Global Journal of
Archaeology & Anthropology
ISSN: 2575-8608

Juniper Publishers
key to the Researchers

Research Article
Volume 14 Issue 5 - March 2026
DOI: 10.19080/GJAA.2026.14.555897

Glob J Arch & Anthropol

The Landscape in The Context of The Go-Ja-02 Archaeological Site, Serranópolis – Brazil

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Submission: March 17, 2026**; Published:** March 27, 2026

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Abstract

The municipality of Serranópolis, located in the central-western region of Brazil, features an important set of archaeological sites dating back approximately 12,000 years BP. Academic research in the region began in the 1970s and, after a hiatus of about 40 years, was resumed in 2021 at the GO-Ja-02 archaeological site. This article presents a landscape study concerning visibility, viewsheds, and intervisibility in the context of the GO-Ja-02 site. To this end, computational tools were necessary, mainly for generating and processing maps, as well as digital models that enabled the analysis of these three variables. As a result, six maps were produced to discuss how the landscape may have influenced human choices in the past based on visual analysis.

Keywords: Landscape; Archaeology; Visibility; Visibilization; Intervisibility

Introduction

Landscape Archaeology deals with the relationship between humans and the landscape and how they influence each other. This relationship is perceived by humans, often, through observation. An observer can understand the landscape in different ways through movement. In this regard, Pellini [1] understands that the perception and knowledge of the landscape, its natural resources, products, and services, are obtained through movement.

From this movement, the observer can determine the best point of viewshed (the way one is seen), visibility (what is seen from a given location), and intervisibility (which concerns the visual relationship between the observation point and other elements in the surrounding region), meanings defined by Criado-Boado [2]. This landscape analysis "can be read through different theoretical and analytical tools, thus establishing itself as a rich field of research for Archaeology" [3, p. 97], opening up various "possibilities for new ideas, perceptions, and dialogues" [4, p. 1].

Landscape Archaeology is comprehensive and multidisciplinary, and it also draws on foundations from the Geosciences to understand the factors that influenced the use and occupation of space by past groups. Thus, the objective of this work is to conduct an initial approach on how the compartmentalization of the relief may have influenced the choice of the shelter at the GO-Ja-02 site for prolonged occupation, temporary occupation, or other activities by past populations, and how it may have influenced the process of appropriation and construction of space and the lived landscape.

Landscape is here considered as an artifact, resulting from human action, a social construction, as discussed by Fagundes [5]. Relief influences the environment in which humans built and build landscapes; therefore, relief and landscape traverse the text in the company of humans from the perspective of viewshed, visibility, and intervisibility.

The GO-Ja-02 site is part of a set of shelters studied, initially, by the team coordinated by Dr. Pedro Ignácio through the Goiás Archaeological Program, started in the 1970s. Its objective was the study of archaeological sites in the state of Goiás, and among them, those found in the municipality of Serranópolis, due to their diversity of material culture, rock art representations (engravings and paintings), and remote datings, approximately 11,000 years Before Present - BP [6].

The archaeological sites in this region were divided into six clusters the GO-Ja-02 site is linked to Cluster "A" (Figure 1), which consists of 4 sites in shelters, with only GO-Ja-01 (of larger dimensions and greater quantity of rock art representations) mentioned in this text due to its proximity to GO-Ja-02. Both are located on a stepped slope with a base segment resembling a talus resulting from geomorphogenetic processes that structured the relief. The talus is locally called "sandstone wall," where, mainly due to weathering processes, differential erosion of the sandstone occurred, resulting in the formation of the shelters. The GO-Ja-02 site is divided into two sections: the external one, measuring 43 m in opening and 13 m in depth, and the internal one, measuring 23 m in opening and 29 m in depth. The shelter features various rock engravings and paintings and has important sources of natural resources nearby, mainly associated with the Rio Verde, about 4 km away with a prominent alluvial plain and an important source of natural resources, and the Bela Vista stream, smaller in scale, 0.8 km away [6,7].

Research at the site resumed in 2022 with a transdisciplinary approach that has produced a series of new findings, enabling the expansion of interpretations related to the site's occupation, particularly regarding the formation of the archaeological record, datings, paleoenvironment, material culture, human burials, and landscape, as highlighted by Rubin [8] and Barbosa [9].

Pereira [10], Rubin [11,8], and Barbosa [9] establish a series of considerations regarding the landscape and the archaeological sites of Serranópolis, encompassing regional and local perspectives from different approaches, highlighting the multiple perspectives involved in the theme.

Materials and Methods

The use of computational tools, mainly those related to the generation and processing of maps, was essential throughout the execution of this work, from the initial stages of delimitation of the study area to the generation of results.

During the process of delimitation of the study area, *Google Maps* was used to dimension the workspace. During the generation of visibility and intervisibility maps, QGIS software was used, which requires a Digital Elevation Model (DEM) to calculate visible areas. This model was obtained from the Alos Palsar[1], satellite which has a spatial resolution of 12.5 m (with a maximum detail scale of 1:62,500).

For generating maps in the QGIS software, two components, also called plugins, were used: *"Viewshed" and "Intervisibility Network"*. For the use of both plugins, it was first necessary to define the points known as "*observers*" and their characteristics, such as their height and viewing radius. For this work, the height considered for the observer points was 1.6 meters, which may vary up to 40 m depending on the observer's location in the landscape, and as the viewing radius, taking the observer at the center of a circle, a diameter of 10 km was considered.

Results

The results obtained are presented according to visibility, intervisibility, and viewshed. Figure 2 highlights the visible area on the map (indicated by the lighter color) from an observer positioned at the top of the talus above the site, which has a height of 40 m. Visibility analysis assesses the extent of the visual field from the archaeological site, taking into account the physical characteristics (elevation) of the surrounding landscape and the height of the observer.

The visibility map (Figure 3) explores the field of view of an observer positioned in front of the site entrance, after a current vegetation barrier approximately 10 m wide, using the observer height parameter of 1.6 m.

Correlating Figures 1 and 2, it can be observed that the compartmentalization of the area, which resulted in the mentioned stepped arrangement, is responsible for the variation in visibility. In this case, the two observation points integrate differently into the landscape according to the altimetric variation in the region.

Figure 4 addresses, in greater detail, the impact of landscape compartmentalization on visual analysis. It can be seen that the darker areas on the map, or the non-visible areas, correspond to those regions separated by elevations higher than those of the site. Therefore, the visible regions (in yellow) are those where the elevations fall within the observer's angle of view, which corresponds approximately to 45° above and below their line of sight. Thus, these areas are predominantly the surrounding slopes and the flat areas downstream of the site talus.

In intervisibility (Figure 5), it is observed that the observer positioned above the site talus, at 40 m height, is visible from only four points located north of the site and two south of it, and vice versa (mutual visibility). The height of the points is also 1.6 m, and as can be verified, intervisibility—which occurs when two points positioned at a certain distance can observe each other—takes place only within the visible area (yellow legend).

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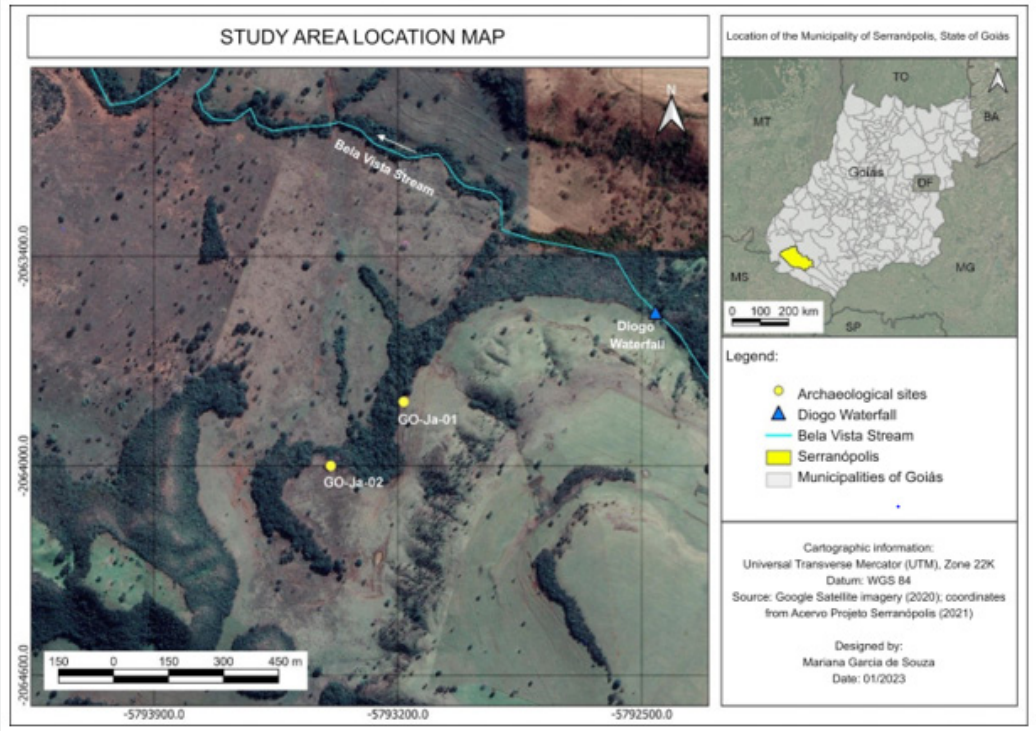

Figure 1: Location of the archaeological sites GO-Ja-01, GO-Ja-02 and the municipality of Serranópolis.

Source: Serranópolis Project Collection.

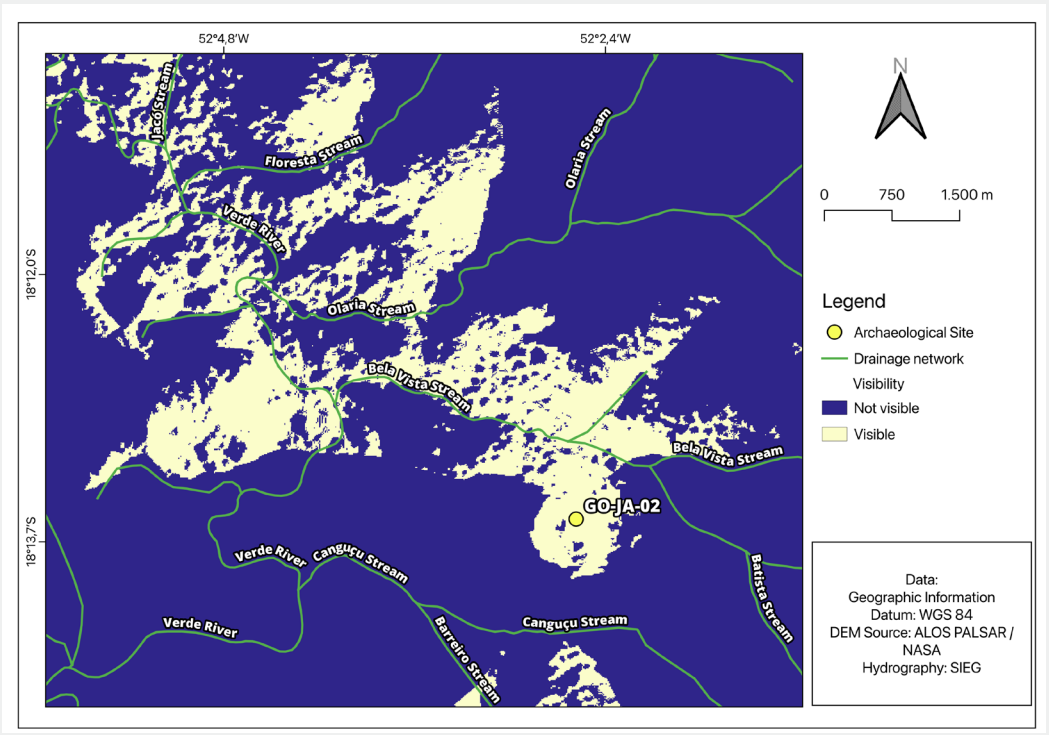

Figure 2: Areas visible from the top of the talus above the site (40 m height) and with an approximate extension of 10 km in diameter (the image is just a crop of the area).

Source: Radel [13].

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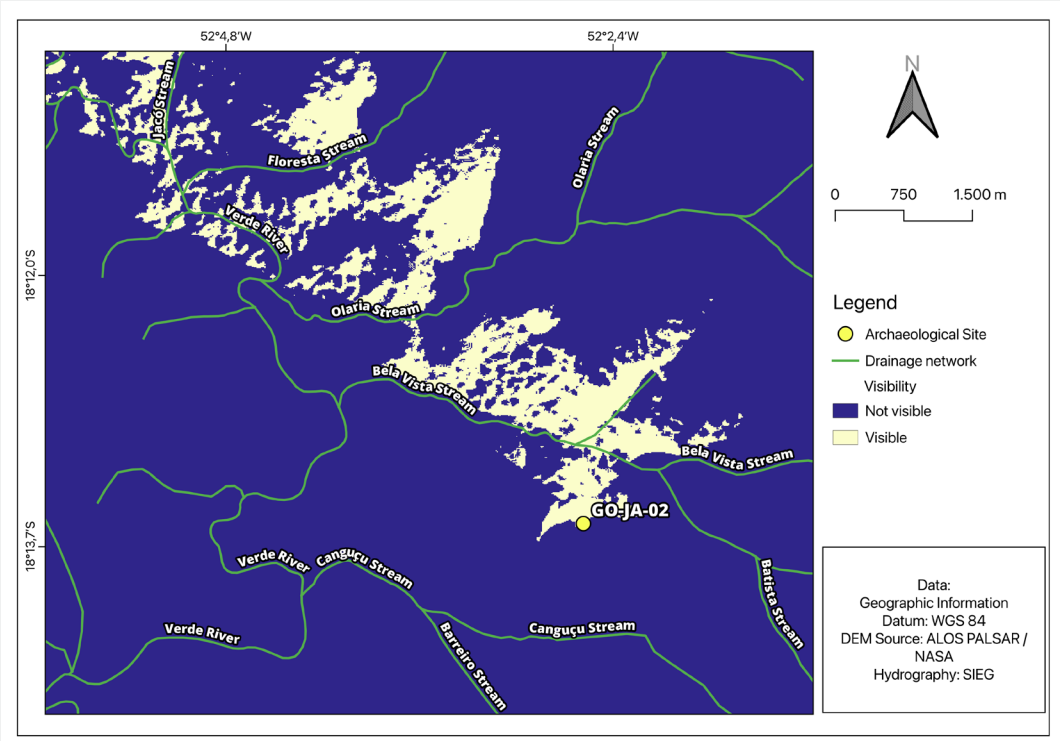

Figure 3: Areas visible from the base of the site, with an observer 1.6 m tall.

Source: Radel [13].

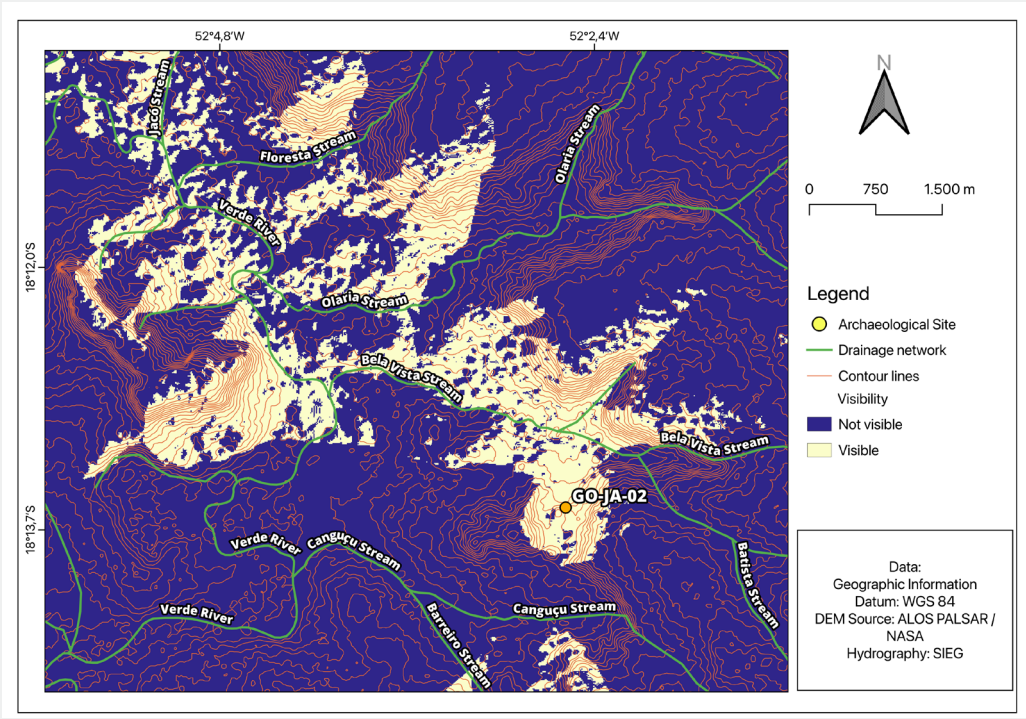

Figure 4: Relationship between the visibility of the area and elevation contours.

Source: Radel [13].

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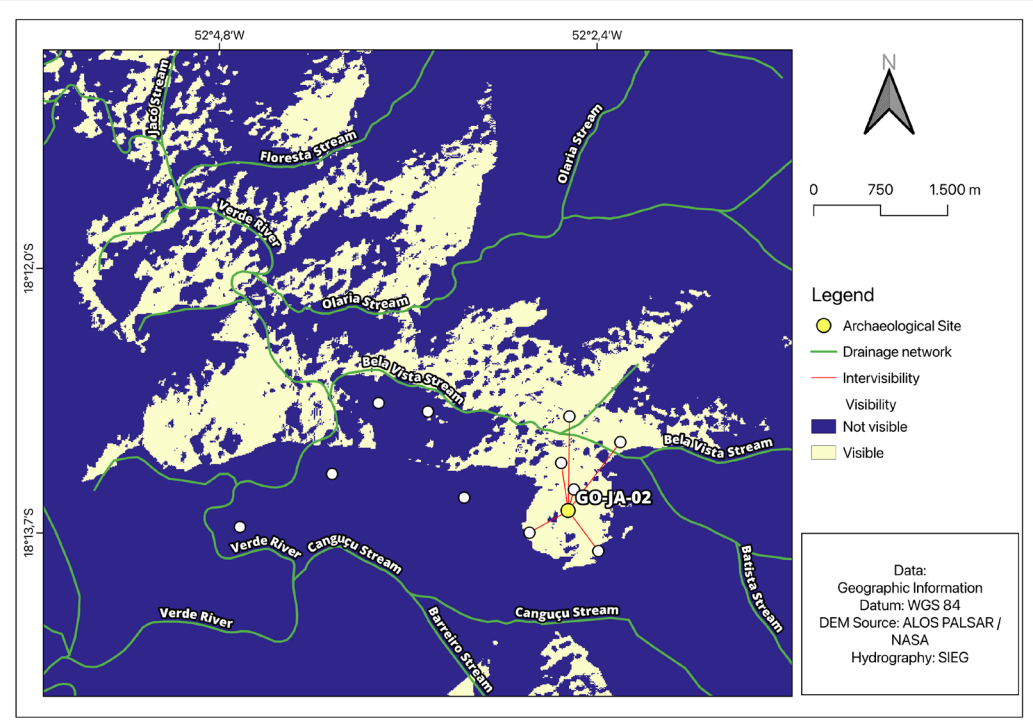

Figure 5: Intervisibility between the observer above the site talus and other observers placed at various points in the region.

Source: Radel [13].4).

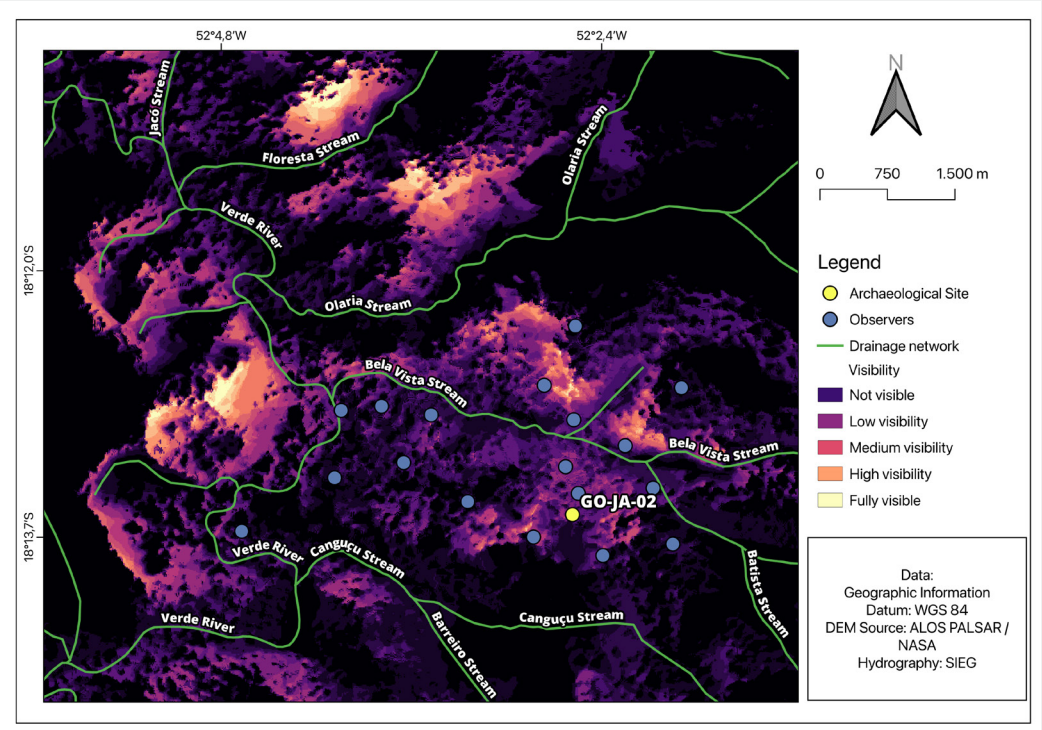

Figure 6: Viewshed of GO-Ja-02 from the points marked on the map (observers).

Source: Radel [13].

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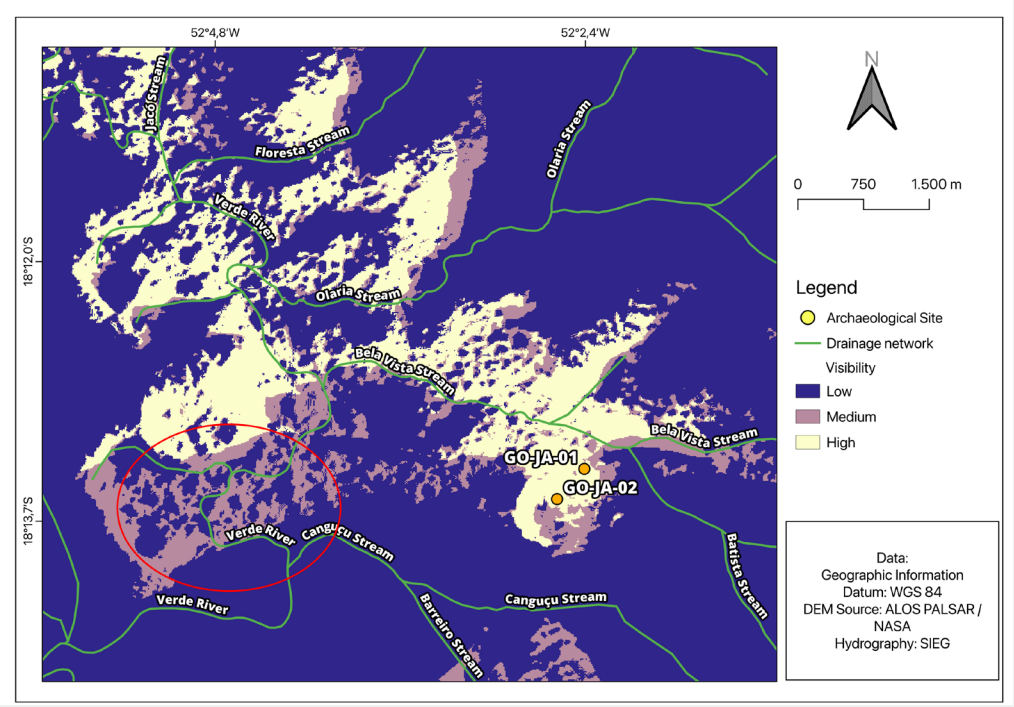

Figure 7: Visibility from the GO-Ja-01 and GO-Ja-02 sites. The point highlighted with a red circle may have been an important source of resources, visible only from the GO-Ja-01 site.

Source: Radel [13].

Figure 8: Frontal view of the archaeological sites GO-Ja-01 and GO-Ja-02.

Figure 6 assesses whether the site is seen from observers placed in the area near it, which was defined by Criado-Boado [2] as the "viewshed" of the archaeological element. Thus, 18 observers were inserted at various points in the area, each measuring 1.6 m in height. In this case, the view of the site from all marked observation points on the map is low to medium, as seen by the pinkish coloration at the site marking point. The scale of the figure allows the reader to establish correlations between the highlighted visibilities.

From the analysis of the maps, it is observed that there is low visual reach from the site, where only a narrow strip is visible to the north, northeast, and northwest, reaching a maximum of 5 km visible on the horizon. To the west, visibility is much lower, while

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to the south it is almost null. This is due to the relief configuration that limits the site through slopes, thus preventing visual reach.

When comparing the visibility of the GO-Ja-02 site with that of the GO-Ja-01 site, located approximately 0.5 m away on the same wall, it is possible to verify that there is greater visual reach from the latter, as it is possible to view the Rio Verde, about 6 km away, from the top of the shelter talus (Figure 7), as cited by Botelho [14] , and by Schmitz [6] as important sources of resources for the pre-colonial groups that lived there.

Additionally, intervisibility is also low between the GO-Ja-02 site and the points scattered across the area, being limited only to the visible area (lighter), as shown in Figure 5. In contrast, the viewshed of the site from its external environment is low to medium, considering that the site location is seen by only six of the 18 observers inserted on the map (Figure 6).

Given the particularities of GO-Ja-02 in relation to its neighbor GO-Ja-01 (Figure 8) and due to the low viewshed and visibility, limited by the spatial configuration of the area, which makes it more secluded, it can be inferred that visual analysis may have played an important role in defining the site's functionality, facilitating some specific type of activity, whether as a camp or ritualistic, as suggested by Schmitz [15].

This perspective is being addressed in the resumption of research at GO-Ja-02, as mentioned earlier. The intensity of the material culture, notably lithic, the set of datings between approximately 12,000 and 1,200 years BP indicate consistent and prolonged occupations, and the presence of human burials and a set of 10 human skulls, at different depths between 1.9 and 0.6 m, may be related to the site's functionality, [8,9] and perhaps the low viewshed and visibility was a determining factor.

Ashton [16], Brughmans and Brande [17], Gillings [18], Nazareno [19], Pacheco and Romero [20] and Strupler [21] highlight methodological procedures that can be adopted regarding the theme, as well as the set of variables used and the weight of each in the final analysis, always considering the current characteristics of the research areas and, when possible, paleoenvironmental ones. Milheira [22] addresses visibility, intervisibility, communication, and movement in the context of the cerriteiros of the Laguna dos Patos region in southern Brazil, highlighting that:

The populations that built cerritos which inhabited the Laguna dos Patos clearly constructed their world in the aquatic environment. The mosaic of flat lands composed of wetlands, rivers, and streams, connected to the estuary, was the stage where, over approximately 2,000 years, the cerriteiros fished and moved systematically throughout their history (22, 202: 16).

In relation to the context of GO-Ja-02, human groups occupied a shelter with viewshed, visibility, and intervisibility also conditioned by the compartmentalization of the relief, with variations in the intensities of each of the three variables, highlighting the stepped slope and the possibilities provided. In this context, vegetation cover is a variable that can modify analyses related to visibility, viewshed, and intervisibility. However, in the case presented here, the compartmentalization of the relief is considered the main variable, notably due to the relationship between slopes, flat areas, availability of raw materials, streams, rivers, alluvial plain, fauna, flora, mobility, and territory.

Conclusion

Through this work, it was possible to analyze the visibility, intervisibility, and viewshed involving the GO-Ja-02 site, allowing the assessment of the influence that relief and landscape may have exerted in this approach and how visual analysis may have been used in the human-landscape relationship in pre-colonial occupation. [13,23].

Thus, it was possible to understand the compartmentalization of the landscape built from a relief with specific forms and characteristics of the Brazilian Central Plateau as a limiter of the visibility, viewshed, and intervisibility of this site and, possibly, through this limitation, the groups appropriated and constructed their spaces and landscapes [8,9,13,23,24].

Another example of the agency of relief and landscape!

Acknowledgements

The National Council for Scientific and Technological Development – CNPq, for supporting research through processes 307231/2022-4 - productivity grant and 409320/2023-4 - universal research funding.

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DOI: 10.19080/GJAA.2026.14.555897

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