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Who Documents Ethnobiological Knowledge in Traditional Communities in the Brazilian Amazon? A Scientometric Assessment with a Focus on the Perception of Snakes

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Abstract

Background

Traditional communities hold knowledge that matters for conserving Amazonian biodiversity and for dealing with problems such as snakebite, yet it is unclear who documents this knowledge, where, and about what.

Methods

We combined scientometric and qualitative analyses of 50 empirical articles (1999–2025) on ethnobiological research with traditional communities in the Brazilian Amazon, selected from Web of Science, SciELO, and Scopus following the PRISMA 2020 guideline. We classified the institution of the first author as Amazonian, from other Brazilian regions, or foreign, and compared it across environments.

Results

Research is recent (68% of articles since 2020) and concentrated in Pará and Amazonas (74%), in floodplain and aquatic environments (52% versus 26% in terra firme), and in studies of animals (64%). Amazonian institutions led most articles (first authors from the Amazon in 64%), but 46% of the floodplain and aquatic studies were led from other regions, more than half of them by a single institution. Authorship was fragmented, with 88% of 177 authors appearing once. Only three articles (6%) addressed snakes, all focused on venomous snakes and snakebite.

Conclusions

The documented knowledge is uneven in space, environment, and leadership, and it barely covers community perceptions of snakes, a gap relevant to snakebite prevention and snake conservation alike.

Background

The Amazon holds exceptional biological and cultural diversity. In Brazil, the Amazon biome covers about 4.2 million km², roughly 49% of the national territory [1], and is home to Indigenous peoples, riverine populations, *quilombola* communities, extractivists, and other traditional groups. These populations hold detailed knowledge of the use, management, and ecology of plants, animals, and landscapes, built and transmitted across generations [2], and archaeological and ecological evidence indicates that this relationship spans millennia [3, 4]. This knowledge matters for conservation, because Indigenous lands and protected areas have contributed substantially to curbing deforestation in the

Brazilian Amazon [5, 6], and the territories of Indigenous peoples encompass a considerable share of the world's lands of conservation value [7].

In the Amazon, this knowledge also bears on a public health problem. Snakebite is a neglected tropical disease, and the Brazilian Amazon has the highest incidence per inhabitant in the country, with Pará reporting the most cases [8]. Riverine communities live alongside snakes every day, often far from health services, and respond with their own practices, which include home treatments [8, 9]. How communities perceive snakes also shapes conservation, because the relationship between people and snakes is permeated by myths and tends to be negative, often resulting in the killing of animals out of perceived self-defense or economic loss [10, 11]. Understanding these perceptions is therefore a basis for proposals that serve both snakebite prevention and snake conservation, and that are built with communities and not only for them.

Who produces this knowledge, and where, also matters. Previous surveys show that Brazilian ethnobotany concentrated in the Northeast and Southeast and that the Amazon biome accounted for only 30 of 258 articles (11.6%) published between 1988 and 2013 [12, 13], while Brazil is the main producer of ethnobiological studies in Latin America [14]. The structure of scientific collaboration (who produces knowledge, from which institutions, and in partnership with whom) shapes research agendas and has implications for the ethical and participatory dimensions of work with traditional communities [15]. Scientometric tools have been applied to Brazilian ethnobotany [12], Latin American ethnobiology [14], citation behavior [16], and the use of the “ethno” prefix [17], but, to our knowledge, not specifically to research with traditional communities in the Brazilian Amazon, and none has combined quantitative mapping with a qualitative analysis of study content.

This study offers three contributions. It provides, to our knowledge, the first integrated scientometric and qualitative map of ethnobiological research with traditional communities in the Brazilian Amazon. It adds an analysis of who leads this research, by environment, which shows whether documentation depends on institutions inside or outside the region. And it quantifies how little of this literature addresses community perceptions of snakes, an animal group at the center of both snakebite and conservation conflicts.

Here we ask who documents the knowledge of traditional communities in the Brazilian Amazon, where, and about what, with a focus on the perception of snakes. We address four questions. How has this research grown, and where is it published? Who produces it, and do the producers work in the region where the research takes place? Which states, environments, taxa, and social groups does it cover? And how well do studies of snakes, a group tied to conservation conflicts and to snakebite, cover community perceptions? We hypothesized that research effort would be concentrated in a few states, environments, and taxa, that leadership would be uneven across environments, and that studies of snake perceptions would be rare. By answering these questions, we aim to show where documented knowledge falls short of what conservation and public health need, and to guide research priorities.

Methods

Study design

This study is a scientometric and qualitative analysis of the published literature. Its aim was to describe who documents the knowledge of traditional communities in the Brazilian Amazon, where, and about what. The setting was the Brazilian Amazon, the unit of analysis was the empirical article, and the reporting followed the PRISMA 2020 guideline [18], and the completed checklist is provided as Additional file 3. No review protocol was registered in advance.

Databases and search strategy

The literature search was first conducted on 23 September 2025 (results exported on 21 January 2026) and updated on 4 September 2026, when Spanish was added as an accepted article language. The results reported here refer to the September 2026 search. We searched the Web of Science Core Collection and the SciELO Citation Index (both through the Web of Science platform, Clarivate) and Scopus (Elsevier) for records published up to 2025. In Web of Science and in the SciELO Citation Index, we searched the Topic field (title, abstract, and keywords) with the string “Ethnobiolog*” OR “Ethnoecolog*” OR “Ethnobotan*” OR “Ethnozoolog*” OR “Ethnoherpetolog*” OR “Traditional ecological knowledge” AND “Amazon” AND “Brazilian Amazon” AND “Traditional Knowledge”. In Scopus, to capture more articles, the same search string was applied to all fields, instead of the Topic field used in Web of Science and SciELO, with the same filters. The operators were entered without parentheses, and operator precedence differs between the platforms (AND before OR in Web of Science, and OR before AND in Scopus), so the same string was interpreted differently in each. The search histories were not saved in the databases, and the strategies were recorded manually by the authors. The search strategies and the list of included articles are provided in Additional file 1: Tables S1–S3.

The raw search retrieved 3,136 records (Web of Science Core Collection, n = 1,963; SciELO Citation Index, n = 956; Scopus, n = 217). Filters applied within each platform restricted results to peer-reviewed original articles in English, Portuguese, or Spanish, linked to Brazil according to author affiliation (that is, with at least one Brazilian affiliation, which retains articles with coauthors from other countries), yielding 867 records.

Screening and eligibility

Study selection followed the PRISMA 2020 guidelines (Fig. 1) [18]. Titles, abstracts, and keywords of the 867 records were assessed by one researcher directly in each database, and 121 records were selected (Web of Science, n = 54; SciELO Citation Index, n = 30; Scopus, n = 37). These records were exported in .bib format and imported into R (v. 4.6.1) with the Bibliometrix package [19], where seven duplicates were removed, leaving 114 unique records. The merged table was then reviewed by three researchers,

and 67 records that proved to be outside the scope, although their titles, abstracts, and keywords seemed relevant, were excluded, leaving 47 articles. Three eligible articles identified after Spanish was added to the search in September 2026 were downloaded separately and added manually to the analysis spreadsheet, with metadata entered manually, for a total of 50 articles.

The three researchers reviewed the records, including these three articles, in meetings. They selected the articles that required closer inspection, checked whether each one met the eligibility criteria, and retained a record only when all agreed. Disagreements were resolved by returning to the eligibility criteria. Full texts of the 50 potentially eligible records were then sought, and 49 were retrieved.

Studies were included if they were empirical, had ethnobiology or its subdisciplines as a central focus, were conducted in the Brazilian Amazon (including its coastal zone), and involved fieldwork conducted directly with traditional peoples and communities (Brazilian Decree No. 6,040/2007), such as riverine populations, artisanal fishers, quilombolas, extractivists, and Indigenous peoples. We excluded purely theoretical studies, narrative reviews, research restricted to urban contexts without a traditional-community interface, biological surveys lacking a sociocultural dimension, and studies outside the Brazilian Amazon. The database of origin of each included article was identified by matching DOIs and titles against the exported files. The final corpus comprised 50 studies, of which 49 were read in full text. The remaining one could not be obtained and was included based on title, abstract, and bibliographic metadata.

We deliberately restricted the corpus to empirical studies conducted with traditional peoples and communities in the Brazilian Amazon, instead of all ethnobiological literature that mentions the region. Of the 3,136 records retrieved, 50 met all criteria. This restriction defines the population of interest, the studies in which community knowledge was documented directly and that can therefore inform conservation and public health proposals built with communities. A focused corpus also made it possible to read 49 of the 50 articles in full and to code them for environment, taxon, social group, and snakes, which a larger corpus analyzed only through abstracts could not support at this depth. Its size is therefore a result as much as a limit, because it shows how little of the literature meets these criteria.

Data extraction and analysis

The analysis combined two complementary approaches. Before analysis, variants of author and institution names were harmonized manually. The quantitative scientometric analysis was performed in R software (v. 4.6.1) using the Biblioshiny web interface of the Bibliometrix package (v. 5.5.0) and covered the temporal distribution of publications, dissemination outlets, author productivity, coauthorship networks, and interinstitutional collaboration, based on the standardized affiliations of each article. International coauthorship was calculated from the countries listed in the affiliation addresses of each article. Network figures were redrawn from the same dataset in Python (v. 3.12) with NetworkX (v. 3.7) and Matplotlib (v. 3.11), and communities were detected with the Louvain algorithm. Years were grouped by decade for description (1999–2009, 2010–2019, and 2020–2025, which covers

only six years because the search ended in 2025). Given the size of the corpus, with at most eight articles per year, results were treated descriptively, and no statistical test for temporal breaks was applied.

The qualitative analysis was based on the content of the articles (full text for 49 articles, title and abstract for the other one). In a spreadsheet, we recorded the state(s) of the study area, the focal environment (floodplain and aquatic environments, *terra firme*, coastal and estuarine environments, or more than one environment, classified by the dominant habitat named in the study-area description), the ethnobiological subfields addressed (non-exclusive categories), the taxonomic groups addressed, the social group studied, and any mention of snakes and the theme of perception or knowledge about them. An article was counted in each state it covered, so state totals exceed the number of articles. The coding was performed by one author (BCCM).

The selection of studies on snakes was organized as a four-level funnel, from all ethnobiological studies with traditional communities in the Brazilian Amazon, to ethnozoological studies, to studies addressing snakes, to studies on community perceptions, knowledge, or attitudes regarding snakes. Scarcity was assessed by the proportion of studies at each level, compared with other taxonomic groups.

Institutional location and leadership

To assess who leads research and where, we classified each institution in the dataset by the location of its headquarters as Amazonian (in the states of the Legal Amazon), from other Brazilian regions, or foreign. Five institutions that could not be assigned to a single location (the national agencies and companies ICMBio, Eletronorte, and Embrapa, and two non-academic organizations) were left unclassified (Additional file 1: Table S4). We used the institution of the first author as a proxy for leadership, taking the first listed when an author had more than one affiliation (one article), and compared the share of articles led from the Amazon across periods and environments. The classification is descriptive and does not capture where authors were born or trained.

Use of generative AI

During the preparation of this manuscript, the authors used Anthropic Claude to translate the manuscript from Portuguese into English, to support language editing and the drafting of some passages, to verify references, to recompute descriptive counts from the authors' dataset, to carry out the additional analysis of institutional leadership (classification of institutions and counts), to write Python code for figures (color palettes, label layouts, and graphical parameters), and to write an R script to open the Biblioshiny interface. The search, selection, coding, and bibliometric analyses in Bibliometrix were performed by the authors using their own empirical data, and the authors critically reviewed all AI outputs and verified all literature citations and results. The authors take full responsibility for the integrity and content of the work.

Results

Scientific output and journals

The final corpus comprised 50 articles published between 1999 and 2025 (Fig. 2A). There was a single article before 2010 (in 1999) and 15 between 2010 and 2019, with no records between 2000 and 2009 or in 2017. Output concentrated from 2020 onward, which accounted for 34 articles (68%), with a peak of eight in 2020. The articles appeared in 36 journals. Ethnobiology and Conservation and the Journal of Ethnobiology and Ethnomedicine were the most frequent (five articles each), followed by Human Ecology (three) and by Agroforestry Systems, Anais da Academia Brasileira de Ciências, Ethnobiology Letters, and Hydrobiologia (two each), and the other 29 journals published one article each (Fig. 2B). Only 13 articles (26%) appeared in four ethnobiology journals (the two journals above, Ethnobiology Letters, and the Journal of Ethnobiology). Most were published in ecology, conservation, fisheries, social science, and health journals.

Forty-six articles were in English and four in Portuguese, and none were in Spanish. Only seven of the 47 articles retrieved from the databases were found in more than one of them (22 only in Scopus and 18 only in Web of Science), so no single database captured more than 60% of them (Additional file 1: Table S3). Three more articles were added after the September 2026 update.

Authorship and collaboration

We identified 177 authors, with a mean of 4.4 authors per article (median 4, range 1–12). Only one article had a single author. Productivity was concentrated, since 155 authors (88%) appear in a single article and 22 in two or more (Fig. 2C). Hallwass G and Silvano RAM were the most productive (seven articles each), followed by Barros FB (five), Clement CR and Pereyra PER (four each), and Junqueira AB and Shepard JR GH (three each). The coauthorship network had 450 links (on average, each author published with 5.1 different coauthors) and was strongly fragmented, with 26 groups that had no links between them, the largest with 33 authors (19% of the total), followed by groups of 19, 13, 12, and 12 authors (Additional file 1: Figure S1). Figure 3 shows a subset of 49 authors in six groups.

We identified 64 institutions, and 36 (56%) appeared in a single article. Universidade Federal do Pará (UFPA) was the most frequent (15 articles), followed by INPA (eight), UFRGS (seven), UFAM (six), and UFOPA, FIFO, and MPEG (five each; Fig. 2D). The interinstitutional network (143 links) was more connected than the author network, since 57 of the 64 institutions formed a single component, in which UFPA held a central position (22 links), ahead of INPA and UFAM (15 each; Fig. 4). Twelve articles (24%) had international coauthorship, that is, institutions from more than one country, mainly with Spain (four articles), the United States (four), and Norway and the United Kingdom (two each). One article had only foreign institutions in its recorded affiliations (France).

Geographic and thematic distribution

Of the 50 articles, 37 (74%) included Pará or Amazonas (Table 1). Pará appeared in 23 articles and Amazonas in 16, and one article was conducted in a community in the Middle Amazon whose state is not specified (Pará or Amazonas). Mato Grosso had a single article, and there were no studies in Amapá or Tocantins. Half of the articles (26; 52%) were conducted in floodplain and aquatic environments, twice as many as in *terra firme* (13; 26%). Coastal and estuarine environments accounted for seven articles (14%), and no article was classified in savannas or *campinaranas*.

Studies on animals (32 articles; 64%) outnumbered those on plants (14; 28%), and fishes and fisheries were the most frequent animal group (11; 22%). Ethnoecological approaches were the most frequent subfield (34; 68%), followed by ethnozoological (32; 64%) and ethnobotanical (14; 28%) approaches. Riverine residents (28; 56%) and artisanal fishers (20; 40%) were the most frequent participants, whereas Indigenous peoples (four articles; 8%) and *quilombola* communities (three; 6%) were less frequent.

Table 1
Distribution of the 50 articles by state, environment, taxon, social group, and subfield

Category	Articles (n)	% of articles
State(s)		
Pará	23	46
Amazonas	16	32
Acre	6	12
Maranhão	5	10
Rondônia	5	10
Roraima	3	6
Mato Grosso	1	2
Amapá	0	0
Tocantins	0	0
Middle Amazon, state not specified	1	2
Focal environment		
Floodplain and aquatic environments	26	52
Terra firme	13	26
Coastal and estuarine environments	7	14
More than one environment	4	8
Taxonomic group		
Plants	14	28
Fishes and fisheries	11	22
Reptiles	6	12
Terrestrial vertebrates	6	12
Aquatic mammals	6	12
Invertebrates	3	6
Mixed or environmental	4	8
Social group		
Riverine residents	28	56

Category	Articles (n)	% of articles
State(s) [1]		
Artisanal fishers	20	40
Extractivists	11	22
Indigenous peoples	4	8
Quilombola communities	3	6
Ethnobiological subfield [1]		
Ethnoecology	34	68
Ethnozoology	32	64
Ethnobotany	14	28

Percentages are of the 50 articles, and bold rows name the variable. [1] Categories are not mutually exclusive: an article was counted in each state, social group, or subfield it covered, so totals exceed 50. [2] Community in the Middle Amazon, in Pará or Amazonas; the article is included in the 37 articles (74%) from Pará or Amazonas. [3] Excluding the article without full text, the percentages are 51, 27, 14, and 8 (n = 49).

Leadership and location of research

We classified the 64 institutions by location (see Methods). Of the 50 articles, 43 (86%) had at least one Amazonian institution, and 13 (26%) had only Amazonian institutions. The first author's institution was Amazonian in 32 articles (64%), from another Brazilian region in 15 (30%), and foreign in three (6%). The share of Amazonian first authors was 60% (9 of 15) in 2010–2019 and 68% (23 of 34) since 2020, and the single article before 2010 had a first author from another region. Leadership differed by environment (Table 2). In floodplain and aquatic environments, 14 of 26 articles (54%) were led from the Amazon and 12 (46%) from other Brazilian regions, seven of them by the same institution (UFRGS). In *terra firme*, all 11 articles with a Brazilian first author were led from Amazonian institutions, and two were led from abroad. All three articles on snakes were led by Amazonian institutions (UFAC and UFPA).

Table 2
First-author institution by focal environment

Focal environment (articles)	Amazonian	Other Brazilian regions	Foreign
Floodplain and aquatic (26)	14 (54)	12 (46)	0 (0)
Terra firme (13)	11 (85)	0 (0)	2 (15)
Coastal and estuarine (7)	5 (71)	2 (29)	0 (0)
More than one environment (4)	2 (50)	1 (25)	1 (25)
All articles (50)	**32 (64)**	**15 (30)**	**3 (6)**

Values are numbers of articles (percentage of the row). Institutions were classified by headquarters location (see Methods). Seven of the 12 floodplain and aquatic articles led from other Brazilian regions had a first author from UFRGS.

Snakes

Only three articles (6%) addressed snakes with traditional communities, published in 2020 (two) and 2024, at two sites, namely the lower Moa River in Acre and Aritapera in Santarém (PA), the only one in the Lower Amazon. The two Acre studies were conducted in the same region, with 100 interviewees. Judging by titles and abstracts, all three address venomous snakes, snakebite, or perceived dangerousness, and two were published in health and toxicology journals (Toxicon and Revista da Sociedade Brasileira de Medicina Tropical) rather than in ethnobiology journals. A fourth article, on medicinal fauna in Pará, mentions snakebite only secondarily. The other reptiles studied were chelonians (turtles and tortoises, order Testudines, including the yellow-footed tortoise *Chelonoidis denticulatus*) and the green iguana (*Iguana iguana*) (three articles). In the funnel of the analysis, snakes accounted for 3 of the 32 articles on animals (9%), and all three addressed community knowledge or perceptions of snakes.

Discussion

This assessment shows that ethnobiological research with traditional communities in the Brazilian Amazon, as captured by the indexed literature, is recent, uneven in space and environment, and produced by fragmented author networks that are led mostly from within the region. The pattern is consistent with Brazilian ethnobotany surveys, in which the Amazon biome accounted for only 30 of 258 articles (11.6%) published between 1988 and 2013 [12] and studies concentrated where research groups are located [13]. Our results add that, within the Amazon, research effort is also unevenly distributed. Brazil is the main producer of ethnobiological studies in Latin America (289 of 679 studies, 41%) [14], which makes the regional imbalance within the country more evident.

The time series shows how recent this research is (Fig. 2A). Only one article predates 2010, 15 were published between 2010 and 2019, and 34 (68%) since 2020, which is about 1.5 articles per year in 2010–2019 and 5.7 per year since 2020. The scarcity before 2010 should not be read as absence of

fieldwork. It may reflect the lower concentration of specialists in the northern region, the limited indexing of older and regional literature, and the fact that many earlier studies were not labeled “ethno-” even though they fit the field [20]. The recent increase is consistent with the growth of Brazilian ethnobotanical research after the Convention on Biological Diversity [21], although we cannot test its causes.

The recent expansion was accompanied by dispersion across journals. Most articles appeared in ecology, fisheries, health, and social-science journals, and only a quarter in ethnobiology journals, which fits the multidisciplinary character of the field, practiced by researchers from anthropology, botany, zoology, and ecology [14]. The two most frequent journals are open access, and Ethnobiology and Conservation was created to integrate ethnobiology and conservation [22]. This dispersion may hinder the accumulation of knowledge and its use in conservation planning, since consolidating a field depends on research groups that develop long-term studies and shared protocols [14], and it suggests that traditional knowledge is often studied in connection with management problems, such as fisheries, hydropower, and public health, rather than as an object of ethnobiology itself. The databases also complemented each other, because only seven of the 47 articles retrieved from them appeared in more than one database. A search restricted to a single database would have missed roughly half of the corpus.

Authorship was concentrated and fragmented. Most authors appeared in a single article, and the coauthorship network split into 26 groups, many of which correspond to the team of a single article. Collaboration was more cohesive among institutions, in which UFPA, INPA, and UFAM occupied central positions, suggesting that regional institutions anchor this research. Early ethnobiological research in the Amazon was largely conducted by foreign investigators, and the region still has fewer specialists than other parts of Brazil [12], so consolidating regional institutions is itself a research priority. International coauthorship occurred in about one quarter of the articles. Because the ethical and participatory dimensions of work with traditional communities depend on who produces knowledge and in partnership with whom [15], stronger and more durable collaborations, including with local institutions and communities, are desirable.

Our classification adds nuance to this picture. Amazonian institutions led 64% of the articles and took part in 86%, and their share was higher after 2020 (68%) than in 2010–2019 (60%). Leadership was uneven across environments, however. Nearly half of the floodplain and aquatic studies (12 of 26) were led from other Brazilian regions, and seven of them by a single institution, whereas *terra firme* studies were led from the Amazon or from abroad (Table 2). This suggests that the weight of floodplain fisheries in the literature reflects, in part, the sustained effort of one external group rather than a broad regional pattern, and that the knowledge documented for other environments depends more on regional institutions.

Studies concentrated in Pará and Amazonas, and none was identified in Amapá or Tocantins, with only one in Mato Grosso. Most studies took place in floodplain and aquatic environments and only a quarter

in *terra firme*. No study was classified in savannas or *campinaranas*, and *igapó* appeared only together with *várzea*. This agrees with the pattern reported for ecological field research in the Brazilian Amazon, where the largest knowledge gaps are in *terra firme* uplands rather than in wetlands and aquatic habitats, which the authors attribute to the broad network of navigable waterways facilitating access to wetlands and aquatic habitats [23]. Animals, especially fishes, outnumbered plants, a pattern that may partly reflect our search strategy, which relied on specific terms and may therefore favor some types of study.

Indigenous peoples participated in few articles, which may reflect that our search did not use terms specific to them and that research with Indigenous peoples is published in other fields or outlets not captured here. A limited research effort has also been reported for Indigenous lands in ecological research [23]. Indigenous peoples were also rare in Brazilian ethnobotanical studies (14 of 258 articles), which Ritter et al. [12] linked to the scarcity of specialists working with Indigenous communities, especially in the Amazon, and to restrictions on legal access to traditional knowledge. These asymmetries matter for conservation because knowledge of *terra firme*, savannas, Indigenous contexts, and underrepresented states appears less documented in the indexed literature than that of floodplain fisheries, which may bias the knowledge available for planning in a region where Indigenous lands and protected areas play a central conservation role [5–7].

In practice, protected areas and Indigenous lands are central to curbing deforestation in the Brazilian Amazon [5, 6], and the people who live in them hold knowledge relevant to their management [2]. Ethnobiological research in protected areas and their surroundings has been recommended as a way to support biodiversity conservation, to address social and environmental conflicts, and to inform management plans [12]. If this research remains concentrated in floodplain and coastal fisheries, in a few states, and in a few research groups, management plans for *terra firme*, savannas, and Indigenous territories will have little local knowledge to draw on. Closing these gaps requires not only more studies but also partnerships in which communities take part in defining questions and using results [15], and the training of specialists in the northern region, where they are fewer [12, 20].

Studies of community perceptions of snakes were scarce, with only three articles (6%), at two sites, all centered on venomous snakes and snakebite, and two of them published in health and toxicology rather than ethnobiology journals. This focus is understandable, since snakebite is a concern in riverine communities [8, 9], but it leaves other dimensions of the human-snake relationship little explored, such as mythology, persecution, and coexistence with non-venomous species such as anacondas, which has been documented in a study of the Lower Amazon floodplain [11] that our search did not retrieve.

The few studies available are consistent with the main concerns reported for the region. In riverine communities of the lower Purus River, bites occurred mainly during the harvest of Brazil nuts (*Bertholletia excelsa*) and timber, when people spend more time in the forest, and about 88% reached the lower limbs [9]. In Aritapera, 28.7% of participants had already been bitten, and difficult access to health centers and the lack of energy to store antivenom led residents to use home treatments, including the fat of the endangered Amazon River dolphin, *Inia geoffrensis* [8]. This shows that knowledge about snakes

also bears on the conservation of other species, and that studies restricted to venomous snakes capture only part of the human-snake relationship.

A study published in April 2026, after our search window, in another floodplain community of the Lower Amazon (Alenquer, Pará) found a similar pattern. Of 39 interviewees, 84.6% reported a personal or family history of snakebite, 33.3% sought hospital care, and traditional treatments included dolphin fat [24]. It was not part of our corpus, but it was also published in a public health journal and points to the same focus on snakebite. Documenting these perceptions is relevant for conservation because killing snakes out of fear or perceived self-defense is common [11], and community knowledge can inform coexistence strategies.

Documenting how communities perceive snakes is also a step toward conservation proposals built with, and not only for, them. In the Lower Amazon, for example, listening to riverine dwellers showed that killing anacondas was driven mainly by anger over losses of poultry, rather than by fear or myth, and that men and women reacted differently, which pointed to practical measures such as safer henhouses and the management of anaconda fat [11]. Such nuances within communities allow proposals for neglected animals such as snakes to dialogue on equal terms with local knowledge, safety concerns, and livelihoods, in line with calls for equitable co-creation of research with local communities [23]. More studies of community perceptions would therefore widen the paths to coexistence strategies that communities can adopt in the long term.

These patterns speak to two broader debates. The first concerns who produces knowledge about traditional communities. Because the structure of collaboration shapes research agendas and the ethical and participatory dimensions of the work [15], a literature produced mostly within the region, but with floodplain research depending on one external group, suggests that regional capacity exists but is unevenly distributed across environments. The second concerns how documented knowledge becomes conservation and health action. Equitable co-creation of research with local communities can support more inclusive science and better resource management [23], and restrictions on legal access to traditional knowledge have been pointed out as a barrier to research with traditional communities [12]. In this context, the scarcity of studies of snake perceptions is not only a gap in knowledge but also a gap in the evidence base for coexistence proposals built with communities.

In sum, this study moves from asking how much has been published to asking who documents the knowledge of traditional communities, where, and whether it serves the problems these communities face. By showing that documentation is recent, uneven across space and environments, led mostly from within the region but dependent on one external group for floodplain research, and nearly silent on community perceptions of snakes, it gives research agendas an evidence base for priorities that serve both conservation and public health.

Based on these gaps, we suggest five research priorities. The first is studies in underrepresented states, such as Amapá, Tocantins, Mato Grosso, and Roraima. The second is studies in *terra firme*, savannas, and *campinaranas*, and in *igapó* as a distinct environment. The third is research with Indigenous peoples,

together with searches that use terms specific to them, to assess how much of it has been published. The fourth is research on community perceptions of snakes, including non-venomous species, persecution, and coexistence, in more regions and communities. The fifth is stronger collaboration networks involving local institutions and communities, together with the indexing of regional literature.

This study has limitations that should be considered, first regarding what the corpus covers. Because scientometric analyses typically take the indexed scientific article as the unit of analysis, the corpus was restricted to peer-reviewed articles indexed in Web of Science, Scopus, and SciELO. Theses, dissertations, book chapters, reports, and articles in non-indexed journals were excluded. Because part of the ethnobiological research in the Brazilian Amazon is produced in graduate programs and disseminated in national and regional outlets, our estimates reflect the indexed literature and may underestimate total research effort, especially on niche topics such as perceptions of snakes.

Indeed, at least one relevant study on conflicts between riverine communities and anacondas in the Lower Amazon floodplain [11] was not retrieved by the search. We chose not to add it manually, in order to preserve the reproducibility of the selection and to avoid a bias that would favor only snakes among the taxonomic groups compared. It nevertheless illustrates that the search may have missed eligible studies. In addition, the search terms, mainly ethnobiological terms in English, may have excluded studies that address local knowledge without using these terms, as many earlier studies in the Amazon were not labeled “ethno-” even though they fit the field [20], and the search was limited to records published up to 2025 (for example, Muniz et al. [24], discussed above). The search did not include terms specific to Indigenous peoples or to other social groups, so their share in the corpus may be underestimated.

Finally, the corpus is small (50 articles), which reflects the narrow scope of the question (empirical studies with traditional communities in the Brazilian Amazon) and is itself a sign of how little has been indexed, but limits the stability of scientometric indicators, which are more reliable in larger samples [25]. We therefore treated the results descriptively, and percentages, network structure, and small differences between categories should be interpreted with caution.

Other limitations concern how the corpus was assembled and coded. The initial screening of titles, abstracts, and keywords in the databases was performed by a single person, so possible wrongful exclusions at that stage were not cross-checked, whereas the merged table was reviewed by three researchers. Exclusions were not recorded separately by criterion, and no formal measure of agreement was calculated. The search string was entered without parentheses, so it was processed differently in Web of Science and Scopus, and the Scopus search was run in all fields, unlike the Topic field used in Web of Science and SciELO. This may help explain the difference in records retrieved (1,963 versus 217) and means that the databases are not strictly comparable. The search histories were not saved in the databases, and the strategies were recorded manually by the authors, which limits the reproducibility of the search. One article retrieved from Scopus had only foreign affiliations in the exported records, so the country filter and the exported address field may not coincide exactly. No review protocol was registered

in advance. One article without available full text was classified for the qualitative variables from its title and abstract. Finally, we did not code whether the studies addressed conservation or management outcomes, so we cannot assess how far the knowledge documented has been translated into conservation action.

Conclusions

Ethnobiological research with traditional communities in the Brazilian Amazon is recent, uneven in space, environment, and taxa, and led mostly by Amazonian institutions, although floodplain studies depend heavily on one group from outside the region. Community perceptions of snakes are barely documented, with only three articles, all focused on venomous snakes and snakebite. Studies of how communities perceive neglected animals such as snakes are a first step toward coexistence proposals built with them, which can serve snakebite prevention and snake conservation at once. Filling these gaps, particularly in underrepresented states and environments and with Indigenous peoples, together with stronger collaborations that include local institutions and communities, would make the documentation of traditional ecological knowledge more representative and more useful for biodiversity conservation and public health in the biome.

Abbreviations

ICMBio
Instituto Chico Mendes de Conservação da Biodiversidade
INPA
Instituto Nacional de Pesquisas da Amazônia
MPEG
Museu Paraense Emílio Goeldi
PRISMA
Preferred Reporting Items for Systematic Reviews and Meta-Analyses
UFAC
Universidade Federal do Acre
UFAM
Universidade Federal do Amazonas
UFMA
Universidade Federal do Maranhão
UFOPA
Universidade Federal do Oeste do Pará
UFPA
Universidade Federal do Pará
UFRGS
Universidade Federal do Rio Grande do Sul
UNIR

Universidade Federal de Rondônia.

Declarations

Ethics approval and consent to participate

Not applicable. The study analyzed published articles and did not involve human participants or animals.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

SR and APSJ conceived the study. BCCM carried out the database search, screening, coding, and analyses, and wrote the first draft. APSJ and SR supervised the work and reviewed the merged table of records. All authors read and approved the final manuscript.

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Data Availability

All data generated or analysed during this study are included in this published article and its supplementary information files (Additional files 1 and 2).

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Figures

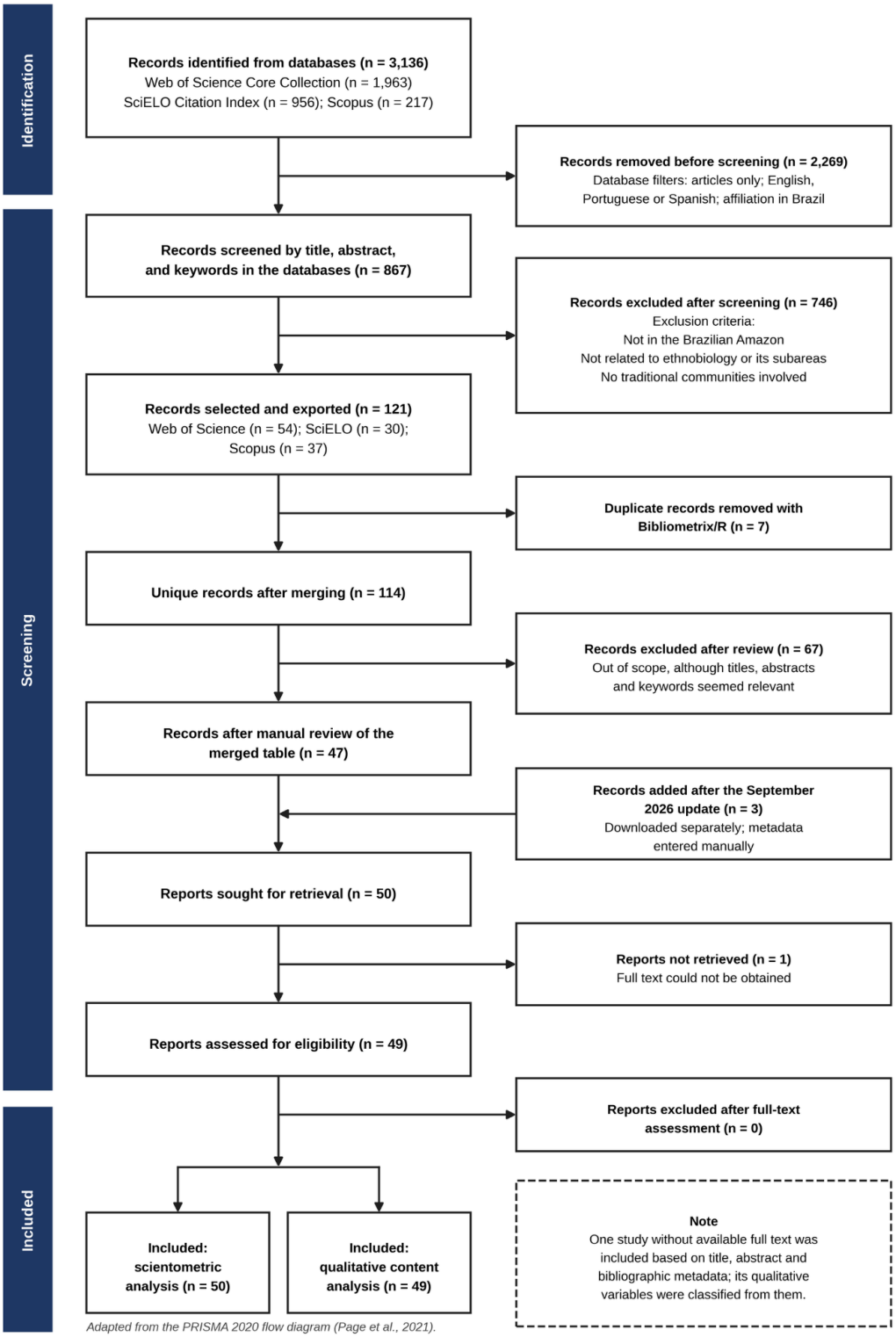


Figure 1

PRISMA 2020 flow diagram of study selection. Records identified from Web of Science, SciELO, and Scopus, screened, and included in the analysis. Adapted from Page et al. [18].

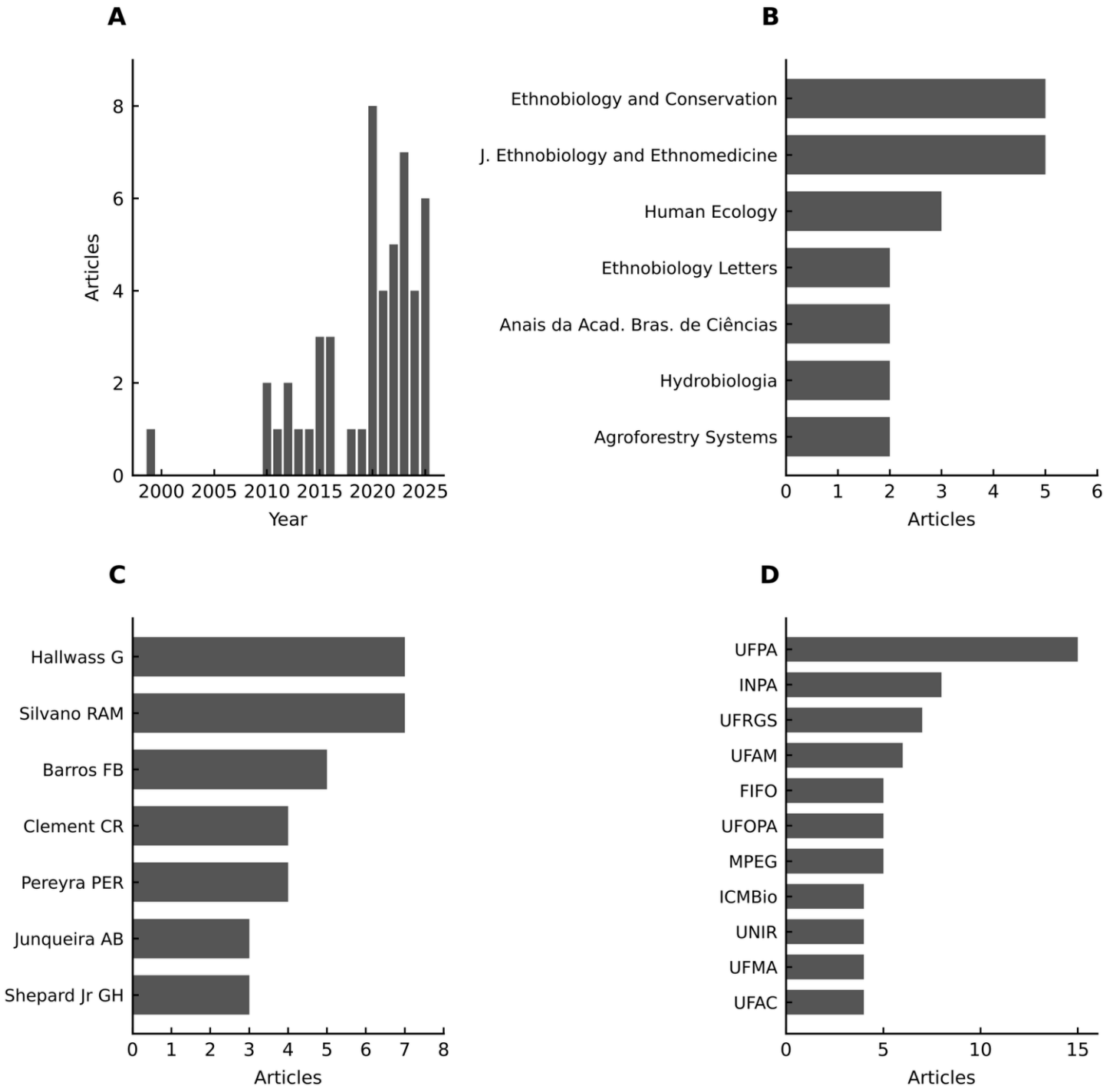


Figure 2

Scientific production on Amazonian ethnobiology with traditional communities. n = 50 articles. (A) Articles per year, 1999–2025. (B) Journals with two or more articles. (C) Authors with three or more articles. (D) Institutions with four or more articles. UFPA, Universidade Federal do Pará; INPA, Instituto Nacional de Pesquisas da Amazônia; UFRGS, Universidade Federal do Rio Grande do Sul; UFAM, Universidade Federal do Amazonas; FIFO, Fisheries and Food Institute; MPEG, Museu Paraense Emílio Goeldi; UFOPA, Universidade Federal do Oeste do Pará; ICMBio, Instituto Chico Mendes de Conservação

da Biodiversidade; UFAC, Universidade Federal do Acre; UFMA, Universidade Federal do Maranhão; UNIR, Universidade Federal de Rondônia.

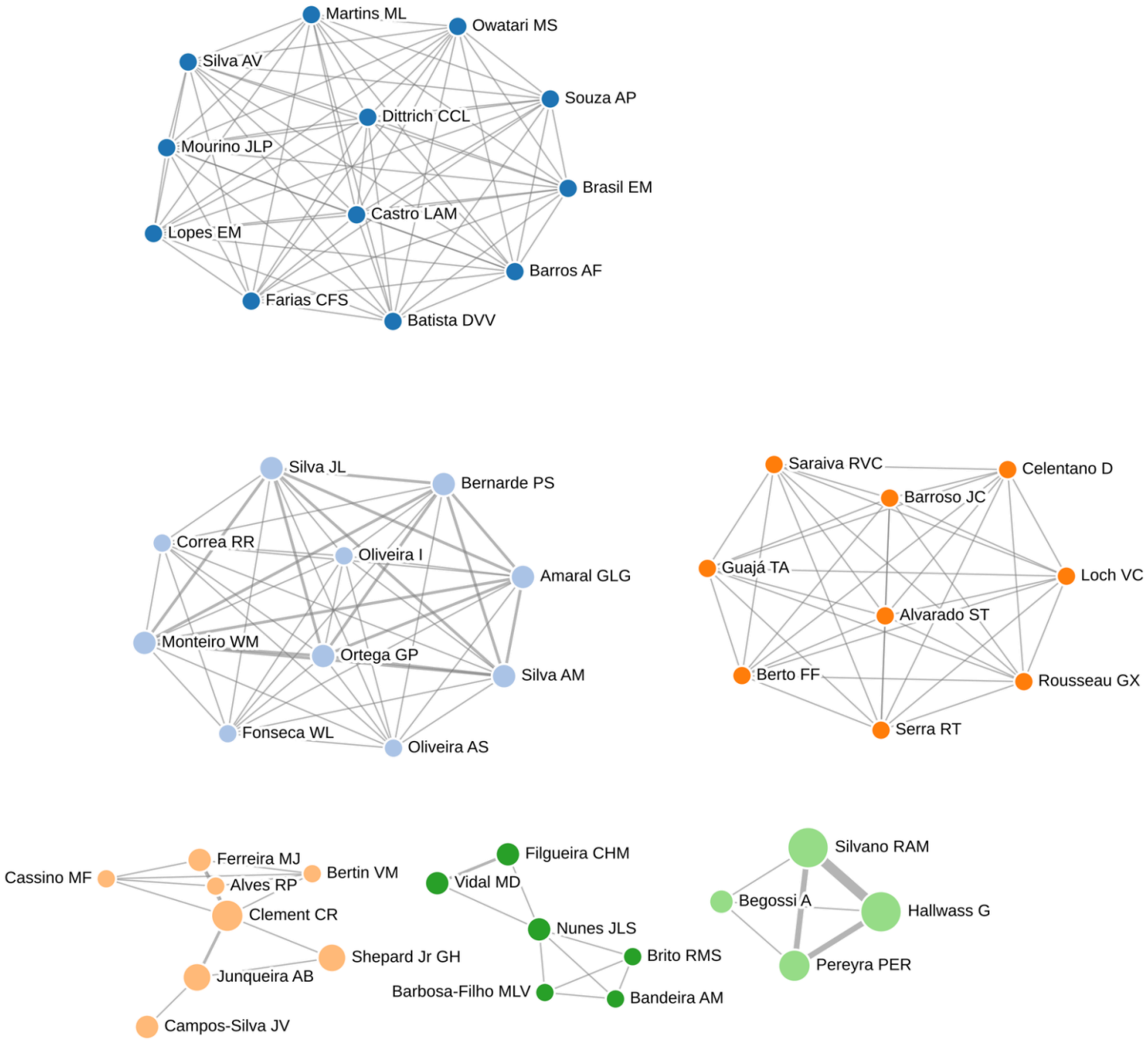


Figure 3

Coauthorship network of 49 authors. Network of the 49 authors shown by the networkPlot function of Bibliometrix (n = 50 nodes), in six groups. Node size is proportional to the number of articles and line

width to the number of co-authored articles. Colors indicate communities detected with the Louvain algorithm. The complete network (176 authors in 25 groups; the 26th group, the author of the single-authored article, is not shown) is in Additional file 1: Figure S1.

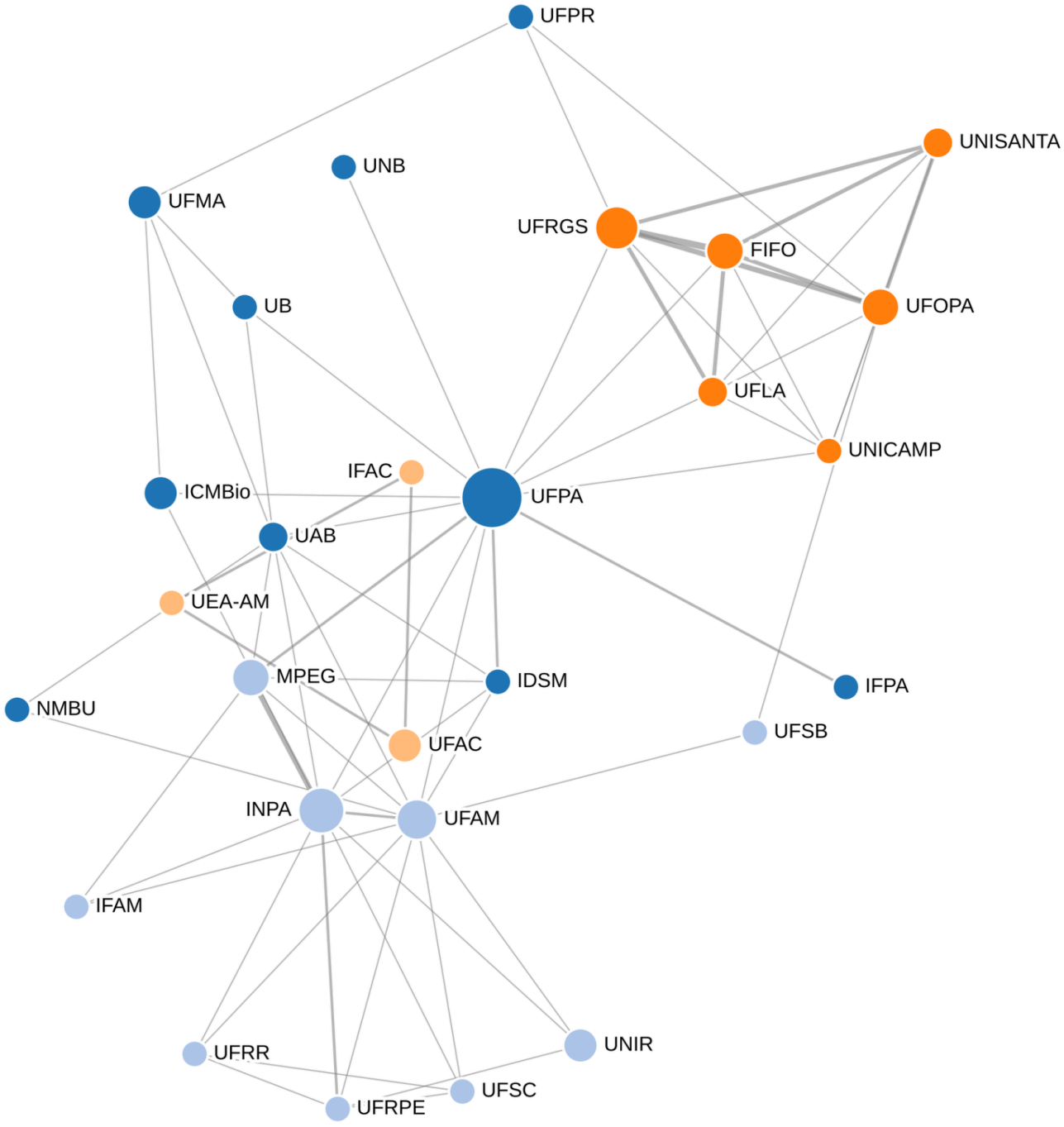


Figure 4

Collaboration network of 28 institutions. Institutions with two or more articles. Node size is proportional to the number of articles and line width to the number of collaborations. Colors indicate communities detected with the Louvain algorithm. Acronyms not defined in Figure 2: UAB, Universitat Autònoma de Barcelona; UB, Universitat de Barcelona; IDSM, Instituto de Desenvolvimento Sustentável Mamirauá; IFAM, IFAC, and IFPA, Instituto Federal do Amazonas, do Acre, and do Pará; NMBU, Norwegian University of Life Sciences; UNB, Universidade de Brasília; UFPR, Universidade Federal do Paraná; UFRPE, Universidade Federal Rural de Pernambuco; UFSB, Universidade Federal do Sul da Bahia; UFSC, Universidade Federal de Santa Catarina; UFRR, Universidade Federal de Roraima; UFLA, Universidade Federal de Lavras; UNICAMP, Universidade Estadual de Campinas; UNISANTA, Universidade Santa Cecília; UEA-AM, Universidade do Estado do Amazonas.

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