

Studies on Gullies: an evaluation of Brazilian scientific production (2009/2019)

*Juliana Sousa Pereira*¹ 
*Silvio Carlos Rodrigues*² 

Keywords

Geography
Bibliometrics
Soil Erosion

Abstract

Bibliometrics makes it possible to observe the state of science through academic records. It consists of a fundamental investigation of the production of analytical studies in a determined area of knowledge. This study aimed to provide a profile of the panorama of scientific production in soil erosion by gullies based on the abstracts of theses and dissertations published by researchers in Brazil, in order to identify the institutional actors and contribute to the construction of a solid database able to provide support for future investigations. A total of 127 studies published in the period from 2009 to 2019 were analyzed using the Banco de Teses da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Theses Database of the Coordination for the Improvement of Higher Education Personnel) (CAPES). Iramuteq software was used as a textual analysis tool, this being an important resource in the bibliometric study. The results show that the greatest number of thesis and dissertation defenses occurred from 2016 to 2018. There was a predominance of the local scale observed over other scales in all surveys. Geographic science graduate programs are responsible for the largest academic production, corresponding to 47.2% of all publications in the adopted time frame. The Southeast region has the largest number of universities and, consequently, the largest number of tutors of studies focused on the abovementioned theme. It is important to emphasize the importance of the role of institutions in the evolution of science, which is underpinned by the multiplicity of works produced.

¹ Universidade Federal de Uberlândia - UFU, Uberlândia, MG, Brazil. julianasousa_geo@hotmail.com

² Universidade Federal de Uberlândia - UFU, Uberlândia, MG, Brazil. silgel@ufu.br

INTRODUCTION

Gullies are features established on slopes through both natural, relief sculpting processes and human action. The impacts produced by the establishment of such landforms include environmental, economic, and social damage.

It is practically impossible to use areas hit by gullies for agriculture, livestock, or any urban structure. In cities, these features often become deposits for domestic or industrial waste, further aggravating soil degradation and groundwater contamination (ALBUQUERQUE; VIEIRA, 2014).

Considering this problem, various areas of knowledge have significant studies aimed at understanding the terrestrial geodynamics, in which understanding the genesis and evolution of gullies together with the different impact monitoring and mitigation techniques have facilitated landscape interpretation in light of the geomorphological responses to land use.

It is in this context that Geography has been indispensable in understanding the dichotomous relationship between Society and Nature, in which the role of the geographer in the proposal of solutions, environmental diagnosis, and geomorphological risk control stands out (SAADI, 1997). It is based on this integrative science that the professional can apply technical-scientific knowledge, and, thus, contribute to planning actions (TOMÉ; REIS, 2001).

This study aims to map the theses and dissertations developed in different graduate study programs between 2009 and 2019, considering various areas of knowledge, albeit with a greater focus on geographic science. The intention is to know technical-operational procedures, the teaching institutions, and trends in Brazilian research aimed at the theme of gullies.

The database used was the Catálogo de Teses e Dissertações (Theses and Dissertations Catalogue) developed by CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior in Portuguese, which means Coordination for the Improvement of Higher Education Personnel). The bibliographic review was supported using bibliometric and technological analysis tools on IRAMUTEQ software.

Thus, this study will present the results obtained through the bibliometric survey on the distribution of annual publications and discuss

some of the difficulties intrinsic to scientific practice.

OPERATIONAL AND METHODOLOGICAL PROCEDURES

For the initial organization of this study, the CAPES Catálogo de Teses e Dissertações (CAPES Theses and Dissertations Catalogue) was consulted with the aim of developing a consistent database that would provide support for research and subsequent analyses.

The theme inserted in the CAPES database search field was "Voçoroca" – which means gully in Portuguese or "Gully", the data being collected in January 2020, considering the period from 2009 to 2019. A total of 42 graduate programs were considered and 127 studies were analyzed, being 94 master's dissertations and 33 doctorate theses, organized on the database by title, area, year of publication, institution, and geographic location. Of the 94 dissertations evaluated, two were produced on professional master's degrees.

For the studies without their abstracts available on the platform, because they were published prior to its creation, the specific repositories of the courses were checked.

With the aim of making the information more didactic, some of the programs with the same name and/or those with some specificity in relation to the focus area were grouped, adding up to a total of 42 programs. After constructing the specific database, the command and codification lines of the body of the text were engendered with the use of IRAMUTEQ software, which was used as an auxiliary tool in the statistical analysis of the textual information.

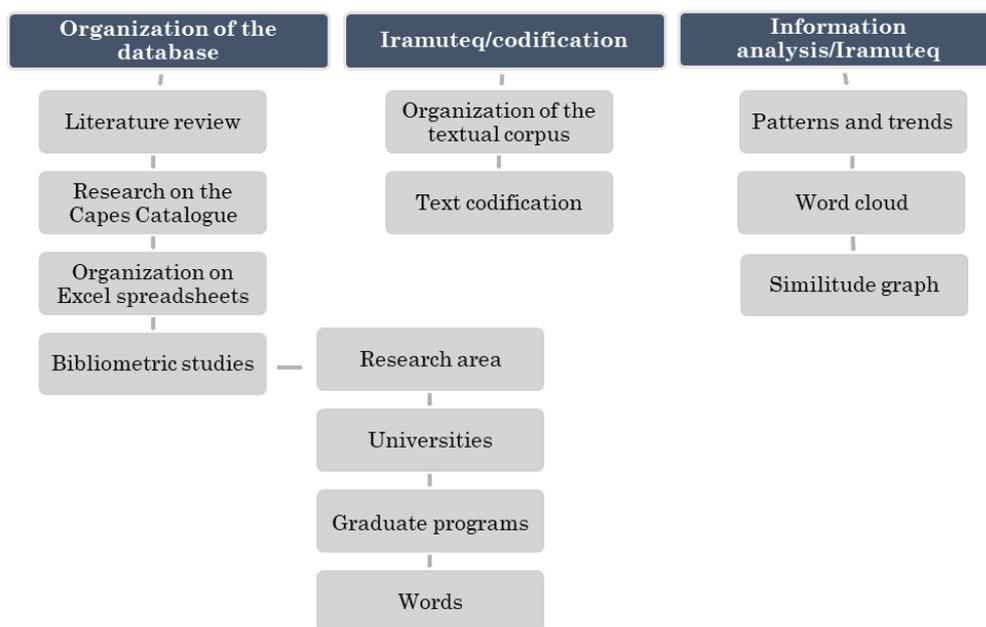
Codification consists of the creation of a document of text in UTF-8 format, without paragraphs, parentheses, brackets, bullets, dashes, or apostrophes. When underwriting the text, the compound nouns should have an underscore inserted between the words to maintain the union of word sets.

With the textual corpus established in the IRAMUTEQ reading settings, the similitude and cloud analysis functions were applied. Consequently, it was possible to understand the structure of the text and themes of significant relevance. Of the 52 forms (component words of the titles), 38 were considered, respecting the minimum frequency of 4 occurrences. A static graph with maximum tree formation was chosen due to the higher quality visual aspect.

The word cloud was constructed based on a simple frequency indicator, demonstrating a compendium of words structured in cloud format; the words are presented in different sizes, whereby the largest are those that have a certain importance in the textual corpus. In the

cloud creation process, standard IRAMUTEQ settings were preestablished, considering the maximum and minimum frequencies of the words. Figure 1 shows a summary of the operational procedures conducted.

Figure 1 – Technical-operational procedures for bibliometrics.



Source: The authors (2020).

RESULTS AND DISCUSSION

Studies on soil erosion in Brazil are considered relatively recent, with the first studies by the pioneering Instituto Agronômico de Campinas (IAC - Agronomic Institute of Campinas) dating back to the 1950s. Their research was aimed at understanding erosive processes, being mainly directed towards laminar erosion.

Long experimentation periods enabled the numerical adaptation of conditioning factors, and, consequently, the application of mathematical models for the prediction of soil losses, which, until then, had only been implemented in temperate climate regions. The concepts and methods addressed in these studies provided a foundation for the research of subsequent decades, being replicated in various locations around the country.

As mentioned above, the present study covers the period from 2009 to 2019; however, on

the CAPES database of theses and dissertations, the first studies related to the theme of gullies date from 1997, being developed in Environmental Engineering programs at the Universidade de São Paulo (USP - University of São Paulo in English), with a perspective of surveying degraded areas proposed for recuperation. The first Geotechnics studies (UNB – Universidade de Brasília, University of Brasília in English) were aimed at the evolution of environmental impacts, while the first studies in Geography (UFPE - Universidade Federal de Pernambuco, Federal University of Pernambuco in English) referred to the evolution of erosive processes.

A total of 127 studies developed at 42 different universities were quantified (Table 1). Regarding the defenses of theses and dissertations, non-sequential quantitative distribution of the studies can be observed, being concentrated in certain periods.

Table 1 - Evolution of the number of Theses and Dissertations on the theme of soil erosion by gullies, defended in various graduate programs at Brazilian universities between 2009 and 2019

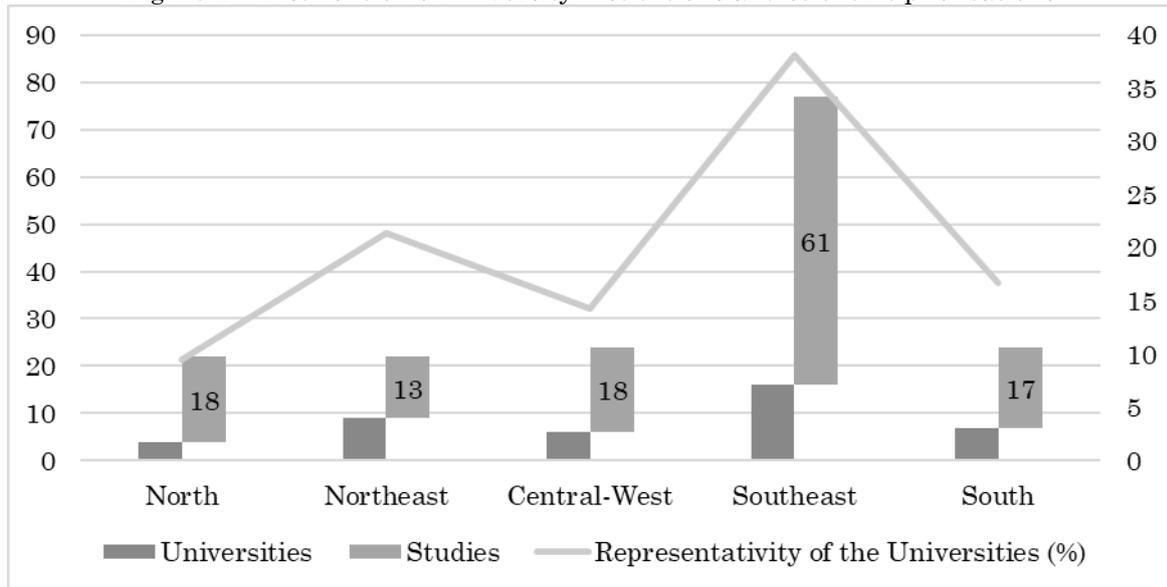
INSTITUTION	PERIOD											Total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
(UNIEVANGÉLICA)		1										1
(UFMS)			1		1							2
(UFRR)							1		2	1		4
(UFS)										1		1
(PUC/Minas Gerais)					1					1		2
(PUC/Rio)									1		1	2
(ESALQ/USP)			1					1	1	1		4
(UNB)			1	2	1		1			1		6
(USP)	1				2	1		1		1	1	7
(UNESP)	2		1	1	1	3	1	2	1		1	13
(UEG)								1		1		2
(UEM)		1								1		2
(UNIMONTES)										1		1
(UEPG)		1										1
(UECE)								1				1
(UEMA)										1		1
(UNIOESTE)											1	1
(UFBA)								1		1	1	3
(UFPB)									1			1
(UFMG)								1				1
(UFG)		1	1				1					3
(UNIFEI)			1									1
(UFLA)	1		1							1*		3
(UFMT)					1	1		1	1			4
(UFMG)											1	1
(UFOP)			1	1	1			1				4
(UFPE)							1					1
(UFRO)	1											1
(UFSC)	1											1
(UFSM)	1					1				1		3
(UFSCar)									1			1
UFU)		1		2	1	1						5
(UFV)		1			1				2			4
(UFAM)						1		5	2	1	2	11
(UFC)		1							1	1		3
(UFPR)		1	1				1		1			4
(UFPA)					1				1*			2
(UFRJ)		1	2	2	1		1	1	1			9
(UFRGS)	1					1	1		2			5
(UFVJM)									1			1
(UFRPE)									1			1
(UFRRJ)		1			1				1			3
Total	8	10	11	8	13	9	8	16	21	15	8	127

Source: CAPES (2020). Elaborated by the authors (2020). *Professional Master's.

Among the 42 institutions considered, 16 are in the Southeast, which corresponds to 38% (Figure 2). The universities in the Southeast constitute the majority in Brazilian scientific development in practically all areas of knowledge. According to Schwartzman (2006), USP (University of São Paulo in English),

Universidade Estadual Paulista "Júlio de Mesquita Filho" (UNESP - University of São Paulo State in English), and Universidade Estadual de Campinas (UNICAMP - University of Campinas in English) are responsible for around a third of all doctorates granted in Brazil each year.

Figure 2 – Distribution of university institutions and scientific publications



Source: CAPES (2020). Elaborated by the authors (2020).

Lencione (2013) explains that until the mid-1990s, the North and the Central-West did not have post-graduate programs in Geography. Furthermore, in 1996, only the programs at USP, Universidade Federal do Rio de Janeiro (UFRJ - University of Rio de Janeiro in English) and UNESP (RC) at Rio Claro Campus included doctorates (SUERTEGARAY, 2007).

Considering the highest frequencies of studies, UNESP and UFAM (Universidade Federal do Amazonas - Federal University of Amazonas in English) lead this scenario. The linearity of publications from the São Paulo State University is greater than that of the Federal University of Amazonas, which has placed itself at the forefront due to the short consolidation time of the post-graduate programs on its courses.

The publications from UFAM date back to 2014 onwards and represent the current decentralization and expansion of master's courses, besides challenging the continued centralization of doctorates in the Southeast. By 2017, only two Brazilian states, Amapá and Acre, did not have graduate courses in Geography (CAPES, 2017b). However, this is no longer the case due to the creation of master's courses by Universidade Federal do Amapá (UNIFAP - University of Amapá in English) and Universidade Federal do Acre (UFAC - University of Acre in English) in 2019.

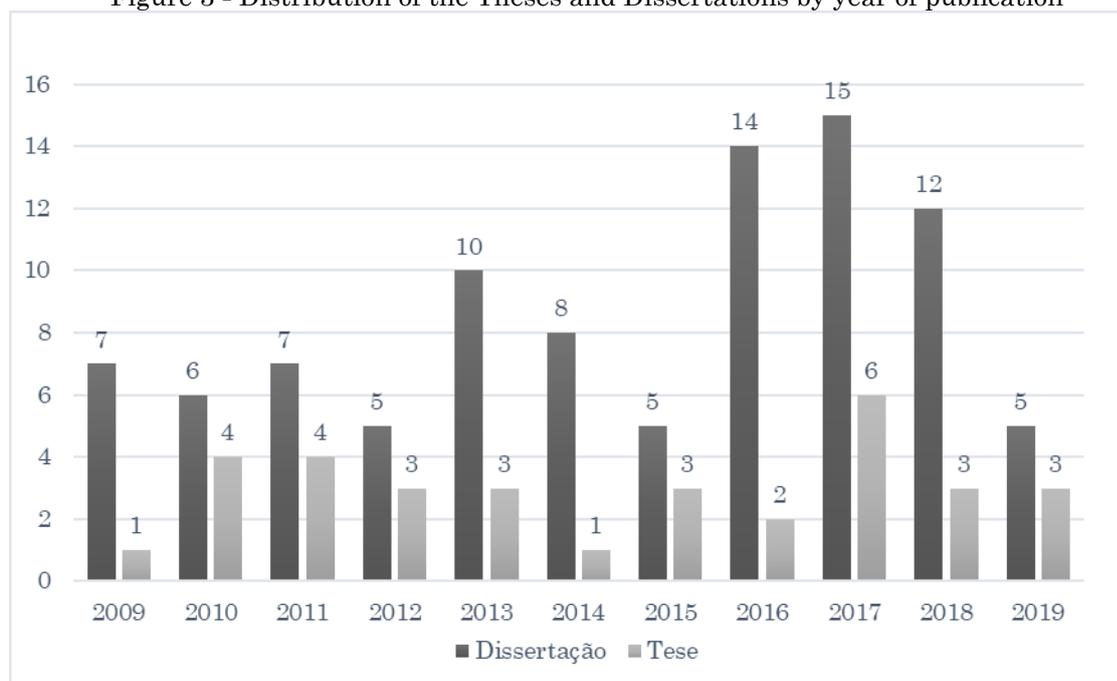
According to the four-yearly assessment report by Capes (Geography) in 2017, the Brazilian scenario had 64 graduate programs in geographic science, with the internalization of the courses being observed, ultimately correcting the asymmetric distribution model in force until the end of the last decade.

Regarding the analyzed publications, it is found that the Southeast accounts for 48.03% of the academic production. The theses and dissertations contemplate the factors involved in erosion and represent a direction of the institutional line of research under the bias of the graduate programs and the tutors, which is highlighted in the methodological conceptual discussion existing in the studies.

The years 2016 to 2017 had the highest productivity; in contrast, the quantity of studies carried out in 2019 was the same as in 2009. However, this may be associated with not adding or updating studies on the Capes platform in the last year.

When observing the distribution of studies by type of defense or level, master's degrees represent 74% of the analyzed total, followed by doctorates with 26% (Figure 3). Some of the evaluated programs still do not offer doctorates. Of the 42 different programs, only 13 had theses defenses.

Figure 3 - Distribution of the Theses and Dissertations by year of publication



Source: CAPES (2020). Elaborated by the authors (2020).

In the perspective of geographic science, Suertegaray (2005; 2007) recognizes that the dominance of the local scale approach, to the detriment of others, reveals the current tendency of Geography to be influenced by the demand for the explanation of specific questions in nearby spaces, neighborhoods, river basins, settlements, parks, and reserves, among others. The adoption of broader scales was seen in the examination of texts and validated by the analyses on Iramuteq with the formation of the word cloud and the similitude analysis.

According to Suertegaray and Nunes (2015), it is increasingly necessary for utilitarian geomorphology was able to provide information on the dynamic of nature in the present. It is well known that there is great difficulty involved in regional studies due to the intrinsic complexity of the scale of analysis, in addition to the need for greater financial and human resources. However, recent policies in the allocation of funds to education make the progress of studies of this magnitude even more difficult.

Specific fields of knowledge have also been developed over time, with an emphasis on techniques that end up corroborating with the creation of proposals for graduate programs in Geography. This is the case of Geographic Information Systems, according to Lencione

(2013), which began appearing in the titles of several studies.

With a lower frequency of publications, but also contributing to the accumulated information, studies arising from professional graduate programs likewise contemplate erosion by gullies. Both the dissertations apply aerial surveys with unmanned aerial vehicles (UAV) for the analysis of erosive processes in gullies.

Nascimento (2017) evaluated the Geoanthropogenic impacts by monitoring the accelerated erosive process in a gully at the Geossítio Cemitério Arqueológico Indígena (Indigenous Archeological Cemetery Geosite) in the city of Manaus-AM. As a result of the study, it was shown that the concentrations of gullies at certain specific points are the result of a combination of deforestation and earthwork, with a deficient artificial drainage system associated with the convex shape and slope declivity.

Through the analysis of the published theses and dissertations, it was possible to establish certain more comprehensive thematic axes in Geography. However, this systematization has only a didactic character, since many studies contemplate various aspects related to the erosive dynamic (Table 3).

Table 3 – Main themes covered in the Theses and Dissertations (2009/2019)

Geography	Thematic axes
Rehabilitation of degraded areas	<ul style="list-style-type: none"> • Implementation and analysis of recovery techniques and the mitigation of erosive processes through revegetation, the adoption of physical barriers, and bioengineering.
Monitoring of erosive processes:	<ul style="list-style-type: none"> • Studies aimed at understanding soil erosion at its interface with geological, geomorphological, pedological, and land use determinants;
Mapping and modeling:	<ul style="list-style-type: none"> • Diagnostic studies on the distribution and classification of gullies; • Monitoring of the erosive dynamic in headwaters of gullies with the use of erosion pins and hydrosedimentological analysis.
Risk Analysis:	<ul style="list-style-type: none"> • Research on vulnerability and susceptibility to linear processes; • Risk mapping; • Analysis of environmental impacts caused by the occupation of slopes in urban areas, indigenous lands, and highways.

Source: The authors (2022).

There is notable evolution in cartographic techniques since the evaluation of the first publications which is evident in increasingly more integrated and didactic maps present in predictive modeling and automatic gulley detection studies, together with environmental fragility models. The creation of registers and the development of stabilization and/or control proposals are also present in the executed studies.

In the context of a decade of scientific studies, the evolution of methodological and operational procedures has greatly contributed to understanding the genesis and spatialization of erosive processes, especially in studies on geomorphological mapping, risks, the spatial

and temporal evolution of gullies, and environmental zoning, among others.

Word Cloud and Similitude Analysis

The cloud formed by words from the titles of the studies developed in Geography emphasizes the vocabulary with certain importance in the textual corpus: “rio” (river), “erosivo” (erosive), “município” (municipality), “voçoroca” (gulley), “processo” (process), “estudo” (study), “SP” (acronym of São Paulo), “bacia hidrográfica” (river basin), and “análise” (analysis), all of which have a frequency greater than 10 occurrences, highlighting the river basin analysis unit in the scales of approaches (Figure 4).

Figure 4 - Word cloud generated using IRAMUTEQ software



Source: The authors (2021).

Defined by geomorphological criteria and consisting of an open system and constant exchanges of material and energy flows, the river basin is an integrator of all hydrological processes (PORTO; LAINA PORTO, 2008). It has occupied a prominent position in the Brazilian academic scenario since 1990, being relevant to current studies directed at environmental diagnostics, especially with recent derivations at lower hierarchical levels, such as sub-basin and micro basin, which are usual terms in various studies.

The information obtained permits the affirmation that there is currently a strong trend toward studies on environmental impacts. Lencione (2013) and Suertegaray (2005) indicate the displacement of research in the field of Geographic Science in its physical aspect to the field of the environment, which can be perceived in the studies evaluated through the connection between words from the titles and keywords. For the authors, the word “nature” has been surpassed by “environment”, in an attempt to overcome the epistemological conflict of Society *versus* Nature, given its integrative essence in regard to phenomena of the geographic space.

However, it is possible that this direction has not only happened in the field of Physical Geography, but also in a relevant portion of the programs in other scientific domains, being distinguished by their nomenclature. As such, 30.95% of the graduate programs with studies aimed at erosion through gullies, have the word “environment” in its different forms in their names (Table 4).

The themes addressed in the studies represent a commitment to understanding the dynamics of the physical environment and the community, presenting, through their integrative character, a new theoretical and philosophical reflection on the environmental problem.

As previously mentioned, the environmental studies are centered on river basins, on a local scale, given the possibility of diagnosis, prognosis, and environmental zoning being used in planning activities for land use and occupation in rural and urban areas. Moreover, for these studies, the geological, geomorphological, and pedological determinants have been indispensable in the analysis of the erosive dynamic of slopes, and the consequent implications on the landscape.

Table 4 - Graduate programs with an environmental perspective

Graduate program	Research Dept. /Institute	Institution
Environment and Society	Agrarian Sciences and Sustainability	UEG
Environmental and Forestry Sciences	Institute of Forests	UFRRJ
The Science of Environmental Engineering	Department of Hydraulics and Sanitation	USP
Environmental Sciences	Center of Biological and Health Sciences	UFScar
Science and the Environment	Institute of Exact and Natural Sciences	UFPA
Environmental Engineering	Department of Environmental Engineering	UFOP
Agricultural and Environmental Engineering	Department of Engineering	UFRRJ
Geoscience and the Environment	Institute of Geosciences	UNESP -RC
The Environment and Hydric Resources	Institute of Natural Resources	UNIFEI
Hydric Resources and Environmental Sanitation	Institute of Hydraulic Research	UFRGS
Society, Technology and the Environment	Department of Post-Graduation, Research, Extension and Community Action	Uni EVANGÉLICA
Environmental Technologies	Faculty of Engineering, Architecture, and Urbanism and Geography	UFMS
Environmental Technologies and Innovations	Departments of Engineering, Chemistry, Forestry Sciences, and Soil Science	UFLA

Source: CAPES (2020). Elaborated by the authors (2020).

The Brazilian production in the scope of erosion in the form of gullies indicates that the publications had at least one of the objectives elucidated, such as zoning, risk mapping, monitoring, and diagnostic studies and the use of geotechnology in information analysis.

The research on the theme has contributed to the multiplication of techniques and conceptual and/or methodological discussions in the various forms of geographical practice. It can be stated that the environmental discussions are supported by Physical Geography on multiple horizons.

Society and its production of space cannot be disregarded when referring to soil erosion. Erosive processes have an impact to some degree on any of the observed bases, whether economic, social, or environmental. The similitude graph indicates the connected space of the terms supporting the identification of the structure of contents present in the research (Figure 5).

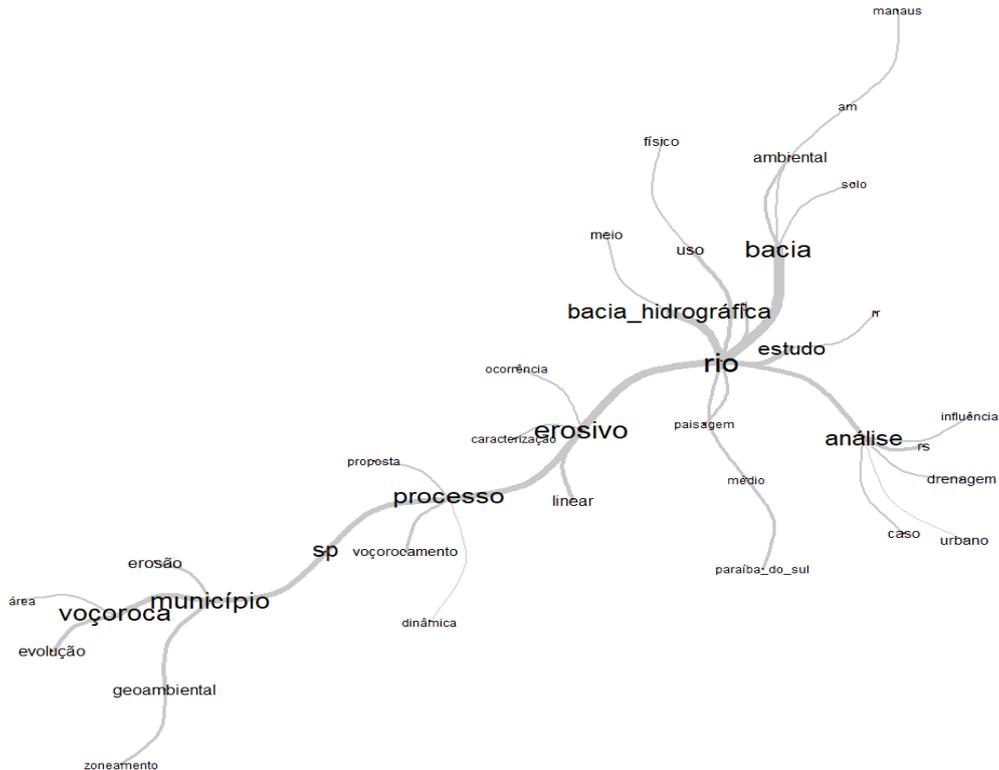
The words are structured in branches according to their influence in the textual

corpus, thus, the words that are arranged on the horizontal branch are those with greater prominence in the titles of the evaluated studies. The words “gullies, municipality, sp, process, erosive, river, and basin” have the same exhibition frequency in the textual corpus and are related to the others that appear on smaller branches.

In the case of the word “study”, it is grounded in the sphere of case studies developed in municipalities and basins, always at a scale of detail arising from the magnitude of the manifestation of the erosive processes on the relief.

The specific themes on gullies were deployed in the most diverse aspects, and the diagnostic and monitoring studies, together with those on genesis and morphology, were deployed in distinct forms of land modeling. The geotechnology applied to erosion is also present in the current research on the evolution of slopes, be it due to the dynamic of the drainage network or inefficiently planned anthropic interventions.

Figure 5 – Similitude Analysis among the titles of Theses and Dissertations developed in graduate programs in Geography



Source: The authors (2020).

Studies carried out by the researchers Biulchi (2012) and Santana (2017) proposed the adoption of low-cost measures to mitigate erosive processes and to recover degraded areas. As such, the construction of palisades and the planting of specific plant species were used.

The Paraíba do Sul River Basin (São Paulo and Rio de Janeiro states) stands out for appearing as the study area in 4 studies, according to the analyzed titles. In addition, the state of Amazonas has been highlighted in the publications regarding erosive processes, especially those associated with highways.

The words and the well-defined spatial outlines indicate that the evaluation of the physical environment in its perspective of risks has also taken place in urban areas. The

expansion of cities through recent allotments requires analyses directed at these spaces in their specific characteristics. The number of neighborhood case studies is growing, which, in addition to aiming at understanding the active processes, corroborate physical-territorial planning, demonstrating the relevance of research on soil erosion in planning and management.

The centrality of the keywords assists in the understanding of the titles arranged in the similitude tree (Table 5). In the similitude analysis, the river basin is a systemic entity supported by geomorphological maps and the automatic detection of gullies, which are enabled by the various modeling techniques, facilitated by Remote Sensing.

Table 5 - Frequency of the keywords in the geography studies generated using IRAMUTEQ software

Keyword	f (%)
Erosion	23
Gulley	20
Erosive	10
Landscape - River Basin	8
Geomorphology – Soil	7
Environmental – Process	6
Urban	5
Model - Earth - Analysis - Linear - Agriculture – Agroenvironmental, Feature - Resource	4
Mapping - Environment – Geomorphological - Impact - Use - Slope - Geography - Hydric - Vulnerability - Evolution – Mitigation	3

Source: CAPES (2020). Elaborated by the authors (2021).

Of the 60 evaluated studies on the geography programs, only 2 studies were extensionist in character, considering smallholdings from family agriculture and/or agrarian settlements. Research such as this, which used a quantitative approach and was based on participative methodologies, brought to the debate questions based on the social relationships of production established through land ownership. Furthermore, they enabled the minimization of erosive impacts through educative practices and the adoption of techniques aimed at containing sediments.

Obviously, science cannot be limited to its immediate applicability, as it could consequently diminish the quality of its processes, which is a question that was debated at the meeting of the 8th Global Research Council (GRC) (CHAVES, 2019). However, when referring to the return to society, this is difficult to measure, just as it is difficult to estimate the impact that a study has within its reach. It is important to endorse the fact that professional and personal formation alongside the production of innovations are primordial gains triggered by experience and accumulated knowledge.

The incorporation of themes and the insertion of technology have contributed to the advance in various forms of practice and thinking in Geography. The studies on the hydrosedimentological dynamic, soil micromorphology, limnological parameters, morphometric parameters, and cartographic techniques have contributed to the understanding of the genesis, evolution, and impacts caused by the establishment of gullies.

It is in light of this elementary science in the understanding of the physical environment that, in the name of knowledge, we mention the various approaches present in the studies of certain universities. These are mentioned as a result of the quantity of theses and dissertations

on the graduate programs in Geography during the last decade and for being directed at the theme of erosion by gullies.

At UFAM, the research has been aimed at mapping areas at risk of gullies in river basins, with special attention to erosion close to highways. All the studies developed at this institution refer to the state of Amazonas, with a focus on Manaus.

At UFU (Universidade Federal de Uberlândia) - Federal University of Uberlândia), the studies were aimed at understanding the erosive dynamic in gullies from the spatialization of the features to the use of low-cost mitigating techniques aimed at containing sediments and revegetation in areas inserted in the morphoclimatic domain of the Cerrado.

At UNESP-PP at Presidente Prudente Campus - Faculdade de Ciências e Tecnologia, which means Faculty of Science and Technology in English, generally, the studies refer to environmental vulnerability in the face of erosive processes in rural and urban areas and include recuperation proposals and control mechanisms for the minimization of impacts in degraded areas. In contrast, at UFRJ the research alludes to geomorphological mapping, the influence of changes in land use, and the reactivation of the erosive dynamic.

The environment is a recurring theme in academic discussions and is part of different political agendas. Thus, it is up to the different areas of knowledge to collaborate in the enrichment of information. In the specific case of erosion in gullies, the studies could contribute further with the application of geotechnology in the understanding of the evolution of slopes and the rehabilitation of degraded areas.

FINAL CONSIDERATIONS

The set of evaluated studies confirms that those aimed at soil erosion demand technical knowledge linked with the understanding of new forms of production and reproduction of the geographical space. Moreover, geographic science has a marked presence within this context, with significant studies that address topics from the different mapping techniques for areas of risk, through environmental vulnerability studies, and the genesis and chronology of erosive processes to the proposal of measures for the rehabilitation of degraded areas.

The centralization of scientific production at institutions in the Southeast region was observed, as was the reaffirmation of the environmental theme within Geography, which is a new trend before the demands of contemporary society. In addition to conveying its interdisciplinary character for nature, the scientific production favored approaches at local scales, demonstrating the need for immediate diagnoses, aimed at understanding the morphodynamics of local relief, notably expressed by the river basin unit and its subdivisions.

The survey of publications was made striving for a robust database able to support the production of knowledge, without emphasizing productivism or stimulating any competition between the programs of any institution. It is more of a reflective directive on the production of science regarding the addressed theme. It is also important to mention the existence of several studies published in the form of articles, resulting from research projects with or without public finance, although these were not addressed in this study.

Few studies elucidated educative proposals aimed at university and/or rural extension, and no partnership with extensionist organs was found. When considering the theme of erosive processes, the participation of the academy is essential for the promotion of methodologies and techniques developed for the mitigation of generated impacts, given that sedimentation and soil impoverishment, together with the devaluation of rural property, are elements interfering in environmental equilibrium, the local economy, and, consequently, land planning.

Knowing the relevance of a structured database in the support of knowledge production, it is worth mentioning the need to improve the platform provided by CAPES so as to facilitate research and avoid time wasting.

Some suggestions are voiced in this text and aimed at the representatives of graduate programs responsible for entering study data on the CAPES page. The first is in respect to the differentiation of upper-case and lower-case writing, given that the system is unable to differentiate between the two. This ends up generating duplicates among author names, tutors, programs, institutions, etc, which circumstantially demands greater attention, besides making research more time-consuming as per the size of the analyzed database.

Secondly, there is notable information inconsistency on the page tabs, which are often not consistent with the recorded information. When making a superficial reading of a determined data, a result is obtained; however, when a deeper search is made through an available filter, the result provided is different, forcing the researcher to check the information over and over again.

The textual analyses carried out using Iramuteq software proved to be valid, especially in the aspect of correlation between themes, visual disposition, and statistical analyses. Therefore, the similitude analysis, together with the word cloud, provided a didactic representation of the considered words.

It is worth mentioning that, in the last decade, there has been an expansion of the graduate study network, enabled by public policies favoring the consolidation of programs and courses at the universities. Nevertheless, there is currently a concern in relation to the quantity and quality of future research, due to the reduction in investment in science and the breakup of institutions.

ACKNOWLEDGMENTS

The authors thank CNPQ for the support of the second author's Grant PQ 302924/2019-1 and the project PRINT/CAPES/UFU 88881.311521/2018-01.

REFERENCES

- ALBUQUERQUE, A. R. C.; VIEIRA, A. F. S. G. Erosão dos Solos na Amazônia. In: GUERRA, A. J. T.; JORGE, M. C. O. (Org). **Degradação dos Solos no Brasil**. 1ªed. Rio de Janeiro, Bertrand Brasil, p.217-257, 2014.
- BARRETTO, A. G. O. P.; BARROS, M. G. E.; SPAROVEK, G. Bibliometria, história e geografia da pesquisa brasileira em erosão

- acelerada do solo. **Rev. Bras. Ciênc. Solo**, Viçosa, v. 32, n. 6, p. 2443-2460, 2008. <https://doi.org/10.1590/S0100-06832008000600022>. Access on: Apr. 3, 2020.
- BERTONI, J.; LOMBARDI NETO, F. **Conservação do solo**. 8ª edição. São Paulo: Ícone, 2012, 335 p.
- BIULCHI, D. F. **Uso de leguminosas arbóreas no controle da evolução de voçoroca no Domínio do Cerrado**. 2012. 279 f. Tese (Doutorado em Geografia) - Instituto de Geografia. Universidade Federal de Uberlândia, Uberlândia, 2012. Available: <https://repositorio.ufu.br/bitstream/123456789/15952/1/UsoLeguminosasArboreas.pdf> Access on: May. 25, 2020.
- CHAVES, L. R. Plenária do GRC no Hotel Renaissance, em São Paulo: agências compartilham experiências sobre gestão e financiamento. **Pesquisa Fapesp**. São Paulo, v.280, p. 36-39. 2019. Available: https://revistapesquisa.fapesp.br/wp-content/uploads/2019/06/036-039_Balan%C3%A7o_280.pdf Access on: Apr. 08, 2020.
- COORDENAÇÃO DE APERFEIÇOAMENTO DE PESSOAL DE NÍVEL SUPERIOR. (CAPES). **Catálogo de Teses e Dissertações**. Brasília, 2020. Disponível em: <https://catalogodeteses.capes.gov.br> Access on: em: Jan. 02, 2020.
- COORDENAÇÃO DE APERFEIÇOAMENTO DE PESSOAL DE NÍVEL SUPERIOR. (CAPES). **Relatório da Avaliação Quadrienal 2017: Agronomia**, relatório de gestão do exercício de 2017, Ministério da Educação, Brasília, 2017a. Diretoria de Avaliação. 27 p. Relatório. Available: <https://www.feis.unesp.br/Home/Pos-Graduacao/strictosensu/agronomia/documento-de-area---ciencias-agrarias-i---capes---2019.pdf> Access on: Oct. 19, 2020.
- COORDENAÇÃO DE APERFEIÇOAMENTO DE PESSOAL DE NÍVEL SUPERIOR. (CAPES). **Relatório da Avaliação Quadrienal 2017: Geografia**, Ministério da Educação, Brasília, 2017b. Diretoria de Avaliação. 35 p. Relatório. Available: https://www1.capes.gov.br/images/documentos/Relatorios_quadrienal_2017/20122017-Geografia_relatorio-de-avaliacao-quadrienal-2017_final.pdf Access on: Out. 19, 2020.
- COORDENAÇÃO DE APERFEIÇOAMENTO DE PESSOAL DE NÍVEL SUPERIOR (CAPES). Fundação do Ministério da Educação e Cultura (MEC), 2020. Apresenta informações sobre a história e missão da Capes. Available: <https://www.capes.gov.br/historia-e-missao>. Access on: Mar.13, 2020.
- LENCIONI, S. Linhas de pesquisa da Pós-Graduação em Geografia. Mudanças, esquecimentos e emergência de (novos) temas. **Revista da ANPEGE**, [S.l.], v. 9, n. 11, p. 5-19, jul. 2017. <https://doi.org/10.5418/RA2013.0911.0001> Access on: Mar. 13, 2020.
- LOUREIRO, H. A. S. **Monitoramento e diagnóstico de áreas degradadas na bacia hidrográfica do Rio São Pedro (RJ) - Estudos experimentais em voçoroca e utilização de geotêxteis de fibra de bananeira**. 2013. 216 f. Dissertação (Mestrado em Geografia) - Instituto de Geografia. Universidade Federal do Rio de Janeiro, Rio de Janeiro, 2013. Available: https://sucupira.capes.gov.br/sucupira/public/consultas/coleta/trabalhoConclusao/viewTrabalhoConclusao.jsf?popup=true&id_trabalho=115172 Access on: May. 25, 2020.
- NASCIMENTO, M. J. L. do. **Geomorfologia urbana por meio de plataforma SIG: monitoramento do processo erosivo acelerado (voçoroca) no Geossítio do Cemitério Arqueológico Indígena de Manaus**. 2017. 72 f. Dissertação (Mestrado Profissional em Ciências e Meio Ambiente) - Instituto de Ciências Exatas e Naturais, Universidade Federal do Pará, Belém, 2017. Available: <http://ppgema.propesp.ufpa.br/ARQUIVOS/Disserta%C3%A7%C3%A3o%20Homologada%202017/Disserta%C3%A7%C3%A3o%20Homologada%202017/Turma-Manaus/Marcio%20Nascimento/Disserta%C3%A7%C3%A3o%20Marcio%20de%20jesus%20llima%20do%20nascimento.pdf> Access on: May. 25, 2020.
- PORTO, M. F. A; PORTO, R. L. L. Gestão de bacias hidrográficas. **Estud.** São Paulo, v. 22, n. 63, p. 43-60, 2008. <https://doi.org/10.1590/S0103-40142008000200004> Access on: Ma. 25, 2020.
- SAADI, A. A Geomorfologia como ciência de apoio ao planejamento urbano em Minas Gerais. **Geonomos**. Belo Horizonte, v. 5, n. 2, p. 1-4, 1997. <https://doi.org/10.18285/geonomos.v5i2.174> Access on: May. 25, 2020.
- SANTANA, A. D. de. **Pensar e fazer geografia: uma contribuição para o controle de erosões em propriedades rurais no município de regente Feijó/SP**. 2017. 180 f. Dissertação (Mestrado em Geografia) Faculdade de Ciências e Tecnologia. Universidade Est. Paulista Júlio De Mesquita Filho/Pr. Prudent, Presidente Prudente. 2017. Available:

- <http://hdl.handle.net/11449/151579>. Access on: May. 25, 2020.
- SCHWARTZMAN, S. A universidade primeira do Brasil: entre intelligentsia, padrão internacional e inclusão social. **Estudos Avançados**. São Paulo, v. 20, n. 56, p. 161-189, 2006. Available: <https://doi.org/10.1590/S0103-40142006000100012> Access on: May. 26, 2020.
- SILVA, A. S.; BOTELHO, R. G. M. Degradação dos Solos no Estado do Rio de Janeiro. In: GUERRA, A. J. T.; JORGE, M. C. O. (Org). **Degradação dos Solos no Brasil**. 1ªed. Rio de Janeiro. Bertrand Brasil, p. 261-292, 2014.
- SUERTEGARAY, D. M. A. O atual e as tendências do ensino e da pesquisa em Geografia no Brasil. **Revista Do Departamento De Geografia**, São Paulo, v.16, p. 38-45. 2005. Available: <https://doi.org/10.7154/RDG.2005.0016.0004> Access on: Apr. 3, 2020
- SUERTEGARAY, D. M. A. Rumos e Rumores da Pós-graduação e da Pesquisa em Geografia no Brasil. **Revista da ANPEGE**, [S.l.], v. 3, n. 03, p. 11-19, 2007. <https://doi.org/10.5418/RA2007.0303.0002> Access on: May. 25, 2020.
- SUERTEGARAY, D. M.; NUNES, J. O. R. A natureza da Geografia Física na Geografia. **Terra Livre**. São Paulo. n. 17, p. 11-24. 2015. Available: <https://www.agb.org.br/publicacoes/index.php/terralivre/article/view/337/319> Access on: Access on: May. 23, 2020.
- TOMÉ, R.; REIS, P. O geógrafo no planejamento e gestão do território: Domínios de Intervenção. **Inforgo**, Lisboa, v.17, p. 177-189, 2002. Comunicação apresentada no IV Congresso Nacional de Geografia, Lisboa. 2002. Available: https://www.apgeo.pt/sites/default/files/inforgo_1617.pdf. Access on: Apr. 3, 2020.

AUTHORS' CONTRIBUTION

Juliana Sousa Pereira collected the data, processed the information, generated statistics and wrote the paper. Silvio Carlos Rodrigues, conceptually reviewed and guided the development of the research



This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited