laboratory, Biodiversity, Nature Conservation and Endogenous Knowledge, Department of Environmental Sciences, Faculty of Sciences, University of Kinshasa, B.P 190 Kinshasa XI, Democratic Republic of Congo

[5]Faculty of Sciences, University of Kisangani. B.P 2012, Democratic Republic of Congo

ABSTRACT

This study was conducted in the peat bog of the ERA-CONCO forest concession between 16° and 20°30° East longitude and 2° and 4° South latitude in the province of Mai-Ndombe in the Democratic Republic of Congo (DRC). The main objective of this study was to assess and estimate the above-ground biomass and carbon sequestered by trees in the ERA-CONGO forest concession. To achieve this object, a one-hectare device was installed and subdivided into 4 plots of 25 m x 100 m within which all individuals with a DBH ≥ 10 cm were inventoried and measured at 1.30 m above the ground or 30 cm above the foothills as well as their *x,y* geographic coordinates were taken. In total, 389 individuals were recorded and grouped into 43 genera, 46 species and 21 families. Results revealed the total values of basal area, above-ground biomass, sequestered carbon and carbon equivalent as follows: 34.5906 m²/ha; 339.8420 t/ha; 159.7257 t/ha and 537.7966 t/ha, respectively. The first ten most important species and families that produce more aerial biomass than others include *Gilbertiondedron dewevrei* (42.3%), *Parinaria excelsa* (19%), *Plageostyles africana* (16.7%), *Strombosiopsis tetrandra* (12.8%), *Pentaclethra eetveldeana* (12.7%), *Millettia laurentii* (11.2%), *Uapaca guineensis* (9.6%), *Strombosia pustulata* (9.1%), *Polyalthia suaveolens* (4.4%) and *Angylocalyx pynaertii* (4.1%) as well as *Fabaceae* (83%), *Strombosiaceae* (21.9%), *Euphorbiaceae* (20.5%), *Chrysobalanaceae* (19%), *Urticaceae* (12.7%), *Annonaceae* (8.4%), *Meliaceae* (8.2%), *Myristicaceae* (4. 8%), *Sapotaceae* (4.4%) and *Sapindaceae* (2.9%).

Keywords: Aerial biomass, Carbon, Peatlands, ERA-Congo

INTRODUCTION

The forest ecosystems of the Congo Basin are the second largest tropical forest massif, after the Amazon, and represent a quarter of the dense humid forests on the planet. They cover over six countries in Central Africa (Cameroon, Congo, Gabon, Equatorial Guinea, Central African Republic and Democratic Republic of Congo) (Boyemba, 2006; Dorisca et al., 2011). Despite its low rate of deforestation (0.17 % on annual average), the entire Congo Basin still preserves the habitats of certain endangered species on the one hand and the ecological functions of the forests on the other hand (Lubini, 2001).

* Corresponding Author

In January 2017, scientists unveiled new discoveries proving that the peatlands of the central Congo basin form the largest area of peat swamp forest in the tropics (Dargie et al., 2017). Estimates of soil organic carbon reserves in Popular Congo and the Democratic Republic of Congo have thus increased, enormously, to 30 Gt. The degradation of these peatland reserves could have serious impacts on the climate (Ewango, 2019). Furthermore, the increase in the concentration of greenhouse gases, a limiting factor for human life and the environment in general, constitutes a major concern for all humanity (Boyemba, 2014; Kidikwadi, 2018). Among these gases, carbon dioxide (CO_2) is especially mentioned as the primary cause of climate change (Lubini et al., 2014; Loubota Panzou et al., 2016). To alleviate this situation, the United Nations Framework Convention on Climate Change has provided the REDD+ mechanism, to which the Democratic Republic of the Congo (DRC) has subscribed, because of its large forest area, its richness and its high floristic diversity. Thus, the estimate of this floral diversity shows more than 10,000 species (Anonymous, 1993).

In the Democratic Republic of Congo, there is so far reliable information regarding the measurement of emissions linked to deforestation and forest degradation, as well as the feasibility, impact and effectiveness of the implementation of emission reduction interventions, though the country has been engaged in the REDD+ process for a long time (WWF, 2013). It becomes, therefore, crucial for the Democratic Republic of Congo to adequately respond to this call by carefully evaluating and providing detailed estimates of biomass and carbon stocks across the entire country, hence the focus of this study on carbon estimates in a peat ecosystem, -such as the case of the Province of Mai-Ndombe. Indeed, the province of Mai-Ndombe is considered a high priority area to support the national REDD+ strategy. It can contain more than 8 million hectares of forests, which represent approximately 66 % of the surface area (Menga, 2010).

The region is home to the country's REDD+ pilot project with an emissions reduction program estimated at 29 $MtCO_2$ to be reduced over the next few years. However, it has very little forecast information on estimates of biomass and carbon stock in the different types of forests they contain. This information, however, remains crucial for delivering the biomass map and assessing the carbon stock over large areas of the region, where reference data are not yet elucidated in depth. To obtain credible data on aerial biomass (phytomass) measurements in the region, and to make it possible to predict the quantity of carbon that could be retained or lost following these changes during deforestation or forestry degradation, we assessed the estimation of aerial phytomass and carbon stock sequestered in the ERA-CONGO (Democratic Republic of Congo) forest concession, located in the province of Mai-Ndombe in the Democratic Republic of Congo.

MATERIAL AND METHODS

The study area covers the entire province of Mai-Ndombe. It is between 16° and 20°30° East longitude and 2° and 4° South latitude. Thus, the region is limited to the North by the province of Equateur, to the West by the Congo River, which separates it from the Republic of Congo, to the South by the Kasai River, and finally to the East by the province of Kasai Occidental and that of Tshuapa (Menga, 2010) (Figure 1).

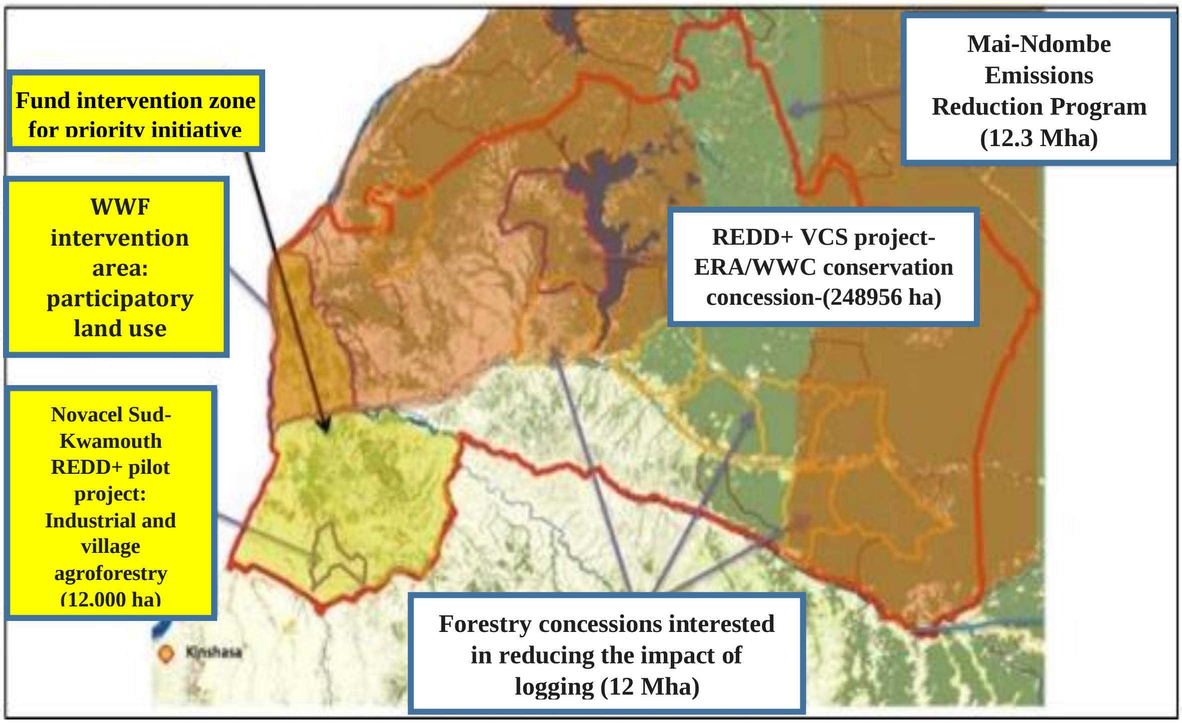

Figure 1. Location of the ERA Congo (Democratic Republic of Congo) forest concession

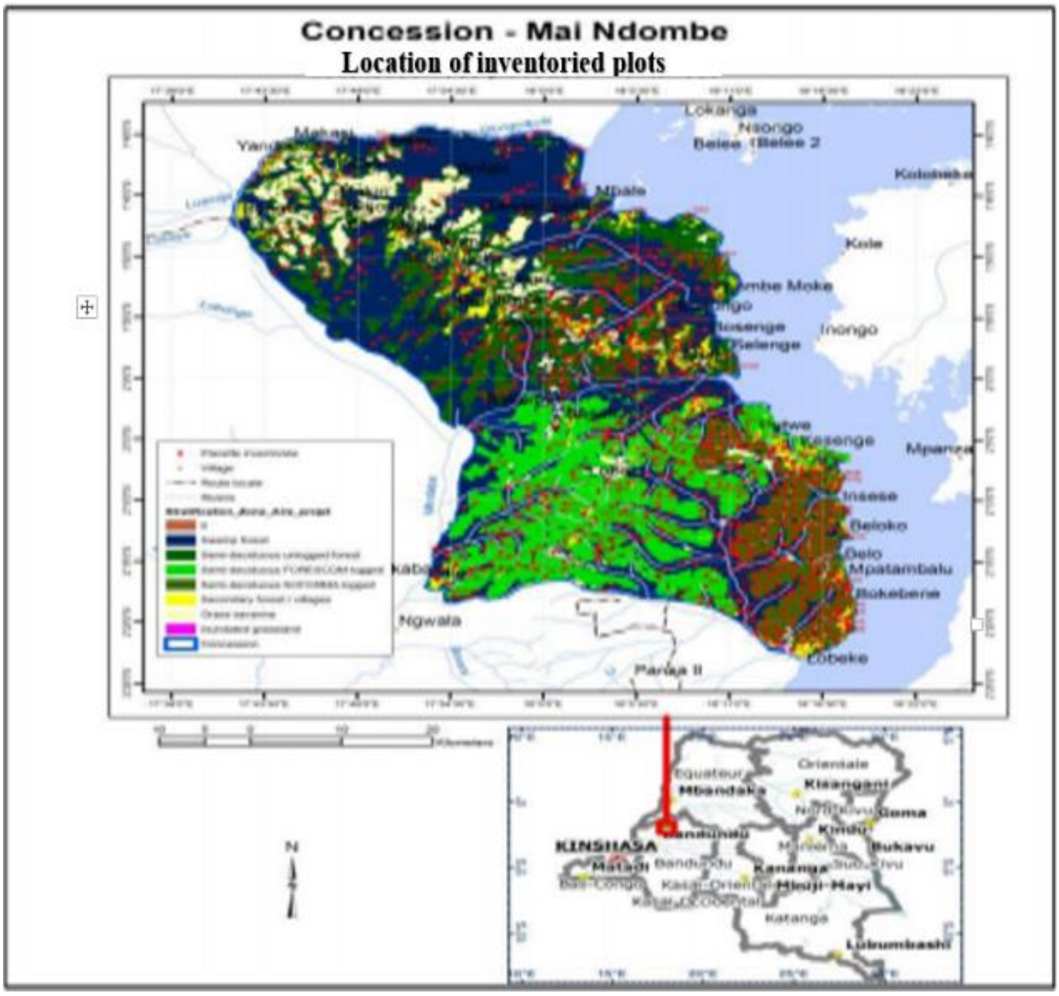

Figure 2. Amplitude of the REDD program in Mai-Ndombe (Drouillard, 2014)

REDD+ activities are carried out by several projects linked to an emissions reduction program estimated at 29 mtCO2 by 2030. Figure 2 shows the scale of the REDD+ program in Mai-Ndombe (Drouillard, 2014) (Figure 2).

To carry out this study, a one-hectare device was installed and subdivided into 4 plots of 25 m x 100 m within which all individuals with a DBH ≥ 10 cm were inventoried and measured at 1.30 m above from the ground or 10 cm above the buttresses as well as their *x*, *y* geographic coordinates were taken (Figure 3).

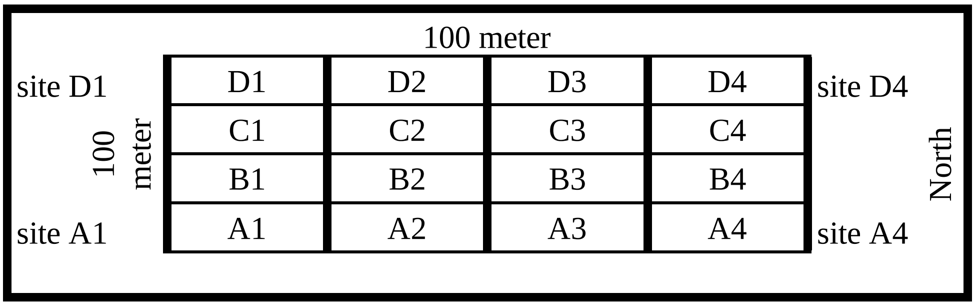

Figure 3. Inventory device installed in the dealership

The structural parameters (basal surface area and aboveground biomass) were calculated. To determine the most important species or family (s) in the stand, we calculated the Importance Value Index (IVI), derived from the Importance Value Index of Curtis & McIntosh (1950). This index represents the sum, (for each species or family), of the relative abundance (Ab) and the relative dominance (Dr). This index varies between 0 and 200; in other words, the sum of the maximum index values of all the species in a plot is worth of 200.

The allometric equation of Fayolle et al. (2018) was used for the calculation of the aboveground biomass. Tree carbon is obtained by multiplying the value of aboveground biomass with 0.47 fraction of carbon that IPCC attributes to tropical and subtropical forests; and the carbon equivalent is obtained by multiplying the carbon value by the coefficient 3.667 (Lubini et al., 2014). The chi-square test was used to compare the numbers of individuals according to diameter classes.

RESULTS

Density and Basal Area

A total of 389 individuals grouped into 44 genera, 47 species and 21 families were inventoried in an area of one hectare with a total basal area of 34.5906 m^2/ha.

Diametric Structure

The average diameter was found to be 25.04 cm with a maximum of 253.82 cm and a minimum of 10 cm. The diameter structure was "stretched S", with a first bump at the class level ranging from 40 to 50 cm and a second bump ranging between 70 and 80cm (X-squared = 730.56, df = 6, p-value < 2.2e-16) (Figure 4).

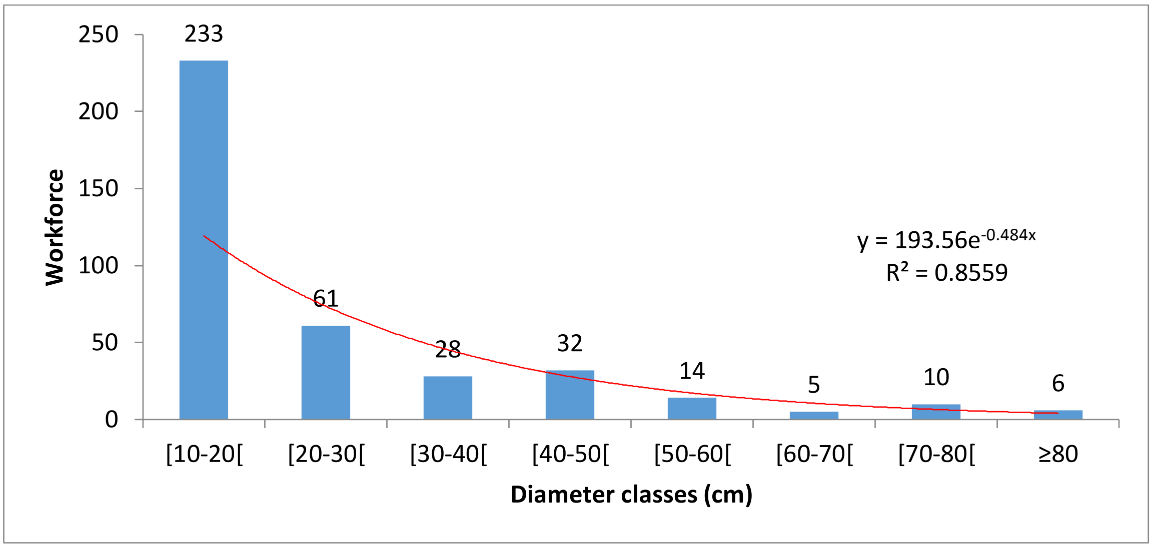

Figure 4. Diametric distribution of inventoried individuals

Floristic Composition

Among the top ten most important species, *Gilbertiondedron dewevrei* occupied the first position (42,3%), followed by *Parinaria excelsa* (19 %), Plageostyles africana (16,7 %), *Strombosiopsis tetrandra* (12,8 %), *Pentaclethra eetveldeana* (12,7 %), *Millettia laurentii* (11,2 %), *Uapaca guineensis* (9.6%), *Strombosia pustulata* (9,1%), *Polyalthia suaveolens* (4,4 %) and finally, *Angylocalyx pynaertii* (4,1 %) while the other species represent 58% during the inventory (Table 1).

Table 1. The ten most important species of the flora (BA: basal area; RA: relative abundance; RD: relative dominance, and IIV: index of importance values evaluated at 200%)

No	Species	Density	BA (ha^{-1})	RA (%)	RD (%)	IIV (%)
1	*Gilbertiondedron dewevrei*	78	7,6832	20,05	22,21	42,3
2	*Parinaria excelsa*	11	5,6058	2,83	16,21	19
3	*Plageostyles africana*	47	1,5999	12,08	4,63	16,7
4	*Strombosiopsis tetrandra*	24	2,2973	6,17	6,64	12,8
5	*Pentaclethra eetveldeana*	25	2,1672	6,43	6,27	12,7
6	*Milletia laurentii*	15	2,5531	3,86	7,38	11,2
7	*Uapaca guineensis*	14	2,0919	3,60	6,05	9,6
8	*Strombosia pustulata*	1	3,0704	0,26	8,88	9,1
9	*Polyalthia suaveolens*	13	0,3732	3,34	1,08	4,4
10	*Angylocalyx pynaertii*	6	0,8743	1,54	2,53	4,1
11	Others	155	6,2743	39,85	18,14	58
	Total	**389**	**34,5906**	**100**	**100**	**200**

As for families, among the first ten most important, Fabaceae occupied the first place (83%), followed by Strombosiaceae (21.9 %), Euphorbiaceae (20.5 %), Chrysobalanaceae (19 %), Urticaceae (12.7 %), Annonaceae (8.4 %), Meliaceae (8.2 %), Myristicaceae (4.8 %), Sapotaceae (4.4 %) and finally, Sapindaceae (2.9 %), while the rest of the inventoried families represented 17.1 % (Table 2).

Table 2. The ten most important families of the florule (BA: basal area; RA: relative abundance; RD: relative dominance, and IIV: index of importance values evaluated at 200%)

No	Families	Density	BA (ha^{-1})	RA (%)	RD (%)	IIV (%)
1	*Fabaceae*	155	14,9425	39,8	43,2	83
2	*Strombosiaceae*	25	5,3677	6,4	15,5	21,9
3	*Euphorbiaceae*	60	1,7460	15,4	5,0	20,5
4	*Chrysobalanaceae*	11	5,6058	2,8	16,2	19
5	*Urticaceae*	14	2,0919	3,6	6,0	9,6
6	*Annonaceae*	25	0,6995	6,4	2,0	8,4
7	*Meliaceae*	22	0,8834	5,7	2,6	8,2
8	*Myristicaceae*	13	0,4893	3,3	1,4	4,8
9	*Sapotaceae*	11	0,5613	2,8	1,6	4,5
10	*Sapindaceae*	10	0,1106	2,6	0,3	2,9
11	Others	43	2,0926	11,1	6,0	17,1
	Total	**389**	**34,5906**	**100**	**100**	**200**

Biomass, Carbon and Carbon Equivalent

The total above-ground biomass was found to be 339.8420 t/ha, or 159.7257 tca/ha corresponding to 537.7966 eqCa/ha (carbon equivalents per hectare). Among the top ten species, which produce more aerial biomass and sequester more carbon, *Gilbertiondedron dewevrei* occupied the first position (biomass: 87.0501t/ha; sequestered carbon: 40.9135tca/ha and carbon equivalent: 137.7559 teqca/ha), followed by *Millettia laurentii* (biomass: 33.7635t/ha; sequestered carbon: 15.8688 tca/ha and carbon equivalent: 53.4304 teqca/ha), *Strombosiopsis tetrandra* (biomass: 29.9614t/ha; sequestered carbon: 14.0819 tca/ha and carbon equivalent: 47.4136 tca/ha), *Pentaclethra eetveldeana* (biomass: 28.1700t/ha; sequestered carbon: 13.2399tca/ha and carbon equivalent: 44.5788 tca/ha), *Uapaca guineensis* (biomass: 26.5301t/ha; sequestered carbon: 12.4691 tca/ha and carbon equivalent: 41.9836 tca/ha), *Parinaria excelsa* (biomass: 18.5215t/ha; sequestered carbon: 8.7051 tca/ha and carbon equivalent: 29.3101 tca/ha), *Plageostyles africana* (biomass: 16.9538 t/ha; sequestered carbon: 7.9683 tca/ha and carbon equivalent: 26.8291 tca/ha), *Strombosia pustulata* (biomass: 12.5875 t/ha; sequestered carbon: 5.9161 tca/ha and carbon equivalent: 19.9196 tca/ha), *Angylocalyx pynaertii* (biomass: 11.0950 t/ha; sequestered carbon: 5.2146 tca/ha and carbon equivalent: 17.5577 tca/ha) /ha), and finally, *Irvingia grandifolia* (biomass: 6.4238t/ha; sequestered carbon: 3.0192 tca/ha and carbon equivalent: 10.1655tca/ha), while the other species were found to produce less aerial biomass and sequestered carbon as well as the carbon equivalents (biomass: 68.6715 t/ha; sequestered carbon: 32.2756 tca/ha and carbon equivalent: 108.6720 tca/ha) overall (Table 3).

Table 3. The top ten species that produce the most aboveground biomass and sequestered carbon as well as carbon equivalent

No	Species	Biomass (t/ha)	Carbon (tca/ha)	Carbon Equivalent (eqtca/ha)
1	*Gilbertiondedron dewevrei*	87,0501	40,9135	137,7559
2	*Millettia laurentii*	33,7635	15,8688	53,4304
3	*Strombosiopsis tetrandra*	29,8087	14,0101	47,1719
4	*Pentaclethra macrophylla*	28,1700	13,2399	44,5788
5	*Uapaca guineensis*	26,4155	12,4153	41,8023
6	*Parinaria excelsa*	18,5215	8,7051	29,3101
7	*Plageostyles africana*	16,9538	7,9683	26,8291
8	*Strombosia pustulata*	12,5875	5,9161	19,9196
9	*Angylocalyx pynaertii*	11,4762	5,3938	18,1610
10	*Irvingia grandifolia*	6,4238	3,0192	10,1655
11	Others	68,6715	32,2756	108,6720
	Total	**339,8420**	**159,7257**	**537,7966**

As for the families, among the first ten most important, Fabaceae comes first (biomass: 179.7355t/ha; sequestered carbon: 84.4757tca/ha and carbon equivalent: 284.4296teqca/ha), followed by Strombosiaceae (biomass: 42.3962t/ha; sequestered carbon: 19.9262tca/ha and carbon equivalent: 67.0915tca/ha), Urticaceae (biomass: 26.4155t/ha; sequestered carbon: 12.4153tca/ha and carbon equivalent: 41.8023tca/ha) /ha), Chrysobalanaceae (biomass: 18.5215t/ha; sequestered carbon: 8.7051tca/ha and carbon equivalent: 29.3101tca/ha), Euphorbiaceae (biomass: 17.9628t/ha; sequestered carbon: 8.4425tca/ha), ha and carbon equivalent: 28.4260 teqca/ha), Meliaceae (biomass: 10.1543t/ha; sequestered carbon: 4.7725tca/ha and carbon equivalent: 16.0691teqca/ha), Annonaceae (biomass: 7.0531t/ha) ha; sequestered carbon: 3.3150tca/ha and carbon equivalent: 11.1615tca/ha), Sapotaceae (biomass: 6.7344t/ha; sequestered carbon: 3.1652tca/ha and carbon equivalent: 10.6572tca/ha), Irvingiaceae (biomass: 6.4238t/ha; sequestered carbon: 3.0192tca/ha and carbon equivalent: 10.1655tca/ha) and finally, Myristicaceae (biomass: 5.6192t/ha; sequestered carbon: 2.6410tca/ha and carbon equivalent : 8.8924tca/ha) while that the other families represent aerial biomasses of 18.8257t/ha, or 8.8480tca/ha sequestered carbons corresponding to 29.7915tca/ha of the whole (Table 4).

Table 4. The top ten families that produce the most above-ground biomass and sequestered carbon as well as carbon equivalent

No	Species	Biomass (t/ha)	Carbon (tca/ha)	Carbon equivalent (eqtca/ha)
1	*Fabaceae*	179,7355	84,4757	284,4296
2	*Strombosiaceae*	42,3962	19,9262	67,0915
3	*Urticaceae*	26,4155	12,4153	41,8023
4	*Chrysobalanaceae*	18,5215	8,7051	29,3101
5	*Euphorbiaceae*	17,9628	8,4425	28,4260
6	*Meliaceae*	10,1543	4,7725	16,0691
7	*Annonaceae*	7,0531	3,3150	11,1615
8	*Sapotaceae*	6,7344	3,1652	10,6572
9	*Irvingiaceae*	6,4238	3,0192	10,1655

No	Species	Biomass (t/ha)	Carbon (tca/ha)	Carbon equivalent (eqtca/ha)
10	*Myristicaceae*	5,6192	2,6410	8,8924
11	Others	18,8257	8,8480	29,7915
	Total	**339,8420**	**159,7257**	**537,7966**

Correlation between Aboveground Biomass and Diameter

Statistically, it was found that above-ground biomass (t = 6.0852, p-value = 2.813e-05), sequestered carbon (t = 5.1083, p-value = 0.0001592) and carbon equivalent (t = 6.3844, p-value = 1.698e-05) increased proportionally with the increase in diameter classes with strong correlation coefficient value of r= 0.924175 (S = 46, p-value = 0.2675) (Figure 5).

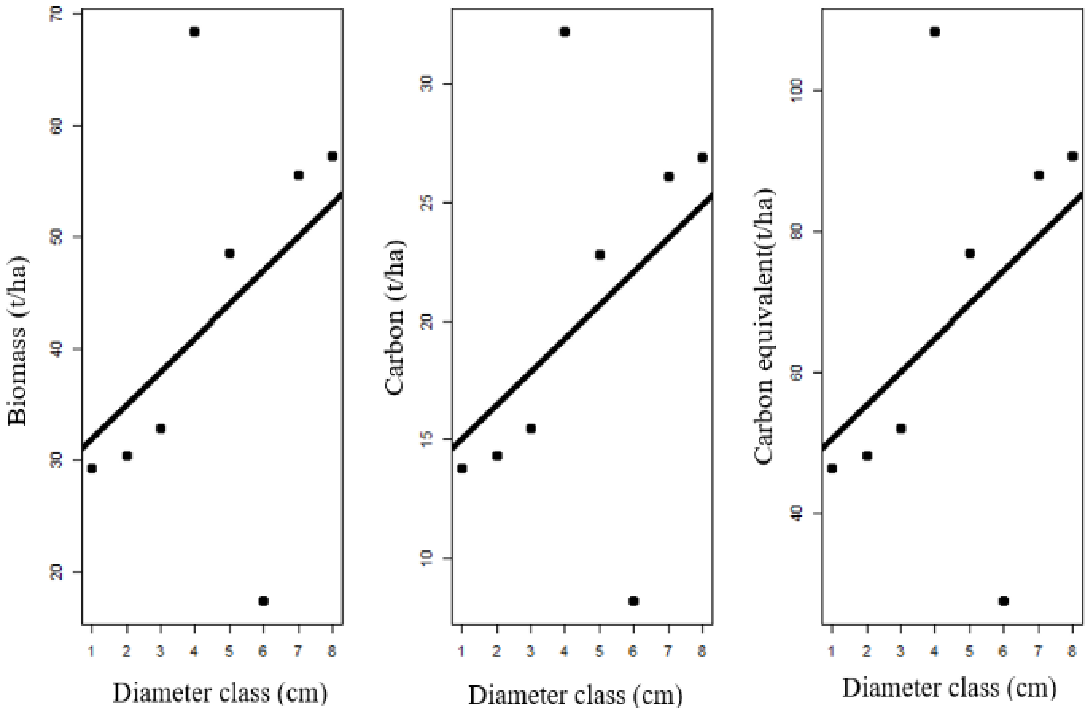

Figure 5. Correlation between tree diameters and aboveground biomass, sequestered carbon and carbon equivalent

DISCUSSION

As mentioned above, few studies have been conducted in the Democratic Republic of Congo (DRC), regarding the assessment of the emissions linked to deforestation and forest degradation, as well as the feasibility, impact and effectiveness of the implementation. There is, therefore, a need to first investigate these emissions. The present study focused on certain components such as floristic composition and structure and biomass produced as well as carbon sequestered.

Floristic Composition and Structure

The 389 individuals recorded during the inventory were grouped into 47 species, 43 genera and 21 families with a basal area of 34.5906 m^2ha-1. According to (Pierlot R. 1966), the basal area of tree layers (dbh ≥ 10 cm) in most forests is estimated between 27 and 32 m²/ha because it depends on the number and size of the trees. From these basal area values, we noted that the basal area value obtained in this study was slightly higher than those of assessed by Kidikwadi et al. (2020). Nevertheless, our results seem to corroborate with those of Sabongo (2015) in a monodominant forest in Gilbertiondedron dewevrei where he obtained basal area values of 35.53 m^2/ha in the Yoko reserve and 33.83 m^2/ha in Masako in the province of Tshopo and 35.26 m^2/ha in Lenda in the province of Ituri in the DRC. As for the importance value indices (IVI), among the top ten most important species, our results revealed that, *Gilbertiondedron dewevrei* came first (42.3%), followed by *Parinaria excelsa* (19%), *Plageostyles africana* (16.7%), *Strombosiopsis tetrandra* (12.8%), *Pentaclethra eetveldeana* (12.7%), *Millettia laurentii* (11.2%), *Uapaca guineensis* (9.6%), *Strombosia pustulata* (9.1%), *Polyalthia suaveolens* (4.4%) and finally, *Angylocalyx pynaertii* (4.1%). Of these important species, only *Gilbertiondedron dewevrei* and *Plageostyles africana* could be observed on land.

As can be seen in Table 4, which depicts the list of families inventoried during the study period, the first ten most important (IV) included Fabaceae (83%), followed by Strombosiaceae (21.9%), Euphorbiaceae (20.5%), Chrysobalanaceae (19%), Urticaceae (9.6%), Annonaceae (8.4%), Meliaceae (8.2%), Myristicaceae (4.8%), Sapotaceae (4.5%) and Sapindaceae (2.9%). In the province of Tshopo, a study conducted by Nshimba (2008) on Mbiye Island, in an area of five hectares each in each forest type (dry land, periodically flooded and marshy ground), reported firstly on dry land 395 species grouped together in 255 genera and 80 families with an average basal area of 21.15 m^2/ha with the first ten most important species. These species included *Cleistanthus mildbraedii* (13.7%), *Symphonia globulifera* (9.4%), *Cynometra hankei* (9. 1%), *Gilbertiodendron dewevrei* (8.3%), *Hannoa klaineana* (8.2%), *Petersianthus macrocarpus* (7.9%), *Coelocaryon botryoides* (7.5%), *Aidia micrantha* (6.3%), *Dispyros bipendensis* (5.5%) and *Drypetens likwa* (4.1) %. And the ten most important families comprised Fabaceae (26.9%), Euphorbiaceae (22.2%), Myristicaceae (11.8%), Clusiaceae (9.9%), Moraceae (9%), Ebenaceae (8. 9%), Annonaceae (8.6%), Rubiaceae (8.4%), Simaroubaceae (8.1%) and Lecythidaceae (7.9%). Secondarily, on the periodically flooded soil, 3 Nshimba (2008) recorded 27 species, which were grouped into 225 genera and 67 families with an average basal area of 16.66 m^2/ha. The first ten important species included notably *Coelocaryon botryoides* (62.21%), *Gilbertiodendron dewevrei* (58.43%), *Cleistanthus mildbraedii* (5.55%), *Strombosia grandifolia* (3.9%), *Diospyros boala* (3.65%), *Pycnanthus marchalianus* (3.5%), *Cleistopholis patens* (3. 13%), *Dichostemma glaucescens* (2.9%), *Symphonia globulifera* (2.65%) and *Funtumia elastica* (2.27%). The author pointed out the following ten most important families are: Myristicaceae (65.33%), Fabaceae (63.17%), Euphorbiaceae (14.97%), Olacaceae (8.39%), Ebenaceae (4.48%), Apocynaceae (4.23%), Rubiaceae (3.19%), Clusiaceae (3. 45%), Annonaceae (4.03%) and Verbenaceae (2.64%). And finally, thirdly, on the marshy soil, Nshimba (2008) inventoried 267 species grouped into 186 genera and 64 families with an average basal area of 19.36 m^2/ha including the species.*Coelocaryon botryoides* (40%), *Symphonia globulifera* (19, 1%), *Lasiodiscus mannii* (19%), *Cleistanthus mildbraedii* (12.2%), *Baikiaea insignis* (11.1%), *Dichostemma glaucescens* (8.7%), *Diospyros bipendensis* (7.8%), *Pachystela seretii* (6.7%), *Anthonotha macrophylla* (6.1%) and *Anthonotha pynaertii* (5.9%) were found to be the top ten most important species, and Myristicaceae (44.6%), Fabaceae (41%), Euphorbiaceae (24.2%), Rhamnaceae (19.2%), Ebenaceae (10.2%), Clusiaceae (24%), Sapotaceae (7.9%),

Meliaceae (3.8%), Lecythidaceae (3.3%) and Annonaceae (2.8%), the ten most important families. From all these results, we see that the peat forest has a higher basal area than all forest formations on Mbiye Island. As for the most important families, the most common are Fabaceae, Euphorbiaceae, Annonaceae and Myristicaceae.

Concerning the diameter structure, it is important to highlight that the number of individuals decreases with the increase in diameter class, which shows that there is good natural regeneration of the peat forest in the province of Mai-Ndombe in the DRC. According to Sonké

(2004), in a forest in equilibrium, the numbers of the 10-20 cm class are generally double of those of 20 -30 cm class because there is a relationship between the numbers of two contiguous classes. Similar results were obtained by Nshimba (2008) and Sabongo (2015) where they observed an inverted J curve where the number of individuals decreases with increasing diameter class.

Biomass Produced and Carbon Sequestered

The total above-ground biomass is 339.8420 t/ha, thus sequestering 159.7257 tca/ha corresponding to 537.7966 eqCa/ha (carbon equivalents per hectare) was recorded. If we compare this biomass value with those of other forests in the DRC such as: Lenda (578.9 t/ha), Masako (575.4 t/ha) and Yoko (588.5 t/ha), it is important to note that these forests produce more biomass than that of the peat bog. However, neotropical forests, African tropical forests, and particularly monodominant *G. dewevrei* forests have a strong capacity to produce forest biomass. In these regions of the globe, the values obtained in these different studies are slightly different from those obtained in the present study: 250 t/ha reported by DeWalt & Chave (2004), 281 t/ha by Chave et al. (2008) and 372 t/ha by Keller et al. (2001). It is well known that the biomass contribution of mixed forests and periodically flooded forests has always been below that of monodominant *G. dewevrei* forests (Peh, 2009; Djuikouo et al., 2010; Makana et al., 2011). Nevertheless, results of this study do not deviate much from the interval fixed between 152 and 736 t/ha. According to Gibbs et al. (2007), the biomass produced by the African tropical forest is estimated at more than 360 t/ha, which corroborates the finding of the present study result. Among the species, which produce the most aboveground biomass in the peatland forest, *Gilbertiondedron dewevrei* occupied the first position (87.0501t/ha), followed by *Millettia laurentii* (33.7635t/ha), S*trombosiopsis tetrandra* (29.9614t/ha), *Pentaclethra eetveldeana* (28.1700t/ha) and *Uapaca guineensis* (26.5301t/ha); while the other species produce less than 20 t/ha each.

This biomass production would be linked to the abundance and dominance of these species in the Mai-Ndombe peat forest, where the positive contribution of large diameter trees in the estimation of above-ground biomass has been proven in several studies (Brown et al., 1989; Chave et al., 2008; Peh, 2009; Djuikouo et al., 2010). By comparing the above mentioned biomass values with certain species such as *Guarea thompsonii* (95.7103 t/ha) (Yangambi, 2023), *Prioria oxyphylla* (65.1233 t/ha) (Lumba, 2023), *Prioria balsamifera* (309.85 t/ha) in Luki (Kidikwadi, 2018) and *Scorodophloeus zenkeri* (274.0079 t/ha) (Liombi, 2023); we note that, *Prioria balsamifera* produces the most biomass, followed by *Scorodophloeus zenkeri, Guarea thompsonii, Gilbertiondedron dewevrei* and *Prioria oxyphylla*, while the other species produce less than 50 t/ha.

CONCLUSION AND RECOMMENDATIONS

The study focused on the estimation of above-ground biomass and sequestered carbon stock of woody species in a peatland area of the ERA-CONCO WWC forestry concession in the province of Mai-Ndombe. The main objective of this study was to estimate the above-ground biomass, the sequestered carbon and the carbon equivalent stored by the trees in the said concession. The main results obtained reveal in total that 389 individuals grouped into 47 species, 44 genera and 21 families were inventoried in an area of one hectare with a total basal area of 34.5906 m^2/ha. The average diameter is 25.04 cm with a maximum of 253.82 cm and a minimum of 10 cm. Gilbertiondedron dewevrei, *Parinaria excelsa, Plageostyles africana, Strombosiopsis tetrandra, Pentaclethra eetveldeana, Millettia laurentii, Uapaca guineensis, Strombosia pustulata, Polyalthia suaveolens* and *Angylocalyx pynaertii* as well as Fabaceae, Strombosiaceae, Euphorbiaceae, Chrysobalanaceae, Urticaceae Annon, aceae, Meliaceae, Myristicaceae, Sapotaceae and Sapindaceae are both the top ten most important species and families and produce more above-ground biomass than the others. The total above-ground biomass is 339.8420 t/ha, or 159.7257 tca/ha corresponding to 537.7966 eqCa/ha (carbon equivalents per hectare). The results of the present study open avenues for reflection for prospective studies to reduce emissions due to deforestation and forest degradation.

From findings of the present study, there is a need to carry out similar work in other municipalities in the ERA-CONGO forest concession and in other forest ecosystems, in order to meet the requirements of the REDD+ process in the DRC.

REFERENCES

Anonyme (1993). *Mémento de l'agronome* (4^{ième} éd.). Collection technique rurale en Afrique, 1635p.

Boyemba F.B. (2006). *Diversité et régénération des essences forestières exploitées dans les forêts des environs de Kisangani (RD Congo).* Mém. DEA, inéd., ULB, 101p.

Boyemba, F.B. (2014), *Ecologie de Pericopsis elata (Harms) Van Meeuven (Fabaceae), arbre de forêt tropicale africaine à répartition agrégée*. Thèse de doctorat, ULB, 206p.

Chave, J., Condit, R., Muller-Landau, H. C., Thomas, S. C., Ashton, P. S., Bunyavejchewin, S., ... & Losos, E. C. (2008). Assessing evidence for a pervasive alteration in tropical tree communities. *PLoS biology*, *6*(3), e45.

Dargie, G. C., Lewis, S. L., Lawson, I. T., Mitchard, E. T., Page, S. E., Bocko, Y. E., & Ifo, S. A. (2017). Age, extent and carbon storage of the central Congo Basin peatland complex. *Nature*, *542*(7639), 86-90.

Dewalt, S.J. & Chave, J. (2004). Structure and Biomass of Four Lowland Neotropical Forests. *Biotropica*, *36*(1), 7619.

Djuikouo, M.N.K., Doucet, J.L., Nguembou, C.K., Lewis, S.L. & Sonké, B. (2010)**.** Diversity and aboveground biomass in three tropical forest types in the Dja Biosphere Reserve, Cameroon. *Afr. J. Ecol.*, *48*, 105361063.

Dorisca S., L. De Madron, Fontez B., Giraud A., Riera B., 2011. Établissement d'équations entre le diamètre et le volume total de bois des arbres, adaptés au Cameroun. *Bois For. Trop.*, *308*(2), 87-95.

Drouillard, A. (2014). *Le programme de réduction d'émissions de Mai-Ndombe*. Présentation orale, CN REDD, Kinshasa, 2 septembre.

Ewango C. (2019). Gestion intégrée des tourbières du bassin du Congo pour l'homme, la biodiversité et le changement climatique, pp. 7-50.

Gibbs, H. K., Brown, S., Niles, J. O. & Foley, J. A. (2007). Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environ. Res. Lett.*, *2*, 045023.

Keller, M., Palace, M & Hurtt, G. (2001). Biomass estimation in the Tapajos National Forest, Brazil Examination of Sampling and allometric uncertainties. *Forest Ecology and Management*, *154*, 371-382.

Kidikwadi, T., Azangidi, M., Ntalankwa, M., Balianga, B., & Kolokota, B. (2020). Aerial Biomass and Carbon Stock Study in Plot Trees in the Boyera District in the City of Mbandaka, Equateur Province in DR-Congo. *International Journal of Latest Research in Humanities and Social Science (IJLRHSS)*, *3*(8).

Kidikwadi Tango (2018). *Etude écologique et phytogéographique des populations naturelles de Prioria balsamifera (Harms) Breteler dans le bas-guineo-congolais*. Thèse de doctorat, Université de Kinshasa 208 p.

Liombi, B.J. (2023). *Dynamique de Scorodophloeus zenkeri Harms dans les deux dispositifs DYNAFOR (Dynamique Forestière) de la réserve forestière de Yoko (Ubundu, Province de la Tshopo, RD. Congo).* Mémoire de fin d'études, FGRNR/UNIKIS, 43 p.

Loubota Panzou, G. J., Doucet, J. L., Loumeto, J. J., Biwole, A., Bauwens, S., & Fayolle, A. (2016). Biomasse et stocks de carbone des forêts tropicales africaines (synthèse bibliographique). *Biotechnologie, Agronomie, Société et Environnement*, *20*(4), 508-522.

Lumba, B.M. (2023). *Etude de la dynamique de Prioria balsamifera (Vermoesen) Bretteler dans les deux dispositifs DYNAFOR (Dynamique Forestière) de la réserve forestière de Yoko (Ubundu, Province de la Tshopo, RD. Congo).* Mémoire de fin d'études, FGRNR/UNIKIS, 33 p.

Lubini, A., Belesi, K., Kidikwadi, T., & Kisompa R. (2014). Note préliminaire sur le mesure de biomasse aérienne et de stock de carbone dans un ilot forestier à kinshasa. *Congo Sciences*, *2*(2), 114-119.

Lubini, A. (2001). Analyse phytogéographique de la flore forestière du secteur du Kasai au Congo-Kinshasa. *Systematics and Geography of Plants*, *72*(2), 859-872.

Makana, J.R., Hart, T. & Hart, J. (1998)**.** Forest structure and diversity of lianas and under story Treelets in monodominant and mixed stands in the Ituri Forest. Democratic Republic of the Congo. *Man and The Biosphère series*, *20*, 429-446.

Menga, P. (2010). *Ecologie des peuplements naturels de Millettia laurenttii (De wild) dans la région du lac Mai-Ndombe, en RD Congo : Implication pour la gestion durable d'une espèce exploitée.* Thèse de Doctorat. Université de Kinshasa, 208p.

Nshimba, S.W.M. (2008). *Etude floristique, écologique et phytosociologique des forêts de l'île Mbiye à Kisangani, RD Congo*. Thèse de doctorant, FS/ULB, 271 p**.**

Peh, K. S.H.. (2009*). The relationships between species diversity and ecosystem function in low- and high-diversity Tropical African Forests*. PhD. Thesis. The University of Leeds school of geography. 212 p.

Pierlot, R. (1966). Structure et composition des forêts denses d'Afrique centrale, spécialement celles du Kivu. *Ac. Roy. Sc. Outre-Mer, CI. Sc. Nat. & Méd.*, *16*, 120-130.

Sabongo Y. (2015). Etude comparative de la structure et de la diversité des forêts à *Gilbertiodendron dewevrei* (De Wild.) J. Léonard des régions de Kisangani et de l'Ituri (RDCongo). Thèse de doctorant, FS/Unikis, 173 p**.**

Sonké, B. (2004). *Environnement Biologique du site de Nkamouna (Biodiversité – Flore).* REC. Rapport final – Biodiversité Flore pour l'EIE du projet Nkamouna. 37 p.

WWF. (2013). The carbon map and model project in the Démoctratic Rrepublic of Congo. *Remote sensing of Environments*, *22*, 11.

Yangambi, B.P. (2023). *Dynamique de Guarea thompsonii Sprague et Hutch. dans les deux dispositifs DYNAFOR (Dynamique Forestière) de la réserve forestière de Yoko (Ubundu, Province de la Tshopo, RD. Congo).* Mémoire de fin d'études, FGRNR/UNIKIS, 36 p.