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Edge Effects Up to 30-40 Meters Into Seasonal Forests Demonstrated Through Vegetation Indices and Floristic Similarity

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INTRODUCTION & AIM

Forest edges in fragmented landscapes are exposed to various environmental pressures, which can influence the interior of these ecosystems. However, the precise extent of this edge effect remains uncertain. This study aims to assess the edge effect in seasonal forest fragments by examining floristic composition and vegetation indices. The specific objectives are to: (1) determine the depth of edge influence into the forest interior, (2) identify which vegetation indices, including NDVI, EVI, PV, and Moisture, are most effective in capturing these changes, and (3) propose the application of these indices for monitoring and developing conservation strategies for vegetation remnants within rural properties in the Brazilian Cerrado, particularly within the framework of the Environmental Regularization Program (PRA). This approach will help assess the functionality of Legal Reserves and support the maintenance of ecosystem services.

METHOD

The study was conducted in five seasonal forest fragments (figure 1).

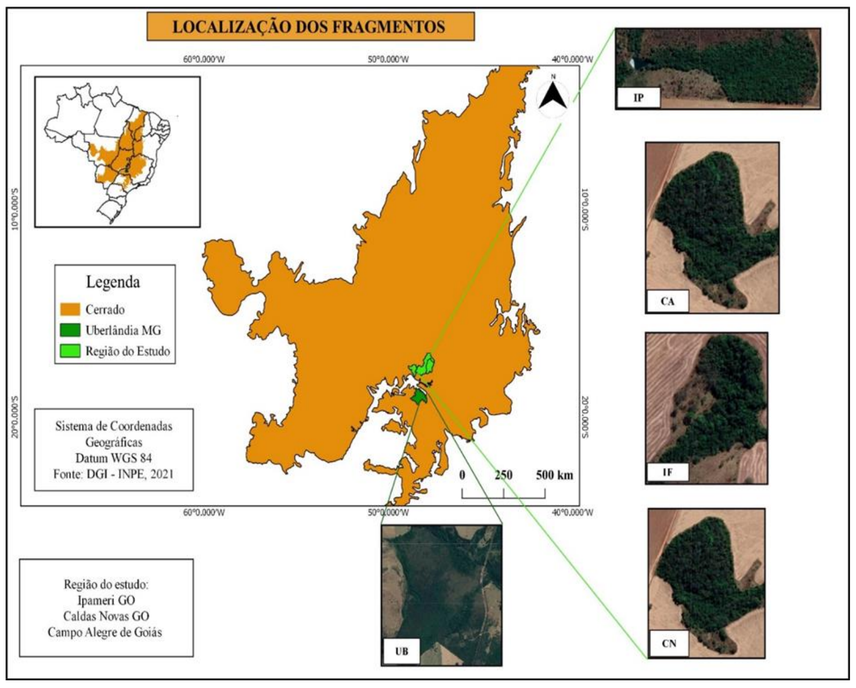

Figure 1. Fragments of semi-deciduous seasonal forests sampled in this study. Fragments: IP = UEG — Ipameri, CA = Campo Alegre GO, IF = Rural Zone of Ipameri GO, CN = Highway that connects to Caldas Novas — GO, UB = Control Area — Uberlândia – MG.

Sampling plots were established at intervals of 10 meters from the forest edge (0-10 m, 10-20 m, 20-30 m, 30-40 m, 40-50 m, 50-60 m, 60-70 m, 70-80 m, 80-90 m, 90-100 m) to measure vegetation density. Floristic differences between plots were analyzed using two similarity dendrograms. Remote sensing data were collected for vegetation indices, including NDVI, GNDVI, EVI, SAVI, Moisture, PV, Emissivity, and LST. The average values for each index were calculated for each distance interval (figure 2).

Statistical analyses, including dendrograms, Principal Component Analysis (PCA), and linear and non-linear regressions, were performed to determine the spatial gradient of the edge effect and identify which indices best reflect changes related to the edge.

RESULTS & DISCUSSION

Floristic Analysis and Remote Sensing

The floristic and remote sensing analyses both revealed clear distinctions between forest edge and interior zones within 30 to 40 meters from the edge. Dendrograms using the Jaccard coefficient and the Morisita-Horn index (figure 3A) showed significant differences in species composition, with edge effects extending beyond 40 meters. Remote sensing data aligned with these findings (figure 3B), confirming its effectiveness in distinguishing forest edges from interiors. This integrated approach offers valuable insights for future conservation strategies and monitoring of forest remnants.

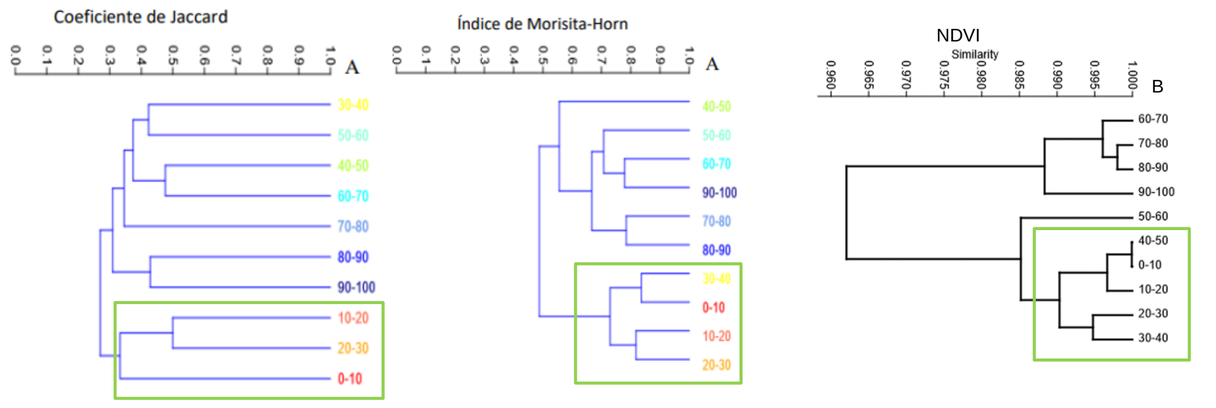

Figure 3 (A) Floristic group analysis of the Ipameri GO-IPA forest remnant (B) Vegetation index group analysis (NDVI) of the Ipameri GO-IPA forest remnant

The vegetation indices analysis (NDVI) successfully identified the forest edge at 39.8 meters in the IPA fragment (figure 4A). It also generated a contrast map (figure 5A) highlighting edge areas and revealing lower density regions and disturbances within the forest interior.

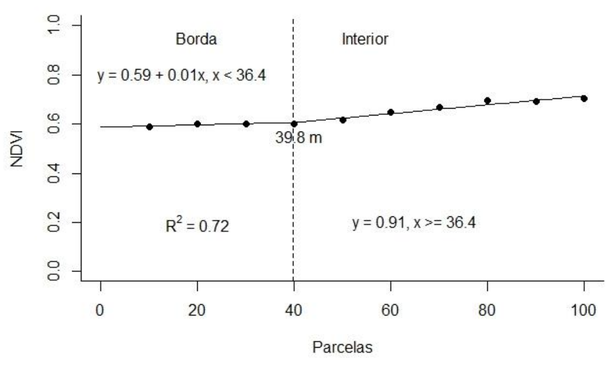

Figure 4 A - Contrast graph based on NDVI

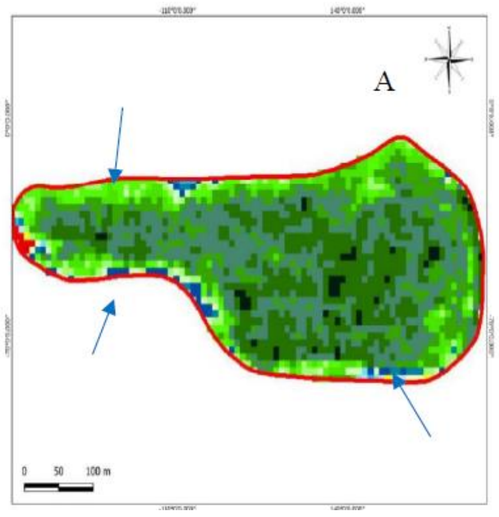

Figure 5 A – NDVI based contrast map

For all other vegetation indices and study areas, similar results were observed, showing consistency between the vegetation indices and floristic analysis (full details can be found in the complete study). This further highlights the effectiveness of vegetation indices as valuable tools for conservation strategies.

CONCLUSION

This study shows that vegetation indices, combined with floristic analysis, effectively detect edge effects within forest interiors. The alignment between remote sensing and floristic data highlights the value of these tools for monitoring forest health and guiding conservation efforts. Vegetation indices offer practical applications for managing and restoring Legal Reserves in rural areas, supporting biodiversity conservation in the Brazilian Cerrado.

FUTURE WORK / REFERENCES

In future studies, we aim to quantify the carbon stored in these forest remnants using vegetation indices and evaluate whether unprotected edge areas are maintaining their ecosystem services. For further information, please contact valdivino.junior@ufv.com.

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