

2024

EVALUATION REPORT PROGRAMA BIOTA



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BIOTA Program Evaluation Report

This committee was charged with a critical review of the progression of the BIOTA/FAPESP program, and asked to provide suggestions as the latter expands over the years to come. The most recent evaluation of the program took place seven years ago. Responding to this request, the two international reviewers listed above, with documented experience in biodiversity science research and funding in Europe and the United States, have reviewed and analyzed the following information:

- 1) documents sent by the BIOTA/FAPESP program coordinators, including the Biota 2030 Strategic Plan, previous evaluation reports, and summaries of results achieved to date,
- 2) information about the BIOTA program available on its webpage and online platforms, including metadata compiled from the progress reports submitted by principal investigators. Available metadata include the number of ongoing and approved projects, contributions to human resources, number of publications and citations, and impact indexes,
- 3) data and opinions collected at the X BIOTA Symposium, held at the Hotel Fonte Colina Verde (São Pedro, SP) from the 4th to the 7th of March of 2024. The reviewers observed daily round tables and associated discussion sessions, visited scientific posters led by principal investigators or team members, observed training workshops, held informal discussions with the BIOTA community, and led a final meeting with coordinators of the program.

Based on our study and in-person interactions, it became absolutely clear that the quality of the science, the training, and the outreach enabled by the BIOTA program continues to be cutting-edge: the program continues to be a reference and a model in Brazil and abroad. Given this success, we argue that the BIOTA program must be maintained and reinforced. For one, the program is essential if the state of São Paulo and Brazil want to meet the urgent needs imposed by the current climate and environmental crises, and the loss of biodiversity observed at local, regional and global levels. Secondly, the results achieved to date, the continuous evolution of the program, and its multiple strengths demonstrate a high return on investment, as listed below.

Strengths of the BIOTA/FAPESP program

- The BIOTA/FAPESP program has 25 years of history and success – a fact amply recognized by the BIOTA community and fully articulated by FAPESP's own leadership at the opening of the X BIOTA Symposium. BIOTA is FAPESP's oldest program, and commonly referred to as a “crown jewel” within the Foundation. Traditionally, it has experienced seamless a succession of coordinators, all of whom have been passionately committed to its mission. The drive to advance

biodiversity science at multiple biological, temporal and spatial scales is evident among the BIOTA investigators and their research teams. Moreover, the program has promoted the training of thousands of student-scientists, leveraged and dignified careers in the field of biodiversity science, and established multiple research grant calls and direct support to scholarship holders (including undergraduate-level research, master's students, doctoral and post-doctoral training and support).

- In its 25 years of history, the BIOTA/FAPESP program actively responded to the environmental crisis, the charges of Rio 92 meeting, and the Biodiversity Convention. It is impressive that the program is continually innovating to meet the new demands of biodiversity research in Brazil and around the world. Some examples that deserve to be highlighted include the launch of Sinbiota (to promote the organization of data collected by BIOTA/FAPESP), the Biota Neotropica magazine (to disseminate experiences and results), public exhibitions, workshops and documents to guide the monitoring and conservation of biodiversity in the State of São Paulo, BIOprospectTA (to explore the development of patents based on research promoted by the program), and Sisbiota-Brasil (expanding the program's operations at the national level). The program has also established partnerships with SinBiose and international initiatives such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), facilitating the establishment of the Brazilian Platform on Biodiversity and Ecosystem Services (BPBES). The launching of the BIOTA 20 Webinars in response to the social distancing imposed by the COVID-19 pandemic is another example of the program's adaptability and resilience.
- The results achieved over these 25 years are truly impressive. Data gathered at the time of writing of this document (April 2024) indicates an investment of more than US\$100,000,000 and a total of 366 funded projects (90 currently active), the training of 3,912 human resources, 5,798 publications, 15,619 citations and an H citation index of 339 (projetos.biota.org.br/em, accessed on March 15, 2024). Because these numbers are self-reported, we recognize that they may well be higher.
- It is commendable that the BIOTA program managed to promote public policies, to become a transformative instrument in education (particularly through public outreach, for example through environmental education), and to innovate in partnerships within the industry. For these reasons, we consider this a complete program: not only it is a guiding vehicle for thematic research projects that support training in the areas of biodiversity documentation, biodiversity study, preservation and restoration, but it is also a promoter of public policy, of entrepreneurial innovation, and socio-environmental transformation. These elements are now formally and appropriately included as primary structural axes of the program.

- The scientific work carried out over 25 years, the trainees, the public policies resulting from the funded science, the BIOTA community of scientists and apprentices, the state-, national- and international-level programs inspired by the BIOTA Program (including joint calls with other Brazilian funding agencies, as the case of the *Amazonia+10* call for proposals, and partnerships with international foundations, such as the National Science Foundation of the United States and the *Dimensions of Biodiversity* program), constitute a legacy. The state of São Paulo and its people must value and maintain this legacy, with ever-greater strength and investment.
- The quality of the science generated by BIOTA's regular and thematic projects is exceptional. This was clear at the X BIOTA Symposium: current research projects are diverse and rich in data. They have thematic diversity (focusing on collections, on descriptions of biodiversity elements and their drivers, and on the integration of studies of the terrestrial and marine biota into social transformation and bioprospection), geographic diversity (with projects focused on the state of São Paulo, but also other Brazilian states or with international implications), and a diversity of career stages (including experienced professors and senior scientists that are nationally and internationally recognized, alongside early career scientists, newly hired professors, postdocs, and students).
- The transformation that is taking place in the program now, aiming at its future strategic positioning, is absolutely on-point. We applaud the BIOTA 2030 Strategic Plan, which was co-constructed with the BIOTA community and the public society, while involving and counting with the institutional endorsement of FAPESP. We were excited to learn that the plan resulted from an open and broad year-long discussion, a preparatory workshop, and a public consultation. For the first time in the program's history, an ambitious strategic plan was framed around five major structural axes with objective impact indicators. They are: Biota Coleções (aiming at improving biological collections and their access), Biota Descoberta (uncovering biodiversity and its processes), Biota Síntese (promoting collaborative science, the integration of biodiversity knowledge and idea incubators, associative and creative lateral thinking), Biota Transformação (promoting sustainable transitions based on the knowledge and use of biodiversity, and the concept of One Health), and Biota Innovation (promoting production chains with biodiversity assets, including products and processes).
- These five major structural axes of the revised BIOTA program are highly relevant given the six cross-cutting themes of particular relevance to FAPESP, the state of São Paulo and Brazil, at this very moment. These themes include the Ocean Decade, the Restoration Decade, Climate Change, Sustainable Development, Low Economy Carbon, and Biodiversity Education. The five axes provide

flexibility and broaden the horizons and the applicability of the research developed and supported by FAPESP.

- Through the recognition of these five axes of action, the BIOTA 2030 Action Plan places FAPESP at the forefront of biodiversity research funding, globally. We find FAPESP's recognition of the urgent need to promote integration and convergence between studies of biological diversity and socio-economic advances to be pioneering. By ensuring the continuation of fundamental research that describes, documents, and preserves biodiversity, while incorporating new calls to promote synthesis, entrepreneurial innovation, and socio-economic-environmental transformation, the BIOTA Program becomes a model that will inspire other funding agencies in and out of Brazil.
- The organization of the sessions of the X BIOTA Symposium was fully aligned with the new strategic plan, which was then presented and discussed, giving coherence to the event and allowing the BIOTA community to jointly discuss address the challenges and objectives set out in BIOTA 2030. Discussion sessions allowed all participants – from project coordinators to collaborators and students – to contribute to the future of the program. We found the meeting and the community involvement to be extremely positive, engaging scientists and students; efforts like this must be repeated over time.
- The BIOTA 2030 Strategic Plan also innovated by ensuring the publication of a timeline for calls for proposals. We find FAPESP's commitment to release the dates of future calls for regular aid projects, special (thematic) projects, discovery and collection infrastructure projects, synthesis projects, projects for innovation and transformation, and follow-up meetings to be highly positive; this initiative was applauded by the whole community at the X Symposium. Knowledge of these deadlines gives the BIOTA community confidence and predictability, optimism, and hope for the future.
- The feeling of belonging of the entire BIOTA community, and its capacity for mobilization and active participation, were evident during the X BIOTA Symposium. It was clear to the evaluators that there is a true "BIOTA family", a community that admires and wants to continue participating in the program and helping to expand it. The fact that BIOTA was created with the active participation of researchers from the State of São Paulo, having a "bottom-up" dynamic, clearly and significantly contributes to the success of the program. The transformative element of the BIOTA 2030 Action Plan reflects the active participation of the scientists who are part of its coordination team.
- The existence of a multidisciplinary coordination team, whose members represent different personalities, career stages, and research expertise, enriches

the BIOTA program. This diversity of coordination team members is an excellent practice that should be continued and replicated. Given the five axes defined as strategic in the new BIOTA 2030 Action Plan (Discovery, Collections, Synthesis, Transformation, and Innovation), we were noticed the appropriateness of the research areas reflected by the current BIOTA coordination team (Dr. Jean Paul Metzger, USP: Landscape Ecology; Dr. Leticia Veras Costa Lotufo, USP: Pharmacology of Natural Products; Dr. Gabriela Marques Di Giulio, USP: Public and Environmental Health, Sustainability; Ecosystem Ecology; Dr. Alexandre Turra, USP: Oceanography; Dr. Simone Aparecida Vieira, UNICAMP: Ecosystem Ecology). This composition is particularly timely and relevant when representing the priority axes of the new plan. During the X BIOTA Symposium, it became clear that the team works harmoniously in search of true integration across those axes. This team integration and diverse representation is fundamental to the continued success of the program.

- The existence of a technical reserve fund is a great competitive advantage for the BIOTA program. It allows it to be autonomous, facilitating communication with its community (eg. via magazines and newsletters), and enables the organization of technical and programmatic meetings, symposia and workshops deemed relevant or strategic by the coordination. We urge that it be maintained over time.

Challenges, suggestions and recommendations

As in any program, there are challenges to be overcome by the BIOTA, areas for improvement, situations that deserve reflection, and opportunities for evolution and growth. It is in this context that the evaluation committee lists the observations below, making suggestions and recommendations about the current and future challenges to be embraced by the BIOTA program.

1. About the ability to measure the impact of the program

Challenge: Both the program coordination and the BIOTA grantees recognize that the reporting protocols and forms currently in place are not efficient. As such, the return of information about the impact of each BIOTA project back to FAPESP is suboptimal. This impacts the accuracy of the descriptions of the program's impact (including the outcomes reported on FAPESP's own webpages). It seems, for instance, that the reporting form available online often fails to capture the true impact of ongoing projects. Also, relevant information about the number of students involved in the projects and their publications - provided in the form of a PDF file - and often not transferred to the online system that summarizes the impact of the program. That rich information, available to FAPESP, is getting lost and not being acknowledged or publicized.

Recommendations:

- Review the form that summarizes the results of each project, consulting the scientific community about new fields to add.
- To ensure that researchers report back on the impact of their projects (eg. training of human resources, number and impact of scientific articles, etc.), the program should consider making the release of new resources conditional on the submission of an updated progress report form, similarly to what is requested by foreign agencies.
- To retrieve useful and relevant information from documents already submitted in the form of PDF files, it may be possible to explore the use of Artificial Intelligence to recognize and extract the data.
- We suggest that FAPESP invests time and efforts to accurately measure and report the outcomes of the BIOTA program, given that what is currently stated is likely an underrepresentation of the program's true impact.

2. About the dissemination of the revised structural axes the BIOTA 2030 Program

Challenge: Part of the BIOTA community at the X Symposium was unaware of the expanded scope of the BIOTA 2023 Program, posing questions and conflicting interpretations regarding the central concepts of synthesis, transformation, and innovation.

Recommendations:

- To create a presentation of the new strategic plan in a leaflet and/or a simpler communication version (eg. one page). This document must describe the structural axes and their definitions, their objectives, the timeline for project submission, and contact information.
- The area of social and/or socio-environmental innovation must be explicitly defined and placed within the transformation axis - so that there are no conflicts of interpretation and alignment of projects with the innovation axis, which is specific to bioproducts and ecosystem services.
- To promote special issues in FAPESP's journal Neotropical Biota to broadcast the scope of the novel work developed within the most transformative new programmatic axes within BIOTA (Synthesis, Transformation, and Innovation). This will serve to disseminate results and to clarify the program's vision to the scientific community.

3. About meeting the goals established in the BIOTA 2030 Action Plan

Challenge: In 2022, a calendar of calls for proposal and deadlines for submission, as defined in the 2030 Strategic Plan, was fully met. However, in 2023, contrary to the plan, only one call was announced by FAPESP. Although the call for Synthesis proposals was ready for dissemination, as originally planned, FAPESP failed to follow the strategic plan and did not make it public. At the X Symposium, it became clear that this new axis is

highly relevant and strategic to the program and to its scientists; the BIOTA community is legitimately demanding its opening. Delays in opening these new calls, and FAPESP's lack of attention to the BIOTA 2030 Strategic Plan, call into question the credibility of the agency and of the program itself, generating uncertainty and insecurity among researchers.

Recommendations:

- It is urgent that FAPESP responds to its recent failure to follow the Strategic Plan: the Synthesis call must be publicly released, allowing the Foundation to honor the commitments already made. This will set an example that can and should be replicated, as good practice, by other funding programs within and outside of FAPESP.
- FAPESP's institutional commitment is fundamental to the continued success of the BIOTA Program. Communications between FAPESP and the BIOTA Program must be improved, ensuring that the strategic plan continues to be enforced.

4. About the exchange of experiences between the BIOTA Program Coordination, FAPESP, and BIOTA researchers

Challenge: Due to the COVID-19 pandemic and changes at FAPESP, the BIOTA program spent seven years without a meeting of grantees, fellows, and associated scientists, leading to the isolation of research groups. At the X Symposium, several participants reported a post-pandemic decrease in the level of engagement among and within research groups. Yet all of the event's discussion sessions were very well attended; scientists and students saw them as opportunities to exchange experiences, to contribute ideas for the future of the BIOTA program, and to achieve the objectives and goals defined in the strategic plan. Likewise, the workshops held at the X Symposium had broad participation and were highly praised, demonstrating the commitment of the BIOTA community to the continuation and expansion of the program.

Recommendations:

- The round tables, guided discussions, and workshops of the X Symposium were met with enormous enthusiasm and participation from all members of the BIOTA Program, particularly young researchers and students; they should be maintained. We suggest that these workshops evolve into a full-day format at FAPESP headquarters, and that they become open to the entire BIOTA community.
- The creation of opportunities for integration, contact and discussion within the BIOTA community is fundamental to the advancement of the program. This may be achieved through thematic meetings within the scope of the five strategic axes or orthogonally, and through preliminary discussions for the co-construction of special calls and programmatic changes.
- The creation of an official BIOTA network, with registered members (project leaders, scientists, fellows, students, community and industry partners) will give

an official “body” to the already existing “BIOTA family”, and will serve to disseminate project results, calls, seminars, and other opportunities. The network can transform the BIOTA community, which is now active, committed, and with a sense of belonging, making official its relationship with the Program. Establishing a more formal commitment to the program through a BIOTA network will strengthen the program, its legacy, and its sustainability.

- A better communication between the BIOTA Program and other FAPESP sectors will enable greater participation and exchange of experiences among its participants. The dates of the X Symposium, for example, partially coincided with Science and Technology Week – another event with FAPESP participation. Aligning events between programs will promote deeper conversations between them and their members.

5. About the communication between the BIOTA Program and the Brazilian society

Challenge: Despite the enormous work carried out to date, it became clear that FAPESP’s communication with the greater society can and should be improved, so that the program is more widely recognized by the community as a whole - and not just within the scientific community.

Recommendations:

- Create a lay version of the strategic plan, to be shared with the general public, to establish a communication channel with the entire non-scientific community.
- Compile a BIOTA 25th anniversary book to not only showcase its work and achievements to date, but also to highlight the program’s societal relevance and need. The book could communicate how the 25 years of the program has transformed society through the valorization and conservation of biodiversity.
- The program coordination, and FAPESP as a whole, will benefit from a closer proximity to (and a formal support from) São Paulo’s main higher education and research institutions. This can be initiated, for example, by extending formal invitations to higher education institutions to participate in events such as the X Symposium, whether at the opening or closing. Formal institutional support from universities, given their social and transformative importance, can be central to the growth and the future of the BIOTA program.
- The BIOTA program plays a fundamental role in the training of taxonomists, which are essential for the advancement of biodiversity science in the country and the world. As such, it will be strategic to create a relational “lobby” so that institutions, in particular public and private universities and museums, support the maintenance of biological collections and better integrate with (and create career opportunities for) taxonomists.
- Evaluate the possibility of creating calls for proposals within the scope of the five strategic axes (and particularly the innovation axis) that involve partnerships with the private sector, particularly small and medium-sized companies. This can be

especially useful in the development of processes, products and/or services to society.

6. About the diversity of BIOTA researchers and coordinators

Challenge: The BIOTA community, as well as these evaluators, were shocked to learn that only two of the 15 Thematic Projects currently supported by the BIOTA Program are led by female scientists. The representation data from the Programa Jovem Pesquisador has a similar gender bias. This is unacceptable. When asked about the representation of races among BIOTA's main investigators, the program coordination was unable to provide a ratio of male to female project leaders because these data are not collected. It is also suspected that the numbers of funded researchers from private institutions be significantly lower than those in public universities and research centers.

Recommendations:

- It is essential that the BIOTA coordination initiates the collection and analysis of data describing the gender, racial, geographic distribution, and institutional representation within the program – both at the time of proposal submission and after the selection process.
- The BIOTA Program must prioritize equity in all of those spheres, monitor these dimensions permanently, and propose mechanisms to promote equal opportunity and balance among its grantees.
- Hosting proposal evaluation panels made up of several experts, instead of relying on individual expert opinions, may help ensuring a more even representation among the projects funded by FAPESP. By assigning a panel of scientists to select projects for funding, the Coordination and panelists will be immediately aware of disparities in representation during the selection process, and will be able to discuss and take steps to explore and rectify the disparity. To support this effort, BIOTA can ask all panelists and panel leaders to undergo a short training on the topic of unconscious biases before the panel meeting starts.
- To include a greater representation and diverse perspectives in the BIOTA program, FAPESP must ensure that the program coordinators and its panelists are, themselves, a diverse group. Ensuring a diversity of genders, races, geographic distribution, areas of study and institutions is key to the future success of the program. While the current coordination team shows diversity in scientific fields and, although limited, in the institutions they represent, it still has low racial diversity. It will be good to keep these biases in mind and address them as much as possible when the next team of coordinators is selected.

7. About the BIOTA program review mechanisms:

Challenge: Two potential challenges have been identified at the X Symposium. First, as mentioned above, it will be important to verify if the peer review mechanism currently

employed by the BIOTA program is contributing to the low diversity of researchers it funds. Secondly, the BIOTA community fears that some of the expert referees who evaluate their proposals lack an understanding of the challenges of transdisciplinary research – especially those reviewing projects that integrate the environmental and social sciences. The community argues that projects at this transformation interface are frequently penalized given their unique needs (e.g. to co-construct goals with local communities, as opposed to clearly identify the goals upfront) and receive unfavorable reviews. It will be important to verify this information with data describing rates of success across FAPESP's new thematic axes and, if confirmed, to address this shortfall.

Recommendations:

- All BIOTA program calls must have evaluation panels composed of a diverse set of scientists who represent the various axes and fields addressed by the proposals.
- If widespread implementation of panels is not viable for financial, technical and/or administrative reasons, the program should recognize that they are essential for the evaluation of proposals within the new strategic axes - including synthesis, innovation, and socio-environmental transformation.
- Proposals within the axis of socio-environmental transformation are highly desirable and can result in unique scientific and societal advances, representing a leap further within FAPESP. However, it is important that evaluators and the Program understand that any transdisciplinary activity progresses at a slower pace relative to the biological sciences: it depends on the establishment of trust and dialogue with communities, requiring the co-production of questions and results. Therefore, the BIOTA program should consider making the format of these proposals more flexible, perhaps considering offering smaller, seed grants for co-production of proposals with stakeholders in preparation for full proposals to BIOTA Transformação.
- Given the proposed changes in proposal evaluation, namely through the introduction of proposal panels, it is essential that FAPESP strengthens the technical support available to the Program. This may require the addition of a dedicated staff member.
- It may be advisable to reassess FAPESP's definitions of research areas to guide project evaluation. During the X Symposium, the community proposed that the program considers the possibility of creating an assessment area called "biodiversity", hence avoiding restrictive classifications such as "genetics" vs. "zoology". This will allow BIOTA's integrative projects to be better described and assessed, in agreement with the newer, more trans-disciplinary framing of the BIOTA program.

8. Additional challenges identified by BIOTA Program researchers:

- The interoperability across platforms linked to the BIOTA Program (eg. SinBiota and BIOprospecTA), as well as the databases generated by the BIOTA projects (eg. proteomics, metabolomics, genetic diversity, and morphological datasets) is generally small, or non-existent. Connecting these databases will allow for novel convergence, and conceptual and empirical advances, boosting the quality of the science generated by the program. This may require new hires (e.g. computer scientists) and additional program resources. We consider this act, however, a strategic investment by the program.
- The lack of long-term biodiversity studies prevents a real understanding of the complex processes that impact the Brazilian biota. We would like to encourage a discussion about the program's potential contribution to this gap, preferably involving the BIOTA community of scientists and students.
- The lack of continuous ocean monitoring also prevents in-depth knowledge about Brazil's marine systems. We would like to encourage a discussion about the program's potential contribution to observation systems operating throughout the entire annual cycle, preferably involving the BIOTA community of scientists and students.

Final suggestions

To promote the continued evolution of the BIOTA program, we suggest defining a calendar for reassessing the 2030 strategic plan, taking into account the observations, strengths, and challenges identified at the X Symposium and reported here. Considering all contributions collected at the X Symposium, it may be relevant to implement a mid-term evaluation and, if needed, review of the 2030 strategic plan. This would strengthen its dynamism.

Given the cutting-edge science currently promoted by the BIOTA Program, it is essential to maintain and expand the program's tools for international collaborations, especially those program calls that allow for cross-country collaborations. BIOTA is a reference program that can and should be showcased internationally – it inspires and serves as a model for other funding agencies, globally. It is our hope that these suggestions will strengthen it further.
