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BIOPHYSICAL INDICATORS INFLUENCE FLORISTIC DIVERSITY IN A SEASONALLY DRY TROPICAL FOREST FRAGMENT

INDICADORES BIOFÍSICOS INFLUENCIAM A DIVERSIDADE FLORÍSTICA EM UM FRAGMENTO DE FLORESTA TROPICAL SAZONALMENTE SECA

LOS INDICADORES BIOFÍSICOS INFLUYEN EN LA DIVERSIDAD FLORÍSTICA DE UN FRAGMENTO DE BOSQUE TROPICAL ESTACIONALMENTE SECO

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ABSTRACT

Understanding how soil influences floristic diversity in seasonally dry tropical forests is crucial for guiding conservation strategies. The semi-arid region exhibits significant environmental variability, where biophysical soil indicators play a decisive role in maintaining vegetation structure and composition. This study aimed to evaluate the relationship between soil indicators and floristic diversity at the Olho D'Água das Onças Ecological Reserve, located in a seasonally dry tropical forest environment. To this end, plant species were sampled across five distinct environments characterized by the following soil types: Red-Yellow Acrisol (Argissolo Vermelho-Amarelo), Haplic Cambisol (Cambissolo Háplico), Yellow Ferralsol (Latossolo Amarelo), Regolithic Neosol (Neossolo Regolítico), and Petric Plinthosol (Plintossolo Pétrico). Sampling comprised a total of 20 units—four per soil type—arranged in 16 m x 4 m transects subdivided into contiguous 4 m x 4 m subunits. Biophysical variables such as penetration resistance, structure, infiltration, texture, porosity, physical quality index, and organic matter content were analyzed. Principal Component Analysis (PCA) results highlighted the influence of these indices on soil ordination. Linear regression revealed a positive correlation between organic matter content and both floristic diversity and species distribution, a relationship that was also reflected in the different phytophysiognomies. It is concluded that the area's floristic composition directly corresponds to the organic matter content.

KEYWORDS: *Organic matter. Soil quality. Principal component analysis. Soil physical attributes. Phytophysiognomy.*

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RESUMO
Entender como o solo influencia a diversidade florística em florestas tropicais sazonalmente secas é fundamental para orientar estratégias de conservação. A região semiárida apresenta grande variabilidade ambiental, em que indicadores biofísicos do solo exercem papel determinante na manutenção da estrutura e composição da vegetação. Este estudo teve como objetivo avaliar a relação entre indicadores de solo e diversidade florística na reserva ecológica Olho D'Água das Onças, localizada em ambiente de floresta tropical sazonalmente seca. Para tal, espécies vegetais foram amostradas em cinco ambientes distintos, caracterizados pelos solos Argissolo Vermelho-Amarelo, Cambissolo Háplico, Latossolo Amarelo, Neossolo Regolítico e Plintossolo Pétrico. A amostragem contemplou 20 unidades no geral, sendo 4 unidades por tipo de solo, as unidades de cada tipo de solo foram alocadas em transectos de 16 m x 4 m, subdivididos em subunidades de 4 m x 4 m, contíguas entre si. Foram analisadas variáveis biofísicas como resistência à penetração, estrutura, infiltração, textura, porosidade, índice de qualidade física e matéria orgânica. Os resultados da Análise de Componentes Principais (ACP) evidenciaram a influência dos índices na ordenação dos solos. A regressão linear revelou que o teor de matéria orgânica apresentou correlação positiva com a diversidade florística e a distribuição das espécies, refletindo também nas diferentes fitofisionomias. Conclui-se que a composição florística da área acompanha diretamente o índice de matéria orgânica.

PALAVRAS-CHAVE: Matéria orgânica. Qualidade do solo. Análise de componentes principais. Atributos físicos do solo. Fitofisionomia.

RESUMEN
Comprender cómo el suelo influye en la diversidad florística en los bosques tropicales estacionalmente secos es fundamental para orientar las estrategias de conservación. La región semiárida presenta una gran variabilidad ambiental, en la que los indicadores biofísicos del suelo desempeñan un papel determinante en el mantenimiento de la estructura y composición de la vegetación. Este estudio tuvo como objetivo evaluar la relación entre los indicadores del suelo y la diversidad florística en la reserva ecológica Olho D'Água das Onças, ubicada en un entorno de bosque tropical estacionalmente seco. Para ello, se muestrearon especies vegetales en cinco ambientes distintos, caracterizados por los siguientes tipos de suelo: Argisol Rojo-Amarillo, Cambisol Háplico, Latosol Amarillo, Neosol Regolítico y Plintosol Pétrico. El muestreo incluyó 20 unidades en total, con 4 unidades por tipo de suelo. Las unidades de cada tipo de suelo se asignaron en transectos de 16 m x 4 m, subdivididos en subunidades de 4 m x 4 m, contiguas entre sí. Se analizaron variables biofísicas como la resistencia a la penetración, la estructura, la infiltración, la textura, la porosidad, el índice de calidad física y la materia orgánica. Los resultados del análisis de componentes principales (ACP) mostraron la influencia de los índices en la clasificación del suelo. La regresión lineal reveló que el contenido de materia orgánica presentó una correlación positiva con la diversidad florística y la distribución de especies, reflejando también las diferentes fitofisonomías. Se concluye que la composición florística del área sigue directamente el índice de materia orgánica.

PALABRAS CLAVE*: Materia orgánica. Calidad del suelo. Análisis de componentes principales. Atributos físicos del suelo. Fitofisonomía.*

1. INTRODUCTION

The seasonally dry tropical forest found in the Brazilian semi-arid region, namely Caatinga, is characterized by a complex mosaic of climatic and edaphic conditions that shape its

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vegetation into diverse domains (Tabarelli *et al.*, 2023). Renowned for its diverse floristic composition, the presence of xerophytic plants, and endemic species, it predominantly consists of shrubs and trees. During periods of water scarcity, most of its vegetation is deciduous (Moro *et al.*, 2016; Silva *et al.*, 2018; Borges *et al.*, 2020).

The variability of vegetation domains is attributed to the mosaic of environmental conditions shaping the region, which serve as predictive variables for landscape characteristics, particularly at the local scale (Rodal *et al.*, 2008; Araújo *et al.*, 2011; Baldeck *et al.*, 2013).

The soils of the Brazilian Semi-arid region exhibit a complex spatial distribution, forming a mosaic of shallow, rocky, sandy, and deep soils (Veloso *et al.*, 2002). This allows for the subdivision and differentiation into Caatinga sensu stricto (shrub-tree domain) and Caatinga on sedimentary basements (tree-forest domain), the predominant domain in the region under study (Araújo; Martins, 2014; Moro *et al.*, 2016). Due to the high complexity and broad soil classifications, the precise identification of soil types at smaller scales can sometimes be overlooked, which affects the formation of Caatinga domains. Even at smaller scales, heterogeneity in soil patches occurs, with varying quality indicators (Araújo *et al.*, 2012). These quality components depend on geomorphological compositions, climatic conditions, and land-use history (Hobley *et al.*, 2018).

Despite increasing concerns about soil use history, degradation, and its impact on environmental and human well-being aspects, universal criteria for evaluating soil quality changes remain limited (Arshad; Coen, 1992), particularly in areas more susceptible to degradation, such as the Caatinga. To operationalize this concept, it is essential to identify variables that can be used to assess soil conservation status. These variables, known as indicators, represent characteristics and convey information about changes or trends in soil conditions (Dumanski *et al.*, 1998; Araújo *et al.*, 2012).

According to Adriaanse (1993), indicators are analytical tools that simplify and quantify complex phenomena. For soil quality, these indicators can be physical, chemical, and biological properties or processes occurring within the soil (Ditzler *et al.*, 2002). Indicators should express the main soil constraints in accordance with the primary functions being evaluated, as suggested by Astier-Calderón *et al.* (2002).

It has been proposed by Doran *et al.* (1994) that, for physical, chemical, and biological soil properties, to be considered quality indicators, they should meet the following criteria: a) describe ecosystem processes; b) integrate soil physical, chemical, and biological properties; c) reflect sustainability attributes to be measured; d) be sensitive to variations in climate and management; e) be accessible to various users and applicable under field conditions; f) be

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reproducible; g) be easy to understand; h) be sensitive to soil changes resulting from anthropogenic degradation; i) whenever possible, be components of an existing soil database.

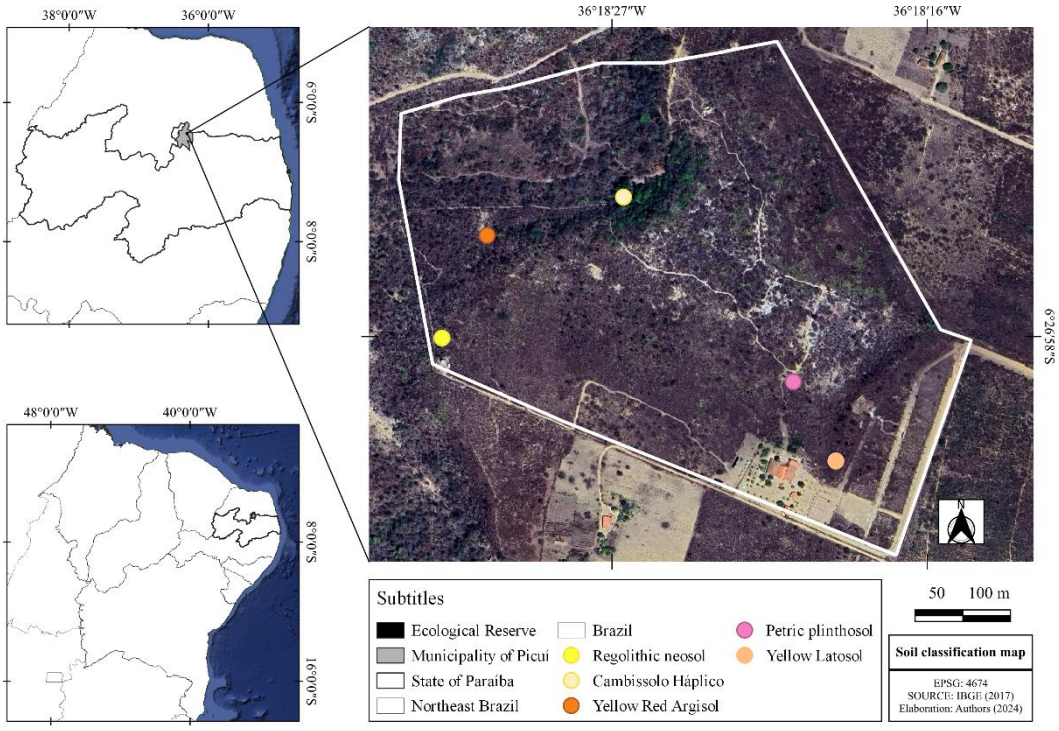
Each soil quality indicator reflects the relationship between edaphic characteristics and the dynamics of plant communities. Based on the hypothesis that different soil types and biophysical variables influence floristic diversity, since the classification and organization of soil types depend on their qualitative and quantitative constitution (EMBRAPA, 2013), this study aimed to understand the relationship between soil biophysical indicators and floristic diversity in a fragment of seasonally dry tropical forest at the Olho D'Água das Onças Reserve.

2. METHODOLOGY

2.1. Study area

The fragment of seasonally dry tropical forest at the Olho D'Água das Onças Reserve covers an area of approximately 20 hectares. It is in the municipality of Picuí, Paraíba, in the Seridó Oriental region of Paraíba, situated at coordinates 06º27'02''S and 36º18'21''W (Figure 1).

Figure 1. Forest fragment site, at Olho D'Água das Onças Reserve, Picuí-PB, Brazil.



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2.2. Sampling design

Plant species were sampled across five soil types: Argissolo Vermelho-Amarelo, Cambissolo Háplico, Latossolo Amarelo, Neossolo Regolítico, and Plintossolo Pétrico. Vegetation was sampled in each soil environment using 20 sampling units in total, with 4 units per soil type, structured in 16 m x 4 m transects, subdivided into contiguous subunits of 4 m x 4 m.

During the first sampling, all selected areas were visited to validate the mapped soil types. Data collection focused on both the biophysical variables of the soil and the vegetation.

2.3. Vegetation survey

We quantified species richness and abundance in each soil type according to the sampling design. A combination of visual surveys, metric measurements, and occurrence records was used within each unit and subunit. Floristic composition was documented across herbaceous, shrub, and tree strata.

Plant species were identified and quantified by a taxonomic expert, with updates to synonyms and taxonomic spelling verified through literature and the database of the Virtual Herbarium of the Rio de Janeiro Botanical Garden (Reflora, 2020). For family-level classification, the Angiosperm Phylogeny Group system (APG IV, 2016) was adopted.

Species diversity for each soil type was evaluated using the Shannon-Wiener Index (H'). This non-parametric method combines species' richness and similarity into a single measure based on proportional species abundance. As highlighted by Souza; Soares (2013), the Shannon-Wiener Index is calculated using the mathematical expression (Expression 1).

$$H' = -\sum_{i=1}^{S} \frac{n_i}{N} ln \frac{n_i}{N} \quad (1)$$

where: ni = number of individuals sampled for the i-th species; N = total number of individuals sampled, S = number of species sampled, ln = natural logarithm (e = 2.71828).

2.4. Biophysical soil indicators

Soil biophysical variables were measured in each unit and subunit across the different soil types, focusing on a local scale approach. The following predictor variables were assessed: Penetration Resistance (PR), Structure, Infiltration, Texture, Porosity, and Organic Matter (OM). Each variable was assigned scores: 1 (poor), 5 (medium), and 10 (good), based on their descriptions and field observations as per Altieri; Nicholls (2002).

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Field-measured variables were normalized using the non-linear scoring function method described by Masto *et al.* (2008), as recommended by Nabiollahi *et al.* (2018). The normalization process applied a sigmoidal function (Expression 2) for scoring.

$$NLS = \frac{a}{1+\left(\frac{X}{X0}\right)^{b}} \quad (2)$$

where: NLS = non-linear score of the variable, ranging from 0 to 1; a = maximum score, set to 1; X = observed value of the variable; X0 = mean value of the variable; b = slope, assumed as −2.5 for "more is better" functions and +2.5 for "less is better" functions (Zhang *et al.*, 2011).

Subsequently, the standardized variables were integrated and applied in Equation (3) to determine the Biophysical Soil Quality Index (QI), adapted from Andrews *et al.* (2002) (Expression 3).

$$QI = \frac{\sum_{1}^{n} N_i}{n} \quad (3)$$

where: QI = Quality index; N = total number of biophysical variables sampled for the soil types; n = number of variables analyzed.

2.5. Data analysis

First, to avoid issues of multicollinearity, we ran a Pearson's correlation analysis. Subsequently, to examine the biodiversity and biophysical soil quality parameters, we used a Principal Component Analysis (PCA). Then, to examine the relationship between diversity levels and soil organic matter, a linear regression was conducted.

It was subsequently assumed that species and families occurred across all levels of organic matter content. Therefore, a visual ordering approach was applied to determine the distribution and abundance of species and families in relation to organic matter levels. This was achieved by ordering the sample points and comparing the occurrence patterns across different organic matter levels.

3. RESULTS AND DISCUSSION

The Shannon-Wiener index (H') ranged from 1.43 to 1.74 nats.ind^{-1}, reflecting variation in plant species diversity under different edaphic conditions, as shown in Table 1. The Haplic Cambisol had the highest H' value of 1.74, indicating greater species heterogeneity in this soil type. In contrast, the Yellow Latosol exhibited the lowest H' of 1.43. The diversity index values for

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the other soil types were 1.57 for both Red-Yellow Argisol and Regolithic Neosol, and 1.49 for Petric Plinthosol. These data are crucial for understanding the relationship between plant species diversity and the characteristics of different soil types in the seasonally dry tropical forest.

Table 1. Diversity index (nats.ind^{-1}) for different soil types in a fragment of seasonally dry tropical forest at the Olho D'Água das Onças Reserve

Soil type	Shannon-Wiener – (H')
Red-Yellow Argisol	1.57
Haplic Cambisol	1.74
Yellow Latosol	1.43
Regolithic Neosol	1.57
Petric Plinthosol	1.49

Source: Authors (2026).

The floristic composition of our area is shown in Table 2, which is organized by botanical families, listing the species identified within each family. Additionally, the table includes a list of morphospecies found in the area.

Table 2. Floristic composition of our fragment of seasonally dry tropical forest

FAMILY / Species	FAMILY / Species
ANACARDIACEAE	**EUPHORBIACEAE**
Schinopsis brasiliensis Engl.	*Acalypha multicaulis* Müll.Arg.
APOCYNACEAE	*Croton blanchetianus* Baill.
Aspidosperma pyrifolium Mart.	*Croton urticifolius* Lam.
AVICENNIACEAE	*Jatropha mollissima* (Pohl) Baill.
Lippia sp 1	*Manihot* sp 1
BIGNONIACEAE	**FABACEAE**
Bignoniaceae sp 1	*Canavalia brasiliensis* Mart. ex Benth.
Bignoniaceae sp 2	*Cenostigma pyramidale* (Tul.) Gagnon & G.P.Lewis
BORAGINACEAE	Fabaceae sp 1

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FAMILY / Species	FAMILY / Species
Myriopus rubicundus (Salzm. ex DC.) Luebert	*Indigofera* sp 1
Varronia globosa Jacq.	*Mimosa paraibana* Barneby
Varronia leucomalloides (Taroda) J.S.Mill.	*Mimosa* sp 1
BROMELIACEAE	*Nissolia vincentina* (Ker Gawl.) T.M.Moura & Fort.-Perez
Bromeliaceae sp 1	**FAMILY_1**
CACTACEAE	Morphospecies 1
Cereus jamacaru DC.	**FAMILY_2**
Facheiroa cephaliomelana Buining & Brederooo	Morphospecies 2
Melocactus bahiensis (Britton & Rose) Luetzelb	**FAMILY_3**
Pilosocereus gounellei (F.A.C.Weber) Byles & Rowley	Morphospecies 3
CAESALPINIACEAE	**MALVACEAE**
Bauhinia cheilantha (Bong.) Steud.	Malvaceae sp 1
Chamaecrista sp 1	*Sida galheirensis* Ulbr.
CAPPARACEAE	**RHAMNACEAE**
Neocalyptrocalyx longifolius (Mart.) Cornejo & Iltis	*Sarcomphalus joazeiro* (Mart.) Hauenshild
COMMELINACEAE	**SAPINDACEAE**
Commelina erecta L.	Sapindaceae sp 1
CONVOLVULACEAE	**TALINACEAE**
Ipomoea brasiliensis (L.) Ooststr.	*Talinum paniculatum* (Jacq.) Gaertn.
Ipomoea sp 1	**VERBENACEAE**
	Lantana pohliana Schauer

Source: Authors (2026).

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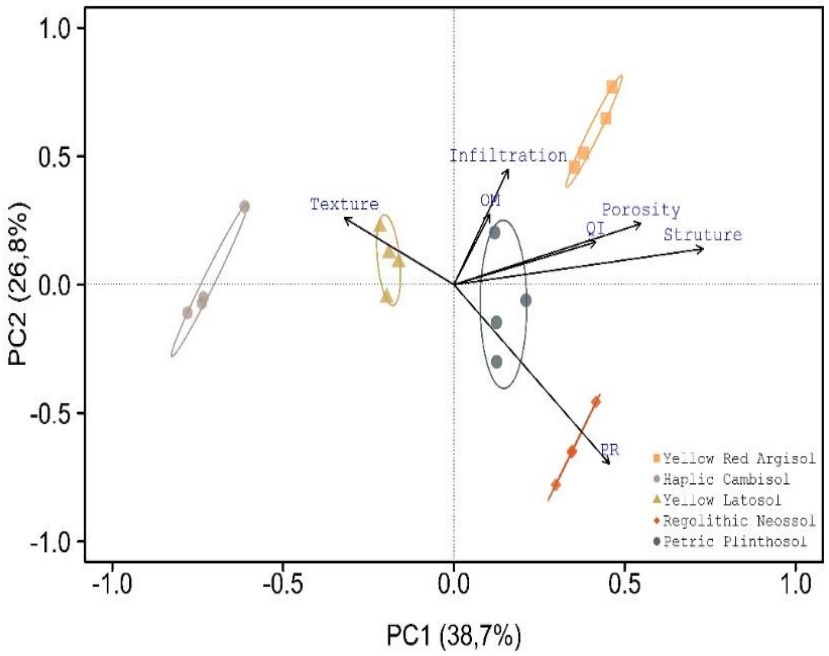
The area shows the presence of 21 distinct botanical families and 41 species, with 27 identified genera. Six species were identified only at the genus level, five at the family level, and three families and three species were recorded as morphospecies, indicating significant taxonomic diversity within the studied forest fragment.

The Principal Component Analysis (PCA) resulted in two principal components that explain most of the variance in the soil parameters (Figure 2). The PCA showed that the soil variables that most influenced data ordering were penetration resistance (PR) (PC1 - 38.70%) and texture (PC2 - 26.80%). Together, PC1 and PC2 account for 65.5% of the total variance, demonstrating that the first two principal components capture a substantial proportion of the dataset variability and adequately summarize its multivariate structure.

Figure 2. Principal Component Analysis (PCA) of soil parameters at the Olho D'Água das Onças Reserve



Source: Authors (2026).

The distribution of the variables (soil quality index and organic matter) is represented in the boxplots in Figures 3 and 4.

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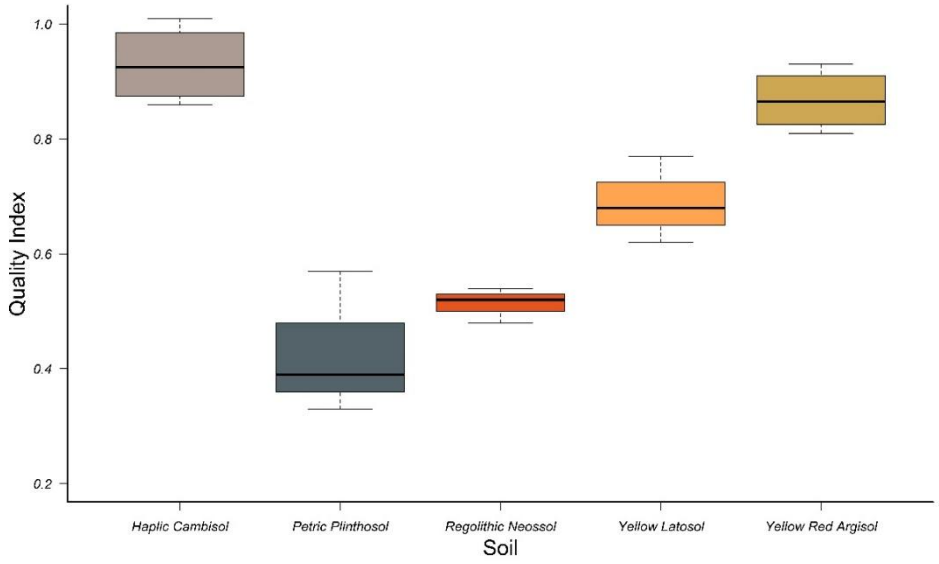
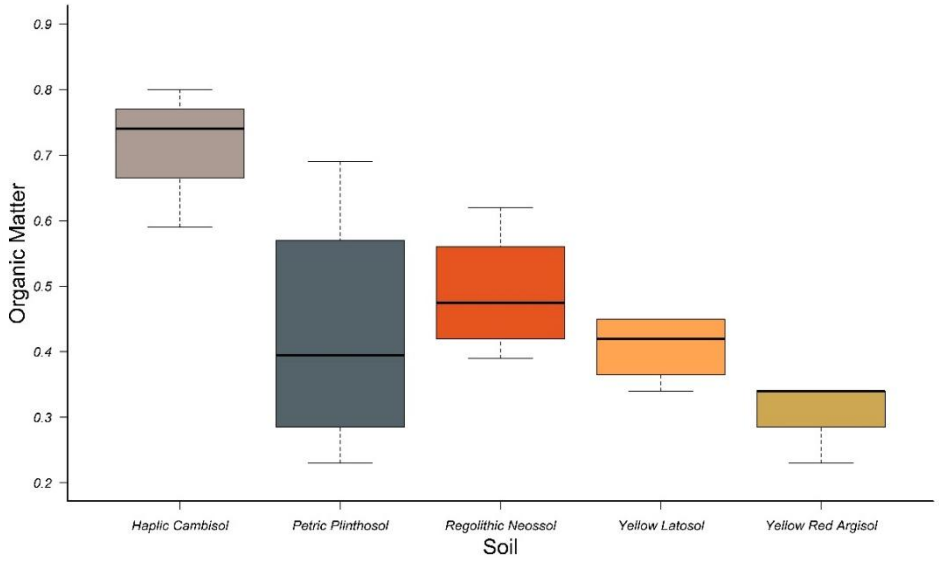
Figure 3. Distribution of the Soil Quality Index, according to soil types



Source: Authors (2026).

Figure 4. Distribution of Organic Matter levels, according to soil types



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The soil type Cambisol presented the highest quality index (Figure 3), with a value close to 1.0. The median is slightly below 1.0, with a narrow interquartile range, indicating little variation in soil quality within this group. The Petric Plinthosol showed the lowest quality index, with a median around 0.4. The interquartile range is also narrow, suggesting consistency in the low quality of this soil.

Regarding the level of organic matter in the soil (Figure 4), among the different soil types, it was found that Cambisol had the highest organic matter content, with the median close to 0.7. The interquartile range is relatively narrow, suggesting that the variation in organic matter is low within this soil type. The extreme values (outliers) are close to 0.8. In contrast, the Petric Plinthosol had moderate organic matter content, with a median around 0.5. The interquartile range is the widest among all the soils presented, indicating a large variability in organic matter, with outliers reaching up to 0.7.

Figure 3 clearly shows that Cambisol and the Red-Yellow Argisol have the highest soil quality indices, suggesting better conditions for plant growth and greater ecological sustainability. On the other hand, the Petric Plinthosol has the lowest quality index, which may indicate limitations in its capacity to support native vegetation.

Regarding organic matter content, this boxplot (Figure 4) provides a detailed understanding of edaphic conditions. Organic matter is a crucial indicator of soil quality and the capacity to support plant growth. These data are fundamental for guiding soil management and conservation strategies, aiming to maintain ecological health and the sustainable productivity of the different soil types in the region.

Figure 5 shows the relationship between the diversity index and soil organic matter content across the different soil types in the seasonally dry tropical forest fragment, based on linear regression analysis. The positive slope indicates an association between the variables, suggesting that higher organic matter levels are related to greater floristic diversity. The linear regression analysis revealed a statistically significant relationship between soil organic matter and diversity ($p < 0.05$). Residual diagnostics confirmed normality and homoscedasticity.

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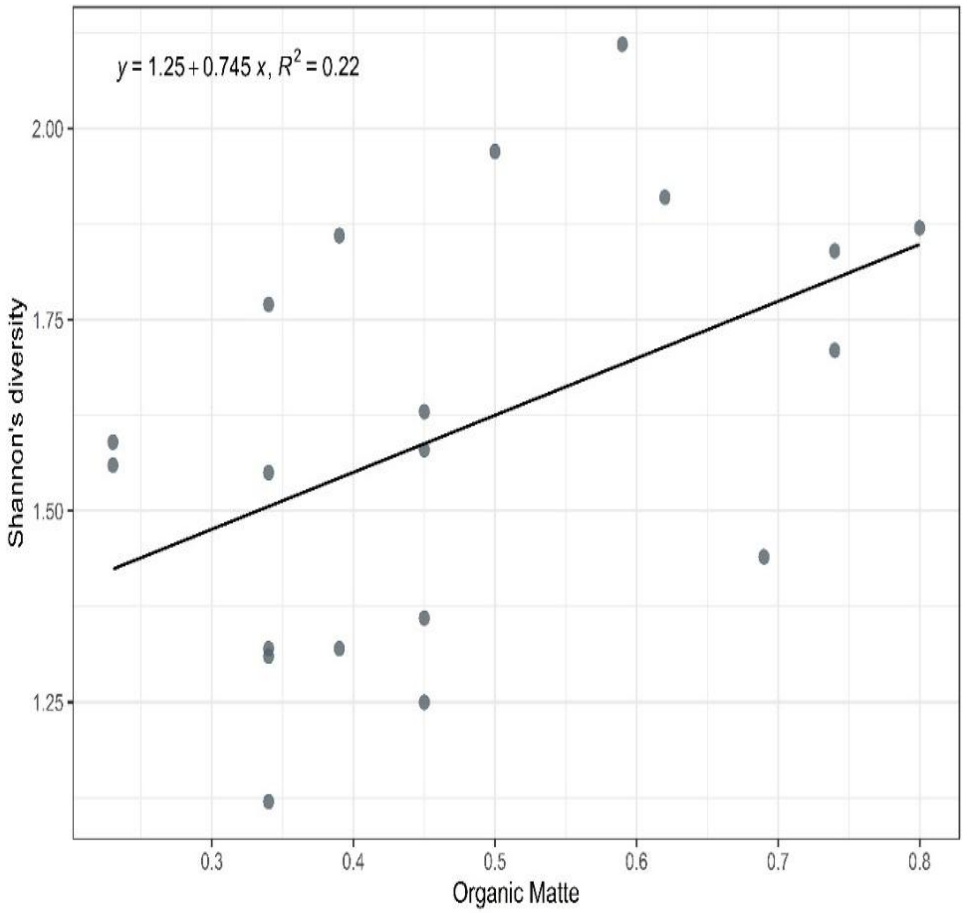
Figure 5. Linear regression between Shannon Diversity Index and Soil Organic Matter



Source: Authors (2026).

The abundance ordering of plant families and species based on soil organic matter is shown in Figure 6. The families are arranged according to relative abundance (vertical axis), with soil organic matter on a scale from 0 to 0.8, and each color represents the soil type where the family is found. Each species is represented by columns indicating its relative abundance and the level of organic soil matter it is found in.

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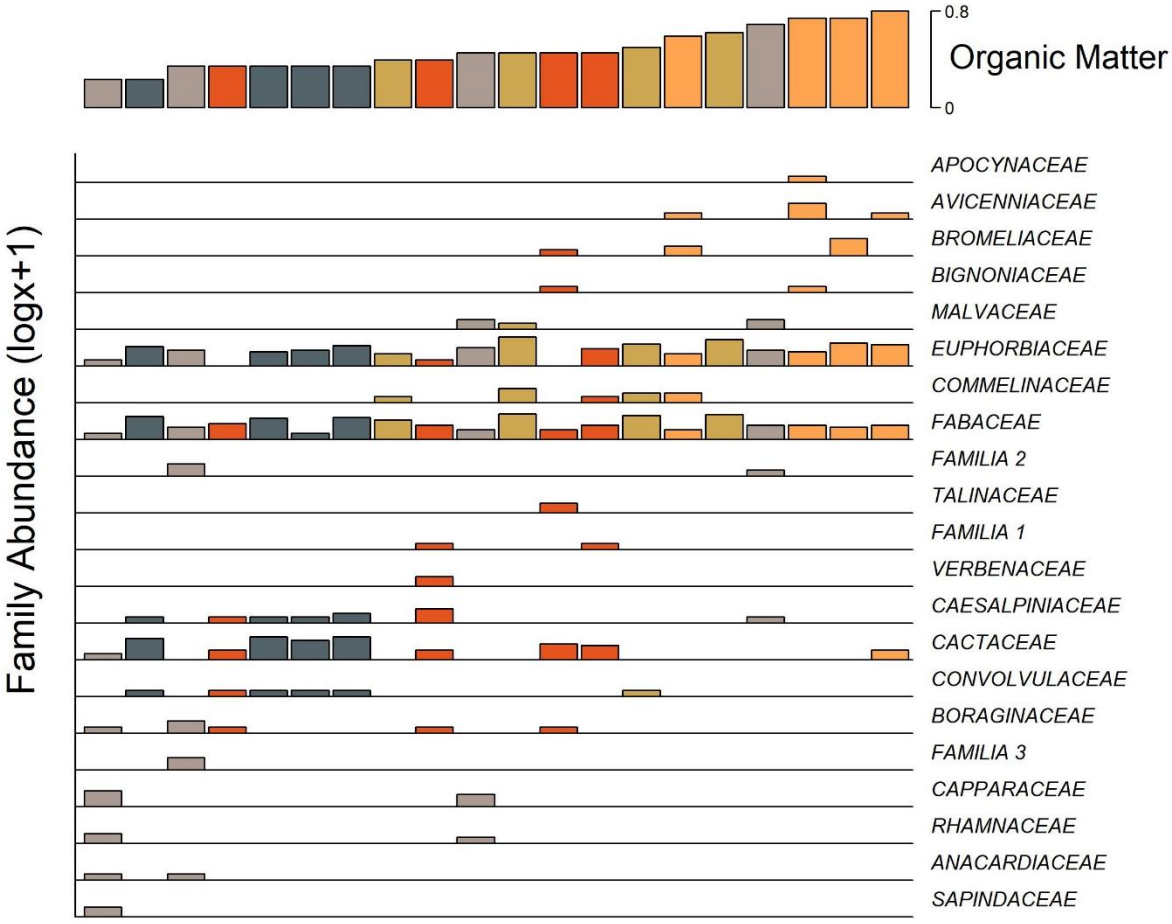
Figure 6. Ordination of plant families, based on abundance and organic matter of the soils, respectively; for each soil type, in the Olho D'Água das Onças Reserve



Source: Authors (2026).

Species belonging to the most abundant families, such as *S. brasiliensis* (Anacardiaceae) and *C. blanchetianus* (Euphorbiaceae), show high abundance in soils rich in organic matter (Figure 7). Species from less abundant families have a smaller presence and are found in soils with lower organic matter content. The distribution of species based on soil organic matter follows a pattern similar to that observed in the ordering of families, reinforcing the importance of organic matter in determining the abundance and distribution of plant species listed in the study area.

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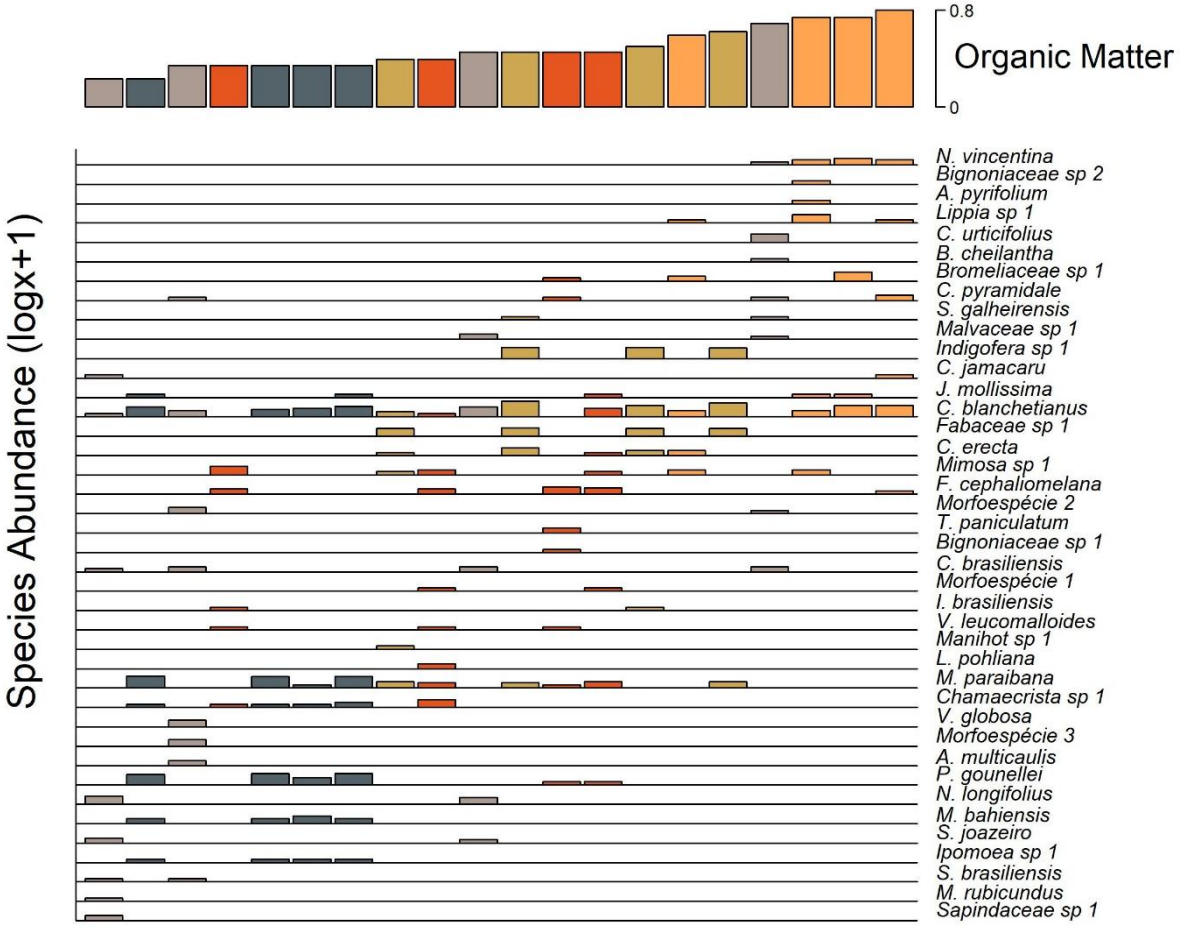
Figure 7. Ordination of plant species, based on abundance and organic matter of the soils, respectively; for each soil type, in the Olho D'Água das Onças Reserve



Source: Authors (2026).

Among the most represented families are Fabaceae and Euphorbiaceae (Table 2), each with several identified species. For example, the Fabaceae family includes species such as *C. brasiliensis*, *C. pyramidale*, and *M. paraibana*. Notable species include Schinopsis brasiliensis (Anacardiaceae), known for its resistance to dry conditions, and *P. gounellei* (Cactaceae), a cactus typical of semi-arid areas. Some species were identified only as morphospecies, suggesting the need for more detailed taxonomic studies for accurate identification.

The Anacardiaceae family is represented by Schinopsis brasiliensis Engl., an important species for local ecology, while the Apocynaceae family is highlighted by *A. pyrifolium*, known for

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its medicinal properties. The highest diversity was found in the Fabaceae family, with eight different species, including *C. pyramidale* and *M. paraibana*, both significant for nitrogen fixation in the soil. The diversity of families and species underscores the importance of conserving this ecosystem, which hosts flora adapted to challenging environmental conditions. Several studies in the region have addressed and quantified the level of floristic diversity of plant species in relation to biophysical soil variables (Costa *et al.*, 2009).

Thus, the Red-Yellow Argisol and Haplic Cambisol showed the highest penetration resistance (PR), while the Regolithic Neosol exhibited the lowest penetration. The Haplic Cambisol and Petric Plinthosol showed moderate penetration resistance. As for texture (the soil composition based on the particles present), the Petric Plinthosol and Regolithic Neosol had the best texture indices, while the Yellow Latosol and Red-Yellow Argisol had moderate texture, and the Haplic Cambisol had the poorest texture.

In PC1 (Figure 2), the variables Porosity and Structure are strongly associated, pointing in the same direction with long arrows, indicating a strong contribution to PC1. PC2, on the other hand, is more associated with Texture and Infiltration, which also have considerable arrows pointing in directions distinct from PC1.

However, despite certain soil types having higher values, it is important to highlight the existence of variability within each soil type, represented by the interquartile range of the boxes. This indicates that, although some soils consistently have high or low quality, others, such as the Regolithic Neosol, show greater variation, reflecting possible micro-environmental or management differences.

Thus, it becomes evident that soils rich in organic matter tend to be more fertile, retain more moisture, and have better structure, providing a more favorable environment for the growth and maintenance of a wide variety of plant species (Voltr *et al.*, 2021). Although the linear regression indicates a positive correlation, it is important to consider the existence of other variables and anthropogenic interventions in the environments, which can influence Shannon's diversity, such as the heterogeneity of specific nutrients. Therefore, studies that incorporate these factors are needed to gain a more comprehensive understanding of the dynamics of the environment.

This fact shows that the heterogeneity of soil characteristics is one of the components of environmental filtering at the local scale (Baldeck *et al.*, 2013). Despite the relatively small spatial area of the study site, it was possible to verify the presence of edaphic heterogeneity. The reserve contains five classified soil types, which were able to influence the distribution and abundance of

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woody and herbaceous species. This heterogeneity has long been recognized as a predictor of vegetation domains' characteristics in the Caatinga (Ab'Saber, 1974; Andrade-Lima, 1981).

Soils from arid and semi-arid regions (such as those in the Caatinga) are characterized by low organic matter and nutrient content, poor structure, high salinity, water deficiency, extreme temperatures, and desiccation (Soussi *et al.*, 2016). The soil quality indicators used point to a mosaic of these conditions, with different soil types having different requirements for characteristics. The results show that the Red-Yellow Argisol has the best physical quality, but it has the lowest organic matter content and the greatest depth. Regarding depth, shallower soils had medium organic matter and lower physical quality. This mosaic contributes to the formation of distinct domains, analyzed by the soil and vegetation indicators used here.

The study area is characterized by at least three vegetation domains: shrubland, shrub-tree, and tree, demonstrating a complex successional dynamic of the area, reflecting the recent conservation history and different land use histories that shape community dynamics (Hobley *et al.*, 2018). The different domains and the different predominant or restricted species (here related to soil types) are synonymous with successional stages in the Caatinga (Carvalho *et al.*, 2012). The formation of vegetation domains in the Caatinga, as well as the distribution and diversity of plant species, still depend on another component: water availability (Ab'Saber, 1974; Andrade-Lima, 1981; Moro *et al.*, 2016), which is directly influenced by the soil parameters studied here, potentially determining water retention in the soil, the soil's ability to absorb nutrients for the plants, and whether or not species will persist in the areas (Araújo *et al.*, 2012; Moro *et al.*, 2016).

The organic matter indicator, the main variable obtained in the study, can have a significant influence on the physical, chemical, and biological properties of the soil, as well as on the functioning processes of the ecosystem (Stevenson, 1994; Baldock; Nelson, 2000; Araújo *et al.*, 2012). It can also be an indicator of conservation in areas, as it is highly susceptible to changes in the landscape (Araújo *et al.*, 2012), such as vegetation clearing and subsequent changes in the vegetation domain.

4. FINAL CONSIDERATIONS

The soil and vegetation quality indicators used were able to differentiate between different soil types and the dynamics in the structuring of plant communities. The biological index (Shannon) explained the relationship between diversity and soil; organic matter showed a positive and statistically significant association with floristic diversity, albeit with limited explanatory power

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(R^2 = 0.22), suggesting that other environmental factors also influence the structuring of the plant community.

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