

Ecological path

From basic research to public policy, FAPESP has been investing in biodiversity studies for five decades

Fabrício Marques

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Hundreds of São Paulo researchers in disciplines connected with the study of biodiversity met in São Carlos in early July to discuss the progress of their work. Concurrently, an evaluation committee composed of foreign scientists analyzed the results presented and suggested possible paths for the upcoming years. The two events highlighted the seventh evaluation of the Program of Research on the Characterization, Conservation, Recovery and Sustainable Use of the Biodiversity of the State of São Paulo, better known as Biota-FAPESP, an effort that began in 1999 and that involves 1,200 professionals in the identification of biodiversity in São Paulo.

The program has promoted more than 100 research projects and has enabled the pursuit of knowledge, including the identification of 1,766 species (1,109 microorganisms, 564 invertebrates and 93 vertebrates) and the publication of more than 1,145 scientific articles, 20 books, 2 atlases and several maps that have begun to guide public policy. At present, São Paulo State has 6 governmental decrees and 13 resolutions that mention the guidance provided by the program. In the area of training human resources, the program





has led to 190 Master's degrees, 120 PhDs and 86 post-doctoral fellowships. FAPESP has invested R\$ 82 million in only the first 10 years of this program.

According to its coordinator, the botanist Carlos Alfredo Joly, a professor at the State University of Campinas (Unicamp), Biota-FAPESP is the first Brazilian scientific program to receive investments regularly for more than 10 years. When the program reached its 10th anniversary, its organizers proposed a new scientific plan to FAPESP for the next 10 years. "This evaluation meeting is very special because it is the first to be held since FAPESP renewed its support for the program up to 2020," says Joly. "A long-term outlook is fundamental for scientific research," he stated. Biota-FAPESP is the principal example of the heavy investment by the Foundation for research in the fields of natural sciences and ecology, all of which started long before the name biodiversity was coined. In its early years, FAPESP was already supporting studies of marine algae, at first along the São Paulo coast (1962-1963) and subsequently along the northern, northeastern and eastern coasts of Brazil (1964-1965), conducted by the Department of Botany at the former

School of Philosophy, Sciences and Literature at USP, which was subsequently incorporated into the Institute of Biosciences (IB). The survey conducted along the coast of the state led to several research studies published in scientific journals, the training of marine biologists specializing in algae and the expansion of the algae herbarium at the Department of Botany. The survey of the algal flora of the remainder of the Brazilian coast was part of an international cooperation project that had the support of the Section of Oceanography of Unesco. The combined results of these projects comprise the first version of the Marine Phycological Flora of Brazil.

A key investigator involved in this line of research was Aylthon Brandão Joly (1924-1975), a University of São Paulo professor who began to study algae in Brazil in the 1950s. In 1957, he published the book *Contribuição ao conhecimento da flora ficológica marinha da baía de Santos e arredores* [Contribution to the knowledge of marine phycological flora in the bay of Santos and surroundings], the first planned survey of algae in a specific area of Brazil. "Up until about 1960, Joly worked by himself at the university. Afterward, he formed a veritable school in the

Department of Botany of USP. Directly or indirectly, he was the advisor of most of the first generation of Brazilian phycologists and also of phycologists from other Latin American countries,” wrote Carlos Bicudo, a researcher at the Institute of Botany of São Paulo, in the article “O estudo de algas no estado de São Paulo” [“The study of algae in the state of São Paulo”], published in 1998. Aylthon Joly left many descendants – one of them in both the literal and the academic sense of the term. His son, Carlos Alfredo Joly, the coordinator of Biota-FAPESP, followed his father’s example. “There is a generation of marine algae researchers that are my father’s academic grandchildren,” says Joly. “Professor Mariana Cabral de Oliveira from USP, a member of the coordination of the Biota-FAPESP Program, is a good example of this new generation because, in addition to incorporating DNA bar coding techniques into her research, she has shown the same innovative spirit that has always characterized Brazilian phycologists.”

WATER RESERVOIRS

In the 1970s, when FAPESP took the initiative to organize special projects, the Foundation decided to dedicate one project to the field of ecology and commissioned a proposal from Professor José Galizia Tundisi who, even then, was already an expert on water studies. The result was the project “Typology of the Water Reservoirs in the State of São Paulo”, which involved 70 researchers from the Laboratory of Limnology at the Federal University of São Carlos (UFSCar), the Institute of Biosciences of USP, and the Institute of Fishing at the Agricultural Bureau of the State of São Paulo. “At that time, a researcher from Spain had conducted a study on the profile of 104 water reservoirs in that country, taking into account the biology of the waters, contamination and pollution; I proposed a similar design,” says Tundisi. The project yielded robust scientific data. The project expanded the understanding of the workings of water reservoirs, clarifying the differences between them and lakes. The project also enriched the collections of aquatic organisms maintained at research institutes and led to 150 published studies in Brazil and abroad, 4 books (3 in other



PERSONAL ARCHIVES

Aylthon and Carlos Joly:
from marine algae to
Biota-FAPESP

countries), and 10 PhDs and 15 Master’s degrees. The project also enabled, for example, the development of an unprecedented methodology for comparing the aquatic ecosystems of Brazil. Additionally, the project generated information about the geographic distributions of aquatic organisms and the characteristics of the reservoirs that had effects on the use of hydrographic basins. Today, this information continues to furnish the basis for new studies. Finally, the project set parameters for the management of reservoirs. “We managed to determine that the ideal amount of time to retain water in the reservoirs must be less than 10 days to ensure the quality of the water and the health of the ecosystems. If the water in a reservoir takes too long to be replaced, the retained pollutants, nitrogen and phosphorus have an im-

pact on the maintenance of the species in the reservoir. This information was fundamental for the planning of new hydroelectric power stations,” states Tundisi. Once the project was approved, Tundisi sought out the scientific director of FAPESP, William Saad Hossne, and stated that he had a new requirement. “I asked for 15 young investigator awards to train new researchers within the project. This turned out to be a success. Of the 15 young researchers, 13 are now head professors,” says Tundisi.

DESCRIPTION

Whereas the study of water reservoirs trained leaders and created competence in the field, the Phanerogamic Flora of

the State of São Paulo project was a landmark in terms of learning how to function in a multi-institutional environment. Subsequently, this project involved acquiring a broader outline that involved networks of institutions and researchers under the Biota-FAPESP program. The project, which began in 1993, brought together experts from the three state universities – Unicamp, USP and Paulista State University (Unesp) –, from three research institutes – Botanical, Forestal and Agronomical – and from one municipal body – the Department of Parks and Green Areas of the São Paulo City Government. As one of the chief contributions to the knowledge of the diversity of the Brazilian flora, this project has already yielded six volumes with descriptions of the species of phanerogamic plants, i.e., those that produce seeds. The goal is to publish another 10 volumes in addition to updating the earlier works on the Internet.

The aim of the project was to fill the gap in environmental conservation in Brazil, which was being discussed by the members of SBB (the Botanical Society of Brazil); the Brazilian flora, acknowledged as having the largest number of species, was also among the least known and most threatened on the planet. “In 1992, at the National Congress of Botany, held in [the city of] Aracaju, [state of] Sergipe, the principles for the preparation of the Flora of Brazil were consolidated and approved. This not only provided for the study of vegetation but also for the training of human resources and the establishment of botanical expedition programs in the country’s different ecosystems,” recalls Maria das Graças Lapa Wanderley, a researcher at the Institute of Botany who now coordinates the project. The following year, with FAPESP’s first public call for thematic projects, the botanists at a congress in the city of São Luís in the state of Maranhão decided to submit a proposal using the plan of the flora of São Paulo State as a pilot project. The coordination of this was undertaken by Professor Hermógenes de Freitas Leitão Filho (1944-1996) from the Department of Botany of Unicamp, one of the few Brazilian experts on the *Compositae* family, which has some 10,000 species, including daisies, chamomile and several medicinal plants.

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Hermógenes Leitão: Phanerogamic Flora

In the early 1990s, the Brazilian flora was simultaneously among the least known and the most threatened in the world.

The first two years constituted the planning phase, including a survey of the collections at herbariums, which enabled the creation of the project’s database. The second phase consisted of the scientific expeditions, most of them conducted between 1996 and 1997, which resulted in approximately 20,000 plants that are distributed in the state’s herbariums. When Hermógenes Leitão died suddenly in February of 1996 while leading a field trip, the project coordination was transferred to Maria das Graças Lapa Wanderley and George Shepherd from Unicamp and Ana Maria Giuliatti from USP. The third phase led to the reporting of the results, with the expectation of the publication of 16 volumes. FAPESP continued to support the project until 2005. The six volumes published to date describe 132 families, including 655 genera and 2,767 species, or 37% of the 7,058 referred species of São Paulo State. “All of the researchers who want to study a phanerogamous plant consult our databases. The impact of the project extends to all of the fields of botany,” says Maria das Graças Wanderley.

GAPS

The Phanerogamic Flora project inspired Biota-FAPESP. In 1995, the Bureau of the Environment of the State of São Paulo attempted, in vain, to involve researchers in work that went beyond preparing a list of the state's threatened species. "There were many gaps in our knowledge, but the researchers resisted commitment, fearing that eventual political changes at the bureau might jeopardize the work's continuity," says Carlos Joly, then an advisor to the secretary of the Environment, Fabio Feldmann. At the time, Joly was also a member of the Coordination of Biological Sciences at FAPESP, working with Professor Naércio Menezes. "The idea of a research program about biodiversity was maturing in FAPESP. I had talked a lot with Professor Hermógenes at Unicamp and was highly familiar with the Phanerogamic Flora project. However, unlike this project, which was a thematic project centered on just one taxonomic group, we wanted to encompass all of the biodiversity of the state, which, obviously, wouldn't fit under a single thematic project," recalls Joly. The idea of creating a program with a set of articulated thematic projects was presented by a scientific director of FAPESP, José Fernando Perez, at a workshop held in the town of Serra Negra in 1997. The group in charge of coordination at the time (*see details at www.biota.org.br/info/historico*) decided to use the Internet to create tools to integrate and share data. Thus, the Virtual Institute of Biodiversity (another name used for Biota-FAPESP) came into being.

The data accrued by Biota-FAPESP now provides guidance for the criteria to create new conservation units and for the authorization for the removal of native vegetation. It also forms the bases of the agroecological zoning for the sugarcane plantations in the state of São Paulo. Government decrees and the resolutions of the Bureau of the Environment mention and take into account the maps of the priority conservation and restoration areas of the São Paulo biodiversity that are produced by the Biota Program.

Although the first 10 years of Biota-FAPESP were underscored by the progress of the characterization of biodiversity in the use of the database as a tool for the improvement of public policies, the program now aims to broaden its



MIGUEL BOYAYAN

The Biota-FAPESP Program data provide guidance for the criteria used to create new conservation units in São Paulo

scope. The subprogram BIOprospecTA, which identifies compounds or molecules of economic interest, merits particular emphasis. Additionally, the Biota-FAPESP program now also produces educational material for elementary, junior high and high schools and studies connected with ecosystem services and with the functioning of terrestrial ecosystems. "Professor Arthur Chapman, from the Australian Service of Information on Biodiversity and a member of the international evaluation committee, praised the program, saying that it strives to implement the suggestions that the committee had previously made," says Joly. "In 2008, the evaluators criticized the small number of marine biology and microorganism projects. Now, there are 10 new marine biology projects; in the case of microorganisms, for which there was only one thematic project, more than 40 proposals were submitted after the last call for proposals. These are capable groups, and the coordination has had the sensitivity to listen to the wishes of the São Paulo scientific community. That is why these things are occurring so quickly," says Joly. ■