World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(Research Article)

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CONTRIBUTION OF TREE SPECIES TO CARBON SEQUESTRATION AT THE PELEFORO GON COULIBALY UNIVERSITY SITE IN KORHOGO (NORTHERN CÔTE D'IVOIRE)

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World Journal of Advanced Research and Reviews, 2026, 31(02), 1300–1311

Publication history: Received on 06 July 2026; revised on 17 August 2026; accepted on 19 August 2026

Article DOI: https://doi.org/10.30574/wjarr.2026.31.2.2116

ABSTRACT

This study forms part of an assessment of the carbon sequestration capacity of tree species in the courtyard of Peleforo Gon Coulibaly University in Korhogo. The aim was to assess the diversity of tree species and the amount of carbon sequestered by the trees in the university courtyard, with a view to demonstrating the importance of these plants and encouraging their conservation. Data collection was carried out using a floristic inventory based on transect surveys. The various surveys identified a total of 1,540 trees comprising 59 species, 51 genera and 24 families, with a density of 37 stems per hectare and an estimated species richness of 2 species per hectare. The amount of carbon sequestered was estimated at 132.63 tonnes, representing an average yield of 3.14 t C/ha. This shows that the tree species on the UPGC campus play an important role in conserving biodiversity and combating climate change. These findings now give us an idea of the total amount of carbon sequestered in the UPGC courtyard. To maintain and increase this amount, the tree species on the university campus will need to be protected and further reforestation undertaken in certain areas of the UPGC courtyard.

Keywords: Tree species, Carbon sequestration, Peleforo Gon Coulibaly University, Floristic diversity.

1 INTRODUCTION

The world today is facing the problem of global warming, one of the causes of which is the accumulation of greenhouse gases in the atmosphere (Seguina and Soussana, 2008) [1]. The natural reduction of the excess stock of these gases in the air requires the involvement of several ecological processes, including plant photosynthesis (AFF, 2022; Muller-Feuga, 2025) [2] [3]. Among plants, tree species play a key role in carbon sequestration (Gauthray-Guyénet, 2022) [4]. Their presence at a site is an effective means of combating global warming. It is therefore important to promote their conservation wherever they are found. An assessment of the carbon stock sequestered by the trees on the site of

Peleforo Gon Coulibaly University (UPGC) was envisaged at one point, with a view to gaining an understanding of the ecosystem service provided by the site, which comprises two parts: the Forest Reserve and the UPGC campus grounds. In 2023, Silué *et al.* [5] conducted a study on carbon sequestration in the UPGC Forest Reserve. However, no consideration was given to the university campus, which nevertheless contains a significant number of tree species. Furthermore, these trees, which students, lecturers and administrative staff encounter on a daily basis, are little known to the public, as is their role in carbon sequestration. The main objective of this study is to contribute to a better understanding of the diversity of tree species in the UPGC courtyard and their carbon sequestration capacity. The aim is to supplement the study carried out in the Forest Reserve, in order to assess the carbon stock sequestered by the entire UPGC. Specifically, the aim will be to: (1) determine the floristic and structural diversity of the tree species in the UPGC courtyard; (2) assess the amount of carbon sequestered by these species.

2 MATERIAL AND METHODS

2.1 Study site

The study site, covering a total area of 41.8 ha, is situated within the grounds of Peleforo Gon Coulibaly University (UPGC), located to the south of the town of Korhogo (9°25’38’’ N and 5°37’58’’ W), on the Korhogo–Abidjan road. It is bounded to the north by the Teguere neighbourhood; to the south by the Félix-Houphouët-Boigny secondary school; to the east by the Lokaha neighbourhood; and to the west by the Dokaha-extension neighbourhood (Figure 1). The climate, of the tropical transitional type, comprises a rainy season, from May to October, and a dry season, from November to April, characterised by the passage of the harmattan. Average annual rainfall ranges from 1000 to 1700 mm, and temperatures from 21°C to 36°C. The area belongs to the Sudanese region, which is characterised by open climax formations with a grassy cover (Konan *et al.*, 2023) [6]. Average relative humidity varies between 60 and 80 per cent, depending on the season (Figure 2). The soil, of the tropical ferruginous type, is characterised by a good mineral content but is susceptible to erosion. Soils on crusts, in areas of isolated hills (inselbergs), and lowland soils, which are richer in silt, are also present.

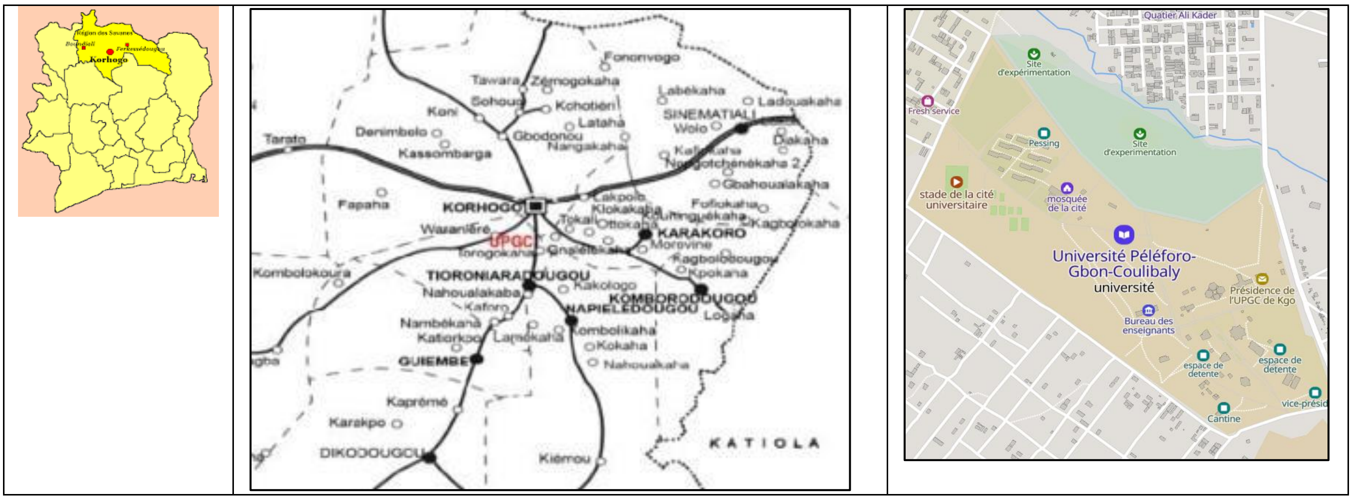

Figure 1: Maps showing the location of the study area

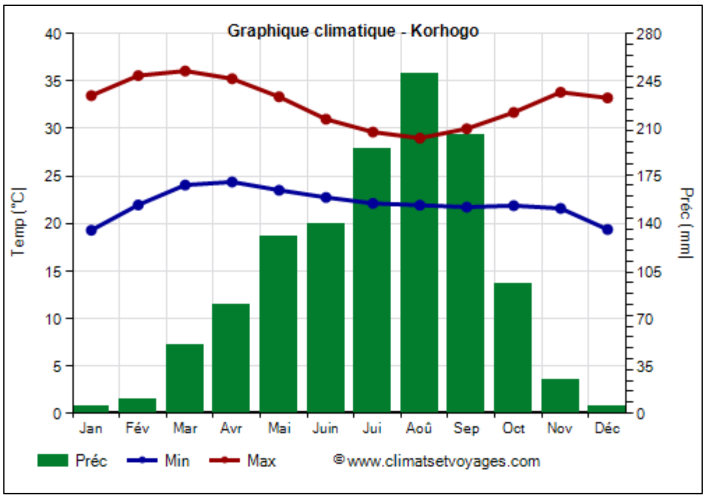

Figure 2: Korhogo rainfall-temperature diagram

2.2 Data collection method

Data collection was carried out by means of a floristic inventory of tree species, based on transect surveys, across the entire campus, which covers a total area of 41.8 ha. This method, which enables the quality of a biotope's overall floristic composition to be assessed (Vroh, 2013) [7], has been adopted by several botanists in Côte d'Ivoire (Jongking *et al.*, 1999; Aké Assi *et al.*, 2005; Malan *et al.*, 2007; Vroh, 2013) [8] [9] [10] [7]. It involved surveying the plant species present on the UPGC site, moving in all directions. During the survey, all taxa, whether planted or self-sown, with a DBH ≥ 5 cm were recorded. For each individual, the circumference at 1.30 m above ground level and the total height of the plant were measured. For trees with branches below 30 cm, measurements were taken on each trunk. Tree heights were estimated in metres using 2-metre-high markers. Circumferences were measured in centimetres using a tape measure. Samples of leafy, flowering or fruiting twigs were collected from all taxa encountered during the inventory to compile an herbarium. These species were identified by comparing the samples with the herbaria of the Swiss Centre for Scientific Research (CSRS) and the National Centre for Floristics in Abidjan (CNF). The nomenclature of the species was determined.

2.3 Method for analysing floristic and structural diversity

Data processing involved determining the qualitative and quantitative diversity of the inventoried species and the structure of the vegetation.

The analysis of qualitative diversity made it possible to determine the richness and composition of the flora within the UPGC. Thus, for each species, the taxonomic classification was assessed at the species, genus and family levels. The results were subsequently expressed as percentages of species, genera and families. Biotic types and chorological affinities were determined using subdivisions based on the work of Raunkiaer (1934) [11] and Aké-Assi (2001) [12].

In terms of quantitative diversity, the most commonly used parameters for plant species diversity namely Shannon's diversity index H and Piélou's evenness index E were calculated for each species in order to assess spatial heterogeneity.

The Shannon index was calculated using the following formula (1) :

$$\mathbf{H = - \Sigma\, (ni/N)\, ln\, (ni/N) \quad (1)}$$

In this formula, H is the Shannon index, ni is the number of individuals of species i, and N is the total number of individuals of all species.

The Pielou evenness index, derived from the Shannon index, is given by the formula (2) :

$$\mathbf{E = H/lnS \quad (2)}$$

E is the Piélou equity index and S is the total number of species in an area.

Structural diversity comprises horizontal structure and vertical structure.

Horizontal structure consists of the diameter structure, density and basal area of the stands. Vertical structure, on the other hand, is defined by height classes.

Diameter structure has been defined by the following diameter classes: **[5–10[; [10–20[; [20–30[; [30–40[; [40–50[; [50–60[; [60–70[; [70–80[; [80–90 [; [90–100[; [100–+[**

Density is the number of individuals (N) per unit area (S): **Density (d) = N/S**

The basal area (AB) represents the sum of the basal areas of the individuals (taken individually) that make up the plot. It is estimated using the formula: $\mathbf{AB = \pi D^2/4}$ D = Tree diameter at 1.30 m above ground level; π = 3.14 and **Diameter (D) = (Circumference (C))/π** ;

The vertical structure of the vegetation is defined by the following height classes:

[2–4[; [4–8[; [8–16[; [16–20[; [20–24[; [24–28[; [28–32[; [32 and above [.

2.4. Method for estimating the rate of carbon sequestration

The rate of carbon sequestration was estimated on the basis of the total biomass produced by the woody plants, comprising both above-ground and below-ground biomass.

The amounts of above-ground biomass for the various individuals were determined using the allometric equations developed by Chave *et al.* (2014) [13]. These allometric equations are more accurate and robust. According to Panzou *et al*. (2016) [14], the use of these equations results in 90 per cent accuracy in biomass estimates at a scale of 0.25 ha in tropical rainforests. The allometric equation model incorporating dbh and measured height was used. The mathematical formula is given by Equation (3), which is defined as follows (3) :

$$\mathbf{Ba = 0.0673 \times (\rho \times D^2 \times H)^{0.976}} \quad \mathbf{(3)}$$

In this formula, Ba, ρ, D and H represent, respectively, above-ground biomass (in kg), specific wood density (in g/cm^3), tree diameter (in cm). and total tree height (in m). For species for which no literature data on density are available, the default value (default ρ = 0.58 g/cm^3) for African tropical forests was used, as recommended by Reyes *et al*. (1992) [15].

Underground biomass (Bs) is calculated from above-ground biomass using the following formula (4) :

$$\mathbf{Bs = Ba \times 0.24} \quad \mathbf{(4)}$$

The total biomass (BT), in kilograms, is therefore the sum of the above-ground (Ba) and underground (Bs) biomasses:

$$\mathbf{BT = Ba + Bs} \quad \mathbf{(5)}$$

The rate of carbon (in kg) sequestered is determined by multiplying the biomass value by the conversion factor equal to 0.5.

$$\mathbf{Carbon\ stock = BT * 0.5} \quad \mathbf{(6)}$$

The determination of the equivalent CO_2 is done by taking into account the molar mass of CO_2, which is equal to 44 and the molar mass of carbon which is equal to 12. The ratio of the molar masses of CO_2 and carbon is 3.67. Thus, the estimate of CO_2 equivalent is done by multiplying the carbon stock from biomass by 3.67. The formula is as follows:

$$\mathbf{CO_2\ equivalent = Carbon\ Stock * 3.67} \quad \mathbf{(7)}$$

3 RESULTS

3.1 Floristic diversity

In terms of floristic richness, the survey identified a total of 59 species across 51 genera and 24 families. The families, containing more than three species, in descending order, are: the Fabaceae (20 species), accounting for 33.9 per cent of the species; the Combretaceae and Moraceae, each with 4 species, accounting for 13.6 per cent of the species; followed by the Anacardiaceae and Meliaceae, each with 3 species, accounting for 10.2 per cent of the species. These five families account for more than half of the species, or 57.4 per cent. The remaining 19 families, comprising between one and two species, account for only 42.6 per cent of the species recorded (Figure 3).

With regard to the floristic composition, the ten most abundant species at the site are: *Isoberlinia doka* (180 trees), *Daniellia oliveri* (114 trees), *Pericopsis laxiflora* (108 trees), *Pinus caribaea* (99 trees), *Azadirachta indica* (97 trees), *Tectona grandis* (92 trees), *Acacia senegal* (77 trees), *Diospyros mespiliformis* (76 trees), *Khaya senegalensis* (71 trees) and *Parkia biglobosa* (69 trees). The other species account for only 17 per cent of the total number of trees, or 261. The least well-represented species, with only a single tree trunk each, are: *Entada africana*, *Berlinia grandiflora*, *Borassus aethiopum*, *Combretum velutinum*, *Eucalyptus sp* and *Terminalia mantaly* (Figure 4).

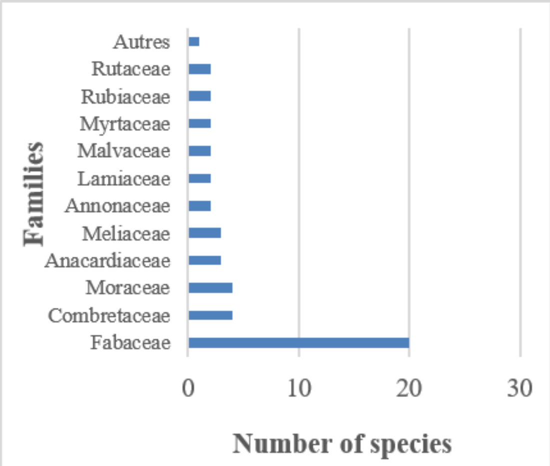

Figure 3: Breakdown of families by number of species

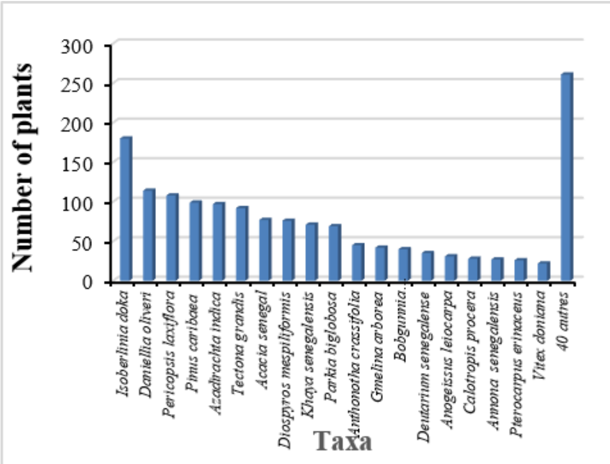

Figure 4: Number of plants per taxon

The dominant biological types at the site are Microphanerophytes (mp), accounting for 69 per cent of species, followed by Mesophanerophytes (mP), accounting for 17 per cent of species. Megaphanerophytes (MP) and Nanophanerophytes (np) are poorly represented (Figure 5)

Furthermore, an analysis of chorological affinities reveals that savannah species dominate the flora of the Korhogo campus, with 26 taxa from the Sudano-Zambesian (SZ) phytogeographic region, accounting for 44.1 per cent of the species. Species from the forest-savannah transition zone (GC-SZ) number 14, accounting for 23.7 per cent.

There are 15 introduced species (i) originating from other regions, accounting for 25.4 per cent. Three species from the Guinea-Congo (GC) region and one species endemic to West Africa (GCW) were recorded. These are *Berlinia grandiflora* (Figure 6).

The analysis identified one Endangered (EN) species, *Pterocarpus erinaceus*, and one Vulnerable (VU) species according to the IUCN Red List, namely *Vitellaria paradoxa*. In addition, there is a species endemic to West Africa (*Berlinia grandiflora*) and a species classified as rare according to the local Aké-Assi list (Table 1).

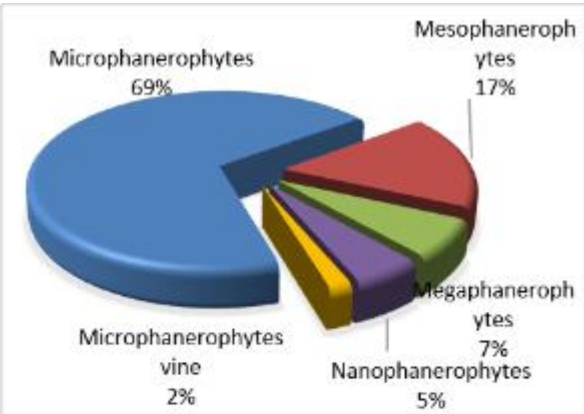

Figure 5: Spectrum of biological types at the site

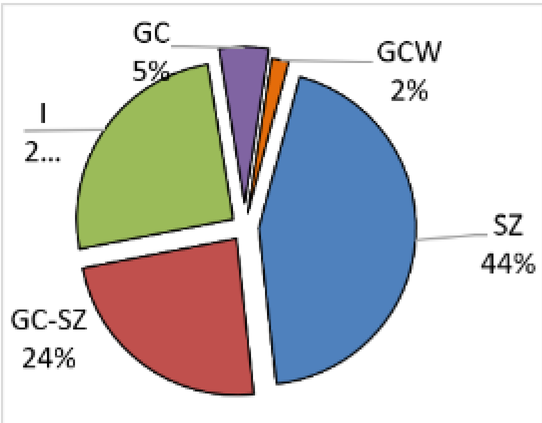

Figure 6: Spectrum of species chorology

Table 1: List of species with special status at the site

N°	Species	IUCN status	Aké-Assi status
1	*Berlinia grandiflora*		GCW
3	*Pterocarpus erinaceus*	En	
4	*Syzygium guineense*		Rare
5	*Vitellaria paradoxa*	Vu	

Vu: Vulnerable; En: Endangered species; GCW: West African endemic species

For species diversity, the Shannon index is 3.325 and the Pielou evenness index is 0.81. The latter value approaches 1; this indicates that species are evenly distributed across the site, with no single species dominating over the others.

3.2 Structural diversity

Across the 41.8 ha surveyed, 1,540 stems were recorded, representing an overall density of 37 stems/ha. This density varies according to species. Table 2 lists the species with densities of at least 1 stem/ha. The species with the highest density is *Isoberlinia doka* (4.30 stems/ha), followed by *Daniellia oliveri*, *Pericopsis laxiflora*, *Pinus caribaea*, *Azadirachta indica* and *Tectona grandis*, all with more than 2 stems/ha.

Table 2: Species with densities greater than 1 stem/ha

Species	Number of individus	Density (stem/ha)
Isoberlinia doka	180	4.30
Daniellia oliveri	114	2.72
Pericopsis laxiflora	108	2.58
Pinus caribaea	99	2.36
Azadirachta indica	97	2.32
Tectona grandis	92	2.20

The total basal area occupied by the individuals surveyed is 43.3 m^2 across the 41.8 ha, giving an average of 1.03 m^2/ha. This area varies according to species. Table 3 lists the species whose basal areas exceed 1 m^2/ha. Among these species, *Cola cordifolia* has the largest basal area, followed by *Azadirachta indica* and *Isoberlinia doka*.

Table 3: Species with basal areas exceeding 1 m^2/ha

Species	Number of individus	Land area (m^2/ha)
Cola cordifolia	18	8.28
Azadirachta indica	97	3.28
Isoberlinia doka	180	3.01
Diospyros mespiliformis	76	2.61
Parkia biglobosa	69	2.57
Gmelina arborea	42	2.27
Anacardium occidentale	18	2.26
Ficus sur	19	2.09

The individuals recorded have diameters ranging from 5 to 110 cm. The diameter class]10–20] is the most common, with 690 specimens (44.8 per cent), followed by the class [5–10] with 577 specimens (37.5 per cent). These two classes together total 1,267 specimens, representing 82.27 per cent of the total (Figure 7),

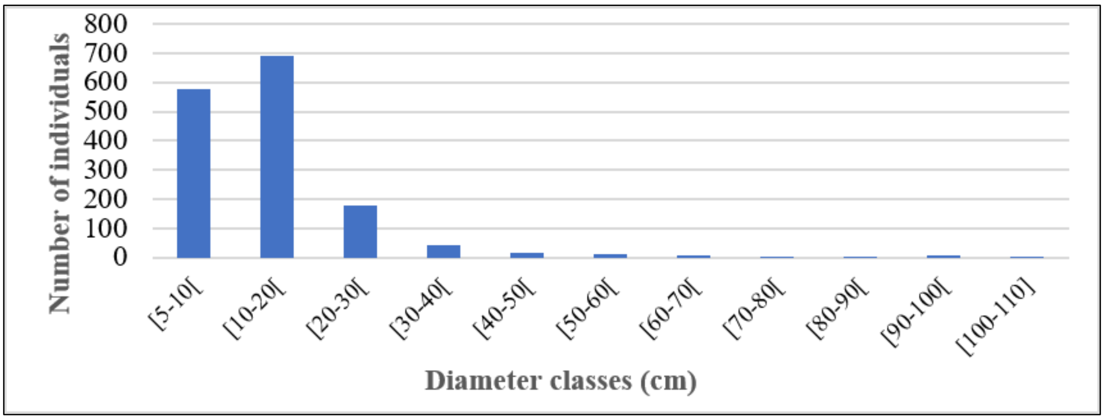

Figure 7: Diameter classes as a function of the number of individuals

The height of the trees surveyed ranges from 2 to 20 metres. Trees between 4 and 8 metres in height are the most common, numbering 895 (58.1 per cent), followed by the [8–16] class with 513 trees, or 33.3 per cent (Figure 8).

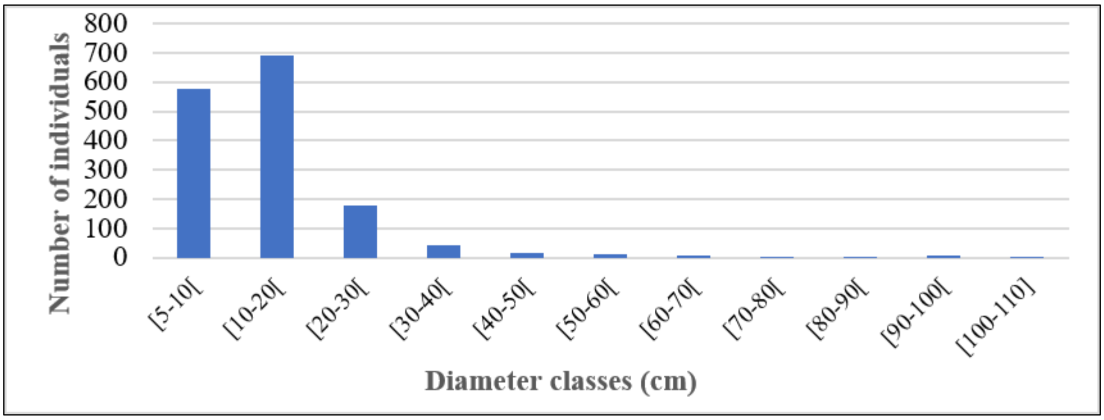

Figure 8: Height classes by number of individuals

3.3 Amount of carbon sequestered by woody plants

3.3.1 Amount of carbon sequestered by all woody plants on the UPGC site

The total amount of carbon sequestered by woody plants on the university site is 132,636 kg, or 132.63 tonnes, giving an average rate of 3.14 t/ha. This amount varies according to the diameters of the woody plants, their biological types and species.

3.3.2 Amount of carbon sequestered by diameter class

The diameter class [10–20 [recorded the highest amount of carbon sequestered, followed by the class [20–30[. Together, these two classes account for 37.32 per cent of the site's carbon stock. The class [90–100 [, comprising only 7 individuals, accounted for 13.19 per cent of the carbon stock (Table 4).

Table 4: Biomass, sequestered carbon stock and CO_2 equivalent by diameter class

Diameter class	Number of trees	ST (m^2/ha)	BT (t/ha)	SC (t)	SC (t /ha)	SC (%)	CO_2 (t/ha)
[5-10[	577	2,7	10.6	5.3	0.12	4	19.4
[10-20[	690	10.5	51.9	26.0	0.62	19.60	95.2
[20-30[	177	7.7	47.1	23.5	0.56	17.72	86.3
[30-40[	44	4.1	26.1	13.1	0.31	9.87	47.9
[40-50[	16	2.5	18.4	9.2	0.22	6.93	33.8

[50-60[	12	2.7	19.5	9.7	0.23	7.31	35.7
[60-70[	9	3.1	21.7	10.8	0.25	8.14	39.7
[80-90[	6	3.1	21.7	10.8	0.25	8.14	39.8
[90-100[	7	5.0	35.0	17.5	0.42	13.19	64.1
[100 et +	2	1.8	13.3	6.7	0.16	5.05	24.4
Total	1540	43.3	265.3	132.6	3.14	100	486.4

ST: Basal area; BT: Total Biomass; SC: sequestered carbon stock; CO_2 equivalent

3.3.3 Amount of carbon sequestered by biological type

More than 66.65 per cent of the carbon stock was sequestered by microphanerophytes and more than 30.58 per cent by mesophanerophytes, totalling 97.23 per cent for the two biological types. (Table 5).

Table 5: Amount of carbon sequestered by biological type

Biological type	Number of individuals	Amounts of Carbon Sequestered in kg	Percentages
Microphanérophytes (mp)	1043	88408.1	66.65%
Mésophanérophytes (mP)	269	40558.1	30.58%
Mégaphanérophytes (MP)	193	3420.2	2.58%
Nanophanérophytes (np)	35	250.5	0.19%
Total	1540	132636.9	100%

3.3.4 Amount of carbon sequestered by species

The amount of carbon sequestered varies depending on the species. It is higher for species such as *Cola cordifolia*, *Diospyros mespiliformis*, *Azadirachta indica* and *Isoberlinia doka*, and lower for *Maytenus senegalensis*, *Carica papaya* and *Citrus aurantiifolia* (Table 6).

Table 6: Amount of carbon sequestered by species

Species	Number of trees	Quantity of Carbon (in kg)	Quantity of carbon by tree (in kg)
Cola cordifolia	18	30782.6	1710
Diospyros mespiliformis	76	10323.6	135
Azadirachta indica	97	10295.4	106
Isoberlinia doka	180	10167.5	56.4
Parkia biglobosa	69	7801.9	113
Anogeissus leiocarpus	31	7551.9	243
Ficus sur	19	6281.2	330
Gmelina arborea	42	5581.2	133
Bobgunnia madagascariensis	40	5410.5	135
Anacardium occidentale	18	5060.8	281
Acacia senegal	77	3625.8	47
Mangifera indica	18	3137.3	174
Khaya senegalensis	71	3110.5	43.8
Tectona grandis	92	2457.9	26.7
Ficus ingens	11	2204.4	200

Sterculia setigera	2	1935.6	967
Pericopsis laxiflora	108	1932	17.8
Daniellia oliveri	114	1830.5	16
Anthonotha crassifolia	45	1506	33.4
Pterocarpus erinaceus	26	1307	50.2
Acacia sieberiana	9	1088.8	120
Piliostigma thonningii	17	1071.4	63
Ficus dicranostyla	2	1008.7	504
Pinus caribaea	99	830.2	8.38
Detarium senegalense	35	650.7	18.5
Vitex doniana	22	593.1	26.9
Albizia zygia	4	566.6	141
Terminalia macroptera	12	550.6	45.8
Zanthoxylum zanthoxyloides	17	495	29.1
Nauclea latifolia	17	491.3	28.9
Lannea velutina	2	359.3	179.65
Leucaena leucocephala	2	265.6	132.8
Calotropis procera	28	234.2	8.36
Stereospermum kunthianum	5	176.6	35.32
Annona senegalensis	27	174.8	6.47
Acacia auriculiformis	2	174.6	87.3
Erythrina senegalensis	3	160.7	53.56
Adansonia digitata	3	150.3	50.1
Berlinia tomentella	3	129.7	43.23
Flacourtia flavescens	9	115.6	12.84
Cassia siamea	1	113.9	113.9
Vitellaria paradoxa	12	108.3	9.025
Melia azedarach	3	107.6	35.86
Albizia lebbeck	8	106.7	13.33
Borassus aethiopum	1	102.7	102.7
Uvaria chamae	7	88.8	12.68
Entada africana	1	70	70
Cumbretum velutinum	1	63.4	63.4
Terminalia mantaly	1	62.5	62.5
Strychnos spinosa	3	60.4	20.13
Gardenia ternifolia	4	56	14
Eucalyptus sp.	1	29.6	29.6
Moringa oleifera	7	27.2	3.88
Syzygium guineense	2	25.5	12.75
Berlinia grandiflora	1	25.4	25.4

Ficus benjamina	4	19.7	4.925
Maytenus senegalensis	3	16.8	5.6
Carica papaya	5	12.3	2.46
Citrus aurantiifolia	2	11.8	5.9

4 DISCUSSION

According to the results, the study site is home to 59 species of woody trees, comprising 51 genera and 24 families, across an area of 41.8 ha. This species richness, at around 2 species per hectare, is relatively high compared with the protected forests of Kimbirila (127 species across 3,040 ha, or 0.041 species per ha) and Kaniasso (104 species across 7,400 ha, or 0.014 species per ha) in the Odienné department, an area similar to the study site (Ibrahima *et al*., 2023) [16]. This high floristic diversity at the site can be explained by the fact that, in addition to the site's native species, species from elsewhere have been introduced there. These include shade and ornamental species such as *Gmelina arborea*, *Mangifera indica*, *Tectona grandis*, *Melia azedarach* and *Pinus caribaea*,

At the family level, the Fabaceae are by far the most dominant on the site. This is because the site is located in the Guineo-Congolese region, which is characterised by open forests and forms part of the African tropical forests of the 'Rubiaceae-Euphorbiaceae-Caesalpiniaceae' type (Adou *et al*., 2005) [17]. The majority of species in this region are legumes comprising former families such as the Mimosaceae, Papilionaceae and Caesalpiniaceae, which are now grouped within the large Fabaceae family.

With regard to plant composition, the results show that the most abundant species in terms of number of individuals is *Isoberlinia doka* with 180 plants, followed by *Daniellia oliveri* (114 plants), *Pericopsis laxiflora* (108 plants) and *Diospyros mespiliformis* (76 plants). The abundance of these native species can be explained by the type of vegetation formation in which the UPGC site is located. This is an open forest area dominated by these types of species (Guillaumet & Adjanohoun 1971) [18]. The abundance of the other exotic species listed below, with significant numbers of trees—namely *Pinus caribaea* (99 trees), *Azadirachta indica* (97 trees), *Tectona grandis* (92 trees), *Acacia senegal* (77 trees), *Gmelina arborea* (42 trees) and *Calotropis procera* (28 trees), is explained by the fact that these species are among the most commonly planted ornamental plants on the site, owing to the shade they provide and their aesthetic appeal. The other, less commonly found species are those that do not tolerate disturbed sites, but rather prefer well-preserved habitats.

Microphanerophytes, followed by Mesophanerophytes, are the most commonly represented biological types. This is explained by the fact that the university site constitutes a habitat disturbed by human presence and infrastructure (Sangne, 2009) [19]. This prevents the development of megaphanerophytes, which require undisturbed habitats such as undisturbed primary forest sites (Vidal, 1966) [20].

In terms of structural diversity, the results indicate an average density of 37 stems/ha for the site. This figure is quite low compared with that obtained by Missa *et al.* (2026) [21] in the same region of Korhogo, which was estimated at 138 stems/ha. This reduction in tree density at the site can be explained by the fact that it is a university campus, the construction of whose infrastructure led to the destruction of several trees. The species with the highest density is *Isoberlinia doka*, followed by *Daniellia oliveri* and *Pericopsis laxiflora*. The predominance of these species in terms of density is confirmed by several studies (Silué *et al*., 2023, Missa *et al*., 2026) [5] [21].

For basal area, the results show an estimated average value for the site of 1.03 m^2/ha. Compared with data from the classified forests of Kaniasso (11.653 m^2/ha) and Kimbirila (12.488 m^2/ha) in north-western Côte d'Ivoire (Ibrahima *et al*., 2023) [16], the basal area at our study site is very low. This is due to the fact that the university site includes buildings and roads which occupy a significant portion of the site.

Furthermore, analysis of the diameter and height structures of the inventoried stands showed that the majority of trees at the study site are young, medium-sized trees in active growth; however, the site also contains large-diameter and large-sized species such as *Cola cordifolia*, *Gmelina arborea* and *Anogeissus leiocarpus*.

According to the results, the total carbon stock sequestered by woody plants at the UPGC site amounts to 132,636.87 tonnes, or 3.14 t C/ha. This figure is significantly lower than that found in the UPGC Forest Reserve, which was 109.96 t C/ha (Silué *et al*., 2023) [5]. This significant discrepancy could be explained by the fact that the University's Forest Reserve is an island of dense, undegraded forest where all the necessary ecological conditions are present (ecological balance, relatively high stand density and basal area), which favours maximum carbon sequestration by the trees. This is not the case for the site of the present study, which is an open area dotted with trees, with infrastructure occupying a significant portion of the land. Furthermore, the site is located in an open woodland area with a lower density of woody plants than that of the Forest Reserve, which is a dense forest. Furthermore, the analysis of carbon sequestration by species showed that the species which sequestered the most carbon was *Cola cordifolia*, followed by *Diospyros mespiliformis*, *Azadirachta indica* and *Isoberlinia doka*. The high amount of carbon sequestered by *Cola cordifolia* is due to its large basal area, for *Isoberlinia doka* by its high stand density, and for *Azadirachta indica* and *Diospyros mespiliformis* by their high wood densities, which range from 0.64 to 0.90 g/cm^3 and 0.72 to 0.93 g/cm^3 respectively.

Furthermore, the distribution of sequestered carbon stock by diameter class indicates that it is the diameter classes [10–20[and [20–30 [that have sequestered the most carbon. It can therefore be inferred that it is the young, rapidly growing plants that sequester more carbon compared with large-diameter plants that have reached their sequestration limit (Laitat *et al*., 2004; Dubé *et al*., 2006) [22] [23].

5 CONCLUSION

On completion of this study, we can conclude that the woody plants at the UPGC site have sequestered a certain amount of carbon, a significant proportion of which is stored in species such as *Cola cordifolia*, *Diospyros mespiliformis*, *Azadirachta indica* and *Isoberlinia doka*, as well as in rapidly growing young plants. Given that the majority of the carbon sequestered in the university courtyard is stored in young plants, the rate of carbon sequestration could increase over time. To this end, we recommend that the UPGC authorities take measures to protect the plant species in the UPGC courtyard in order to promote their growth and thereby maximise the site's carbon sequestration potential.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

We would like to express our deep gratitude to the management of Peleforo Gon Coulibaly University, whose approval has facilitated our work on site.

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

Informed consent was obtained from all study participants.

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