Theme 3 | Soil data for policy and decision-making

SOIL – VEGETATION RELATIONSHIPS IN QUADRILÁTRO FERRÍFERO: HOW THE SUBSTRATE IS AN ENVIROMENTAL CONDITIONER

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INTRODUCTION

The Quadrilátero Ferrífero (QF) is the main mineral province in the southeastern region of Brazil and one of the oldest landscapes in the country (figure 1). Geological variability and historical, economic and cultural significance are highlighted in studies of the area with few studies dedicated to soils. Lithology significantly influences the evolution of the relief and the characteristics of the soils.

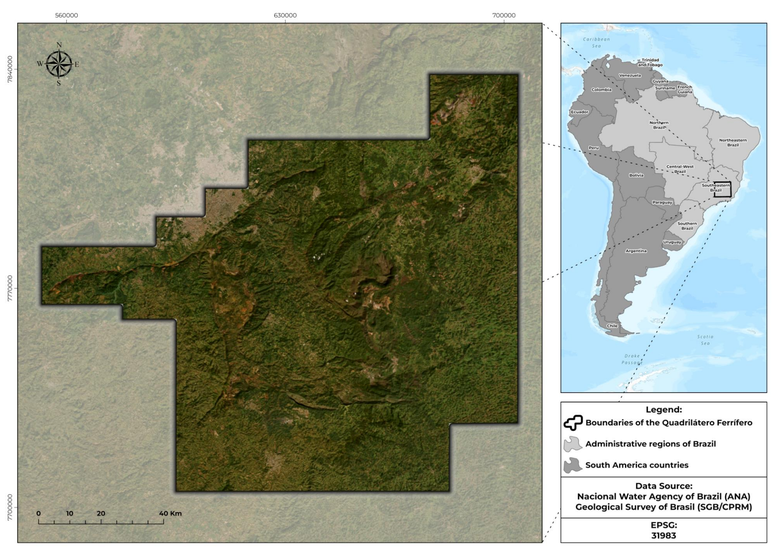


Figure 1. Location map of the study area.

OBJECTIVE

– This study evaluated the relationship between soils and vegetation in the QF.

MATERIALS AND METHODS

– Data from soil surveys and mappings of a representative area of the QF, provided by the Geological Survey of Brazil (SGB/CPRM), were compiled;
– Morphometric Variables (MVs) were derived from the NASADEM Digital Elevation Model (DEM), Geophysical Variables (GVs) such as Magnetometry (MGT) and Gamma Spectrometry (GMS) were used and the Iron Oxide Index (IOI) was applied;
– Some qualitative MVs were discarded and all data were harmonized to the DEM resolution;
– For Principal Component Analysis (PCA), all information was extracted from the geographic coordinates of soil collection points;
– The importance of the variables was determined by Machine Learning (Random Forest) using accuracy as a metric.
– The 10 most important variables were selected and the PCA was performed with these variables;
– All processing was conducted using the R language;

RESULTS

– The soils of the QF are poorly developed and have low natural fertility, influenced by the parent materials and have an intrinsic association with vegetation;
– There was a significant difficulty in separating the Cerrado (CE) from the Rupestrian Grasslands (RG), requiring a higher level of detail (figure 2);
– The IOI and MVs related to valley openness were positioned between the CEs and RGs in the PCA. These phytophysiognomies are found in the smoother and higher areas of the QF with the CEs on more convex slopes;
– Some RGs were described in areas of banded iron formations with carbonate rock influence, explaining the importance of base saturation in the PCA;
– The MGT showed high importance, positioning itself between Forest (FT) areas and RG due to the high presence of iron in the soils of these areas (figure 3). FTs generally develop on colluvial deposits and the RGs are ferruginous;
– The proximity of the GMS of equivalent Uranium and Thorium in the mid-slopes is explained by the high resistance of these elements to weathering.

Figure 2. Separation between vegetation types based on QF soils.

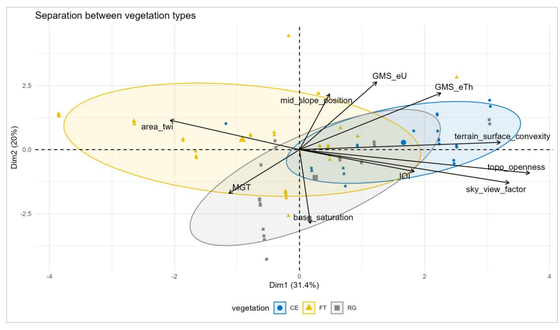
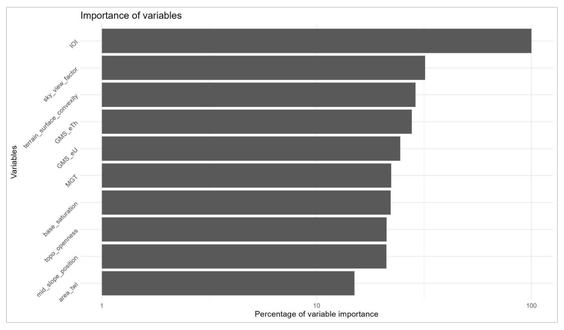


Figure 3. Degree of importance of the 10 most important variables in the soil-vegetation relationship



CONCLUSIONS

– The PCA grouped the data and better defined how the soils and phytophysiognomies of the QF correlate;
– Therefore, understanding the soils, an important natural resource, is fundamental to comprehend the biotic and abiotic interrelationships of the landscape;
– Deepening studies on the soils of the QF, as a common good and understanding their relationships with vegetation is essential for sustainable development, especially in a region with high social, phytophysiognomy and environmental importance.

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