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Floristic Composition and Structure of a Deciduous Dry Forest from Southern Ecuador: Diversity and Aboveground Carbon Accumulation

Vinicio Carrión-Paladines[1*] and Roberto García-Ruiz[2]

[1]Department of Food and Agricultural Sciences, Universidad Técnica Particular de Loja, San Cayetano Alto s/n C.P. 11 01 608, Loja, Ecuador
[2]Department of Animal Biology, Vegetable Biology and Ecology, Universidad de Jaén (Spain)

Corresponding author

KEYWORDS

Composition, Diversity, Abundance, Dominance, Categories, Carbon reserve.

ABSTRACT

Semi deciduous dry forests in southern Ecuador are valued internationally for their conservation significance, and important locally as a source of timber for agroforestry. Data with which to evaluate the compatibility of these interests is currently lacking. In permanent sample plots (PSP) established according to a simple random design, 12 species were found, representing 12 genera and 11 botanical families. The ecological analysis was performed by determining the basal area, height, density, frequency, dominance, IVI and FIV. The most diverse families are Burseraceae, Bignoniaceae and Caesalpiniaceae. However, the species with the highest IVI are: *Bursera graveolens*, *Tabebuia chrysantha* and *Caesalpinia glabrata*. The basal area of the species studied was 11.4 m^2 ha^{-1} with a volume of 66.35 m^3 ha^{-1}. The size class distribution for most tree/species highlighted the absence of the large/order individuals, which reflect the disturbance of the forest. Aboveground biomass was estimated and the carbon found was 68.06 Mg ha^{-1}, with an amount of 33.04 Mg ha^{-1} of carbon stored, results that are within normal ranges for the seasonally dry tropical forests. This study provides important baseline information on the species composition of the forest as well as the conservation status of species.

Introduction

Dry Forests (DF) are the most utilized, perturbed, fragmented and less conserved of the planet among the forests (Murphy & Lugo, 1986; Stoner & Sánchez -Azofeifa, 2009; Quesada *et al*, 2009). Despite the fact that DF represent 42% of global vegetable formations (Hartshorn, 1983; Gentry, 1990), there is scant information about the natural regeneration of this valuable ecosystem (Vieira & Scariot, 2006; Bertoncini & Ribeiro, 2008; Esquivel *et al.*, 2008; Stoner & Sánchez -Azofeifa, 2009). DF are characterized by having regular events of dryness that define the temporal regimes and magnitude of the majority of their ecological processes (Murphy & Lugo, 1995; Maass & Burgos, 2011). Annual precipitation is lower than 1.600mm and, the dry season, with a precipitation lower than 100mm, lasts up to six months (Pennington *et al.*, 2000). Therefore, ecological processes in DF show a marked seasonal behavior. For example, the net primary productivity is less than that in the tropical rainforests because it only occurs during the rainy period (Aguirre *et al.*, 2006). These forests are also characterised for having a lower height and basal area than typical tropical humid forests (Linares-Palomino 2004a, 2004b; Aguirre *et al.*, 2006). Compared with all the other biomes, the DFs have experienced the greatest loss of habitat and conversion of the land due to the settlement and increase of human population, poverty, forest exploitation, and agricultural expansion (Novick *et al.*, 2003; Kolb & Diekmann, 2004; Stork, 2010). In addition, natural regeneration is seriously negatively affected as a result of the introduction of exotic species and the over pasturing of species such as goats (*Capra hircus*), cows (*Bos taurus* Linnaeus) and the pastures of wild animals such as *Melopsittacus undul*atus (Shaw), *Odocoileus virginianus* (Zimmermann), and *Sylvilagus floridanus* (J. A. Allen) that feed on young plants (Coblentz, 1978; Schofield, 1989; Campbell & Donlan, 2005; Peacok & Sherman, 2010; García *et al.*, 2012). Kharkwal *et al.* (2005) posit that this process accelerates the loss of species and therefore could lead, at the medium to long term, to the collapse of the eco-system.

Therefore the maintenance of DFs are likewise important for protecting the environment, as well as for the rural economy. In fact, many people have integrated them into their daily lives and use them to take advantage of their (natural) resources. Woody forest species, which are as economically important, such as *Tabebuia chrysantha* and *Loxopterigium huasango* and fuelwood can also benefit rural communities. Useful plants such as *Myroxylum peruiferum*, *Piscidia carthagenensis, Cordia lutea*, *Erythrina smithiana*, *Bursera graveolens* [Kunth Triana & Planchon] from which bark, latex, and resins can be extracted, are further examples of benefits to local farming communities and agricultural workers (Aguirre *et al.*, 2006; Espinosa *et al.*, 2012; Aguirre-Mendoza, *et al.*, 2013). However, in such forests, the rate of exploitation surpasses other possibilities of natural recovery (Aguirre *et al.*, 2006). Despite this anthropegenic pressure, many DFs have been declared areas of special protection and conservation, that is, compared with other ecosystems (Hoekstra *et al.*, 2005; Janzen, 1988; Miles *et al.*, 2006; Portillo-Quintero & Sánchez-Azofeifa, 2010).

In Latin America, DFs are frequently studied in the fields of ecology, floristic diversity, economics, and in the assessment of the impacts of deforestation (Murphy & Lugo. 1986; Mendes *et al.*, 2012; López-Barrera *et al.*, 2014). In Ecuador, however, they are characterized by their structure, composition, diversity, endemism, functions, and by the usage of forest species that comprise it (Cerón, 1993, 1996; Hernández & Josse, 1997; Madsen *et al.*, 2001, Aguirre *et al.*, 2006; Espinosa *et al.*, 2012). The DFs from the south-west of Ecuador are thus considered to be fragile, i.e. seeing that they contain many endemic species that are under threat with regards to their original composition (Aguirre *et al.*, 2006; Espinosa *et al.*, 2012). In these forests, ethno-botanical studies have been carried out on the usage of trees and plants of various medicinal and edible species (Van den Eynden *et al*., 1999; Béjar *et al*., 2001; 2003; Sánchez *et al*., 2006).

It has been observed that some researchers have implemented quantitative floristic inventories based on the establishment of Permanent Parcels (PSP), with the aim of characterizing the vegetation of DFs. In these sample areas, their structure, composition and diversity have all been documented (Parthasarathy, 2001; Sagar *et al*., 2003). Finally, there has been a growing interest in the documentation of the dynamics of the DFs in the long-term via the establishment and monitoring of PSP. These forest inventories constitute an invaluable research base for various aspects of tropical ecology, while at the same time providing crucial information about their conservation and management (Ayyappan & Parthasarathy, 1999).

The main objective of this research paper is to describe the structure of vegetation throughout the evaluation of its composition, diversity, and content of biomass and forest carbon in a moderately perturbed DF of the south-west of Loja, Ecuador. In addition, it aims to provide information that will help to understand the current DF situation, the ecological implications and the conservation efforts that are required for eco-systems.

Materials and Methods

Site of the Study Area

The research was carried out in the province of Loja, in the region of Zapotillo, which is located in the south-west of Ecuador (4° 16´ 44´´ south and 80° 17´ 44´´ west, and between 4° 21´ 27´´ south and 80° 19´ 53´´ west; Figure 1). The altitude varies from 230 to 328 m a.s.l. The annual average temperature is 25°C, with an average annual precipitation rate of between 400 to 600mm. (Sánchez *et al*., 2006). The experimental site corresponds to a tropical dry forest (DF –T) (Holdridge, 1967; Cañadas, 1983), forming part of the Tumbesian region, which contains a great diversity of endemic species from different taxonomic groups that are constantly under the threat of extinction because of human activities (Best & Kessler, 1995; Leal-Pinedo & Linares-Palomino, 2005; Mittermeier *et al*., 2005; Sánchez *et al*., 2006; Aguirre *et al*., 2006; Linares-Palomino *et al*., 2010; 2011; Espinosa *et al*., 2012; López-Barrera *et al*., 2014).

Sampling Description

In the research area, 20 PSP were installed by means of simple random design (De Souza & Ferreira, 2004; Tarrasón *et al*., 2010). The dimension of each PSP corresponds to 400 m^2 (20 m x 20 m), covering a total sample area of 8000 m^2. Altitude and the UTM coordinates were recorded. The number of species and individuals were recorded in each PSP during the rainy season (March and April). Leaves, flowers and fruit samples were collected and trees were identified at species level.

Basal Area and Aboveground Biomass and Carbon Calculation

In this study, the diameter was measured at breast height (DBH) ≥ 5 cm (Aguirre & Delgado, 2005; Imaña *et al*., 2010), and the sizes and total measurement of the branch stub (m) were recorded using the Haga altimeter. The diametric classes were determined at the following intervals: (1) < 0.1 m; (2) 0.11 – 0.2 m; (3) 0.21 – 0.3 m; (4) 0.31 – 0.4 m; (5) 0.41 – 0.5 m and (6) > 0,5 m (LaFrankie *et al*., 2006). The average basal area by diametric size was obtained with the following equation: $AB=\pi/4$ *

DAP^2 (Pardé & Bouchon, 1994; Philip, 1994). The average volume (V) was calculated according to: $V=Ht * AB * f$ where Ht is total height, AB basal area and f form factor (Pardé & Bouchon, 1994; Philip, 1994; Orozco & Brumér, 2002). Values were transformed to hectare according to:

$AB\ (m^2\ ha^{-1}) = Na\ ha^{-1} * AB$, for basal area and

$V\ (m^3\ ha^{-1}) = Na\ ha^{-1} * V$, for tree volume

Where:

$Na\ ha^{-1}$ = Number of trees per hectare.

With this information, we calculated the quantity of biomass by diametric class and by ha^{-1}, utilizing the formula proposed by Brown, (1997) and Dávalos *et al*. (2008):

$B = VT * pi * FEB$

Where:
B = Biomass
VT = Volume ha^{-1}
pi = Specific weight of wood ($g\ cm^{-3}$)
FEB = Expansion Factor of Biomass

pi was assumed to be the weighted average per ecoregion such as that recommended by Brown & Lugo, (1992) and Brown, (1997). In this study, the wood densities were used according to the studies performed by Zanne *et al*. (2009), that is, for the eco-region of South America (tropical) and whose value is 0,641 $gr\ cm^{-3}$. The value used for the FEB corresponds to 1.6, according to Dixon, (1995) and Andrade & Ibrahim (2003).

The carbon content was calculated using the following formula (Brown, 1997; Dávalos *et al*. 2008).
$C = B * fc$

Where:
C = stored carbon by trees (TC ha^{-1})
B = biomass (weight) of trees
fc = fraction of Carbon in the biomass (a calculation of 0.5 IPCC, 1994; Figueroa *et al*., 2005; Díaz *et al*., 2007).

For this parameter, we carried out a regression analysis and a linear correlation with the average volume data by diametric class, and calculated biomass. We used Version 15.0 of the SPSS statistical software program (SPSS Inc, Chicago), and considered as an independent variable, the different classes of DBH. For the dependent variable, we considered the kg of tree biomass. The calculation of the biomass (ha^{-1}) and C (ha^{-1}) by diametric class was done by calculating the number of individuals per hectare. In this case, we only considered the quantity of carbon stored in the aerial part of the biomass. The total biomass of the trees was converted into carbon storage values (C ha^{-1}) in accordance with the studies carried out by Dávalos *et al*. (2008).

The Structural Analysis of the Forest

The structural analysis of the forest was carried out based on the ecological indices such as benchmarks for Relative Abundance (RA), Relative Dominance (RD), Importance Value Index (IVI), Family Importance Value (FIV), and Relative Diversity (RD) according to Curtis & Cottam (1962), Mori *et al*. (1983) and Cerón, (1993).

Results and Discussion

Floristic Composition

Trees of the dry forest PSP were comprised of 12 species belonging to11 families and 12 genera (Table 1). There are on average 299 individuals per ha^{-1}, most of which are concentrated in the diametric classes: 0.1 –

0.2 (161 individuals) and 0.21 – 0.3 m (64 individuals) (Figure 2). The highest density was recorded for *Tabebuia chrysantha* and *Caesalpinia glabrata*, with 116 ha^{-1} and 69 ha^{-1} (Figure 3) individuals, respectively.

Dasometric Parameters

Figure 4 shows the highest basal area for the diametric classes, 0.21 – 0.3 and 0.31 – 0.4 m. The individuals that are greater than 0.50 m in diameter correspond to *Bursera graveolens*, *C. glabrata* and *Eriotheca ruizii*. These reach a diameter of 0.54; 0.59 and 0.59, respectively, that is, with a basal area of 1,028 m^2 ha^{-1}. The highest volumes were found in classes 0.21 – 0.3 and 0.31 – 0.4 m, with 16 and 23.6 m^3 ha^{-1} (Figure 5). 59.5% of individuals are located in classes with a height of 5 – 10 m (Figure 6). Conversely, less than 15.7% of trees belong to classes greater than 10 m, implying that the forest is comprised of small trees that are less than 10 m in height. There is only one individual of *B. graveolens,* which reaches 16 m.

Biomass and Forest Carbon

The dispersion in the observed values of tree biomass is shown in figure 7. Upon adjusting the equation for determining the biomass function of the normal diameter, the coefficient of determination (r^2 = 0,93; P >0,05) was highly significant. The summary of the model indicates that the DBH (m), influences 93% of the weight (kg) of the species. In other words, there is an increase in the diameter and the age of the species and a greater quantity of biomass (kg).

The values of biomass and carbon that were obtained by diametric classes and hectare calculation are shown in figure 8. In DF, there is an approximate quantity of 68.06 Mg ha^{-1} of accumulated biomass, and an approximate quantity of 33.04 Mg ha^{-1} of carbon. The diametric class 0.31 – 0.4 m accumulates the greatest quantity of biomass (24193.9 kg aboveground biomass ha^{-1}), and carbon (12097.0 kg C ha^{-1}), followed by the diametric class 0.21 – 0.3 m (16409.6 kg aboveground biomass ha^{-1} and 80204.8 kg C ha^{-1}).

Ecological Parameters

The most abundant species is *T. chrysantha* (38.9%) followed by *C. glabrata* (23%), *B. graveolens* (19.2%) and *P. carthagenensis* (10.5%). Abundance of the remaining species was lower than 8 individuals per hectare and less than 1.3% of relative abundance. Trees in PSPs were dominated by *B. graveolens* and *C. glabrata*, with 41.7% and 21.7% respectively, followed by the species and values of *T. chrysantha* y *Piscidia carthagenensis* - with 9.9% and 9.7%, respectively (Table 2). The species with greater IVI were *B. graveolens*, *T. chrysantha* and *C. glabrata* - with 60.9, 48.8, and 44.7, respectively, whereas *P. carthagenensis* showed an intermediate value (20.2). *E. ruizii* showed a value of 13.0 IVI. IVI values for the 7 remaining species was lower than 4.2.

On the other hand, the values of the Family Importance Value (FIV) are shown in Table 2. The highest values are for the *Burseraceae* family (69.3); *Bignoniaceae* (57.1) and *Caesalpinaceae* (53.0). The other families have values that are less than 28.5 FIV.

There are 11 families with 12 species (Table 1). These values were lower than those typically reported in other DF located on the Pacific coast in the north-west of South America. Indeed, in the DF of the Colombian forests of Tierra Bomba, Galerazamba and Tasajero it Has Been Recorded Between 26 and 56 families, 55 to

67 families and 30 families with 60 species respectively (Gentry, 1995; Mendoza, 1999; Carrillo-Fajardo *et al*., 2007). In DF of the north of Peru, García-Villacorta (2009) found 75 species belonging to 25 families in Tarapoto. In the north-eastern biosphere, Leal-Pinedo & Linares-Palomino (2005) reported 34 families with 85 species on average in a single hectare. Similarly, in some DFs of Ecuador a greater quantity of families was reported. In the Nature Reserve "La Ceiba", which is very close to our study zone, 37 families were found with 49 species. What is more, for the DF in the province of Loja, it is estimated that there are on average 29 families with 58 species (Aguirre *et al*., 2013; Aguirre *et al*., 2014). With regard to tree density of the DF that were examined, there are 299 individuals (per ha^{-1}). Similarly to species quantification, these values are lower than others that have been registered for dry zones of Ecuador. For example, for the deciduous DF forest *El Pechiche*, 538 individuals ha^{-1} were reported (Josse, 1997). Similarly, Madsen (2001) reported 422 individuals (per ha^{-1}) for the vegetation on *Isla Puná*. For the DF protected areas in the province of Loja, Klitgaard *et al*. (1999) found 670 individuals per ha^{-1} in the DF in Puyango (Aguirre *et al*., 2014), as well as 1,057 individuals per ha^{-1} in the Reserve called "La Ceiba". The reason there are fewer few species in the DF in Loja compared with the protected areas is that they are constantly subjected to very severe anthropogenic pressure (Aguirre *et al*. 2014). This includes fire and over-pasturing, indeed, fire is used as a technique to establish new crops (Lewis, 1994; Anderson, 1999; Fulé *et al*., 2011), which is an activity that is carried out in the province, i.e. on the banks of the rivers, leading to a continuous landscape fragmentation. The main consequences of the fragmentation are loss of habitat, change in the configuration of habitat, increases in the extinction of species, loss of bio-diversity, and increase in the vulnerability of local human populations (Mooney & Hobbs, 2000; Pimm & Raven, 2000; Jules & Shahani, 2003; Steffen *et al*., 2003). Notwithstanding, over-pasturing and the trampling on the undergrowth by she-goats (*Capra hircus* L.), goat cattle (*Bos taurus*) and the harvesting of non-timber forest products (NTFP), despite not being directly related to the transformation of forest cover, reduces the diversity of species and limits the processes of regeneration (Stern *et al*., 2002; Ticktin. 2004; Carrión *et al*., 2007; Chynoweth *et al*., 2013).

Table.1 Forest Species that make up the Tropical Dry Forest of South Western Ecuador

Family	Scientific name
ANACARDIACEAE	*Loxopterygium huasango*
BIGNOCIACEAE	*Tabebuia chrysantha*
BIXACEAE	*Cochlospermum vitifolium*
BOMBACACEAE	*Eriotheca ruizii*
BURCERACEAE	*Bursera graveolens*
CACTACEAE	*Cereus diffusus*
CAESALPINACEAE	*Caesalpinia glabrata*
FABACEAE	*Geoffroea spinosa*
FABACEAE	*Piscidia carthagenensis*
POLYGONACEAE	*Coccoloba ruiziana*
RHAMNACEAE	*Ziziphus thyrsiflora*
RUBIACEAE	*Simira ecuadorensis*

Table.2 Ecological Parameters of Vegetation

Family	Scientific name	Tree density (ha^{-1})	Relative abundance (%)	Relative dominance (%)	IVI	FIV
ANACARDIACEAE	*Loxopterygium huasango*	4	1,3	2,9	4,2	12,5
BIGNOCIACEAE	*Tabebuia chrysantha*	116	38,9	9,9	48,8	57,1
BIXACEAE	*Cochlospermum vitifolium*	4	1,3	2,9	4,2	12,5
BOMBACACEAE	*Eriotheca ruizii*	8	2,5	10,1	13,0	20,9
BURCERACEAE	*Bursera graveolens*	58	19,2	41,7	60,9	69,3
CACTACEAE	*Cereus diffusus*	1	0,4	0,1	0,5	8,8
CAESALPINACEAE	*Caesalpinia glabrata*	69	23,0	21,7	44,7	53,0
FABACEAE	*Geoffroea spinosa*	1	0,4	0,7	1,1	17,8
FABACEAE	*Piscidia carthagenensis*	31	10,5	9,7	20,2	17,8
POLYGONACEAE	*Coccoloba ruiziana*	5	1,7	0,4	2,1	28,5
RHAMNACEAE	*Ziziphus thyrsiflora*	1	0,4	0,3	0,7	10,4
RUBIACEAE	*Simira ecuadorensis*	1	0,4	0,1	0,5	9,1

Figure.1 Geographic Location of the Study Area

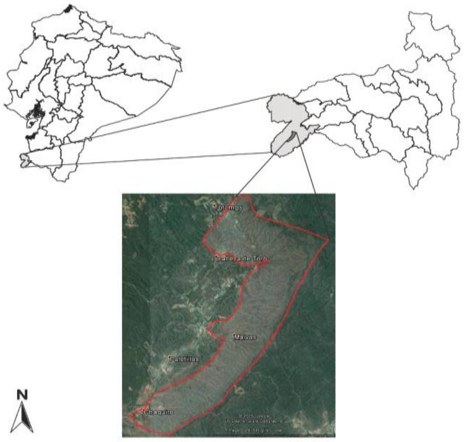


Figure.2 Number of Individuals Per Hectare

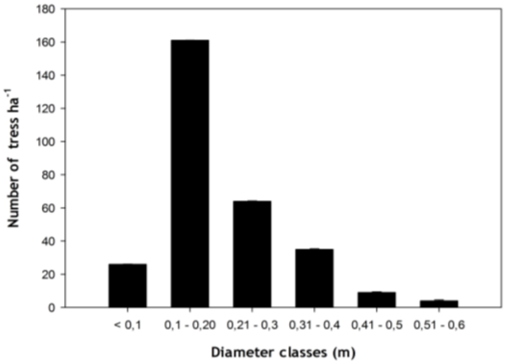


Figure.3 Number of Individuals Per Hectare and Per Species

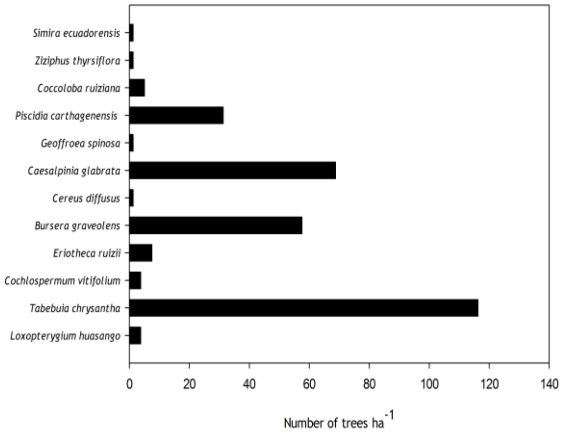


Figure.4 Density of Trees and Basal Area of Tropical Dry Forest

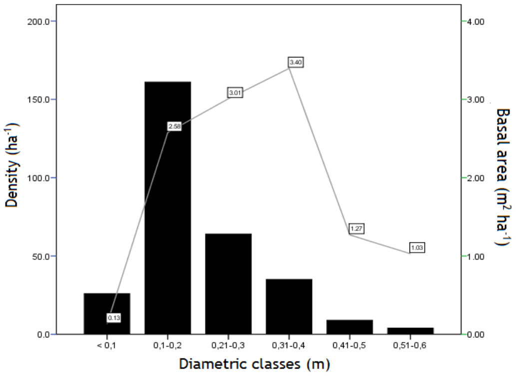


Figure.5 Density of Trees and Timber Volume in the Dry Tropical Forest

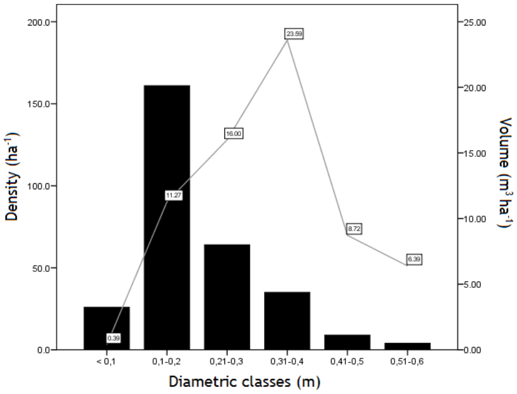


Figure.6 Distribution of Trees by Height Classes

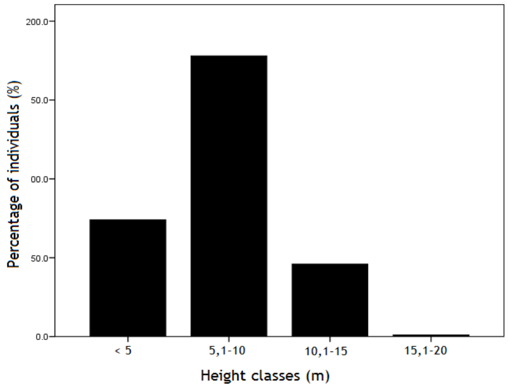


Figure.7 Dispersion of Observed Values and Exponential Regression Line Data Generated with Biomass Content

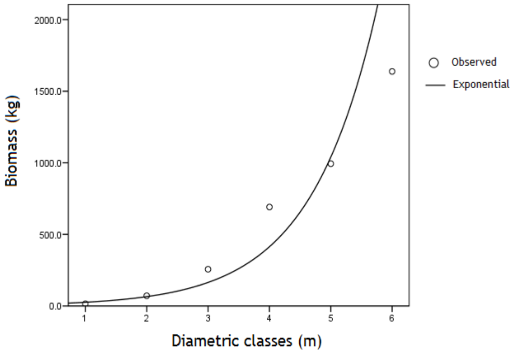
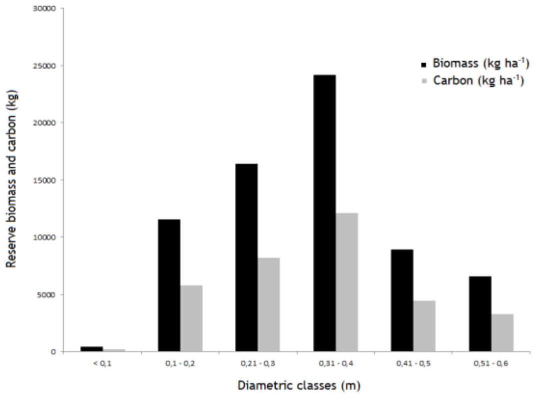


Figure.8 Biomass and Carbon Content in the Dry Tropical Forest, According to Diameter Classes



Despite the fact that the DFs tree abundance was relatively low compared to other DFs, basal area (11.4 m^2 ha^{-1}) and volume (66.4 m^3 ha^{-1}) were higher than that of others DF. For instance, a basal area and volume of about 1 m^2 ha^{-1} and 13 m^3 ha^{-1} has been reported in a DF of Ghana (Appiah, 2012). However, values were lower than that reported for others, for example in India´s Bhadra Wildlife Sanctuary. In this DF basal area was calculated to be 18.09 m^2 ha^{-1} (Krishnamurthy *et al*., 2010). In some parts of the Americas, DF with much greater basal area have been found. For instance, Gillespie *et al*. (2000) reported values of 22.03 m^2 ha^{-1} for some DF of Central America, and White & Hood (2004) reported 20.7 m^2 ha^{-1} in the Peninsula of Yucatán. Castro *et al*. (2005) reported in Nicaragua's Chacocente Wildlife reserve a, basal area (15.62 m^2 ha^{-1}) slightly higher than that found in this study. In the DF in Loja, Aguirre *et al*. (2014) found in protected areas such as the Reserve "La Ceiba", basal area and volume (26.73 m^2 ha^{-1} and 169.41 m^3 ha^{-1}) between two and three times higher than that reported in this study. For this reason, it is likely that values of this study correspond to that of a perturbed DF. Indeed, tree distribution in our DF was considered to be very "sparse" (Dry forest project, 1998). On the other hand, according to Aguirre *et al*. (2013), the diametric structures of the DF in the province of Loja are characterized by the concentration of individuals in the first classes; these results coincide with that of our study. Higher tree density corresponded to that of classes 0.1 – 0.2 and 0.21 – 0.3 m. This proves that most trees were thin, likely as a consequence of selective felling practices without appropriate planning. With regard to the height of the trees, our results are similar to others registered in DF from the province. Thus, Klitgaard *et al*. (1999) in their floristic and structural studies in the El Tundo and Puyango forests, found that the canopy reaches heights between ranges 5 – 10, or above.

In the DF, accumulated aboveground biomass accounted for about 68,06 Mg ha^{-1} and 33.04 Mg C ha^{-1}. These figures were found to be within the range reported by Becknell *et al*. (2012), who found that in the seasonally dry tropical forests, the quantity of biomass varies from 39 to 334 Mg ha^{-1} (or 19.5 to 167.0 Mg C ha^{-1}). However, the actual figure is lower in relation to other DF of America. Vargas *et al*. (2008) found, in the forest reserve El Eden in Mexico, values which doubled that of our study (143.9 Mg ha^{-1} or 71.9 Mg C ha^{-1}). The differences in the amount of aboveground biomass and carbon stock among forests is highly related to the annual precipitation in the DF (Becknell *et al*., 2012). These variations reflect the age, diameter, and height of the forest components, as well as the density of the population of each layer (Alegre *et al*., 2000; Martel & Cairampoma, 2012).

Tabebuia chrysantha (119 ind. ha^{-1} with AB = 1.6 m^2 ha^{-1}) and *Caesalpinia glabrata* (70 ind. ha^{-1} with AB = 2.4 m^2 ha^{-1}) are ecologically more important for their higher density levels. However, those species such as *Bursera graveolens*, despite having less density (i.e. 58 ind. ha^{-1}), are more predominant because of their greater basal area (4, 4 m^2 ha^{-1}). Compared with the DF from the North of Peru and the province of Loja, some researchers have reported *Ceiba trichastandra*, *Simira ecuadorensis*, *Tabebuia chrysantha*, *Eriotheca ruizii* and *Terminalia valverdeae* as the most important species (Klitgaard *et al*., 1999; Linares & Ponce, 2005; Linares *et al*., 2010; Aguirre *et al*., 2013). However, only the species *Tabebuia chrysantha* was present in our study. Moreover, for protected forests such as the reserve "La Ceiba", the species with greater IVI correspond to *Simira ecuadorensis* (17.49%), *Tabebuia chrysantha* (14,21%), *Ceiba trichistandra* (11,54%) and *Cordia macrantha* (10,52%). This could be due to the environmental and physiographic conditions, and the levels of anthropogenic alteration that the DF are subjected to, which not only influence certain species, but also fluctuate between abundant and dominant types (Aguirre *et al*., 2014).

Conclusion

The floristic wealth of DF is characterized by 12 species that exist within a range of 12 genera and 11 botanical families. The most diverse families in this study are the following: *Burseraceae*, *Bignoniaceae* and *Caesalpiniaceae*. However, the species with a greater IVI are: *B. graveolens*, *T. chrysantha* and *C. glabrata*. The basal area of the studied species was 11.4 m^2 ha^{-1}, whereas the volume was 66.35 m^3 ha^{-1}. The species that provided the greatest contribution to the basal area production and tree volume were *B. graveolens*, *C. glabrata* and *Eriotheca ruizii*. Most of the trees examined in this study can be grouped into the first three diametric classes. These diametric classes are determined by an *inverted* "*J*" *trend*, indicating that the forest is perturbed. The mean quantity of aboveground biomass was about 68.06 Mg ha^{-1} and a pre-established quantity of 33.04 Mg ha^{-1} of stored carbon. This quantity is found within normal ranges for seasonally dry tropical forests.

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