IMPACTO CIENTÍFICO EDITORA

IMPACTS OF DEFORESTATION ON ANIMAL AND PLANT BIODIVERSITY IN TROPICAL ECOSYSTEMS

IMPACTOS DO DESMATAMENTO NA BIODIVERSIDADE ANIMAL E VEGETAL EM ECOSSISTEMAS TROPICAIS

IMPACTOS DE LA DEFORESTACIÓN EN LA BIODIVERSIDAD ANIMAL Y VEGETAL EN ECOSISTEMAS TROPICALES

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ABSTRACT

Biodiversity conservation in tropical ecosystems constitutes a fundamental challenge of contemporary times, especially given the accelerated expansion of deforestation caused by anthropogenic activities. This study analyzes the impacts of deforestation on animal and plant biodiversity in tropical ecosystems, investigating mechanisms through which vegetation cover loss affects species diversity and ecological processes. The research is justified by the need to systematize knowledge about the consequences of habitat fragmentation for tropical fauna and flora conservation, providing support for environmental public policies. The general objective consists of analyzing the main impacts of deforestation on tropical biodiversity. Methodologically, a qualitative exploratory approach is adopted through systematic literature review in international scientific databases, with thematic content analysis of 54 selected articles. Results show that habitat fragmentation compromises population viability of species, reduces genetic variability, and alters fundamental ecological processes such as nutrient cycling and pollination. It is concluded that integrated conservation strategies, including protected areas, agroforestry systems, and ecological restoration, prove essential to mitigate deforestation effects, although the effectiveness of these strategies depends on political commitment, substantial investments, and engagement of local communities.

Keywords: Deforestation. Tropical Biodiversity. Habitat Fragmentation. Environmental Conservation.

RESUMO

A conservação da biodiversidade em ecossistemas tropicais constitui desafio fundamental da contemporaneidade, especialmente diante da expansão acelerada do desmatamento provocado por atividades antrópicas. Este estudo analisa os impactos do desmatamento sobre a biodiversidade animal e vegetal em ecossistemas tropicais, investigando mecanismos pelos quais a perda de cobertura vegetal afeta a diversidade de espécies e

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processos ecológicos. A pesquisa justifica-se pela necessidade de sistematizar conhecimentos sobre as consequências da fragmentação de habitats para a conservação da fauna e flora tropicais, fornecendo subsídios para políticas públicas ambientais. O objetivo geral consiste em analisar os principais impactos do desmatamento sobre a biodiversidade tropical. Metodologicamente, adota-se abordagem qualitativa exploratória, mediante revisão sistemática de literatura em bases científicas internacionais, com análise de conteúdo temática de 54 artigos selecionados. Os resultados evidenciam que a fragmentação de habitats compromete a viabilidade populacional de espécies, reduz variabilidade genética e altera processos ecológicos fundamentais como ciclagem de nutrientes e polinização. Conclui-se que estratégias integradas de conservação, incluindo áreas protegidas, sistemas agroflorestais e restauração ecológica, mostram-se essenciais para mitigar os efeitos do desmatamento, embora a efetividade dessas estratégias dependa de compromisso político, investimentos substanciais e engajamento de comunidades locais.

Palavras-chave: Desmatamento. Biodiversidade Tropical. Fragmentação de Habitats. Conservação Ambiental.

RESUMEN

La conservación de la biodiversidad en los ecosistemas tropicales es un desafío contemporáneo fundamental, especialmente dada la acelerada expansión de la deforestación causada por las actividades humanas. Este estudio analiza los impactos de la deforestación en la biodiversidad animal y vegetal de los ecosistemas tropicales, investigando los mecanismos por los cuales la pérdida de cobertura vegetal afecta la diversidad de especies y los procesos ecológicos. La investigación se justifica por la necesidad de sistematizar el conocimiento sobre las consecuencias de la fragmentación del hábitat para la conservación de la fauna y la flora tropicales, brindando apoyo a las políticas públicas ambientales. El objetivo general es analizar los principales impactos de la deforestación en la biodiversidad tropical. Metodológicamente, se adopta un enfoque cualitativo exploratorio, mediante una revisión sistemática de la literatura en bases de datos científicas internacionales, con análisis de contenido temático de 54 artículos seleccionados. Los resultados muestran que la fragmentación del hábitat compromete la viabilidad poblacional de las especies, reduce la variabilidad genética y altera procesos ecológicos fundamentales como el ciclo de nutrientes y la polinización. Se concluye que las estrategias integradas de conservación, que incluyen áreas protegidas, sistemas agroforestales y restauración ecológica, son esenciales para mitigar los efectos de la deforestación, si bien su efectividad depende del compromiso político, inversiones sustanciales y la participación de las comunidades locales.

Palabras clave*:* Deforestación. Biodiversidad Tropical. Fragmentación del Hábitat. Conservación Ambiental.

1 INTRODUCTION

The conservation of biodiversity is one of the most pressing challenges of contemporary times, especially in tropical ecosystems, recognized as repositories of biological wealth unparalleled on the planet. These environments are home to approximately 60% of the known species, performing fundamental ecological functions for the maintenance of biogeochemical cycles, climate regulation, and the provision of ecosystem services essential to human survival. However, the accelerated expansion of anthropogenic activities, particularly deforestation, has caused profound changes in the structure and functioning of these ecosystems, compromising their ability to sustain biological diversity and associated ecological processes.

Deforestation in tropical regions has intensified in recent decades, driven by the conversion of forest areas to pastures, intensive agriculture, logging, and urban expansion. Andreza *et al.* (2024, p. 1422) highlight that "the interference of deforestation in environmental and social quality is manifested through the degradation of habitats, loss of connectivity between forest fragments, and reduction of the resilience capacity of ecosystems". This statement shows that the impacts of deforestation transcend the ecological dimension, also affecting human communities that depend directly on natural resources for their livelihoods. The fragmentation of habitats resulting from deforestation creates heterogeneous landscapes, in which animal and plant populations become isolated, reducing gene flow and increasing vulnerability to local extinction.

The specialized literature has shown that biodiversity loss in tropical ecosystems does not occur in a linear or homogeneous way. Different taxonomic groups respond differently to environmental disturbances, and the magnitude of the impacts varies according to the intensity of deforestation, the history of land use, and the ecological characteristics of the affected species. Andrade *et al.* (2025, p. 37) argue that "innovative strategies for biodiversity conservation require integration of traditional technologies and practices for the protection of ecosystems, recognizing the complexity of interactions between biotic and abiotic components". Such a perspective underlines the need for multidimensional approaches that consider not only biological aspects but also social, economic, and cultural dimensions of conservation.

In addition, deforestation compromises fundamental ecological processes, such as nutrient cycling, pollination, seed dispersal, and pest regulation. The removal of vegetation cover alters local microclimates, increases soil erosion, modifies hydrological regimes, and reduces the capacity of ecosystems to sequester atmospheric carbon. Alcântara (2023, p. 24) states that "the integration of interdisciplinary approaches in the study of environmental

problems allows us to understand the multiple dimensions of anthropogenic impacts on natural ecosystems". This observation reinforces the importance of investigations that articulate knowledge from different areas of knowledge, promoting a more comprehensive understanding of ecological phenomena.

Given this panorama, the central problem of this research emerges: what are the main impacts of deforestation on animal and plant biodiversity in tropical ecosystems, and how do these impacts manifest themselves at different spatial and temporal scales? This issue becomes particularly relevant in a context in which deforestation rates remain high in several tropical regions, despite international commitments to reduce the loss of natural habitats. Understanding the mechanisms by which deforestation affects biodiversity can provide important subsidies for the formulation of public conservation policies, territorial planning, and the implementation of ecological restoration strategies.

Therefore, this study is justified by the need to systematize the existing knowledge about the impacts of deforestation on tropical ecosystems, identifying patterns, processes and consequences for biodiversity. The research contributes to the advancement of the academic debate by proposing a critical analysis of the main changes caused by the loss of vegetation cover, examining their implications for the conservation of tropical fauna and flora. In addition, the study offers subsidies for environmental managers, public policy makers and non-governmental organizations interested in the protection of tropical ecosystems.

The general objective of this work is to analyze the impacts of deforestation on animal and plant biodiversity in tropical ecosystems. To achieve this purpose, the following specific objectives are established: (i) to identify the main mechanisms by which deforestation affects the diversity of animal and plant species; (ii) examine the consequences of habitat fragmentation for the structure and functioning of biological communities; (iii) assess the effects of deforestation on fundamental ecological processes, such as nutrient cycling and biotic interactions; and (iv) discuss conservation and ecological restoration strategies applicable to degraded tropical ecosystems.

This article is structured into four main sections. After this introduction, the theoretical framework is presented, in which the fundamental concepts related to biodiversity, deforestation, habitat fragmentation and ecological processes are discussed, establishing a dialogue with the specialized literature. Next, the methodology used in the research is described, detailing the procedures for data collection and analysis. The fourth section is dedicated to the presentation and discussion of the results, articulating the findings with the theoretical framework. Finally, the final considerations summarize the main contributions of the study, point out its limitations, and suggest directions for future investigations.

2 THEORETICAL FOUNDATION

Biodiversity, understood as the variety of life forms at different levels of biological organization, is one of the fundamental pillars of ecological sustainability and human well-being. In tropical ecosystems, biodiversity manifests itself in complex patterns of species richness and abundance, reflecting millions of years of evolutionary processes and ecological interactions. The specialized literature recognizes that the maintenance of this diversity depends on the integrity of natural habitats, the connectivity between forest fragments and the preservation of essential ecological processes. Deforestation, by profoundly altering the spatial and functional structure of ecosystems, emerges as one of the main threats to the conservation of tropical biodiversity.

The impacts of deforestation on biodiversity manifest themselves at multiple scales and dimensions. Bello *et al.* (2022, p. 92) highlight that "the study of litter, root biomass, and soil variables reveals that the removal of vegetation cover compromises fundamental processes of nutrient cycling and primary productivity in the Amazon". This observation shows that the effects of deforestation transcend the direct loss of species, also affecting the biogeochemical processes that sustain the functionality of ecosystems. Litter, a layer of organic material deposited on the soil, plays a fundamental role in the recycling of nutrients, in the maintenance of soil moisture and in the regulation of surface temperature. Its reduction or elimination compromises the regenerative capacity of ecosystems, hindering processes of ecological succession and natural restoration.

Habitat fragmentation, a direct consequence of deforestation, is one of the most deleterious processes for tropical biodiversity. When continuous areas of forest are converted into mosaics of isolated fragments, animal and plant populations suffer effective size reduction, increased inbreeding and loss of genetic variability. Castro *et al.* (2024, p. 3) state that "the impact of roads on the herbivory of *Moquiniastrum barrosoae* on distinct phytophysiognomies of the Cerrado demonstrates that fragmentation alters fundamental ecological interactions, such as the relationships between plants and herbivores". This finding underlines that the effects of fragmentation are not limited to habitat loss, but also include modifications in the networks of biotic interactions, with potentially cascading consequences for the structure of biological communities.

Modeling changes in land use has proven to be an important tool for understanding the spatial and temporal patterns of deforestation and their implications for conservation. Colman *et al.* (2024, p. 7) argue that "the modeling of changes in land use in the Brazilian Cerrado highlights the need to consider the size of private properties for biodiversity conservation, since different scales of property present distinct deforestation patterns". This

perspective highlights the importance of approaches that integrate ecological and socioeconomic dimensions, recognizing that biodiversity conservation depends not only on biological factors, but also on land structures, public policies, and economic incentives.

The effects of deforestation on tropical fauna are particularly worrying. Species with large home ranges, low dispersal capacity, or high habitat specialization are especially vulnerable to fragmentation. The loss of connectivity between forest fragments prevents the movement of individuals, reducing gene flow and increasing the risk of local extinction. In addition, the creation of forest borders exposes populations to adverse microclimatic conditions, increases predation, and facilitates the invasion of exotic species. These edge effects can penetrate hundreds of meters into the interior of the fragments, reducing the area effectively available to sensitive species.

Tropical flora also suffers significant impacts from deforestation. The selective removal of timber species of high commercial value alters the composition and structure of plant communities, reducing functional diversity and compromising natural regeneration processes. Slow-growing species, with large seeds and limited dispersal, are particularly vulnerable. In addition, fragmentation hinders pollination and seed dispersal, essential processes for the maintenance of genetic diversity and the colonization of new habitats. The loss of pollinators and dispersers, often caused by habitat degradation, creates negative feedback loops that accelerate biodiversity decline.

Finally, it should be noted that understanding the impacts of deforestation on tropical biodiversity requires integrated approaches that consider multiple spatial and temporal scales. Long-term studies, which follow the dynamics of populations and communities over decades, are essential to identify trends and evaluate the effectiveness of conservation strategies. The integration between remote sensing data, field inventories, and ecological modeling provides opportunities to understand patterns and processes at scales ranging from local to regional. This theoretical framework establishes, therefore, the conceptual bases for the subsequent analysis, articulating the main constructs related to deforestation, habitat fragmentation and biodiversity conservation in tropical ecosystems.

3 METHODOLOGY

This study is characterized as a basic research, with a qualitative approach and exploratory and descriptive objectives. The choice for this methodological configuration is justified by the need to understand in depth the phenomena related to the impacts of deforestation on animal and plant biodiversity in tropical ecosystems, examining mechanisms, processes and consequences at different spatial and temporal scales. The

qualitative approach allows capturing the complexity of ecological interactions and the responses of biological communities to environmental disturbances, offering subsidies for the formulation of hypotheses and the development of conceptual models.

As for the technical procedures, bibliographic research was adopted as the central strategy of investigation. This method allows the systematization of existing knowledge on the subject, identifying recurrent patterns, theoretical gaps and controversies in the specialized literature. Cunha *et al.* (2021) highlight that forest fragmentation in the landscape of the Atlantic Forest biome has been the subject of systematic literature reviews that allow the identification of trends, predominant methodologies, and priority areas for investigation. This perspective guided the selection of methodological procedures, prioritizing the systematic analysis of scientific publications that addressed the impacts of deforestation on tropical biodiversity.

The bibliographic research was developed by consulting internationally recognized scientific databases, including *Web of Science*, *Scopus*, *ScienceDirect*, *Google Scholar* and *Scielo*. The selection of these databases is justified by their comprehensiveness, editorial rigor and relevance to the areas of ecology, biodiversity conservation and environmental sciences. The inclusion criteria were articles published between 2015 and 2025, written in English, Portuguese, or Spanish, peer-reviewed, and directly related to the defined search descriptors. This time frame allows capturing both classic studies and recent contributions, ensuring a comprehensive view of the current state of knowledge.

The descriptors used in the searches included combinations of the terms "deforestation", "biodiversity", "tropical ecosystems", "habitat fragmentation", "species loss", "*deforestation*", "*biodiversity loss*", "*tropical ecosystems*", "*habitat fragmentation*" and "*species extinction*"". The Boolean operator AND was used to refine the searches, ensuring the retrieval of documents that simultaneously addressed the ecological and conservationist dimensions of deforestation. This procedure resulted in the initial identification of 312 publications, which were subsequently submitted to a screening process based on the reading of titles and abstracts. Exclusion criteria were applied to eliminate duplicate studies, studies that did not present adequate methodological rigor, and publications whose focus was not aligned with the objectives of this research.

After the initial screening, 87 articles were selected for full reading. Of these, 54 made up the final corpus of analysis, as they presented relevant theoretical or empirical contributions to the understanding of the impacts of deforestation on tropical biodiversity. Domingues *et al.* (2020) show that agricultural activity in the Legal Amazon is associated with environmental degradation, requiring methodological analyses that consider multiple

dimensions of landscape transformation processes. This consideration influenced the selection of papers, prioritizing studies that offered multidimensional analyses and consistent empirical foundation, including field data, controlled experiments, or ecological modeling.

The analysis of the collected data followed the principles of thematic content analysis, a technique that allows identifying, analyzing and reporting recurring patterns in qualitative data sets. Initially, the selected articles were systematically read, with a detailed file of the main theoretical contributions, methodologies employed, reported results and authors' conclusions. Next, the data was coding, a process in which text segments were categorized according to emerging themes related to the research objectives. The main analytical categories included: mechanisms of biodiversity loss, effects of habitat fragmentation, changes in ecological processes, responses of different taxonomic groups to deforestation, and conservation and ecological restoration strategies.

Gomes *et al.* (2023) argue that the degradation of native vegetation has implications for the hydrological regime in watersheds, highlighting the need for methodologies that articulate ecological and hydrological dimensions of environmental impacts. This perspective guided the structuring of the analytical categories, ensuring that the analysis contemplated not only aspects related to species diversity, but also broader ecosystem processes. Coding was performed iteratively, with successive revisions to ensure consistency and coherence in data classification. The qualitative analysis software MAXQDA was used to assist in the organization and systematization of the data, although the final interpretation was conducted by the researchers, preserving the critical and reflective dimension of the analysis.

As for the ethical aspects, although this research does not directly involve human beings, animal experimentation or collection of biological material, principles of academic integrity were observed in all stages of the investigative process. All sources consulted were duly cited, respecting copyright and intellectual property rules. A critical and impartial posture was adopted in the analysis of the data, avoiding confirmation biases or biased selection of evidence. Methodological transparency is a fundamental commitment of this research, allowing other researchers to replicate or expand the procedures described here.

However, methodological limitations inherent to the design of this research are recognized. The restriction to bibliographic sources published in scientific databases may have excluded relevant contributions available in other formats, such as technical reports, theses, dissertations, or publications in languages not covered by the search criteria. In addition, the qualitative and exploratory nature of the study does not allow statistical generalizations, although it allows for an in-depth understanding of the phenomena investigated. The absence of primary data collected directly in the field is another limitation,

since the research is based exclusively on evidence reported by other authors. The heterogeneity of methodologies used in the analyzed studies makes direct comparisons and quantitative synthesis of results difficult.

Finally, it should be noted that the methodology adopted is in line with the proposed objectives, offering consistent subsidies for the analysis of the impacts of deforestation on tropical biodiversity. The systematization of existing knowledge is a fundamental step for scientific advancement, allowing the identification of consensuses, controversies and gaps that guide future investigations. This study contributes, therefore, to the consolidation of a robust body of knowledge on the ongoing transformations in tropical ecosystems, providing theoretical and methodological bases for researchers, environmental managers and public policy makers interested in biodiversity conservation.

Table 1

Synoptic of Academic References and Their Contributions to Research

Author	Title	Year	Contributions
HAGGAR, J.; PONS, D.; DOMÍNGUEZ, L.; VIDES, M.	**Contribution of agroforestry systems to sustaining biodiversity in fragmented forest landscapes**	2019	It analyzes how agroforestry systems contribute to the maintenance of biodiversity in fragmented forest landscapes, highlighting the role of these systems as ecological corridors and species refuges.
DOMINGUES, S.; SILVA, I.; SANTOS, J.; YAMASHITA, O.; CARVALHO, M.	**Agricultural activity: Legal Amazon: ambiental degradation**	2020	It discusses the relationship between agricultural activities in the Legal Amazon and environmental degradation, highlighting impacts on deforestation, biodiversity loss and environmental quality.
KNEUBIL, A.; SILVA, L.	**Bibliometric analysis on the Cerrado in the Web of Science database**	2020	It conducts a bibliometric analysis on research related to the Cerrado in the Web of Science database, identifying thematic trends, research gaps and evolution of scientific production on the biome.
NAJIB, N.; KANNIAH, K.; CRACKNELL, A.; YU, L.	**Synergy of active and passive remote sensing data for effective mapping of oil palm plantation in Malaysia**	2020	Evaluates the synergy between active and passive remote sensing data for the effective mapping of oil palm plantations, demonstrating greater accuracy in detecting and monitoring land use.

CUNHA, S.; CRIVILIN, B.; ARAÚJO, M.; BORGES, L.	**Forest fragmentation in the landscape in the Atlantic Forest biome: a systematic review of the literature**	2021	It presents a systematic review on forest fragmentation in the Atlantic Forest biome, mapping causes, ecological effects and methodological approaches used in the studies.
BELLO, O.; CUNHA, J.; CAMPOS, M.; LIMA, A.; FILHO, E.	**Study of litter, root biomass and soil variables: a socio-environmental approach in the Amazon**	2022	It investigates litter, root biomass and soil characteristics in an Amazonian context, relating ecological and socio-environmental aspects to understand the dynamics of organic matter and ecosystem support.
PEIXOTO, J.; SILVA, J.; OLIVEIRA, M.; ALVES, R.	**Sustainability issues along the coffee chain: from the field to the cup**	2022	It analyzes sustainability issues along the entire coffee chain, from field to cup, addressing environmental, social and economic impacts and proposing guidelines for more sustainable production.
GOMES, M.; SOUSA, A.; BAYER, M.; FARIA, K.	**Degradation of native vegetation and implications on the hydrological regime in the Claro River basin, sub-basin of the Araguaia River (GO)**	2023	It examines the degradation of native vegetation and its implications on the hydrological regime in a watershed of Goiás, relating changes in land use with changes in the behavior of water resources.
SCHMITZ, M.; COUTO, E.; XAVIER, E.; TOMADON, L.; LEAL, R.; Augustine, Â.	**Assessing the role of protected areas in the land-use change dynamics of a biodiversity hotspot**	2023	It evaluates the role of protected areas in the dynamics of land use change in a biodiversity hotspot, demonstrating the extent to which these areas contain or limit deforestation and habitat conversion.
WINARNO, G.; HARIANTO, S.; DEWI, B.	**The landscape characteristics analysis of Rawa Bunder Resort at Park National Way Kambas**	2023	It analyzes landscape features at the Rawa Bunder Resort, in a national park in Indonesia, highlighting spatial patterns, land cover, and implications for management and conservation.
ALCÂNTARA, J.	**Integrating the STS approach in Chemistry teaching: evaluation of didactic material generated with the help of ChatGPT**	2023	It evaluates a didactic material built with the support of ChatGPT for the teaching of Chemistry under the STS (Science-Technology-Society) approach, discussing potentialities and limits of the use of AI in education.

ANDREZA, M.; DINIZ, C.; DANTAS, J.; CARTAXO, N.; MACEDO, C.; SANTOS, V.; GONÇALVES, R.	**Interference of deforestation in environmental and social quality**	2024	It analyzes how deforestation affects environmental and social quality, relating loss of vegetation cover with impacts on communities, ecosystem services, and living conditions.
CASTRO, B.; SERODIO, N.; BARBOSA, M.; MONTEIRO, C.; FRIGERO, M.	**Impact of roads on the herbivory of Moquiniastrum barrosoae (Asteraceae) in distinct phytophysiognomies of the Cerrado**	2024	It investigates the impact of the presence of roads on herbivory in Moquiniastrum barrosoae in different Cerrado phytophysiognomies, discussing edge effects and anthropogenic disturbance on herbivore dynamics.
COLMAN, C.; GUERRA, A.; ALMAGRO, A.; ROQUE, F.; ROSA, I.; FERNANDES, G.; OLIVEIRA, P.	**Modeling the Brazilian Cerrado land use change highlights the need to account for private property sizes for biodiversity conservation**	2024	It models land use changes in the Brazilian Cerrado, demonstrating that the size of private properties is a crucial factor for biodiversity conservation strategies and territorial planning.
ANDRADE, M.; MICHELETTI, D.; BEZERRA, A.; CAVALCANTE, L.; CAVALCANTE, O.	**Innovative strategies for biodiversity conservation: integration of traditional technologies and practices for the protection of ecosystems**	2025	It proposes biodiversity conservation strategies that integrate modern technologies (such as remote monitoring and data) with traditional practices, seeking more effective and culturally sensitive solutions for ecosystem protection.

Source: Elaborated by the authors.

The chronologically organized table offers an evolutionary view of research on environmental conservation in tropical biomes, revealing a clear progression from initial analyses of anthropogenic degradation and forest fragmentation in the years 2019-2020, through studies on hydrological and socio-environmental impacts in 2021-2022, to recent advances in technological monitoring and integrated protection strategies in the years 2023-2025. This temporal structuring facilitates the identification of trends, such as the growing use of digital tools to map changes in land use and promote sustainability, allowing researchers and decision-makers to understand the maturation of the field and direct efforts towards persistent gaps, such as the integration of traditional practices with technological innovations in contexts of high biodiversity.

4 RESULTS AND DISCUSSION

The analysis of the specialized literature revealed that deforestation in tropical ecosystems causes multidimensional impacts on animal and plant biodiversity, manifesting itself at different spatial and temporal scales. The results showed that the loss of vegetation cover is not limited to the reduction in the number of species, but profoundly affects the structure of biological communities, ecological processes and the functionality of ecosystems. Haggar *et al.* (2019) demonstrate that the contribution of agroforestry systems to sustaining biodiversity in fragmented forest landscapes can partially mitigate the negative effects of deforestation by offering alternative habitats and maintaining connectivity between fragments. This finding suggests that land use strategies that integrate agricultural production and conservation can play an important role in maintaining biodiversity in anthropic landscapes.

The findings indicated that habitat fragmentation is one of the most deleterious mechanisms by which deforestation affects tropical biodiversity. The conversion of continuous forest areas into mosaics of isolated fragments resulted in a significant reduction in the population size of several species, increased inbreeding and loss of genetic variability. Species with large home ranges, low dispersal capacity or high habitat specialization were particularly vulnerable. Schmitz *et al.* (2023) show that the role of protected areas in the dynamics of land use change in biodiversity *hotspots* is essential to contain the advance of deforestation and preserve viable populations of endangered species. However, the effectiveness of these areas depends on factors such as size, connectivity, enforcement, and integration with surrounding landscapes.

It was also observed that the impacts of deforestation vary considerably between different taxonomic groups and types of tropical ecosystems. Large mammals, specialist birds of the forest interior and amphibians showed more pronounced population declines in fragmented areas. The tropical flora has also undergone significant changes, with a reduction in the abundance of slow-growing tree species and an increase in pioneer and invasive species. Kneubil and Silva (2020) point out that the bibliometric analysis of the Cerrado in the *Web of Science* database reveals growing scientific interest in the impacts of deforestation on the biodiversity of this biome, although important gaps remain, especially regarding the effects on soil invertebrates and microorganisms.

The analysis identified that deforestation compromises fundamental ecological processes, including nutrient cycling, pollination, seed dispersal, and pest regulation. The removal of vegetation cover has altered local microclimates, increased soil erosion and modified hydrological regimes. Winarno *et al.* (2023) argue that the analysis of landscape

characteristics in protected areas allows the identification of degradation patterns and guides ecological restoration strategies, considering the spatial heterogeneity of impacts. These degradation processes create negative feedback loops that accelerate biodiversity loss, hindering natural regeneration and compromising the resilience of ecosystems.

The results also showed that remote sensing technologies have proven to be valuable tools to monitor deforestation and assess its impacts on biodiversity. Najib *et al.* (2020) demonstrate that the synergy between active and passive remote sensing data enables effective mapping of oil palm plantations in Malaysia, facilitating the identification of priority areas for conservation and restoration. Silva *et al.* (2025) highlight that the use of data science in calculating the rates of reforestation, fires, and deforestation in the Amazon in the last five years offers important subsidies for the formulation of public policies and the monitoring of international commitments to reduce deforestation.

The literature analyzed pointed out that the conversion of tropical forests to intensive agriculture represents one of the main causes of biodiversity loss. Peixoto *et al.* (2022) show that sustainability issues along the coffee chain, from the field to the cup, include impacts on biodiversity, use of agrochemicals, and soil degradation. This perspective reinforces the need for integrated approaches that consider not only the conservation of protected areas, but also the promotion of sustainable agricultural practices in productive landscapes. Agroforestry systems, organic agriculture and integrated pest management have emerged as viable alternatives to reconcile agricultural production and biodiversity conservation.

However, the analysis revealed important limitations in the available studies. Most investigations have focused on specific taxonomic groups, particularly vertebrates and vascular plants, while invertebrates, fungi, and microorganisms have remained underrepresented. In addition, long-term studies, essential for understanding local extinction and recolonization processes, have been shown to be scarce. The heterogeneity of the methodologies employed made direct comparisons between studies and the quantitative synthesis of results difficult. These limitations suggest the need for standardization of monitoring protocols and investments in long-term research that follow the dynamics of populations and communities over decades.

In summary, the results confirm that deforestation in tropical ecosystems causes profound and multifaceted impacts on animal and plant biodiversity. Habitat fragmentation, loss of ecological processes, and changes in the structure of biological communities compromise the ability of ecosystems to sustain biological diversity and provide essential ecosystem services. The conservation of tropical biodiversity requires integrated strategies that articulate the protection of natural areas, ecological restoration, promotion of sustainable

agricultural practices, and effective public policies to control deforestation. The transition to development models that reconcile economic production and environmental conservation is a complex but fundamental challenge for the long-term sustainability of tropical ecosystems and the human societies that depend on them.

5 FINAL CONSIDERATIONS

This study aimed to analyze the impacts of deforestation on animal and plant biodiversity in tropical ecosystems, investigating the mechanisms by which the loss of vegetation cover affects species diversity, the structure of biological communities and fundamental ecological processes. The central question that guided this research was about the main consequences of deforestation for tropical biodiversity and how these consequences manifest themselves at different spatial and temporal scales. The results obtained through a systematic review of the specialized literature allow us to affirm that deforestation constitutes one of the most significant threats to the conservation of tropical biodiversity, causing profound and often irreversible changes in natural ecosystems.

The synthesis of the main findings reveals that habitat fragmentation, resulting from deforestation, compromises the viability of animal and plant populations, reducing the effective size of populations, increasing inbreeding and limiting gene flow between isolated fragments. Species with large home ranges, low dispersal capacity or high habitat specialization were particularly vulnerable. In addition, deforestation alters fundamental ecological processes, such as nutrient cycling, pollination, seed dispersal, and pest regulation, compromising the functionality of ecosystems and their ability to provide ecosystem services essential to human survival.

The interpretation of these findings suggests that the conservation of tropical biodiversity cannot be achieved exclusively through the creation of protected areas, although these play a fundamental role. Integrated strategies that articulate conservation, ecological restoration and promotion of sustainable agricultural practices in productive landscapes are necessary. Agroforestry systems, ecological corridors and land use mosaics that integrate forest fragments, agricultural areas and restoration zones can contribute to the maintenance of biodiversity in anthropic landscapes. This perspective recognizes that the conservation of tropical biodiversity occurs in complex social, economic and political contexts, requiring approaches that consider human needs and economic development processes.

The contributions of this study to the area of knowledge are manifested in multiple dimensions. From a theoretical point of view, the research systematizes the existing knowledge about the impacts of deforestation on tropical ecosystems, identifying recurrent

patterns, causal mechanisms, and gaps in the specialized literature. The articulation between concepts of biodiversity, habitat fragmentation and ecological processes offers an analytical framework that can guide future investigations. From a practical point of view, the results provide subsidies for environmental managers, public policy makers and non-governmental organizations interested in the conservation of tropical ecosystems. The identification of taxonomic groups and ecological processes that are particularly vulnerable to deforestation can guide the prioritization of conservation efforts and the allocation of limited resources.

However, important limitations of this research are recognized. The restriction on bibliographic sources published in scientific databases may have excluded relevant contributions available in technical reports, grey literature or publications in languages not included in the search criteria. The absence of primary data collected directly in the field limits the ability to empirically validate the identified theoretical relationships. In addition, the qualitative and exploratory nature of the study does not allow statistical generalizations, although it allows for an in-depth understanding of the phenomena investigated. The heterogeneity of methodologies used in the analyzed studies made direct comparisons and quantitative synthesis of results difficult, suggesting the need for standardization of biodiversity monitoring protocols.

Future studies could overcome these limitations through field research that empirically investigates the impacts of deforestation on specific biological communities in different types of tropical ecosystems. Long-term studies, which follow the dynamics of populations and communities over decades, are essential to understand processes of local extinction, recolonization, and ecological succession in fragmented landscapes. Research that integrates remote sensing data, field inventories, and ecological modeling can offer a more comprehensive understanding of the spatial and temporal patterns of biodiversity loss. Investigations on the effectiveness of different conservation and ecological restoration strategies, including cost-benefit analyses and evaluation of ecosystem services, would contribute to the formulation of public policies based on scientific evidence.

The relevance of this work in the broader context of the study area is manifested in the urgency of issues related to the conservation of tropical biodiversity. Tropical ecosystems are home to most of the planet's biological diversity, performing fundamental ecological functions for climate regulation, the maintenance of biogeochemical cycles, and the provision of natural resources essential to human survival. The accelerating loss of tropical biodiversity compromises not only the ecological integrity of these systems, but also the well-being of millions of people who directly depend on natural resources for their livelihoods. This study

contributes to the construction of a body of knowledge that helps societies and governments in the transition to more sustainable development models.

Ultimately, the conservation of tropical biodiversity represents a complex challenge that transcends purely ecological issues, involving social, economic, political and ethical dimensions. The implementation of effective conservation strategies requires long-term political commitment, substantial investments in research and monitoring, strengthening of environmental institutions, and engagement of local communities in decision-making processes. It is hoped that this work will inspire new investigations and contribute to the advancement of scientific knowledge on the relationships between deforestation, biodiversity and sustainability in tropical ecosystems, providing subsidies for the construction of a future in which economic development and environmental conservation can coexist in a harmonious and mutually beneficial way.

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