

**REPORT OF THE SECOND EVALUATION OF THE BIOTA-FAPESP PROGRAM BY THE
SCIENTIFIC ADVISORY COMMITTEE
Parque Estadual Intervales – 11 to 18 December 2000**

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Background

1. The Committee attended a number of meetings in São Paulo, Campinas and Parque Estadual Intervales from 11 to 18 December 2000.
2. Discussions were held with the Director of FAPESP, Professor José Fernandez Perez, three members of the Coordenação Biota, Professor Carlos A. Joly (Program Leader), Dr Vanderlei Perez Canhos and Dr Naercio A. Menezes.
3. The Committee attended verbal presentations by Project Leaders of 22 of the Biota projects over two days (14 and 15 December).
4. The Committee held discussions with students involved with the projects who met prior to the Program Evaluation meeting. The Committee also viewed and studied about 65 poster papers presented to the meeting by both the students and project leaders and discussed these with the presenters. The Committee held discussions with all of the participants on the Biota program, its aims and future plans and on perceived gaps in the Biota Program.
5. Prior to and following the Program Evaluation meeting, on the 11th, 17th & 18th December, the Committee members examined in more detail some aspects of the program, including:
 - Strengthening of the Biota/FAPESP information system and study of the GIS for the program - especially SinBiota (Bisby, Chapman and Colwell),

- Molecular ecology and polyphasic taxonomy of bacteria of environmental and agroindustrial importance (Staley).
- Algal Flora of the State of São Paulo (Bisby)
- Species and interaction diversity in plants of phytophagous insects (Colwell).

Prof. Bisby also visited the Flora of São Paulo project which is separately funded by FAPESP.

6. The Committee also reported on a number of Global Initiatives of relevance to the BIOTA Program, including Species 2000, the Global Biodiversity Information Facility (GBIF) and the Global Taxonomic Initiative (GTI), and invited discussion on how BIOTA may relate to, and benefit from, these initiatives.

Aims of Biota

- to study and increase the knowledge of São Paulo State's biodiversity and to disseminate this knowledge and its importance
- to understand the processes of biodiversity generation, maintenance and decline
- to increase the State's capacity in monitoring, managing and utilizing its biodiversity
- to evaluate the effectiveness of conservation efforts in the State, identifying areas and priority components for conservation
- to develop methods and reference standards for environmental impact assessments
- to estimate the loss of biodiversity in different scales
- to produce reliable information for decision making
- to enable the State as well as public and private organizations to benefit from the sustainable use of genetic/biological resources
- to enable the State to estimate the value of its biodiversity and services, such as soil and water conservation, biological control, etc. ...
- to enable institutions within the State to attend legal dispositions referent to living organisms such as the deposit of specimens.
- to improve the quality of formal and informal teaching of science and environmental education, especially as to knowledge in conservation and use of biological diversity
- to promote public awareness and knowledge as to conservation and use of biological diversity
- to contribute towards the implementation of the Convention on Biological Diversity within the State of São Paulo, participating and supporting existing state programs, particularly the PROBIO/SP and other national and international programs and/or efforts.

Review of the Program

General Comments

1. The Committee would again like to praise the efforts of Biota in reaching its present stage of development in such a short time. As mentioned in last years' report, it appears to be a well-structured and well-coordinated program. We would like to congratulate Professor Joly and his Coordenação Biota team.
2. The science in Biota is in most projects of high quality equivalent to that in other countries, and in several projects it is of outstanding quality at the cutting edge. In many respects the Biota program sets an example that many countries would be happy to follow.
3. The Committee endorses the introductory remarks of the first annual report, and continues to be impressed with the support from FAPESP and the continuity of funding it represents, the multidisciplinary nature of the Biota program, and the enthusiasm of all involved.

Skills and protocols

4. As mentioned last year, specialized workshops continue to strengthen common skills and Biota-wide recording protocols. But there remain areas that need strengthening, especially as the projects move from *preliminary* taxonomic and base-line surveys to analytical, hypothesis-testing and dissemination phases.
5. Rather few projects made use of sample-based biodiversity statistics and multivariate approaches, and almost none used bioclimatic modeling, biogeographic null models, and other techniques from the growing tool kit of biodiversity analytical tools.
6. Several projects included unnamed or unidentified species in their presentations, and we felt some concern that protocols for handling these need strengthening, to ensure that data will remain referenced to organisms into the future.
7. Several projects have rightly studied distributions and biogeographic hypotheses either over the whole Mata Atlantica, or over the whole neotropical biome. Such studies are an important component in understanding the biodiversity of the State. We therefore suggest that SinBiota make at least some provision for recording and displaying out-of-State records.
8. Several projects reported specialized databases that were being developed as satellites of the main SinBiota. Some of the junior scientists also raised queries at the symposium as to how the copyright, authorship or custodianship, and in particular their own credit, would be recognized. It is similarly important for proper academic credit that these databases be treated as any other scientific publication and have clearly agreed titles, editors, editions and acknowledgements. These are issues that should be addressed at the very start of each database so as to avoid any misunderstandings at a later date.

Recommend: that

- i) *workshops be held on the following topics:*
 - a) *sample-based biodiversity statistics: richness estimation, biotic overlap/complementarity, multivariate approaches*
 - b) *predictive modeling: bioclimatic and other modeling, biogeographic null models, representativeness, taxic distance models, etc.*
 - c) *identification/natural history tools for the public: natural history visitors/ecotourists, schoolchildren, professionals.*
- ii) *A cross-project protocol be developed for handling data on species and infraspecies that are believed to be new and/or are awaiting formal description.*
- iii) *consideration be given to expanding geographic coverage in SinBiota to appropriate areas outside the State.*

Collaboration and cohesion amongst Biota projects

9. Substantial progress in co-operation and synergy between projects was evident in the 2000 review. This may partly be a result of projects now running at full effort, but actions by Coordenação Biota in response to last year's review have also been effective. Real levels of joint working, shared field samples and shared data were reported. Similarly, the efforts of Coordenação Biota in organizing the symposium for the project junior scientists at Intervales were rewarded with a major success. Indeed several further opportunities for collaboration between projects were identified during both the Evaluation Meeting and the Symposium by junior scientists and many of these are sure to be developed during the coming twelve months.

10. This symposium for project junior scientists apparently benefited by not having their senior professors present for the period of the symposium. Discussion with the students, however, suggest that overlap with the Principal Investigators' meeting would benefit and extend networking initiated by the junior scientists.
11. There may be some misunderstanding amongst Principal Investigators that there is a 'requirement' to interact even where natural synergy is not possible. We would rather see this as an 'opportunity' for exploring possible synergies and benefits to their project where applicable, but certainly not as a rigid obligation.
12. A similar issue arose on the response to questions on involvement on Conservation & Sustainable Development. It might not necessarily be the responsibility of every member of the project, but something considered as an overall aim of the project.
13. There are, nonetheless, areas where we believe that even further collaboration between projects may be beneficial. For example, use of common sites for interdisciplinary studies might be increased. Although some of the project groups are beginning to work at common sites, this has not been the usual practice. We believe that the selection of specific sites in the Coastal area, the Mata Atlantica and the Cerrado would provide a significant added value to the program. First of all, it would encourage even greater interactions among the Principal Investigators and students, and it could offer greater efficiency and sophistication in terms of environmental monitoring and assessment. Furthermore, because several different projects would be conducted simultaneously, greater added scientific value would be derived from such comprehensive studies and lead to a more detailed understanding of each biome.
14. It also became evident during discussions that there was no database of publications arising out of the Biota Program. This is something that is much easier to do as the program proceeds rather than attempting a retrospective collection later on. Such a collection of publications will be valuable for annual reporting and for engendering publicity for the program.
15. During the meetings, it also became evident to the Committee that there is a gap in the co-ordination between Coordenação Biota and the various FAPESP programme officers. Although Coordenação Biota sees the pre-proposal and advises on its appropriateness to Biota and on related projects with which the project may fit, it does not see the final proposal prior to its approval and implementation. This means that Coordenação Biota is unaware of the final form of the projects, and precludes it from commenting on the continued relevance of the project to Biota and from commenting on, further possible collaborations.
16. An issue raised by both principals and junior researchers was the efficacy of the quarterly short reports to FAPESP. It was felt that the seasonality of biodiversity fieldwork, uncertainties of weather conditions, and the long-term nature of many of the projects made reporting on progress in three-monthly units of little perceived value. It was suggested that twice annual reporting may be more appropriate to Biota projects.

Recommend: that

- iv) *if future symposia for junior scientists, similar to this year's, are held at (remote) field stations, Biota consider making time available for natural history tours of the site guided by students working at those sites.*
- v) *where possible, Biota consider choosing a few representative sites as a reference for broader-scale studies, while also retaining the broader geographic coverage where appropriate.*

- vi) *the project establish a centralized bibliographic database of publications arising out of the Biota project.*
- vii) *for Biota, twice-annual reports replace the present quarterly reports.*

Education and outreach

17. The Scientific Advisory Committee believes that the time is ripe for the Biota FAPESP project to develop a long-term plan for increasing public awareness and appreciation of the habitats and organisms of SP State, not only within the State, but also nationally and internationally.
18. The protection and restoration of natural areas can be successful only when the public values them. Although promoting public appreciation of such intangibles as ecosystem services and aesthetic values is important, we believe that Biota can make a more immediate impact by creating the knowledge infrastructure for natural history study by children and young people, and for natural history tourism by adults and families.
19. Through involvement of existing projects and development of new ones, Biota can work toward providing “schoolyard natural history” materials that can help the next generation of young adults in SP to be more fully aware of the natural world than their parents were. Most children are born naturalists, but maintain and develop their interest in organisms and habitats only if encouraged and empowered by knowledge of the natural world. These have been extremely effective in some other countries.
20. Field guides may also present an opportunity to involve local communities in the recording and monitoring biodiversity across the State, eg. Stream Watch, Frog Watch, a Bird Atlas etc. where the community and/or school children can be motivated to record biodiversity information. Without appropriate field guides such an activity is impossible.
21. In other parts of Brazil (e.g. the Pantanal, the Manaus area) and in other developing countries (e.g. Costa Rica), ecotourism and the host of associated income-generating activities that ecotourism spawns have helped raise the economic value of wildlands as well as surrounding areas. Not only is Sao Paulo city the economic and population center of Brazil, it has excellent international access and large numbers of foreign visitors. This could create a significant market for easy-access, natural history tours to Mata Atlantica and Cerrado parks or reserves within São Paulo State and thus contribute directly to conservation.
22. Biota may wish to begin a Certificate Program for their PhD or other level students. Interested students would need to take additional credits for them to obtain the certificate. The focus of the program could be interdisciplinary field courses in which professors would take students to natural history sites and conduct field site investigations as recommended below. Also, for example, a student interested in phytoplankton might obtain course credit in another lab where zooplankton are studied so that he/she could learn the different approaches during one term of study. Special seminar programs could also be used for credit. Students who successfully complete such a program would receive, in addition to their PhD, a certificate in Biodiversity.

Recommend: that

- viii) *Biota develop or commission high quality field guides to birds, mammals, fishes, amphibians and reptiles, butterflies, and common trees of the State with editions in Portuguese, English, and Spanish. (At the educational level, these guides in the hand of teachers could be a part of the “schoolyard natural history”kits. An internationally published, high-quality field guide to birds, alone, would very likely bring in a large*

number of serious amateurs from North America and Europe to see the characteristic birds of Mata Atlantica and Cerrado habitats.)

- ix) *through intensive field courses, develop the breadth of natural history knowledge among Biota researchers themselves, particularly junior researchers* (For example, a 3-week course with a week in Mata Atlantica forest, a week in Cerrado/Cerradao--in both cases including aquatic habitats, and a week at a marine site. Because each researcher knows a great deal about some aspect of biota, habitats, or ecosystems, each becomes a teacher as well as a learner in such courses.)
- x) *support projects within Biota on childhood educational outreach, and include interactions with parallel programs in other states and/or countries.*
- xi) *collaborate with State and National Park administrations to develop intensive training courses for local natural history guides.* Biota researchers (junior as well as senior) could contribute directly by sharing their knowledge of particular taxa, habitats, or processes, and research projects. (The Organization for Tropical Studies in Costa Rica has long offered such courses in the communities near their field stations, and could provide some ideas and share experience.)
- xii) *collaborate with State and National Park administrations to plan or improve trail systems that maximize access to both characteristic and unusual habitats or organisms, especially old-growth forest.* (We note that many of the more accessible trails at Intervales are abandoned or even active roads surrounded by second-growth vegetation. Biologists who do their research at a site often have good ideas about which organisms are of most interest to natural history visitors, and where they be found or observed.)
- xiii) *support additional projects within Biota on ecotourism, including travel to other states and/or countries to learn more about their experiences and techniques, with the specific objective of recommending a master plan for developing ecotourism in SP.*
- xiv) *Biota consider the implementation of a Certificate in Biodiversity Program for post-graduates.*

Program Balance

23. While there is no doubt that Biota is now developing into a major biodiversity science program of breadth and depth, there remain some apparent gaps which the Coordenação Biota may wish to consider. These gaps include:
- a) soil biota (eg bacteria, nematodes, earthworms, soil arthropods),
 - b) Coleoptera, Homoptera and Hemiptera
 - c) birds
 - d) higher plants (we are aware of the separate Flora project, but wonder how this fits into Biota)
 - e) secondary, regenerating and planted forests,
 - f) agricultural and urban landscapes,
 - g) the human dimension of biodiversity (cultural and social aspects).
24. Much of the ongoing research in Biota is properly focused on the biodiversity of protected environments, such as old-growth forests, in part with the objective of learning the composition of flora and fauna prior to European contact. In the case of forests, protected, old-growth areas are often imbedded in a matrix of regenerating secondary forests (or may become so, as protected areas are expanded to include matrix areas). Throughout the tropics and subtropics, forest ecologists are increasingly conducting comparative studies on secondary forests, with old-growth forests for reference. These studies focus not only the

natural processes of forest regeneration, but methods for promoting restoration of natural forests, as well as the extractive values of secondary forests for forest and other products.

25. The Student Symposium and Annual Evaluation meeting impressed us with an unanticipated but welcome level of cross-disciplinary exchange, ferment, and synergy. But, with the anticipated rapid expansion of Biota to include many additional projects, we are concerned that the scale of such meetings may become too large for such interactions. Discipline-specific sub-meetings or sessions might help solve a problem of numbers of interactions, but at the same time might eliminate many of the most unanticipated and creative exchanges and decrease appreciation for the need to consider the full scope of taxa and habitats. We have no clear suggestion as to the optimum size of Biota, but want to remind all Biota participants of the potential importance of this issue.
26. Biota is supported by a research and teaching infrastructure that will continually need to be maintained and improved as research and teaching activities change. It is important to see that collections are well supported, including living collections of microorganisms as well as museum collections. In addition, equipment and database support will increasingly need to be provided as the biodiversity effort becomes more extensive and complete.
27. One particular new infrastructure area that complements the increased sequencing capacity of genomics is the area of functional genomics in which large DNA fragments, such as bac libraries, can be retrieved from environmental samples. This approach allows for the association of functional genes with those used phylogenetically such as 16S rDNA. In this manner, novel metabolic activities may be discovered that can be provisionally attributed to specific microbial groups.
28. Biota is now training more than 100 PhD students and 60 MS students. One of the concerns expressed by the Principal Investigators is for the future employment prospects of so many students. Two recommendations that may be helpful are:
 - a) Biota may wish to alert educational, museum and other State authorities to the new generation of biodiversity scientists that are being trained, with a view to creating new posts to keep this valuable resource within the State of São Paulo for continued high quality research within the State.
 - b) Students could serve as administrators and scientists in biodiversity programs in other states as the Biota program model is expanded and nationalized. Students could also be employed in positions that deal with governmental policy.
 - c) Brazilian and international companies interested in the commercial aspects of biodiversity, ranging from ecotourism, through environmental impact assessment to biotechnology, could be founded to provide jobs and careers for students as well as other Brazilian citizens.

Recommend: that

- xv) *consideration be given to studies on soil biota other than mites (eg. bacteria, nematodes, earthworms, soil arthropods); Coleoptera, Homoptera and Hemiptera; and birds.*
- xvi) *consideration be given to expanding geographic coverage in SinBiota to appropriate areas outside the State.*
- xvii) *consideration be given to projects on cultural aspects (human aspects) and social aspects of biodiversity.*

- xviii) *consideration be given to expanding studies on secondary & regenerating forests, disturbed, agricultural and urban areas.*
- xix) *Biota discuss with educational museums and State authorities the possibility of creating new posts so that the best of the young scientists remain in the system*
- xx) *increased support for sequencing and analysis be provided to develop new meta-genomic approaches*

Future Planning

29. The Scientific Advisory Committee believes that it is not too soon to begin viewing Biota as a model or demonstration project for other States in Brazil and maybe even a program at the national level.. This could happen in a number of ways. Already many Biota projects have partners from other States as well as a number of projects that extend well beyond the borders of the State of São Paulo.
30. It was reported that as many as 40 new projects were either approved or were likely to be approved in the near future. As Biota expands, this large increase in projects will add pressure to the Coordenação Biota and to the Annual Evaluation process. By the time of the next Annual Evaluation, many of the projects will not have been running long enough to be in a position to provide extensive reports on progress, and the sheer number of projects, if evaluated as at present, will create an impossible task for the reviewers. It is with this in mind that we suggest that the Principal Investigators of the new projects be invited along as observers and to present a brief (perhaps 5 minute) summary of the aims of their project to those present. Then at following evaluations, projects report only in alternate years – i.e. a mid-term-project report for a four-year project.
31. The Committee would like to also suggest that a full day be set aside at the end of future evaluations to allow adequate time to be given to the writing of the review report.

Recommend: that

- xxi) *the aims of mid Biota be extended to include an aim 'to promote the Biota program as a model for a national program of biodiversity research in Brazil'.*
- xxii) *newly approved projects not be required to report in their first year, but be required to attend the Evaluation meeting and present a brief report on the aims of the project; and that future evaluations be on a biannual basis – ie. Provide a mid-term and final evaluation report.*
- xxiii) *a full day be set aside of future evaluations for the writing of the report.*