TOURISM ASSESSMENT OF THE MORRO DO PENDURADO GEOSITE WITHIN UBAJARA NATIONAL PARK (PNU), CEARÁ, BRAZIL

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INTRODUCTION

Located west of Ceará's capital, the Ubajara National Park (PNU) spans 6,304 hectares across the municipalities of Ubajara, Tianguá, and Frecheirinha (Figure 1 A). Over the past three years, the PNU has recorded an annual average of 211,336 visitors and is widely recognized for its main attraction: the Ubajara Cave. Accessible via aerial tramway, the view reveals the verdant glint of the Ibiapaba Ridge, interrupted by the prominent limestone hills of the Frecheirinha Formation, where the park's caves have developed (Figure 1 B). Due to its high accessibility and range of attractions, the Ubajara Cave has faced challenges related to intensive visitation.

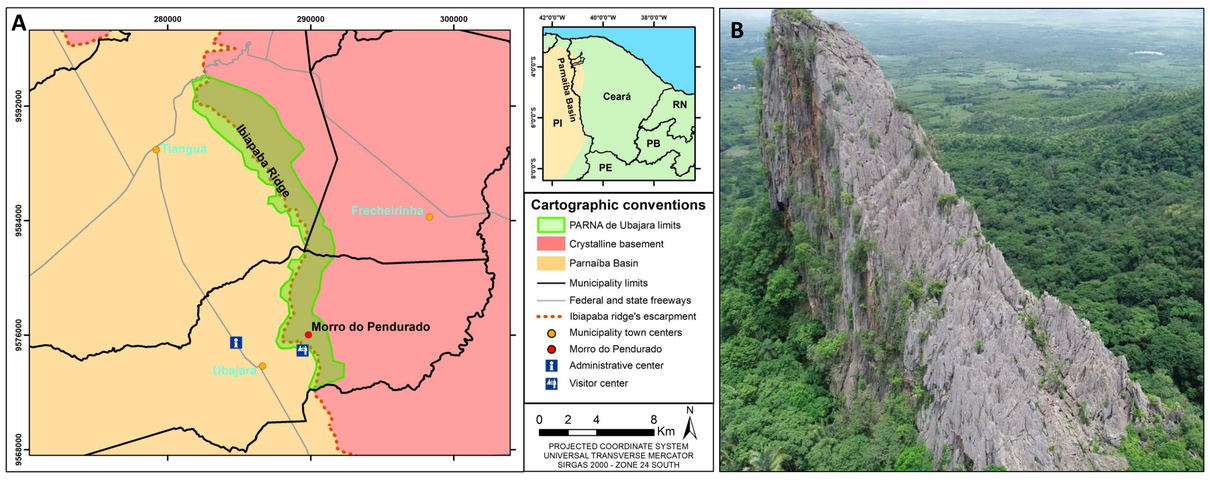

Figure 1: A) Location map of the study area; and B) External view of Morro do Pendurado.

OBJECTIVES

This study evaluates the heritage value and tourism potential of the Morro do Pendurado Geosite to support the development of a new tourist route within the park. The initiative seeks to redistribute visitor flow currently concentrated at the Ubajara Cave — a key challenge for park management. The proposed trail aligns with the Ubajara National Park's Management and Public Use Plans. These instruments, based on physical and biotic assessments and community engagement, establish standards, restrictions, and guidelines for the park's sustainable use.

MATERIALS AND METHODS

The Geosite assessment was based on BRILHA's (2016) evaluative framework, complemented by parameters from models applied to karst and cave environments. Among these, the Geosite Assessment Model (GAM) by VUJIČIĆ et al. (2011) emphasizes the structural and touristic perception of geosites, while the methodology by ZIEMANN & FIGUERÓ (2017) incorporates scenic and landscape criteria, analyzing visual attribute perception along tourist routes.

Additional parameters prioritized tourism-related criteria, enriching elements underrepresented or less developed in prior models. For scenic beauty, GAM provided the criteria: viewpoints, surface features (Figure 2 A and B), surrounding landscape, and visual contrast. From Ziemann and Figueró's framework, aspects such as color, legibility, and complexity were added. Their model also includes interpretive potential through signage and guiding services.

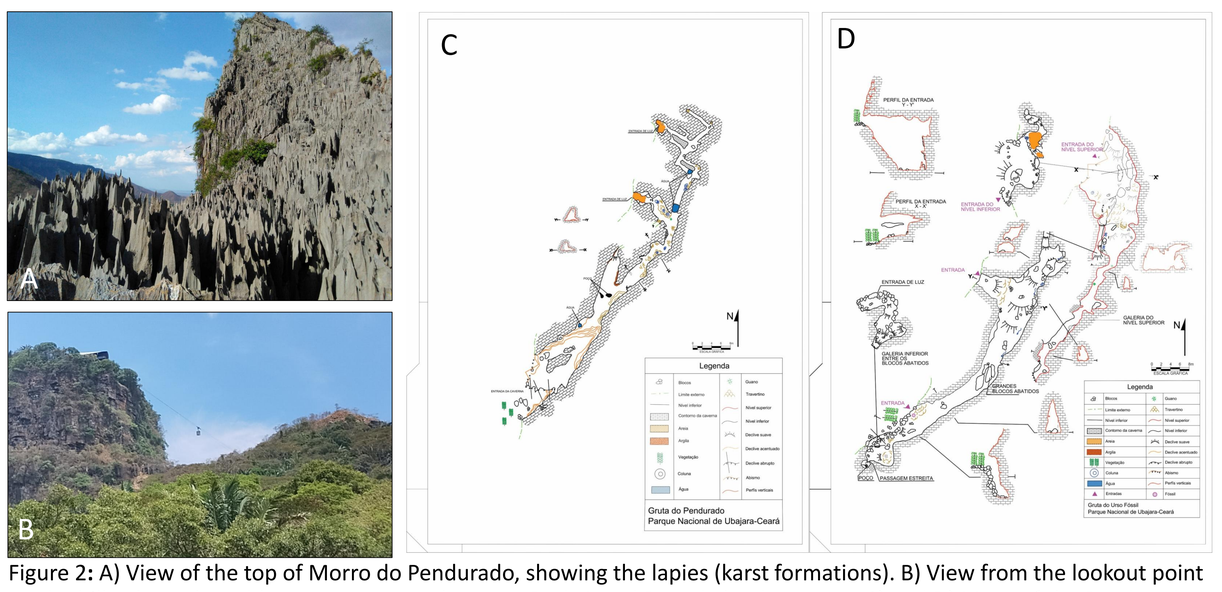

Figure 2: A) View of the top of Morro do Pendurado, showing the lapies (karst formations). B) View from the lookout point on the hill, where the cable car passage can be seen. Both A and B made by the autors. C) and D) Maps of the Pendurado and Urso Fóssil caves, respectively, redigitized from the original map of the Management Plan Review Project developed by ICCN (Instituto Cearense de Ciências Naturais).

RESULTS E DISCUSSION

The Morro do Pendurado and its two caves (Urso Fóssil and Pendurado) stand out for their geological and paleontological significance. The site preserves the geological context of the Frecheirinha Formation and contains rare Pleistocene fossils (8,200–8,000 years BP), including a bear skull (one of the few found in Brazil) alongside remains of mammals, reptiles, and gastropods. These records provide valuable insights into paleobiodiversity and paleoclimate conditions (OLIVEIRA et al., 2011, 2014; HSIOU et al., 2012).

With minimal anthropogenic impacts, these caves preserve their natural integrity and processes. They are among the few fossiliferous sites in the park, comparable only to the Macaco Fóssil Cave. The bear species identified has only three recorded occurrences in Brazil (a replica of the skull is shown in Figure 3 I).

The site's educational potential encompasses cave formation, paleontology, and karst landscape evolution, while the access paths enhance visitor experience through geomorphological diversity. From a tourism perspective, it stands out for its scenic beauty (colorful speleothems, and contrasting shades of green, gray, orange, and white, Figures 3 A to D) and its unique geological context (Figures 3 E to H). Infrastructure remains minimal, requiring improvements to ensure safe visitation. Federally protected under ICMBio regulations, the caves show low vulnerability to human impacts but require monitoring due to karst fragility. Implementing signage and support structures would enable sustainable public use, balancing conservation and tourism.

Figure 3 A) to D) Entrance and internal sections of Pendurado Cave, made by the autors. E) to H) Upper entrance and chambers of Fossil Bear Cave, by Diego Bento in partnership with CECAV and ICMBio. I) Fossil Bear Skull replica.

CONCLUSIONS

The Morro do Pendurado Geosite and its caves stand out for their scientific value (speleological and paleontological) and educational tourism potential, making them suitable for inclusion in a new georoute within the PNU. Their scenic beauty, exploratory features (accessible speleothems and karst landforms), and distinctive geological context appeal to a wide range of visitors—from students to adventure-seeking tourists. While basic infrastructure is needed for safe access, the site's rarity and integrity support conservation and sustainable public use, complementing the park's attractions without compromising its unique character.

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