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**PROPOSALS FOR
AN ACTION PLAN FOR
SUSTAINABLE USE
OF BIODIVERSITY
IN BRAZIL**

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EXECUTIVE SUMMARY

Introduction

The use of products derived from biological resources is an area of activity that is attracting growing attention worldwide. International agreements provide opportunities and obligations for countries that participate in this field of activity. This action plan outlines the first steps needed if Brazil is to participate effectively in inventory, prospecting, research, development and marketing of materials and products derived from its immense biodiversity, while addressing the growing concern about the need to properly protect and sustain tropical forests and other ecosystems. It is designed to complement other aspects of biodiversity protection and management.

International and National Context

The policy context in which biodiversity prospecting may occur is described in the main document.

Goal

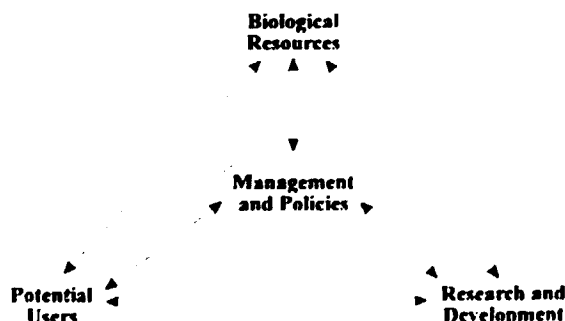
The goal of the action plan is defined as:

To develop and implement a coordinated management system and infrastructural capacity to plan and undertake inventory, prospecting and use of bioactive products from Brazilian ecosystems for the purposes of:

- implementing relevant sections of the Convention on Biodiversity**
- promoting and encouraging the permanent retention and sustainable use of forests**
- generating income and employment at national and local levels**
- enhancing the health and quality of life of the people of Brazil**
- ensuring that Brazil's sovereign rights to its biological resources are respected**
- encouraging parallel action in other parts of the Amazon region**

System Requirements for Sustainable Use and Management of Biodiversity

Sustainable use and management of biodiversity can only be achieved if adequate systems are in place and if the integral relationship among biological resources, management and policies, research and development and potential users is properly recognised. (See diagram).



Biological Resources

Requirements include:

- Identification and demarcation of a properly representative system of protected areas.
- Adequate support of the protected areas system
- An accurate and comprehensive inventory of species, knowledge, distribution and

- An effective biological resources information system.
- Criteria to allow and control access to resources.

Management and Policy

An independent specialist agency is required with the following functions and capabilities:

- Act as an "honest broker" and facilitator.
- Access to or management of biological resources information systems.
- Negotiation skills and market knowledge in the national and international arenas.
- Advisor to Government on legal issues, including sovereignty and intellectual property rights.
- Coordination among existing entities.
- Coordination and planning to ensure efficient use of national resources and capabilities.
- Market research and fund raising.
- Training, community education and information dissemination.

The Market and Potential Users

The agency must also be active in:

- Analysis of market conditions, requirements and trends.
- Determination of user needs and requirements.
- Determination of local markets and technical capabilities.
- Linking research institutions with potential buyers.

Research and Development

Agency functions in this area should be:

- Identification of information, technology and products based on market-driven research
- Detection of in-country skills and infrastructure to move from raw materials to products
- Capacity building to improve national scientific and economic development
- Advancing scientific capabilities through training

An Integrated Strategy

If Brazil is to participate successfully in the biotechnology industry while meeting the multiple goals of economic and social development and effective biodiversity conservation, an integrated strategy is required. This needs to consider issues such as business development, strategic planning, market identification, market research, research collaboration, capacity building, product development, information systems and the distribution of revenues.

Proposed Action Plan

Specific actions proposed are:

Biodiversity Management Organisation

To establish this organisation, a steering (or a suitable existing group) would appoint, recommend or elect a Board of Directors. The Board would function with the advice of expert advisory panels. It would direct the activities of a management group which would be responsible for day to day operations.

Roles:

- function as a central coordination and management group
- correlate existing resources
- expand regional efforts where appropriate
- collect create and manage bioinformatics (databases and software)
- education (including for professional/technical personnel, the community and policy-makers)
- serve as facilitator and honest broker
- coordinate and manage technology transfer through intellectual property rights, licensing, encouragement of creation of new companies in Brazil
- manage directed research in selected areas of activity and products

Research will be directed to both indigenous needs and capacities and international markets

Funding, Transparency, Implementation

- initial seed funding is necessary
- long term self sufficiency is the goal
- organisation must act in the public benefit and be transparent in its operations
- funding is needed to establish an initial organisation with a few professional and limited goals

Benefits of a Successful Organisation

These are seen as:

- meeting requirements of Biodiversity Convention
- capacity building
- economic development
- Identification and use of bioresources responsibly with preservation of resources
- fair and equitable sharing of benefits
- building of international and national connections and collaborations
- community involvement
- selection of sites and activities so that maximum benefits are obtained from reasonable investments through coordination, planning and prioritisation
- organisation or parts can be duplicated at a regional, state or local level

Assets and Capabilities Review

As an essential basis for development of a long term action plan, this review is proposed. It would cover:

- information on biodiversity resources in Brazil
- equipment and scientific laboratory facilities
- communications capability and technology
- private capacity
- existing collaborative activities among relevant organisations
- major affected and potentially affected groups
- available and needed human resources

- relevant existing legal provisions and policies

Business Development and Intellectual Property Rights

The Biodiversity Management Organisation should:

- support business development in biodiversity prospecting and use
- develop clear objectives and criteria for commercial access to biological resources
- take a strong interest in intellectual property matters

Pilot Projects

Two or three pilot projects in selected areas are proposed. These are intended to test the organisational structure and capability of biodiversity prospecting and use, and to provide an opportunity for "learning by doing". The pilot projects should be designed to advance knowledge and experience in issues such as:

Management

- areas of activities and classes of products
- institutional roles and commitments
- multidisciplinary and multisectoral participation
- market approaches
- financial requirements
- returns to conservation and local communities

Experimental issues

- market driven taxa selection vs. all taxa inventory
- intensive efforts vs. less intensive efforts with more rapid access to markets and quicker returns
- building on existing information and projects vs. newly generated information
- early vs. later relationships with industry
- products for local vs. international markets

Access to Biological Resources

- access to resources in private lands vs. public lands
- distant and inhospitable access vs. easy and well-defined access
- access to resources in well managed lands vs. areas with no or little management
- access to resources associated or not associated with indigenous communities
- access to resources in areas under local, state and national control

Policy and Legislation Review and Development

The Biodiversity Management Organisation should take a strong interest in ensuring that the policy and legislative framework affecting biodiversity management is appropriate.

Education and Public Relations

The Biodiversity Management Organisation has an important role in developing education, training and public relations programmes to ensure a maximum understanding of the biodiversity prospecting and development programme and its objectives.

1. Introduction

The use of products derived from biological resources is an area of activity that is attracting growing attention worldwide. International agreements such as the Convention on Biodiversity provide both opportunities and obligations for countries that participate in this field of activity. This action plan is intended to provide a basis for Brazil to enhance its capability and level of activity in inventory, prospecting, research, development and marketing of materials and products derived from its immense biodiversity. It is also intended to contribute to addressing the growing concern about the need to properly protect and sustain tropical forests and other ecosystems.

This action plan is designed to complement other aspects of biodiversity protection and management. It has a particular focus on biodiversity prospecting, defined here as exploration for chemical components, genes and their products, and wild species of potential use for pharmaceutical, agrochemical, biotech, cosmetic and other applications. Other products and services from biodiversity such as direct exploitation of natural resources, ecotourism, watershed management, CO₂ trade-offs, education, recreation, general wildland research, gene banking and other wildland income-generators can also contribute to sustainable use of biological resources, but are not addressed by this action plan.

Biodiversity prospecting opens new opportunities and a different approach to sustainable use of biological resources. However, the economic impact of this activity should not be overestimated. It can only complement other economic activities designed to enhance human development. In other words, it is not a panacea to solve all problems, but is just one instrument. It requires a great deal of science and technology, some already existing but a majority of which has to be developed.

This document can only provide suggestions for the first steps that might be taken. The authors recognise their limited knowledge and experience of Brazil, and accept that these proposals may need modifications to suit the country's specific needs and circumstances. Further detailed policy development and planning for this important area of activity will be needed when the outcome of these first steps is known.

2. International Context

On the international level, agreements, conventions and other mechanisms establish the relationship and protocols for biological genetic resource sharing between countries. The more significant international conventions, agreements and organisations defining the international arena for biodiversity conservation and natural resource use include the following:

2.1 The 1940 International Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere

This prohibited the exploitation of national parks, and set the stage for the access to and control of resources, setting aside designated areas for environmental protection.

2.2 The 1992 Convention on Biological Diversity

This created new guidelines for international conduct regarding natural resource use by:

- calling on 157 countries to create national frameworks for regulating access to and control of resources, sovereign rights, environmental protection and commercial laws.
- requiring these frameworks to be harmonised with goals of development, conservation and the fair and equitable sharing of benefits derived from the sustainable use of biological/genetic resources.

2.3 The United Nations World Intellectual Property Organisation (WIPO)

This currently establishes the regulations that define what is considered intellectual property and patentable, aiming to consolidate these international definitions on a global level.

2.4 Trade Related Intellectual Property Rights (TRIP's) of the General Agreement on Trade and Tariffs (GATT)

This was formally approved in 1994, and establishes regulations surrounding the commercial use of intellectual property, and equally attempts to harmonise its commercial application on the international level.

2.5 Indigenous Community Rights

Other fundamental agreements and conventions address the more difficult and amorphous issues of indigenous community rights, tending to transcend national definitions.

2.6 Bilateral agreements

Agreements such as the North American Free Trade Agreement (NAFTA) and the Pacto Andino guide more specific instances of international relations regarding resource protection and use, unifying policies in regions sharing common resources and political and economic paradigms. Through the Amazonian treaty signed in 1978, Brazil and other Latin American countries are developing joint programmes for protection and management of protected areas in the Amazon Region.

These mechanisms, in addition to many others, have broadly defined the international arena regarding resource access. Nevertheless, conventions, agreements and organisations have left responsibility for designing adequate legislature and the regulations to each individual country. This is problematic for some countries, but beneficial for others.

Lack of detailed international laws and precedents to guide national policy makers has often led to difficulties, largely because the language employed is often not specific enough to elaborate legislative details if there is no pre-existing foundation upon which to build.

At the same time, however, open interpretation of international guidelines has provided broad backing for countries to act, while simultaneously allowing them enough room to freely create new laws based on existing circumstances and experiences.

3. National Context

3.1 General

On the national level, sovereign governments determine the macro-policies that deal with issues such as land ownership, land tenure rights, the creation of protected areas, biological-genetic resource use, nationally recognised intellectual property rights, the definition of public-domain resources, and the creation of market incentives or deterrents for private enterprise and research investments.

Incentives: Where they already exist, clear laws regulating land ownership and access to resources are conducive to collaboration on research activities, and promotion of in-country partner stability and manoeuvrability attractive to private industry, academic and scientific research counterparts.

Deterrents: National policy vacuums and outdated legislature existing in many countries create disadvantages:

- difficulties in elaborating legislation where no precedents exist
- questions of how to enforce new legislation
- obstacles in rewriting existing laws and regulations to accommodate changing global paradigms.

Industry incentives: Given the importance of advancing national economic development as a part of prospecting activities, tax exemption and other measures arranged by governments can create the incentives necessary for local industrial development.

3.2 The Need to Focus Effort and Resources

Brazil has a great diversity of scientific skills and business infrastructure which provides a substantial science and technology base with large local markets. Data and relevant information exist in abundance, although some may need to be collected and collated. However, there is a need to focus on and re-examine the infrastructure, data and information in the context of the unique issues, problems and potential of bioprospecting and biodiversity management. This is particularly important because of the size and diversity of the country. This raises issues such as coordination between and among institutions, logistics of bioresource access, and the present dispersal of information on bioresources and their management and use.

It is clear that there is a need to focus action initially on projects which can be undertaken effectively with existing resources, with particular emphasis on projects which take advantage of any particular strengths that can create a competitive advantage.

This need to focus, understand then act is a central theme of this action plan.

4. Goals

The goal of this action plan is:

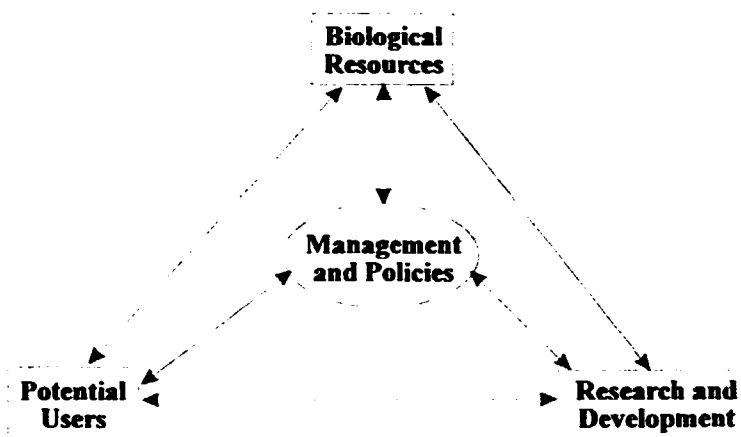
To develop and implement a coordinated management system and infrastructural capacity to plan and undertake inventory, prospecting and use of bioactive products from Brazilian ecosystems for the purposes of:

- implementing relevant sections of the Convention on Biodiversity**
- promoting and encouraging the permanent retention and sustainable use of forests**
- generating income and employment at national and local levels**
- enhancing the health and quality of life of the people of Brazil**
- ensuring that Brazil's sovereign rights to its biological resources are respected**
- encouraging parallel action in other parts of the Amazon region**

5. System Requirements for Sustainable Use of Biodiversity

5.1 Introduction

It is possible to manage biodiversity to meet conservation objectives while also using products of biodiversity to bring social and economic benefits. However, this can only be achieved if adequate systems are in place and if the integral relationships among biological resources, management and policies, research and development and potential users is properly recognised. (See diagram).



5.2 Biological Resources

A basic requirement for the conservation and sustainable use of biological resources is the identification and demarcation of an effective system of protected areas. These should be supported by secure land tenure and adequate and sustainable legal provisions, management systems, infrastructure, personnel and finance, with particular emphasis in the areas where bioprospecting will be undertaken.

Protected areas should be selected and defined to include representatives of all ecosystems in the region, with the objective of representing the greatest possible proportion of ecosystem types and taxonomic groups.

A preliminary requirement for biodiversity prospecting and possible development of uses of biodiversity products is an accurate inventory of species knowledge and distribution within the protected areas and if possible in other areas. A key requirement is the ability to fix and record precise locations, enabling sites to be accurately and readily relocated if required. In addition, knowledge of natural history, life cycles and interactions with other organisms is required to fully understand ecosystems and detect potential leads, as well as to relocate species and collection sites if necessary.

A biological resources information system is required to record all inventory information, both new and existing. This should include a data base supported by accurate maps. Sophisticated technology such as database software and computerised geographic information systems can greatly enhance the effectiveness of an information system. Criteria to allow and control access to biological resources are required.

The effectiveness of biodiversity inventory and management can be enhanced by establishing international and national collaboration networks among experts in areas such as taxonomy, ecology and ecosystem management. Community level involvement in collection and

identification and in preservation and conservation management can be effective, while also providing employment and increasing understanding and support for conservation.

Biodiversity information can also be used for other purposes such as education, recreation and ecotourism.

5.3 Management and Policy

For a country to develop an effective capability in the marketing and use of the products of biodiversity, it must recognise that new or changed institutional, legal and policy arrangements will be required. A programme for prospecting, research and sale of products of biodiversity requires different skills and expertise to those required for more traditional management and conservation of protected areas, or for scientific research that is not involved in adding value. It is best managed by an agency that is independent from the official agencies with responsibilities for protected area and natural resources management and conservation. Such an agency can act as an honest broker, facilitator and coordinator in negotiation of contract arrangements for the prospecting, research and sale process. It should not have direct responsibility for management of real estate and resources.

It is important that the agency has the right skills and resources and that it can win the confidence of potential buyers. It must have access to detailed and accurate biological resource information, and it is advantageous if it manages the inventory, data management and prospecting process. It is important that in-country capabilities are known, and that they are correlated with information on product demand and potential markets. The agency must have the ability and skills to understand the complexities of the international and national marketplace, and to negotiate effectively with international and national corporations.

This agency can also act as an independent advisor to Government on new or changed laws and procedures required to manage the relationship between biodiversity conservation and business development. This will include attention to protection of national sovereign rights over biological resources and intellectual property rights, including considerations such as the location of ownership and management of rights and the sharing of resulting income. It should also advise on development of mechanisms to return benefits to support inventories and conservation as well as to local development and enhancement of human welfare.

In its independent advisory role, the agency should liaise with other relevant agencies and can help to achieve the necessary coordination among the various agencies involved, and can also have a role in developing any necessary structural changes and institution building. It can help to establish timeframes and criteria to prioritise research and development activities.

An important task is to devise and implement a strategy to stimulate market-driven research and development, and to raise necessary funds. The agency might also have an important role in in-country training to build the necessary skills base, and in community education and information dissemination.

5.4 Research and Development

This is an important subject to be addressed by the agency. It should work to facilitate the acquisition and development of information systems, technology and products that enhance

the potential value of biological resources for product research and development, with particular emphasis on market-driven research.

It is important to identify in-country research and development skills, infrastructure, assets and capabilities that can contribute to the various stages involved in moving raw materials through the process from initial inventory to final products.

The agency can seek to facilitate capacity building in the biotechnology field to improve national scientific and economic development. The objective should be to create a cyclic process in which continually advancing technological and scientific capacity attract more business partners and resulting funding. Funds can then be reinvested in further capacity building.

Scientific capability for prospecting should be enhanced through training programmes, with emphasis on areas identified as having market opportunities, while not neglecting more general research.

5.5 The Market and Potential Users

Effective participation in the complex international marketplace requires the ability for detailed analysis and understanding of market conditions and requirements. Feasibility studies and market surveys are required.

It is important to understand what potential users require, and whether this matches with what can be made available. The negotiating agency must be able to identify and define the market, its needs and the major actors in the field. In this new and competitive field of activity, it may be necessary to create markets through acquiring adequate knowledge and understanding of the assets and abilities that can be offered, and through marketing these effectively.

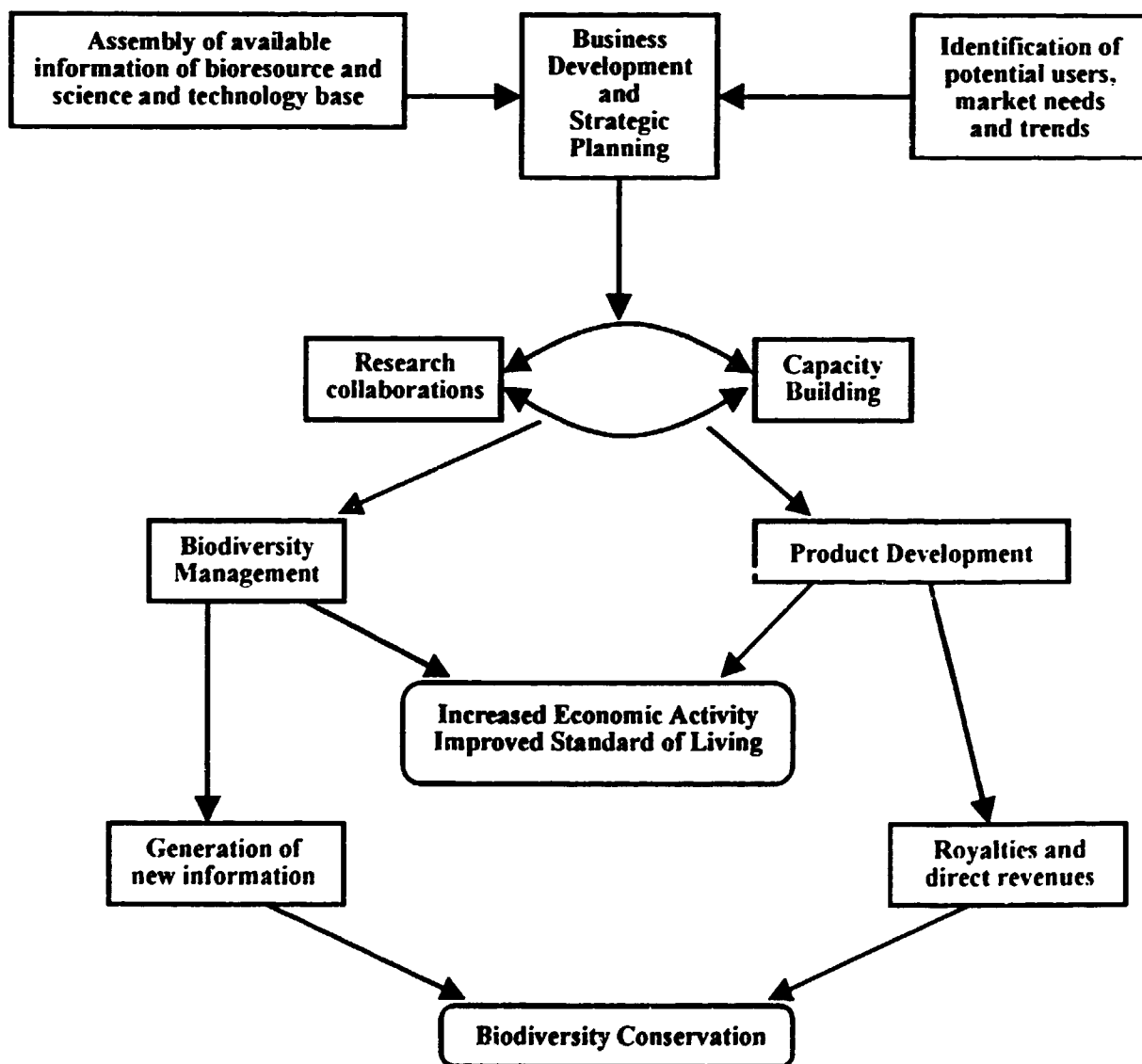
Local markets and capabilities must be located and understood, and be built upon. Because of the nature of the product development process, there is a potential competitive advantage in taking the development process as far as possible using in-country skills and resources and in adding value to products prior to export. This requires a close understanding of the skills and resources available, and the building of multi-sectoral collaboration.

There can be a wide variety in the levels of processing and value addition in the use of products of biodiversity. This must be understood and the market segmented accordingly. In some cases, the same source material with different processing can open access to different markets and create different employment opportunities.

Prompt support for existing research activities that are close to having a product ready for transfer can help to ensure that the right connections are made to industrial partners or other phases of the research process.

6. An Integrated Strategy

If Brazil is to participate successfully in the biotechnology industry while meeting the multiple goals of economic and social development and effective biodiversity conservation, a strategy is required. This needs to consider, in an integrated manner, issues such as business development, strategic planning, market identification, market research, research collaboration, capacity building, product development, information systems and the distribution of revenues. The following diagram shows the way in which these various issues can be incorporated in an integrated strategy.



7. Proposed Action Plan

Taking into account the needs and current situation in Brazil, the following actions are proposed.

7.1 Biodiversity Management Organisation

7.1.1 Establishment

As outlined below in detail, it is envisaged that a management group would exist that would facilitate the implementation of this action plan. The organisation would not exist for its own benefit, but rather for the greater good of the infrastructure, but would contribute a unique blend of expertise, organisation, and business skills as necessary to succeed in the biodiversity management area.

(The following presumes the creation of a "new" organisation to manage the infrastructure and outreach proposals. The alternative would be to adapt an existing organisation to the Biodiversity Management Organisation task. The legal arrangements and nature of the organisation would draw on experience and requirements in Brazil).

A Steering Group representing government, academics, business, NGOs, native populations and the general population would recommend, appoint or elect a managing Board of Directors for the Biodiversity Management Organisation, whose function it would be to set goals and priorities, and provide general management oversight. The Board would be a suitable small working size (8-15 persons). (The Steering Group would provide a sense of inclusion to various constituencies. The Board of Directors would be a working business body).

The Board of Directors would be assisted with expert advice as needed from a number of advisory panels which would report to it. For example, there may be advisory panels on science, business, social issues and infrastructure coordination.

The Board of Directors would appoint or hire the Management Group for the Organisation, for example titled Unit Directors. These persons would manage one or more defined task areas and would have appropriate skills in areas such as science management, business management, intellectual property management and licensing. The Unit Directors would be responsible for the day to day operations of the organisation.

7.1.2 The Role of the Biodiversity Management Organisation

The Organisation would function through its Board and Unit Directors as a central coordination and management group; not to serve itself and to create a bureaucracy but to marshal capabilities efficiently and make the process "user-friendly" and cost efficient. This would be done by correlating existing resources, such as facilities, personnel, organisations, data and funding sources, rather than first looking to create new infrastructure. The first goal would be to identify existing efforts and assets which exist on a smaller scale or regional scale and expand them.

A major first step would be to locate and expand, and as necessary create, and manage a bioinformatics system where data is collected and correlated; data and sample collection

systems improved and coordinated, and infrastructure entities linked and provided with a sense of community and common national goals.

Another role for the Organisation would be education. Biodiversity management requires particular skills that can be taught or enhanced in the science community. Directed training for researchers and product developers could be instituted. The local economy and public perception would benefit from the training of paraprofessionals who would assist the professionals in effectively and efficiently achieving the goals of the Organisation.

In addition, the education effort would be directed to the community at large and to particular sub-sets such as politicians, business people and lawyers, as well as the general population. This education effort would include school courses, university courses, travelling exhibits, video tapes, short courses, books, pamphlets and general public relations press releases.

The fundamental role of the Organisation would be to serve as a facilitator to organise bioresource inventory and capability, a physical properties data base and in-country human resources and infrastructure. It would coordinate them with market driven partners which include international industry and local industry and infrastructure, with special emphasis on discerning trends and needs of industry and assisting in deal making with industry.

Another key role would be to facilitate and encourage coordination among the various agencies and personnel that have interests in biodiversity use and management.

The expected result could be an increase in the value of biodiversity resources and economic development within Brazil by facilitating market driven research and development, generating capacity building and generating income for biodiversity management and conservation.

It seems clear that international competition for the same financial resources and business interactions, as well as, from the business side, the desire of business to deal with professionals who appear capable of making appropriate business decisions and reaching agreements and then delivering the results promised, require concerted action. The Organisation can provide invaluable assistance in coordinating management, advising on business deals and accomplishing technology transfers through contracts in general and through the identification, protection and licensing of intellectual property and materials. A key first step is the identification of sovereign rights and intellectual property and materials. These rights must then be protected, as appropriate, with early transfer of information, often accomplished through confidentiality agreements and/or materials transfer agreements. Finally, the organisation will quickly establish an invaluable skill set and history of deal making through contracts, licensing or other management of intellectual property and/or sovereign rights. The result will be that the business community both in-country and internationally will respond positively to a professional, efficient organisation.

The Organisation should establish criteria for deal making with in-country business as well as international business, and it may be that the terms of reference for international and in-country deals will be different.

One possibility is the creation of start-up companies in Brazil based on intellectual property exclusivity which would encourage capital investment.

7.1.3 Research Efforts

Another major thrust of the Organisation would be the management of specific directed research projects. There are apparent logical areas for possible market driven research. Actual area selection will depend on resource review and prioritisation, and the location of possible business partner interest and funding. Probable areas include pharmaceuticals, cosmetics, agricultural chemicals such as pesticides, herbicides and insecticides, food products, agronomically significant plants, agricultural biotechnology, industrial oils, chemicals and fibres, and bioremediation.

The research efforts should be directed to both indigenous needs and capabilities, and international markets.

The first pilot projects would be at sites and with projects selected based on existing knowledge, organisations, infrastructure and funding availability. These would demonstrate the workability of the concept and allow all involved to begin to move up the learning curve, before beginning more ambitious efforts of broadened scope or area and new technology areas. It is suggested that success requires deliberate speed. The organisation must walk well before it should attempt to run.

7.1.4 The Public Nature of the Organisation, its Funding and Initial implementation

The Organisation, regardless of its legal structure, must operate in the general public interest and be above suspicion as to mismanagement, influence or conflict of interest. Therefore it must be open to public scrutiny and audit.

In the long term, the Organisation must become self-sufficient by charging for services to the infrastructure or taking costs from deals made, passing the net proceeds through to the designated income or benefit recipient after retaining costs or charges.

Initially there must be seed funding for several years' efforts until the Organisation has a deal flow. The seed funding may come in part from Government loans, grants or contracts, from international donor organisations, foundations, NGOs, business and the like. The various tasks or functions discussed separately above might be funded separately from various sources.

A logical action plan with predictable success, based on realistic action goals and time frames, should be able to attract seed funding from a variety of sources.

It is envisaged that the organisation would consist initially of a small group with complementary skills. The leader should be a Brazilian who preferably has strong peer recognition among scientists in Brazil and the international community, as well as having experience in organisation or laboratory creation in Brazil, so that he or she can confront and access government, academia and business. The remaining staff persons would augment the leader's skills in varied science areas, business, law, legislation or infrastructure communication.

With a few selected early functioning pilot research projects, information gathering projects and infrastructure coordination projects, the first several years' costs should be in the order of five million dollars.

7.1.5 The Benefits of a Successful Biodiversity Management Organisation

A successful organisation, along the general outlines above, would help Brazil meet its requirements under the Biodiversity Convention, cause capacity building, cause economic development, substantially enhance the identification and use of bioresources responsibility with preservation of bioresources, facilitate the fair and equitable sharing of benefits from biodiversity management, build international and national connections and collaboration between persons and organisations within a particular microculture (e.g. scientists taxonomists, ecologists, ecosystem management) and also between microcultures (e.g. science, business and conservationists).

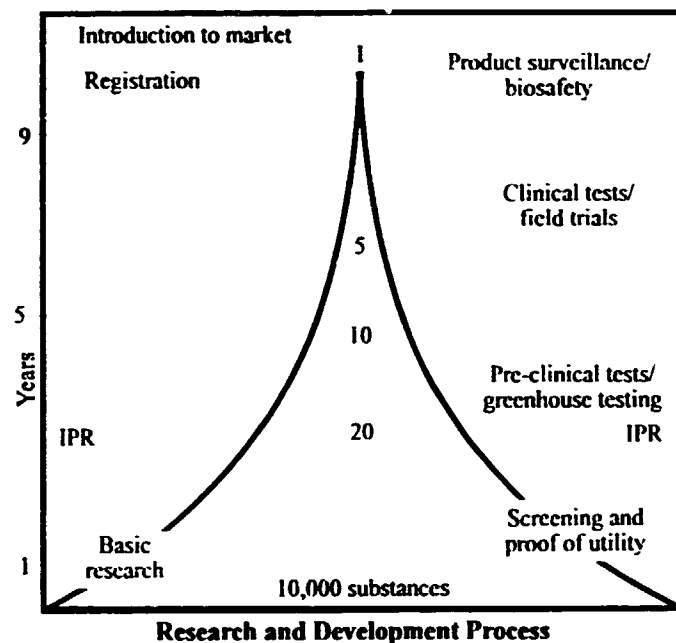
In addition the Organisation would stimulate community involvement, seeking to listen and learn and use local resources where possible.

In a very practical sense, action site selections could be done by the Organisation with a breadth of expertise otherwise unavailable, so as to maximise benefits from reasonable investments through coordination, planning and prioritisation.

7.2 Assets and Capabilities Review

7.2.1 The Need

Brazil already has significant scientific and technological capability in the field of biotechnology. This provides the potential for it to develop a competitive edge in biotechnology products in the international marketplace. The typical research and development process for products derived from biodiversity is shown in the diagram alongside. It can be seen that a very large proportion of substances are eliminated in the first screening stages. The potential value of products increases dramatically as they pass successive filters in the process, and can increase by orders of magnitude. There are therefore great potential advantages if a maximal part of the necessary effort undertaken builds on existing resources and capabilities, and that the research and development process is taken as far as possible within the country.



A major objective of the Biodiversity Management Organisation should therefore be to ensure that as many products as possible proceed well up the research and development ladder within Brazil. However, this can only be achieved if the level and nature of the existing Brazilian assets, infrastructure and capability are known and understood. They must be marshalled and coordinated effectively towards achieving the goals of this action plan. For this reason, it is considered to be imperative that a purpose-designed survey and review of existing assets and capabilities is undertaken.

The proposed content of the review and survey is outlined below.

7.2.2 Information on Biodiversity Resources in Brazil.

Of crucial importance are biodiversity surveys. These include information regarding the taxonomy, the ecology, distribution and ecological mapping of organisms, as well as the biological interactions among organisms and their ecosystems that increase the value of raw biological resources. In addition, biological inventories and management information systems are necessary, and need to be identified and described.

7.2.3 Equipment and Scientific Laboratory Facilities.

Biodiversity prospecting activities in Brazil will be affected by Brazil's investment in physical scientific research infrastructure. Of special importance is Brazil's investment in telecommunications facilities and the cooperative research linkages that can be set up between

laboratories, that build on the comparative advantages of each institution or group in joint efforts.

7.2.4 Private Capacity.

A survey of scientific research facilities and infrastructure in privately owned companies that have shown willingness to cooperate in national efforts will be important in coordination and consolidation of efforts.

7.2.5 Coordination.

Areas in which there is a lack of coordination of efforts among Brazilian organisations and institutions should be identified in order to identify ways to consolidate resources, eliminate overlapping and duplication of efforts, and efficiently implement the strategic action plan.

7.2.6 Collaborative Activities

Collaboration must occur among and between universities, research organisations, industry and appropriate government agencies within and outside Brazil. In addition to direct payments and possible royalties on products of potential commercial interest, collaborations create necessary links to transfer technology and develop the local skills needed to stimulate new industries and jobs that foster sustainable uses of biodiversity.

7.2.7 Major Groups Affected.

The identification of and inclusion of affected groups of people into the consultation process from its very beginning will be crucially important to the long-term success of the initiative. Their inclusion will assure the cooperation and collaboration of all major players by ensuring that ways to minimise or reverse potentially negative economic or social impacts have been adopted. Such groups will include NGOs, indigenous peoples living in and obtaining their livelihood from the protected areas selected, and conventional business enterprises that might feel a negative economic impact through the introduction of new products derived from these activities.

7.2.8 Human Resources.

To advance the ability of the country to effectively engage in the non-damaging, sustainable and economic use of its bioresources, Brazil should identify the kinds and levels of training required to fit this national effort. Once gaps have been identified, a concerted effort to focus human resource development and training in these areas should be undertaken.

7.2.9 Key Policies in the Successful Commercialisation of Biodiversity Products.

Government policies important in encouraging commercial investments include national regulatory policies in the areas of biosafety, land ownership, biodiversity conservation areas, access to and control of biological resources, nationally and/or internationally recognised intellectual property rights laws, and economic incentives or disincentives to undertake given research and industrial activities.

7.3 Business Development and Intellectual Property Rights

7.3.1 Business Development

The Biodiversity Management Organisation should support business development in biodiversity prospecting and use through activities such as:

- directing entrepreneurs to business start-up information and services, including business plan development and venture capital
- assisting diverse parts of the infrastructure in deal making, including correlation, contracting and licensing between the formal infrastructure and industry.

An important early task for the Biodiversity Management Organisation is to develop clear objectives and criteria that it will pursue in any future negotiations for commercial access to biological resources. These might include:

- generation of income to support management of protected areas and other conservation activities through direct payments and future royalties
- limitations on the quantity of samples to be taken, to ensure the sustainability of ecosystems and species populations
- supply of equipment, technology, knowledge and training
- limitations on exclusive right of access
- requirements for future profit-sharing through royalties if commercial products result

7.3.2 Intellectual Property Rights

From its inception, the Biodiversity Management Organisation must take a strong interest in intellectual property matters, which are integral to the successful development and protection of biodiversity-based enterprises. Whether the organisation would hold title to intellectual property is less important than that it have the right to manage the rights of third parties through a licensing system, and to equitably distribute income, if any.

The Biodiversity Management Organisation should offer advice on intellectual property matters to the infrastructure and other parties both directly and through recommended experts.

7.4 Pilot Prospecting and Product Development Projects

7.4.1 Introduction

The intention here is to implement two or three pilot projects in different areas. These are intended to test the feasibility and capability of biodiversity prospecting and use, and to provide an opportunity for "learning by doing". Detection of abilities to perform and learning by experience are expected to facilitate larger initiatives. Biodiversity information generated by inventories (development and management of biological, ecological, taxonomical and related systematic information on living species and systems) will be the foundation for the pilot projects. Information derived from the review proposed in 7.2 on the current "state of the art" of in-country capabilities and market needs will form the criteria for project selection. Selection and design of projects will need to consider current legal provisions and policies regulating access to biological resources.

The pilot projects will provide the opportunity to compare alternative scenarios and approaches, and thus will help to establish longer term effective management policies and practices. They should be designed to enhance experience and knowledge in the following areas.

7.4.2 Access to Biological Resources

- Access to resources in private lands vs access to resources in public lands.
- Distant and inhospitable access to biological resources vs close, easy and well defined access.
- Access to biological resources in conservation units with management plans and good administration and facilities vs access in areas with non-existent or rudimentary management.
- Access to biological resources close to or related to indigenous communities vs access in lands with no relationship to existing communities.
- Access to biological resources in areas under local, state or national management.

7.4.3 Management Issues:

- Areas of activities and classes of products. Examples are food and drink additives, cosmetics, medicinals, pesticides, enzymes for the chemical transformation industry, fuel alternatives and new materials.
- Definition of institutions and individuals and their roles and commitments in terms of responsibility, contract arrangements and distribution of intellectual property rights.
- Multidisciplinary and multisectoral participation
- Various market approaches with multiple products and different levels of value added processing.
- Financial requirements and sustainability of the effort.

- Mechanisms for returns to conservation and local communities by sharing revenues at different stages of research and product development as well as from commercialisation.

7.4.4 Experimental considerations:

- Market driven inventory by taxa selection vs all taxa inventory.
- Science and technology intensive efforts vs less intensive efforts which provide more rapid access to markets and short term benefits to local communities.
- Projects based on already existing information or research close to a product vs newly generated information
- Industrial relationships established very early in the process vs providing a product to industry in the late phases of research
- Products for the local market vs products for the national and international markets.

7.5 Policy and Legislation Review and Development

From its inception, the Biodiversity Management Organisation should have a role in ensuring that the policy and legislative framework affecting biodiversity management is appropriate. It should analyse the existing framework and offer advice to Government on changes required, if any, to:

- accomplish rational and efficient biodiversity protection, management and utilisation, for example through addressing the issue of rights of access to resources on public and private land
- stimulate business development in the area of biodiversity utilisation, for example through considering measures for tax relief or market incentives for business development.

7.6 Education and Public Relations

7.6.1 Education

There is a need to provide information for various groups in order to sensitise these groups to the issues particular to biodiversity management. Short courses of ½ or one day or 3 day seminars can provide information to or provide continuing professional education for politicians, governmental agencies, scientists, lawyers, the business community and local community groups. Once these courses are perfected, video tape sessions can be produced for distribution or use by discussion facilitators.

7.6.2 General Public Relations

A public relations publication can be created that describes the general plan being undertaken, and establishes that the plan is inclusive, not exclusive, of existing structures, organisations and constituencies. It would describe the benefits to the country as a whole and to local regions. The publication, which will address who, what, why, when and the beneficiaries, will serve as the principal outreach communication.

7.6.3 Targeted Public Relations

Additional publications and presentations would be prepared to target particular persons or groups, with the presentation shaped to gain approval, support and financing on the one hand, and at least moderate or neutralise opposition on the other hand.

8. Implementation Schedule

The following table shows the proposed sequence and timing of implementation of the proposed actions.

Proposed Actions	1995	1996	1997	1998	1999
Establish Biodiversity Management Organisation	■	■			
Review and Inventory of Current Situation in Brazil		■			
Business Development and Intellectual Property Rights		■			
Policy and Legislation Review and Development		■			
Education and Public Relations		■			
Pilot Prospecting and Product Development Projects		■			