

Scientometric analysis of Ecotourism in the Pantanal wetlands

Análise cienciométrica do Ecoturismo na área úmida Pantanal

Análisis cientometrico de Ecoturismo en humedales del Pantanal

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Abstract

This scientometric study aimed to outline an overview of studies on ecotourism in the Pantanal published between 1990 and 2020. In this sense, studies published in the form of books, book chapters and scientific articles in journals were selected. Data were collected using the Web of Science, Scopus and, Science Direct databases, as well as the Google Scholar tool. We identified 36 published works on the subject. In 2020, seven studies were published, this being the year with the largest number of publications. 84% (n = 30) of the works were published in scientific journals, 8% (n = 3) in the form of book chapters and 8% (n = 3) in the form of books. Altogether, 92 authors wrote on the subject, but only 13 of them published at least two works. The highlights were C.J.R. Alho, with 4 publications, followed by R. Hoogesteijn and F. R. Tortato, with 3 each. Among the journals, Ecological Economics was the only one to present 3 articles. The most discussed topics were Ecotourism, Conservation, Biodiversity and Pantanal. Similarly, in the works' keyword network, the words Pantanal, Conservation, Biodiversity and Tourism stood out. Finally, it is suggested that research institutions and Brazilian tourism associations should increase their partnerships to strengthen the research process on ecotourism in the Pantanal.

Keywords: Nature tourism; Review; Publications in tourism; Publications in ecotourism; Scientific knowledge.

Resumo

O objetivo desta pesquisa cienciométrica foi traçar um panorama dos estudos sobre o ecoturismo no Pantanal publicados entre 1990 e 2020. Neste sentido, foram selecionados estudos publicados em forma de livros, capítulos de livros e artigos científicos em periódicos. A técnica de coleta dos dados utilizou as bases de dados Web of Science, Scopus, Science Direct e a ferramenta Google Scholar. Foram identificados 36 trabalhos publicados sobre o tema. Em 2020 foram publicados 07 estudos, sendo este o ano com o maior número de publicações. 84% (n=30) dos trabalhos foram publicados em periódicos científicos, 8% (n=3) em forma de capítulos de livros e 8% (n=3) em forma de livros. Ao todo 92 autores escreveram sobre o tema, mas somente 13 deles publicaram ao menos dois trabalhos. Os destaques foram Alho, C.J.R com 4 trabalhos, seguido por Hoogesteijn, R. e Tortato, F.R. com 3 cada. Entre os periódicos, a Ecological Economics foi a única que apresentou 3 artigos. Os temas mais abordados foram Ecotourism, Conservation, Biodiversity e Pantanal. De forma bem similar, na rede de palavras-chave dos trabalhos sobressaíram as palavras Pantanal, Conservation, Biodiversity e Tourism. Por fim, sugere-se que as instituições de pesquisa e as associações brasileiras de turismo, aumentem suas parcerias para fortalecer o processo de investigação sobre o ecoturismo no Pantanal.

Palavras-chave: Turismo de natureza; Revisão; Publicações em turismo; Publicações em ecoturismo; Conhecimento científico.

Resumen

Este estudio cienciométrico tuvo como objetivo esbozar un panorama de los estudios sobre ecoturismo en el Pantanal publicados entre 1990 y 2020. En este sentido, se seleccionaron estudios publicados en forma de libros, capítulos de libros y artículos científicos en revistas. Los datos se recopilaron utilizando las bases de datos Web of Science, Scopus y Science Direct, así como la herramienta Google Scholar. Identificamos 36 trabajos publicados sobre el tema. En 2020

se publicaron siete estudios, siendo este el año con mayor número de publicaciones. El 84% (n = 30) de los trabajos se publicaron en revistas científicas, el 8% (n = 3) en forma de capítulos de libros y el 8% (n = 3) en forma de libros. En total, 92 autores escribieron sobre el tema, pero solo 13 de ellos publicaron al menos dos trabajos. Los aspectos más destacados fueron C.J.R. Alho, con 4 publicaciones, seguido de R. Hoogesteijn y F. R. Tortato, con 3 cada uno. Entre las revistas, *Ecological Economics* fue la única que presentó 3 artículos. Los temas más discutidos fueron Ecoturismo, Conservación, Biodiversidad y Pantanal. Asimismo, en la red de palabras clave de las obras, destacaron las palabras Pantanal, Conservación, Biodiversidad y Turismo. Finalmente, se sugiere que las instituciones de investigación y las asociaciones de turismo brasileñas deberían incrementar sus alianzas para fortalecer el proceso de investigación sobre ecoturismo en el Pantanal.

Palabras clave: Turismo de naturaleza; Revisión; Publicaciones en turismo; Publicaciones en ecoturismo; Conocimiento científico.

1. Introduction

Pantanal is already recognized worldwide as a destination for ecotourism (Arts et al., 2018; Tortato & Izzo, 2017; Tortato et al., 2017; Greve, 2014; Mittermeier et al., 2005). The biome's rich biodiversity includes 174 mammal species (Alho et al., 2011), more than 260 fish species (Britski et al., 2007) and more than 580 bird species (Nunes, 2011) which, together with the scenic beauty, have attracted visitors to contemplate nature and observe fauna.

Practices such as birdwatching, nature photography and the observation of jaguars are increasingly common in the region (Tortato & Izzo, 2017), especially by foreign tourists. In addition to favoring cultural ecosystem services (Seidl & Moraes, 2000; Costanza et al., 1998), ecotourism has the potential to leverage the economy in developing countries (Rylance & Spenceley, 2017; Mowfourth & Munt, 2016; Meyer, 2010; Balmford et. al, 2009; Benetti et. al., 1999) through socioeconomic development (Alho, 2019) and valuation of nature (Newsome & Rodger, 2013).

Although the ecotourism activity in the Pantanal is constantly growing, the state of the art of scientific knowledge regarding this theme in the biome is unknown, which makes it impossible to analyze the current scenario and the trends of its development. In this context, one can question the approaches, topics, and studied areas to identify the gaps in scientific production and which subjects and areas lack or have more academic studies resulting from this economic activity.

Ramires and Souza (2020) point out that, in the last twenty years, there has been a significant contribution to Brazilian scientific knowledge derived mainly from publications coming from universities. In this sense, according to Oliveira (2018), the Metric Information Studies (MIS), a subarea of Information Science, are very important in offering subsidies not only for the development of research but also for governmental and non-governmental organizations.

The evaluation of academic production techniques can be subdivided into bibliometrics, scientometrics, informetrics and webometrics, with similar functions, but with different approaches (Vanti, 2002). The terms scientometrics and bibliometrics are complex (Kalachikhin, 2018), with different conceptualizations (Oliveira, 2018). Pritchard (1969) was the first to propose the use of the term bibliometrics. From there, several other definitions appeared, as in the works of Sengupta (1992) and Macias-Chapula (1998). According to Bufrem and Prates (2005), for example, the term bibliometrics is associated with the term library. The term scientometry, according to Milkilov et al. (1984) apud Spinak (1996) is "the scientific discipline that studies the structure and properties of scientific information and the laws of the communication process". Regarding the above concepts, Oliveira (2018) clarifies that the boundaries between these subareas are blurred, and the terms have been used interchangeably in recent years. The term bibliometrics is universal (Kalachikhin, 2018) and older (Ramires & Souza, 2020; Oliveira, 2018). However, when there is the use of quantitative methods in the study of technical or scientific activities, from the perspective of their production or communication, usually the term scientometrics is used, the science of science (Vanti, 2002). Thus, as our study measures information and uses the basic production indicator approaches, we chose to use the term scientometrics, which has been most widely used in the most recent surveys (Colavizza et al., 2021; Zakka et al., 2021; De Castilho Ghisi et al., 2020; Espécie et al., 2019; Olawume & Chan, 2018; León-De La O et al., 2018).

To provide a systemic and objective view of research on ecotourism in the Pantanal, this study identified bibliometric characteristics and visualized the relationships of publications in the area through scientometric analysis. We seek to answer, in this way, what is the state of the art of ecotourism in the Pantanal and aim to: 1. Verify the number of publications, researchers, institutions, locations and countries; 2. Identify the most researched keywords and topics in academics in journals; 3. Describe the characteristics of collaboration in research in the field of ecotourism in the Pantanal.

2. Methodology

We used the scientometric methodology to review the scientific studies (Vanti, 2002). The adopted methodology is interdisciplinary (Van Raan, 1997) and efficient in several subareas of knowledge, as demonstrated in several studies (Collavizza et al., 2021; Zakka et al., 2021; Frota et al., 2020; De David et al., 2020; Spanholi et al., 2020; Teodoro et al. 2020; Baldiviezo et al. 2019; Morocco et al. 2019). This type of approach makes it possible to understand how a given field of science is structured and organized (Ochoa et al., 2014) and can map any problems in science, as well as analyze and compare concepts and ideas in a given field (Ding et al., 2001).

The data evaluated in the present study were obtained through a bibliometric survey directed to the Scopus, Web of Science and Science Direct databases and the Google Scholar tool. We used as descriptors the terms [("*ecotourism*" AND "*Pantanal*") OR ("*tourism*" AND "*Pantanal*") OR ("*nature tourism*" AND "*Pantanal*")], present in the title, abstract or keywords. After the results were extracted from the respective databases, we made a preliminary analysis of each article and removed those that had a different focus from our topic of interest. Data collection was performed in January 2021, considering the published studies among 1990 and 2020.

After the processes of survey, selection and analysis of the informational material, a metric study was carried out with the application of the principles of bibliometry and scientometrics according to the bibliometric indicators of production, which involves analysis and/or quantification, such as: profile of the authors, such as gender; academic production per year; journals with the largest number of publications; more productive Brazilian institutions, countries and states; mentioned Pantanal locality; most found keywords defined by the authors that were connected to each other.

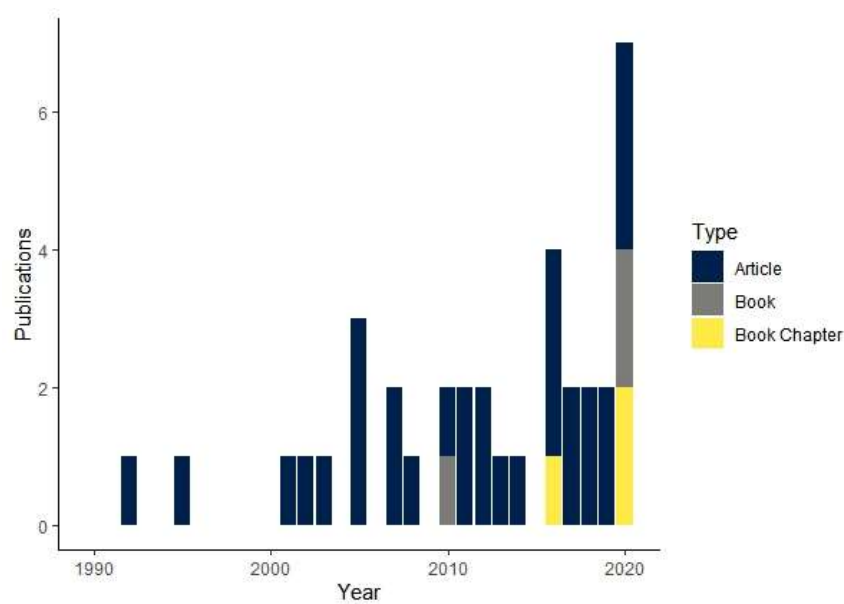
To ascertain the temporal trend in the number of publications, a linear model was carried out between the number of documents and the year of publication. This analysis was performed in R Program (R Development Core Team, 2019) and we considered p values ≤ 0.05 to be significant. Graphs was performed using the “ggplot2” R package (Wickham, 2016). We prepared a map in QGIS 3.10.5 (QGIS.org, 2020) showing how studies on ecotourism are distributed in the Pantanal, and we also indicate the proportion of research found in each location reported in the works.

Based on the partnership established between the authors/co-authors of the publications, we sought to identify the main research centers through a *Cluster* analysis. Thus, each author/co-author was represented by a node (circle), the size of which considered the weight of the relationships *i.e.* the larger the node, the larger the number of scientific productions for that author. For this analysis, we considered only publications with less than 25 authors, since works with a large number of authors could generate biased descriptors. To avoid overlapping, some labels (researcher's name) were not displayed in their respective circles. Still, with the *Cluster* presentation, we created images to identify the authors/co-authors with the largest number of produced documents and classification on a time scale based on the weighted average of the year of publication of the articles. Likewise, the keywords chosen by the authors were also explored through *Cluster* analysis. For this analysis, we considered only the terms mentioned in the works at least 3 times, so that each keyword was represented by a circle whose size considered the weight of the relationships. That is, the larger the circle, the larger the number of citations for each term. The network and image analyses were performed using the VOSviewer software (Van Eck & Waltman, 2010).

3. Results

We found 36 published works on ecotourism, tourism and nature tourism in the Pantanal between 1990 and 2020. Data selection found 80 more documents outside our scope that were removed. Among the selected documents, 29 were written in English and 7 in Portuguese. Of the works, 30 are scientific articles, 3 are books and 3 are book chapters (Figure 1).

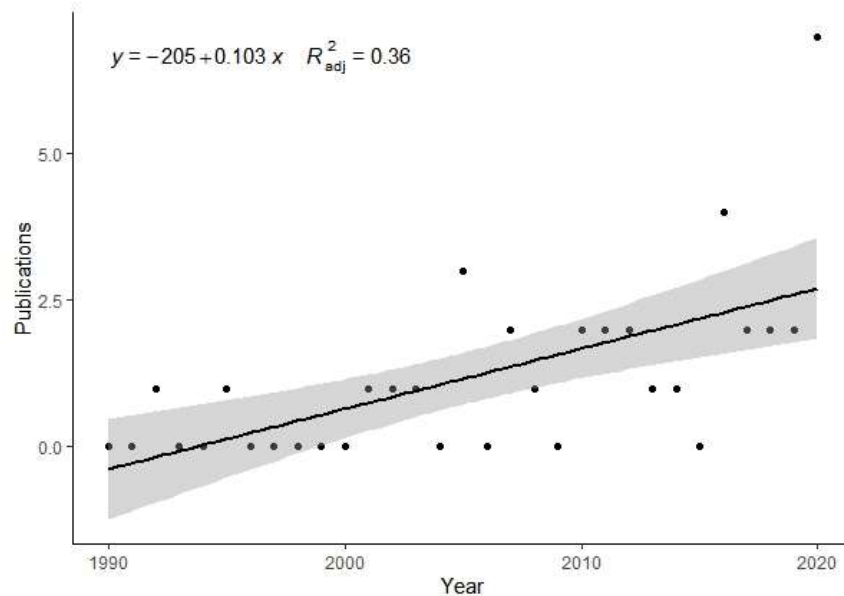
Figure 1. Publications related to ecotourism in the Pantanal from 1990 to 2020. Data from the literature review with the terms “Pantanal”, “Ecotourism”, “Tourism” and “Nature Tourism” presented in the title, abstract and/or keywords found on Scopus, Web of Science, ScienceDirect and Google Scholar platforms with those terms in the title only. The survey was conducted in January 2021.



Source: Self elaboration.

There is an increase significant ($R^2 \text{ adj} = 0.36$; $p < 0.001$) between the number of publications and the years analyzed (Figure 2). The last ten years were the most productive, with 23 out of 36 publications, and the years with the largest number of publications were 2020 (7) and 2016 (4). The period between 1990 and 2000 had the smallest number of publications on this topic (2).

Figure 2. Number of publications per year, showing an increase from 1990 to 2020. Data from the literature review with the terms “Pantanal”, “Ecotourism”, “Tourism” and “Nature Tourism” presented in the title, abstract and/or keywords found on Scopus, Web of Science, ScienceDirect and Google Scholar platforms with those terms in the title only. The survey was conducted in January 2021.

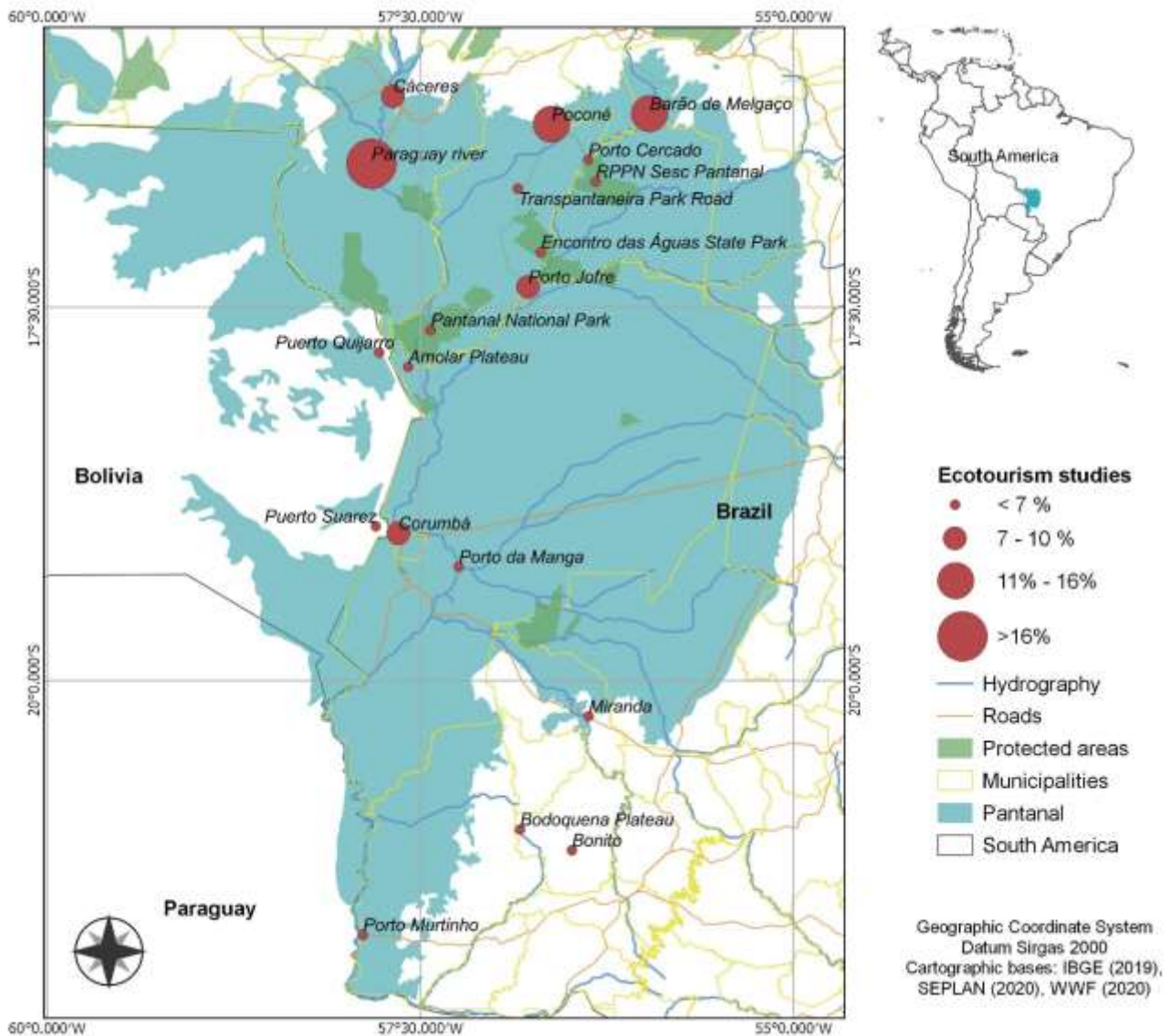


Source: Self elaboration.

The studies were carried out by researchers from 12 countries (Figure 3). Brazil (60), the USA (16), Portugal (7) and the United Kingdom (6) were the ones that most discussed themes related to ecotourism in the Pantanal from 1990 to 2020. Japan (3) and Australia (2) complete the list of countries with at least two publications on ecotourism in the Pantanal. Thus, Brazilian researchers appear as authors/co-authors in 60% of all analyzed works.

Among the most studied areas, the Paraguay River is prominent, as it crosses the Pantanal through the Brazilian states of Mato Grosso and Mato Grosso do Sul, as well as the neighboring countries Bolivia and Paraguay. The municipalities of Poconé and Barão de Melgaço were the most studied so far, followed by Cáceres, and specifically the Porto Jofre region in Mato Grosso, and Corumbá, already in Mato Grosso do Sul (Figure 3). Concerning the Conservation Units, the protected areas of the RPPN SESC Pantanal, Pantanal National Park, Transpantaneira Park Road and Encontro das Águas State Park were contemplated with scientific works dealing with ecotourism.

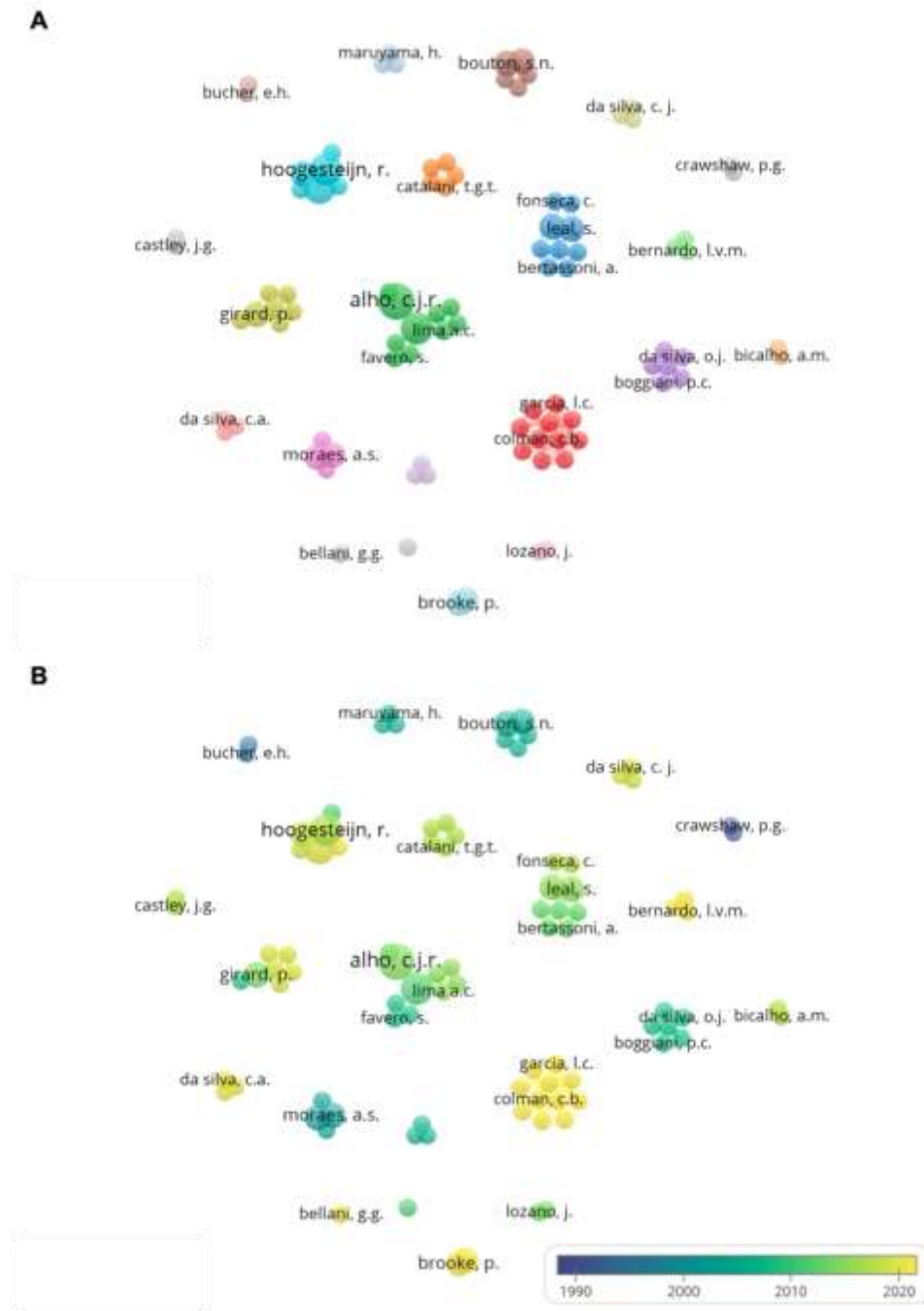
Figure 3. Map of the Pantanal showing the study areas with works on ecotourism in the Pantanal carried out between 1990 and 2020. Circle size illustrates the percentage of documents in that region.



Source: Self elaboration.

We found 92 authors and co-authors and, through network analysis, we obtained 22 *clusters* and 185 links (Figure 4). The authors with more recent publications were I.V.M. Bernardo, G.G. Bellani, C.B. Colman, P. Brooke, and L.C. Garcia. The authors with older publications were E.H. Bucher and P.G. Crawshaw.

Figure 4. A. Network map with clusters. Each author and/or co-author is represented by a node whose size corresponds to their number of publications, so that the larger the node, the more coproduction was recovered. The groups of researchers are represented by different colors. **B.** Overlap showing bibliometric data concerning the researchers and partnerships between authors with 22 clusters and 185 links. To avoid overlapping labels (name of the researcher), some are not shown in their respective circles. The search considered articles published from 1990 to 2020, presenting the terms “Pantanal”, “Ecotourism”, “Tourism” and “NatureTourism” in the title, abstract and or keywords found in Scopus, Web of Science, ScienceDirect, and Google Scholar with those terms in the title only. The survey was conducted in January 2021.



Source: Self elaboration.

Of the 10 authors and co-authors with the largest number of publications, 70% belong to research institutions located

in the states of Mato Grosso and Mato Grosso do Sul, that is, in the Brazilian Pantanal region, including the University for the Development of the State and the Pantanal Region (UNIDERP), Panthera Brazil, Federal University of Mato Grosso (UFMT) and Brazilian Agricultural Research Corporation (EMBRAPA Pantanal). At the international level, only North American institutions are included in the list (4) (Table 1).

Table 1. Authors with at least two publications, their respective number of publications and research institutions that published on ecotourism in the Pantanal from 1990 to 2020.

Order	Author	Publications	Institution
1°	Alho, C.J.R.	4	Universidade para o Desenvolvimento do Estado e da Região do Pantanal (UNIDERP)
2°	Hoogesteijn, R.	3	Panthera Foundation
3°	Tortato, F.R.	3	Panthera Brazil
4°	Bouton, S.N.	2	University of Florida (UF)
5°	Frederick, P.C.	2	Universidade Federal de São Carlos (UFSCar)
6°	Girard, P.	2	Universidade Federal de Mato Grosso (UFMT)
7°	Izzo, T.J.	2	Universidade Federal de Mato Grosso (UFMT)
9°	Moraes, A.S.	2	Empresa Brasileira de Pesquisas Agropecuária (EMBRAPA)
10°	Porfírio, G.	2	Universidade Federal de Mato Grosso do Sul (UFMS)
11°	Sabino, J.	2	Universidade para o Desenvolvimento do Estado e da Região do Pantanal (UNIDERP)
12°	Seidl, A.F.	2	Colorado State University
13°	Brooke, P.	2	Grand View University
14°	Donahue, P.	2	-

Source: Self elaboration.

Among the 26 journals found, only Ecological Economics reached three publications, followed by ORYX and Brazilian Journal of Biology with two documents. Other journals had only one publication each (Table 2). The economy of the Pantanal region led to three studies published in Ecological Economics, two of them concerning environmental impacts. Buscher and Huszar (1995) evaluated the environmental costs of a waterway project between the Paraguay and Paraná rivers, and Seidl et al. (2001) discussed cattle ranching and deforestation in the Pantanal. Shresta et al. (2002) dealt with the fishing and tourism ecosystem services through an analysis of travel costs in South Pantanal.

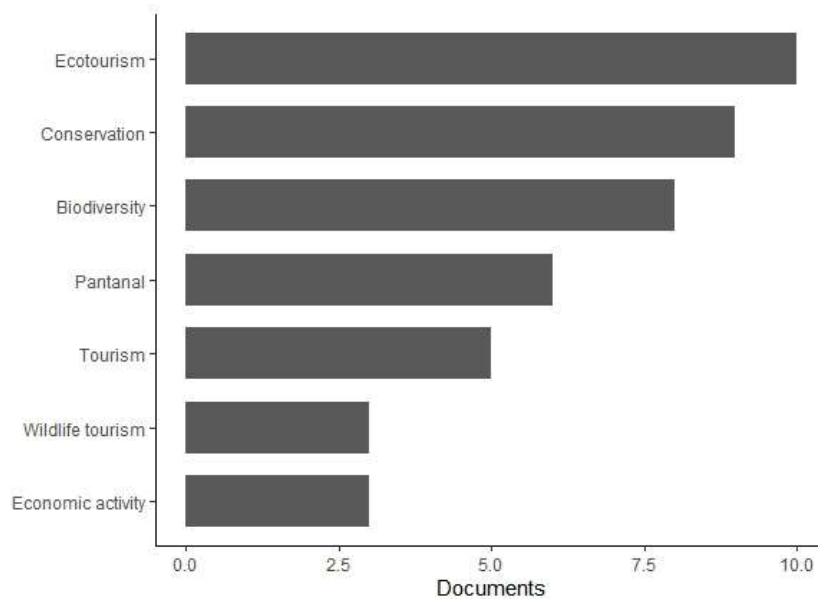
Table 2. Journals and their number of publications (Publ.) on ecotourism in the Pantanal from 1990 to 2020. The keywords used were: Pantanal AND Ecotourism; Pantanal AND Tourism; Pantanal AND Nature Tourism.

Journal	Publ. (N)	Publ. (%)
Ecological Economics	3	10%
ORYX	2	7%
Brazilian Journal of Biology	2	7%
Animals	1	3%
Ardeola	1	3%
Belgian Journal of Geography	1	3%
Biological Conservation	1	3%
Biotropica	1	3%
Conservation Biology	1	3%
Desenvolvimento e Meio Ambiente	1	3%
Formação	1	3%
Geociencias	1	3%
Geographical Review of Japan	1	3%
Global Ecology and Conservation	1	3%
Great Plain Research	1	3%
Journal for Nature Conservation	1	3%
Journal of Environmental Management	1	3%
Marketing & Tourism	1	3%
Neotropical Ichthyology	1	3%
Pan-American Journal of Aquatic Sciences	1	3%
Perspectives in Ecology and Conservation	1	3%
Revista Brasileira de Gestão e Desenvolvimento Regional	1	3%
Revista Brasileira de Ornitologia	1	3%
Sociedade e Estado	1	3%
Sustainability	1	3%
Waterbirds	1	3%

Source: Self elaboration.

Seven main topics have been identified in studies on ecotourism in the Pantanal: Ecotourism (10), Conservation (9), Biodiversity (8), Pantanal (6), Tourism (5), Wildlife tourism (3) and Economic activity (3) (Figure 5).

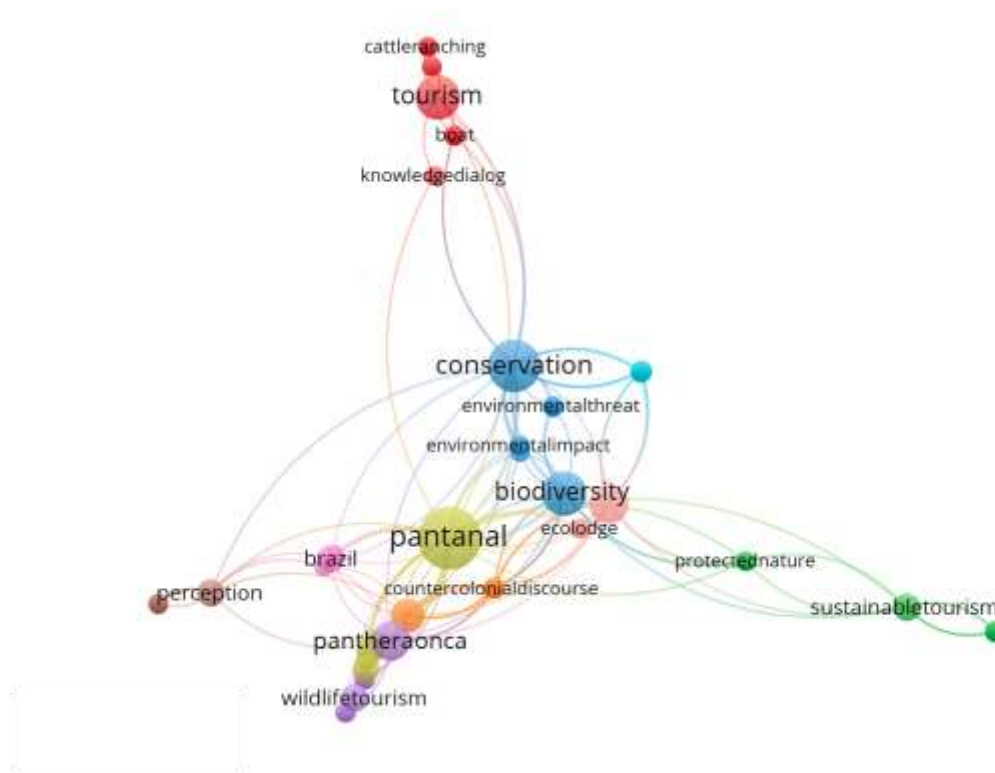
Figure 5. Main topics of publications between 1990 and 2020 with the terms “Ecotourism”, “Nature tourism”, “Tourism” and “Pantanal” presented in the title, abstract and/or keywords found on Scopus, Web of Science or ScienceDirect platforms, and Google Scholar.



Source: Self elaboration.

From the 105 keywords chosen by the authors, we elaborated the network map of co-occurrence of terms. This showed the 70 most expressive keywords in 10 *clusters* based on the co-occurrence values. The combined network characterizes the development of thematic areas over time (1990 to 2020), showing the most significant links between the related research documents. Each point represents a node in the network and the lines that connect the nodes are co-occurring links. The ten groups show homogeneity with the topics previously considered. The most cited terms were “Pantanal”, “Conservation”, “Tourism” and “Biodiversity” (Figure 6). This result corroborates that found for the themes addressed in studies on ecotourism in the Pantanal. Also, these were the terms with the highest similarity index, demonstrating that the connectivity between them is high.

Figure 6. Network map of co-occurring keyword terms with 10 clusters and 256 links. The ten colored groups represented by us are identified by labels (keywords). Each keyword is represented by a node with a size corresponding to its number of co-occurrences, so that the larger the node, the greater the force of co-occurrences. The connections between keywords are represented by lines. To avoid overlapping labels, some have not been displayed on their respective nodes.



Source: Self elaboration.

4. Discussion

The possibility of future research opportunities finds fertile ground when it comes to nature tourism and ecotourism in the Pantanal, because even with an increase in production in recent years in relation to the 1990s, the area still does not keep up with the growth of works on ecotourism in the world (Zhang et al., 2015). Regarding publications at the international level, and considering a smaller scale, our result was similar to that of Zhang et al., 2015, which indicated the USA and the United Kingdom as the most productive countries in the area of tourism between 1974 and 2013.

The Pantanal has a total area of almost 140 thousand km² between Brazil, Bolivia and Paraguay (Boulhosa & Azevedo, 2014), covering 16 municipalities in Brazil. Of these, Barão de Melgaço, Poconé and Cáceres, in the state of Mato Grosso, and Bodoquena, Corumbá, Miranda and Porto Murtinho, in Mato Grosso do Sul, have already been studied within the scope of ecotourism, accounting for 44% of the total of Pantanal municipalities.

Research carried out in the Pantanal shows, until 2020, a tendency to integrate topics such as conservation, biodiversity and tourism. In this sense, some works encourage sustainable tourism (Maruyama et al., 2005) through the observation of wildlife (Tortato et al., 2017; Tortato & Izzo, 2017) as an alternative to help contain the progress of deforestation (Guerra et al., 2020; Seidl et al., 2001), understand the perception of stakeholders (Bolton & Frederick, 2003) and analyze social indicators of tourist activities (Farinha et al., 2020).

The connectivity between research institutions proved to be very low at all levels (regional, national and international), which serves as an alert for institutions and researchers who wish to expand scientific knowledge in the area of Pantanal

ecotourism. Collaboration between researchers provides support to maximize the potential of scientific production (Balancieri et al., 2005). The interaction, information sharing and communication between researchers in ecotourism in the Pantanal proved to be incipient, so as not to present significant collaboration, even among the research institutions located in the Pantanal. Universities such as UNEMAT, UFMT, UFMS, UEMS and UNIDERP presented some works on the theme over the years. However, statistically, there is no collaboration between the analyzed research groups.

Journals considered more productive due to the number of articles, such as *Annals of Tourism Research* and *Tourism Management* (Zhang et al., 2015) have not yet published any work on ecotourism in the Pantanal. The contribution of Brazilian researchers to tourism in general, between 1974 and 2013, was only 1.38%, showing the possibility of growth in this area of knowledge.

The keywords *Tourism*, *Wildlife Tourism* and *Sustainable Tourism* represented the tourist activity in the co-occurrence network, which indicates the proximity between the words chosen by the researchers and were more connected with *Livestock*, *Protection of nature* and *Panthera onca* (jaguar), indicating that the study of tourism also included themes such as *cattle*, *protection of the environment* and *the jaguar*.

Among biological groups, the jaguar was widely highlighted and appeared in documents that address conservation issues (Bellani, 2020; Tortato et al., 2017; Tortato & Izzo, 2017; Quigley & Crawshaw, 1992), conflicts between humans and wildlife (Tortato et al., 2017; Zimmermann et al., 2005) and jaguar watching tourism (Brooke and Donahue, 2020; Tortato et al., 2020; Tortato et al., 2017; Tortato & Izzo, 2017). Still concerning the fauna, the study of Pivatto et al., (2007) was the only one that directly addressed bird watching, an aspect of ecotourism with a high potential for development in the Pantanal due to the rich avifauna in the biome and easy observation of individuals given the abundance of species in the same locality. Thus, bird watching should be further studied since, according to Nunes et al., (2018), in addition to contributing to the tourism production chain, the practice can still contribute to conservation.

5. Final Considerations

This article presents a review of the literature in the field of ecotourism in the Pantanal between the years 1990 and 2020. Even with a high incipience compared to other fields of science, scientific knowledge on the subject has grown, especially in the last five years, with a substantial increase in the number of publications. The applied scientometrics revealed gaps in researched areas since only 44% of Pantanal municipalities were studied. Additionally, only a few organic groups have been identified as tourist motivation, and a small number of ecological articles were focused on them. Biodiversity and conservation were linked both as research topics and as keywords, showing a tendency to bring ecotourism and biodiversity conservation closer together. The research also highlighted the absence of collaboration between authors and institutions, especially those from the Pantanal region, who, therefore, have common interests in the political, social, economic and environmental subjects of this area. In this way, closer collaboration has the potential to increase scientific production and the presence of regional institutions and, consequently, influence decision-making concerning public ecotourism policies in the Pantanal.

For the above, future research on ecotourism in the Pantanal is needed in various fields of science in order to fill gaps and to enhance the development of ecotourism in the Pantanal that is increasingly sustainable and aligned with the ecosystem services provided by this important biome.

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