Biodiversity Strategy Planning in a Sustainable Development Context

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FOREWORD

On a global scale, loss of biodiversity is recognized as one of the most critical environmental problems facing mankind. In ratifying the United Nations Convention on Biological Diversity, 176 nations have, to date, agreed to contribute to international efforts directed at the conservation of biodiversity, the sustainable use of biological resources and the equitable sharing of the benefits arising out of the utilization of genetic resources, conditions regarded as key to sustainable development.

One of the commitments undertaken by parties to the Convention on Biological Diversity is the preparation of a biodiversity strategy and action plan. According to the United Nations Development Programme (UNDP), many countries encounter problems in implementing the multisectoral planning approach recommended by the Convention on Biological Diversity. In 1998, a study conducted by the Secretariat of the Convention also showed that methodological resources to facilitate work with the new, complex and multisectoral nature of biodiversity planning were inadequate (UNEP/CBD/COP/4/11).

The present publication proposes the use of a framework developed in *Cadre de référence théorique pour le développement durable et la biodiversité au Québec** (Gauthier 1995, 1998). This framework is a simple, effective tool intended for managers, planners, coordinators, national focal points and experts involved in the preparation and implementation of national biodiversity strategies and action plans. It was used as a foundation for the preparation of a multisectoral strategy and action plan in Quebec in 1996. These planning documents, the implementation of which has, to date,been the subject of four annual reports, have led to the mobilization of numerous ministries, agencies and non-governmental organizations in Quebec working in the field of biodiversity. The framework has also been used in one of Quebec's administrative regions (Saguenay–Lac-St-Jean), the Democratic Republic of Congo, the Republic of Niger, the Islamic Republic of Mauritania, the Republic of Djibouti and the Sultanate of Oman.

The promotion of the biodiversity planning matrix developed in Quebec was the subject of a recommendation made in workshops at the Fourteenth Global Biodiversity Forum (Prescott and Gauthier, 1999a). The framework was also presented at the Fourth Meeting of the Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA) in Montreal (Canada) in June 1999 with a view to improving the integration of biodiversity into sectoral planning exercises. Experience has also showed that the use of this matrix can facilitate the integrated implementation of biodiversity related conventions.

1. [Theoretical framework for sustainable development and biodiversity in Quebec]; available in French only.

CONTENTS

THE CONVENTION ON BIOLOGICAL DIVERSITY, A SUSTAINABLE DEVELOPMENT LEVER

Biological diversity, or biodiversity, refers to the variety of species and ecosystems on Earth and the processes of which they are part. It is made up of three components: species diversity, ecosystem diversity and genetic diversity.

Biodiversity supports human societies on ecological, economic, cultural and spiritual levels. Its benefits are, however, compromised by human activity which, in conjunction with population growth, results in the rapid deterioration of ecosystems and a decline in the number of species and their genetic diversity.

The Convention on Biological Diversity is a key instrument that serves to promote and guide actions for biodiversity conservation and the sustainable use of biological resources. Since the Earth Summit in Rio de Janeiro in 1992, over 176 nations have ratified this international convention. The primary objectives of the Convention are as follows:

- the conservation of biological diversity, that is, the variety and variability of genes, species and ecosystems;
- the sustainable use of biodiversity components; and
- the fair and equitable sharing of the benefits arising from the utilization of genetic resources.

The three objectives of the Convention on Biological Diversity call to mind the three dimensions of sustainable development (the environmental dimension – maintain environmental integrity, the economic dimension – improve economic efficiency, and the social dimension – develop social equity), making the Convention a real lever for the implementation of sustainable development. Signing countries agree, as it were, to contribute to the protection of the natural environment, guided by the definition of sustainable development proposed by the Brundtland Commission in 1987: "Development which meets the needs of the present without compromising the ability of future generations to meet their own needs." (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, 1987).

THE CHALLENGE OF IMPLEMENTING THE CONVENTION ON BIOLOGICAL DIVERSITY

When the Convention on Biological Diversity is ratified by a country, the latter is bound by its terms to undertake the preparation of a biodiversity strategy. This strategy must aim to achieve the objectives of the Convention.

National biodiversity planners may rely on a number of instruments developed with the express purpose of assisting them in implementing the Convention on Biological Diversity, including publications by Carew-Reid et al (1994), Miller and Lanou (1995) and Hagan (1999). These documents basically describe the steps involved in the elaboration of a strategy and action plan, from work organization to the preparation of biodiversity reports.

In addition to following certain preliminary steps in the elaboration of an effective strategy, biodiversity planners are faced with a significant hurdle when it comes to selecting the key themes to be covered by the actual strategy. Indeed, these themes must both integrate all the problems observed on a national scale and allow the formulation of achievable, measurable actions. Planners and decision makers need a global framework to allow them to define their areas of action and describe in simple terms the innumerable interactions that exist between human activities and the natural environment. They also have to make an effort to integrate in their national planning exercises the numerous commitments associated with the diverse international conventions related to biodiversity.

Biodiversity is a vast domain that may be interpreted or viewed differently depending on the point of view or field of expertise. For example, in the course of its activities, the Conference of the Parties addressed a number of thematic areas to guide biodiversity planners in their work. Topics include diverse natural ecosystems (inland waters, marine and coastal waters, mountains, forest, etc.), sectors of activity (biosafety, sustainable tourism, taxonomy, etc.) or issues related to assessment (criteria and indicators), sharing, synergy between conventions, etc. At the time of this writing, there were some 20 key themes around which a national biodiversity strategy could be structured (see table 1), and the list is likely to be extended as the work of the Conference of the Parties progresses.

TABLE 1
Thematic Areas Formulated by the Conference of the Parties to the Convention on Biological Diversity

Thematic Areas
Access and Benefit Sharing
Protected Areas
Biosafety
Criteria and Indicators
Agrobiodiversity
Forest Biodiversity
Mountain Biodiversity
Marine and Coastal Biodiversity
Inland Water Ecosystems
Dryland Ecosystems
Species and Taxonomy
Impact Assessment
Incentive Measures
Biodiversity Legal Issues
Capacity Building
Traditional Knowledge
Biodiversity Funding Sources
Synergy with Rio Conventions and Other Biodiversity Conventions
Sustainable Tourism
Sustainable Use of Biodiversity

The ecosystemic approach advocated by the Convention on Biological Diversity is extremely useful in the production of national monographs which provide a portrait of natural resources and environments and evaluate efforts undertaken in the field of biodiversity. However, when it comes to preparing a strategy and action plan that call upon all sectors concerned and encourage their participation in a concerted national effort, this approach poses problems. Indeed, in most countries, global planning and management of biodiversity resources are conducted by sector rather than by ecosystem.

Given that one of the greatest challenges in the implementation of a national biodiversity strategy is that of appealing to all sectors involved so as to induce as many partners as possible (managers, farmers, breeders, fishermen, forestry workers, traditional healers, mining workers, land use planners, educators, etc.), both from the public and the private sectors, to participate in the attainment of the stated objectives, it is imperative that the sectoral management approach, which is ultimately effective in human organizations, be given consideration.

In other words, while the state of national biodiversity may be successfully analysed using an ecosystem approach, implementing the strategy will prove less problematic if a sectoral approach, that is, a resource-based approach, is employed. By appealing to managers in their own particular sector of activity, the sector approach raises their awareness of the impact of their activities; they may then more readily become involved in an intersectoral collaboration process.

An integrated sectoral approach contributes to the "ecosystemic approach" recommended in the texts of the Convention on Biological Diversity and facilitates taking into account of the commitments associated with the diverse biodiversity-related conventions. Indeed, the ecosystemic approach refers to the collaboration that must be established between the partners implementing the strategy in order to prevent their respective activities from causing ecosystem degradation. Ultimately, an integrated national management strategy that favours the conservation and sustainable development of land, water and living resources in an equitable manner will have to be elaborated (UNEP/CBD/SBSTTA/511).

By directly inviting all players to subscribe to the principles of the biodiversity strategy and participate in the achievement of its objectives, planners will, in all institutions, enhance understanding of the concept of biological diversity and commitment thereto, thereby contributing to the success of the national strategy.

The planning matrix presented in the following pages is intended to encourage sector players to participate in the implementation of the Convention on Biological Diversity.

THE SUSTAINABLE DEVELOPMENT AND BIODIVERSITY PLANNING MATRIX

A theoretical frame of reference for sustainable development and biodiversity was recently developed by ecologist Benoît Gauthier, from the Ministère de l'Environnement du Québec, to facilitate the implementation of the Convention of Biological Diversity (Gauthier 1995, 1996, 1998). It is essentially a framework or planning matrix to assist biodiversity planners.

Experience has shown that this framework can easily be adapted to any social, political or geographical context and contribute to the integration of biodiversity related conventions (Prescott, Gauthier and Gaudreau, 1998, 1999; Prescott and Gauthier, 1999b). Indeed, in addition to proving its relevance in Quebec and in one of its administrative regions (Saguenay–Lac-St-Jean), it has been used by national planning teams to prepare national biodiversity strategies and action plans for four African countries, namely, the Democratic Republic of Congo, the Republic of Niger, the Islamic Republic of Mauritania and the Republic of Djibouti, as well as for one Middle Eastern country, the Sultanate of Oman.

General Presentation and Use of the Planning Matrix

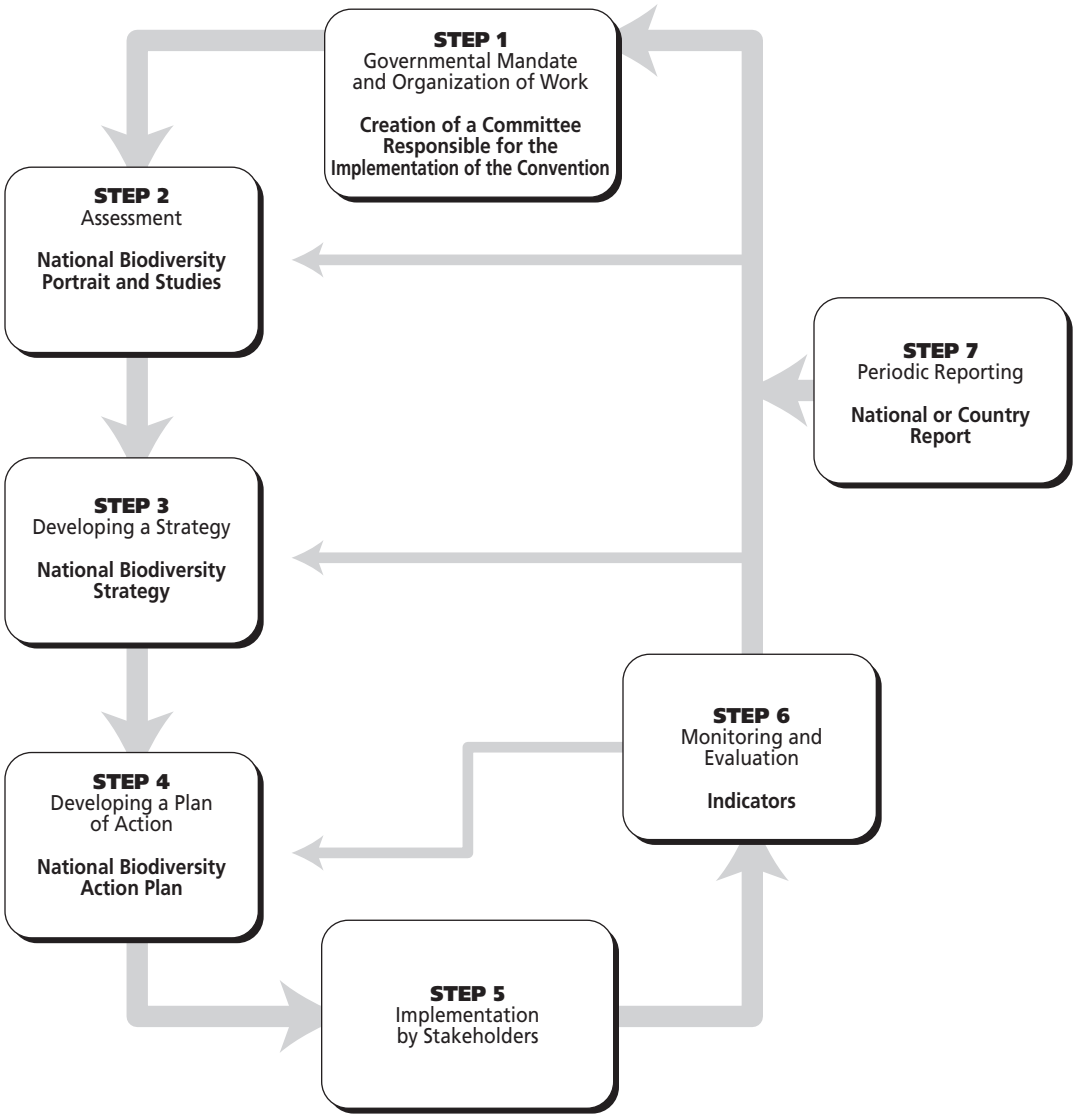
Implementing the Convention on Biological Diversity is a cyclic, adaptive process comprising seven steps described in detail by Miller and Lanou (1995). Figure 1 gives an overview of these steps. The planning matrix presented in table 2 contributes mainly to the realization of steps 3, 4 and 5 of this process, namely, the development and implementation of a biodiversity strategy and action plan. It may also prove useful in the realization of other steps of the process.

The horizontal axis of the matrix shows the five broad phases involved in the development of a national strategy and action plan: a) bases for action, b) objectives and directions, c) actions, d) aspects related to implementation, and e) indicators. The vertical axis is built around 15 themes, which integrate all current issues and any issues that might be raised by the Conference of the Parties in the future. The 15 themes proposed bring together all sectors in society whose activities are likely to directly or indirectly impact biodiversity. Each theme comprises a number of subthemes or sectors of activity (which are presented in detail in the section "Detailed Presentation and Examples of the Use of Planning Matrix Themes"), thus allowing a single strategy to call upon all social players and create a synergy between them.

The first theme deals with activities associated with energy production, transport and use (1). The following seven themes (2 to 8) refer to systems recognized by ecologists; they reflect the escalation of human impact on the territory (Dansereau 1957, 1970) and the use made of the territory and resources (conservation of resources, exploitation of fauna and flora, agriculture, mines, industries, technology and services, activities associated with the urban and rural environment. The atmospheric and aquatic basins (9) are used in determining the environmental quality of resource development; they encompass management and monitoring activities for air and water, the ultimate reservoirs for polluting emissions. Territories under special jurisdiction (10) concern, for example, Aboriginal reserves, overseas territories and enclaves governed by specific agreements. Environmental and civil emergencies (11) integrate prevention and response mechanisms and disasters. Two themes deal with individual (12. Eco-civism: Participation) and collective (13. Societal Values: Education, Legislation, Cooperation) values and are closely related to quality of life (14. Social Security, Health, Financial Activities), often considered to be the ultimate goal of sustainable development. The final theme (15. Spiritual Values) focuses on man's wisdom, morality and spirituality, values generally overlooked by planners yet essential to effective biodiversity management.

The 15 themes presented in the planning matrix cover, within a limited number of categories, all the topics and activities directly or indirectly related to biodiversity. In preparing or revising a national strategy, a planning team may use these themes as a basis when selecting subjects to be addressed in its planning efforts. If necessary, it could take one (or other) of the sector activities covered by the themes as a chapter

FIGURE 1
A Seven-Step Implementation Process for the Convention on Biological Diversity
(adapted from Miller et Lanou, 1995)



heading. In developing a portrait of the situation, identifying objectives or determining priority actions, the planning team may examine the relations that exist between each of the themes. For example, in developing the theme *Conservation of Natural Resources*, the impact on the conservation of resources of activities listed under the 14 other themes would be brought to light. Tables 3 to 9, presented in the section dealing with case studies, show how the integrating themes were addressed by different planning teams.

To prepare a national biodiversity strategy, the relevant information must be filed under each heading in the matrix. Planners must:

1. Adequately delimit the territory in question and the appropriate scale of perception.
2. Take note of the 15 integrating themes proposed and the sector activities related to each theme.
3. Select those themes and associated subthemes that are relevant to the national context.
4. For each theme selected at the national level, apply the decision process, identifying:
   - bases for action (concerns, data, pressures and impacts, litigation);
   - objectives or directions;
   - actions (related to data and information, development and planning, management or cooperation and coordination);
   - aspects related to implementation (scientific and technological requirements, responsibilities and human resources, financial resources, expected results)
   - indicators.

The section "Detailed Presentation and Examples of the Use of Planning Matrix Themes" describes the content of each of the themes and gives examples of how to fill in the matrix.

The following criteria may be used to identify the priority actions that will be included in the national action plan:

- geographical impact (national actions take precedence over local actions);
- consistency with the objectives of the Convention on Biological Diversity (actions which indirectly affect biological diversity are deemed less relevant);
- consistency with national objectives and directions;
- urgency;
- sequence (certain actions, related to knowledge acquisition for example, ought to be implemented before others);
- opportunity (substantial interest or genuine commitment on the part of partners or funding parties).

The use of this planning matrix has many advantages:

- it limits the number of topics for consideration to a finite list of 15 themes;
- it ensures that all activities impacting conservation and the sustainable use of biodiversity are taken into account (including activities related to the implementation of other biodiversity related conventions);
- it calls upon potential managers and partners and encourages their participation. The strategy passes from the hands of experts into those of government managers and their partners, thereby maximizing spin-offs;
- it fosters synergy between players and sector actions;
- it can be adapted to each territory's particular situation; themes may be merged or subdivided as necessary;
- it increases transparency and prevents duplication of efforts in the event, for example, of the person in charge of biodiversity in an organization leaving;
- it can be used to cover territories of all sizes.

The various steps and themes included in this planning tool are detailed in the following section "The Biodiversity Planning Matrix: An Overview".

TABLE 2
Biodiversity Planning Matrix

Decision Process / Themes	Bases for Action				Objectives and Directions	Actions				Aspects Related to Implementation				Indicators
	Concerns (International, National, Provincial)	Data (Society, Economy, Environment)	Pressures and Impacts	Litigation	General and Specific	Data and Information	Related to Development and Planning	Related to Management	Cooperation and Coordination	Scientific and Technological Requirements	Responsabilities and Human Resources	$ 1 Year 5 Years 10 Years	Expected Results 1-5-10 Years	Performance, state, pressure, response
1. Energy Resources														
2. Conservation of Natural Resources														
3. Development of Wildlife Resources														
4. Development of Forest Resources														
5. Development of Agricultural Resources														
6. Development of Mineral Resources														
7. Industrial Development of Technology and Services														
8. Development of the Urban and Rural Environment														
9. Atmospheric and Aquatic Basins														
10. Territories under Special Jurisdiction														
11. Environmental and Civil Emergencies														
12. Eco-civism														
13. Societal Values														
14. Quality of Life														
15. Spiritual and Religious Values														

(Adapted from Gauthier, 1995, 1998)

The Biodiversity Planning Matrix: An Overview

Activity Sectors Covered by the Integrating Themes (Vertical Axis)

1. ***Energy Resources***
   - Energy resources development.
   - Energy production and transportation.
   - Energy use, etc.
2. ***Conservation of Natural Resources***
   - Establishment and development of a representative network of protected areas.
   - Management of protected areas.
   - Maintenance or restoration of fauna and flora at risk (rare, threatened or vulnerable species).
   - Conservation, outside of protected areas, of non-exploited species.
   - Establishment, development and management of *ex-situ* conservation sites (zoos, botanical gardens, arboretums, seed banks and seed production centres, etc.).
3. ***Development of Wildlife Resources***
   - Knowledge of exploited animal species and their habitats.
   - Management of wildlife exploited through hunting, trapping, sport- and commercial fishing.
4. ***Development of Forest Resources***
   - Logging.
   - Forest management and reforestation.
   - Gathering of leaves, fruits, fungi, medicinal plants.
   - Production of pulp, paper, paperboard, etc.
5. ***Development of Agricultural Resources***
   - Cereal crops.
   - Vegetable crops.
   - Irrigation.
   - Pastoralism.
   - Livestock production.
   - Aquaculture.
   - Processing of agricultural and livestock products, etc.
6. ***Development of Mineral Resources***
   - Mining resources extractive activities.
   - Metallurgical processing of mining resources.
   - Inorganic chemistry.
   - Restoration of mining sites, etc.
7. ***Industrial Development of Technology and Services***
   - Biotechnology.
   - Petrochemistry.
   - Plastics processing.
   - Computer technology.
   - Tourism.
   - Regular control measures for harmful species (pests, parasites), etc.
8. ***Development of the Urban and Rural Environment***
   - Land use planning.
   - Urban sprawl.
   - Demography.
   - Waste management.
   - Transport, etc.
9. ***Atmospheric and Aquatic Basins***
   - Air quality monitoring.
   - Climate change monitoring.
   - Use of water resources (coastal areas, inland waters, wetlands, etc.) to meet human needs (potable water, industrial processes, agricultural production, etc.).
   - Water quality monitoring.
10. ***Territories under Special Jurisdiction***
    - Management of Aboriginal territories.
    - Management of overseas principalities, ministries and territories, etc.
11. ***Environmental and Civil Emergencies***
    - Prediction and prevention, as appropriate, of disasters.
    - Planning and coordination of responses to disasters.
    - Restoration, as appropriate, of sites struck by a disaster.
    - Control of invasive pest species, etc.

12. Eco-civism (Civil society participation)

- Participation in activities related to the planning and implementation of biodiversity strategies and action plans.
- Encouragement and support for local initiatives that contribute to the conservation and sustainable management of biological diversity, etc.

13. Societal Values

- Public awareness, education, and training.
- Research.
- Adoption and revision of laws and regulations (legal and institutional framework).
- Environmental impact studies.
- International cooperation and the implementation of the various conventions on biodiversity.

14. Quality of Life

- Ensuring environmental, economic and social security.
- Health promotion.
- Distribution of wealth, etc.

15. Spiritual and Religious Values

- Knowledge and practices of biodiversity resources management related to spiritual values.
- Dissemination and practice of spiritual values, religious precepts, cultural taboos, etc.

Decision Process (Horizontal Axis)

(The example given below deals with the theme Energy Resources. It shows how the boxes in the matrix should be filled out for this theme.)

Bases for Action – Gathering Information and Analysing the National Situation

Concerns (International, National and Provincial):

List of conventions, policies or agreements to which the country is party.

Example: The following conventions were ratified nationally: Convention on Biological Diversity, Framework Convention on Climate Change, Convention to Combat Desertification, Ramsar Convention, etc. By virtue of these conventions, the country wishes to reduce the impact of energy demand on biodiversity, etc.

Data (Society, Economy, Environment):

Information from monographs or other national documents that describe, quantify or qualify biodiversity resources and their use.

Example: Traditional energy resources, namely, wood and charcoal, meet over 80 percent of the national energy demand; for households, this figure increases to 90 percent.

Pressures and Impacts:

List of pressures and impacts on biodiversity.

Example: The unplanned harvesting of fuelwood results in deforestation.

Litigation:

Conflicts, social debates or problems, at a local, regional or national level, that could interfere with the attainment of objectives.

Example: The use of forms of energy other than wood is costly and is not approved of by the population and certain national groups.

Objectives and Directions – Preparing the National Strategy

The objectives or directions of the national strategy will be formulated on the basis of the information given in the section "Bases for Action."

Example: Promote the sustainable use of fuelwood.

Actions – Preparing the National Action Plan

Data and Information:

Actions related to the gathering, analysis and monitoring of information required to achieve the stated objectives or directions.

Example: Set up a system to monitor fuelwood harvesting in regions where forests are threatened.

Development and Planning:

Actions related to the elaboration of policies, programmes, and projects or to land use planning and building of infrastructures.

Example: Develop a national programme for energy safety and efficiency.

Related to Management:

Actions related to the development and exploitation of resources.

Example: Develop blueprints for fuelwood supply.

Cooperation and Coordination:

Actions related to cooperation with neighbouring countries or the coordination of national activities.

Example: Create a National Energy Efficiency Agency.

Aspects Related to Implementation – Implementing, Monitoring and Updating the National Strategy and Action Plan

Scientific and Technological Requirements:

Physical resources or technological processes required.

Example: Knowledge of and access to energy efficiency technologies (e.g. improved fireplaces).

Responsibilities and Human Resources:

Organizations responsible for implementing the action, partner organizations and human resources (jobs) required.

Example: Ministry of Energy, Ministry of Forests, Ministry of the Environment, Association of Wood Producers, 3 persons/year.

$ 1 Year, 5 Years, 10 Years:

Financial resources required.

Example: $50,000 per year.

Expected Results:

Spin-offs arising from the successful implementation of the action.

Example: A decrease in fuelwood consumption will help protect forests from deforestation and reduce desertification.

Indicators –

Quantifiable measuring tools. (State, pressure, response or performance indicators)

Example: Per capita consumption of fuelwood or the quantity of substituted fuelwood.

Integrating the Various Thematic Areas of the Convention on Biological Diversity into the Planning Matrix

When preparing a national strategy, planners must ensure that the various articles of the Convention on Biological Diversity and the thematic areas formulated by the Conference of the Parties are taken into account. The following table establishes a connection between the thematic areas of the Conference of the Parties and the planning matrix themes. Certain thematic areas concern only one matrix theme (protected areas, agrobiodiversity, sustainable tourism), others focus on one theme, although not exclusively so (incentive measures, legal issues, impact assessment, capacity building, funding sources, synergy with other conventions); most, however, refer to a number of planning matrix themes. Table 10 illustrates the relationship between the various articles of the Convention and the planning matrix themes.

Thematic Areas Formulated by the Conference of the Parties to the Convention on Biological Diversity	Planning Matrix Themes That May Incorporate These Thematic Areas (See Table 2)
Access and Benefit Sharing	2,3,4,5,7,12,13,14
Protected Areas	2
Biosafety	7,11
Criteria and Indicators	All Themes
Agrobiodiversity	5
Forest Biodiversity	4,3,2,9
Mountain Biodiversity	4,3,2,9
Marine and Coastal Biodiversity	3,2,5,9
Inland Water Ecosystems	9,3,2,4,5
Dryland Ecosystems	5,3,2,4
Species and Taxonomy	2,3,4,5
Impact Assessment	12
Incentive Measures	12
Biodiversity Legal Issues	13
Capacity Building	13
Traditional Knowledge	All Themes
Biodiversity Funding Sources	12
Synergy with Rio Conventions and Other Biodiversity Conventions	13
Sustainable Tourism	7
Sustainable Use of Biodiversity	3,4,5,7

Detailed Presentation and Examples of the Use of Planning Matrix Themes

In order to clearly understand the scope and content of the 15 planning matrix themes, they are presented in the following pages using information from national strategies designed on the basis of this framework. The following considerations are addressed:

Typical Sector Activities: The sector activities and subjects covered by each integrating theme are listed so as to clearly explain what each theme encompasses. The seven case studies presented in section 4 (tables 3 to 9) show which themes or subthemes were given priority by planning teams.

Bases for Action – Pressures and Impacts: Pressures and impacts are usually detailed in monographs describing biological diversity, the state of a country's biological resources, laws, policies, organizations, programs, budgets and human resources devoted to biodiversity at a national level. The examples given here illustrate the impact of sector activities on biodiversity. In national strategy documents, such information often comes under the heading "Issues " or "Status Report".

Objectives or Directions – Examples: This list contains the objectives or practical and operational directions which will serve as the foundation for the elaboration of an action plan for conservation, the sustainable use of biodiversity resources and the just and equitable sharing of benefits arising from the use of genetic resources, in response to the problems outlined under the previous heading.

Actions – Examples: Actions underway or planned actions related to conservation, the sustainable use of biodiversity and the equitable sharing of its benefits are described by specifying the public or private organizations that will be directly entrusted with their implementation as well as the necessary or proposed means, resources and time frames. The examples are taken or adapted from existing national strategies.

Aspects Related to Implementation – Partners: In order to call upon and make all players aware of their responsibilities, a number of possible partners are listed.

Indicators – Examples: Indicators must be selected and monitored in order to assess the performance of each of the actions outlined in the action plan and, eventually, that of all aspects of the theme in question.

Note that biodiversity strategies and action plans are continually evolving and may be improved in the course of their implementation.

Theme 1 ENERGY RESOURCES

This theme deals with activities related to the multiple sources of energy available, namely, wood, agricultural residues, petroleum products, hydroelectricity, hydro energy, wind energy, solar energy and nuclear energy. These forms of energy are used to satisfy the needs of populations (for food, heat, transport, etc.) or for industrial purposes.

Typical Sector Activities

- Energy resources development.
- Energy production and transportation.
- Energy use, etc.

Bases for Action – Pressures and Impacts

- Energy resources development (drilling, etc.), energy production and transportation (construction of dams, dikes, transmission lines, etc.) may degrade ecosystems.
- The use of fossil fuels is responsible, on a global scale, for climatic warming, urban smog and depletion of the ozone layer.
- Unplanned harvesting of fuelwood results in deforestation.

Objectives or Directions – Examples

- Promote technologies that contribute to energy conservation.
- Promote the environmentally sound development of energy resources.
- Promote renewable energy resources.
- Promote the use of energy forms other than wood in arid zones.

Actions – Examples

- Develop a national strategy for energy safety and efficiency.
- Develop a guide to good practices for energy development, production and transportation.
- Implement a national coal and natural gas development program.
- Implement an energy conservation information campaign.
- Develop blueprints for fuelwood supply.

Aspects Related to Implementation – Partners

- Ministries, companies or agencies responsible for energy, water, the environment, etc.
- Local communities.

Indicators – Examples

- Release rate of greenhouse gases.
- Assessment of energy efficiency.
- Per capita consumption of fuelwood.
- Quantity of substituted fuelwood.

CONSERVATION OF NATURAL RESOURCES

Theme 2

This theme concerns (1.) the *in-situ* conservation of biological diversity, particularly by the creation of protected areas (national parks, wildlife areas, forest reserve, etc.) and the conservation of rare, threatened or vulnerable species and ecosystems, and (2.) the *ex-situ* conservation of biological diversity in zoos, botanical gardens, arboretums, seed banks, seed production centres, etc. This theme also deals with the conservation of exceptional landscapes, geological formations or water bodies.

1. *IN-SITU* CONSERVATION

Typical Sector Activities

- Establishment and development of a network of protected areas that is representative of biological diversity.
- Management of protected areas.
- Maintenance or recovery of rare, threatened or vulnerable faunal and floral species.
- Conservation, outside protected areas, of non-exploited species.

Bases for Action – Pressures and Impacts

- Networks of protected areas are not representative of the diversity of national ecosystems.
- The inadequacy of financial, physical and human resources allocated to protected areas leads to gaps in their management, namely, a lack of blueprints and management plans, insufficient monitoring of wild populations of fauna and flora, etc.
- Local communities are not aware of the role protected areas play in biodiversity conservation. Lack of awareness combined with poverty in communities may result in encroachment into protected areas for purposes such as agriculture, grazing, logging, poaching, etc.
- Faunal or floral species are rare, threatened, vulnerable or likely to be designated as such due to the degradation of natural environments, overexploitation, poaching, etc.
- Insufficient data are available on species at risk and their exact status is difficult to determine.
- Many human activities, such as agriculture, livestock production, logging, water level management, urbanization, etc., result in the degradation, fragmentation or disappearance of wildlife habitats outside protected areas.

Objectives or Directions – Examples

- Increase the number of protected areas to improve the representativeness of the national network.
- Maintain and develop the existing network of protected areas.
- Increase knowledge regarding the situation of species at risk.
- Maintain or restore rare or threatened animal and plant species.
- Crack down on the illegal trade of threatened species and their products.

Actions – Examples

- Establish protected areas to fill gaps in the protected areas network.
- Develop blueprints and management plans for protected areas.
- Implement a program for the inventory and monitoring of biological resources in protected areas.
- Develop a transboundary management strategy for protected areas.
- Develop a management policy for protected areas, thereby encouraging community involvement.
- Implement a national program to protect threatened fauna and flora which comprises the inventory and monitoring of populations, the preparation and implementation of rehabilitation plans, etc.
- Undertake a project to reintroduce a given species.
- Implement a program to restore wildlife habitats.

Aspects Related to Implementation – Partners

- Ministries, organizations or agencies responsible for the environment, protected areas, fauna, flora, etc.
- Environmental organizations and local communities.
- Research scientists interested in these fields.

Indicators – Examples

- Number of hectares or percentage of territory devoted to protected areas.
- Number of protected areas with a management plan.
- Proportion of protected floral or faunal species versus the number of species on the list of species at risk.
- Number of recovery plans implemented.
- Number of species on the list of threatened species found in protected areas.

2. *Ex-Situ* Conservation

Typical Sector Activities

- Establishment, development and management of ex-situ conservation sites (zoos, botanical gardens, arboretums, seed banks, seed production centres, etc.).

Bases for Action – Pressures and Impacts

- Species used for cultivated farm crops are threatened by drought, changes in flood patterns, poor farming and pastoral practices, the introduction of new varieties of crops, etc.
- The diversity of races and varieties of livestock adapted to local conditions is decreasing.
- The contribution of botanical gardens and zoos to biodiversity conservation is often underestimated or underdeveloped.
- *Ex-situ* conservation sites are faced with inadequate facilities, insufficient monitoring, and deficiencies in human, financial and physical resources.

Objectives or Directions – Examples

- Protect races and varieties used to supply food and in agriculture by developing collections to conserve genetic material (gene and seed banks).
- Promote research and training activities related to *ex-situ* conservation.

Actions – Examples

- Inventory and typify the different races and varieties of livestock and crops.
- Introduce a legislation to regulate the production, multiplication and distribution of improved seeds.

- Create a seed bank.
- Adopt a master plan for the development of botanical gardens and zoos.

Aspects Related to Implementation – Partners

- Ministries, companies or agencies responsible for the environment, agriculture, livestock production, research and technology, etc.
- Environmental groups and local communities.
- Research scientists interested in environment, agriculture, livestock production, etc.

Indicators – Examples

- Number of species and varieties (animal or plant) conserved in the national seed bank.
- Number of species in aquariums, zoos or botanical gardens targeted by a recovery plan.

Theme 3 DEVELOPMENT OF WILDLIFE RESOURCES

This theme refers to the knowledge and management of wildlife (aquatic, terrestrial and winged). Species harvested for sporting and commercial purposes, or which are victims of poaching, require priority actions.

Typical Sector Activities

- Knowledge of animal species exploited in their habitats.
- Management of wildlife exploited through hunting, trapping, sport- and commercial fishing.

Bases for Action – Pressures and Impacts

- Knowledge of numerous animal species and their habitats is incomplete.
- Many wildlife species whose exploitation is permitted are threatened by overexploitation due to excessive hunting, fishing or trapping. Controlling harvesting (licences, quotas, exploitation periods, equipment, etc.) proves difficult due to staff shortages or inadequate intervention measures.
- Species are poached to such an extent that their survival is threatened.

Objectives or Directions – Examples

- Promote wildlife exploitation methods that perpetuate resources.
- Improve knowledge about the state of animal populations, their demographic trends, habitats and degree of exploitation.

- Determine the current status of each wildlife species exploited and establish measures that support sustainable use.
- Step up measures to reduce poaching.

Actions – Examples

- Develop and implement a blueprint for research on wildlife and wildlife habitats.
- Establish mechanisms for the management of exploited wildlife (quotas, exploitation periods, etc.) and monitor species harvesting at regular intervals.
- Create a data bank and atlas on wildlife.

Aspects Related to Implementation – Partners

- Ministries, companies or agencies responsible for wildlife and wildlife exploitation.
- Hunters' and fishermen's associations.
- Local communities.

Indicators – Examples

- Number of exploited species targeted by a population-monitoring program.
- Harvesting rate of wildlife exploited and observance of quotas.
- Number of poaching-related offences.

DEVELOPMENT OF FOREST RESOURCES

Theme 4

This theme concerns activities related to ligneous (wood, leaves, bark, fruits, roots, etc.) and non-ligneous (fungi, herbaceous plants, small fruits, etc.) resources. These resources are exploited for papermaking, timber production, food, handicraft objects, housing construction or the manufacture of mats, medicines, cosmetics, etc.

Typical Sector Activities

- Logging.
- Forest management and reforestation.
- Gathering of leaves, fruits, fungi, medicinal plants.
- Production of pulp, paper, paperboard, etc.

Bases for Action – Pressures and Impacts

- Knowledge of ligneous species and forest ecosystems is often incomplete.

- Logging has many impacts, including pollution of waterways, modification of water regime balance, compaction and decreased fertility of soils, degradation or fragmentation of wildlife habitats, degradation of landscape quality.
- Excessive harvesting and gathering for commercial purposes endangers certain species of great value (medicinal, nutritional, etc.).
- Drought, desertification and bushfires are natural threats to forests.
- Pulp- and paper-manufacturing processes generate many types of water and air pollution.

Objectives or Directions – Examples

- Improve knowledge about the state of ligneous and non-ligneous resources and the extent of their exploitation.
- Promote measures that support the rational and sustainable exploitation of ligneous and non-ligneous resources.
- Improve exchanges of information, expertise and know-how in the field of ligneous resources management.
- Promote environmentally sound pulp- and paper-manufacturing processes.

Actions – Examples

- Identify forest resources, determine deforestation and regeneration rates and monitor the state of forest ecosystems.
- Develop a national reforestation program and promote the natural regeneration of degraded sites.
- Implement forest resources management methods based on annual reforestation and harvesting rates.
- Develop forest exploitation methods that do not threaten water and wildlife resources.

Aspects Related to Implementation – Partners

- Ministries, companies or agencies responsible for ligneous and non-ligneous resources, the environment, water, agriculture, livestock production, etc.
- Industrialists and forestry workers.
- Associations and organizations involved in the harvesting of non-ligneous products (fungi, wild fruits, etc.).
- Woodlot owners.
- Local communities.

Indicators – Examples

- Harvesting rates of the allowable cut.
- Reforestation rates.
- Quantity of non-ligneous products produced locally and sold on the market.

DEVELOPMENT OF AGRICULTURAL RESOURCES

Theme 5

In order to feed himself, man acts on nature and shapes ecosystems conducive to livestock production or plant growth. This theme concerns all types of crops and livestock production connected with meeting the food needs of collectivities.

Typical Sector Activities

- Grain crops.
- Vegetable crops.
- Land irrigation.
- Pastoralism.
- Livestock production.
- Aquaculture.
- Processing of agricultural and animal products; etc.

Bases for Action – Pressures and Impacts

- Agriculture causes a reduction in soil quality (organic matter and mineral deficiencies, decreased fertility, increases in acidity levels), susceptibility to water and wind erosion, contamination of waterways or groundwater (use of fertilizers, organic matter, pesticides), etc.

- Livestock production gives rise to significant pressures due to localized overgrazing, access to water points, etc.
- Agriculture and livestock production are often poorly integrated and conflicts frequently exist between these uses of biodiversity.
- Uncontrolled growth of livestock may lead to degradation of pastoral lands.
- Techniques used to process agricultural products may generate pollution that adversely affects ecosystems.
- Protection of crops and livestock from pests sometimes impacts non-target species.

Objectives or Directions – Examples

- Promote the adoption of practices that support the sustainable development of livestock production and agriculture.
- Reduce the impact of agricultural activities and livestock production on wild species and natural environments.
- Effectively integrate the management of pastoralism and agriculture.
- Promote the adoption of non-polluting techniques for processing agricultural resources.
- Ensure that the agricultural land base is protected from urban encroachment.

Actions – Examples

- Implement a blight control program.
- Work towards the integration of agriculture/livestock production/forest by increasing and improving the use of agricultural by-products in cattle fodder.
- Implement a decentralized financing system for the livestock production sector and support breeders' associations.
- Develop a management plan for the pastoral land base that supports the preservation of pastoral ecosystems, a better distribution of water points and their management.
- Support fishfarming development cooperatives.
- Develop a network of windbreaks and green corridors in agricultural environments.
- Implement a program to protect waterways in agricultural environments.

Aspects Related to Implementation – Partners

- Ministries, agencies or companies responsible for the management of agriculture, livestock production, the environment, water, etc.
- Agricultural producers' associations and agricultural cooperatives.
- Breeders' associations.
- Private producers.
- Local communities.

Indicators – Examples

- Percentage of land devoted to agriculture.
- Animal density on the agricultural land base.
- Quantity of pesticides used per unit of cultivated land.

DEVELOPMENT OF MINERAL RESOURCES

Theme 6

While mineral resources are not part of the living world, their exploitation and processing have repercussions on biological diversity. It must also be noted that the exploitation of coal, natural gas, crude oil and uranium reserves could significantly reduce fuelwood consumption in desert countries.

Typical Sector Activities

- Mining resources extractive activities.
- Metallurgical processing of mining resources.
- Inorganic chemistry.
- Restoration of mining sites; etc.

Bases for Action – Pressures and Impacts

- Mining exploitation and extraction processes result in contamination due to the discharge of exploitation waste or the use of toxic chemicals, overtapping of water resources, etc.

MRN

- The establishment of mining sites involves extensive destruction of vegetation cover to allow access to resources or to satisfy employees' energy and housing needs.
- When extractive activities have been completed, mining sites are not always rehabilitated.
- Old metallurgical and steel processes are major pollutants.

Objectives or Directions – Examples

- Promote ecologically sustainable mining exploitation practices.
- Promote the restoration of mining sites upon completion of exploitation activities.
- Promote the use of ecologically sound metallurgical and steel processes.

Actions – Examples

- Develop environmentally sound guides to good practices for mining development and exploitation.
- Create reforestation areas around quarries and mines.

- Promote the recycling of mining waste.
- Introduce incentive measures for the restoration of mining sites upon completion of exploitation activities.

Aspects Related to Implementation – Partners

- Ministries, companies or agencies responsible for the management of mines, energy, water, the environment, etc.
- Mining companies and mining workers.

Indicators – Examples

- Total area of sites restored.
- Percentage of mineral substances salvaged and recycled from rejects and waste.

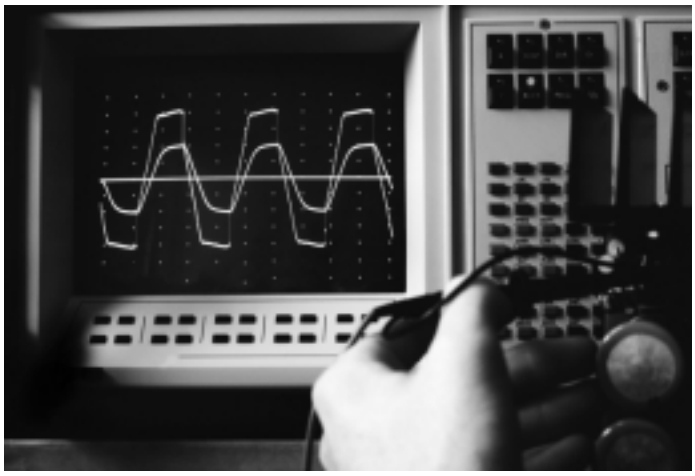
INDUSTRIAL DEVELOPMENT OF TECHNOLOGY AND SERVICES

Theme 7

This theme covers technological processes and services used for industrial purposes (with the exception of those dealt with under more specific themes, for example processes associated with the development of energy, forest, agricultural, mineral resources, etc.).

Typical Sector Activities

- Biotechnologies (applications that use genetic engineering and diverse biological techniques to increase yields and improve the efficiency of products used in the fields of agriculture, agrifood, livestock production, animal health, depollution, etc.) and biosafety (biotechnological risk prevention).



- Aeronautics.
- Petrochemistry.
- Plastics processing.
- Computer technology.
- Tourism.
- Regular control measures for harmful species (pests, parasites); etc.

Bases for Action – Pressures and Impacts

- Any species that is genetically modified is an alien species, even in its original ecosystem; the introduction of alien species or genetically modified organisms may give rise to imbalances in the functioning of ecosystems.
- Industrial processes use a huge quantity of resources and may contaminate ecosystems through the discharge of wastes or pollutants.
- Tourist activities and infrastructures result in the degradation of natural environments of great ecological value.

Objectives or Directions – Examples

- Promote the adoption of a national biosafety strategy.
- Promote and support research to mitigate the impacts of pollution caused by industrial processes.
- Promote ecologically sustainable types of tourism, including ecotourism.

Actions – Examples

- Develop institutional biotechnology and biosafety capacities (in vitro culture laboratories, training, professional development, etc.).
- Implement a research program to mitigate the impacts of a given industrial process, and allocate it the necessary financial support.
- Adopt a tourist code that takes the environment into account.

Aspects Related to Implementation – Partners

- Ministries, companies or agencies responsible for industry, water, the environment, higher education, research and technology.
- Industrial developers, tourism agencies.
- Local communities.

Indicators – Examples

- Number of genetically modified species that are not targeted by measures in the national biosafety strategy.
- Quantity of pollutants discharged by industries from a given sector.
- Number of companies certified in conformity with environmental requirements.
- Number of tourist companies with an environmental code of ethics.

DEVELOPMENT OF THE URBAN AND RURAL ENVIRONMENT

Theme 8

This theme refers to problems that are typical of built environments and to demography, factors that are a burden on biological resources firstly due to the space occupied but also by virtue of the quantity of natural resources required to satisfy individual and collective needs.

Typical Sector Activities

- Land use planning.
- Urban sprawl.
- Demography.
- Waste management.
- Transport; etc.

Bases for Action – Pressures and Impacts

- Accelerated urbanization has various impacts on urban centres and villages, including reduced access to potable water, poorer air quality, lack of management measures for solid waste, foul- and rainwater, etc.

- Expansion of the urban and rural environment usually has an adverse effect on nearby natural environments.
- Demographic growth and migratory movements exert considerable pressures on natural resources, exceeding the environment's carrying capacity.
- Modes of transportation consume large quantities of fossil fuels and are responsible for the emission of numerous air pollutants.

Objectives or Directions – Examples

- Adopt an integrated land use planning approach that takes the environment's carrying capacity into account.
- Control irresponsible urbanization.
- Promote the creation of a network of green spaces in urban centres and villages.
- Prevent the migration of rural populations.

Actions – Examples

- Develop and implement regional and subregional land development plans.
- Improve the refuse collection and treatment system.

- Introduce incentive measures to promote the use of mass transit and decrease the use of individual means of transport in urban centres.
- Create green spaces in urban centres and villages.

Aspects Related to Implementation – Partners

- Ministries, companies or agencies responsible for the management of facilities, infrastructures, land use planning, finance, planning, public health, etc.
- Municipal and rural entities.
- Local communities.
- Social or environmental organizations.

Indicators – Examples

- Number of land development plans implemented.
- Rate of sprawl of urban centres.
- Urban population growth rate.
- Waste collection rate.
- Foulwater treatment rate.
- Total area of green spaces in the urban environment.

ATMOSPHERIC AND AQUATIC BASINS

Theme 9

This theme refers to atmospheric and water resources which, in their respective basins, are indicative of environmental pressures associated with the conservation and use of biodiversity in a territory.

Indeed, most human populations and the activities described under the eight previous themes are concentrated in the watersheds of large rivers and great lakes. Analysing the state of a major waterway and the pressures it is subject to may therefore be useful in an initial assessment of overall biodiversity status. The state of the waterway reflects the results of initiatives undertaken in its watershed and consequently may be regarded as a global indicator of the quality of the living environment and the state of biodiversity.

Similarly, the air quality in a given environment may reflect the intensity of human activities in a territory and be an indicator of their impact on the atmospheric environment.

Typical Sector Activities

- Air quality monitoring.
- Climate change monitoring.
- Use of water resources (coastal areas, inland waters, wetlands, etc.) to meet human needs (potable water, industrial processes, agricultural production, etc.).
- Water quality monitoring.

Bases for Action – Pressures and Impacts

- Atmospheric waste, chiefly arising from the burning of hydrocarbons and wood, reduces air quality and results in the formation of smog and acid rain, which adversely affect wildlife species and ecosystems.
- Climatic warming, caused by an increase in greenhouse gases, has major impacts on natural ecosystems.
- Depletion of the ozone layer leads to an increase in ultraviolet rays, which cause damage to the genetic integrity of living organisms.
- Water bodies are polluted by toxic substances, bacteriological contamination, suspended particulates and the use of nutritional substances.

- Surface and groundwater resources are overexploited, which has an adverse effect on the integrity of aquatic environments and wetlands.
- Human and animal pressures in the area around water points result in overcutting of plants that protect bodies of water from silting up, leading to bank erosion.
- Wetlands are destroyed by embankment construction.

Objectives or Directions – Examples

- Preserve air quality by fighting all forms of pollution.
- Improve knowledge of water resources and aquatic ecosystems.
- Satisfy the water needs of populations and livestock.
- Preserve water quality by fighting all forms of pollution and protecting wetlands, places of natural water purification.

Actions – Examples

- Monitor air quality in urban areas.
- Monitor the bacteriological and physicochemical quality of water.
- Foster consensus-building between stakeholders to ensure the integrated management of the diverse uses of aquatic environments and water resources (fishing, livestock production, agriculture, ecosystem conservation, etc.).
- Establish a vegetation belt around wetlands to prevent their silting up.

Aspects Related to Implementation – Partners

- Ministries, companies or agencies responsible for the management of the environment, water, transport, agriculture, etc.
- Users of water resources such as agricultural cooperatives, breeders' associations, agro-industries, etc.
- Local communities and NGOs.

Indicators – Examples

- NO_x concentration in the air.
- Per capita CO_2 emissions.
- Percentage of the population living in areas that do not comply with air quality standards.
- Total (or per capita) emissions of greenhouse gases.
- Index of the bacteriological and physicochemical quality of waterways.
- Percentage of the population that does not have access to drinking water that complies with standards in effect.

TERRITORIES UNDER SPECIAL JURISDICTION

Theme 10

Responsibility with respect to biodiversity may be shared differently between national governments and other bodies, for example those governing Aboriginal territories. The latter must be invited and urged by national governments to develop their own implementation tools of the Convention on Biological Diversity, as proposed under this theme.

Typical Sector Activities

- Management of Aboriginal territories.
- Management of overseas principalities, ministries and territories; etc.

Bases for Action – Pressures and Impacts

- Biodiversity in territories under special jurisdiction is potentially subject to the same risks associated with human activities as the rest of the country: exploitation of species and natural environments, degradation of natural habitats, pollution, etc. Should a State include such territories, it would be useful to compile under this heading all information concerning problems related to conservation and the use and sharing of benefits arising from the exploitation of the territory's biodiversity.

Louise Leblanc

Louise Leblanc

Objectives or Directions

- Objectives or directions are the same as those set out under the other integrating themes in the action plan framework.

Actions

- Actions are the same as those set out under the other integrating themes in the framework.

Aspects Related to Implementation – Partners

- Representatives of populations and organizations (decision makers, private sector, environmental groups, etc.) living in these territories must be encouraged, using appropriate means, to participate in all stages of the planning and implementation of the biodiversity strategy and action plan.

Indicators

- Indicators are the same as those set out under the other integrating themes in the framework.

Theme 11 ENVIRONMENTAL AND CIVIL EMERGENCIES

This theme refers to all activities concerned with the prevention and management of natural disasters and technological accidents, as well as actions, where necessary, to restore sites struck by such a disturbance. Planners of emergency responses and response team members will thereby ensure that biodiversity is protected, along with people and property.

Natural disasters include droughts, floods, bushfires, livestock epidemics, insect plagues, earthquakes, wind- and icestorms, cyclones, tornadoes, etc. This theme also deals with the control of very invasive pest species, particularly when major action is required.

Technological disasters include oil spills in coastal areas, spills of chemicals during road or rail accidents, etc. Armed conflicts also number among human-induced disasters that may result in irrecoverable loss of biodiversity.

Typical Sector Activities

- Prediction and prevention of disasters.
- Planning and coordination of responses to disasters.
- Restoration, as appropriate, of sites struck by a disaster.
- Control of invasive pest species; etc.

Jean-David Turcotte

Bases for Action – Pressures and Impacts

- Droughts and floods result in the degradation and loss of natural resources, which in turn lead to the shift of populations and livestock to other territories, increasing pressures in these areas.
- Bushfires and insect plagues may destroy thousands of hectares of forest or pastureland annually.
- Spills of petroleum products or other chemicals may result in the contamination of the aquatic environment, death of fauna and flora, habitat degradation, etc.
- Invasive species replace native species and create imbalances in ecosystems.

Objectives or Directions – Examples

- Provide maximum protection for protected areas, fragile and vulnerable ecosystems, *ex-situ* conservation sites and the main agricultural, pastoral and forestry production areas during environmental or civil emergencies.
- Promote international cooperation in the field of environmental emergency prediction.

Actions – Examples

- Develop emergency response plans that take biodiversity into account for protected areas, fragile and vulnerable ecosystems, *ex-situ* conservation sites and the main agricultural, pastoral and forestry production areas.
- Inform emergency response teams (police, army, civil defence, etc.) of the contingency plans developed.
- Improve coordination of activities related to environmental emergencies by creating a bank of pertinent data.
- Study methods for the control of invasive species that threaten ecosystems.

Aspects Related to Implementation – Partners

- Ministries, companies and agencies responsible for public safety, water, the environment, agriculture, livestock production, etc.
- The army, police, civil defence.
- The media.

Indicators – Examples

- Number of contingency plans developed.
- Total area of territory affected by natural disasters.

Theme 12 ECO-CIVISM

The conservation and sustainable use of biodiversity cannot become a reality without the active participation of local communities, socioprofessional associations, NGOs, representatives from the private sector, etc. A theme is therefore devoted to activities that may prompt as many partners as possible to become involved in the attainment of the objectives set out in strategies and action plans.

Typical Sector Activities

- Participation in activities related to the planning and implementation of biodiversity strategies and action plans.
- Encouragement and support for local initiatives that contribute to the conservation and sustainable use of biological diversity; etc.

Bases for Action – Pressures and Impacts

- The design and implementation stages of biodiversity strategies and action plans often fail to sufficiently involve local communities, which are holders of traditional knowledge and practices essential to the success of actions undertaken in the territory.

Objectives or Directions – Examples

- Encourage all players to participate in planning and implementing the biodiversity strategy and action plan.
- Promote the creation of associations and NGOs that will participate in biodiversity management (village groups, breeders' groups, fishermen's associations, forestry associations, etc.).

Jean-Pierre Drapeau

Conseil régional de l'environnement de la Montérégie

- Give local communities more responsibilities for and rights over their natural resources and support them in the elaboration and implementation of measures to prevent the degradation of biodiversity resources.
- Promote private sector involvement in the field of the conservation and sustainable use of biological diversity.

Actions – Examples

- Implement a support program for national NGOs and local associations.
- Oversee pilot programs for the management of biodiversity resources by NGOs and local associations (for example, the management of a reserved forest by a local forestry association).
- Publicize successful partnerships with the private sector.
- Adopt provisions (incentives, tax breaks, social recognition, etc.) to encourage individuals and groups to contribute to biodiversity conservation.

Aspects Related to Implementation – Partners

- Local communities, NGOs, cooperatives, women's associations, youth associations, scientists' associations, artists' associations, etc.
- The private sector (including banks), labour organizations, boards of trade and professional bodies.
- Ministries, agencies or companies responsible for development, the environment, etc., and funding agencies.

Indicators – Examples

- Effective participation of NGO representatives in the planning stages of the national biodiversity strategy.
- Number of associations independently managing biodiversity resources.
- Financial assistance for biodiversity protection and development.

Theme 13 SOCIETAL VALUES

This theme refers to awareness-raising, educational and training activities, which are an ideal framework in which to bring about a change in attitude in favour of the conservation and sustainable use of biodiversity. Pupils and students at all levels, farm and forestry officers and operators, fishermen, members of NGOs and socioprofessional organizations, landowners and the general population are targeted by these activities.

This theme also concerns the legal and institutional framework, the laws and regulations governing the use of natural resources and protection of the environment. The integration of environmental concerns into development activities and social programs is also covered by this theme.

Jean-Pierre Drapeau

Typical Sector Activities

- Information, public awareness, education, and training.
- Research
- Adoption and revision of laws and regulations (legal and institutional framework).
- Environmental impact studies.
- International cooperation and the implementation of the various conventions on biodiversity.

Bases for Action – Pressures and Impacts

- Few public awareness programs target local communities; yet many of the latter still believe that natural resources are unlimited.
- Educational programs overlook or deal superficially with biodiversity issues.
- Employees are not given adequate training to upgrade their practical knowledge of natural resources management practices.
- Legislation in effect in the field of the environment and natural resources management is sometimes exceeded by current realities and fails to take into account concern for the conservation and sustainable use of biodiversity.
- The lack of specific guidelines for environmental assessments means that not all development options and environmental consequences are examined in the project design stage.
- Lack of collaboration or the refusal to participate in the implementation of agreements, at international and national levels, compromises the protection of shared biological resources.

Objectives or Directions – Examples

- Adopt a national policy for education, public awareness and training on the importance of biological diversity and the need to conserve and use it in a sustainable manner.

- Improve the legal framework (laws and regulations) so as to take biodiversity into account.
- Assist international efforts to protect and develop biodiversity.

Actions – Examples

- Organize people-oriented activities (workshops, fairs, exhibitions, etc.) to educate local communities and raise their awareness of the importance of biological diversity.
- Adapt school, university and technical curricula so as to better integrate concern for the conservation and the sustainable use of biological diversity.
- Offer educators responsible for educational programs and training specialization courses in biodiversity.
- Develop specific guidelines for environmental assessments.
- Adopt legal measures that support the conservation of biological diversity and the sustainable use of biological resources.

Aspects Related to Implementation – Partners

- Ministries, agencies or companies responsible for education, justice, the environment, etc.
- Educator and trainer networks.
- Educational and technical training institutions.
- NGOs and local associations.
- The private sector, labour organizations and boards of trade.

Indicators – Examples

- Number of public awareness or training workshops held and the number of workshop participants.
- Number of users of information products (brochures, magazines, etc.) devoted to biodiversity.
- Number of visitors to sites dedicated to biodiversity (national parks, botanical gardens, zoos, arboretums, etc.).
- Number or percentage of development projects subjected to environmental assessments.

Theme 14 QUALITY OF LIFE

The quality of life of collectivities is the ultimate goal of sustainable development. This theme provides an integrated portrait of the socioeconomic situation of populations targeted by a biodiversity strategy (GNP, unemployment rate, economic growth, life expectancy, health care, etc.). These carefully selected indicators denote a population's capacity to use available and abundant natural resources for food, income generation, etc. They reflect both their living conditions and standard of living.

Typical Sector Activities

- Ensuring environmental, economic and social security.
- Health promotion.
- Distribution of wealth; etc.

Bases for Action – Pressures and Impacts

- The unequal distribution of wealth and ensuing poverty result in rural migration and exert considerable pressure on resources around cities.
- The disparity between rich and poor is a source of social tensions and conflicts that may directly impact the quality of the natural environment.
- The failure to integrate environmental aspects into public accounts results in overexploitation of resources.

Objectives or Directions – Examples

- Develop and implement anti-poverty programs that address food security, income-generating activities, etc.
- Promote health.

- Adopt measures that promote the equitable distribution of wealth.
- Integrate environmental aspects into public accounts.

Actions – Examples

- Introduce a health program for all citizens.
- Introduce a social security or guaranteed minimum income scheme.

Aspects Related to Implementation – Partners

- Ministries, companies or agencies responsible for development planning, finance, health, etc.

Indicators – Examples

- United Nations Quality of Life Index.
- Number of jobs associated with the exploitation (primary and secondary) of biological resources.
- Production value associated with the exploitation (primary and secondary) of biological resources.
- Percentage of the population that has access to health care.
- Average per capita income.

SPIRITUAL AND RELIGIOUS VALUES

Theme 15

By virtue of their past and present influence on relations between local populations and biodiversity resources, spiritual and religious values are a dimension that cannot be ignored when it comes to preparing a strategy for the conservation and sustainable use of biodiversity. Myths, sacred chants, stories, proverbs, rites, cultural taboos and religious beliefs reflect a genuine concern for protection of the environment and contribute indirectly to biodiversity conservation. Indeed, all the great religions include rites and ceremonies that worship creation (ecosystems, species, etc.), thereby contributing to the protection of species and natural environments (Ribaut, 1997).

Typical Sector Activities

- Knowledge and practices of biodiversity resources management related to spiritual values.
- Dissemination and practice of moral and spiritual values, religious precepts, cultural taboos; etc.

Bases for Action – Pressures and Impacts

- Spiritual and religious values are not given sufficient consideration when developing biodiversity tools; they are disregarded and lack of recognition and appreciation may even result in their loss.
- Environmental resources management and exploitation practices that run counter to religious beliefs or teachings sometimes have a negative impact on biodiversity conservation.

Objectives or Directions – Examples

- Take spiritual values into account in the development of tools for the conservation and sustainable use of biodiversity.
- Improve knowledge and appreciation of traditional learning and know-how, cultural taboos and spiritual values that may contribute to the conservation and sustainable use of biodiversity.
- Facilitate the preservation of social and cultural traditions that will support the handing down, from generation to generation, of traditional knowledge and practices that link spiritual values and the sustainable use of biological resources.

Actions – Examples

- Draw up an inventory of traditional knowledge and practices related to spiritual values that contribute to the conservation and sustainable use of biological biodiversity.
- Introduce a mechanism to disseminate conservation concepts related to spiritual or religious values.

Aspects Related to Implementation – Partners

- Religious bodies, marabouts, shamans, ethicists, etc.
- Associations and communities of devotees.

Indicators – Examples

- Number of pilgrims visiting holy places.
- Number of sacred sites.

PLANNING BIODIVERSITY STRATEGIES AND ACTION PLANS: CASE STUDIES

Quebec and one of its administrative regions, as well as four African countries and one Middle-Eastern country have, to date, used the planning approach proposed in the present paper and adapted it to develop their own national or regional strategies and action plans. In addition to Quebec, the territories in question are: the Saguenay–Lac-St-Jean administrative region, the Democratic Republic of Congo, the Republic of Niger, the Islamic Republic of Mauritania, the Republic of Djibouti and the Sultanate of Oman.

This section presents the themes covered in each of the strategies and demonstrates how easily the biodiversity planning matrix can be adapted to the distinctive characteristics of regions, provinces or countries. Tables 3 to 9 illustrate how planning teams adapted the matrix themes to their needs. For each of the themes and subthemes selected, planning documents instance the sector's concerns and issues (bases for action), strategic directions (objectives), and planned measures (actions). Aspects related to implementation and indicators are generally described in the project sheets of national action plans. Planners are invited to consult these documents directly to examine in greater detail how the method was used and adapted to the specific context.[1]

QUEBEC

Geographic and Ecological Overview

Quebec is the first territory in which the biodiversity planning matrix was used. Quebec, which has a population of over 7.1 million and occupies an area of 1,667,926 km^2, is the largest of the Canadian provinces. Climatic conditions range from a humid continental climate to polar conditions.

From north to south, Quebec comprises five biogeographic zones: tundra, taiga, the spruce belt, the balsam fir belt and deciduous forest.

Freshwater and saltwater occupy equal proportions of 10 percent each. Southern Quebec is characterized by the drainage basin of the St. Lawrence, which flows over a distance of more than 1,200 km and alone drains 40 percent of the total area of Quebec; it is also the outflow of the world's largest freshwater reserve, the Great Lakes. The St. Lawrence's fluvial, estuarine and marine environments have the greatest biological diversity in Quebec.

Quebec is responsible for managing over 9,044 vascular and non-vascular plant species. It is also responsible for the protection of 653 animal species, including 199 fish species, 21 species of amphibians, 16 reptile species, 326 bird species, 91 species of mammals, and 25,000 insect species.

Use of the Planning Matrix

Quebec's biodiversity strategy and action plan were adopted in 1996. Table 3 shows the 11 themes Quebec selected and adapted from the 15 planning matrix themes.

1. The strategies of the four African countries may be consulted at: http://www.kbinirsnb.be/bch-cbd/
Quebec's strategy may be consulted at:
http://www.menv.gouv.qc.ca/biodiversite/strateg/index.htm

Table 3
Biodiversity Themes Selected by Quebec Compared with Planning Matrix Themes

Planning Matrix Themes	Themes Selected by Quebec
-	Global Factors
Energy Resources	Energy Resources
Conservation of Natural Resources	Conservation
Development of Wildlife Resources	Wildlife Resources
Development of Forest Resources	Forest Resources
Development of Agricultural Resources	Agricultural Resources
Development of Mineral Resources	Mining Resources
Industrial Development of Technology and Services	Biotechnology
Development of the Urban and Rural Environment	Urban Environment
Atmospheric and Aquatic Basins	-
Territories under Special Jurisdiction	Nordic Environment
Environmental and Civil Emergencies	Environmental Emergencies
Eco-civism	-
Societal Values	Education
Quality of Life	-
Spiritual and Religious Values	-
Total: 15 Themes	**Total: 12 Themes and Subthemes**

The theme *Nordic Environment* is a concrete example of the adaptation of the theme devoted to territories under special jurisdiction; in Quebec's case, the territories in question are located north of the 52° 30' parallel north and governed by two agreements signed with Aboriginal nations.

Two themes were partially addressed by Quebec, namely, *Education and Biotechnology,* which deal with some of the sector activities proposed under the themes devoted to societal values and the industrial development of technology and services respectively.

Quebec formulated a new theme, *Global Factors,* which covers a number of different activities. First, it refers to those aspects of Quebec's biodiversity that require an additional strategic effort in order to enhance understanding and management of biodiversity; it led to the development of actions such as the preparation of ecological inventories, the production of regular reports, the improvement of data banks, the development of monitoring methods, etc. The theme *Global Factors* also encompasses the issue of demography, usually associated with the theme *Urban Environment*. Climate and air quality monitoring is likewise among the sector activities addressed under *Global Factors*. The theme *Societal Values* is also partly dealt with under *Global Factors*, through issues related to collaboration with other governments and the economy.

While the theme *Eco-civism* was not addressed per se in the action plan, a number of measures were nonetheless recommended by those responsible for implementing the action plan to encourage the participation of all Quebecers in the achievement of stated objectives.

Given that a Canada-Quebec harmonization program was initiated in 1988 to implement actions for the protection, conservation and development of the St.

Lawrence, the theme *Atmospheric and Aquatic Basins* was omitted. It was decided that joint Canada-Quebec actions from the St. Lawrence Agreement would not be integrated into the biodiversity action plan.

Two other themes have not yet been integrated into biodiversity tools in Quebec, namely, *Quality of Life* and, since it was not included in the action plan framework when Quebec developed its strategy and action plan, *Spiritual and Religious Values*.

Biodiversity Planning Progress Report

Quebec's biodiversity strategy, which comprises 33 broad objectives, was adopted in 1996 following public consultation. The resultant action plan is monitored annually and four reports have been filed to date. Monitoring of the progress of Quebec's biodiversity action plan for the period from April 1, 1998 to March 31, 1999 showed that the number of actions continues to increase, from 350 in the first year to 429 in 1997-1998, and to 444 in 1998-1999. Almost two-thirds of these actions are already underway or will be refined by the different partners, while the remaining third consists of new actions. Just over half of the actions are recurrent, that is, they will be realized over a number of years. Ninety-four of the ad hoc actions were completed during the first three years of implementation.

The number of governmental and non-governmental partners involved in implementing the strategy has likewise continued to grow. The Quebec government also encourages all Quebecers to participate in the effort to safeguard biodiversity. Thus any regional or national agency may contribute to annual reports by sending the secretariat responsible for monitoring a description of the actions they have carried out.

The action plan was originally initiated for a period of four years, from 1996 to 2000. The government was, however, advised to continue monitoring for two additional years. Indeed, Quebec's biodiversity action plan still appears to be valid, given that it has been updated, year after year, with numerous actions added and abandoned actions deleted. Furthermore, ministries, partners and the public are only just starting to become accustomed to this Quebec dynamic; it therefore seems desirable to consolidate the progress achieved before undertaking a second major biodiversity effort.

The Interdepartmental Committee on Sustainable Development therefore has two more years before it must undertake the elaboration of a new strategy and action plan for Quebec for 2002-2007. At the same time, it will complete work in progress in order to develop global indicators to measure the impact of government activities and those of the population, or even of neighbouring provinces or countries on Quebec's biodiversity. Quebec will thereby satisfy articles 7 to 10 of the Convention, which require that indicators for monitoring the state and trends of biological diversity be established.

SAGUENAY–LAC-SAINT-JEAN

Geographic and Ecological Overview

Saguenay–Lac-Saint-Jean is one of Quebec's 17 administrative regions. It has a population of over 286,000 and covers an area of 104,035 km^2. Saguenay–Lac-Saint-Jean comprises two extensive forest zones, namely, boreal forest and mixed forest (the latter being the transition zone between deciduous forest, further south, and boreal forest).

Water covers approximately 10 percent of the regional territory, which derives its name from Lac Saint-Jean and its main outflow, the Saguenay River, a tributary of the St. Lawrence. Lac Saint-Jean covers an area of approximately 1,000 km^2, making it the fifth largest lake in Quebec. Almost 165 km long, the Saguenay receives the drainage of over 20 tributaries. The last 100 kilometres of the river form the Saguenay fjord, an environment rich in biodiversity where brackish water and marine species coexist. The administrative region's territory corresponds to the territory of the Saguenay River and Lac Saint-Jean watershed, as the watershed drains an area of over 85,500 km^2.

The region is believed to have 76 fish species, 304 bird species, 63 species of mammals and an unspecified number of reptiles, amphibians and invertebrates. The region's plant biodiversity has not yet been precisely estimated.

Use of the Planning Matrix

As shown in table 4, the Saguenay–Lac-Saint-Jean region selected and adapted 10 themes from the planning matrix, subdividing a number of them.

Aluminium-related activities form the basis of an extremely important industry for the Saguenay–Lac-Saint-Jean region, employing close to 30 percent of the manufacturing workforce. In view of this industry's importance for the region and the environmental consequences of related activities, the theme *Development of Mineral Resources* was subdivided so as to devote a subtheme entirely to aluminium. A number of other themes were also broken down, giving *Water and Air*, *Urbanization* and *Transport*.

The theme *Industrial Development of Technology and Services* was devoted to hazardous material on account of concerns expressed at a regional level when the action plan was developed regarding the expansion of activities in the fields of storage and salvage of hazardous material. The theme *Societal Values* was devoted to education. The theme *Wildlife* covers a wider range of sector activities than that provided for in the planning matrix under *Development of Wildlife Resources*, since it also addresses issues related to the conservation of natural resources.

The integrating nature of the biodiversity planning matrix, which allows for the inclusion of all activities that have a potential impact on biodiversity, has made it possible to respond to concerns regarded as important by the region's population. Indeed, in 1996, torrential rains had a considerable impact on the environment, as well as bringing to light significant gaps regarding the integration of environmental considerations into the issue of public safety. The theme *Environmental Emergencies* thus allowed regional stakeholders to study these issues and formulate actions

TABLE 4
Biodiversity Themes Selected by Saguenay–Lac-Saint-Jean Compared with Planning Matrix Themes

Planning Matrix Themes	Themes Selected by Saguenay–Lac-Saint-Jean
Energy Resources	Energy
Conservation of Natural Resources	-
Development of Wildlife Resources	Wildlife
Development of Forest Resources	Forestry
Development of Agricultural Resources	Agriculture
Development of Mineral Resources	Mines Aluminium
Industrial Development of Technology and Services	Hazardous Material
Development of the Urban and Rural Environment	Urbanization Transport
Atmospheric and Aquatic Basins	Air Water
Territories under Special Jurisdiction	-
Environmental and Civil Emergencies	Environmental Emergencies
Eco-civism	-
Societal Values	Education
Quality of Life	-
Spiritual and Religious Values	-
Total: 15 Themes	**Total: 13 Themes and Subthemes**

to remedy the repercussions of the 1996 flood on the one hand and, on the other, prevent emergencies and prepare adequate contingency plans for implementation should a similar event ever occur again.

The theme *Territories under Special Jurisdiction* was omitted as it has only limited application in the Saguenay–Lac-Saint-Jean regional territory.

Biodiversity Planning Progress Report

The elaboration of the biodiversity strategy and action plan was overseen by the Saguenay–Lac-Saint-Jean Regional Council for the Environment. First, using the 13 themes as a starting point, an assessment of the region's environmental status was made. Then, in 1999, an extensive public consultation was initiated to allow regional stakeholders, including citizens, to review the reports and suggest possible actions.

In response to the measures formulated during this consultation, the Council for the Environment adopted a program comprising 202 actions. At present, the Council for the Environment is producing a book in order to publicize the salient facts of the reports and action plan. The Council is also setting up a structure to monitor the action plan's implementation over the next five years.

Democratic Republic of Congo

The Democratic Republic of Congo occupies an area of 2,344,860 km^2, making it the third largest country in Africa. Its population was estimated at 43.9 million in 1995, with approximately 71 percent living in rural areas. Congo's economy is based on agriculture and mining.

The climate is typically equatorial in the northern part of central Congo with rain (1,500 to 2,000 mm) throughout the year and humidity at saturation point. The remainder of the country has a tropical climate with a wet season from March to November in the extreme north, and from October to May in the central south. While the extreme south is also located in the tropical region, its dry season lasts from April to October. Only one small region receives negligible rainfall (800 mm/year).

The climate is extremely favourable to vegetation growth and the Democratic Republic of Congo, in addition to a well-developed agricultural sector, has large expanses of equatorial and tropical forest, and savannahs (tree and grass).

The Democratic Republic of Congo has a very dense river system, covering 3.5 per cent of the national territory. This system is characterized by the Congo River which cuts across the country from east to west and receives the drainage of numerous tributaries. The country is bordered by the Atlantic Ocean, with a narrow strip of coast approximately 50 km long.

The range of climates and habitats is reflected in the rich diversity of flora and fauna, making the Democratic Republic of Congo one of the countries with the greatest biological diversity. It has more types of primates than any other country in the world and the second highest number of species. The number of species of mammals is estimated at 482 and fish at almost 1,000. The country has approximately 1,086 bird species, 216 amphibian species, 352 reptile species and over 10,000 plant species.

Use of the Planning Matrix

Twelve of the planning matrix themes were selected and adapted by the Democratic Republic of Congo in its national biodiversity strategy (see table 5).

Table 5
Biodiversity Themes Selected by the Democratic Republic of Congo Compared with Planning Matrix Themes

Planning Matrix Themes	Themes and Subthemes Selected by the Democratic Republic of Congo
	Knowledge Acquisition
Energy Resources	Energy Resources
Conservation of Natural Resources	Protected Areas Vulnerable or Threatened Species and Ecosystems *Ex-Situ* Conservation
Development of Wildlife Resources	Wildlife Resources
Development of Forest Resources	Forest Resources
Development of Agricultural Resources	Agricultural Resources
Development of Mineral Resources	Mining Resources
Industrial Development of Technology and Services	Biotechnology Biosafety
Development of the Urban and Rural Environment	Combating the Adverse Effects of Global Change
Atmospheric and Aquatic Basins	-
Territories under Special Jurisdiction	Aboriginal Groups
Environmental and Civil Emergencies	Environmental Emergency Response Measures
Eco-civism	Participation of Populations, Non-Governmental Organizations and the Private Sector Incentive Measures
Societal Values	Legal and Institutional Framework International Cooperation Environmental Assessments Information, Public Awareness, Education and Training Evaluation and Monitoring
Quality of Life	-
Spiritual and Religious Values	-
Total: 15 Themes	**Total: 21 Themes and Subthemes**

Given that knowledge available on national ecosystems and biological resources appeared incomplete and sectoral when the strategy was elaborated, a new theme, *Knowledge Acquisition*, was formulated. Rather than stress this knowledge gap in each sector, national planners decided to introduce a new theme.

Several of the action plan framework themes were subdivided. The themes *Protected Areas, Vulnerable or Threatened Species and Ecosystems* and *Ex-Situ Conservation* are actually subdivisions of the theme devoted to conservation; the themes *Incentive Measures* and *Participation of Populations, Non-Governmental Organizations and the Private Sector* derive from the theme devoted to eco-civism; issues related to societal values are covered under five themes: *Legal and Institutional Framework, International Cooperation, Environmental Assessments, Information, Public Awareness, Education and Training, and Evaluation and Monitoring*.

The development of technology and services is partially dealt with under the themes *Biotechnology* and *Biosafety*. Customs and cultural taboos, if not dealt with separately, are addressed under the theme *Incentive Measures*.

A new theme, *Combating the Adverse Effects of Global Change*, groups together a number of sector activities connected with the urban environment (demographic growth, urban development) and the atmospheric basin (reduction of greenhouse gases).

Biodiversity Planning Progress Report

The strategy was developed by national experts and approved by participants in a national seminar, in November 1997. It was then submitted to participants in provincial workshops organized throughout the country for their appraisal. All social and professional strata were represented at the workshops: farmers, non-governmental organizations (including churches) working in various fields, research scientists, independent loggers, fishermen and hunters, customary chiefs, men and women, primary- and secondary-level teachers, storekeepers and businessmen, etc.

Workshop participants expressed their commitment to working in favour of biodiversity through their numerous suggestions for actions that could be undertaken to achieve the objectives set forth in the national strategy. Workshop participants also drew up guidelines for the strategy's implementation. Proposals concerning the institutional framework, participation of the population, NGOs and the private sector together with a certain number of incentive measures were formulated and discussed.

The various propositions were harmonized and priority actions selected for the country as a whole. Priority 1 actions in the national strategy form the body of the national action plan, which covers a five-year period (1999-2003), at the end of which it will be revised and updated. Priority 2 and 3 actions in the national strategy will progressively be incorporated into the national plan. The content of this first plan consists of 17 projects. Some projects cover several priority 1 actions.

As an appendix to the national action plan, the action plans of the Democratic Republic of Congo's 11 provinces were published in June 1999. In contrast to the national action plan, where the priority actions selected have a much wider area of action, the provincial action plans comprise local activities related to each province's specific problems. Actions proposed by the provinces that were not selected for the national action plan are included in the provincial action plans.

Republic of Niger

Geographic and Ecological Overview

A landlocked country, with fairly uniform relief, the Republic of Niger has a total area of 1,267,000 km^2, 75 percent of which is desert. The population of Niger was estimated at 9.7 million in 1988, with 80 percent living in rural areas. Most Nigerians are farmers or breeders but may also be involved in other secondary activities, such as handicraft production or business. Consequently, they live predominantly off environmental resources and are organized into communities whose relationship with the land is strongly marked by cultural phenomena.

Located in one of the sunniest and hottest regions on the planet, Niger has a mostly dry climate, with significant ranges of temperature. Rainfall is less than 800 mm throughout the country and even less than 100 mm over almost half of the country. There are three regimes: the arid Saharan regime, in the north, where 160 mm of rain usually falls in under one month annually, except in the desert where it very rarely

rains; the transition Saharan-tropical regime, which receives between 75 and 160 mm of rainfall per year, with a certain regularity; the Sahelian regime in the south with 600 mm precipitation over three to four months (June to September), and a dry and a wet season.

Natural physiographic features include forests, savannahs, steppes, plains and mountains. The River Niger is the country's only permanent waterway; it traverses the south-eastern part of the country and is 550 km long. The country has abundant groundwater resources, which constitute the country's main water resources.

The inventory of Niger's biological diversity components revealed an abundance of flora and fauna. The country has approximately 3,200 animal species, with insects accounting for the greatest number of these at 2,021 species or 63 percent. A total of 168 species of mammals and 512 bird species were listed. Based on current knowledge, Niger's biodiversity is also thought to include 2,124 plant species.

Use of the Planning Matrix

Twelve of the planning matrix's 15 themes were selected and adapted by the Republic of Niger in its national biodiversity strategy (see table 6).

The development of agricultural resources was addressed under two separate themes, *Agriculture* and *Livestock Production*, in view of existing tensions regarding the use of land for these two activities. The development of technology and services was limited to issues related to biotechnology and biosafety. *Societal Values* was broken down into several

Table 6
Biodiversity Themes Selected by the Republic of Niger Compared with Planning Matrix

Planing Matrix Themes	Theme and Subthemes Selected by the Republic of Niger
Energy Resources	Energy Resources
Conservation of Natural Resources	Conservation
Development of Wildlife Resources	Wildlife
Development of Forest Resources	Forest Resources
Development of Agricultural Resources	Agriculture Livestock Production
Development of Mineral Resources	Mining Resources
Industrial Development of Technology and Services	Biotechnology and Biosafety
Development of the Urban and Rural Environment	Land Use Planning
Atmospheric and Aquatic Basins	Water and Aquatic Resources Management
Territories under Special Jurisdiction	-
Environmental and Civil Emergencies	Environmental Emergencies
Eco-civism	Participation of Populations, Civil Society and the Private Sector
Societal Values	Environmental Assessments Public Awareness, Training, Research Legal and Institutional Framework
Quality of Life	-
Spiritual and Religious Values	Traditional Knowledge and Spiritual Values
Total: 15 Themes	**Total: 16 Themes and Subthemes**

themes, while the theme devoted to territories under special jurisdiction, of little relevance at a national level, was omitted.

The national biodiversity strategy and action plan were elaborated and validated under the supervision of the national planning team.

Priority actions were selected from the national strategy for inclusion in the national action plan. The plan extends over five years and will be updated by progressively incorporating priority 2 and 3 actions. Priority actions were consolidated and harmonized in order to include them under coherent themes, formulated into seven projects and programs.

Islamic Republic of Mauritania

Geographic and Ecological Overview

The Islamic Republic of Mauritania covers a total area of 1,025,520 km^2. Its total population was estimated at 2.3 million in 1988, with 46 percent dependent on agriculture and livestock production.

Mauritania is a very arid country with diversified relief which includes plateaus, sand dunes and plains.

The country may be divided into three ecoclimatic regions: a sparsely populated Saharan region with annual rainfall of less than 100 mm; a Sahelian region with between 100 and 400 mm of rainfall; and a Sudano-Sahelian region, along the Senegal River, which receives a little over 500 mm of rainfall annually, making it the main focus of crop production.

Mauritania's fauna is abundant and diversified. The national territory boasts the highest concentration of waders in the world and millions of migratory birds spend the winter there.

Use of the Planning Matrix

The Islamic Republic of Mauritania's national strategy comprises 17 themes and subthemes, adapted from 13 of the planning matrix themes (see table 7).

The Islamic Republic of Mauritania's strategy differs from tools described previously in that it subdivides the theme *Development of Wildlife Resources* into two separate themes, namely, Terrestrial Wildlife Resources and Halieutic Resources. The importance attributed to marine and coastal biodiversity is explained by the fact that offshore fishing is the leading foreign exchange earner and employer in Mauritania.

Biodiversity Planning Progress Report

As the planning process had not been completed in Mauritania at the time of publication, we are unable to provide a report.

TABLE 7
Biodiversity Themes Selected by the Islamic Republic of Mauritania Compared with Planning Matrix Themes

Planning Matrix Themes	Themes and Subthemes Selected by the Islamic Republic of Mauritania
Energy Resources	Energy Resources
Conservation of Natural Resources	Conservation
Development of Wildlife Resources	Terrestrial Wildlife Resources Halieutic Resources
Development of Forest Resources	Ligneous and Non-Ligneous Resources
Development of Agricultural Resources	Agricultural Resources
Development of Mineral Resources	Mining Resources
Industrial Development of Technology and Services	Biotechnology and Biosafety
Development of the Urban and Rural Environment	Land Use Planning
Atmospheric and Aquatic Basins	Water Resources
Territories under Special Jurisdiction	-
Environmental and Civil Emergencies	Environmental Emergencies
Eco-civism	Participation of the Population, Non-Governmental Organizations and the Private Sector Incentive Measures
Societal Values	Environmental Assessments Public Awareness, Education and Training Legal and Institutional Framework
Quality of Life	-
Spiritual and Religious Values	Traditional Knowledge and Spiritual Values
Total: 15 Themes	**Total: 17 Themes and Subthemes**

REPUBLIC OF DJIBOUTI

Geographic and Ecological Overview

A small territory covering an area of 23,200 km^2, the Republic of Djibouti has a hot, arid climate and highly diversified, chiefly volcanic, relief. In 1998, the population of Djibouti was estimated at about 650,000.

The climate is tropical, arid or semi-arid, varying with altitude. While relative humidity varies widely, from 40 to 90 percent, the average temperature is more stable, ranging from 25 °C in winter to 35 °C in summer. The climate, far from being uniform across this rather small territory, varies according to season and region. Annual rainfall usually ranges from 50 mm to 215 mm with an average of 130 mm, but may vary greatly from year to year.

Terrestrial biodiversity is unevenly distributed according to altitude-related variations in rainfall and climate. In high-altitude mountainous regions, the mild climate and relatively abundant rainfall result in a concentration of biological diversity. Other mountainous regions at lower altitudes have lower temperatures and less dense fauna and vegetation. The remainder of the territory is made up of low-altitude, generally semi-desert, regions (plateaus, plains and depressions).

The country lies at the confluence of the Red Sea (one of the seas with the richest diversity of fish) and the Indian Ocean. In addition, Djibouti has a 370 km-long coastline and four main islands. Marine biodiversity is therefore varied. The principal coastal ecosystems are coral reefs and mangrove forests.

Based on current knowledge, Djibouti's biodiversity (terrestrial and marine) numbers 826 plant species and 1,417 animal species, including 493 invertebrate species, 455 fish species, 40 reptile species, 3 species of amphibians, 360 bird species and 66 species of mammals.

Use of the Planning Matrix

Table 8 shows that 13 of the planning matrix 15 themes were selected and adapted in the elaboration of the Republic of Djibouti's biodiversity strategy and action program.

The main difference between the strategy elaborated in the Republic of Djibouti and that of previously described strategies is its subdivision of the theme *Industrial Development of Technology and Services* into two separate themes, namely, *Biotechnology and Biosafety* and *Tourism*. Considerable importance is therefore attributed to the development of tourism. As explained in the national strategy, the natural environment forms the basis for tourism. The development of this sector is therefore largely reliant upon the country's capacity to safeguard the environment. Consequently, planners considered it of prime importance to closely link tourist development and biodiversity planning efforts.

Biodiversity Planning Progress Report

The preparation of the Strategy was preceded by a national biodiversity assessment. The biodiversity strategy itself was prepared and validated by an interdepartmental committee and then submitted for public consultation. It must be noted that the elaboration of the action program was facilitated by the exercise in planning and identifying priority actions conducted previously within the framework of the National Action Plan for the Environment.

Table 8
Biodiversity Themes Selected by the Republic of Djibouti Compared with Planning Matrix Themes

Planning Matrix Themes	Themes and Subthemes Selected by the Republic of Djibouti
Energy Resources	Energy Resources
Conservation of Natural Resources	Conservation
Development of Wildlife Resources	Terrestrial Wildlife Resources Halieutic Resources (Marine and Coastal Biodiversity)
Development of Forest Resources	Ligneous and Non-Ligneous Resources
Development of Agricultural Resources	Agricultural Resources
Development of Mineral Resources	Mineral Resources
Industrial Development of Technology and Services	Biotechnology and Biosafety Tourism
Development of the Urban and Rural Environment	Land Use Planning and Urban Development
Atmospheric and Aquatic Basins	Water Resources
Territories under Special Jurisdiction	-
Environmental and Civil Emergencies	Environmental Emergencies
Eco-civism	Participation of the Population, Non-Governmental Organizations and the Private Sector Incentive Measures
Societal Values	Environmental Assessments Public Awareness, Education and Training Legal and Institutional Framework
Quality of Life	-
Spiritual and Religious Values	Traditional Knowledge and Spiritual Values
Total: 15 Themes	**Total: 18 Themes and Subthemes**

SULTANATE OF OMAN

Geographic and Ecological Overview

The territory of the Sultanate of Oman occupies an area of 212,460 km^2 and is made up of desert plains and mountain ranges. Its coastline stretches for 2,092 km. The population is estimated at approximately 2.5 million.

Despite the generally hot, arid climate, the territory's biodiversity is relatively abundant, particularly in regions with high precipitation. In the northern part of the country, distinct biogeographic regions support species native to Iran and Pakistan, while the relative number of African species increases toward the south.

According to current inventories, the plains and woodlands comprise over 1,208 plant species, including many that help prevent soil erosion and desertification. In terms of fauna, 54 species of mammals, 454 bird species, 89 species of amphibians and reptiles and 1,149 fish species and a wide variety of coral species have been identified.

The plant community has 78 endemic species, while fauna includes five species of mammals endemic at regional and national levels, in addition to six species of reptiles and amphibians and 26 species and subspecies of scorpions endemic at a national level. Several of these species are threatened.

Use of the Planning Matrix

Table 9 shows that the Sultanate of Oman's national biodiversity strategy was largely structured around the planning matrix themes, fourteen of which were selected (the only theme omitted from the national strategy is that of *Territories under special jurisdiction*, of which there are none in the Sultanate).

In elaborating the strategy, planners adapted the planning matrix themes, subdividing the theme *Development of Wildlife Resources* into two new themes, *Terrestrial and Freshwater Wildlife* and *Marine Wildlife and Fisheries*. The importance attributed to marine biodiversity resources and related activities is explained by their position in the national economy, and the fact that many problems (lack of knowledge, impacts of human activities, including aquaculture, natural threats, etc) were identified.

The theme *Industry, Technology and Services* deals largely with tourism, a developing sector.

It must be noted that the theme *Water Resources* makes it possible to integrate actions set out in the national action plan to comply with the Convention to Combat Desertification.

The theme *Societal Values* addresses public awareness, education and training, environmental impact studies and the legal and institutional framework. The theme *Quality of Life* focuses on the integration of environmental considerations into public accounts. Lastly, in keeping with Islamic principles, the theme *Spiritual Values* recalls the unique and irreplaceable character of every life form and stresses the importance of taking spiritual values into account in the conservation and use of biodiversity.

Biodiversity Planning Progress Report

The strategy was submitted to various ministries and the principal government partners for consultation. The process initiated in the Sultanate of Oman should lead, in 2001, to the implementation of a five-year action plan comprising approximately 70 actions including the main actions not yet realized within the framework of the 1992 National Conservation Strategy, the 1993 National Strategy to Combat Desertification and the 1995 Management Plan for Coastal and Marine Areas.

Table 9
Biodiversity Themes Selected by the Sultanate of Oman Compared with Planning Matrix Themes

Planning Matrix Themes	Themes and Subthemes Selected by the Sultanate of Oman
Energy Resources	Energy Resources
Conservation of Natural Resources	Conservation of Natural Resources
Development of Wildlife Resources	Terrestrial and Freshwater Wildlife Marine Wildlife and Fisheries
Development of Forest Resources	Terrestrial and Aquatic Flora
Development of Agricultural Resources	Agricultural Resources
Development of Mineral Resources	Mineral Resources
Industrial Development of Technology and Services	Industry, Technology and Services
Development of the Urban and Rural Environment	Urban Environment
Atmospheric and Aquatic Basins	Water Resources
Territories under Special Jurisdiction	-
Environmental and Civil Emergencies	Environmental Emergencies
Eco-civism	Participation of the Population, Non-Governmental Organizations and the Private Sector
Societal Values	Societal Values
Quality of Life	Quality of Life
Spiritual and Religious Values	Spiritual Values
Total: 15 Themes	**Total: 15 Themes and Subthemes**

SYNERGY BETWEEN BIODIVERSITY – RELATED CONVENTIONS

In addition to the Convention on Biological Diversity, numerous multilateral treaties and agreements are closely connected to the conservation and sustainable use of biological resources. Chief among these are:

- the United Nations Framework Convention on Climate Change;
- the Convention to Combat Desertification;
- the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- the Convention on the Conservation of Migratory Species of Wild Animals (CMS);
- the Convention on Wetlands of International Importance (Ramsar);
- the World Heritage Convention (WHC).

In recent years, the lack of synergy between biodiversity-related conventions has been deplored and many international workshops have addressed this issue. The Conference of the Parties to the Convention on Biological Diversity has made special efforts to facilitate the concerted action of experts working on the implementation of these conventions. In 1998, participants at the eleventh session of the Global Biodiversity Forum noted that, while these environmental treaties are closely related, their application is parallel rather than complementary, which leads to difficulties in their implementation.

> (...) this proliferation of agreements has led to a more and more fragmented international environmental regime. The planning and implementing capacity of many countries has become stressed.
>
> It was recommended that the international environmental regime be viewed in a more holistic manner and that, at the national level, countries endeavour to do more to coordinate their efforts to implement these agreements.
>
> (...) Workshop participants stressed the need to identify areas of common concern that can be pursued in the action plans under the three Rio Conventions. (IUCN, 1999)

It is possible, using the planning matrix, to establish complementary linkages between biodiversity related conventions within the diverse themes covered, within the sectoral strategies and within financial and economical aspects (Prescott, Gauthier and Nagahuedi, 1998. This can be achieved through simultaneously considering the stakes, the objectives and the actions related to the implementation of each convention. When sectoral strategies or action plans have already been adopted, one could find helpful to redistribute in the matrix the information coming from these documents to identify converging or overlapping elements.

The close examination of each article of the conventions can lead to relating them to the corresponding theme of the matrix. Table 10 shows the integration of three conventions, the Convention on Biological Diversity, the United Nations Framework Convention on Climate Change and the Convention to Combat Desertification into the themes and decision process.

Table 10 demonstrates the matrix capacity to deal with the themes addressed by the three conventions under consideration. Articles from the Convention on Biological Diversity are widely distributed across the framework, while the more sectoral United Nations Framework Convention on Climate Change and the Convention to Combat Desertification pertain only to some of the planning matrix themes. The simultaneous consideration of several conventions in the matrix thus permits the implementation of a comprehensive national strategy, covering all themes related to biodiversity. (It would be a simple matter to add to table 10 the CITES Convention, which chiefly covers the themes of the conservation of natural resources, the development of wildlife resources, the development of forest resources, eco-civism, societal values, quality of life and spiritual values).

In short, the planning matrix makes it possible to fulfil many national commitments related to biodiversity. The product of this exercise, while longer than the strategy concerning the Convention on Biological Diversity alone, is nonetheless not as lengthy as several strategies prepared separately. Moreover, a strategy that integrates the objectives of several commitments is more effective and minimizes the risk of duplication of human, physical and financial resources.

TABLE 10
Integration of Three Biodiversity – Related Conventions into the Planning Matrix Themes

Planning Matrix Themes	Convention on Biological Diversity	Framework Convention on Climate Change	Convention to Combat Desertification
1. Energy Resources	**Art. 8l** Regulation or management of threats to biodiversity	–	**Art. 10.4** Development and efficient use of various energy sources
2. Conservation of Natural Resources	**Art. 8a, b, e** Establishment and management of protected and adjacent areas **Art. 8c** Regulation and management of biological resources **Art. 8d, f** Protection and restoration of ecosystems and species **Art. 8i** Compatibility between use and conservation **Art. 8k** Protection of threatened species and populations **Art. 8l** Regulation or management of threats to biodiversity **Art. 9** *Ex-situ* conservation	**Art. 4.1.d** Sustainable management of sinks and reservoirs of greenhouse gases (biomass, forests, oceans, and other ecosystems)	**Art. 10.2c** Preventive measures for lands that are not yet degraded **Art. 10.4** Sustainable management of natural resources
3. Development of Wildlife Resources	**Art. 8c** Regulation and management of biological resources **Art. 8i** Compatibility between use and conservation **Art. 8j** Knowledge of indigenous and local communities **Art. 8l** Regulation or management of threats to biodiversity **Art. 10b** Measures for sustainable use **Art. 10c** Customary use	**Art. 4.1.d** Sustainable management of sinks and reservoirs of greenhouse gases (biomass, forests, oceans, and other ecosystems)	**Art. 10.4** Sustainable management of natural resources
4. Development of Forest Resources	**Art. 8c** Regulation and management of biological resources **Art. 8i** Compatibility between use and conservation **Art. 8j** Knowledge of indigenous and local communities	**Art. 4.1.d** Sustainable management of sinks and reservoirs of greenhouse gases (biomass, forests, oceans, and other ecosystems)	**Art. 10.4** Sustainable management of natural resources

TABLE 10 (CONTINUED)
Integration of Three Biodiversity – Related Conventions into the Planning Matrix Themes

Planning Matrix Themes	Convention on Biological Diversity	Framework Convention on Climate Change	Convention to Combat Desertification
	Art. 8l Regulation or management of threats to biodiversity **Art. 10b** Measures for sustainable use **Art. 10c** Customary use	–	–
5. Development of Agricultural Resources	**Art. 8c** Regulation and management of biological resources **Art. 8i** Compatibility between use and conservation **Art. 8j** Knowledge of indigenous and local communities **Art. 8l** Regulation or management of threats to biodiversity **Art. 10b** Measures for sustainable use **Art. 10c** Customary use	**Art. 4.1.e** Elaboration of plans for the management of agriculture	**Art. 10.3e** Sustainable irrigation programs **Art. 10.4** Ecologically sustainable agricultural practices
6. Development of Mineral Resources	**Art. 8l** Regulation or management of threats to biodiversity	–	–
7. Industrial Development of Technology and Services	**Art. 8g** Regulation, management or control of organisms resulting from biotechnology **Art. 8l** Regulation or management of threats to biodiversity **Art. 15** Access to genetic resources **Art. 16** Access to and transfer of technology **Art. 19** Handling of biotechnology and distribution of its benefits	–	–
8. Development of the Urban and Rural Environment	**Art. 8l** Regulation or management of threats to biodiversity	–	**Art. 10.4** Demographic dynamics

TABLE 10 (CONTINUED)
Integration of Three Biodiversity – Related Conventions into the Planning Matrix Themes

Planning Matrix Themes	Convention on Biological Diversity	Framework Convention on Climate Change	Convention to Combat Desertification
9. Atmospheric and Aquatic Basins	**Art. 7 to 10** Identification and monitoring *In-situ* conservation *Ex-situ* conservation Sustainable use	**Art. 4.1.d** Sustainable management of sinks and reservoirs of greenhouse gases (biomass, forests, oceans, and other ecosystems) **Art. 4.1.e** Elaboration of plans for coastal zone and water resources management	**Art. 10.2d** Enhancement of national climatological, meteorological and hydrological capabilities **Art. 10.4** Strengthening of capabilities for assessment and observation **Art. 17.1g** Research to enhance the availability of water resources
10. Territories under Special Jurisdiction	Depending on a country's situation, convention articles may or may not apply in full to these territories		
11. Environmental and Civil Emergencies	**Art. 8h** Control or eradication of those alien species which threaten ecosystems, habitats or species **14.1d,e** Prevention of danger or damage and establishment of contingency plans	**Art. 4.1.e** Elaboration of plans for the protection and rehabilitation of areas affected by drought, desertification or floods	**Art. 10.3a** Establishment of early warning systems **Art 10.3b** Contingency plans
12. Eco-Csivism	**Art. 8m** Provision of financial support **Art. 10d** Support for local populations to implement remedial action **Art. 10e** Fostering of cooperation between governemental authorities and the private sector in developing methods for sustainable use	–	**Art. 10.2f** Participation of non-governmental organizations and local populations
13. Societal Values	**Art. 8j** Knowledge of indigenous and local communities **Art. 11** Adoption of economic incentives **Art. 12** Research and training **Art. 13** Public education and awareness **Art. 14.1a, b** Introduction of impact assessment studies (projects, programs, policies)	**Art. 4.1.f** Use of impact assessments **Art. 4.1.i** Education, training and public awareness **Art. 6** Education, training and public awareness	**Art. 10.2.e** Promotion of policies and strengthening of institutional frameworks **Art. 10.4** Promotion of alternative livelihoods and improvement of national economic environments. Institutional and legal frameworks. Capacity building, education and public awareness. **Art. 17.1.d** Development and strengthening national research capabilities **Art. 19** Capacity building, education and public awareness

TABLE 10 (CONTINUED)
Integration of Three Biodiversity – Related Conventions into the Planning Matrix Themes

Planning Matrix Themes	Convention on Biological Diversity	Framework Convention on Climate Change	Convention to Combat Desertification
14. Quality of Life	**Art. 7 to 10** Identification and monitoring I*n-situ* conservation *Ex-situ* conservation Sustainable development	–	**Art. 10.3c** Food security systems **Art. 10.3d** Alternative livelihood projects to provide incomes **Art. 17.1b** Research on the improvement of living conditions **Art. 17.1e** Research on poverty and migration
15. Spiritual and Religious Values	**Art. 8j** Knowledge of indigenous and local communities	–	–

CONCLUSION

Recent decades have been marked, on an international scale, by increasing concern for the environment. International agreements regarding the conservation and use of natural resources have multiplied, addressing a growing number of interrelated subjects.

To follow up on their commitments, signing countries of these agreements have undertaken to collect extensive data on species and ecosystems. In doing so, they face the considerable challenge of incorporating this information into the national decision-making dynamic.

In this context, the biodiversity planning matrix represents a first-rate tool to facilitate the preparation of effective strategies and action plans, that is, strategies and action plans capable of prompting all sectors of society to contribute to the attainment of objectives related to the conservation and sustainable use of natural resources.

The biodiversity planning matrix has been used successfully in various social, political and geographical contexts. In each case, it allowed diverse sectoral data to be classified in a coherent whole, as well as allowing environmental concerns to be integrated into society's various sectors of activity.

Experience has also shown that the planning matrix enables diverse related conventions to be implemented simultaneously, providing countries with a unique action framework to facilitate the achievement of sustainable development.

Furthermore, this planning tool allows existing strategies to be evaluated by revealing their strengths and weaknesses, facilitating the integration and refinement of current sectoral strategies. Lastly, the matrix promotes the adoption of the same planning framework by neighbouring countries, facilitating the resolution of common problems.

For all the above reasons, the biodiversity planning matrix proves to be one of the most pertinent tools for integrating the conservation and sustainable development of environmental resources into planning processes, bringing us one step closer to the achievement of sustainable development.

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