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João Barbosa Rodrigues: lore and practices

João Barbosa Rodrigues and "The Decrease of Water in Brazil"

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Abstract

The article has as its central theme the text *A Diminuição das Águas no Brasil* ('The Decrease of Water in Brazil'), written by João Barbosa Rodrigues and published in the Report of the 3rd Meeting of the Latin American Scientific Congress, held in the city of Rio de Janeiro, in 1905. Among the aspects highlighted, the construction of the author's narrative, when defending his thesis on the decrease in the volume of water in rivers and springs throughout the country, brings peculiar aspects of his educational background as a botanist and scientist and of his network of relationships with the Brazilian and international scientific community.
Key words: drought, João Barbosa Rodrigues, Rio de Janeiro Botanical Garden, scientific congress.

Resumo

O artigo tem como tema central o texto "A diminuição das águas no Brazil", escrito por João Barbosa Rodrigues e publicado no Relatório da 3ª Reunião do Congresso Scientifico Latino-Americano, realizado na cidade do Rio de Janeiro, em 1905. Entre os aspectos ressaltados, a construção da narrativa do autor, ao defender a sua tese sobre a diminuição do volume de águas em rios e mananciais por todo o país, traz aspectos particulares de sua formação como botânico e cientista e de sua rede de relações com o meio científico brasileiro e internacional.
Palavras-chave: seca, João Barbosa Rodrigues, Jardim Botânico do Rio de Janeiro, congresso científico.

Introduction

Debates about the causes of droughts and the decrease of river waters in Brazil are on the agenda of the day, but they are not recent. So much so that the botanist João Barbosa Rodrigues (1842-1909) presented a Memoir entitled *A Diminuição das Águas no Brasil* ('The Decrease of Water in Brazil')[1], at the 3rd Meeting of the Latin American Scientific Congress, held from August 6th through 16, 1905, in the city of Rio de Janeiro.

Barbosa Rodrigues, at the time director of the Rio de Janeiro Botanical Garden and recognized as a scholar in the field of botany, brought to the public the results of the observations he had made, after traveling through the lands of South America.

For the botanist, field observations, not only in Brazilian territory, had an important weight in his statements. The drought as a result of the decrease of water and the lack of rain was not, for Barbosa, a plausible hypothesis. His argument went through what he used to call the conjunction of geological and botanical studies. Moreover, in his opinion, even before the 19th century, there was already a "geological revolution" in process: "For more than a century, a geological revolution has been taking place in the Brazilian territory, slow, linked or producing another one, meteorological, which together result in the drying of the earth's crust, the decrease in rainfall and the absence or weakening of thunderstorms and hence the cause of the lack of water and perhaps

[1] See the insightful book coordinated by historian Ana Maria Ribeiro de Andrade, The Third Meeting of the Latin American Scientific Congress: science and politics. CGEE/MAST, Brasília/Rio de Janeiro. 2002. 144p. In it, Ana Maria Ribeiro de Andrade, Hugo Rogélio Suppo, Luiz Felipe Vieira Ferrão and Evando Mirra de Paula e Silva discuss the congress, its meaning and its memory.

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of the diseases that develop, given that they find now a more appropriate environment for microbial development which they did not have in the past." (Barbosa Rodrigues 1909: 156, translated by the authors).

The core idea of Barbosa's text is the disappearance of water, which had caused so much drought in Brazilian states, motivated by the end of water springs, which reduced the volume of water. According to the botanist, this fact would have been observed by local residents who informed him about what they had seen over the years. For these men, the rivers, which in the past were mighty, gradually became streams and from streams they became rivulets, until their total disappearance.

For Barbosa, his field observations were intended to draw the attention of government authorities and scholars to the future that was unfolding in the form of a progressive general drying of the earth's crust.

Amidst the quoting of observations made by naturalists who have passed through the Amazon, such as those of the explorer, geographer and mathematician Charles Marie de La Condamine, and observations of local droughts, such as that of Ceará, Barbosa sought, in his text, to present elements to strengthen his explanation. "The Amazon, this giant liquid serpent, that once, a little more than a century ago, spread its waters washing the sides of the mountains, which received its torrential tributaries far away, today with less than a third of the volume of water presents its mouths in the meadows that were once its riverbed. Where in times gone by the low-lying maxim slumbered, today the full maxims do not arrive." (Barbosa Rodrigues 1909: 157, translated by the authors).

Barbosa based his statements about channels that no longer existed, for example, and also on data from local newspapers, when he spent some time in the north of the country, in 1875. Tapajós River and its decrease in water flow would be a glaring example for him. He also concluded that the decrease of the water in the tributaries and streams dried them up, turning them into bushes, as it will be mentioned later.

In observations carried out in Minas Gerais and Espírito Santo states, the botanist saw voluminous rivers that, over the years, disappeared. "In Minas Gerais and Espirito Santo, rivers that I once knew were voluminous, are now small streams. Parahyba, Rio Grande, Rio Verde, Itapemirim, Castello and Fruteira, all of them do not have half the volume they once had, and Rio Caxixe has completely disappeared. In these regions one could say that it has happened due to the disappearance of forests, replaced by fields and crops; but why in Matto-Grosso, in the primitive fields, cut by large rivers, have these also disappeared, or why have their waters decreased? The fields today are the same as in the past (...) their rivers had plenty of water, which they conserved and today have decreased or dried up" (Barbosa Rodrigues 1909: 164, translated by the authors).

Barbosa used the knowledge he had about the city of Rio de Janeiro to constitute his numerous inquiries, which, illustrated by many examples from other parts of the country, reinforced his thesis and the arguments of his reflections, such as the removal of vegetation cover: "Where is Carioca River, which alone would provide water for the current population? Where is Mãi d'agua, which 40 years ago was impressing? Where are the Faria River, Cattete, Laranjeira, Bannana Podre, the Comprido River, the Macacos, the Cabeça, that we all know? It was not the landfills, the water collection, or the buildings that have been making them dry. Where are the old wells, the mines, the fountains, the waterholes? All grounded, because they dried up. We know that the water springs are fed by the rains and that these are attracted by the forests, and that, if these are lacking, those will decrease and, consequently, the former will dry up" (Barbosa Rodrigues 1909: 164, translated by the authors).

In addition, the botanist makes a point of presenting in his argument about the cause of the decrease of water levels in Brazil, his distance from the explanations he called a "laboratory" about the causes of the epidemics that devastated especially the city of Rio de Janeiro. "Today it is current, theoretically, that telluric emanations, the ancient miasmas, do not conduct microorganisms, but in practice, constant facts prove the opposite, going against laboratory experiments. These, however perfect, more cautious and made with greater scientific rigor, are never made under the same conditions as in the actual natural environment" (Barbosa Rodrigues 1909: 266, translated by the authors).

According to the congress report, the Memory of Barbosa Rodrigues was not in the midst of controversy or discussion. It is important to emphasize that the model for the presentation of scientific studies at the congress did not provide space for this discussion. So much so that, at the sixth Ordinary Session, President Luis Morandi

made the following statement: "Mr. President invites the present Members of Congress, for tomorrow 13 of the current month at 3 pm, to be in Largo do Machado, in order to go in special vehicles to the Botanical Garden, for the flower festival that takes place there, and schedules for the 15th at 8:30 am, the reading of the study by Dr. João Barbosa Rodrigues, under the title *A Diminuição das Águas no Brasil* ('The Decrease of Water in Brazil'), and the study by Dr. Simoens da Silva under the title of 'Travels through the inland of the Argentine Republic'." (Report 1909: 27, translated by the authors).[2]

Fact is that the Memoir *A Diminuição das Águas no Brasil* was not even read by its author. It is in the seventh Ordinary Session, also under the presidency of Luis Morandi, that the publication of the work by João Barbosa Rodrigues is deliberate, given that the text was large and the time was short. The text was then forwarded to the publication committee. "Not being able to be read for lack of time, the study by Dr. Barbosa Rodrigues under the title of "The Decrease of Water in Brazil" was sent to the respective commission to be published" (Report 1909: 30, translated by the authors).[3]

Barbosa Rodrigues, the Meeting and sociabilities

João Barbosa Rodrigues actively participated as a member of the Executive Committee and was a speaker at the Congress that took place in the room of the Congregation of the Polytechnic School, in the city of Rio de Janeiro, in 1905.

The botanist was accompanied by scientists who, like him, worked for important institutions or played an important role in their areas of expertise. We can mention Henrique Morize (National Observatory, which still operated in Morro do Castelo, in the city of Rio de Janeiro); Luís Morandi (Physical Climatological Observatory of Montevideo); José Arechavaleta (University of the Republic, in Montevideo, Uruguay); Alberto Löfgren, a Swedish botanist living in Brazil who, between 1910 and 1913, headed the botany section of the Inspectorate of Work Against Droughts (IOCS) and who worked for the Rio de Janeiro Botanical Garden at different times; Alberto Garcia (Municipal Hygiene Institute in Lima, Peru), among other scientists from the section who presented important works in the field of physical and natural sciences.

Barbosa Rodrigues was present in the organization of the meeting and took the congress participants to the Botanical Garden, on a visit with no scientific character, for the flower festival, in the afternoon of the 13th. In addition, his interaction with different topics of the session in which he participated indicates his effective collaboration, not only as a scientist, but also as an organizer, suggesting his insertion in an important network in South American countries (Fig. 1).

The botanist was present at the 2nd Latin American Scientific Congress in Montevideo, in 1901, as part of a commission of five Brazilian representatives, including doctor Manoel Victorino Pereira, engineer Alfredo Lisboa and agronomist and professor at the National Museum, Domingos Sergio de Carvalho. At the end of the meeting, the city of Rio de Janeiro was chosen to host the next meeting, which would take place in 1905. Jornal do Commercio of Rio de Janeiro announced this fact: "The present participants will provide some information, among which, in a solemn session of the Congress of Montevideo, it was acclaimed that the 3 Scientific Latin American Congress will take place in the city of Rio de Janeiro, in the year of 1904 (*sic*), being constituted the Organizing committee with the effective members of the current Executive Committee, and the five participants, that is, Marquez de Paranagua, dr. Paula Freiras, dr. Guedes de Mello, dr. Manoel Victorino, dr. Sá Visona, dr. Barbosa Rodrigues, dr. Alfredo Lisboa and dr. Sergio de Carvalho" (Jornal do Commercio 1901).

A total of 83 institutions from Latin America, being 44 of them from Brazil, from several states, were invited, such as the Rio de Janeiro Botanical Garden, the National Museum, the Auxiliary Society of National Industry, the School of Ouro Preto, the National Society of Agriculture, engineering clubs and law faculties, among others. Such institutions are represented in details in the contents of the Sections and in the reports produced about them.[4]

[2] Minutes of the Sections (1909). Mello HG (org.). General Report and Memoirs referring to the Physical and Natural Sciences section. Volume III. Book A. p. 27. Rio de Janeiro: National Press.

[3] It is important to emphasize that the Report contains the studies in their entirety. General Report and Memoirs referring to the Physical and Natural Sciences section. Volume III. Book A, published in Rio de Janeiro by the National Press, in 1909.

[4] See the chapter "The memory of the Congress" by Luiz Felipe Vieira Ferrão and Evandro Mirra de Paula e Silva. *In*: Andrade AMR (coord.) The Third Meeting of the Latin American Scientific Congress: science and politics. CGEE/MAST, Brasília/Rio de Janeiro .2002, p. 123-126.

Figure 1 – Barbosa Rodrigues and his group. Source: Revista Kosmos. Jul-Set, 1905. *Apud in*: Andrade AMR (2002).

Barbosa, member of the steering committee of the 3rd Congress, acted in an expressive way. A few months before the event, an executive committee was created, headed by the Marquis of Paranaguá, to supervise the organization of the sections. Barbosa was also a member of this commission, along with Carlos Seild, Jose Americo dos Santos, Alfredo Lisboa, Antonio Paula Freitas and Deodato Villela dos Santos, which demonstrates how relevant his participation was.

Sixteen studies were published in the Physical and Natural Sciences Section, including two studies by João Barbosa Rodrigues: *A diminuição das águas no Brasil* and *Structure et formation de la tige des palmiers* ('Structure and formation of the trunk of the palm trees' - original title in french). In the field of botany, we can mention Botanical Geography of the flower of St. Paul, by Alberto Löfgren, and, in meteorology, Meteorological Studies in the High Atmospheric Layers, by Luis Morandi, and Vertical Deviations and Seismic Movements in Rio de Janeiro, by Henrique Morize. The publications are preceded by a report, presented by Monteiro Autran, and the minutes of the sessions, all available in full.

The event was reported by the press, especially by Jornal do Commercio, as mentioned above, Jornal do Brazil, A Manhã, A Gazeta de Notícias and O Paiz, through chronicles, editorials and cartoons. There was an expressive production of images about the event, especially of the participants in the tours throughout the city's tourist attractions.

It all informs us about the presence of Barbosa Rodrigues in exchange networks with scientists from inside and outside the country, understanding them as important spaces for the circulation of knowledge.

Undoubtedly, such spaces of sociability allow us to infer about institutions and the circulation of theories. According to Lopes, it is possible to say that meetings can be "understood as important

mechanisms to draw conceptual frameworks related to the discussions on the circulation of knowledge and technical-scientific practices. These International, Latin and Pan-American meetings contemplated themes related to coal until the first decades of the 20th century. And one cannot ignore the inseparable social, economic and political dimensions at work in these meetings" (Lopes 2015: 157-158).

Meetings were already important during the Great Exhibitions of the 19th and early 20th centuries, as they produced information on the intentions of the organizers of these preparatory events, present in the memoirs, reports and catalogs published especially for these moments.

In the Exhibitions, scientific meetings presented the results of conferences that appeared as "public studies". The meetings were conceived by the organizers of the exhibitions as a meeting place for "men of all competencies" (Heizer 2005: 69). In such events, scientists debated different topics, which also resulted in the expressive production of articles in specialized and scientific journals. Such magazines and periodicals, with different editorial profiles, announced the exhibitions and their meetings and constitute important sources for studies that privilege the circulation of information in these events. For a better notion, it is important to mention that, between 1882 and 1905, there were seven American meetings in the cities of Buenos Aires, Washington, Rio de Janeiro, Montevideo and Santiago de Chile (Kuhlmann Jr. 2001: 146-147). Furthermore, "in the beginning of the 20th century, medical congresses held in Latin America and other initiatives to strengthen academic contacts on the continent expressed the willings of its organizers to consolidate a Latin American scientific network" (Almeida 2012).

The congresses played an important role and the Baron of Rio Branco, José Maria da Silva Paranhos, Minister of Foreign Affairs at the time (1902–1912) was its main protagonist. So much so that one of his strongest defenses for holding these events was that Brazil should come out of the isolation that the monarchical regime would have imposed on it. It was then necessary to be in tune with the republics of the Americas. The meeting was an opportunity for Brazil to assert itself as a republic of men of science in various fields.[5]

The image of Brazil, a republic that wanted to be modern, was at stake, and it is no exaggeration to say that the meetings were opportunities for access to research and a very efficient propaganda space. Thus having access to the themes of these events is enough to understand it.

The participants, in 1905, however, in the midst of the scientific sessions, excursions to institutions and tours, were oblivious to the changes that had taken place in the city of Rio de Janeiro during the remodeling that had taken place there in the years prior to the meeting. "Paris in the tropics" was the image of the city of Rio de Janeiro that was registered by the participants, who knew little about the popular uprisings that took place in the previous year, or about the situation of the working and disadvantaged population, expelled from the "civilized" center of the city and seen as threatening the order and progress of the country.

Thus, the supporters and organizers of the congress, representatives of institutions, places that hosted debates and disagreements, presented to other countries the image of a republic in full progress, leaving out an unequal country that did not translate into the capital, Rio de Janeiro.

It is important to keep in mind that the foreign policy guidelines in that period had as main objectives dealing with the borders with neighboring countries and seeking a more effective approach with the USA. At that moment, the diplomacy supported the Pan-Americanism, not losing sight of the ties with the so-called civilized Europe. An example of this was the fact that Rio de Janeiro hosted the III Pan-American Conference, a year later, in 1906.

The decrease of water in Brazil

"I conclude with what was said by Mr. Stanier, professor of Geology at the Gembloux Institute, that is, water is decreasing on earth and that there will come a time when the entire crust of our planet will be an arid desert and we will die of thirst, telling us to look in the mirror of the planet Mars, whose inhabitants do not perish due to lack of water and what was supposed to be the seas of Mars are nothing more than immense solitudes" (Barbosa Rodrigues 1909: 172, translated by the authors).

"The decrease of water in Brazil" was the last text by João Barbosa Rodrigues to be published. Although it was written in 1898, it was published posthumously in the General Report of the congress, months after the author's death, on March

[5] See the article by Suppo HR (2003) Science and international relations: the meeting of 1905. Revista da SBHC I No. I/2003 I Science and International Relations I p. 6-20. The author analyzes in detail the performance of Minister Rio Branco and the meaning of Congress.

6, 1909. The narrative that Barbosa Rodrigues seeks to construct in the text, in order to support the complex argument he defends, reveals aspects of his journey as a scientist, particular perspectives and, at the same time, networks that connect him with the scientific community in South America and elsewhere (Fig. 2).

The text reflects natural phenomena and Brazilian geographic scenarios. Barbosa gives importance to certain information in the midst of the seriousness of the decrease of water in the country, demonstrating how much he was a connected scientist, as a self-taught, who delved into various disciplinary fields, such as ethnography, linguistics, archeology, indigenism, botany, chemistry and pharmacy. (Sá 2001: 900)

Barbosa Rodrigues begins his text with a prologue ("Sirva de Prólogo") in the midst of a wave of drought faced by most of the country. He argues that the rains temporarily remedy the problem, but do not solve it. It is from this statement that the author builds his line of argument, bringing the hypothesis that there is a general decrease in the volume of water from springs in large regions, if not the entire national territory: "The geological study is confirmed by the botanical study, which shows the difference in age of the lands, due to the quality of the vegetation. Having traveled all over Brazil from the borders of Bolivia, Peru and Venezuela to the Paraguayan lands, that is, going around the whole country from the Amazon to the center of Mato Grosso, it seems to me that the observations I make will have some weight to be presented, proved and counter-proved in all the states that I have traveled throughout these 35 years" (Barbosa Rodrigues 1909: 155, translated by the authors).[6]

What motivated him to publish this study, six years after having written it, would be alarmist journalistic publications from the city of Rio de Janeiro, precisely about the mathematical survey on the decrease in the hydric volume of the water reservoirs of the city, which, once again, strengthened his arguments (Barbosa Rodrigues 1909: 173).

A botanist for much of his career until then, it is not just geological aspects that support Barbosa's observations on the subject. As quoted by the author

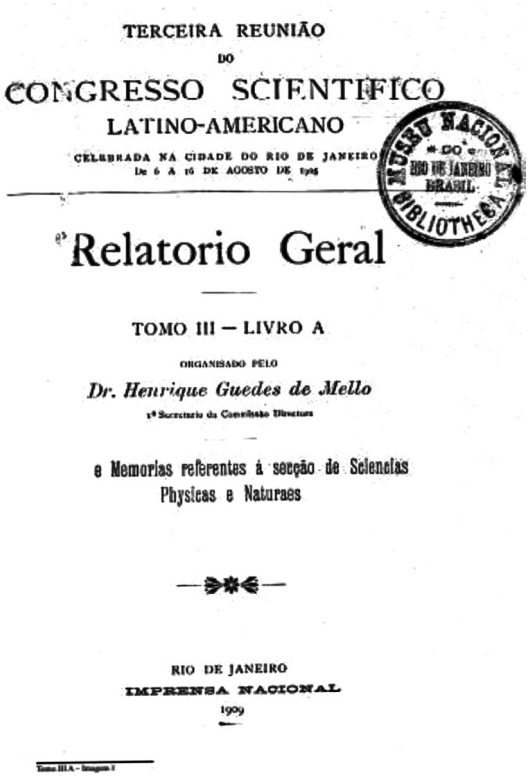
TERCEIRA REUNIÃO
DO
CONGRESSO SCIENTIFICO
LATINO-AMERICANO
CELEBRADA NA CIDADE DO RIO DE JANEIRO
De 6 A 16 DE AGOSTO DE 1905
Museu Nacional
Rio de Janeiro
Brasil
Bibliotheca
Relatorio Geral
TOMO III — LIVRO A
ORGANISADO PELO
Dr. Henrique Guedes de Mello
1º Secretario da Commissão Directora
e Memorias referentes á secção de Sciencias
Physicas e Naturaes
RIO DE JANEIRO
IMPRENSA NACIONAL
1909

Figure 2 – Frontispiece of the General Report and Memoirs referring to the Physical and Natural Sciences section. Volume III. Book A. Published in Rio de Janeiro by the National Press, in 1909. Source: Ribeiro AM (2002) The Third Meeting of the Latin American Scientific Congress: science and politics. CGEE/MAST, Brasília/Rio de Janeiro.

himself, "the geological study is confirmed by that of botany, which shows the difference in age of the land, by the quality of the vegetation" (1909: 155, translated by the authors), later in his text, he states his botanical view: "where once the *ubás*[7] were furrowed, chestnut trees, rubber trees and cacao trees are now displayed" (1909: 157, translated by the authors).

The particularities of the researcher's analysis of the environment here bring a perspective of discrete, but not obvious, contribution, understanding biodiversity as an indicator of climate change, a technical knowledge that strengthens his line of argument. It is also worth

[6] *Sirva de Prólogo. A Diminuição das Águas no Brasil.* General Report and Memoirs referring to the Physical and Natural Sciences section. Volume III. Book Published in Rio de Janeiro by the National Press, in 1909.p.155. *In*: Andrade, Ana Maria Ribeiro (2002) The Third Meeting of the Latin American Scientific Congress: science and politics. CGEE/MAST, Brasília/ Rio de Janeiro.

[7] Ubá is the popular name given to a grass, *Gynerium sagittatum* (Aubl.) P. Beauv., common in floodplains and riparian slopes (on the banks of rivers). Precisely because of this habit, the mention of this plant, in contrast to other arboreal plants, which need stable soils (that is, less floodable), reinforces his thesis regarding the reduction of water.

noting that this observation is made about the Amazon region, with which Barbosa has a certain intimacy, as a result of his work as a researcher and director of the Amazon Botanical Museum, between 1883 and 1890 (Sá 2001: 906), in addition to numerous expeditions, descriptive studies on fauna, flora, geology, ethnographic aspects and many others developed throughout his scientific career.

Based on the observation of diverse scenarios on mighty rivers that lost volume of water, in addition to the extinction of fluvial phenomena, the disappearance of channels and deformation of banks and islands, Barbosa Rodrigues exposes as the main thesis that Brazil had been passing by the geological and meteorological revolutions that were possibly associated with the proliferation of microbial diseases resulting from climate change. He also understands, as previously mentioned, that the publication of this text calls on the appropriate authorities to see and address this problem.

Barbosa complements his argument by bringing the information that the Rhine River, in Europe, was also experiencing dryness, and that specialists had already begun to investigate the cause, still without success. He relates that the droughts in many of the places mentioned are seasonal. However, it seems that with each new period of drought, the volumes of rainwater and river water decrease more.

In the following pages, Barbosa Rodrigues dedicates himself to bringing and describing examples, with numerical data, of springs, rivers and bodies of water from which the volume has been decreasing, in a discreet or expressive way. For this, he uses not only numerical information and journalistic statements, but also statements from his years of research and observations on expeditions. He organizes this list of examples regionally and once again his relationship with the Amazon region becomes clear. The author begins with this region and dedicates many pages to it, resorting to Amazonian rivers again to compare them with those from other regions.

Although we can say that, in fact, the Amazon River basin is the largest in Brazil, it should be noted that the quality of his considerations to talk about the decrease in water is quite authorial and multidisciplinary when referring to the Amazon. Barbosa makes a detailed description, with an observation of the natural processes that signal the reduction of the Amazon River, evoking, for the construction of his narrative, those of explorers, since the 16th century, such as the Portuguese Pedro Teixeira and the Spanish Cristóbal de Acuña, up to Barbosa's own time: "I don't go back to prehistoric times, I come from the journey of Pedro Teixeira and Acuña, reaching Father Samuel Fritz and La Condamine and from there I reach our days. When the king of the rivers spread his white mantle over the present forests, which did not exist, many of which today only form *igapós*, in the past its tributaries were more vigorous and powerful. Its high ravines today, dug and deepened by the decrease and speed of the waters, did not exist in the past, they rose very far away. Decadent, day by day it loses its grandeur; its rivers are drying up, its lands are rising, the vegetation is covering them, its islands are connecting to form peninsulas; on the banks, its *paranás* narrows, the streams disappear, and the *pororocas* weaken. Who, studying, furrowed the waters of the great river and Javary, went to Capim, from Macapá to Tocantins, that is, traveled the upper and lower Amazon; who crossed hundreds of waterfalls, through the tributaries, and walked through forests, it seems that saying what he observed for the benefit of his country does not deserve vituperation" (Barbosa Rodrigues 1909: 157, translated by the authors).

Choosing terms of indigenous origin also draws attention to the writing of Barbosa Rodrigues. The use of words such as *paraná* to refer to creeks, in addition to *igarapés*, *igapós*, *pororocas* and other terminologies when referring to nature, observed in much smaller numbers in scientists of the same time and purposes, is another mark of his work profile in the Amazon, an important part of the way Barbosa builds his texts, studies and narratives. In one of his appendices, entitled *Histórico das Derrubadas e dos Mananciaes* (1909: 175-191), when referring to names of indigenous villages, as well as toponyms of islands and rivers of indigenous origin, Barbosa provides all translations of the used names in footnotes.

In its first pages, it follows the analysis of the decrease of water in the Amazon River and in its dozens of tributaries, citing the rivers Negro, Trombetas, Jamundá (currently known as Nhamundá), Tapajós, Javary (Javari), Madeira, Urubu, Anibá (Anebá) and Uatumã, among others. He cites passages from his travel reports, as well as excerpts from the Diário do Grão-Pará publications in 1875, which comment on the formation of islands and the natural closure of numerous channels, which are only refilled with water when a flood period takes place.

Still on the Amazon River, Barbosa Rodrigues makes a very curious observation about what the decrease in the volume of the river had begun to expose to the eyes: deposits of mollusc shells on river islets, which were possibly unearthed with the rising tides, probably from Amazonian *sambaquis*, although the author does not cite this terminology. However, in addition to considering that these remains would help to provide information about ancient banks of the Amazon, he already attributes ethnoanthropological importance to what seems to be archaeological sites: "The truth is that these molluscs give more light to ethnography than to geology, this was the opinion I formed after a few days of observations and studies. Showing one of the uses of the extinct tribe that once inhabited these regions, this deposit of shells also indicates that it was easy for molluscs to be found in the Amazon waters that then passed through the Ayayá[8] bathing a land that I estimate to be fifty feet above the current level of the Amazon, then unobstructed by the low islands and alluvial lands, which today separate these from the mountain ranges" (Barbosa Rodrigues 1909: 161, translated by the authors).

This mention is related to another work of his authorship, *Antiguidades do Amazonas* (1876: 23-24), in which he comments on the deposits of shells of a fluvial nature, attributing to them a probable artificial origin and, with that, giving them ethnographic and archaeological, *i.e.*, cultural value. It is clear that this mention in the text "Decrease of water" is not just a comment, but a new reference to the importance of these material vestiges for scientific appreciation. Domingues (2012) writes about the relevance that Barbosa gives to the archaeological sites, the *sambaquis*, which he himself preferred to call *sernambi*, as they belong to the indigenous vocabulary. "When introducing *Antiguidades do Amazonas*, Barbosa Rodrigues warns about "our" ignorance on those relics kept by the Earth, claiming that such ignorance was due to the lack of special explorations, which, in turn, led to the disappearance and destruction of the archaeological material, the consequence of which was the ignorance of the customs and uses of the indigenous people. He appealed to the need to carry out scientific work in the natural environment and, at the same time, made it clear that Archeology was a way of preserving culture, an issue that still afflicts intellectuals and specialists who work with cultural memory" (Domingues 2012: 43, translated by the authors).

Once again, the author's interest in indigenous peoples is evident, and he exposes this interest as part of the construction of the defense of his argument about the reduction of waters in Brazil. In addition to botanical examples, such as the replacement of *ubás* for cocoa trees, Barbosa also resorts to the emergence of archaeological sites that were previously immersed in the waters of the great river to warn about the loss of water by the spring, again drawing the attention of the scientific community to these findings.

Barbosa Rodrigues still wondered about the Amazon, whether the increasing ebbs of the river were not associated with the felling and disappearance of forests, immediately answering the reader that no, since there have already been, in the past, more deforested areas, occupied by ranches, farms, crops and several indigenous peoples, now disappeared and covered by forest. As evidence, he cites the comparative count of fireplaces (populations, as shown in Fig. 3) on the banks of the Negro River between the years of 1796 and his time, which shows a decrease of more than 10,455 fireplaces counted, sustained by plantations of sugarcane, coffee, tobacco and indigo, to less than 100.

He completes his argument about the Amazon basin stating the tendency for the Capim river's *pororocas* to disappear, due "not only to the destruction of the lowlands, but to the decrease in the volumes of water" (1909: 163), a topic he talks about properly, given the development of a survey with fieldwork along the entire river (1874-1875), presented in the report Exploration and study of the Amazon Valley (1875).

The same disappearance would occur with the rivers Mearim, in Maranhão, and Itapicuru, in Bahia, from where he amends to address, in a much shorter way, the decrease of waters in the northeast region. He transcribes an excerpt from a letter sent to him by Senator Joaquim Nogueira Paranaguá (1855–1926), working for the province of Piahuy (current state of Piauí), which complements his exposition on the decrease in torrential rains, the decrease in tributaries and streams, dried up and turned into bush (1909: 163).

[8] Name corresponding to the Colombian Yaya Ayayá River, a tributary of Caquetá River (Japurá in Brazil), which feeds the Amazon River from the northwest.

Airão, em 1788, tinha	180 fogos
Arvellos, em 1744, ...	300 »
Alvarães.	120 »
Barcellos, em 1790, ...	460 »
Carvoeiro, em 1790, ...	380 »
Castanheiro Novo.	700 »
Lamalonga.	350 »
Moreira.	470 »
Sant'Anna	290 »
S. Bernardo de Camanã	390 »
Senhora de Caldas, 1785.	400 »
S. Philippe.	320 »
Senhora da Guia	600 »
Santa Isabel.	200 »
S. João do Mobé	480 »
S. Joaquim do Coani.	780 »
Maravilanas	1.580 »
Santa Maria	65 »
S. Miguel do Yparaná	800 »
S. Marcellino	400 »
N. S. de Nazareth do Curianá. . .	800 »
S. Pedro	600 »
Thomar, 1779,.	780 »

Figure 3 – List of fires from 1796 on the banks of the Rio Negro exposed by the author to compare with the less than 100 fires that remained in his day, according to himself. Source: Barbosa Rodrigues, 1876: 162).

He then refers to the south, particularly to the present southeast and central-west regions, and declares to show the same phenomenon of drought on a larger scale. Barbosa mentions several rivers in Minas Gerais and Espírito Santo, in addition to the current Mato Grosso do Sul, Paraná and São Paulo, extending to the Paraguayan Chaco, and then holds all his attention on the federal capital, the city of Rio de Janeiro.

For the city of Rio de Janeiro (Fig. 4), the examples are very numerous, and Barbosa Rodrigues does not hesitate to list dozens of river names, including Banana-Podre, Cabeça, Catete, Comprido, Laranjeiras, and Macacos, emphasizing Carioca and Mãe d'Água (aqueduct region of Carioca, present-day Arcos da Lapa). He also mentions regions that, previously surrounded by sugarcane and coffee plantations, were reforested, as a way of reinforcing his argument that the loss of forests would not explain the loss of volumes of water. "Once, from 1575 to 1800 and even almost to 1820, the mountains that surround this capital, such as those of Tijuca, Corcovado, Gavea etc. which fed and feed the springs that supplied water to its inhabitants, were devoid of vegetation, because in them and on their sides, there were extensive plantations with large crops. However, at that time its springs were abundant. Today the cultures have disappeared, the old *sapezaes* that were formed were transformed into new forests, such as those of Jacarepaguá, Tijuca, Paineiras, Cascadura etc. Today there is vegetation that previously did not exist; however, the springs provide less water" (Barbosa Rodrigues 1909: 168, translated by the authors).

Through a detailed description and historical listing of the fountains, spouts and springs that supplied water to the capital since 1575, comparing the growing number of inhabitants with the decreasing liters of water supplied by these sources, the author concludes his argument that he does not recognize another reason for such desiccation other than its hypothetical geological revolution, which entails a meteorological revolution: "if the cause is not a geological revolution and neither the one I give, let others present it" (1909: 167).

Final considerations

The congress for which Barbosa worked actively in the organization and through which he

Carioca e outras fontes, em 1846, forneciam a agua da seguinte maneira:

	Barris
Rio Carioca (Monte do Regello). . . .	46.702
Paineiras (montanhas da lagôa Rodrigues de Freitas)	19.753
Silvestre	7.900
Lagoinha (montanha dos machados). .	13.272
	87.727

Que o rio Maracanã com os seus affluentes dava:

	Barris
Rio Maracanã.	275.954
Rio S. João.	27.672
Corrego abaixo do S. João.	7.900
Soberbo	10.640
Rio Comprido.	10.643
Corrego do Serpa.	3.193
	336.002

Os outros chafarizes eram alimentados por fontes proprias:

	Barris
Fonte das Laranjeiras, dava	6.386
» de Mata-Cavallos ».	9.193
» » Botafogo.	4.080
Mina do cáes da Gloria	260
Bica da Rainha	532
	20.451

Figure 4 – Exposition of the water barrels count of some of the main spouts and springs in Rio de Janeiro in 1846. Barbosa compares with volumes of water in his days throughout the text, criticizing the lack of updated comparative data, which would contribute to the elucidation of the problem.

made public not only the memory *A Diminuição das Águas no Brasil* but also the study *Structure et formation de la tige des Palmiers*, allows us to infer about Barbosa's networks and the circulation of his studies.

As a man of his time, the botanist circulated in scientific meetings, as well as he privileged, in his studies, the knowledge not sacralized by the scientific practices of his time. Furthermore, his studies can be analyzed in the light of the production of other works from Latin America in the context of the cultural, political and intellectual history (Mäder 2008).

Barbosa asserted himself as a scientist who had observation *in loci* as an argument of authority. His studies deal with different fields and are expressed in his publications and in the production of images about his own figure. In addition, Barbosa took advantage of the fact that he had served the Emperor in Amazonas, at the head of the Museum and on expeditions, as well as his experience in the Botanical Garden of Rio de Janeiro, to affirm his place in the history of science and botany, particularly.

The plurality of his interest in knowledge is also observed in the text *A Diminuição das Águas no Brasil*. While building an argument around the geological revolution as the cause of the growing water crisis, the author exposes aspects of other natures, in addition to geology, that contribute to his thesis. Barbosa presents relevant themes, such as the Amazon *sambaquis*, deforestation and aspects of flora. The botanist presents knowledge acquired from his relationship with the Amazon, some of which comefrom indigenous peoples, to visualize problems that we would today call environmental.

It is a fact that Barbosa's performance as a botanist is merged with his performance at the head of institutions. It is not by chance that most writings on the history of the Botanical Garden of Rio de Janeiro, for example, reproduce the history written about the institution by Barbosa's own hand, in the first part of the publication Hortus Fluminensis (1894). For him, the Republic inaugurated a new moment in which scientific practices would have a leading role, unlike the institution's past, in which science was not in tune with other botanical gardens abroad.

However, far from being a convinced republican, at most we can say that he was a last-minute republican, given that Barbosa was trusted by Pedro II and in a letter, he even claimed to be a monarchist and supporter of the emperor (Heizer 2012). We know that after the proclamation of the republic there was a significant number of individuals who joined the new regime at the last minute, republicans with different profiles, monarchists who wanted the return of the previous regime, among others (Carvalho 1987). Barbosa also wanted to assert himself in this new moment and, for that, denying the immediate past was a legitimizing path.

Barbosa is presented in the publications with the characteristics that the laudatory biographies imprinted on him, sometimes with the profile of a brilliant, radical, intransigent, "quarrelsome" man and, at other times, as the botanist who dedicated himself to the know-how of societies that did not have his knowledge recognized, like the studies he did in other fields of knowledge.

However, it is possible not to remove Barbosa Rodrigues from his universe of production and reflection. Institutional histories, for a long time, pointed to the centrality of their directors, leaving aside other characters who acted in a forceful way in the formation of institutions. In the Botanical Garden of Rio de Janeiro, this is evident.[9] Barbosa Rodrigues does not escape this possibility of reflection. In fact, during his administration, he immediately tried to create a museum, an herbarium and a library and to assert himself by denying the institution's performance, when it was subordinated to the Imperial Fluminense Institute of Agriculture.[10]

Analyzing him, still in the light of the moment in which he lived and acted, without losing sight of the importance of recognizing what Schaffer (1999: 415) called the impregnation "of narratives of cumulative intellectual progress", the search for precursors, among other factors, still so present in research on scientists and institutions.

In the *Hortus Fluminensis* Barbosa Rodrigues wrote about the history of the Rio de Janeiro

[9] It is important to emphasize the lack of research on the work of the enslaved in the institution during the 19th century. It is possible to observe such absence in documents as the "List of slaves belonging to the nation attached to the Botanical Garden of Lagoa Rodrigo de Freitas". Rio de Janeiro, 03/30/1844. 2p. Rio de Janeiro Collection deposited at the National Library (RJ). Available at <http://bndigital.bn.gov.br/hemeroteca-digital/>. Accessed on 10 January 2022.

[10] On this period, see Bediaga B (2014) Marked by its own nature: Imperial Fluminense Institute of Agriculture - 1860 to 1890. Faperj/FGV, Rio de Janeiro.

Botanical Garden from his perspective. Later works updated this story. It is not a matter of removing Barbosa's leading role or excellence, but trying to understand him in a more complex universe of tensions, debates, advances and setbacks. To seek the specificity of his writing and the plurality of his actions, bringing his practices as collective practices to the analysis. Furthermore, seeking to bring to the scene the universe of creation of the botanist, corroborating what, when analyzing the production of biographies and scientific practices in Brazil, Figueirôa (2001: 243) highlighted in his text: they were like Social Studies Science, at least three decades ago, drew attention to the fact that science is understood as a social activity, understanding that scientific practices are socially contextualized.

A Diminuição das Águas no Brasil, sometimes seems, to us, to be a compilation of other studies, sometimes it seems to us to be the result of observations. It does not matter, it is a dated text, and it is necessary to read it from that perspective. Scientists need to be analyzed for what they have in common with their time. *A Diminuição das Águas no Brasil* is the product of a man of his time and should be read without losing sight of the current issue of droughts and can be useful to think about the diversity of topics of interest to botanists at that time, as was the case of the botanist Barbosa Rodrigues.

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