

CARBON STOCK QUANTIFICATION FOR SAN RAFAEL RESERVE PARK, AN APPROACH TO REALITY.

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SUMMARY: The present work was done with the aim to obtain the carbon stock quantification in one hectare of the Reserve for Park San Rafael, the studied reservoirs were the forest aboveground biomass and root biomass. The methodology consisted in developing an inventory of the diameter and height of the individual in a Temporal Parcel of Monitoring (TPM). This parcel was situated at random in the forestry formation. From each tree with more than 10 cm of breast height diameter was measured. Dasometric data such as breast height diameter and commercial height was registered.

The parcel measurement showed an aboveground biomass of 117.653 tC/ha and 28.237 tc/ha root biomass that totalizes 145.890 tC per hectare as estimated quantity of stock of carbon.

Key words: Inventory, aboveground biomass, root biomass and carbon stock.

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1. INTRODUCTION

The survey in field could be done with the support of the NGO Guyra Paraguay. Afterwards the quantification of the Reserve for Park San Rafael was made. These values give us an approximation of the reserve and its potential of carbon sequestration and of its carbon stock reality. This data gives us a vision and a valuation of this kind of ecosystem so important for the environmental services they give us.

These obtained values reveal to us an important potential of carbon stock and it is a real proof of the need of conserving, not just because of the accumulated carbon that it has as a deposit but also because the high variability of fauna and flora species and finally because it represents an unique and representing spot of the BAAPA.

2. MATERIALS AND MÉTHOD

Location and site of the installation of the Parcel

The location of the parcel was localized at random in the forest. This parcel has a length of equal sizes of 100 x 100 meters. This forms a block of 10,000 m² (1 hectare, this represents 2.471 acres). This parcel was divided in four square blocks, with equal sizes of 50 meter long (2500 m²) in order to facilitate the data collect.

Survey in the field

Each tree with BHD – breast height diameter is measured at 1.30 m above the ground – above 10 cm was measured. In order to do so a diametric belt was used. The total height was estimated. Afterwards qualitative parameters such as phenology were registered.

Volume calculation

Once the data of the forest inventory was obtained the calculation to obtain the volumes values of each species was done. For this, the following formula was used:

$$Ab = \frac{\pi * d^2}{4}$$

Where:

Ab = basal area in m²

π = 3.1416

d = Brest height diameter (1.30 m)

$$V = Ab * f * h$$

Where:

V = volume in m³

Ab = basal area en m²

f = form factor ²

h = height in meter

Conversion from volume to biomass.

The specific density data of each species was adjusted, considering that the manuals show 12% of humidity. Then, the obtained values of volume calculations were multiply with this value of specific density. To acquire this, the following formulas were used:

²For the factor form the coefficient of 0.775 for native species was used. Class notes.

$$Y = 0.0134 + 0.8 * X$$

$$(r^2 = 0.99)^2$$

Where:

Y = Dry wood density Kg/m³

X = Wood density at 12% of humidity in Kg/m³

$$B = (V * Pe)/1000$$

Where:

B = biomass in tons

V = volume in m³

Pe = specific density in Kg/m³

Biomass conversion to total biomass

In order to obtain the total biomass the biomass obtained with the conversion of the volume data was multiplied with expansion factor (FEB)³. For this the following formula was used:

$$BT = B * FEB$$

Where:

BT = total biomass in tons

B = biomass in tons

FEB = expansion of biomass factor

³ For the expansion of biomass factor the value 3.4 for Tropical Climatic Zone of Wide Leaf Wood type was used (IPCC, 2005).

Total biomass conversion to total carbon.

The next step consisted in multiply the values of total biomass with a 0.5 factor, since the dry material has an average of 50% of carbon. For this, the following formula was used:

$$\mathbf{CT} = \mathbf{BT} * \mathbf{0.5}$$

Where:

CT = total carbon in carbon tons (tC)

BT = total biomass in Tn

Attainment of the root biomass values through indirect method of calculation.

The root biomass values were acquired through the indirect calculation method, that consists in relate the aerial biomass of each species with the following formula ⁴ proposed for the IPCC.

$$\mathbf{BR} = \mathbf{0.24} * (\mathbf{BA})$$

Where:

BR = root biomass in (Tn/ha)

BA = aerial bomass (Tn/ha)

⁴ Average relation of belowground biomass/aboveground biomass for Tropical/Subtropical Humid Primary Forest (IPCC, 2005).

3. RESULTS

Quantity of founded species and volume

The forestry inventory of the temporal parcel showed that the quantity of individuals was of 395 corresponding to 66 forestry species and a total volume of 142.709 m³ per he. The quantity of volumes per species is detailed in table 1.

Table 1. Quantity of volumen per species

N°	Species	Common name	VOL. (m ³)
1	<i>Myrciaria rivularis</i> Cambess.	Yvaporoyty	3.502
2	<i>Ocotea puberula</i> (Rich) Ness	Laurel guaika	0.109
3	<i>Luehea divaricata</i> Mart	Ka'a oveti	9.452
4	<i>Matayba elaeagnoides</i> Radlk	Jaguarata'y	2.928
5	<i>Citrus aurantium</i> L.	Naranja ha'y	0.303
6	<i>Cabralea canjerana</i> (Vell.)Mart	Cancharana	3.255
7	<i>Machaerium stipitatum</i> (DC.) Vog.	Ysapy'y moroti	1.132
8	<i>Chrysophyllum gonocarpum</i> (Mart & Eichler) Engl	Agua'y	9.389
9	<i>Sebastiania brasiliensis</i> Sprengel	Yvyra Kamvy	0.213
10	<i>Nectandra angustifolia</i> (Schrader)	Laurel hu	23.515
11	<i>Balfourodendron riedelianum</i> (Engl.) Engl.	Guatambu	6.415
12	<i>Tabernaemontana australis</i> Muell. Arg.	Sapirangy	0.093
13	<i>Trichilia catigua</i> A Juss.	Katigua pyta	0.471
14	<i>Casearia sylvestris</i> SW	Aratiku mbavy	0.321
15	<i>Sebastiania</i> sp.	Lancrillo	0.204
16	<i>Helietta apiculata</i> Benth.	Yvyra ovi	1.212
17	<i>Parapiitadenia rigida</i> (Benth.) Brenan	Kurupa'yra	1.410
18	<i>Inga vera</i> Willd	Inga guazu	1.147
19	<i>Rollinia emarginata</i>	Aratiku	0.442
20	<i>Sygarus romanzoffiana</i> (Cham.) Glas	Pindo	1.881
21	<i>Inga marginata</i> Willd	Inga'i	0.718
22	<i>Trichilia pallida</i>	Cedrillo	0.104
23	<i>Rapanea lorentziana</i> Mez	Canelon guazu	0.206
24	<i>Jacaratia spinosa</i> (Aubl.) A. DC.	Jacaratia	11.607
25	<i>Campomanesia xanthocarpa</i> Berg	Guavyra pyta	1.242
26	<i>Fagara hyemalis</i>	Kuratura	0.967
27	<i>Cecropia pachystachya</i> Trecul	Amba'y	0.709
28	<i>Maclura tinctoria</i> Subsp.tinctoria	Tatajyva	0.885
29	<i>Bastardiopsis densiflora</i> (Hook & Am) Hassler	Loro blanco	0.568
30	<i>Holocalyx balansae</i> Micheli	Alecrin	8.996

31	<i>Patagonula americana L.</i>	Guajayvi	3.307
32	<i>Cariniana estrellensis (Raddi) Kuntze</i>	Ka'i kaygua	0.099
33	<i>Alchornea triplinervia</i>	Chipa rupa	5.997
34	<i>Dendropanax cuneatus (DC.) Decne</i>	Ombu ra	6,340
35	<i>Hexachlamys edulis (Berg) Kausel & Legrand</i>	Yva ha'y guazu	0.110
36	<i>Cordia trichotoma (Vell.) Arráb. Ex Steud</i>	Peterevy	0.185
37	<i>Myrocarpus frondosus Allemao</i>	Incienso	0.027
38	<i>Trichilia pallens C de Candolle</i>	Katigua moroti	0.955
39	<i>Nectandra lanceolata Nees & Mart. ex Nees</i>	Laurel sayju	3.218
40	<i>Allophylus edulis (St.-Hill.) Radlk</i>	Koku	0.444
41	<i>Lonchocarpus leucanthus Burkart</i>	Rabo ita	1.590
42	<i>Pilocarpus pennatifolius</i>	Yvyra tai	0.079
43	<i>Diatenopteryx sorbifolia Radlk.</i>	Yvyra piu	3.609
44	<i>Strychnos brasiliensis (Sprengel) Mart</i>	Ñuaty Kuruzu	1.272
45	Not determinated	Ka'i ranga	0.334
46	<i>Cupania vernalis</i>	Jaguarata'y pyta	1.263
47	<i>Chorisia speciosa St.-Hill</i>	Samu'u pyta	1.096
48	Not determinated	Jagua pety guazu	0.161
49	Not determined	Ka'a ka'aguy	0.029
50	<i>Peltophorum dubium (Spreng.) Taub</i>	Yvyra pyta	6,001
51	<i>Ocotea diospirifolia (Meisn.) Mez</i>	Laurel moroti	0.436
52	<i>Rupretchia laxiflora</i>	Marmelero	0.746
53	<i>Cedrela fissilis Vell</i>	Cedro	2.723
54	<i>Calliandra tweediei</i>	Niño azote	0.052
55	<i>Ficus enornis (Mart. ex Miq.) Miq</i>	Guapo'y	0.277
56	<i>Enterolobium contortisiliquum (Vell.) Morong</i>	Timbo	1.319
57	<i>Pentapanax warmingianus (Marchal) Harms</i>	Paraparai guazu	1.583
58	<i>Annona amambayensis Hassler</i>	Aratiku guazu	0.999
59	<i>Faramea porophylla (Vell.) Müll. Arg.</i>	Mborevi rembiu	0.044
60	<i>Vitex megapotamica (Sprengel) Mold</i>	Taruma	1.510
61	<i>Apuleia leiocarpa (Vogel) J.F. Macbr</i>	Grapia	0.149
62	<i>Banara arguta Briq.</i>	Mbavy	0.113
63	<i>Pterogyne nitens Tul.</i>	Yvyra ro	0.193
64	<i>Syzygium sayeri</i>	Yva mbopy	0.132
65	<i>Enterolobium contortisiliquum (Vell.) moroni</i>	Timbo	1.909
66	<i>Rheedia brasiliensis</i>	Pakuri	0.123
TOTAL			142.709

Quantity of aerial biomass for each species







The quantity of aerial biomass was of 69.208 Tn/he, the contribution of each species in the whole is detailed in table 2.

Table 2. Quantity of biomass for species

Nº	Species	VOL. (m³)	Density (kg/m³)	Adjusted Density	Biomass (Tn/he)
1	<i>Myrciaria rivularis</i> Cambess.	3.502	900	720.0134	2.521
2	<i>Ocotea puberula</i> (Rich) Ness	0.109	440	352.0134	0.038
3	<i>Luehea divaricata</i> Mart	9.452	610	488.0134	4.613
4	<i>Matayba elaeagnoides</i> Radlk	2.928	850	680.0134	1.991
5	<i>Citrus aurantium</i> L.	0.303	500	400.0134	0.121
6	<i>Cabralea canjerana</i> (Vell.) Mart	3.255	600	480.0134	1.562
7	<i>Machaerium stipitatum</i> (DC.) Vog.	1.132	580	464.0134	0.525
8	<i>Chrysophyllum gonocarpum</i> (Mart & Eichler) Engl	9.389	700	560.0134	5.258
9	<i>Sebastiania brasiliensis</i> Sprengel	0.213	650	520.0134	0.111
10	<i>Nectandra angustifolia</i> (Schrader)	23.515	550	440.0134	10.347
11	<i>Balfourodendron riedelianum</i> (Engl.) Engl.	6.415	800	640.0134	4.106
12	<i>Tabernaemontana australis</i> Muell. Arg.	0.093	445	356.0134	0.033
13	<i>Trichilia catigua</i> A Juss.	0.471	880	704.0134	0.331
14	<i>Casearia sylvestris</i> SW	0.321	500	400.0134	0.128
15	<i>Sebastiania</i> sp.	0.204	500	400.0134	0.082
16	<i>Helietta apiculata</i> Benth.	1.212	750	600.0134	0.727
17	<i>Parapiptadenia rigida</i> (Benth.) Brenan	1.410	950	760.0134	1.072
18	<i>Inga vera</i> Willd	1.147	680	544.0134	0.624
19	<i>Rollinia emarginata</i>	0.442	590	472.0134	0.209
20	<i>Sygarus romanzoffiana</i> (Cham.) Glas	1.881	500	400.0134	0.752
21	<i>Inga marginata</i> Willd	0.718	695	556.0134	0.399
22	<i>Trichilia pallida</i>	0.104	700	560.0134	0.058
23	<i>Rapanea lorentziana</i> Mez	0.206	750	600.0134	0.124
24	<i>Jacaratia spinosa</i> (Aubl.) A. DC.	11.607	100	80.0134	0.929
25	<i>Campomanesia xanthocarpa</i> Berg	1.242	860	688.0134	0.854
26	<i>Fagara hyemalis</i>	0.967	820	656.0134	0.634
27	<i>Cecropia pachystachya</i> Trecul	0.709	250	200.0134	0.142
28	<i>Maclura tinctoria</i> Subsp. tinctoria	0.885	800	640.0134	0.567
29	<i>Bastardiopsis densiflora</i> (Hook & Am) Hassler	0.568	700	560.0134	0.318
30	<i>Holocalyx balansae</i> Micheli	8.996	900	720.0134	6.478
31	<i>Patagonula americana</i> L.	3.307	800	640.0134	2.116
32	<i>Cariniana estrellensis</i> (Raddi) Kuntze	0.099	500	400.0134	0.039
33	<i>Alchornea triplinervia</i>	5.997	440	352.0134	2.111
34	<i>Dendropanax cuneatus</i> (DC.) Decne	6.340	380	304.0134	1.927
35	<i>Hexachlamys edulis</i> (Berg) Kausel & Legrand	0.110	700	560.0134	0.061
36	<i>Cordia trichotoma</i> (Vell.) Arráb. Ex Steud	0.185	600	480.0134	0.089
37	<i>Myrocarpus frondosus</i> Allemao	0.027	800	640.0134	0.017
38	<i>Trichilia pallens</i> C de Candolle	0.955	500	400.0134	0.382
39	<i>Nectandra lanceolata</i> Nees & Mart. ex Nees	3.218	600	480.0134	1.545
40	<i>Allophylus edulis</i> (St.-Hill.) Radlk	0.444	670	536.0134	0.238
41	<i>Lonchocarpus leucanthus</i> Burkart	1.590	840	672.0134	1.069
42	<i>Pilocarpus pennatifolius</i>	0.079	1030	824.0134	0.065

43	<i>Diatenopteryx sorbifolia</i> Radlk.	3.609	800	640.0134	2.310
44	<i>Strychnos brasiliensis</i> (Sprengel) Mart	1.272	882	705.6134	0.897
45	Not determined	0.334	500	400.0134	0.134
46	<i>Cupania vernalis</i>	1.263	690	552.0134	0.697
47	<i>Chorisia speciosa</i> St.-Hill	1.096	225	180.0134	0.197
48	Not determined	0.161	500	400.0134	0.064
49	Not determined	0.029	500	400.0134	0.011
50	<i>Peltophorum dubium</i> (Spreng.) Tabú	6,001	860	688.0134	4.129
51	<i>Ocotea diospirifolia</i> (Meisn.) Mez	0.436	650	520.0134	0.227
52	<i>Rupretchia laxiflora</i>	0.746	750	600.0134	0.447
53	<i>Cedrela fissilis</i> Vell	2.723	500	400.0134	1.089
54	<i>Calliandra tweediei</i>	0.052	850	680.0134	0.035
55	<i>Ficus enornis</i> (Mart. ex Miq.) Miq	0.277	400	320.0134	0.089
56	<i>Enterolobium contortisiliquum</i> (Vell.) Moroni	1.319	330	264.0134	0.348
57	<i>Pentapanax warmingianus</i> (Marchal) Harms	1.583	480	384.0134	0.608
58	<i>Annona amambayensis</i> Hassler	0.999	250	200.0134	0.200
59	<i>Faramea porophylla</i> (Vell.) Müll. Arg.	0.044	500	400.0134	0.018
60	<i>Vitex megapotamica</i> (Sprengel) Mold	1.510	810	648.0134	0.978
61	<i>Apuleia leiocarpa</i> (Vogel) J.F. Macbr	0.149	800	640.0134	0.095
62	<i>Banara arguta</i> Briq.	0.113	635	508.0134	0.058
63	<i>Pterogyne nitens</i> Tul.	0.193	800	640.0134	0.124
64	<i>Syzygium sayeri</i>	0.132	500	400.0134	0.053
65	<i>Enterolobium contortisiliquum</i> (Vell.) Moroni	1.909	330	264.0134	0.504
66	<i>Rheedia brasiliensis</i>	0.123	450	360.0134	0.044
TOTAL					69.208

SOURCE:

-  ATENCIA (2003)
-  CARRERE (1990)
-  CHAVE et al (2006)
-  GTZ (2007)
-  LÓPEZ (2002)
-  NO DATA ⁵

⁵ A modest value of 500 Kg/m³ is assumed.

Quantity of total aerial biomass for each species

The quantity of aerial biomass in the whole is of 235.306 Tn/he. The contribution of each species is detailed in table 3.

Table 3. Quantity of total aerial biomass for species

N°	Species	Common name	Total Biomass (Tn/ha)
1	<i>Myrciaria rivularis</i> Cambess.	Yvaporoyty	8.572
2	<i>Ocotea puberula</i> (Rich) Ness	Laurel guaika	0.131
3	<i>Luehea divaricata</i> Mart	Ka'a oveti	15.684
4	<i>Matayba elaeagnoides</i> Radlk	Jaguarata'y	6,770
5	<i>Citrus aurantium</i> L.	Naranja ha'y	0.412
6	<i>Cabralea canjerana</i> (Vell.)Mart	Cancharana	5.312
7	<i>Machaerium stipitatum</i> (DC.) Vog.	Ysapy'y moroti	1.787
8	<i>Chrysophyllum gonocarpum</i> (Mart & Eichler) Engl	Agua'y	17.877
9	<i>Sebastiania brasiliensis</i> Sprengel	Yvyra Kamvy	0.377
10	<i>Nectandra angustifolia</i> (Schrader)	Laurel hu	35.180
11	<i>Balfourodendron riedelianum</i> (Engl.) Engl.	Guatambu	13.959
12	<i>Tabernaemontana australis</i> Muell. Arg.	Sapirangy	0.113
13	<i>Trichilia catigua</i> A Juss.	Katigua pyta	1.128
14	<i>Casearia sylvestris</i> SW	Aratiku mbavy	0.436
15	<i>Sebastiana</i> sp.	Lancrillo	0.277
16	<i>Helietta apiculata</i> Benth.	Yvyra ovi	2.473
17	<i>Parapiitadenia rigida</i> (Benth.) Brenan	Kurupa'yra	3.644
18	<i>Inga vera</i> Willd	Inga guazu	2.122
19	<i>Rollinia emarginata</i>	Aratiku	0.710
20	<i>Sygarus romanzoffiana</i> (Cham.) Glas	Pindo	2.558
21	<i>Inga marginata</i> Willd	Inga'i	1.357
22	<i>Trichilia pallida</i>	Cedrillo	0.197
23	<i>Rapanea lorentziana</i> Mez	Canelon guazu	0.421
24	<i>Jacaratia spinosa</i> (Aubl.) A. DC.	Jacaratia	3.158
25	<i>Campomanesia xanthocarpa</i> Berg	Guavyra pyta	2.905
26	<i>Fagara hyemalis</i>	Kuratura	2.157
27	<i>Cecropia pachystachya</i> Trecul	Amba'y	0.482
28	<i>Maclura tinctoria</i> Subsp.tinctoria	Tatajyva	1.926
29	<i>Bastardiopsis densiflora</i> (Hook & Am) Hassler	Loro blanco	1.082
30	<i>Holocalyx balansae</i> Micheli	Alecrin	22.024
31	<i>Patagonula americana</i> L.	Guajayvi	7.196
32	<i>Cariniana estrellensis</i> (Raddi) Kuntze	Ka'i kaygua	0.134
33	<i>Alchornea triplinervia</i>	Chipa rupa	7.177

34	<i>Dendropanax cuneatus</i> (DC.) Decne	Ombu ra	6,553
35	<i>Hexachlamys edulis</i> (Berg) Kausel & Legrand	Yva ha'y guazu	0.209
36	<i>Cordia trichotoma</i> (Vell.) Arráb. Ex Steud	Peterevy	0.302
37	<i>Myrocarpus frondosus</i> Allemao	Incienso	0.0584
38	<i>Trichilia pallens</i> C de Candolle	Katigua moroti	1.299
39	<i>Nectandra lanceolata</i> Nees & Mart. ex Nees	Laurel sayju	5.251
40	<i>Allophylus edulis</i> (St.-Hill.) Radlk	Koku	0.810
41	<i>Lonchocarpus leucanthus</i> Burkart	Rabo ita	3.634
42	<i>Pilocarpus pennatifolius</i>	Yvyra tai	0.220
43	<i>Diatenopteryx sorbifolia</i> Radlk.	Yvyra piu	7.852
44	<i>Strychnos brasiliensis</i> (Sprengel) Mart	Ñuaty Kuruzu	3.051
45	Not determined	Ka'i ranga	0.454
46	<i>Cupania vernalis</i>	Jaguarata'y pyta	2.371
47	<i>Chorisia speciosa</i> St.-Hill	Samu'u pyta	0.671
48	Not determined	Jagua pety guazu	0.219
49	Not determined	Ka'a ka'aguy	0.039
50	<i>Peltophorum dubium</i> (Spreng.) Taub	Yvyra pyta	14.038
51	<i>Ocotea diospirifolia</i> (Meisn.) Mez	Laurel moroti	0.771
52	<i>Rupretchia laxiflora</i>	Marmelero	1.521
53	<i>Cedrela fissilis</i> Vell	Cedro	3.703
54	<i>Calliandra tweediei</i>	Niño azote	0.120
55	<i>Ficus enornis</i> (Mart. ex Miq.) Miq	Guapo'y	0.301
56	<i>Enterolobium contortisiliquum</i> (Vell.) Morong	Timbo	1.184
57	<i>Pentapanax warmingianus</i> (Marchal) Harms	Paraparaí guazu	2.067
58	<i>Annona amambayensis</i> Hassler	Aratiku guazu	0.680
59	<i>Faramea porophylla</i> (Vell.) Müll. Arg.	Mborevi rembiu	0.060
60	<i>Vitex megapotamica</i> (Sprengel) Mold	Taruma	3.327
61	<i>Apuleia leiocarpa</i> (Vogel) J.F. Macbr	Grapia	0.325
62	<i>Banara arguta</i> Briq.	Mbavy	0.196
63	<i>Pterogyne nitens</i> Tul.	Yvyra ro	0.420
64	<i>Syzygium sayeri</i>	Yva mbopy	0.179
65	<i>Enterolobium contortisiliquum</i> (Vell.) Morong	Timbo	1.713
66	<i>Rheedia brasiliensis</i>	Pakuri	0.151
TOTAL			235.306

Quantity of carbon accumulated for the temporal parcel of monitoring

The parcel showed the estimative aerial biomass carbon storage of 117.653 tC/he and of root biomass of 28.237 tC/he. This gives us a total quantity of 145.890 tC/he. The storage of each species is showed in table 4.

Table 4. Quantity of sequestered carbon for each species

N°	Species	Common name	Total Carbon (tC/ha)	
			Aerial Biomass	Root biomass
1	<i>Myrciaria rivularis</i> Cambess.	Yvaporoty	4.286	1.029
2	<i>Ocotea puberula</i> (Rich) Ness	Laurel guaika	0.065	0.016
3	<i>Luehea divaricata</i> Mart	Ka'a oveti	7.842	1.882
4	<i>Matayba elaeagnoides</i> Radlk	Jaguarata'y	3.385	0.812
5	<i>Citrus aurantium</i> L.	Naranja ha'y	0.206	0.049
6	<i>Cabralea canjerana</i> (Vell.) Mart	Cancharana	2.656	0.637
7	<i>Machaerium stipitatum</i> (DC.) Vog.	Ysapy'y moroti	0.893	0.214
8	<i>Chrysophyllum gonocarpum</i> (Mart & Eichler) Engl	Agua'y	8.939	2.145
9	<i>Sebastiania brasiliensis</i> Sprengel	Yvyra Kamvy	0.188	0.045
10	<i>Nectandra angustifolia</i> (Schrader)	Laurel hu	17.590	4.222
11	<i>Balfourodendron riedelianum</i> (Engl.) Engl.	Guatambu	6,980	1.675
12	<i>Tabernaemontana australis</i> Muell. Arg.	Sapirangy	0.057	0.014
13	<i>Trichilia catigua</i> A Juss.	Katigua pyta	0.564	0.135
14	<i>Casearia sylvestris</i> SW	Aratiku mbavy	0.218	0.052
15	<i>Sebastiania</i> sp.	Lancrillo	0.139	0.033
16	<i>Helietta apiculata</i> Benth.	Yvyra ovi	1.236	0.297
17	<i>Parapiütadenia rigida</i> (Benth.) Brenan	Kurupa'yra	1.822	0.437
18	<i>Inga vera</i> Willd	Inga guazu	1.061	0.255
19	<i>Rollinia emarginata</i>	Aratiku	0.355	0.085
20	<i>Sygarus romanzoffiana</i> (Cham.) Glas	Pindo	1.279	0.307
21	<i>Inga marginata</i> Willd	Inga'i	0.678	0.163
22	<i>Trichilia pallida</i>	Cedrillo	0.099	0.024
23	<i>Rapanea lorentziana</i> Mez	Canelon guazu	0.210	0.051
24	<i>Jacaratia spinosa</i> (Aubl.) A. DC.	Jacaratia	1.579	0.379
25	<i>Campomanesia xanthocarpa</i> Berg	Guavyra pyta	1.452	0.349
26	<i>Fagara hyemalis</i>	Kuratura	1.078	0.259
27	<i>Cecropia pachystachya</i> Trecul	Amba'y	0.241	0.058
28	<i>Maclura tinctoria</i> Subsp. tinctoria	Tatajyva	0.963	0.231
29	<i>Bastardiopsis densiflora</i> (Hook & Am) Hassler	Loro blanco	0.541	0.130
30	<i>Holocalyx balansae</i> Micheli	Alecrin	11.012	2.643
31	<i>Patagonula americana</i> L.	Guajayvi	3.598	0.863
32	<i>Cariniana estrellensis</i> (Raddi) Kuntze	Ka'i kaygua	0.067	0.016
33	<i>Alchornea triplinervia</i>	Chipa rupa	3.589	0.861
34	<i>Dendropanax cuneatus</i> (DC.) Decne	Ombu ra	3.277	0.786
35	<i>Hexachlamys edulis</i> (Berg) Kausel & Legrand	Yva ha'y guazu	0.104	0.025
36	<i>Cordia trichotoma</i> (Vell.) Arráb. Ex Steud	Peterevy	0.151	0.036
37	<i>Myrocarpus frondosus</i> Allemao	Incienso	0.029	0.007
38	<i>Trichilia pallens</i> C de Candolle	Katigua moroti	0.650	0.156

39	<i>Nectandra lanceolata</i> Nees & Mart. ex Nees	Laurel sayju	2.626	0.630
40	<i>Allophylus edulis</i> (St.-Hill.) Radlk	Koku	0.405	0.097
41	<i>Lonchocarpus leucanthus</i> Burkart	Rabo ita	1.817	0.436
42	<i>Pilocarpus pennatifolius</i>	Yvyra tai	0.110	0.026
43	<i>Diatenopteryx sorbifolia</i> Radlk.	Yvyra piu	3.926	0.942
44	<i>Strychnos brasiliensis</i> (Sprengel) Mart	Ñuaty Kuruzu	1.525	0.366
45	Not determined	Ka'i ranga	0.227	0.055
46	<i>Cupania vernalis</i>	Jaguarata'y pyta	1.185	0.284
47	<i>Chorisia speciosa</i> St.-Hill	Samu'u pyta	0.335	0.081
48	Not determined	Jagua pety guazu	0.110	0.026
49	Not determined	Ka'a ka'aguy	0.019	0.005
50	<i>Peltophorum dubium</i> (Spreng.) Taub	Yvyra pyta	7.019	1.685
51	<i>Ocotea diospirifolia</i> (Meisn.) Mez	Laurel moroti	0.386	0.093
52	<i>Rupretchia laxiflora</i>	Marmelero	0.761	0.183
53	<i>Cedrela fissilis</i> Vell	Cedro	1.852	0.444
54	<i>Calliandra tweediei</i>	Niño azote	0.060	0.014
55	<i>Ficus enornis</i> (Mart. ex Miq.) Miq	Guapo'y	0.151	0.036
56	<i>Enterolobium contortisiliquum</i> (Vell.) Moroni	Timbo	0.592	0.142
57	<i>Pentapanax warmingianus</i> (Marchal) Harás	Paraparaí guazu	1.034	0.248
58	<i>Annona amambayensis</i> Hassler	Aratiku guazu	0.340	0.082
59	<i>Faramea porophylla</i> (Vell.) Müll. Arg.	Mborevi rembiu	0.030	0.007
60	<i>Vitex megapotamica</i> (Sprengel) Mold	Taruma	1.663	0.399
61	<i>Apuleia leiocarpa</i> (Vogel) J.F. Macbr	Grapia	0.162	Not determined
62	<i>Banara arguta</i> Briq.	Mbavy	0.098	0.023
63	<i>Pterogyne nitens</i> Tul.	Yvyra ro	0.210	0.050
64	<i>Syzygium sayeri</i>	Yva mbopy	0.090	0.022
65	<i>Enterolobium contortisiliquum</i> (Vell.) Moroni	Timbo	0.857	0.206
66	<i>Rheedia brasiliensis</i>	Pakuri	0.075	0.018
SUBTOTAL			117.653	28.237
TOTAL				145.890

4. CONCLUSION

The temporal parcel of monitoring contains 395 individuals with more ≥ 10 cm of BHD. This corresponds to 66 forestry species and a total volume in the whole of 142.709 m³/he.

This calculation shows an aerial biomass of 235.306 Tn/he. The major input (35.180 Tn/ha) to the whole is given by the species **Nectandra angustifolia (Schrader)** (Laurel hu). The quantity of total aerial biomass in the conjunction is of 235.306 Tn/he.

This parcel showed an estimative quantity of carbon storage in the aerial biomass of 117.653 tC/he and the root biomass of 28.237 tC/he. This gives us a total quantity of 145.890 tC/he. Transforming this quantity to CO₂e (multiplying by 3,666 that is the conversion factor) it is a total of 534,853 t CO₂e per hectare.

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