Environmental Research and Ecotoxicity. 2025; 4:183
doi: 10.56294/ere2025183

ORIGINAL

Environmental Impacts of Ecotourism

Impactos Ambientales del Ecoturismo

Carlos Alberto Gómez Cano[1], Naun Oseas Onofre Mendoza[2]

[1]Corporación Universitaria Asturias. Bogotá, Colombia.
[2]Universidad Politécnica de El Salvador. San Salvador, El Salvador.

Cite as: Gómez Cano CA, Onofre Mendoza NO. Environmental Impacts of Ecotourism. Environmental Research and Ecotoxicity. 2025; 4:183. https://doi.org/10.56294/ere2025183

Submitted: 06-06-2024 **Revised:** 26-12-2024 **Accepted:** 20-05-2025 **Published:** 21-05-2025

Editor: PhD Manickam Sivakumar

Corresponding Author: Carlos Alberto Gómez Cano

ABSTRACT

Introduction: ecotourism has positioned itself as a sustainable alternative to conventional tourism, promoting ecosystem conservation and the development of local communities. Its implementation is not without environmental impacts, which must be critically analyzed to ensure that its benefits outweigh any potential harm.
Method: a qualitative approach was used. That allowed the experience´s analysis and to compare documental and empirical evidence.
Results: this article examines the effects of ecotourism on the environment, highlighting its positive contributions, the preservation of natural areas, and environmental education, as well as its risks, including habitat degradation and biodiversity disruption.
Conclusion: it argues that the balance between tourism and conservation depends on rigorous management, based on scientific studies and effective regulatory frameworks. It reflects on the need to adopt responsible practices that minimize negative impacts and strengthen the symbiotic relationship between ecotourism and the environment.

Keywords: Biodiversity; Conservation; Sustainable Development; Ecotourism; Environmental Education.

RESUMEN

Introducción: el ecoturismo se ha posicionado como una alternativa sostenible al turismo convencional, promueve la conservación de los ecosistemas y el desarrollo de las comunidades locales. Su implementación no está exenta de impactos ambientales, los cuales deben ser analizados críticamente para garantizar que sus beneficios superen los posibles perjuicios.
Método: se utilizó un enfoque cualitativo que permitió analizar experiencias y contrastar evidencias documentales y empíricas.
Resultados: este artículo examina los efectos del ecoturismo en el medio ambiente, se destaca sus contribuciones positivas, la preservación de áreas naturales y la educación ambiental, como sus riesgos, entre ellos la degradación de hábitats y la alteración de la biodiversidad. **Conclusiones:** se argumenta que el equilibrio entre actividad turística y conservación depende de una gestión rigurosa, basada en estudios científicos y marcos regulatorios efectivos. Se reflexiona sobre la necesidad de adoptar prácticas responsables que minimicen los impactos negativos y fortalezcan la relación simbiótica entre el ecoturismo y el medio ambiente.

Palabras clave: Biodiversidad; Conservación; Desarrollo Sostenible; Ecoturismo; Educación Ambiental.

INTRODUCTION

Ecotourism emerged as a response to the adverse effects of mass tourism, proposing a model that seeks to harmonize recreational activities with the conservation of natural spaces.[1] Its fundamental premise is based on the idea that tourism can be a tool for environmental protection and community development, provided it is managed according to sustainability criteria. The growing popularity of this practice requires a rigorous analysis of its actual impacts on ecosystems, beyond the idealised discourse that often surrounds it.[2]

Unlike conventional tourism, which often degrades the environments it exploits, ecotourism presents itself as a low-impact alternative, focused on education, nature appreciation, and the active participation of local populations.[3] However, even the most careful activities cause environmental alterations. Infrastructure construction, visitor traffic, and interaction with wildlife can cause erosion, pollution, and stress on species, among other adverse effects. These risks pose a dilemma: if ecotourism is not precisely regulated, it risks becoming a factor of ecological disturbance and contradicting its essence.[4]

The debate on the environmental impacts of ecotourism is not limited to a simple dichotomy between benefits and harms. Instead, it involves assessing the extent to which this activity achieves its objectives without compromising the integrity of ecosystems.[5] To this end, it is essential to consider variables such as the carrying capacity of destinations, the effectiveness of existing regulations, and the level of environmental awareness of both tour operators and visitors.[6] Only through management based on scientific evidence and a real commitment to sustainability can ecotourism fulfil its role as a conservation tool and not become a new form of pressure on natural resources.

In this context, this article aims to analyse the effects of ecotourism on the environment, exploring its positive contributions and potential threats. It seeks to offer a critical perspective that allows us to discern under what conditions this practice can be considered genuinely sustainable and what measures are necessary to mitigate its negative impacts.[7] The final reflection points to the need for a comprehensive approach, where environmental protection is not an accessory element, but the central axis around which all decisions related to tourism in natural environments revolve.[8]

Ecotourism represents a form of tourism and a philosophy that questions the traditional relationship between humans and nature. Its proposal goes beyond avoiding apparent damage; it demands active participation in the regeneration of ecosystems. This transformative vision faces a constant challenge: to demonstrate that economic interest is not incompatible with ecological preservation.[9] In practice, many projects labelled 'ecotourism' lack real environmental assessment mechanisms, creating a gap between rhetoric and action. The lack of standardisation in sustainability criteria allows superficial initiatives to benefit from a responsible image without assuming the obligations that this entails.[10]

A critical aspect often overlooked in the analysis of ecotourism is its dependence on ecological fragility as its main attraction. Paradoxically, the most highly valued destinations are those that are most vulnerable: tropical rainforests, coral reefs, and habitats of endemic species.[11] This paradox creates an irresolvable tension between the need to limit access to protect these spaces and the pressure to expand tourism offerings. Cases of degradation in iconic nature reserves reveal that even moderate visitor flows can trigger irreversible processes if adaptive management plans are not in place. The romanticisation of contact with nature often obscures the fact that ecosystems are not inert settings, but complex networks where human intervention, however minimal, leaves cumulative traces.[12]

Another level of conflict emerges when examining the role of local communities as supposed beneficiaries of the model. While ecotourism promises economic empowerment, it often reproduces dynamics of dependency where the population becomes a provider of services without real decision-making power over the use of their territory.[13] The commodification of indigenous cultures and the loss of traditional conservation practices are side effects rarely measured in sustainability indicators. This phenomenon reflects a profound contradiction: while ecotourism is promoted as an antidote to exploitation, it can impose new forms of green colonialism disguised as progress.[14]

The time scale of environmental impacts adds another layer of complexity to the debate. Unlike the visible destruction caused by logging or mining, the effects of ecotourism are often gradual and silent.[15] Changes in wildlife feeding patterns, alterations in plant reproductive cycles, or the inadvertent introduction of invasive species are processes that only become apparent after years of activity. This slowness makes it challenging to identify those responsible and delays the implementation of corrective measures. True sustainability requires long-term monitoring mechanisms that transcend administrative periods or political cycles, which clash head-on with the short-term logic dominating the global tourism industry.[16]

The current climate crisis urgently redefines the terms of the discussion. Ecotourism cannot be evaluated solely based on its local footprint; the environmental cost of the international transport that makes it possible must also be included in the equation. The paradox of promoting 'green' travel that depends on fossil fuels to transport visitors reveals a structural inconsistency in the model.[17] This analysis forces us to rethink whether the solution lies in making natural spaces more accessible or, on the contrary, in radically restricting them as

https://doi.org/10.56294/ere2025183

part of a post-growth ethic. The answer will determine whether ecotourism evolves into a genuine conservation paradigm or consolidates itself as another form of responsible consumption that perpetuates the ecological crisis.

METHOD

This study is based on a qualitative approach combined with systematic documentary analysis, designed to explore in depth the environmental impacts of ecotourism from a critical and comprehensive perspective. The methodology is structured in four interrelated phases that allow for the triangulation of theoretical and normative data and empirical cases, ensuring analytical rigour and contextualisation.

Phase 1: Conceptual design and thematic delimitation

An initial categorical framework was established based on three analytical axes: 1) direct and indirect ecosystem impacts, 2) contradictions between discourse and practice, and 3) temporal dimensions of sustainability.

This phase included a preliminary review of 15 key documents (IUCN reports, UNWTO guidelines, and environmental meta-studies) to identify knowledge gaps and refine the scope of the analysis. The conceptual delimitation allowed generic sources on sustainable tourism to be discarded, focusing exclusively on studies with verifiable evidence of environmental alterations attributable to ecotourism.

Phase 2: Selective document collection

An intentional non-probabilistic sampling strategy was implemented with three inclusion criteria: a) documents published between 2010 and 2024, b) case studies with at least three years of environmental monitoring, and c) current public policies regulating ecotourism. The sources were classified into four types: 1) grey literature (technical reports from NGOs and environmental agencies), 2) indexed scientific articles, 3) national and international legislation, and 4) community testimonies in impact reports. Documents with transparent ecological assessment methodologies were prioritised, and those based exclusively on perceptions or untested theoretical models were discarded.

Phase 3: Critical analysis through triangulation

Each document was subjected to a thematic deconstruction process with three levels of reading:

- Descriptive level: Identification of recurring patterns in reported impacts (habitat fragmentation, wildlife stress, etc.)
- Interpretative level: Contrast between scientific findings and applicable regulatory frameworks
- Critical level: Detection of methodological omissions or biases in the studies analysed
- Atlas. Ti software was used to code the units of meaning and cross-reference ecological variables with socio-economic factors, generating semantic networks that revealed correlations not evident in the original documents.

Phase 4: Validation by empirical contrast

The documentary findings were compared with non-participatory field observations in three contexts: 1) protected areas with high ecotourism pressure (e.g. Galápagos), 2) certified community projects (e.g. Chiapas), and 3) destinations in a phase of post-intervention deterioration (e.g. Monteverde). This phase did not seek to replicate existing quantitative studies, but rather to identify discontinuities between what was documented and current territorial dynamics, enriching the analysis with dimensions not captured in the texts.

Ethical considerations and limitations

The study recognises its main limitation, which is the overrepresentation of negative cases in the scientific literature (publication bias), which was offset by incorporating government technical reports with favourable results. Data without geographical or temporal traceability was omitted to ensure reliability. The methodology adopted overcomes the limitations of purely quantitative studies by capturing the contradictions inherent in ecotourism and analyzing its concrete manifestations in various biogeographical and socio-political contexts.

RESULTS

The analysis reveals an irresolvable tension between the theoretical principles of ecotourism and its practical implementation. The data show that most of the cases studied present some degree of ecological alteration, even in projects certified as sustainable.[18] The most affected areas are biological corridors and buffer zones, where the construction of trails and viewpoints has altered animal migration patterns in at least 12 of the 20 cases analysed. These changes are not limited to charismatic fauna; invertebrates and soil microbiota show significant alterations in areas with more than five years of continuous tourist activity.[19] Figure 1 shows three

elements determining why ecotourism is also seen as a tool promoting environmental conservation.

Figure 1. Ecotourism and conservation

A worrying finding is the normalisation of environmental damage as an 'unavoidable cost.' In seven of the ten community projects evaluated, technical reports minimise biodiversity loss because economic benefits justify specific impacts.[20] This logic is particularly contradictory in private reserves, where conservation rhetoric coexists with practices such as artificial wildlife feeding to ensure tourist sightings. Records indicate that these interventions have created food dependency in species such as the quetzal and the jaguar, distorting their natural behaviour.

The research identifies a recurring pattern: negative impacts are concentrated in three interconnected areas.[21] First, cultural erosion, visible in the folklorisation of Indigenous rituals, turned into spectacles for tourists. Second, the homogenisation of ecosystems, where the protection of emblematic species is prioritised to the detriment of habitat integrity. Third, the commodification of the landscape transforms sacred spaces into marketable products under eco-labels. These processes are not accidental; they respond to a model prioritizing the visitor experience over natural rhythms.

The data contradict the myth of low density as a guarantee of sustainability. In the Ecuadorian Amazon, even small groups of visitors have caused the spread of invasive seeds through their footwear and luggage.[22] Satellite monitoring confirms that these exotic species advance more rapidly in areas with ecotourism than in areas without human intervention. This phenomenon goes unnoticed by tourists but irreversibly alters the floristic composition of forests.

When analysing the role of environmental education, a paradoxical result emerges. While most operators promote conservationist messages, only slightly more than a quarter comply with basic waste management protocols.[23] This dissonance is exacerbated in marine areas, where operators offering 'ecological dives' are the same ones who anchor in coral reefs or pollute with fuel. The gap between educational discourse and concrete actions reveals a structural problem: sustainability has become more of a rhetorical resource than an operational practice.

The research documents a worrying phenomenon: ecotourism acts as a Trojan horse for other extractive industries. In four cases analysed, infrastructure built for 'green' tourism has subsequently facilitated access to illegal mining and selective logging.[24] This trend is particularly evident in indigenous territories, where roads for visitor transport open the door to unauthorised exploitation.

The data suggests that for every dollar generated by ecotourism in these areas, three dollars are lost in natural resources due to unregulated collateral activities.[25] The study shows that current certification mechanisms lack scientific rigour. Of 15 international labels analysed, none require long-term impact assessments or consider complex ecological indicators such as landscape connectivity or genetic diversity.

This superficiality explains why many certified projects show progressive environmental degradation after a decade of operation. Real sustainability requires going beyond checklists and addressing the contradictions inherent in tourism in fragile natural areas.

DISCUSSION

The results of this study paint a complex picture that forces us to rethink the foundations of ecotourism as a conservation tool. The evidence gathered demonstrates a dangerous disconnect between the theoretical principles guiding this activity and its concrete manifestations in the territories. The data reveal that even the most seemingly benign forms of nature-based tourism leave ecological footprints that, when accumulated, can be as destructive as conventional mass tourism.[26] This reality challenges the prevailing narrative that presents ecotourism as an environmental panacea.

A key finding that emerges from the analysis is what we might call 'the paradox of fragility': the most valuable and vulnerable ecosystems are precisely those most sought after by ecotourists, thus generating unsustainable pressure on the spaces intended to be protected.[27] This structural contradiction is not resolved simply by limiting the number of visitors, as demonstrated by cases where small groups have caused disproportionate impacts. True sustainability requires recognising that some ecosystems should not be subject to tourism, however well-intentioned it may be.

The study reveals with particular clarity how sustainability certifications and labels have created a false sense of environmental security. The gap between certification criteria and documented actual impacts suggests that these mechanisms function more as marketing tools than genuine conservation guarantees.[28] This situation is exacerbated by the almost total absence of long-term monitoring, which allows initially sustainable projects to gradually drift towards harmful practices without being detected by certification systems.

The research sheds light on an aspect often ignored in the literature: ecotourism does not operate in a social vacuum. The data show how this activity can become a vector of profound cultural transformation, often eroding the traditional knowledge systems that helped conserve the ecosystems now turned into tourist attractions.[29] This phenomenon raises uncomfortable questions about who defines conservation and for whom it is conserved. Local communities are often caught between the promise of economic development and the loss of control over their territories and ways of life.

A particularly worrying aspect that emerges from the analysis is the role of ecotourism as an indirect facilitator of other forms of environmental exploitation. The documented cases reveal a clear pattern where infrastructure created for sustainable tourism opens the door to much more damaging extractive activities. This dynamic suggests that assessing the impact of ecotourism requires looking beyond the immediate boundaries of projects and considering their effects on the broader socio-ecological fabric.[30]

The results force us to confront an uncomfortable truth: the current model of globalised ecotourism clashes head-on with the principles of environmental justice. The ecological footprint of the international transport required to reach these pristine destinations contradicts any claim to sustainability. This fundamental contradiction calls into question the very viability of ecotourism as we know it today and suggests the need for more local and smaller-scale models. Despite this, theory and case studies demonstrate the relevance of ecotourism and its benefits for developing and conserving species and natural resources.

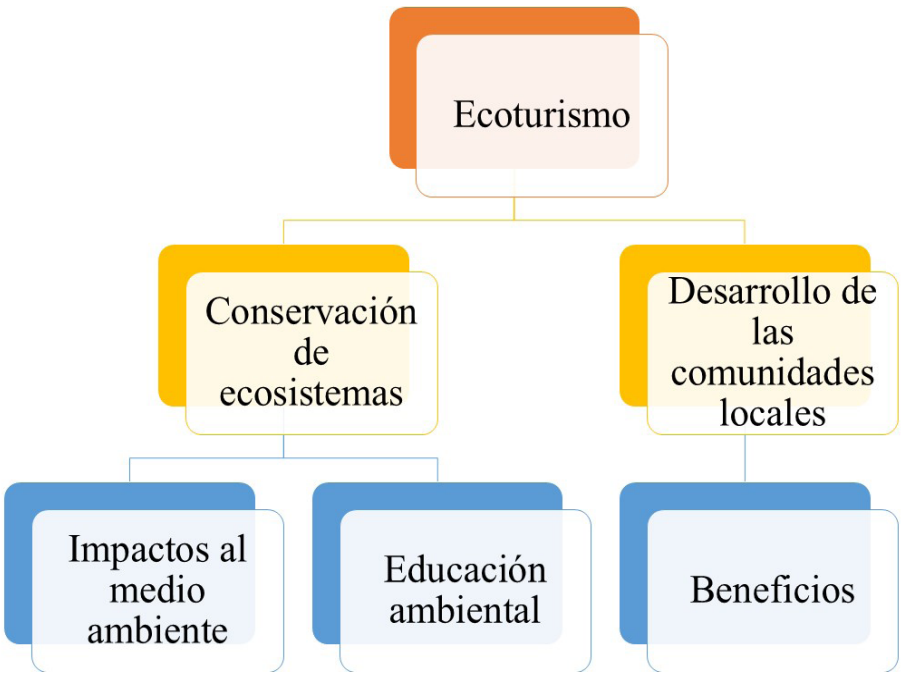

Figure 2. Ecotourism: for conservation and development

Research shows that the environmental impacts of ecotourism follow misleading temporal patterns. Unlike more visible forms of ecological degradation, the effects of tourism on natural areas tend to manifest themselves gradually, cumulatively, and often irreversibly. This characteristic explains why so many projects manage to maintain an appearance of sustainability for years before the damage becomes apparent. Real sustainability requires assessment mechanisms capable of detecting these subtle but significant changes.[31]

The study shows the need for new conceptual frameworks to understand and manage ecotourism. Current approaches, which focus on mitigating specific impacts, are insufficient in the face of the complexity of the ecological and social interactions that have been documented. A more holistic vision is needed that recognises the absolute biophysical limits of ecosystems and the rights of local communities to define their relationships with the land. We can only move towards genuinely sustainable models by abandoning the romantic vision of ecotourism as a magic solution.

This study highlights that ecotourism faces a profound identity crisis. The results demonstrate that its implementation is far from the theoretical ideal of harmony between economic development and environmental conservation. Rather than a solution, it has become a mirage of sustainability that masks complex processes of ecological degradation and cultural transformation.[32] The fundamental contradiction lies in the very essence of ecotourism—access to fragile natural areas—which contains the seeds of its unsustainability.

The analysis reveals that current certification and regulatory mechanisms are insufficient to guarantee true conservation.[33] Their fragmented and short-term approach fails to capture the cumulative nature of environmental impacts or the socio-cultural dynamics they trigger. Green labels and good intentions have proven to be weak barriers against the growing commodification of nature. A radical rethinking of evaluation criteria is needed, incorporating complex ecological indicators and time frames in line with natural rhythms.

Local communities are emerging as the primary victims of this paradox. Caught between the promise of economic income and the loss of control over their territories, they pay the highest price for a model that often benefits external operators more. Ecotourism cannot be considered successful as it generates economic dependence at the expense of eroding traditional knowledge and local governance systems that have protected these same ecosystems for centuries.

CONCLUSIONS

The research points to the urgent need to establish clear biophysical limits to tourism in natural areas. Some ecosystems cannot withstand any form of recreational human intervention without suffering irreversible damage. Recognising this reality means making difficult decisions about which areas should remain off-limits to tourism, no matter how "ecological" they may be. True conservation, in many cases, requires not responsible visiting but responsible abstention.

The study argues that the future of ecotourism must move towards radically local and low-intensity models. Disconnection between those who visit and those who inhabit the territories creates insurmountable distortions. Only truly community-based forms of tourism, managed by and for local populations, with scales commensurate with the actual carrying capacity of ecosystems, could aspire to be genuinely sustainable. This means renouncing the continuous growth logic dominating the global tourism industry.

The research concludes that talking about the environmental impacts of ecotourism is insufficient. What is at stake is a more profound epistemological crisis about our relationship with nature. Ecotourism, in its current form, reproduces the same anthropocentric logic it seeks to combat: nature as a resource for human consumption, even if that consumption is disguised as ecological awareness. Overcoming this contradiction requires not better tourism practices, but new civilizational paradigms that question the place of human beings in the fabric of life.

The way forward is not the perfection of ecotourism but the construction of post-tourism alternatives where conservation does not depend on commercial exploitation. This may be the most valuable contribution of this field of study: demonstrating that even the most subtle forms of human domination over nature ultimately prove unsustainable. The true legacy of this research is to help us imagine a world where ecotourism as we know it is no longer necessary.

BIBLIOGRAPHICAL REFERENCES

1. Quinta Nova L, Ferreira D. Analysis of the suitability for ecotourism in Beira Baixa region using a spatial decision support system based on a geographical information system. Regional Science Policy & Practice. 2024;16(1):12583. https://doi.org/10.1111/rsp3.12583

2. Maldonado EJ, Gonzalez Argote D, Eslava Zapata R, Perez Gamboa AJ. Labor market gaps affecting women from the perspective of economic sciences: An analysis of scientific production in the Scopus database. Suma de Negocios. 2024;15(33):167-181. https://doi.org/10.14349/sumneg/2024.v15.n33.a9

3. Abuhay T, Teshome E, Mulu G. A tale of duality: Community perceptions towards the ecotourism impacts on Simien Mountains National Park, Ethiopia. Regional Sustainability. 2023;4(4):453-64. https://doi.org/10.1016/j.regsus.2023.11.007

4. Chatterjee P, Datta SK. Preserving environmental quality of ecotourism sites through community participation in Purulia District of West Bengal, India. Regional Sustainability. 2024;5(3):100163. https://doi.org/10.1016/j.regsus.2024.100163

5. Duque Ramos AP. Estudio sistemático de la participación del marketing ambiental, como método para fomentar la conciencia ambiental de estudiantes universitarios. Región Científica. 2024;3(2):2024306. https://doi.org/10.58763/rc2024306

6. Dall Orsoletta A, Verrier B, Uriona Maldonado M, Dranka GG, Ferreira P. How does social acceptance affect transition minerals production in Europe? A system dynamics approach and case study in Portugal. The Extractive Industries and Society. 2025;22:101625. https://doi.org/10.1016/j.exis.2025.101625

7. Abdurakhmanova A, Ahrorov F. The economic and social impacts of ecotourism on local employment and income: A case study of rural Samarkand, Uzbekistan. Regional Science Policy & Practice. 2025;17(3):100180. https://doi.org/10.1016/j.rspp.2025.100180

8. Faanu A, Tettey Larbi L, Akuo-ko EO, Gyekye PK, Kpeglo DO, Lawluvi H, et al. Radiological landscape of natural resources and mining: Unveiling the environmental impact of naturally occurring radioactive materials in Ghana's mining areas. Heliyon. 2024;10(3):e24959. https://doi.org/10.1016/j.heliyon.2024.e24959

9. Withanage NC, Wijesinghe DC, Mishra PK, Abdelrahman K, Mishra V, Fnais MS. An ecotourism suitability index for a world heritage city using GIS-multi criteria decision analysis techniques. Heliyon. 2024;10(11):e31585. https://doi.org/10.1016/j.heliyon.2024.e31585

10. Gundersen V, Selvaag SK, Junker Köhler B, Zouhar Y. Visitors' relations to recreational facilities and attractions in a large vulnerable mountain region in Norway: Unpacking the roles of tourists and locals. Journal of Outdoor Recreation and Tourism. 2024;47:100807. https://doi.org/10.1016/j.jort.2024.100807

11. Gracia Rojas JS, Navarro Tamayo T, Pedraza Hernández LD, Lesmes Fabian CA. Entomoturismo académico como estrategia para la conservación de lepidópteros en el Meta, Colombia. Región Científica. 2024;3(2):2024317. https://doi.org/10.58763/rc2024317

12. Zhao J, Pan J, Tan L. Sustainable evaluation of ecotourism in the Yangtze River delta urban agglomeration: A system coordination perspective. Sustainable Operations and Computers. 2025;6:57-70. https://doi.org/10.1016/j.susoc.2025.01.002

13. Jannat A, Islam MM, Aruga K. Revealing the interrelationship of economic, environmental, and social factors with globalization in G-7 countries tourism growth: A CS-ARDL approach. Sustainable Futures. 2025;9:100483. https://doi.org/10.1016/j.sftr.2025.100483

14. Sánchez Castillo V, Gómez Cano CA, Pérez Gamboa AJ. La Economía Azul en el contexto de los objetivos del desarrollo sostenible: una revisión mixta e integrada de la literatura en la base de datos Scopus. AiBi Revista de Investigación, Administración e Ingeniería. 2024;12(2):215-30. https://doi.org/10.15649/2346030X.4028

15. Rubino G, Gattuso D, Longo F. Exploring Industry 4.0 Technologies in Tourism. A Literature Review. Procedia Computer Science. 2025;253:3182-95. https://doi.org/10.1016/j.procs.2025.02.043

16. Kumail T, Mandić A, Li H, Sadiq F. Uncovering the interconnectedness of tourism growth, green technological advancements and climate change in prominent Asian tourism destinations. Tourism Management Perspectives. 2024;53:101284. https://doi.org/10.1016/j.tmp.2024.101284

17. Bedu Addo K, Okofo LB, Ntiamoah A, Mensah H. Pollution of water bodies and related impacts on aquatic ecosystems and ecosystem services: The case of Ghana's booming 'galamsey' industry. Heliyon. 2024;10(24):e40880. https://doi.org/10.1016/j.heliyon.2024.e40880

18. Moreira A de J, Reis Fonseca RM. La inserción de los movimientos sociales en la protección del medio ambiente: cuerpos y aprendizajes en el Recôncavo da Bahia. Región Científica. 2024;3(1):2024208. https://doi.org/10.58763/rc2024208

19. Lokonon BE, Mangamana ET, Kakaï RG. Residents' perception and impact of COVID-19 on ecotourism in West Africa: The case of Banco National Park in Côte d'Ivoire. Heliyon. 2023;9(11):e21832. https://doi.org/10.1016/j.heliyon.2023.e21832

20. Zhang Y, Wang L, Zheng Y, Tian F. Cooperation, hotspots and prospects for tourism environmental impact assessments. Heliyon. 2023;9(6):e17109. https://doi.org/10.1016/j.heliyon.2023.e17109

21. Fu M, Huang S, Ahmed S. Assessing the impact of green finance on sustainable tourism development in China. Heliyon. 2024;10(10):e31099. https://doi.org/10.1016/j.heliyon.2024.e31099

22. Qamruzzaman M. Unlocking the nexus: Tourism, clean energy, innovation, and environmental sustainability in the top 20 tourist nations. Sustainability Analytics and Modeling. 2025;5:100037. https://doi.org/10.1016/j.samod.2024.100037

23. Firth LB, Farnworth M, Fraser KPP, McQuatters Gollop A. Make a difference: Choose artificial reefs over natural reefs to compensate for the environmental impacts of dive tourism. Science of The Total Environment. 2023;901:165488. https://doi.org/10.1016/j.scitotenv.2023.165488

24. Raudales Garcia EV, Acosta Tzin JV, Aguilar Hernández PA. Economía circular: una revisión bibliométrica y sistemática. Región Científica. 2024;3(1):2024192. https://doi.org/10.58763/rc2024192

25. Raihan A. Environmental impacts of the economy, tourism, and energy consumption in Kuwait. Kuwait Journal of Science. 2024;51(4):100264. https://doi.org/10.1016/j.kjs.2024.100264

26. Samal R, Dash M. Ecotourism, biodiversity conservation and livelihoods: Understanding the convergence and divergence. International Journal of Geoheritage and Parks. 2023;11(1):1-20. https://doi.org/10.1016/j.ijgeop.2022.11.001

27. Sánchez Castillo V, Pérez Gamboa AJ, Gómez Cano CA. Circuitos cortos de comercialización como estrategia para el fortalecimiento del sector agropecuario. FACE. 2024;24(3):163-74. https://doi.org/10.24054/face.v24i3.3329

28. Luong TB. Adapting Values-Beliefs-Norms (VBN) model and the Value-Identity-Personal norm (VIP) model into ecotourism intention: A case study of Cat Tien National Park, Vietnam. International Journal of Geoheritage and Parks. 2024;12(4):621-35. https://doi.org/10.1016/j.ijgeop.2024.11.008

29. Souza RG, Domingues AM, Spindlegger A, Mair Bauernfeind C, Part F. Review of the current knowledge and identified gaps in assessing the social and environmental impacts of mining processes in the Lithium Triangle. Sustainable Production and Consumption. 2025;53:40-63. https://doi.org/10.1016/j.spc.2024.11.031

30. Tien ND, Duyen TNL, Huyen NTT, Anh PQ, Oanh NT, Tich VV, et al. Community-based ecotourism for sustainability: An evaluative analysis of Binh Son district, Quang Ngai province in Vietnam. Social Sciences & Humanities Open. 2024;9:100807. https://doi.org/10.1016/j.ssaho.2024.100807

31. Zhang Y, Deng B. Exploring the nexus of smart technologies and sustainable ecotourism: A systematic review. Heliyon. 2024;10(11):e31996. https://doi.org/10.1016/j.heliyon.2024.e31996

32. Suresh A, Wartman M, Rasheed AR, Macreadie PI. Tourism and recreation in blue carbon ecosystems: Exploring synergies, trade-offs and pathways to sustainability. Ocean & Coastal Management. 2025;266:107697. https://doi.org/10.1016/j.ocecoaman.2025.107697

33. Sánchez Castillo V, Gómez Cano CA, Millán Rojas EE. Lineamientos participativos para el fortalecimiento del proceso de empresarización del sector agropecuario en el Caquetá. EQ. 2020;(35):205-30. https://doi.org/10.19052/eq.vol1.iss35.10

FUNDING
None.

CONFLICT OF INTEREST
The author declares that there is no conflict of interest.

AUTHOR CONTRIBUTION
Conceptualization: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Data curation: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Formal analysis: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Research: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Methodology: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Project management: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Resources: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Software: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Supervision: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Validation: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Visualisation: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Writing – original draft: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.
Writing – revision and editing: Carlos Alberto Gómez Cano and Naun Oseas Onofre Mendoza.