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ITV and Emílio Goeldi Museum release study on Carajás's flora

Published by Rodriguésia magazine, from Rio de Janeiro's Botanical Garden, study has already mapped almost 500 species from Carajás mountains, in Brazil

In the Floresta Nacional de Carajás (Carajás National Forest), in Pará, one of the largest mineral provinces in the world and also peculiar vegetal ecosystems, known as cangas or ferruginous fields, are located. In this area, researchers from the Vale Institute of Technology (ITV) and Pará's Emílio Goeldi Museum (MPEG) have developed since 2015 the project "Flora of the cangas of Serra dos Carajás, Pará, Brazil", considered the most recent and systematized botanical study on the ecosystem of the region. The project counts on the collaboration of more than 90 botanist taxonomists from Brazil and abroad, coming from at least 25 national and international institutions. The total number of flora species after the

completion of the survey, scheduled for December 2017, should reach 700, equivalent to 10% of the species related to the state of Pará.

The study has been published in special editions of the *Rodriguésia* magazine, from the Botanical Garden of Rio de Janeiro, considered one of the most important and traditional publications in the botany area, mainly in plant taxonomy. The second volume will be released today (24th), during the 68th edition of the National Congress of Botany, which occurs in the Botanical Garden, during the roundtable discussion: "Multidisciplinary studies in the cangas of Serra dos Carajás, knowing and conserving plant diversity in the Brazilian Amazon".

This second volume, of the three to be published by *Rodriguésia*, is composed of 51 monographs at the level of botanical families, including eight articles of bryophytes, one of lyophytes, 10 of ferns and 32 monographs of angiosperms, adding up 244 species. In addition to the treatments published in 2016, in the first volume, the survey reaches 106 monographs, with 492 species. The last volume will be released in December, closing the survey of about 700 species.

The monographs include taxonomic descriptions, illustrations, geographic distribution, identification keys for genera and species, and many photographs of the species in the field. It is the result of two and a half years of project research, which includes an extensive collection program in the area. Through the systematization of information and the retrieval of records from the past, the current study contributes to the provision of correct and authenticated information, replacing outdated lists and providing the use of this information for a variety of purposes.

The project dedicated to the flora of the cangas of Carajás is also an important contribution to the 2020 Brazilian Flora, a project coordinated by the Botanical Garden of Rio de Janeiro, which gathers more than 700 collaborators who are preparing an online collection in order to meet the goal 1 of the Global Strategy for Plant Conservation, signed by the Brazilian government.

The Goeldi Museum is a pioneer institution in the scientific investigation on the flora of Carajás, with the first expedition of collection in the region performed in 1969. Since then, Carajás has entered the route of institutional research. Two and a half years ago, the agreement between MPEG and ITV was a decisive step to expand the study of the canga vegetation of Carajás, which resulted in the project "Flora of the cangas of Serra dos Carajás, Pará, Brazil". The research is supported by the Chico Mendes Institute for Biodiversity Conservation (ICMbio).

All the material collected since 2015 is already included in a database, with 8,800 samples deposited in the herbarium of the Goeldi Museum, in Belém. With this information, researchers hope to organize information that is often scattered or incomplete about the species.

The botanist Ana Maria Giulietti, ITV's researcher, Goeldi Museum's collaborator and scientific leader in the study of the Brazilian flora, points out that "this work allowed us to update and systematize the data on the flora of this important

region that is the canga of Carajás. Species that didn't appear in the previous lists were found and species considered to be threatened and rare were collected again".

Vera Fonseca, ITV's project coordinator, complements this idea by explaining that many plants had a single sample collected before 2015. "Now, we collect several samples to expand this knowledge, study the populations, because each one carries a differentiated genetic base, and mark matrices for seed collections."

Pedro Viana, curator of the Herbarium of the Goeldi Museum and publisher responsible for the special volume of *Rodriguésia*, points out other impacts of the research. "With the project field work, the Carajás botanical collection in the herbarium of the museum (MG) practically doubled and new materials were collected", he stated.

"The published results come from a project of great relevance, since it represents a more accurate record on the true plant biodiversity of this peculiar region of Brazil and that constitutes subsidy for the definition of management and preservation policies. In addition, the information contained in these two volumes contributes to an increase of knowledge about the Amazon biome, still quite unknown in the scientific context", stated Renato Crespo, research director at the Botanical Garden of Rio de Janeiro, emphasizing that the study reaffirms the importance of *Rodriguésia* in the publication of articles of great scientific relevance.

Cangas

They are vegetal ecosystems associated to places where the outcrop of ferruginous rocks occurs. The cangas are found in several places in Brazil and are known to house living beings very specific and adapted to the characteristics of these places.

Because they are generally associated with the country's main iron ore deposits, the cangas pose challenges to research and planning that conciliates biodiversity conservation and exploitation of natural resources.

The cangas of Carajás are located immersed in the Amazon Forest, considered the large gap of floristic knowledge in Brazil. The organization of the Flora of the cangas of Serra dos Carajás aims to supply part of this gap and help the dialogue between science, the productive sector and agencies responsible for the environmental licensing in the region, providing detailed information on taxonomy (which classifies living beings), morphology and distribution of the species occurring in the cangas of Carajás.

Perspectives

The development of the project also triggered a number of other studies that are in progress. These research studies involve deepening the knowledge of the distribution of species considered threatened, endemic and rare. Among the ongoing studies, there is also the pioneer project dedicated to the implementation a database with molecular identification of the plants already certified by means of the DNA bar code, work conducted by ITV's researchers, in Belém.

At the end of the project and after a complete compilation of the species occurring in the canga of Serra dos Carajás, it will be possible to establish a comparative view of this flora with other areas of rock formations already listed in the Amazon, such as the Cristalino State Park (Mato Grosso) and Serra do Aracá (Amazonas). It will also be of great importance for comparison with other areas of cangas and rock fields in the Amazon and other parts of the country where they occur, and it expected to be an incentive for new inventories in areas with unexplored flora.

The data before this new survey made references to three species of *Ipomoea* as native of Carajás, and considered endemic of the region: *Ipomoea carajasensis*, *Ipomoea cavalcantei* (the flower of Carajás) and *Ipomoea marabaensis*. Current data refer to seven more species of *Ipomoea* as native, but of wide distribution. Other similar cases have also been recorded for other plant groups.

History

The beginning of the botanical investigations in Serra dos Carajás is relatively recent. The first recorded collections date from 1969, when the botanist Paulo Bezerra Cavalcante, from the Goeldi Museum, made his first expedition to the region to collect material. Through his records, genera and several species previously unknown to science, such as the *Monogereion carajensis*, were discovered and subsequently described.

In the following years, collections of botanical material in the region were intensified by researchers from the Goeldi Museum, supported by Companhia Vale do Rio Doce (CVRD), currently Vale, which maintains studies for the conservation of native species. The company developed the Phenological Study of Plant Species of the Carajás Mineral Province and continuously monitors the cycle and development of the species in order to analyze and implement programs to contribute to their protection.

As a result of these efforts, the first floristic listing for the canga vegetation of Serra dos Carajás was published in 1983, organized by Ricardo Secco (MPEG) and Antônio Mesquita (Amazon Technology Institute). The publication served as a basis for studies with several approaches. Later, in 1991, Manoela da Silva (MPEG), in the study "Floristic analysis of vegetation that grows over hematitic canga in Carajás-PA (Brazil)", lists 58 families, 145 genera and 232 species for the canga vegetation.

In this list, 31% of the taxonomic groups (used in the classification system of living beings) were not identified until the species level or lack confirmation in the determination. Much of the botanical material bearing witness to these works is

deposited in the herbarium of the Emílio Goeldi Museum (Herbarium MG) and is being used in the development of the flora, enabling the confirmation or alteration of the identifications made previously.

From the end of 2007, consultants, professors and students linked to the BHCB herbarium, from the Federal University of Minas Gerais, developed studies on the flora of the cangas of Carajás, aiming mostly at the development of environmental impact reports in the areas of the Carajás National Forest. The floristic analyzes of this vegetation resulted in an increase of approximately 5 thousand samples, deposited in the collection of the University of Minas Gerais.

In 2014, MPEG's researchers received a financial assistance from the National Council for Scientific and Technological Development (CNPq) to begin the development of the Flora of Carajás, a medium and long-term project. At the beginning of 2015, the Flora of Carajás project was strengthened by the hiring of the researcher Ana Maria Giulietti, a botanist recognized worldwide and who has already worked in the development and organization of several national floras - such as the Flora of Serra do Cipó, the Phanerogamic Flora of the State of São Paulo, Flora of Grão Mogol and Flora of Bahia. MPEG and ITV signed a Technical Cooperation Agreement for the development of the "Flora of the cangas of Serra dos Carajás" project, aiming at the resumption of systematic studies on this flora, a public-private partnership that would allow a much faster production and with authentication by specialists of the results obtained.

Goeldi Museum - It is the oldest research institution in the Amazon, founded on October 6th, 1866. Currently, it is a research institute linked to the Ministry of Science, Technology, Innovation and Communication. It has three physical bases, a Zoo and Botanical Park and Research Campus in Belém, as well as a Scientific Station in the Caxiuanã National Forest. It maintains 18 major scientific collections with more than 4.5 million registered items, 6 postgraduate programs and is a reference in the research on the Amazon biome, having discovered more than 249 new species of fauna and flora only in the last few years. The institution is a pioneer and has a constant acting in scientific studies in the region of Carajás, not only in the area of Botany, but also in Zoology, Archeology and other specialties.

Vale - Vale began its main activity in the southeast of Pará in 1985, in the operation of the Carajás Iron Project. In addition to the mines in operation at Serra Norte, in Carajás (Parauapebas), the company also operates a mine in Serra Leste (Curionópolis), as well as operations in Marabá, Canaã dos Carajás and Ourilândia do Norte. Vale's most recent operation in the state is the S11D Eliezer Batista Complex, which was inaugurated on December 17, 2016. The company has shown that it is possible to conciliate the mineral activity with respect to the environment. The Carajás National Forest, where the company's mineral complex is located, has 412 thousand hectares of native forest and, even with the implementation of S11D, the interference in the Carajás National Forest due to Vale's mining activities will be around 4%, since the company settled in the region 30 years ago.

The Carajás National Forest is part of the Conservation Unit Mosaic, protected by the Institute of Biodiversity Conservation (ICMBio), supported by Vale, which develops research, monitoring programs and an area recovery program, whose purpose is the plant restoration of the already mined areas by using native species of the forest. In July 2017, part of the National Forest area corresponding to Serra do Tarzan and Serra da Bocaina (compensation area) were associated to form the Ferruginous Fields National Park, where the plants of these two areas will receive continuous protection. Eight years ago, Vale created the Vale Institute of Technology (ITV) with the purpose of seeking innovative

medium and long-term solutions that may improve the company's operational performance and generate fundamental changes in business structures with respect to the environment and communities. Currently, ITV maintains two units: one in Belém (PA), specialized in subjects related to sustainable development; and another in Ouro Preto (MG), focused on mining subjects.

More information



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