

Development processes, conflicts and conservation in the Amazon basin: mapping and analysis of research trends

Procesos de desarrollo, conflictos y conservación en la cuenca amazónica: mapeo y análisis de tendencias de investigación

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ABSTRACT

The Amazon basin faces significant challenges due to resource exploitation, armed conflicts and the need for sustainable development. This paper presents a methodology of thematic review, trend mapping and bibliometric analysis through the analytical tools VOSviewer and RStudio bibliometric package. The information was obtained from the Scopus and Web of Science databases. Sixty-one

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articles meeting the search criteria were identified. The research trends are oriented to: Socio-environmental and political conflicts and impacts, conservation and community resistance, governance and governability, and extractivist practices. The results of this review provide other researchers with a synthesis of the panorama of studies on the problems of degradation, conservation and socio-political conditions of the Amazon basin that can contribute to the development of policies and future research.

KEYWORDS

Development, conflict, conservation, Amazon basin, governance

RESUMEN

La cuenca amazónica enfrenta desafíos significativos debido a la explotación de recursos, conflictos armados y necesidad de desarrollo sostenible. Este trabajo presenta una metodología de revisión temática, mapeo de tendencias y análisis bibliométrico a través de las herramientas de analítica VOSviewer y paquete bibliométrico de RStudio. La información se obtuvo de las bases de datos Scopus y Web of Science. Se identificaron 61 artículos que cumplen con los criterios de búsqueda. Las tendencias de investigaciones se orientan a conflictos e impactos socioambientales y políticos, conservación y resistencias comunitarias, gobernanza y gobernabilidad, y prácticas extractivistas. Los resultados de esta revisión aportan a otros investigadores una síntesis del panorama de estudios frente a la problemática de degradación, conservación y condiciones sociopolíticas del bioma amazónico que pueden contribuir al desarrollo de políticas y futuras investigaciones.

PALABRAS CLAVE

Desarrollo, conflicto, conservación, cuenca amazónica, gobernanza

Introduction

The Amazon represents one of the richest ecosystems on earth in flora and fauna, hosting approximately 10% of plants and vertebrates, concentrated in about .5% of the planet's surface (Albert et al., 2023; Celis et al., 2023; Stegmann et al., 2024). Although these Amazonian landscapes are socio-ecological ecosystems that contribute to biodiversity and climate

regulation, there is no doubt that the increasing population density represents a risk factor, as a consequence of the different productive and extractive activities, infrastructure development, timber exploitation and illicit crops, among others (Chavarría and Redondo, 2023). Another factor that aggravates this panorama is forest fires, which in recent years have caused damage not only to ecosystems, but also to urban and rural communities, suggesting the need to add measures to help understand the factors that trigger this phenomenon and propose mitigation measures (Celis et al., 2023; Mosquera-Guerra et al., 2025).

While deforestation has posed a great threat to Amazonian tree species, climate change could exceed its scope in a very short time, with the aggravating factor that these phenomena combined could cause a decrease of up to 58% in the richness of these species by 2050 (Flores et al., 2024; Gomes et al., 2019). According to the Foundation for Conservation and Sustainable Development (FCDS), in 2020, 109,302 hectares of forest were destroyed in the Amazon, and the devastation continued in 2021 with the loss of an additional 112,899 hectares (FCDS, 2021). There is no doubt that both deforestation and climate change increase the loss of native lands, which amplifies the disruption of the already affected balance. However, although the Amazon plays a fundamental role in regulating the global climate, it cannot alone counteract greenhouse gas emissions that come mainly from industrialized economies, especially China, Europe, and North America. Therefore, climate change mitigation requires a joint and co-responsible effort at the global level, involving transformations in the production and consumption patterns of regions with the largest carbon footprint (Bersalli et al., 2023).

The Intergovernmental Panel on Climate Change (IPCC) has projected that temperatures in tropical forests could potentially increase by up to 4.8 °C by the end of this century (Ometto et al., 2022). The World Wildlife Fund (WWF) reported that more than 15% of the Amazon biome has mining concessions and contracts for oil and gas extraction, and protected areas are no exception. Of these, there are more than 800 mining concessions that have been granted in these areas. When analyzing the 439 protected areas, it has been found that more than half are partially or totally with mining concessions, contracts that could affect 24 million hectares (WWF, 2017).

The loss of tropical forests is associated with human activities that continuously threaten these ecosystems, from cattle ranching to the expansion of infrastructure, causing not only loss of biodiversity, but also a decrease in the protection of soil and water resources (Armenteras et al., 2021; Zheng et al., 2025). In this sense, it seems that the great natural

wealth of the Amazon is in turn one of its greatest threats, considering the historical continuity of extractive activities in the early twentieth century; the current geopolitical trends of degradation and deforestation of nature in the present century highlight the exploitation of natural resources in the Amazon rainforest (Walsh Perú, 2007).

The importance of Latin American forests is planetary in scope, to the point that South America alone possesses 21% of the world's remaining forests (Armenteras et al., 2021, 2021); however, the insertion of this territory in the global economy has generated a high cost to this environmental heritage (Walsh Perú, 2007) and its communities, as a consequence of socio-environmental emergencies, conflicts, violence and resistance of its inhabitants (Villa, 2012). Thus, the development of expansionist projects with extractive actions in South American countries (Bonilla, 2015), has been configured as the cause of social, cultural, ethnic and political crises, intensifying violence due to the dispute over natural resources, intensifying poverty and widening inequalities in these territories.

Perhaps the phenomenon that has become most acute in the territories are related to armed conflict, driven by illegal activities such as logging, mining and drug trafficking with serious environmental and social consequences (Krampe et al., 2025) Illegal logging and mining activities, often protected by armed groups, result in deforestation and contamination of water sources (Nguyen et al., 2023; Rorato et al., 2021). Rainforest destruction contributes to climate change by reducing the Earth's capacity to absorb carbon dioxide (Kafy et al., 2023; Lawrence et al., 2022). In addition, biodiversity loss due to habitat destruction threatens countless species, some of which have yet to be discovered (Boulton et al., 2022; Gonçalves-Souza et al., 2020). The presence of armed groups in the Amazon exacerbates social inequalities. For example, indigenous communities, who have lived in harmony with the rainforest for centuries, are often displaced from their ancestral lands (Pandey, 2024). These communities face violence and intimidation, leading to a loss of cultural heritage and traditional knowledge (Kingston, 2015). In addition, the exploitation of natural resources by armed groups often benefits a few, while the majority of the local population remains impoverished (Watson and Arce, 2024).

The consequences of the armed conflict in these territories are experienced most strongly by vulnerable communities, especially indigenous communities. Despite national and international regulations that protect these territories, armed groups often violate their rights with impunity (Sriram and Ross, 2007). The lack of enforcement of these laws allows for the continued exploitation and marginalization of indigenous communities (Noon et al., 2023). Protection of the Amazon requires not only

environmental conservation efforts, but also recognition and enforcement of indigenous rights (Schwartzman and Zimmerman, 2005; Washington et al., 2024).

Indigenous peoples, who have lived and cared for these ancestral territories for many generations, occupy more than 404 million hectares in Latin America of which 237 million are in the Amazon Basin (FAO, 2021). However, deforestation activities such as agriculture, logging and mining take over these lands, dispossessing communities of their territories, practices and traditional ways of life. In this sense, the armed conflict in the Amazon has far-reaching consequences that go beyond environmental destruction. It exacerbates social inequalities and undermines the rights of indigenous communities (Rojas, 2025). Furthermore, the territories occupied today by Amazonian indigenous peoples are also the result of historical processes of displacement and reorganization. Since the 16th century, epidemics, slavery, and colonial expansion have forced many communities to live in more remote areas of the jungle. These changes transformed the original distribution of the population and consolidated new forms of occupation and cultural resistance (Nascimento et al., 2024).

These problems have brought interest to researchers and the fields of study have focused on specific disciplines and areas such as environmental psychology (Sierra-Barón et al., 2022), cultural anthropology, experimental sociology, among others, cultural anthropology, experimental sociology, among others, which seek to understand and problematize the tensions between human relations with the environment, as well as to contribute to sociocultural transformations in the face of the challenges brought by the development models (Saza Quintero et al., 2023) and the construction of environmental peace (Castro et al., 2022) for the conservation of the planet. In 2015, the United Nations Development Program (UNDP), together with national authorities of countries in the Amazon basin, conducted studies and reports on the serious situation of the Amazon region in its eight main countries: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela. In these, the lack of information of the Amazon region as a whole was demonstrated (UNDP, 2016), posing a complex risk of vulnerability for biodiversity and human life in these territories, although some research on deforestation of the Amazon rainforest is found, there are still few studies that highlight and consolidate orientations of research trends and their main challenges in order to establish a focused overview from the socio-environmental perspective. Thus, this article hopes to contribute to the mapping and analysis of the scientific evidence on this issue by exploring research trends and

emerging challenges related to the processes of development, conflicts and conservation in countries located in the Amazon basin.

Addressing these phenomena requires a multifaceted approach that includes stricter law enforcement, international cooperation and the empowerment of indigenous communities, based on comprehensive efforts that promote the protection of the Amazon rainforest and its inhabitants for future generations. In this process of empowerment and defense of territorial rights, various indigenous organizations stand out for coordinating local and transnational efforts. In Brazil, the Coordination of Indigenous Organizations of the Brazilian Amazon (COIAB) brings together dozens of indigenous peoples and has strengthened the political and environmental representation of Amazonian communities. In addition, the Coordination of Indigenous Organizations of the Amazon Basin (COICA) integrates federations from the nine Amazonian countries, promoting joint actions in the areas of sustainability, autonomy, and climate justice (COICA, 2019; COIAB, 2024). The results of this research contribute to this challenge.

Theoretical framework

The theoretical framework of this research is organized through four concepts that allow us to understand the dynamics of the phenomenon under study:

Amazon Basin

The Amazon basin is one of the largest and most biodiverse regions on the planet (Ruiz-Agudelo et al., 2022). It is an important territory that integrates the global atmospheric circulation and influences the carbon, energy and water cycles (Zhang et al., 2024). Historically, it has been conceived as strategic for the economic growth of the countries that share it, due to its richness in natural resources and its geopolitical value (Dagicour, 2020). It is composed of a complex network of rivers, tropical forests, savannas, wetlands and mountain systems (Wittmann and Junk, 2016). Its classification can be approached from different dimensions of hydrographic, ecological and cultural unity. From a hydrographic perspective by the drainage system of the Amazon River and its tributaries (Feng et al., 2025). In ecological terms by the vast tropical rainforest (Ruiz-Agudelo et al., 2022). In addition, it is configured as a cultural territory inhabited by more than 20 million indigenous people (Bowman et al., 2021). This combination of factors makes the Amazon basin a socio-ecological system in which biological diversity, cultural richness and geophysical processes converge, including local dynamics and global climate (Beveridge et al., 2024).

Socio-environmental conflicts

Environmental conflicts refer to disputes between natural persons, organizations, private companies and/or the State, regarding access, use or control of natural resources. These disputes usually arise when some of the actors perceive that their rights may be violated by certain economic activities or political decisions (Carranza et al., 2020), which generates a configuration of structural dynamics, transforming economic, political and social relations (Orellana, 1999). From a theoretical perspective, Martínez-Alier (2006) introduces the concept of ecological-distributive conflicts, in which local communities, especially indigenous and peasant communities, oppose extractive industries such as mining, oil expansion, deforestation or uniform tree plantations, given that they affect their territories and ways of life.

Conservation and environmental governance

Environmental conservation represents the set of actions, policies and practices aimed at protecting, managing and restoring ecosystems, biodiversity and natural resources (Miller et al., 2012). Its effective implementation implies organizational structures and decision-making processes that guarantee the articulation between different actors. In this scenario, environmental governance has become an important factor in guaranteeing effective management and conservation actions, because it facilitates democratization and spaces for active participation by local communities, indigenous peoples, social organizations and authorities (Vázquez-Villa et al., 2020).

However, various authors from the fields of political ecology and environmental history have questioned whether conservation policies have, in many cases, reproduced forms of exclusion and social inequality. Bio-centric conservation models, particularly national parks and nature reserves that conceive of nature as a space separate from human presence, have led to displacement and conflict with indigenous and poor peasant communities. These practices represent a form of environmental injustice in both state and neoliberal approaches, as they prioritize ecological protection over the territorial and cultural rights of local populations (Martin et al., 2016).

Therefore, environmental governance, is characterized by integrating regulatory processes, mechanisms and institutions through which political, social and economic actors, influence environmental actions and outcomes (Bennett and Satterfield, 2018). Its main focus is oriented to the protection and conservation of the environment and the

natural outcomes on which human well-being and sustainability depend (Agrawal et al., 2022).

Bibliometric analysis

Bibliometric analysis is a quantitative method that evaluates the interrelationships and impact of publications, authors, institutions and countries in a specific area of knowledge. It represents a systematic approach in the study of scientific production, oriented towards the identification of publication patterns, thematic trends and scope of research (Hassan and Duarte, 2024). This procedure is based on the collection of specialized databases, debugging, organization and application of various bibliometric methods (Passas, 2024).

Bibliometric analysis techniques are grouped into two categories: performance analysis and scientific mapping. The former considers the contributions of research constituents by considering metrics such as number of publications, citations per year, productivity per author, institution, journal or country. Scientific mapping focuses on interactions and connections between research constituents and includes citation analysis, co-citations, bibliographic linkage, co-word analysis and co-authorship (Donthu et al., 2021; Lim and Kumar, 2023).

Methods

This is a thematic review and trend mapping type of research whose objective is aimed at evidencing the general perspective of a scientific field, areas of interest, foci and trends (Carrizo and Moller, 2018; Petersen et al., 2008), for this case the processes of development, conflicts and conservation in countries located in the Amazon basin.

Relevant literature was used from the Web of Science (WoS) databases of Clarivate Analytics and Scopus, considered relevant sources due to their broad scope, rigorous review and content selection processes, as well as their widespread use in the academic and scientific community. In the WoS and Scopus integrated search field, the following search equation was included ("Amazon" OR "protected areas") AND ("construction" OR "infrastructure" OR "oil" OR "petroleum" OR "hydroelectric") AND ("development" OR "sustainable development" OR "economic growth") AND ("conflict" OR "dispute" OR "social tensions" OR "defense" OR "resistance" OR "governance" OR "policy" OR "protection") AND ("conservation" OR "environmental protection" OR "sustainability") AND ("indigenous" OR "native" OR "aboriginal") AND ("indigenous" OR "native" OR "aboriginal") AND ("frontier violence in the Amazon"). The search was restricted to the title, abstract and keyword fields. The search equation was designed

without a specific document type, temporal or contextual delimitation, thus, the study covers the period from the first article registered in each database until February 14, 2024. Only empirical articles were included in the review. The article selection process is reported in the selection process diagram (Figure 1).

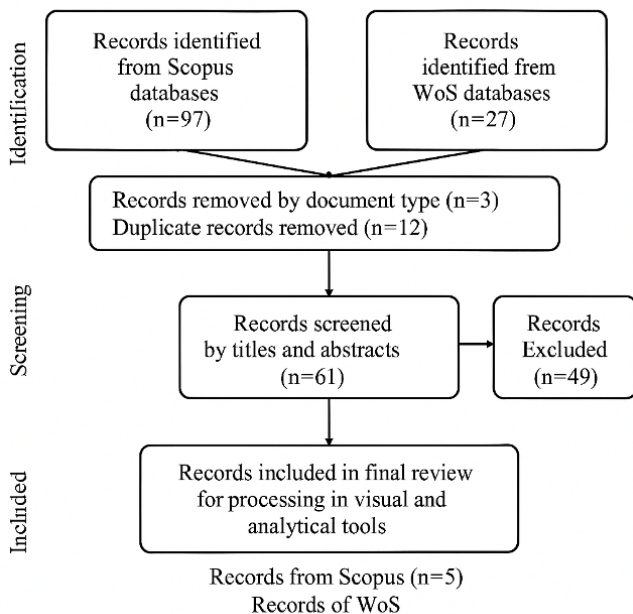


FIGURE 1. Process screening diagram

Subsequent to the bibliometric analysis, content analysis was performed (Krippendorff, 2018), which facilitates identifying patterns in the literature by recognizing both prominent and less explored areas, as well as complementing the previously selected methods. Therefore, the empirical research in this study focuses on understanding the magnitude and growth of scientific production in these topics, identifying the most influential authors and countries in the field, recognizing the main themes, discovering the predominant methodological approaches, and summarizing the main directions for future research. For the bibliometric analysis, the bibliometrix package in the R statistical environment (Aria and Cuccurullo, 2017) was used. The data exploration aimed to determine various metrics, including publication trend, most relevant sources, authors, affiliations and countries, as well as thematic map.

Results

Bibliometric analysis

In total, 61 academic and scientific production documents were identified that meet the established search criteria, of which 86.6% correspond to articles published in English (86.6%), followed by Portuguese (11%) and the remaining documents in Spanish. For example, annual growth in publications in this field was modest from the 2008s to the early 2020s, but experienced exponential growth between 2020 and 2023. The curve representing the number of published papers is shown in Figure 2.

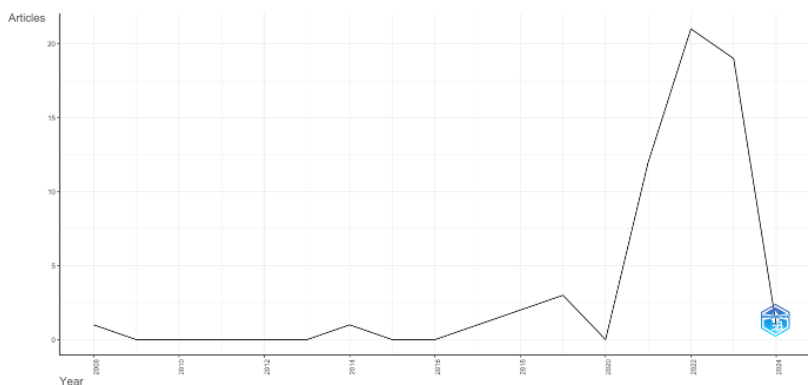


FIGURE 2. Annual distribution of publications

Note. Elaboration in ATLAS.ti software.

Currently, information related to the topics of interest is disseminated through more than 50 specialized journals. Within this broad spectrum, *Biological Conservation* ($n=3$), *PLoS One* ($n=3$), and *Aquatic Conservation: Marine and Freshwater Ecosystems* ($n=2$) stand out, with a greater number of publications. It is important to emphasize that, in this analysis, most of the journals that have contributed to the dissemination of information belong to the field of interdisciplinarity and environment.

On the other hand, Table 1 shows the publications that have been of greatest interest to the academic community, making them a reference in the development of subsequent research and publications related to socio-environmental conflicts in the Amazon.

TABLE 1. Most cited publications

| Author | Country | Title | Magazine | Total appointments |
|----------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------|
| (Finer et al., 2008) | United States | Oil and gas projects in the western Amazon: threats to wilderness, biodiversity, and indigenous peoples | <i>PLoS One</i> | 372 |
| (Bebbington et al., 2018) | Amazon, Indonesia and Mesoamerica | Resource extraction and infrastructure threaten forest cover and community rights | <i>Proceedings of the National Academy of Sciences of the United States of America</i> | 102 |
| (Espinosa et al., 2014) | Ecuador | Road development and the geography of hunting by an amazonian indigenous group: consequences for wildlife conservation | <i>PLoS One</i> | 59 |
| (Siqueira-Gay and Sanchez, 2021) | Brazil | The outbreak of illegal gold mining in the Brazilian amazon boosts deforestation | <i>Regional Environmental Change</i> | 31 |
| (Conceição et al., 2021) | Brazil | Government policies endanger the indigenous peoples of the Brazilian amazon | <i>Land Use Policy</i> | 25 |

Note. Elaboration based on data collected.

Exploration of the geographic distribution of the publications revealed that the production was predominantly led by Latin American countries. The country with the highest number of documents produced related to the specific topics addressed by this review was Brazil (n=39), followed by the United States (n=29), Colombia and Spain (n=8 respectively). The most frequent collaboration was between Brazil and the United States with 4 co-produced publications (see Figure 3). Regarding the list of institutions or organizations responsible for the production of related literature, it is observed that the Universidade Federal do Rio de Janeiro (n=4) has generated the largest number of related contributions. In turn, United States is present through publications derived from Clark University (n=4), and in Colombia, the Universidad Nacional has made a total of 4 contributivos related to the topics of interest.

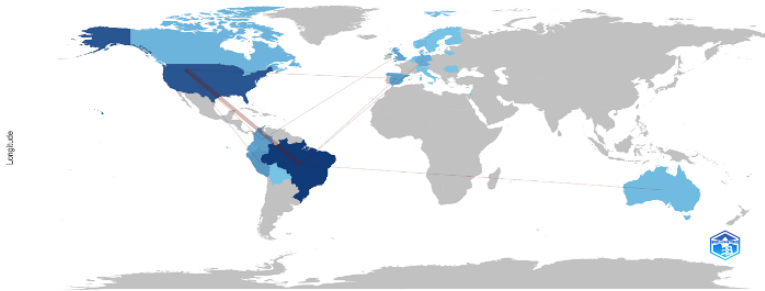


FIGURE 3. Geographical distribution of scientific production and international collaboration networks
Note. Elaboration in ATLAS.ti software.

In order to explore the main themes related to development, conflict and conservation, a keyword analysis was carried out, identifying a total of 316 words. Then, 124 high frequency words were selected, i.e., those that appeared in 5 or more articles, to construct the cooccurrence network presented in Figure 4. Keywords such as deforestation, environmental protection, environment, amazon, protected area and indigenous people are the most prominent among the selected publications and are related to terms such as governance, natural resource conservation and climate change.

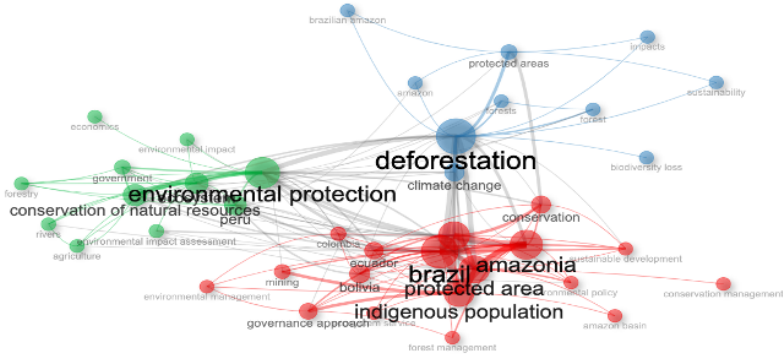


FIGURE 4. High-frequency keyword co-occurrence network
Note. Elaboration in ATLAS.ti software.

Through the analysis of the thematic map, five clusters related to the key concepts used by the authors have been identified, as shown in Figure 6. Within these clusters, indigenous self-determination, protected areas, deforestation, sustainable development and policy are distinguished as driving themes due to their high relevance and significant development in the literature. A basic theme, which despite having a high relevance,

shows a less advanced development compared to the driving themes related to the rights of the indigenous population. And as niche themes, discourse hegemony, socio-environmental conflicts, extractivism and rights of nature stand out.

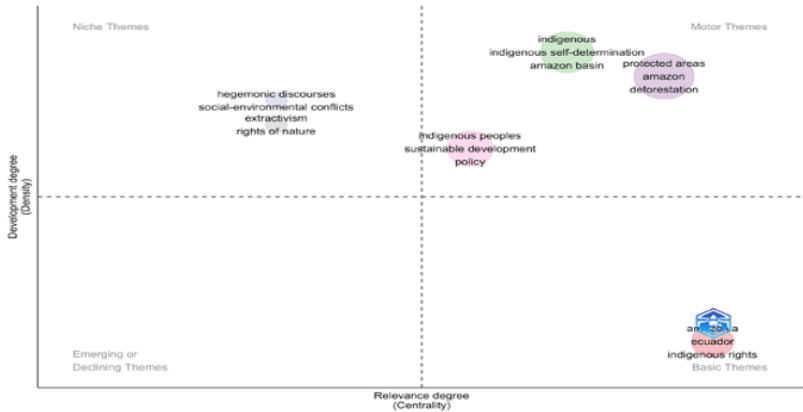


FIGURE 5. Thematic map

Note. Elaboration in ATLAS.ti software.

Content analysis

The results in this section frame the trends in research on development, conflict and conservation in the Amazon regions: a) socio-environmental and political conflicts and impacts, b) conservation and community resistance, c) governance and governability, and d) extractivist practices. At the same time, a discussion is presented as a theoretical contribution for future methodological approaches to the study.

Socio-environmental and political conflicts and impacts

The review showed that the studies address impacts at the social, cultural, economic and political levels, reflected in the contextual content, background and descriptions of the problems they describe. Of the 61 systematized articles, 11 of them reflect a tendency of studies that particularly examine problems in local cases of conflicts and impacts in the borders of countries surrounding the Amazon biome.

They focus on empirically demonstrating that among the main problems are illegal deforestation and fires, the expansion of soybean and beef agribusiness, which impact the land generating a high potential for drought, global climatic instability, and the high risk of zoonotic diseases (Bowman et al., 2021). The conflicts have a geopolitical structural basis. In the case of Brazil, the indigenous communities that inhabit the

Amazonian territories have faced the extractivist political agendas of the federal administration, which has recently attempted to override the protection of the territory and the political participation of the peoples in decisions regarding their territory, as in the case of Pará and Baixo Tapajós (De Souza Mello Bicalho and Hoefle, 2022).

These conflicts of interest, extractive and conservation, generate tension between communities and public administrations that still relate development to economic models. Public-private relations still favor exploitation and extraction, and are still practices and legislation that have been inherited in some cases from right-wing governments and military dictatorships that violated the rights of both indigenous communities and their territories (Neves, 2022). Although the recent political scenario shows a decreasing risk factor, as it is analyzed that the conditions derived from the democratic electoral process in force in the country show progress in relation to the interest in establishing policies to preserve and combat abusive exploitation practices, deforestation and illegal mining (De Souza, 2023). Studies focused on Brazil, as the country with the highest concentration of the biome, find dependence and difficulty for forest conservation, given the historical modifications that Brazilian forestry legislation has had, which until now has been diffuse and has not considered the traditional practices and knowledge of the communities for conservation, but follow neoliberal practices (Dos Santos Massoca and Sonnewend Brondízio, 2022). Finding great difficulty for land legalization and usurpation of land by individuals, fraudulent land claims registered in the national land systems (Kruid et al., 2021).

In the Colombian case, which also has an extensive threatened Amazonian proportion, recent studies defined that it has 92 biomes and 39 general ecosystems that exist in the Colombian Amazon basin, of which 34 are not inhabited by humans, totaling 34 million hectares and by 2020 estimated a loss of natural capital worth 18.1 billion dollars, which is equivalent to 6.7% of the Colombian GDP (Ruiz-Agudelo et al., 2022). Reflecting major policy challenges to improve the governance of indigenous communities' lands, which can incentivize sustainable agriculture and farming. The impacts that these socio-environmental and political tensions bring to the Amazon region have been described as alarming and risky for all forms of forest life. Recent winters have been the driest, up to four months without rain, with the driest rainy summer in northern Brazil, the so-called «reverse south» (Da Silva et al., 2022).

where indigenous communities must develop strategies, leadership and resistance actions, presenting themselves as guardians of the environment (Ponta et al., 2021; Reyes-García et al., 2020).

Governance and governance

This trend involves categories of studies that focus on understanding and analyzing the tensions between the governance carried out by political actors and the governance assumed by the communities and peoples that inhabit Amazonian territories. Although these categories are involved in the initial trends and other studies, they were systematized in a set of 10 articles out of the total number of articles found due to their relevance and specificity. These studies problematize how governance seen in the approach of collective property rights (Baragwanath et al., 2023) community rights (Bebbington et al., 2018), which from the extractive gaze is used in local development and natural exploitation policies, based on racial ethnic differentiation, class and social condition, in which peasant and indigenous communities are left behind and excluded from both political participation and decisions regarding their territories (Noroña, 2022).

Political governance in the face of environmental care excludes and violates the territorial rights of indigenous peoples, leaving them marginalized and contributing to reinforce conflicts and inequality (Merino and Gustafsson, 2021). The studies highlight according to their research, that governments maintain superfluous and convenience relations with the communities inhabiting the territories promoting community participation to facilitate immersion in the territory, extraction and subtle exploitation that in the end manages public political strategies of an economic nature based on the execution of infrastructures (Valladares and Boelens, 2017). The results of these investigations highlight the need for communities to be real recipients of collective rights with sovereignty and autonomy to manage the natural resources granted, encouraging decentralized forest governance (Alejo et al., 2021), regional autonomy and self-government (Anthias, 2022). This autonomy must be accompanied by principles of environmental and social sustainability, given that in several tropical contexts regional governments have promoted development agendas with significant environmental impacts (Newig et al., 2023).

The patterns of scientific production observed reflect the way in which debates about the Amazon have been shaped by tensions between development, conservation, and socio-environmental justice. The repeated presence of terms related to governance, indigenous rights, and deforestation suggests a shift in academic interest toward the political and social dimensions of sustainability, rather than solely toward its ecological aspects.

Discussion

This paper reviewed the scientific production related to development, conflicts and environmental conservation in the countries located in the Amazon basin. The article by no means exhausts the possibilities of other trends and subcategories that may emerge in Amazonian studies, as it is a growing theme in the last two decades and a concern in contemporary political and scientific agendas.

In recent literature, Amazonian studies are part of broader debates on sociopolitical transformations and global environmental risks. From an environmental sociology perspective, these processes can be understood as expressions of the contradictions between modernity, development, and sustainability. In turn, contemporary research on the Amazon shows how the dynamics of governance, rural labor, and deforestation are traversed by relations of power and dependency that shape new forms of conflict and territorial resistance. This theoretical approach allows us to situate the Amazon region within a critical reading of socio-environmental inequalities and global models of development (Islam, 2024; Vásquez, 2024).

The thematic patterns derived from bibliometric analysis broaden our understanding of the socio-environmental dynamics addressed in the study. More than a representation of frequencies, these conceptual associations reflect the way in which scientific production on the Amazon has been articulating ecological, political, and social dimensions around debates on development, governance, and conservation. The coherence between these trends and the categories constructed in the content analysis suggests an interpretive convergence that accounts for the links between academic knowledge and territorial practices. Along these lines, recent works highlight the role of territoriality, sociobiodiversity, and local knowledge as forms of resistance and reconfiguration of Latin American thought (Gaía and Valente de Cruz, 2025; Borda León, 2025; Castillo Guzmán, 2025; Saquet and de Alencar, 2025; Rivas-Ruiz et al., 2024). Thus, an integrated reading is proposed that conceives Amazonian research as a field where scientific perspectives and situated knowledge converge.

There has been a recent increase in contributions and studies related to environmental conservation in the Amazon rainforest that are concerned with establishing the social and economic impacts for the countries that compose it, understanding that the advance of deforestation is part of global, geopolitical and transnational practices. A large number of documents reviewed highlighted the marginal conditions of political participation, autonomy and tensions in governance between governments and indigenous communities, highlighting actions, campaigns, associations and community movements of resistance to exploitation and deforestation, despite the fact that some studies define practical contradictions in the care taken by these communities that assume themselves as guardians of the territories, since they also put into practice deforestation for cattle ranching and indigenous and illegal mining.

At this point, the continuous challenge is to overcome some determining factors such as indigenous territorial rights, the expansion of conciliated governance (Hänggli et al., 2023), among actors that overcome the differences and heterogeneity of the countries that make up the Amazon, since it is not only a matter of overcoming critical conditions in the institutional context of each country, managing collective property rights and separating private and tertiary property. With the above, in view of the challenges of public and social management, the authors concur to articulate strategies from sustainable innovation in agreement with the indigenous territories (Qin et al., 2023) and geotechnologies (Da Silva et al., 2022) for the control and regulation of extractivist strategies, practices and policies.

The studies agree that the recent context of the countries that make up the Amazon biome, although going through different socio-political conditions, are characterized by the advancement of both actions of compensation and conservation of the impact, as well as traditional practices, legal and illegal, of public administrations as well as community agencies, civil society or non-governmental organizations, which put the future of the Amazon rainforest in tension. Demonstrating the risk of occupation of the territories, the advance of legal mining and oil extraction to meet the needs of tertiary countries.

From a theoretical-conceptual perspective, the findings of this study are linked to contemporary debates in environmental sociology and the political sociology of environmental conflicts. Beck (1992) and Anthony Giddens argue that modernity produces its own ecological risks by generating forms of development that exceed institutional capacity for control and prevention. Within this framework, the Amazon can be understood as an expression of this «risk society,» where global threats such

as deforestation and climate change converge with historical inequalities (Dutra e Silva et al., 2023). In turn, the environmental rationality proposed by Leff (2010) offers a critical framework for rethinking the relationship between knowledge, power, and nature, questioning the productivist logic that sustains the extractivist model. Finally, Alimonda (2011) highlights that Amazonian territorial struggles are not only about resources, but also about ways of life, epistemologies, and cultural meanings of nature. Thus, environmental conflicts in the Amazon basin should be interpreted as spaces of epistemic and political dispute, where tensions between modernity, territory, and sustainability reflect the civilizational limits of modern development and the emergence of alternative rationalities rooted in local and community knowledge.

Conclusion

The findings reviewed show a consensus among authors regarding the continuous advance in the degradation of the Amazon rainforest that would cause very harmful effects for South America and the rest of the world, in addition to the problems already caused by climate change, if effective political conditions are not developed with a paradigm shift in land use (Bowman et al., 2021). This review contributes to other researchers a synthesis of the panorama of studies on the problems of degradation, conservation and socio-political conditions of the Amazon biome, which, although other open categories are not reviewed, can contribute to the generation of emerging economic and political theories. However, the Amazon conversation, although important for the environment, will not be enough to reduce global emissions if highly industrialized countries do not commit to reducing their emissions. Effective climate action requires shared and differentiated responsibility, with the world's largest economies taking a leading role in decarbonizing their production and consumption systems.

Contribución de autoría

Willian Sierra-Barón participated in the conceptualization, methodology, formal analysis, data curation, writing (original draft preparation), writing (review and editing) and supervision.

Leidy Tatiana Padilla-García participated in the conceptualization, methodology, software, formal analysis, investigation, data curation, writing (original draft preparation), writing (review and editing).

Henry Steven Rebolledo-Cortés participated in the conceptualization, investigation, writing (original draft preparation) and writing (review and editing).

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Erika Judith López-Santamaria participated in the conceptualization, investigation, writing (original draft preparation) and writing (review and editing).

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Declaración de uso de IA

Los autores de este texto informan que en el desarrollo del manuscrito se utilizó inteligencia artificial generativa (IA-G). Su uso se limitó exclusivamente a mejorar la legibilidad y el lenguaje de la obra, incluyendo apoyo en la traducción, y en ningún caso se empleó como fuente directa de información.

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