NATIONAL POLICY FOR THE INTEGRAL MANAGEMENT OF BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES NPIMBES (PNGIBSE)

INSTITUTO HUMBOLDT COLOMBIA

REPÚBLICA DE COLOMBIA
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Republic of Colombia

MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT
(MINISTERIO DE AMBIENTE Y DESARROLLO SOSTENIBLE)

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INTRODUCTION

In recent decades, biodiversity has won a growing recognition, not only as an expression of the different forms of life present on the planet but also as the foundation of the well-being and quality of life of human beings. In this latter respect, society has come to better understand the direct relationship between biodiversity and human health and development, as well as human security and culture (UNEP 2007). These benefits which derive from biodiversity are known as ecosystemic services. The provision and maintenance of these services are indispensable to the survival of human life on the planet, something which is only possible if the structure and functioning of biodiversity are guaranteed (MEA 2005).

Different countries have been undertaking countless initiatives and efforts to conserve and appraise their biodiversity, with the aim of preventing and controlling its accelerated loss and transformation, as well as reduce and mitigate the negative effects which this has on the quality of life. Colombia has not been the exception and in 1996 formulated a National Biodiversity Action Plan (PNB), an effort which was complemented by the Technical Proposal for the Formulation of a National Biodiversity Action Plan: Colombian Biodiversity in the 21st Century (1998), which, without being an official document, was a guide for institutional work on the topic.

The lessons the country has learned after more than 15 years of management guided by this National Biodiversity Plan, the development of new concepts and schemes related to this subject and the need to incorporate an updated vision of the conflicts and disagreements which affect the actors involved in this enterprise have created the need to review and update the Policy, in order to adjust it to the new conceptual trends and emerging challenges resulting from the global environmental change caused by mankind. These 15 years have shown the need to promote a stronger linkage of this Policy with others of a sectorial character and also to ensure a greater social and community participation in the country`s management of its biodiversity and ecosystemic services.

Additionally, article 6d of the Convention on Biological Diversity (CBD), of which Colombia is a signatory, establishes the need for each party to design and permanently revise its public policies on the subject and adopt concrete mechanisms for protecting biodiversity. Meanwhile, it has become necessary to adjust the national policy framework to the new Action Plan 2011-2020 of the CBD, so that it efficiently aids compliance with the Aichi Targets for reducing the rates of the loss of biodiversity and its ecosystemic services.

In line with this challenge, the Ministry of Environment and Sustainable Development (MADS), through the Forests, Biodiversity and Ecosystemic Services Directorate of the Vice-Ministry of Environment, proposed undertaking and leading a participatory policy for the review and updating of the National Biodiversity Policy. The result of this process, which convoked Colombians from different entities, sectors, trade bodies and organizations engaged in this subject, has been the drafting of this document, which contains an up to date version of a policy that will allow for an integral management of biodiversity and its ecosystemic services, while it also promotes social and sectorial co-responsibility in scenarios of changing socio-ecological systems and the positioning of biodiversity and its ecosystemic services as a public value.

This process advanced after 2008 and counted on the support of the Javeriana University of Bogota (Faculty of Environmental and Rural Studies) and the German Agency for International Cooperation (GIZ), as well as the nearly 500 persons and 190 institutions who participated throughout the process in consultation and construction workshops and which included productive sectors; Afro-Colombian, indigenous and peasant-farmer communities; universities and institutions from the public and third sectors, among others. This policy was presented to the National Environmental Council in July 2010 and all of its recommendations were accepted. Since then, the document has been improved, on the basis of a review by experts from the research institutes of the National Environmental System, the UAESPNN and the branches of the Ministry of Environment and Sustainable Development, pending the reorganization

of the State begun in the middle of 2011, in order to have a document adjusted to the context of the new reality of the country`s institutional framework for the environment.

We thus present the *National Policy for the Integral Management of Biodiversity and Its Ecosystemic Services (PNGIBSE)*, so that the flexibility of the socio-ecological systems may be maintained and improved on the national, regional, local and trans-frontier levels, taking into account scenarios of change and through the joint, coordinated and concerted action of the State, the productive sector and civil society. This means that this Policy will be the one which will conceptually and strategically frame and guide all other environmental management tools (policies, norms, plans, programs and projects), both existing and to be developed, for the conservation of biodiversity on its different levels of organization, as well as serve as the basis for inter-sectorial linkage and as a fundamental part of the country`s development.

In this way the Plan sets forth a significant change in the form of biodiversity management, which is reflected in its conceptual development, as well as the strategic framework which has been constructed. These changes imply, among other aspects, the recognition of a management which allows for the integral handling of closely related ecological and social systems, as well as the conservation of biodiversity in the broad sense, that is, understood as the result of an interaction between systems of preservation, restoration, sustainable use and the building of knowledge and information. Equally, the plan recognizes the strategic character of biodiversity as the foundation of our competitiveness and as a fundamental part of the well-being of Colombian society. The aspects which have received the most attention are guided by the consequent wish to insert flexibility into this management, above all in order to open spaces for communication, cooperation and co-responsibility among the actors who, in different degrees, are responsible for the country´s biodiversity.

Using this technical instrumentation, we present a Policy document which, in its different sections, deals with the subjects which are needed to place the objective and strategic framework in context and make them meaningful, in a manner that will enable the country to conserve its biodiversity, face up to manmade environmental change and maintain the resilience of its socio-ecological systems and thus help to improve the well-being and quality of life of Colombians. In addition, the document establishes the relation between the strategic framework of the Policy and the fulfillment of the CBD´s Aichi Targets for the year 2020, as well as a set of actions which have a short-term priority (2014), to be undertaken by the country for the conservation of its biodiversity and which are in full agreement with the actions and goals proposed in the National Development Plan, 2010-2014: Prosperity for All.

LEGAL, REGULATORY AND INSTITUTIONAL BACKGROUND

With the publication of the Brundtland Report in 1987 ("Our Common Future"), the world began to be aware of the need for sustainable development, a concept which is enshrined in Colombia´s 1991 Constitution and manifested itself in Law 99 of 1993, which, inspired by the agreements and commitments of the 1992 Rio de Janeiro Summit on Environment and Development, created a new institutional framework for the Colombian environmental sector. There then emerged the National Environmental System (SINA), defined as the set of guidelines, norms, activities, resources, programs and institutions which allow for the implementation of the general environmental principles found in the 1991 Colombian Constitution and Law 99 of 1993. The SINA is made up of the Ministry of Environment (now the Ministry of Environment and Sustainable Development, Decree 3570 of 2011), The Autonomous Regional Corporations, the Territorial Entities, the Research Institutes affiliated and linked with the Ministry, the university sector, the NGO´s, civil society and trade bodies. There is also the National Environmental Council, whose aim is to ensure the intersectorial coordination in the public ambit of policies, plans and programs for the field of the environment and renewable natural resources and advise the national government on the formulation of environmental policies (Figure 1).

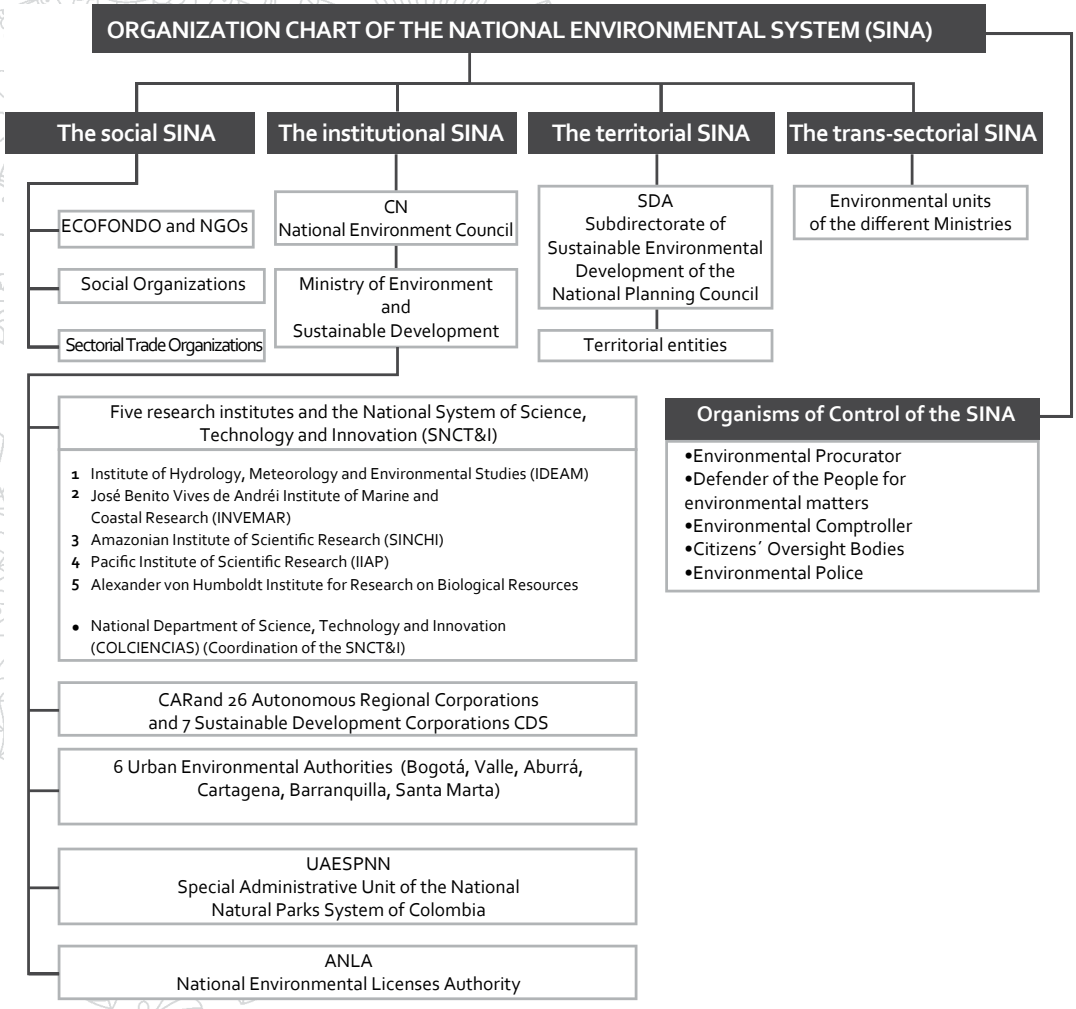

Figure 1. Chart of the National Environmental System (SINA). Law 99 of 1993

National Legal Framework currently in force

With the 1991 Colombian Constitution, the country raised the management and protection of natural resources and the environment, biodiversity in other words, to the status of a constitutional norm, through an acknowledgment of the obligation of the State and the population to protect the cultural and natural wealth of the nation (Art. 8), ensure Colombians´ right to have a healthy environment (Art. 79), promote the use of sustainable development as the model for guiding economic growth and improve the quality of life and social welfare of the nation, without exhausting the natural resource base which upholds these rights, nor deteriorating the environment or jeopardizing the right of future generations to use it for the satisfaction of their own needs. The Constitution also clearly underlines the duty of the State with regard to the need to protect the diversity and integrity of the environment, conserve areas of special ecological importance and plan for a management and exploitation of natural resources which guarantees their sustainable development, conservation, renewal or replacement.

Furthermore, in the management of biodiversity which the country has undertaken a number of general norms stand out which, in a direct or indirect way, have promoted the development of activities for the protection, use and management of biodiversity (Table 1).

Table 1. Main norms currently in force which regulate key aspects of biodiversity management and national environmental institutions.

NORM	SUBJECT
Law 2 of 1959	On the Nation's forestry economy and the conservation of renewable natural resources.
Decree-Law 2811 of 1974	National Code of Renewable and Non-renewable Natural Resources and Protection of the Environment. The environment is a shared heritage, the State and individuals must participate in its preservation and management, which are of public use and social interest. It regulates the management of renewable natural resources, the defense of the environment and its elements.
Law 99 of 1993	Creates the Ministry of the Environment and organizes the National Environmental System (Sistema Nacional Ambiental -SINA). It reforms the public sector in charge of environmental management. It organizes the National Environmental System and requires the planning of the environmental management of projects. The principles that stand out and are related to port activities are: The definition of the foundations of environmental policy, the structure of the SINA headed by the Ministry of the Environment, environmental licensing procedures as a requisite for the implementation of projects or activities that may cause harm to the environment and mechanisms of citizens´ participation in all stages of the development of these types of projects.
Law 388 of 1997	Municipal and District Territorial Ordering and Territorial Ordering Plans
Law 1333 of 2009	Establishes the procedure for environmental sanctions and stipulates other provisions.
Decree 2370 of 2009	Determines the Planning Tools for the Research Institutes assigned and linked to the Ministry of Environment, Housing and Territorial Development.
Decree 2372 of 2010	Regulates Decree-Law 2811 of 1974, Law 99 of 1993, Law 165 of 1994 and Decree-Law 216 of 2003, in relation to the National System of Protected Areas and the management categories which make it up, and stipulates other provisions.
Law 1444 of 2011	By which different ministries are divided (among them the Ministry of Environment, Housing and Territorial Development, in order to create the Ministry of Environment and Sustainable Development).
Law 1450 of 2011	Law to approve the National Development Plan 2010 – 2014
Decree 3570 of 2011	Modifies the objectives and structure of the Ministry of Environment and Sustainable Development and integrates the Administrative Sector of Environment and Sustainable Development
Decree 3572 of 2011	Establishes a Special Administrative Unit and determines its objectives , structure and functions (Special Administrative Unit for the National Natural Parks of Colombia)
Decree 3573 of 2011	Establishes the National Environmental Licenses Authority (ANLA) and stipulates other provisions

National Tools for the Management of Biodiversity and Others Related to Them.

The main planning tools (policies, plans and programs) which have been developed in Colombia to guide the protection, management and use of biodiversity on their different levels of organization or whose implementation promotes conservation actions are resumed in Table 2.

Table 2. Main national instruments for the management of biodiversity and other related subjects.

Type of Instrument	Main Level of Biodiversity Organization Aimed At	Title	Overall Objective	Year
Policy	All levels	National Biodiversity Policy	Promote the conservation, knowledge and sustainable use of biodiversity, as well as the fair and equitable distribution of the benefits derived from the use of the knowledge, innovations and practices associated with it by the scientific community, industry and local communities.	1996
Policy	Ecosystems	Forest Policy (CONPES Document 2834/10)	Achieve a sustainable use of forests for the purpose of conserving them, consolidating the incorporation of the forestry sector into the national economy and improving the quality of life of the population.	1996
Policy	Populations, Species	Policy for the Environmental Management of Wild Fauna in Colomba	Generate the conditions required for the sustainable use and exploitation of wild fauna as a strategy for the conservation of biodiversity and as a socio-economic alternative for the development of the country, guaranteeing the permanence and functioning of natural populations and the ecosystems they belong to.	1997
Policy	Ecosystems	National Environmental Policy for the development of the oceanic spaces and the coastal and island zones of Colombia (CONPES Document 3164/02)	Promote a sustainable development of oceanic areas and coastal zones, which by means of an integrated management, contributes to the improvement of the quality of life of the Colombian population, the harmonious development of productive activities and the conservation and preservation of marine and coastal ecosystems and resources.	2001
Policy	Ecosystems	National Policy for Inland Wetlands in Colombia	Promote the conservation and rational use of the inland wetlands of Colombia with the aim of maintaining and obtaining ecological, economic, and socio-cultural benefits as an integral part of the development of the country.	2001
Policy	All levels	Urban Environmental Management Policy	Establish guidelines for the sustainable management of urban areas, defining the role and scope and identifying the resources and instruments of the different actors involved, in accordance with their responsibilities and functions, with the aim of harmonizing management and sectorial policies, and strengthening areas for inter-institutional coordination and citizens´ participation in order to contribute to urban environmental sustainability and the quality of life of the population, while acknowledging regional diversity and the types of urban areas in Colombia.	2008
Policy	All levels	National Policy for the Promotion of Research and Innovation (Colombia builds and cultivates the future) (CONPES Document 3582/09)	Establish the conditions for knowledge to be an instrument for development. Mainly by means of accelerating economic growth and reducing inequality. This policy views biodiversity as a strategic area and recognizes the need to advance in its knowledge and sustainable use.	2009
Policy	Ecosystems	National Policy for The Integral Management of Water Resources	Guarantee the sustainability of water resources by means of an efficient and effective management and use linked to the ordering and use of territory and the conservation of the ecosystems that regulate the water supply and regard water as a factor for economic development and social well-being and implement equitable and inclusive processes of participation.	2009

Type of Instrument	Main Level of Biodiversity Organization Aimed At	Title	Overall Objective	Year
Policy	All levels	CONPES 3680 SINAP "Guidelines for the consolidation of the National System of Protected Areas "	Establish the guidelines and instructions to advance in the consolidation of the National System of Protected Areas of Colombia as a system which is complete, ecologically representative and effectively managed in order to contribute to territorial ordering, thus fulfilling the objectives of conservation and sustainable development to which the country is committed.	2010
Policy	All levels	Policy of Sustainable Production and Consumption	Guide the change in the patterns of production and consumption of Colombian society towards environmental sustainability, contributing to the competitiveness of businesses and the well-being of the population.	2010
Program	Populations / Species	Programs of species conservation: (*Tremarctos ornatus*, Genus *Tapirus*, *Crocodylus intermedius*, marine and continental turtles (tortuga icotea), Andean condor, sharks, sting-rays, ghost sharks and grey *titi* monkey.	Guarantee the conservation and/or sustainable use of these species.	2001, 2005, 2002, 2006, 2010
Program	Ecosystems	National Program for the Sustainable Use, Management and Conservation of Mangrove Ecosystems.	Undertake actions to achieve the sustainable use of the mangrove ecosystems of Colombia, securing the direct participation of the communities associated with these mangroves and regarding them as life spaces through their conservation and restoration as well as the strengthening of the creation of alternative production systems which are socially, economically and ecologically adequate.	2002
Program	Ecosystems	Program for the Sustainable Management and Restoration of Colombian Highland Ecosystems	Guide environmental management in *páramo* ecosystems at a national, regional and local level and carry out actions for their sustainable management and restoration by means of generating knowledge and the socialization of information about their structure and function, ecological restoration, the consolidation of their hydrological potential, the environmental planning of the territory, the sustainable use of existing natural resources, the development of national and international agreements, treaties and technical cooperation, and the direct and permanent participation of communities associated with these ecosystems, regarding them as life spaces.	2002
Plan	Ecosystems	National Plan for Forestry Development	Establish a strategic framework that actively incorporates the forestry sector into national development, optimizes its comparative advantages and promotes the competitiveness of timber and non-timber forest products in the national and international market through the sustainable management of natural forests and tree plantations.	2000
Plan	Ecosystems	National Plan for the prevention of forest fires and the restoration of affected areas.	Establish guidelines at a national level for the prevention and control of forest fires and the restoration of areas affected by them in order to mitigate their impact and strengthen national, regional and local organization by means of short (3 years), medium (10 years) and long term (25 years) programs.	2002
Plan	Ecosystems	Action Plan for the National Campaign Against Desertification and Drought in Colombia	Implement actions against the degradation of lands and desertification and for relief from the effects of drought, as well as for the sustainable management of dry zone ecosystems through the application of practical measures that facilitate the prevention, halting and reversal of such degrading processes and contribute to the sustainable development of affected areas.	2004
Plan	All levels	Regional biodiversity action plans (Orinoco river basin, South Amazon, Valle del Cauca, Quindío, Nariño, Norte de Santander, Sucre)	Promote the conservation, knowledge and sustainable use of biodiversity as well as a fair and equitable distribution of the benefits derived from its use.	2005

Type of Instrument	Main Level of Biodiversity Organization Aimed At	Title	Overall Objective	Year
Plan	Populations / Species	National Plan for migratory species.	Take actions for the conservation and sustainable management of the migratory species of Colombian biodiversity	2009
Strategy	Populations / Species	National Strategy for the prevention and control of the illegal trafficking of wild species.	Identify, prioritize, guide, coordinate, articulate and carry out actions aimed at reducing the illegal trafficking of wild species and the creation of sustainable productive alternatives to replace it, based on effective links for coordination between the different institutions and other actors directly or indirectly responsible for environmental management.	2002
Strategy	All levels	General guidelines for the ex situ conservation of wild fauna in zoos and aquariums in Colombia. Action Plan 2004 – 2014	Establish the guidelines for the implementation of programs of ex situ conservation in Colombian zoos and aquariums as a complement to in situ conservation, to aid in the maintenance of biological diversity.	2006
Strategy	Populations / Species	National Strategy for the prevention and control of the illegal traffic in wild sloth species in Colombia.	Identify, prioritize, guide, coordinate, articulate and carry out actions aimed at reducing the illegal traffic in wild sloths and creating sustainable production alternatives which replace this illegal activity, based on effective links for coordination between the different institutions and other actors directly or indirectly responsible for environmental management.	2008
Strategy	Populations / Species	National Strategy for the Prevention, Control, Follow-up and Monitoring of Forestry Activities	Establish and implement an integrated group of guidelines which articulate in a harmonized way the preventive, juridical, financial–administrative and operational components of processes for the prevention, follow-up, control and surveillance of the management, use, transport, transformation and commercialization of timber and non-timber forest resources, based on the coordinated management of the environmental authorities and other responsible State bodies and the active participation of the diverse actors in the productive forestry chain, other related productive sectors and the civil society in general.	2010
Technical Proposal	All levels	Biodiversity: 21st century. Technical proposal of the National Action Plan for Biodiversity	Strategies and lines of action to develop knowledge and use of Colombian biodiversity	1998

National Planning Documents

The **National Development Plan, 2010-2014: "Prosperity for All"** sets forth national purposes and objectives, as well as the strategies, guidelines and general goals for the government´s economic, social and environmental policy during the period of its administration. With regard to biodiversity, chapter VI of the Plan, "environmental sustainability and risk prevention" sets forth the need to undertake actions to:

a. Strengthen the protection and renewal of biodiversity and its ecosystemic services

b. Deal with the risks of the loss of biodiversity and its ecosystemic services

c. Strengthen the sustainable use of biodiversity for the benefit of competitiveness and economic and social growth.

In addition, it sets forth actions for the integral management of water resources related to the maintenance of ecosystems that are crucial for their conservation and actions for adapting the nation to climate change.

International Commitments

Table 3 presents some of the main agreements and conventions related to the conservation of biodiversity which Colombia has signed and ratified

Table 3. Main agreements and conventions related to the conservation of biodiversity which Colombia has signed and ratified

Agreement / Instrument	Place and Year of Signing	Main Level of Biodiversity Organization Aimed At	Law which Ratifies it	Objective
Inter-American Tropical Tuna Commission (CIAT)	U.S.A., 1949	Populations / Species	Law 579 of 2000 (ratified in 2007)	Study tuna fish biology and related or similar species and suggest appropriate methods to conserve fish stocks at levels which allow for maximum sustainable harvests.
Convention on the Continental Shelf.	Geneva, 1958	Ecosystems	Law 9 of 1961	Define the continental shelf area and the criteria of management for the Parties in this zone.
The Geneva Convention on Fishing and Conservation of the Living Resources of the High Seas, April 29, 1958,	Geneva, 1958	Populations / Species	Law 119 of 1961	Adopt or collaborate with other States in the adoption of measures, which, in relation to their respective citizens, may be necessary for the conservation of the living resources of the sea. Resolve, when it is possible and on the basis of international cooperation, matters related to the danger of over-exploitation of living resources of the high seas and their conservation, through the concerted action of all the interested States.
Convention Concerning the Protection of the World Cultural and Natural Heritage	Paris, 1972	Ecosystems	Law 45 of 1983	Establish an effective system for the joint protection of the world´s cultural and natural heritage, organized in a permanent manner and in accordance with modern scientific methods.
The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Washington, 1973	Populations / Species	Law 17 of 1981	Protect species endangered and threatened by excessive exploitation by regulating or prohibiting the international commerce in such species or their specimens.
Amazon Cooperation Treaty	Brasilia, 1978	Ecosytems	Law 74 of 1979	Promote the harmonious development of the Amazon and the equitable distribution of its benefits among the parties in order to raise the quality of life of its peoples, maintaining a balance between economic development and the preservation of the environment.
The Convention on Wetlands of International Importance, (RAMSAR)	Ramsar, 1981	Ecosystems	Law 357 of 1997	Guarantee the conservation and rational management of wetlands, recognizing the importance of their functions, wealth of flora and fauna and economic value as ecosystems which generally occupy transitional zones between permanently wet areas and areas which are usually dry.
CONVENTION FOR THE PROTECTION OF THE MARINE ENVIRONMENT AND COASTAL AREA OF THE SOUTH-EAST PACIFIC	Lima, 1981	Ecosystems	Law 45 of 1985	Protect and preserve the marine environment and coastal zone of the Southwest Pacific from all types and sources of contamination by regional cooperation through the work of the Permanent Commission for the South Pacific (CPPS).
Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region. (CPDMEWCR)	Cartagena, 1983	Ecosystems	Law 56 of 1987	Concert bilateral or multilateral agreements for the protection of the marine environment of the zone covered by the Convention
Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (SPAW)	Kingston, 1990	All levels	Law 356 of 1997	Establish the necessary measures to protect, preserve and sustainably manage the marine environment of the Wider Caribbean region. Regulate the activities which may cause adverse effects on marine areas and their species. Prevent fauna and flora species from being threatened or in danger of extinction.

Agreement / Instrument	Place and Year of Signing	Main Level of Biodiversity Organization Aimed At	Law which Ratifies it	Objective
The International Union for the Protection of New Varieties of Plants (*UPOV*)	Geneva, 1991	Populations / Species	Law 243 of 1995	Recognize and guarantee the right of the breeder of a new plant variety or its successor in title, through the creation of the International Union for the Protection of New Varieties of Plants.
Convention on Biological Diversity (CBD)	Rio de Janeiro, 1992	All levels	Law 165 of 1994	The conservation of biological diversity The sustainable use of its components The fair and equitable sharing of the benefits derived from the use of genetic resources
United Nations Framework Convention on Climate Change (UNFCCC)	New York, 1992	Ecosystems	Law 164 of 1994	Set the atmospheric concentrations of greenhouse gas emissions at levels which prevent human activities from dangerously affecting the world climatic system.
The United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, (UNCCD)	Paris, 1994	Ecosystems	Law 461 of1998	Combat desertification and mitigate the effects of serious drought or desertification, particularly in Africa, through the adoption of effective measures at all levels which are supported by international cooperation and association agreements. Implementation of integrated, long term strategies that are centered on the increase of land productivity as well as the rehabilitation, conservation and sustainable use of resources, with the aim of improving living conditions
ANDEAN COMMUNITY DECISION 391*:* Common Regime on Access to Genetic Resources.	Caracas, 1996	Genes	Obligatory national compliance	a) Prepare conditions for a fair and equitable participation in the benefits derived from access; (b) Lay the foundations for the recognition of genetic resources and their derived products and associated intangible elements, especially in the case of indigenous, Afro-American or local communities; c) Promote the conservation of biological diversity and the sustainable use of the genetic resources which biological resources contain: d) Promote the consolidation and development of scientific, technological and technical capacity on a local, national and sub-regional level; and (e) Strengthen the negotiating power of the Member Nations.
The Agreement on the International Dolphin Conservation Program (AIDCP)	Washington, 1998	Populations / Species	Law 557 of 2000	Eliminate the incidental mortality of dolphins in tuna fishing by purse seine nets in the Area of the Agreement, by means of the establishment of annual limits and environmentally adequate methods to catch big yellow-fin tuna which are not associated with dolphins. Ensure long term sustainability in the area as well as that of the related live marine resources, with the aim of reducing and avoiding incidental catches and the release of young tuna and species which are not the objective of fishing.
The Cartagena Protocol on Biosafety to the Convention on Biological Diversity	Montreal, 2000	All levels	Law 740 of 2002	Help guarantee an adequate protection in the sphere of the transference, handling and safe use of living modified organisms (LMO) which result from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, also taking into account the risks to human health and specifically focusing on trans-border movements.
International Tropical Timber Agreement	Geneva, 2006	All levels	Law 1458 of 2011	Promote the expansion and diversification of the international commerce in tropical timber from sustainably managed and legally harvested forests and promote the sustainable management of timber-producing tropical forests.

As of 2011 Colombia has periodically complied with its commitment to report its progress in the implementation of the conventions deriving from the Rio Summit (1992):

a. Convention on Biological Diversity (CBD): 4 national reports, in the years 1998, 2005, 2006 and 2010.

b. United Nations Framework Convention on Climate Change (UNFCCC): 2 national reports in the years 2001 and 2010.

c. United Nations Convention to Combat Desertification: 4 national reports in the years 2000, 2002, 2007 and 2010.

Tools of Information

Since the creation of Law 99/93 (Art 5.Numeral 20 and Art.31, numeral 22), the country has designed and implemented an environmental information system in order to undertake its management of information so that it may support decision-making on a national level.

Environmental Information System for Colombia (SIAC): This is the integrated grouping of actors, policies, processes and technologies involved in the management of the country´s environmental information, in order to facilitate the accumulation of knowledge, decision-making, education and social participation in sustainable development. The SIAC counts on three information systems on the national and regional levels. These are Environmental Information system (SIA), the Information System for Environmental Planning and Management (SIPGA) and the Territorial Information System (SIAT). Within the SIA the following information systems are found:

Biodiversity Information System (SIB): this is a national alliance coordinated by the "Alexander von Humboldt Institute for Research into Biological Resources" (AvH), which aims to facilitate the efficient and permanent management of information on biodiversity that is useful for the processes of analyzing information and creating tools of information for decision-making, and the monitoring of the state of biodiversity and the state of knowledge of the same.

System of Marine Environmental Information (SIAM): This is the integrated set of conceptual aspects, policies, norms, processes, human resources and technologies which link the coastal marine environmental information generated, administered and/or required in the national, regional and local ambits. It is coordinated and administered by the INVEMAR.

National System of Forestry Information (SNIF): This is a tool for promoting an efficient and timely flow of high-quality forestry information to guide decision-making about forests and the development of policies for the sector. It includes the gathering, validation, processing and analysis of information about the supply and demand of the ecosystemic services of forests and the environmental, social and economic dynamic of the forestry sector in the country.

Sub-system of Information on the Use of Renewable Natural Resources (SIUR). This is the set which integrates and standardizes the gathering, storage, processing, analysis, data consulting and protocols for having uniform, homogeneous and systematic information about the use, transformation and exploitation of natural resources arising from the country´s economic activities. The SIUR manages environmental information related to captures, spillages, energy consumption, atmospheric emissions, wastes and other factors which affect the air, soil, climate and biodiversity of the country.

USERS AND INSTITUTIONAL FRAMEWORK RELATED TO THE MANAGEMENT OF BIODIVERSITY

The country´s management of its biodiversity involves seven (7) main groups of actors, who will be fundamental for the implementation of this policy on the national, regional and local scales, and in trans-frontier scenarios (Figure 2)[1]. The selection of these actors has been done on the basis of an acknowledgment of the participatory and democratic character which defines the Social State of Law under the 1991 Colombian Constitution and the subsequent developments which define concrete mechanisms for the citizenry´s participation in the different ambits of public management, from the design of public policies to the social control and citizens´ oversight of that management. A special emphasis is given to those organizations which form part of the National Environmental System and make up the National Environmental Council, in accordance with articles 4 and 13, respectively, of Law 99 of 1993.

- The first group of actors related to the Integral Management of Biodiversity and its Ecosystemic Services are the **Policy Makers and Administrators,** that is, the public institutions responsible for creating the Sectorial Environmental Policy and the respective technical and normative instrumentation directly related to it, and also for exercising authority or rule over the actions permitted for the governance and protection of biological diversity in a given socio-ecological system on the national, regional, local and trans-frontier scales.

  In this group are found the Ministry of Environment and Sustainable Development (Art. 2, Decree 3570 of 2011), the National Environment Licenses Authority (ANLA), the Special Administrative Unit of the National Natural Parks System, the Autonomous Regional and Sustainable Development Corporations (Arts. 21 and 31, Law 99/93), the Urban Environmental Authorities, the armed forces (in the role of the Environmental Police and the Colombian Army in fulfillment of its national security role) and the Departments, Municipalities and Districts, which, under Law 99 of 1993, also have environmental functions (Art. 64, 65 and 66). These actors interact through the: formulation of public policies, programs and strategies, and the management and action plans (including the Plans, Schemes and Basic Plans of Territorial Ordering) and projects in the national, regional, local and trans-frontier ambits (Figure 2).

- The Second Group of Actors refers to the **Direct Users**, that is, those who utilize biodiversity and its ecosystemic services as the main element for the development of their activities or as a source of raw materials or inputs for production on a small, medium or large scale. There belong to this group natural persons and legal entities, both public and private, from the following sectors: agriculture/ stock-rearing and forestry; extractive industries (mining and energy); road and port infrastructure; housing and territorial development; trade and tourism; consumers who exercise a demand for products and services derived from biodiversity; botanical gardens and zoos; as well indigenous reservations and communities; the collective territories of Afro-Colombian communities and the ethnic communities known as *raizales* and *palenqueras*; peasant-farmer reserves and associations of small rural producers; non-associated peasant-farmers and agricultural colonists and environmental NGO´s (Non-Governmental Organizations) (Figure 2). Among the scenarios in which these actors interact are, for example: participation in the construction of public policies and Territorial Ordering Plans (POT, EOT) and joint environmental agendas, applications for permits, environmental

1 The numbering of these groups does not follow any hierarchical order or ranking of importance

licensing processes, cleaner production agreements, public-private intersectorial agendas and self-regulation mechanisms.

- The Third Group of Actors is related to the **Indirect Users**, who, although they benefit from biodiversity and its ecosystemic services, do not extract goods from biological diversity or base their main productive activity on it. In this group are found natural persons and legal entities, both public and private, from the industrial sector of transformation (manufacturing), the services sector and the Civil Society, that is, all of us who daily benefit from the existence of biodiversity and its ecosystemic services, which enable us to have oxygen to breathe, water to fill our aqueducts, a regulated climate in rural and urban areas, clean air, foodstuffs in the marketplaces, etc. (Figure 2). Among the scenarios of public and public-private management in which these actors participate we might mention, among others: interministerial and intersectorial agendas, participation in the construction of public policies and mechanisms of citizens´ oversight.
- The fourth group corresponds to the **Regulatory Bodies,** that is, institutions of a national character such as the Colombian Congress; the Executive Branch of the Colombian government (the Presidency, other Ministries and/or corresponding Administrative Departments – DNP, COLCIENCIAS, DANE, DAFP, DPS-), and the Judicial Branch represented by the High Courts. The first of these is responsible for reforming the Constitution, making laws and exercising political control, while the second is responsible for issuing decrees and other norms to do with aspects of the Policy for the Integral Management of Biodiversity and Its Ecosystemic Services. It is here that the High Courts of the Judicial Branch of the State take on importance, since, through their jurisprudence, they may pronounce on matters related to the themes of this Policy (Figure 2). Furthermore, the Departmental Assemblies and Municipal Councils also form part of this Group, insofar as through their ordinances and agreements they may create guidelines related to the Policy this document discusses. The scenarios of the management these actors undertake or where they interact are: debates on legislation and political control, interministerial agendas and public hearings, among others.
- The Fifth Group of Actors refers to the **Entities of Control,** that is, the Contraloría General de la República (General Comptroller of the Nation), the Fiscalía General de la Nación (Public Prosecutor´s Office), the Public Ministry (Procurator General of the Republic, the Public Defender of the People and Personerías) and the Citizens´ Oversight Councils (Figure 2). These institutions have the mission, among others, of supervising the management of the State budget, investigating crimes, preventing and/or sanctioning disciplinary faults by public servants and promoting respect for human rights and sanctioning their violation. The scenarios of management which these actors promote or where they interact are: mechanisms for the preventive control of public administration, political influence on the legislative agenda and the formation of interest groups.
- In the sixth group one finds the **Generators of Knowledge for Decision-Making**, who are responsible for producing the knowledge and information needed for the conservation of biodiversity and its ecosystemic services, through scientific research and/or empirical and traditional knowledge, so that they guide and are the support for the strengthening of the management capacity of the public institutions concerned with the conservation of biodiversity and its ecosystemic services, as well as the processes for the elaboration of public policies, normative and technical instrumentation, territorial

ordering plans, among others, and social and sectorial territorial planning. In this group of actors are found the research institutes affiliated and linked to the MADS (IAvH, SINCHI, IIAP, INVEMAR and IDEAM -Law 99/93, Title V-), the Natural Sciences Institute of the Universidad Nacional, other research institutes and centers, universities and academies, botanical gardens and zoos, as well as indigenous reservations and communities, the collective territories of Black communities, the communities of the ethnic minorities known as *raizales* and *palenqueras*, peasant-farmer reserves and associations of small rural producers and environmental NGO´s (Non-Governmental Organizations), the National Hydrocarbons Agency (ANH), Corpoica, the Colombian Geological Service and the Mining Energy Planning Unit (UPME). The scenarios of management which these actors promote or where they interact are: research programs, the formulation of public policies and action plans in the national, regional and local ambits and Territorial Ordering Plans (POT, PBOT and EOT), among others.

- The **National and International Collaborators** belong to the Seventh and last Group of Actors. They exert an important influence on the country´s internal dialogues about biodiversity, due to their role as cooperating entities, entities which finance the Policy or even as implementers of the same. In this group of Actors are found: the Presidential Agency for International Cooperation in Colombia (APC), the agencies of multilateral cooperation for development, the multilateral banks, international conventions and foreign governments. The scenarios of management which these actors promote or where they interact are: Cooperation agreements for execution, research or the formation of human capital (Figure 2).

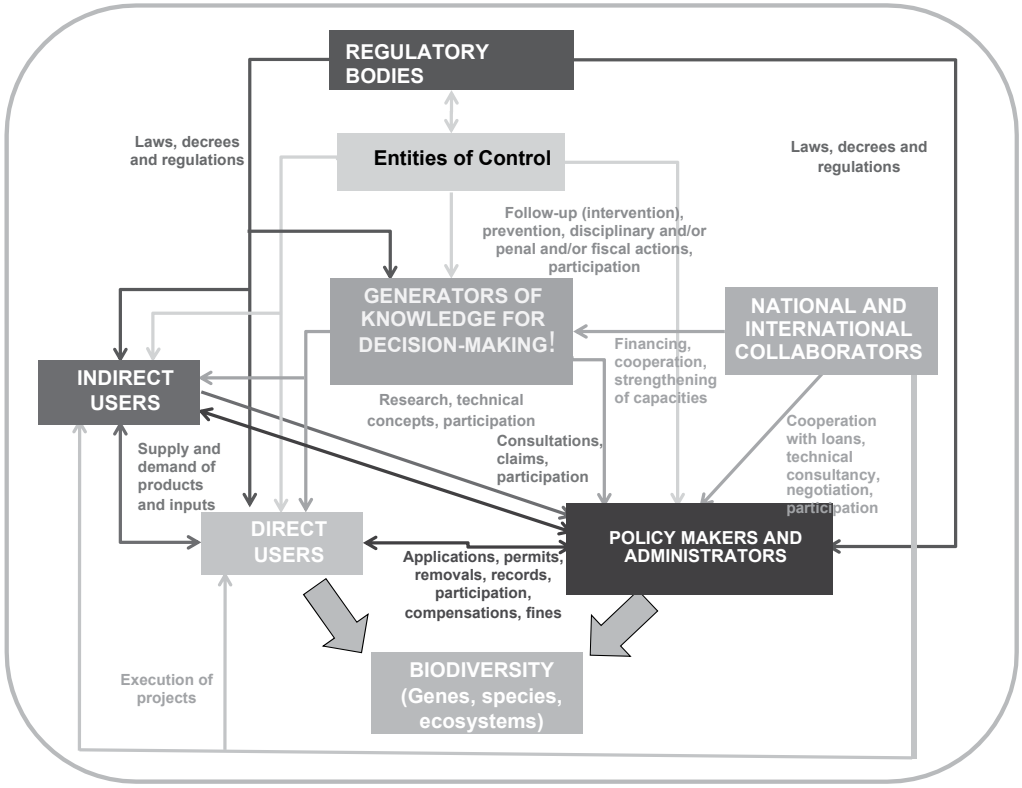

Figure 2. Diagram illustrating the different groups of actors involved in the management of biodiversity and how the relations among them should be.

KINDS OF CONFLICTS AMONG THE ACTORS

While Figure 2 presents the main natural relations among the different groups of actors which have a direct or indirect participation in the management of biodiversity, these relations are not perfect nor stable over time. In this context, socio-environmental conflicts may be understood as the tensions, disagreements, clashes and/or shocks caused by the opposition between two forces of actors (persons, organizations, institutions), because they pursue opposing objectives with regard to the access to, use, management and protection of biodiversity and its ecosystemic serices, or because the actions of one group of actors are not what the other group expects or needs (Table 4). These conflicts are not just to do with problems arising from effects on natural resources. They often involve clashes and confrontations caused by difficulties in social interaction, the absence of dialogue or the meager participation of the local population in public decisions, in other words, the conflicts are more of a social or political than an exclusively technical kind (adapted from Quintana, undated).

Table 4. Breakdown of current main conflicts among the different groups of actors involved in the management of biodiversity in Colombia. The grey boxes single out the conflicts found within each one of the different groups of actors.

Group of Actors	Policy Makers and Administrators	Direct Users	Indirect Users	Regulatory Bodies	Entities of Control	Generators of Knowledge for Decision-Making	National and International Collaborators
Policy Makers and Administrators	• Lack of intra-institutional linkage • Lack of practical clarity about the powers of different entities and jurisdictions • Contradictory opinions and rulings on the regional and national levels • Lack of support, assessment and feedback between the national, regional and local levels • There is often competition for resources of international cooperation.	• Driving forces of the engines of biodiversity transformation and loss • Generation of environmental deficits • Poor understanding of the importance of the EIAs as tools for sustainable development • Failure to comply with current regulations • Persistence of the view that the conservation of biodiversity is a "luxury" that can only be dealt with after true economic growth • Persistence of the view that vulnerability to environmental change is manageable as long as a company is economically strong • Contradictory territorial and sectorial interests • Creation of environmental deficits • Failure to include and take biodiversity into consideration in its actions	• Failure to comply with norms in force	• Delays in considering and adopting administrative acts that favor biodiversity conservation • Adoption of administrative acts that do not contribute to the conservation of biodiversity • Promotion of incentives considered to be harmful to the conservation of biodiversity	• Weak operational capacity in the face of environmental problems	• Generation of knowledge that does not help in decision-making • Use of scientific agendas of their own which do not aim at the management targets	• In some cases the imposition of agendas and thematic priorities

Group of Actors	Policy Makers and Administrators	Direct Users	Indirect Users	Regulatory Bodies	Entities of Control	Generators of Knowledge for Decision-Making	National and International Collaborators
Direct Users	• Delays in application, permit and licensing procedures • Lack of clarity in procedures and the juridical security of investments • Little strengthening of the mechanisms and spaces for participation • Negative perception of agencies as obstructive and only interested in policing • Too many regulations, some contradictory and difficult to apply Lack of clear priorities for action	• Contradictory territorial and sectorial interests • Generation of environmental deficits • Failure to take biodiversity into account in its actions	• Contradictory territorial and sectorial interests	• Rulings against sectorial interests • Too many regulations, some of them contradictory	• Rulings against sectorial interests	• Sectorial decisions that don't take available scientific knowledge into account. • Traditional knowledge is not recognized or used in research or decision- making	• Lack of involvement in the processes
Indirect Users	• Generation of environmental deficits • Slowness with procedures and applications • Little strengthening of mechanisms and spaces of participation • Lack of credibility • Negative perception as agencies only interested in policing and obstruction	• Contradictory territorial and sectorial interests • Flaws in the quality of products and inputs	• Contradictory interests with regard to consumption	• Legislation that goes against the expectations, perceptions and problems of communities • Lack of credibility	• Lack of credibility	• Generation of knowledge that does not add to the construction of social value • Traditional knowledge is not recognized or used in research and decision- making	• Often do not feel like beneficiaries of cooperation
Regulatory Bodies	• Low allocation of financial resources	• Actions only follow objectives and goals of economic growth	• Do not comply with regulations in force	• Contradictory territorial and sectorial interests • Do not include or take biodiversity into account in their actions • Practical lack of knowledge of their powers • Rulings and opinions which do not favor conservation of biodiversity	• Political differences that may affect rulings or decisions or legislative processes • Lack of sensitivity to and appropriation of environmental concerns in legislation and governance	• Low allocation of financial resources • Lack of sensitivity to and appropriation of environmental concerns in legislation • Generation of knowledge that does not contribute to decision-making	• Lack of clarity on agendas of needs for international cooperation

Group of Actors	Policy Makers and Administrators	Direct Users	Indirect Users	Regulatory Bodies	Entities of Control	Generators of Knowledge for Decision-Making	National and International Collaborators
Control Entities	• Findings which result from management problems	• Failure to comply with norms	• Failure to comply with norms	• Political differences that may affect rulings or decisions or legislative processes • Lack of sensitivity to and appropriation of environmental concerns in legislation and governance			• On occasions acts which overlap with those of national entities
Generators of knowledge for Decision-Making	• Low allocation of financial resources • Delays in the granting of licenses for research and access to genetic resources	• Generation of knowledge that does not add to decision-making	• Lack of support in making processes sustainable	• Adoption of administrative acts that do not contribute to the conservation of biodiversity	• Weak operational capacity in the face of environmental problems	• Findings which result from management problems	• Lack of practical clarity on responsibilities
National and International Collaborators	• Lack of clarity on agendas and needs for international cooperation	• Lack of involvement in the processes	• Lack of support in making processes sustainable	• Adoption of administrative acts that do not contribute to the conservation of biodiversity	• Weak operational capacity in the face of environmental problems	• Lack of clarity on agendas and needs for international cooperation need	• Lack of practical clarity on the responsibilities of agencies • Competition for projects and cooperation

IMPORTANCE OF BIODIVERSITY FOR COLOMBIA

According to the Convention on Biological Diversity (CBD 1992), biodiversity is defined as the "the variability of live organisms from whatever source, included, among other things, terrestrial and marine and other aquatic ecosystems and the ecological complexes of which they form part; it is made up of the diversity within each species, among species and ecosystems". This definition allows us to understand biodiversity as a territorially explicit system, which is characterized not only by having a structure, composition (expressed in the diverse arrangements of the levels of organization of biodiversity, from genes to ecosystems) and a functioning among these levels, but also a close and interdependent relation with human systems through a set of ecological processes which are perceived as benefits (ecosystemic services) for the development of the different human cultural systems in all their dimensions (political, social, economic, technological, symbolic, mythical and religious). This system interacts and keeps functioning thanks to the existence of solar energy, the global cycle of water and geo-chemical cycles, which interact with life, producing the complexity of relations and expressions which constitute biodiversity (Figure 3).

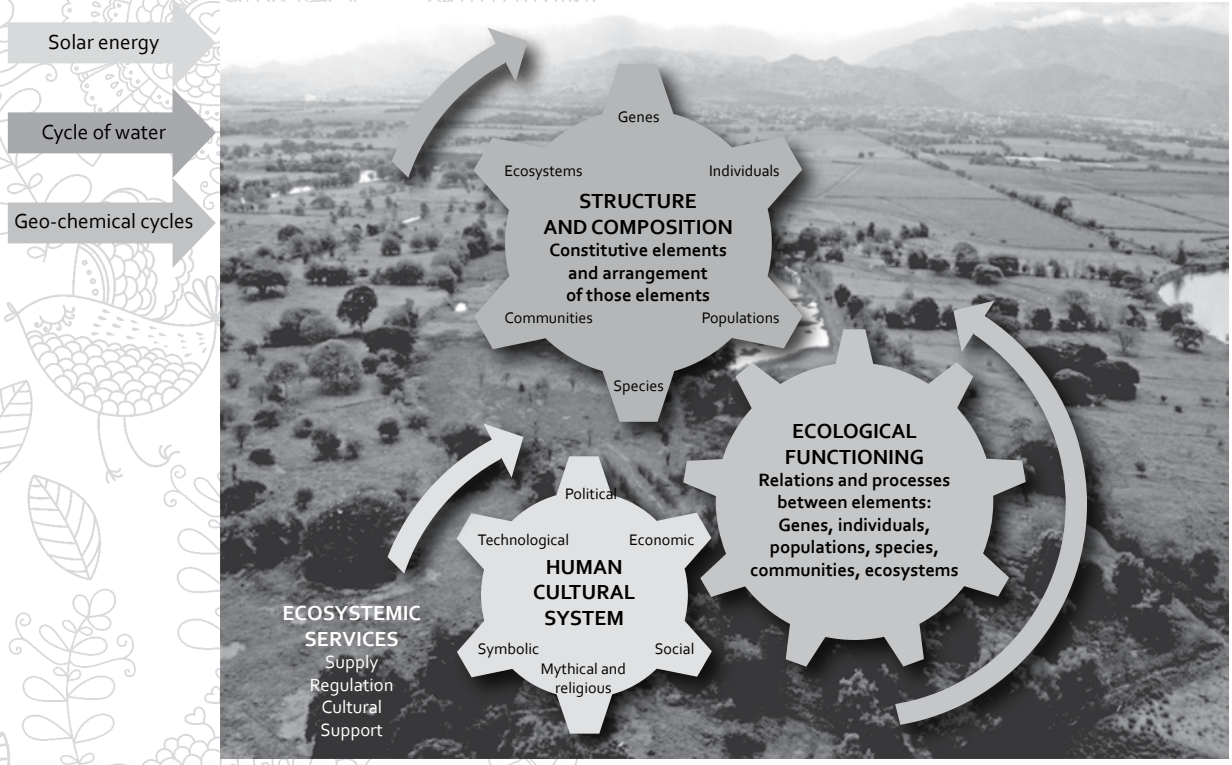

Figure 3. Biodiversity has a concrete territorial expression on its different levels of organization, from genes to ecosystems, which have a composition, structure and functioning within and between these levels; many of these complex ecological interactions are expressed as ecosystemic services, which constitute direct and indirect benefits which human beings receive from biodiversity.

Table 5. Area of the main Colombian continental, coastal and marine ecosystems. Source: IDEAM *et al.* 2007. For ease of understanding, a simplified division of the country´s ecosystems into large general groups is presented.

ECOSYSTEMS		Area (hectares) Official data for management	Area (hectares)	Percentage of total continental area of country	Source
NATURAL FORESTS	**Total Natural Forests**		**61,246, 659**	**53.7**	IDEAM et al. 2007
	Dry Forests		201, 200	0.2	IDEAM et al. 2007
	Tropical Humid Forests		49,358,834	43.3	IDEAM et al. 2007
	Montane Forests		11,377,943	10	IDEAM et al. 2007
	Mangrove Forests		308,682	0.3	IDEAM et al. 2007
PÁRAMOS (High Andean Moors)		1,980,454.06[1]	2,067,987	1.8	IDEAM et al. 2007
WETLANDS		3,020,155[2]	2,711,473	2.4	IDEAM et al. 2007
NATURAL SAVANNAS			10,017,163	8.8	IDEAM et al. 2007
DESERTIC, XEROPHITIC AND SUBXEROPHITIC			1,336,816	1.2	IDEAM et al. 2007
GLACIERS AND SNOW-COVERED LAND			8,567	01	IDEAM et al. 2007
GRASS AND SHRUB LAND			1,374,041	1.2	IDEAM et al. 2007
SECONDARY VEGETATION			8,148,154	7.1	IDEAM et al. 2007
FOREST PLANTATIONS			161,161	0.1	IDEAM et al. 2007
CROPS			9,346,948	8.2	IDEAM et al. 2007
GRASSES			17,313,886	15.2	IDEAM et al. 2007
ROCKY OUTCROPS			15,709	0.01	IDEAM et al. 2007
URBAN AREAS AND GREATLY ALTERED AREAS			300,824	0.3	IDEAM et al. 2007
MARINE BEACHES			952,602	n.a	INVEMAR et al. 2009
CORAL REEFS			181,702	n.a	INVEMAR et al. 2009
SEA-GRASS PRAIRIES			43,058	n.a	INVEMAR et al. 2009
ROCKY COASTLINES			934,779	n.a	INVEMAR et al. 2009
SOFT SEA-BEDS			4,290,546	n.a	INVEMAR et al. 2009
TOTAL CONTINENTAL			**114,049,388**	**100**	IDEAM et al. 2007
TOTAL MARINE ECOSYSTEMS			**6,402,687**	n.a	

1 Data from *Atlas de Páramos* (Morales et al. 2007), Resolution 937 of 2011.
2 The official figure includes the area of mangrove forests.
n.a. Not applicable

COMPONENTS OF BIODIVERSITY IN COLOMBIA

ECOSYSTEMS

According to the "*Map of continental, coastal and marine ecosystems of Colombia*", drawn on a scale of 1:500,000, Colombia has 311 kinds of continental and coastal ecosystems, including natural areas which have been little transformed and landscapes transformed by human activities of settlement, production and extraction (IDEAM *et. al.* 2007) (Table 5).

COMMUNITIES

According to Rangel-Ch. (1997), on a national level there are nearly 366 phyto-sociological associations and vegetal communities[2]. Nevertheless, on the basis of the studies of Rangel-Ch (1995, 1997, 2000, 2004, 2007a, 2007b, 2008, 2009, 2010a y 2010b),

2 The vegetal community, or type of vegetation, is a group of vegetal species in a given place, with well defined characteristics that are constant over time, which may be identified on the basis of the characteristics of dominant species, where one uses one or several dominant species to identify a larger group of species, like those shown in the syntaxonomy (Rangel-Ch. 2004)

Bernal-Hadad (2010) reports more than 1188 vegetal communities in the country, with something more than 1500 dominant species and 700 main dominant species. According to this same study, the high-Andean regions are those which have the highest number of communities (339 in *páramos* or high Andean moors and 236 in other Andean ecosystems), followed by the Amazon, Orinoco, Pacific and Caribbean, with 193, 164, 129 and 127 communities, respectively.

SPECIES AND POPULATIONS

Richness has generally been the most common indicator of biodiversity through a listing of the number of species found in a given territory (Groom *et al.* 2006). Although there are no detailed and complete biological inventories for all of Colombian territory, the current estimates give the country one of the highest places in species diversity on a world level (Table 6). Among these figures Rangel-Ch. (1995, 2006) reports that Colombia has 12% of the vegetal wealth of the planet, including 927 species of mosses, 840 species of hepatics, 1,515 species of lichen, and 1400 species of ferns and similar plants. Groups like the orchids stand out, represented by nearly 3500 species (15% of the total of the world´s orchid species). Similarly, the wealth of bird species corresponds to 19% of the world total (60% of the recorded species in South America). With regard to the diversity of aquatic species, nearly 1,357 species of fresh-water fish have been reported, grouped into 16 orders and 51 families (Maldonado *et al.*2008). In coastal and marine ecosystems it is estimated that there are around 2,500 species of mollusks, 2,000 fishes (176 elasmobranchs) (Invemar, 2008).

Endemic Species

Although we do not have a total estimate, it is thought that around 32 species of mammals, 400 of amphibians, 66 of birds and a third of the world´s plant species are exclusively found in Colombia (Gleich *at al.* 2000, Franco *et al.* 2006). This had led to the conclusion that the country may be regarded as the second highest in terms of the presence of areas of endemism (14) in the case of groups like birds (Stattersfield 1998) and the place where there are two of the most important biodiversity hotspots on the planet: the Andes and Chocó Bio-geographic region (Mittermeier). It is important to point out that broad species diversity just mentioned is not distributed in a homogenous way throughout the whole of Colombian territory but varies from region to region. In the continental part, the Andean region is the one which shows the greatest wealth for groups like amphibians, reptiles, birds, mammals and plants, followed by that of the Amazon and the Pacific region (Chaves and Santamaría 2006, Romero *et al.* 2008)

Migratory Species

In addition, 549 species which may be considered migratory, with an occasional cyclic or permanent distribution in the country, have been identified in Colombia. Among the different taxonomic groups one finds 21 species of marine mammals, 6 species of fresh-water mammals, 28 bat species, 275 bird species, 6 species of turtle, 110 species of fresh-water fishes, 64 species of marine fishes and 39 species of insects (Naranjo and Amaya 2009).

National Agro-biodiversity

Although there are no consolidated data in the country on the number of vegetal varieties

Table 6. Ranking of countries with the highest biological wealth in terms of number of species for different taxonomic groups

PLANTS	AMPHIBIANS	REPTILES	BIRDS	MAMMALS
Brazil 56,000	Colombia 764	Mexico 708	Colombia 1,860	Brazil 566
China 33,000	Brazil 516	Australia 599	Peru 1,680	Indonesia 515
Colombia 29,782	Ecuador 358	Colombia 586	Brazil 1,665	Mexico 507
Mexico 29,000	Mexico 282	Indonesia 531	Indonesia 1,565	Colombia 469

Source: Adapted from Groombridge and Jenkins (2002); Conservation International 2010 (Unpublished data). Also contains specific data from Restall (2007) and Rangel (1995, 2006).

and wild relatives used or with a potential use for the production of food or other kinds of raw materials of commercial interest, we can mention some examples which give an idea of their high diversity. González (2002) has identified nearly 38 genera and 7 species of wild relatives of cultivated and forage plants. With regard to the species used by farmers, for cassava alone (*Manihot esculenta* Krantz, known as *yuca* in Colombia), there are around 200 varieties in the Amazon (for example, the Piopoco tribe has no less than 82 varieties) and the Sibundoyes or Kamtzá indigenous group has 22 varieties of *arracacha* (*Arracacia xanthorrhiza* Bancroft), whereas Western science only knows of four varieties (González 2002).

In the case of Creole races of animals, on which no consolidated data on all the kinds of cattle are available either, there at least 9 Creole bovine races in the country, all derived from European cattle (Corpoica 2007; Pardo 2010); 26 Creole races of chickens (Angarita 2010); 5 races of pigs (Gobernación del Valle del Cauca 2010); 5 of goats and 11 of sheep (ANCO 2010).

Endangered Species

According to what is stated in Resolution 383 of 2010 of the Ministry of Environment (then the MAVDT and now the MADS), 377 species of fauna in Colombian territory are in danger of extinction, of which 43 are mammals, 112 birds, 25 reptiles, 48 amphibians, 28 marine fishes, 34 fresh-water fishes, 7 corals, 14 marine mollusks, 7 marine crustaceans, 1 terrestrial crustacean, 13 butterflies, 3 coleoptera, 31 hymenoptera, 6 spiders and 5 scorpions (MAVDT 2010a). However, the number of species which may be regarded as in danger of extinction may rise to 1,1117 (Amaya-Espinel 2009). In the past fifty years the extinction of at least three species endemic to Colombia has been corroborated: the monk seal (*Monachus tropicalis*), the Colombian Grebe (*Podiceps andinus*) and the greasefish (*Rhizosomichthys totae*).

GENES

Another expression of Colombia´s megadiversity is its genetic richness (Palacio and Hodson, 2006). However, the knowledge of national biodiversity on the genetic level is limited and we do not have representative figures about its current state. Nevertheless, an indirect way of approaching a knowledge of genetic diversity may be through an analysis of the contracts for access to genetic resources granted by the Ministry of Environment and Sustainable Development for research or bioprospecting. Between 2004 and 2011, 45 access contracts were signed, all for research purposes. Of these contracts, 19 have been for access to the genetic material of more than one species. The rest may be broken down into 16 species of fauna, 7 of flora and 1 microorganism (MAVDT 2011f).

BIODIVERSITY AS A SUPPORT FOR ECOSYSTEMIC SERVICES AND HUMAN WELL-BEING

Ecosystemic Services[3] are the direct or indirect benefits which mankind receives from biodiversity and are the result of the interaction among the different components, structures and functions which make up biodiversity (Figure 3). Ecosystemic services have been recognized as the bridge which joins biodiversity to human beings. This means that the actions have been historically taken for the conservation of biodiversity (for example, protected areas, the preservation of focal species, biological corridors, among others) are not activities which are alien to development, but, on the contrary, have significantly aided the provision of ecosystemic services on which depend, directly or indirectly, all human activities of production, extraction, settlement and consumption, as well as the welfare of our societies. In general terms, one can identify four (4) kinds of ecosystemic services (MEA 2005):

SUPPLY SERVICES

These are the goods and services which are obtained from ecosystems, such as foodstuffs, fibers,

3 The concept of ecosystemic services includes what has been traditionally known as environmental goods, since these are the same services of supply. However, the concept of environmental services is not used, since in general it refers to the flow of materials, energy and information of natural capital, combined with human capital or capital manufactured for human welfare (Constanza *et al.* 1997). Environmental services are also related to the supply of environmental resources or environmental sanitation provided by industries and social organizations, like sewage services, the collection and disposal of garbage, sanitation and similar services, and also services for reducing vehicle emissions and noise contamination, among others, but they are not necessarily related to the processes and functions of ecosystems, as ecosystemic services are.

timbers, firewood, water, soil, genetic resources, skins, pets, among others (MEA 2005).

Foodstuffs

In Colombia, the permanent availability of foodstuffs (from crops or livestock), which is one of the conditions needed to guarantee the country´s alimentary and nutritional security, depends not only on the diversity of species and varieties which have resulted from a long process of domestication, selection and improvement. It also directly depends on the fertility of soils, the supply of water resources and the natural occurrence of ecological processes resulting from the interaction among wild species and between them and cultivated species, such as pollination, seed dispersal and natural pest control, among others.

In general terms, the share of agriculture in the country´s GDP has been on the order of 10 to 14% since 1994 (Jarvis 2010), generating 21% of its employment (DANE 2009) and occupying nearly 44.8% of the total planimetric area of the nation (DANE 2009). Of the total agricultural/stock-rearing production in 2007, 55.2% corresponds to agriculture and the remaining 44.8% to stock-rearing (Jarvis 2010). With regard to cattle production, the 2009 national census reported a total of 22,540,251 head of cattle. For the production of meat in 2011, 4,103,337 heads of cattle were killed, which signifies a growth of 4%, while milk production in 2008 was 6.476 billion liters (Fedegan 2012). In the 2001-2006 period the supply of ecological products in the country grew by 25,713 hectares, mainly through crops of bananas, coffee, cacao, cereals, palm oil, tubers, fruits, sugarcane blocks (*panela*), garden produce and Heliconias, among others (MADR 2007).

In the case of fishing and aquaculture in the marine and continental waters of the country, the ecosystemic supply which upholds this activity consists of 91 species of fresh-water fishes and 1 crustacean, and 399 species of marine fishes, 23 crustaceans and 10 mollusks (MAVDT –MADR 2010). It is worth mentioning that fishing is the main source of food and income for the rural populations of some regions of the country. Thus, it is estimated that of the production of the fishing sector, 49% corresponds to marine fishing, 43% to aquaculture (13% marine and 30% continental) and 8% to continental fishing. According to the figures of the Ministry of Agriculture and Rural Development, in the past decade the production of fishing and fish-farming has had an annual average of 166,000 tons, of which 50% comes from industrial fishing, 23% from artisanal fishing and 27% from fish-farming products. In terms of subsector and regions, the share in the annual average production of 114,467 tons over the past decade amounts to 71% for the Pacific, 11.7% for the Caribbean and 17% for continental fishing, mainly in the Magdalena-Cauca, Orinoco and Amazon River basins. On the basis of these figures it has been estimated that annual per capita consumption is nearly 5.8 kilos/year (MADR *et al.* 2008). In the case of aquaculture, it is acknowledged to have been one of the activities with the highest economic potentials on a world level, since it has grown and gained access to international markets in the past few years (MADR *et al.* 2008). The 2007 annual report of the Corporación Colombia Internacional (CCI) mentions an increase of 33% between 1999 and 2006, and particularly emphasizes the contribution of marine aquaculture, which has grown by 133% compared to the 13% growth for continental aquaculture.

Exports of fish products have had an average annual growth rate of 0.9%, with variations in different years. In 2006 alone, the country exported products approximately worth US$ 148,698,245, mainly of tuna, crustaceans, other fishes, processed and canned fish and ornamental fish, which amounted to 4% of exports and mainly went to the United States, Japan, Taiwan, Germany and Mexico, among other countries (CCI 2006).

Timber Forest Products

The records for permits to exploit and transport timber from wild forests granted by the Autonomous Regional Corporations during the 2000-2008 period show a volume of 14,233,861 m^3 for timber exploitation and 15,176, 698 m^3 for legal transports of timber (IDEAM 2010a), while commercial reforestation in the country rose to approximately 296,072 hectares in 2010 (MADR).

The sector of sylviculture and timber extraction products accounts for 0.2% of national GDP and 1.2% of the GDP for that of agriculture, stock-

rearing, hunting and fishing[4]. 80% of the sector´s products correspond to the aggregate value created, from which derive industrial activities like timber transformation and the furniture, wood pulp, paper and cardboard industries (Espinal *et al.* 2005). The breakdown of the domestic demand for such products is shown in Figure 4, where one can see that most of the product goes to sawmills, which, in turn, provide the raw materials for the uses seen in Figure 5.

In Colombia more than 470 species of

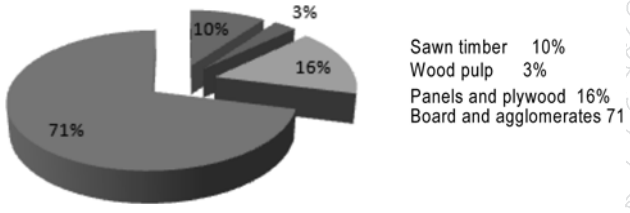

Figure 4. Percentage of annual demand for wood by sectors. Source: Espinal *et al.* 2005

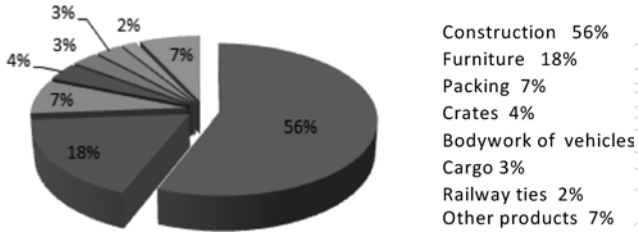

Figure 5. Uses of sawn timber in Colombia. Source: Espinal *et al.* 2005

timber trees are exploited. In 1996 alone an exploitation of 1,313,000 m^3 of timber from natural forests was reported, along with 322,400 m^3 from plantations and 91.000 m^3 from imports (MMA and Asocars, 2002, quoted in Olaya-Álvarez 2006). In large measure, forestry exploitation in Colombia is based on the selective extraction of such native species as *caoba* (mahogany), cedar, *sajo*, *cuángare*, mangrove and *robles*, which meet the demand for sawn timber and rounded logs, wood pulp for paper, triplex boards, agglomerate boards, tannins, firewood and charcoal.

As for the consumption of firewood, the FAO´s biennial report on the State of the World´s Forests (2007) indicates that Colombia is in third place in South America. According to the World Health Organization –WHO-- 15% of the population living in Colombian municipalities in the mist forests depend on combustible solids (firewood and charcoal) for heating and cooking (Aristizábal 2010). According to the IDEAM (2010a), the production and consumption of firewood in Colombia fell between 2000 and 2008, though it has kept at a level of around 21,000 kilotons/year. However, in some areas of the country, consumption may be higher: for example, it is reported that 79% of the families in the municipality of Encino, Santander, exclusively cook with firewood, with an estimated average consumption of 6.2t/year and a per capita one of 2.9 Kg./day (Aristizábal, 2010).

Non-Timber Forest Products (NTFP)

According to López and Cavalier (2007), the use of these kinds of supply services (mainly, in medicine, crafts and building) may reach 3.2 million dollars, involving at least 1,500 species, most of them (700) from the sub-Andean and Andean mountain jungles and nearly another 500 species from dry zones, *páramos* (high Andean moors) and wetlands. It is estimated that 1,200,000 people in Colombia economically depend on the use of NTFP and the number of craftsmen may reach to 350,000 persons (Gómez and Ortega, DNP 2007). In the period between 1998-2005, exports of crafts products rose on average to US$ 135 millions, compared to average imports of US$ 84 millions (Artesanías de Colombia, in DNP 2007), a large part of them corresponding to ceramics and jewelry, but with an equally important share of other crafts and materials like leather, fabrics, seed and woods (Gómez and Ortega 2007).

Hides, Meat and Ornamental Fauna: Animal-breeding in Colombia has recently become an important source of foreign earnings as a sector of non-traditional exports. It has been especially aimed at the production of specimens of caimans (*Caiman croco-*

4 In the fourth quarter of 2009, the GDP of the agriculture/stock-rearing, sylviculture, hunting and fishing sector reported an annual growth of 2.8%. The 8.7% growth of the subsector of other agricultural / stock-rearing products stands out, a record for the past 7 years. Equally prominent is the dynamic of the sector of sylviculture, with a 5.9% increase, and of other fish products, with an increase of 3.9%. Taken as a whole, these activities mitigated and made up for the 22.2% fall in the subsector of coffee products, which represents 10.1% of the agriculture/stock rearing GDP (MADR 2010).

dilus crocodilus, Caiman crocodilus fuscus, Crocodilus acutus) and to a lesser extent, capybaras (*Hydrochaeris hydrochaeris*), iguanas (*Iguana iguana*), gold tegus (*Tupinambis nigropunctatus*) and boas (*Boa constrictor*), mainly for the production of hides and meat (Mancera and Reyes 2008). The breeding of the *babilla* caiman alone produces 20 to 25 million dollars annually (Contraloría General de la República, in Mancera and Reyes 2008).

Another case is the export of ornamental fish. It is estimated that some 25 million individuals are exported annually, with a value of 7 million dollars, almost all of them obtained from their natural habitat. Figures from the DANE and PROEXPORT (Mancera and Reyes 2008) show that these exports reached US$ 6,257, 551 in 2005, representing nearly 0.03% of the country´s total exports that year. 88% of the ornamental fishes which are exported come from the Orinoco basin region (Puerto Inírida, Villavicencio, Puerto Gaitán and Puerto Carreño), 10% from the Amazon region (Leticia, La Pedrera) and 1.7% from the Pacific region (MADR 2008).

Genetic resources

Biodiversity offers stable and permanent sources of basic genetic material made up of wild genetic resources and varieties of ancestral crops, conserved and developed by traditional and local communities (Torres *et al.* 2004). The genetic diversity found in these traditional varieties constitute a direct service of biodiversity, as the basis of the production of foodstuffs and they likewise serve to cushion the effects of and help us adapt to climate change (FAO 2008). In this sense, phytogenetic resources with alimentary uses show an enormous variety of wild relatives and autochthonous varieties of cultivated species. For example, although maize and *frijol* beans originated in Mexico and Peru, respectively, there are a dozen varieties of both maize and *frijoles* that may be regarded as Colombian. The same is true of "*papa criolla*" (the small, yellow "Creole" potato); different Colombian fruits (*mora* berries, guavas, *lulos, uchuvas*, "tree tomatoes", *annonas*, avocadoes and pineapples); and roots and Andean tubers (cassava, *arracacha, olluco, mashua, achira*), which, while they are found in neighboring Andean countries, have some genotypes exclusive to Colombia (Debouck pers. comm. 2010) [5].

With regard to zoogenetic resources, due to its enormous diversity of micro-environments, Colombia has produced an important number of distinctive biotypes of different livestock species, depending on their environmental conditions, so that more efficient and competitive races are created in each particular niche (MADR *et al.* 2003).

Natural Ingredients, Medicinal Plants, Pharmaceutical Products and Cosmetic Products

Approximately 156 species of medicinal and aromatic plants are commercialized in the country, of which 41% are regarded as native species. In addition, 40% of the commercialized species are currently on the list of authorized plants of the Colombian National Institute for the Surveillance of Medicaments and Foodstuffs (Instituto Nacional de Vigilancia de Medicamentos y Alimentos –INVIMA) (Olaya-Álvarez 2006), which has approved 119 plants for medicinal use that make up the Colombian vade mecum of medicinal plants which are widely used and sold in the country and have a strong export potential (Díaz 2003).

Additionally, the use of fresh or dehydrated aromatic plants, as well as oils, colorants, honeys, extracts and many other products is growing in Colombia and the world (Gómez and Ortega 2007, Fondo Biocomercio and Redes Agro Empresariales y Territorio – RAET – of the Jorge Tadeo Lozano University 2009). As an example, in 2007 it was estimated that the total value of the European and United States markets for natural beverages and foods, to which Colombia has exported nearly 17 million dollars of products annually, may rise to 22 billion and 27.5 billion dollars/year, respectively (Gómez and Ortega 2007).

Water

The country has one of the largest supplies of hydric resources on the planet, in the form of an extensive network of rivers which cover the country, favorable conditions for the storage of subterranean waters, bodies of standing water and enormous stretches of wetlands (IDEAM 2010b). This supply is not spread evenly over the different regions of country, which is why conditions in the continental territory of Colombia range from zones which are short of waters to those with a great surplus of them insofar as the latter suffer periodical floods which last for a considerable time (IDEAM 2010b).

5 Daniel Debouck. Leader, Genetic Resources Program, International Center for Tropical Agriculture (CIAT)

SERVICES OF REGULATION AND SUPPORT

Services of regulation are the benefits which result from the regulation of ecosystemic processes, including the maintenance of the quality of air, the regulation of climate, the control of erosion, the control of human diseases and the purification of water (MEA). Those of support, on the other hand, are services and ecological processes needed to supply and maintain the existence of the other ecosystemic services. These services manifest themselves in scales of time and space much broader than those of the rest, since they include processes like primary production, the formation of soils, the provision of habitats for species and the cycling of nutrients, among others (MEA 2005).

Hydrological Regulation: According to estimates by the IDEAM (2010B), the average hydrological yield in the country is 63 l/s-Km^2, which is 6 times that of the world average (10 l/s-Km^2) and thrice that of Latin America (21 l/s-Km^2). The total volume of rainfall in the country rises to 3,700 Km^3/year, of which 61% turns into surface run-off (an average flow rate of 71,800 m^3/s or 2,265 Km^3/year) (IDEAM 2010b). The Pacific is the region with the country´s highest hydrological yield (124 l/s-Km^2), followed by the regions of the Orinoco, the Caribbean (55 l/s-Km^2), the Catatumbo and the Magdalena-Cauca basin (46 l/s-Km^2 and 35 l/s-Km^2) (IDEAM 2010b).

With regard to bodies of lentic waters, their surface area in Colombia is 831,163.7 hectares, of which 397,613.7 correspond to marshes, 51,186.3 reservoirs, 123,412 lakes and 258,273 to swamps. The Magdalena-Cauca rivers basin is the region with the largest area of lentic bodies (48%), followed by the geographical area of the Amazon and the Orinoco (around 22% each) (IDEAM 2010b). In addition, the supply of subterranean water in the country is on the order of 5,848 Km^3, with the hydro-geographical area of the llanos orientales (eastern plains) showing the largest supply (239.06 m^3x10^{10}), followed by the Eastern Cordillera (90.07 m^3x10^{10}) and Caguán Putumayo (66.11 m^3x10^{10}) (IDEAM 2010b).

The areas that fall within the National System of National Parks –SPNN – directly supply 31% of Colombia´s population with water and indirectly supply 50% of its population. Likewise, these protected areas include four of the six most important confluences of water (*estrellas hidrográficas*) in the country and more than 62% of the sources of national aquifers; they also protect 7% of the lakes and natural marshes which contain 20% of the water resources which supply electricity to the country. The cost of regulating the flow rates in the protected areas is estimated at 700 billion pesos per year and the cost of reducing sedimentation 2.5 billion pesos per year, thus reducing the costs of supplying and treating water for municipal aqueducts. In addition to the above, of the total area of medium and large scale irrigation districts in the country, 176,745 hectares are supplied from water sources in the National Parks area (Carriazo *et al.* 2003).

Carbon capture and storage: Estimates of the contents or total reserves of carbon (aerial biomass) in Colombia which employ a middling level of detail (Tier 2, according to the IPCC) show that its natural forests store about 7,459,762,323 t C, when one employs the Holdridge life zone classification, with a margin of error in the estimates of 14.3% (IDEAM 2010C). The kinds of forest which store the largest amount of carbon in their aerial biomass are the humid tropical forest (6,239, 655,586 t C), the very humid tropical forest (372,958,761 t C) and the very humid premontane forest (215,562,351 t C). For the areas of the SINAP, the service of carbon capture creates economic benefits of $830,000 to $2, 500,000 pesos per protected hectare (Carriazo *et al.* 2003).

Despite being the foundation of and necessary condition for the existence of the other ecosystemic services, the ecosystemic services of support have not been sufficiently appreciated or studied. These services are not only essential for the functioning of natural ecosystems but they also constitute an important resource for the sustainable management of agricultural and stock-rearing systems (FAO 2009), one which has not been recognized or valued in country´s productive systems, despite its importance.

CULTURAL SERVICES

These are the intangible benefits obtained from ecosystems, in the form of spiritual enrichment, scenic beauty, artistic and intellectual inspiration, cognitive development, reflection, recreation and aesthetic experiences (MEA 2005).

Ecosystemic context of ethnic cultural development: Colombia is both a megadiverse and a multicultural and pluri-ethnic country. Traditional systems of knowledge of biodiversity form a complex and socially regulated set of values, knowledge, practices, technologies and innovations, historically developed by peoples and communities about the biodiversity which they directly depend on in order to live. These bodies of knowledge about biodiversity are expressed in the gathering and transformation of wild products, traditional agriculture, stock-rearing activities, natural medicine and hunting and fishing, all of which are activities developed by the communities to guarantee their own subsistence (Sánchez 2003).

Recreation and tourism: According to the World Travel & Tourism Council – WTCC – it is expected that the demand for travel and tourism in Colombia will show an annual growth rate of 4.5% between 2006 and 2015, rising from US$ 9.8 billion to US$ 14.3 billion in 2015, and thus surpassing the rate of 4.1% expected for Latin America. Ecotourism accounts for 7% of total world tourism, whose value is estimated at US$ 514 billion per year (Gómez and Ortega 2007). In this field, the country shows a trend of growing visits to natural regions like national parks or bird-watching expeditions. It is estimated that an average of 411, 476 people annually visit the areas of the National Parks System alone and that the total annual benefits from ecotourism vary within a range of between $2.3 and $6.9 billion Colombian pesos (Carriazo *et al.* 2003). These results show the strong potential for earnings from these activities for the inhabitants of rural zones as well as those who live in the areas of influence of parks and natural reserves.

POLICY APPROACH

THE INTEGRAL MANAGEMENT OF BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES (GIBSE)

The Integral Management of Biodiversity and its Ecosystemic Services (GIBSE) is defined as the process by which one plans, executes and monitors the actions needed to conserve biodiversity and its ecosystemic services, in a given social and territorial scenario and in different states of conservation, with the aim of maximizing human well-being by maintaining the resilience of socio-ecological systems on the national, regional, local and trans-frontier scales (Figure 6).

In this way, one sets forth a framework of action which allows for the creation of a balance between the different interests society has with regard to biodiversity and the maintenance of the ecosystemic services which derive from it and are crucial to human welfare, following the principles found in the ecosystemic approach[6] proposed by the Biodiversity Convention. In this manner, the idea that the management of biodiversity is the exclusive concern of the environmental sector and falls under the exclusive jurisdiction of the natural sciences gives way to a management which encourages social and sectorial co-responsibility, and thus fosters social participation and the recognition of biodiversity and its ecosystemic services as a public value, and acknowledges and incorporates aspects related to it into the planning of short, medium and long term actions, in order to increase productivity and national competitiveness in a sustainable way, and at the same time protect and maintain the natural and cultural riches of the country (Annexes 1 and 2).

6 The ecosystemic approach is defined as a strategy for the integrated management of lands, areas of water and live resources which promotes conservation and sustainable use. In this approach, human beings, with their cultural diversity, are recognized to be an integral component of ecosystems (MEA 2005).

KEY CHARACTERISTICS OF THE INTEGRAL MANAGEMENT OF BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES (GIBSE)

Biodiversity has a concrete territorial expression (ecosystems, species and individuals) in any region or municipality of the country. This wealth has been the base and framework of the context in which different cultures have evolved, giving rise to diverse cultural manifestations in the length and breadth of Colombian territory. This close relationship, manifested on different scales, is expressed and understood as the interdependent relation between ecological and social systems in which biodiversity gives shape to culture and culture, in turn, transforms and structures the spatial arrangement of biodiversity.

In order to implement the Integral Management of Biodiversity and its Ecosystemic Services in a territory, one must start by acknowledging this interdependent relation among each of the actions, that is, understand and analyze any territory as a socio-ecosystem, and therefore human beings and their cultures must be regarded as integral parts of biodiversity. The relationship between the ecological and social systems is established through the continual supply of ecosystemic services (provisioning, regulation, cultural ones and support) which the ecological system provides on different scales and which are crucial for the maintenance of human welfare, and from another angle, the different actions undertaken by human beings to guarantee the conservation of the biodiversity from which these ecosystemic services derive, as well as the pressures on biodiversity caused by anthropic (manmade) activities (Figure 7).

At this point, it is important to specify that the conservation of biodiversity is a concept which transcends the view that it exclusively has to do with the preservation of nature. For the GIBSE, conservation must be understood and managed as an evolving characteristic, resulting from the balance between actions for preservation, sustainable use, the production of knowledge and the restoration of biodiversity

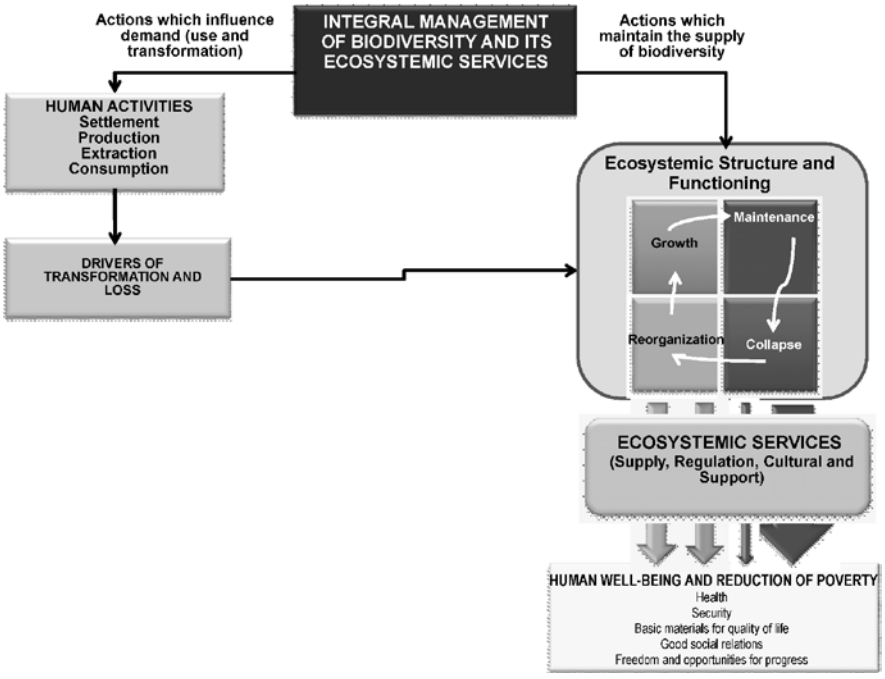

Figure 6. General diagram of an Integral Management of Biodiversity and its Ecosystemic Services – GIBSE – which shows its influence not only on traditional actions to maintain, improve and manage the states in which biodiversity is found (growth, maintenance, reorganization and collapse) (Resilience Alliance 2007; Matteucci 2004) but also the need to act on the human activities which create demands on biodiversity and generate the engines of loss and transformation, so that a balanced relationship between natural supply and the demand from use is maintained and a good supply of ecosystemic services which help to improve human well-being is guaranteed. It is worth clarifying that in each state of biodiversity, the ecosystemic services will be of a different kind. Likewise, the magnitude, intensity and frequency with which they are provided will be different.

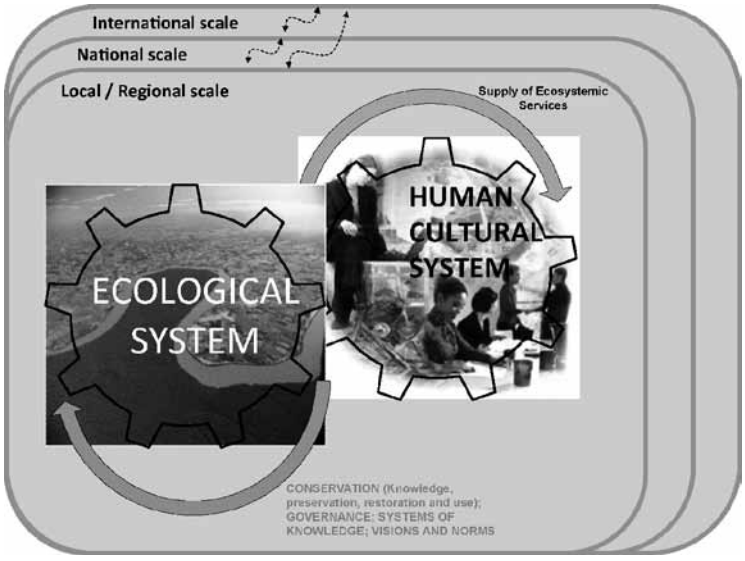

Figure 7. Diagram of the socio-ecological approach to biodiversity management, where there is an acknowledgment of the close relationship between social and ecological systems, which is measured by the ecosystemic services derived from biodiversity and the actions for its conservation. Adapted from Berkes *et al.* 2003.

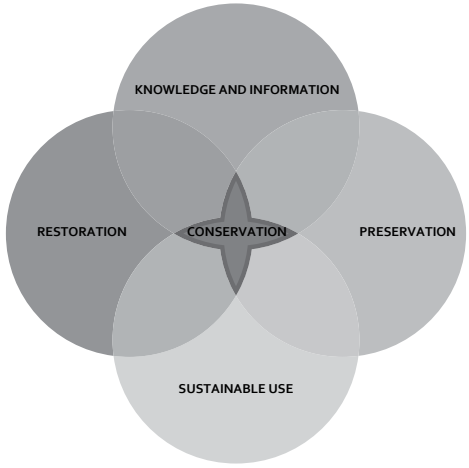

Figure 8. The conservation of biodiversity as an emerging element of preservation, sustainable use, restoration and the creation of knowledge.

(Figure 8), in a manner which maintains or strengthens the resilience of socio-ecological systems and with it, the supply of ecosystemic services fundamental to human welfare. It is worth clarifying that, depending on the situation of each territory, the actions needed to conserve biodiversity may vary, from cases where the four actions just mentioned are necessary to others where only one or two may be.

Resilience refers to the capacity of socio-ecosystems to absorb shocks and reorganize themselves while they carry out changes which enable them to maintain the same function, structure, identity and feedback (Folke *et al.* 2004), thus increasing their ability to learn and adapt to change (Carpenter *et al.* 2004), so that they maintain and increase the supply of ecosystemic services. In this scenario, it is recognized that there are no static equilibriums in Nature and that change and uncertainty are decisive factors that should be taken into account by the GIBSE (Figure 9).

To speak of the resilience of a socio-ecological system implies that the shocks are recognized as an inherent feature of the dynamic of biodiversity and

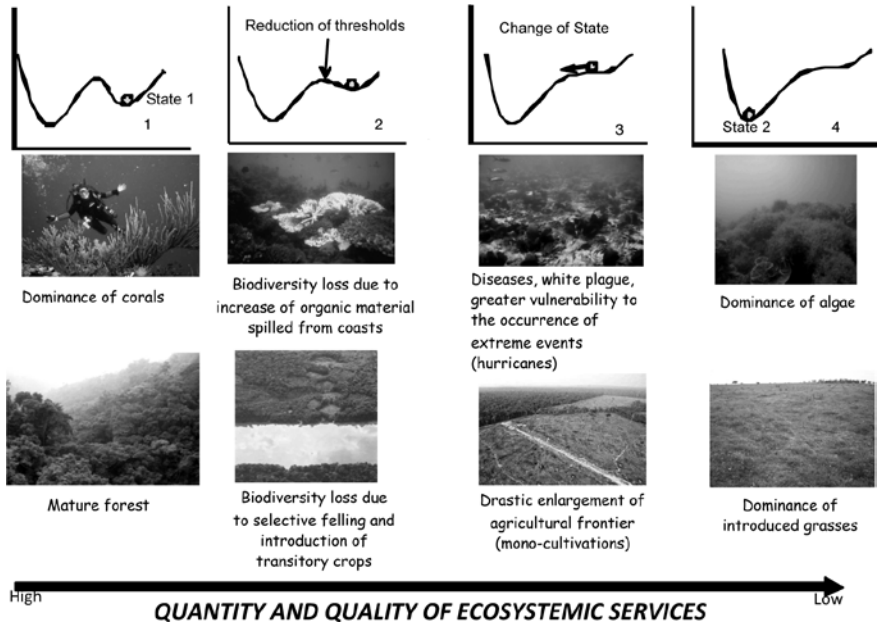

Figure 9. Scenarios of change in the resilience of two different kinds of ecosystems and their effects from the viewpoint of the quantity and quality of the ecosystemic services derived from biodiversity. (Adapted from Elmqvist *et al.* 2003).

govern the temporal nature of successional processes (Holling *et al.* 1995), which do not evidence a long-term stability and whose dynamic goes through different states (maintenance, collapse, reorganization and growth), which may be interpreted as part of cycles of change in which the physical, biological and cultural components are continually reorganizing themselves to allow for the permanent adaptation of socio-ecological systems (Holling 2001, Gunderson and Holling 2002, Calvente 2007) (Figure 6).

In addition, the most concrete expression of implementing the GIBSE to ensure conservation and with it, territorial sustainability, should be territorial ordering, since it is through this political-administrative tool that one guides and plans joint physical actions which guide the development of the territory and regulate the use, transformation and occupation of space, in accordance with strategies for socio-economic development and in harmony with the environment and historical and cultural traditions (adapted from Law 388 of 1997). Thus, all of the actions carried out to ensure the conservation of biodiversity must be contextualized in the framework of a process for the environmental ordering of the territory (Law 99/93), where biodiversity is the most relevant consideration, for being the main feature in structuring processes of territorial ordering, insofar as it is the source of and guarantee for the supply of ecosystemic services which are crucial for the development and sustainability of human activities of production, extraction, settlement and consumption.

The territorial ordering of territory is materialized in the socio-ecological structuring of the territory, a process which will not only allow for the definition of a main ecological structure[7] (environmental determinants and other lands that serve for protection) which constitutes the basic territorial "framework" for guaranteeing the conservation of biodiversity (Decree 3600 of 2007) but also defines a number of guidelines for the environmental management of all the other kinds of land use in a municipality (rural, suburban, urban, urban expansion), as well as ones for the ordering of the country´s marine and coastal areas, so that the supply of a good amount of ecosystemic services of high quality may be ensured through the integral management of the territory (a heterogeneous mosaic of productive systems and natural ecosystems). This socio-ecological structuring must start with the dynamic and adaptive nature of the processes, so that uncertainty should be an integral part of the GIBSE. To achieve this, it is necessary to understand that management must take into account the dynamic connectivity between scales of time and space in order to ensure that the resilience of the socio-ecological systems is maintained. This scalar connectivity means that the activities which are developed on local scales may come to have synergic effects on larger scales of a regional or global kind when they combine with other local events (for example, species loss, contamination). In the same way, events which take place on larger scales may have impacts on local scales by modifying the regimes to which the local activities are adapted (for example, climate change). In some cases, the effects of such activities may be noticed immediately, while in other cases these changes will only occur in the long term.

Furthermore, the socio-ecological structuring of the territory resulting from the GIBSE also requires strengthening processes of participation and governance, based on the acknowledgment not only of the biophysical differences between territories but also the different systems of knowledge[8] and ancestral use of those territories -- which also should be incorporated into such management – in order to optimize the capacity of management from local scales to higher ones of a regional, national or global kind and allow for the creation of strategies for the transformation of socio-environmental conflicts and facilitate the development of processes which culminate in an effective conservation of biodiversity and its ecosystemic services. In this way, one of the main contributions of the GIBSE is its recognition that the production of knowledge and information about the conservation of biodiversity and its ecosystemic services, and likewise

7 The Main Ecological Structure is defined as the group of biotic and abiotic elements which support the territory´s essential ecological processes, whose principal aim is the preservation, conservation, restoration, use and sustainable management of the renewable natural resources which furnish the capacity to support the socio-economic development of populations (Decree 3600 of 2007).

8 Scientific, expert, traditional and/or local systems of knowledge are expressions of mental models derived from ways of interiorizing, systematizing and symbolizing the experience of different actors through the historic process which has established the relationships between the ecological and social systems, and thus serve to acknowledge a reality that is more complex than the one only attained in the scientific or academic ambit.

the decision-making process, should be shared by a wide variety of actors in our society, who also should be explicitly included as legitimate interlocutors, even if their expectations with regard to biodiversity are contradictory.

Additionally, the GIBSE recognizes that men, women, boys, girls and adolescents are distinct members of society, with different interests and a different influence on the territory, which implies multiple scenarios and alternatives for the conservation of biodiversity and its ecosystemic services. Thus, for example, men and women utilize, preserve, have knowledge of and participate in the ecosystemic services offered by biodiversity in a different manner, which results in the incorporation of different areas of knowledge, skills and experience; and they also meet different needs, and all this promotes democracy, justice, social inclusion, peaceful coexistence and a sustainable human development, since an inclusive territorial planning will significantly contribute to the creation of fairness and foment a culture of peace (Sasvari *et al.* 2010; Rodríguez *et. al* 2004).

Moreover, the incorporation of variables like resilience, uncertainty and change into the management of biodiversity on national, regional, local and trans-frontier scales which has been proposed by the GIBSE implies promoting changes in institutional functioning, in order to encourage intra- and inter-institutional links and efforts to improve the adaptive capacity of institutions so that, in this way, they may learn, innovate and be flexible with their management mechanisms in the face of the social, economic, ecosystemic and political changes which occur on different spatial and temporal scales. The design and implementation of systems for a continuous follow-up and periodical evaluation of the GIBSE help to strengthen the institutions´ adaptive capacity, as a characteristic of the social system which allows for the undertaking of effective actions in the territory for the conservation of biodiversity and its ecosystemic services.

All this acknowledgment of the social component which the GIBSE entails culminates in a necessary recognition of the need to evaluate the benefits supplied by ecosystems, or the costs which their loss implies, with the aim of improving or heightening perceptions of the value which biodiversity and its ecosystemic services have, thus strengthening the participation in and co-responsibility for its conservation among the different social and sectorial actors.

In this way, one seeks to arrive at the conception of biodiversity as a public value (Kelly and Muers 2003), that is, a scenario for the encounter between the State and citizens (urban and rural), where their relations are strengthened and there is an optimization of the capacity of response, juridical security, social responsibility and the derived and collateral benefits which are obtained as a result of its conservation, so that it effectively contributes to the achievement of the objectives of reducing inequality and poverty, strengthening democratic States and the citizenry, and overcoming the old idea that biodiversity is a good that is only the responsibility of public sector entities. In this view, its assessment cannot exclusively be limited to the valuation of its monetary worth, but, on the contrary, it should also include qualitative analyses and physical indicators (TEEB 2010), thus promoting an integral evaluation of ecosystemic services, that is, one which takes into account not only the economic aspects but also the non-economic values of biodiversity (Figure 10).

Furthermore, it is important to take into account that many social and ecological relations are not linear and that when resilience is reduced, the socio-ecological system becomes more vulnerable and smaller changes may progressively cause larger ones, leading the system into a different state and forming thresholds of stability and change[9], that is, critical values or ranges for a given social or ecological variable which the system stays within during a given phase or state, or which, once they are surpassed, cause the whole system to rapidly and abruptly change from one state to another, different one which changes the magnitude, intensity and frequency of the ecosystemic services it supplies (Folke *et al.* 2004; Bennet and Radford 2004; Hugget 2005) (Figures 6 and 9). The identification of thresholds of change must enter into making decisions about the appraisement and valuation of the benefits which the exploitation of a given ecosystemic service may bring, in the face of possible

9 As examples of the kinds of thresholds which may be identified to guide the management of biodiversity, there are thresholds for the extinction of species (Tilman *et al.* 1994; Fahrig 2001, 2001), thresholds for the fragmentation of habitat (Andrén 1994, 1999), thresholds for the connectivity between patches of native ecosystems (With & Crist 1995; Metzger & Décamps 1997; Schultz & Crone 2005) and thresholds for the presence of a given species (Hansen *et al.* 1995; Bütler 2004; Guénette & Villard 2004, 2005; Mendoza 2007).

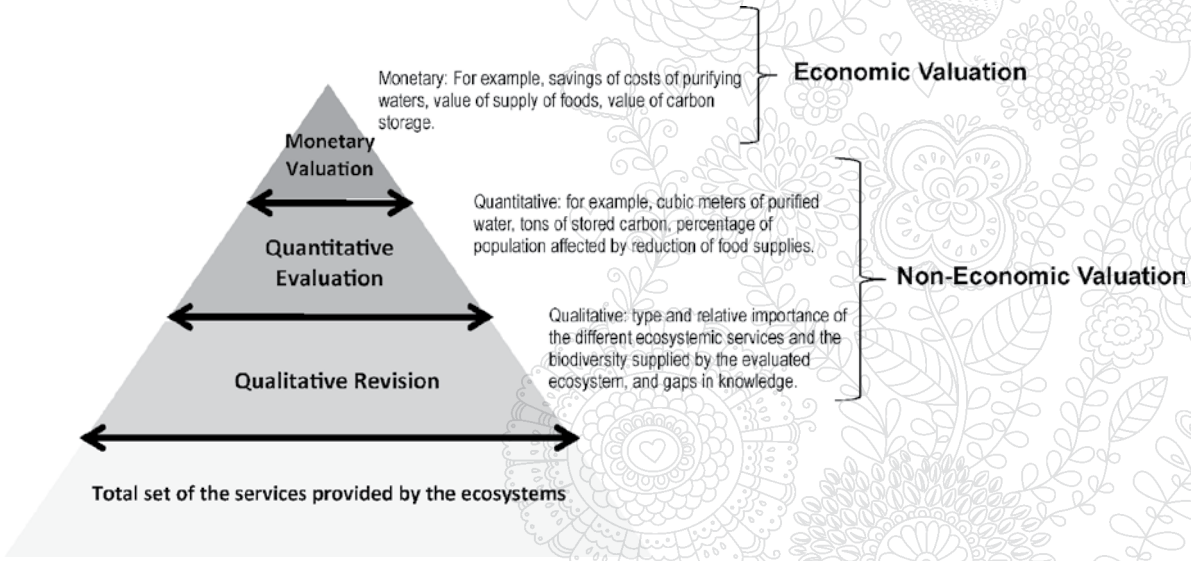

Figure 10. Diagram of the integral valuation (economic and non-economic) of biodiversity and its ecosystemic services. Source: TEEB, 2008.

negative impacts in the short, medium or long term on other ecosystemic services ("trade offs") (Neville *et al.* 2010). Thus, in the GIBSE the precautionary principle is fundamental, since the uncertainty associated with a socio-ecosystem´s movement through the states of the adaptive cycle (Figure 6) may mean that a poor interpretation of the threshold values in decision-making may entail negative consequences for the conservation of biodiversity and its ecosystemic services (Lindenmayer and Luck 2005). The direct effect on biodiversity of human activities of settlement, production and extraction have led the limits for the transformation of or extraction from socio-ecological systems to be surpassed or to approach that condition, so that they go beyond the thresholds of stability and change, and create new states where human well-being and survival are being endangered or are even already gravely affected. These human activities act as direct drivers of the transformation and loss of biodiversity[10], and their isolated and/or combined action has caused the current scenarios of environmental global change (Vitousek 1994; Vitousek *et al.* 1997; Steffen *et al.* 2004; Duarte *et al.* 2006). In general terms, five main and direct drivers of the transformation and loss of biodiversity, which are typified on a global level, have been identified (MEA, Table 7).

In the face of these scenarios of global environmental change, the GIBSE must consider and promote actions for mitigation and adaptation to suitable scales which tend to reduce the risks associated with the loss and transformation of biodiversity and its ecosystemic services. In that sense, the ecosystems-based approaches which have been proposed to mitigate and adapt to climate change[11] (UICN 2008: CDB 2009; World Bank 2009; Andrade 2010) may also conceptually guide actions aimed at confronting all of the threats which typify environmental change.

Ecosystem-Based Adaptation (EbA) is a focus for strengthening and maintaining the capacity to adapt to environmental change (including climate change) of socio-ecosystems and reducing the risk of their degradation or collapse. It integrates the sustai-

10 The direct drivers of the transformation and loss of biodiversity should be recognized as processes which affect the spatial occurrence of biodiversity in a specific territory and its manifestations in genes, species and ecosystems. These typically occur as changes in the surface or quality of ecosystems, usually as the consequence of such processes as the loss of ecosystems or habitats, invasions of exotic species, the over-exploitation of the resources and services derived from biodiversity and the contamination of the same. Some direct drivers are also characteristic of Nature and beyond human control, like tsunamis, telluric phenomena and volcanic eruptions.

11 Adaptation and mitigation are measures which may be complementary, interchangeable or independent. However, one is never a perfect substitute for the other, because mitigation is always necessary to avoid dangerous or irreplaceable changes in climatic (IPCC 2007) and socio-ecological systems.

Table 7. Direct drivers and some of the causes identified for Colombia and their equivalents on a global scale.

Direct drivers of the transformation and loss of biodiversity and its ecosystemic services seen on a global scale (MEA 2005)	Direct drivers of the transformation and loss of biodiversity and its ecosystemic services seen on a national scale and their manifestations in Colombia.
1. Transformation and loss of ecosystems and natural habitats.	**DRIVER 1. Changes in the use of territories (continental or aquatic), their occupation and fragmentation of their ecosystems** Direct transformation and loss of natural or semi-natural ecosystems. Transformation of productive systems which maintain elements and processes of biodiversity. Infrastructure developments Dams and changes in water courses
2. Over – exploitation	**DRIVER 2. Reduction, loss or degradation of elements of native ecosystems and agro-ecosystems.** Overuse of populations of species (terrestrial and marine) Degradation of ecosystems Loss of genetic diversity of cultigens and varieties
3. Biological invasions	**DRIVER 3. Biological invasions** Introduction and transplantation of species Introduction and release of Modified Live Organisms
4. Contamination	**DRIVER 4. Contamination and toxification** Organic contamination of waters and soils (eutrophication of N and P). Chemical contamination (air , soil and water)
5. Climate change	**DRIVER 5. Climate Change**

nable use of biodiversity and its ecosystemic services into a global strategy of adaptation (CBD 2009). This adaptation is seen as a fundamental aspect of the creation of a resilient society (Andrade 2010) and for that aim, the main objectives of the EbA are: i) To promote the resilience of ecosystems, ii) maintain ecosystemic services, iii) support sectorial adaptation, iv) reduce risks and natural disasters and v) avoid poor adaptation.

Ecosystem-based Mitigation (EbM) is based on the capacity which all ecosystems have to stop or reduce the causes which threaten the structural and functional integrity of socio-ecosystems and put the resilience of biodiversity at risk and in the end, of the supply of services derived from it. As was mentioned above, the original development of this concept was applied, almost exclusively, to climate change, where the role of ecosystems in catching and storing greenhouse-effect gases (GHG) is clearly evident. Nevertheless, the sound state of ecological systems and their ecosystemic services of regulation and support help to mitigate other impacts like contamination, bio-geo-chemical changes in soils and biological invasions, among others.

OPERATIONALIZATION OF THE GIBSE

On a national level the GIBSE will require that the actions for the conservation of biodiversity and its ecosystemic services not only be carried out by the environmental sector but also by the productive sectors. The recognition of the role which society in general and each productive sector has in the realization of a co-responsible territorial management, which allows for the conservation of biodiversity on a national, regional and local level, is a fundamental point in achieving the sustainability of the economic activities of the main line items of the national economy (agriculture/stock-rearing and extractive industries), as well as maintaining the ecosystemic services which are fundamental for the welfare of society in general. In this sense, the harmonization of this policy with other instruments of sectorial policy is fundamental for deciding which actions for the conservation of biodiversity and its ecosystemic services should be incorporated into the sectorial actions associated with production, so that they do not endanger biodiversity and reduce the vulnerability of sectors to the shortage of ecosystemic services caused by the drivers of the

Table 8. Main instruments of sectorial policy in Colombia which must be linked and harmonized with this policy in order to carry out an effective GIBSE on a national level.

Instrument of Sectorial Policy	Strategic lines of the sectorial policy that need to be linked with the GIBSE
Agriculture/Stock-rearing Policy 2010 – 2014	• Creation of incomes for the rural population • Strengthening of the competitiveness of agriculture/stock-rearing • Expansion and diversification of domestic and foreign markets • Fairness in regional development • Management of risk in agriculture/stock-rearing
Food and Nutritional Security Policy	• Stability in the supply and development of the food/agriculture market • Support for associative and managerial approaches to create jobs and incomes which facilitate the availability of and access to food • Improving the access of vulnerable sectors of the population to productive factors. • Guaranteed Access to Food • Promotion and protection of health and nutrition, and encouragement of healthy lifestyles. • Improved public services, a cleaner environment and healthy surroundings. • Ensuring the quality and harmlessness of foodstuffs • Scientific and technological development • Development of human capabilities, potentials and powers
National Plan for Mining Development and direct foreign investment in the country 2019	• Lines to facilitate mining activities • Lines to promote sustainable development in mining
National Energy Plan 2010 - 2030	• Reduce the vulnerability of the Colombian energy sector in all energy supply chains and increase the availability and reliability of energy • Exploit Colombian energy resources with criteria of sustainability, taking into account new world tendencies which may benefit the country • Harmonize the institutional framework for the implementation of the national energy policy
CONPES 3272 Integral Policy of Road Infrastructure (2004)	• Stage 1. Building • Stage 2. Maintenance • Criteria for establishing priorities in the projects
CONPES 3527 National Policy for Productivity and Competitiveness (2008)	• Action Plan: Competitiveness in the agricultural sector • Action Plan: Science, technology and innovation • Action Plan: Mines and energy infrastructure • Action Plan: Logistics and transport infrastructure • Action Plan: Environmental sustainability • Action Plan: Institutional strengthening of competitiveness

transformation and loss of biodiversity which typify environmental change (Table 8).

In addition, the ecological structuring of territory, the main result of an adequate GIBSE on the mainly regional and local scales, will have to be guided by the Regional Biodiversity Action Plans (PARGIBSE), which will be formulated or updated by the Autonomous Regional Corporations (CAR) and the Sustainable Development Corporations (CDS), and Urban Environmental Authorities (AAU), so that they turn into the "road map" which guides the management of these institutions and guarantees the conservation of biodiversity (ecosystems, species, genes) and its ecosystemic services on regional and local scales. To formulate them, the PARGIBSE will have to be conceptually and strategically linked with this Policy and with its National Action Plan (see page 97). These Regional Plans will be formulated in a participatory manner and periodically evaluated (every four years or so) and will count on a system for continuous follow-up through indicators of state, pressure and response.

The PARGIBSE will have to be the basis for the prioritization and definition of the actions in the Regional Environmental Management Plan (PGAR) and the Quadrennial Action Plan of the environmental authority (PAC). Likewise, the PARGIBSE will contain the guidelines and actions for the management and

conservation of the components of biodiversity of importance for the region. It will incorporate and develop the actions needed for the ecological structuring of the territory and incorporate guidelines for the management of the risks associated with biodiversity loss and the shortage of ecosystemic services which result from the drivers of the transformation and loss of biodiversity. The POMCA (Decree 1729 of 2002), or the Management Plan of the UAC, will have to be linked with the PARGIBSE and take up its guidelines for the conservation of biodiversity and its ecosystemic services (especially those related to the protection of the cycle of regulation of waters) and incorporate them into the Plans, Basic Plans and Schemes of Municipal Territorial Ordering (Law 388, Chapter IV), treating them as environmental determinants of such ordering and environmental guidelines to ensure conservation in the other types of land uses and the identification of protective lands (Figure 11).

The other tools for regional planning established by the CARs, CDSs and AAUs -- such as the plans for the ordering of forestry (POF) and water resources (POHR), and the plans for the clean-up and management of spillages (PSMV), as well as the activities deriving from those instruments -- will also have to be linked with the PARGIBSE in the areas of the conservation of the ecosystems and ecosystemic services those instruments focus on (for example, the supply and quality of water, timber and non-timber products, potential impacts of the disposal of solid wastes, etc).

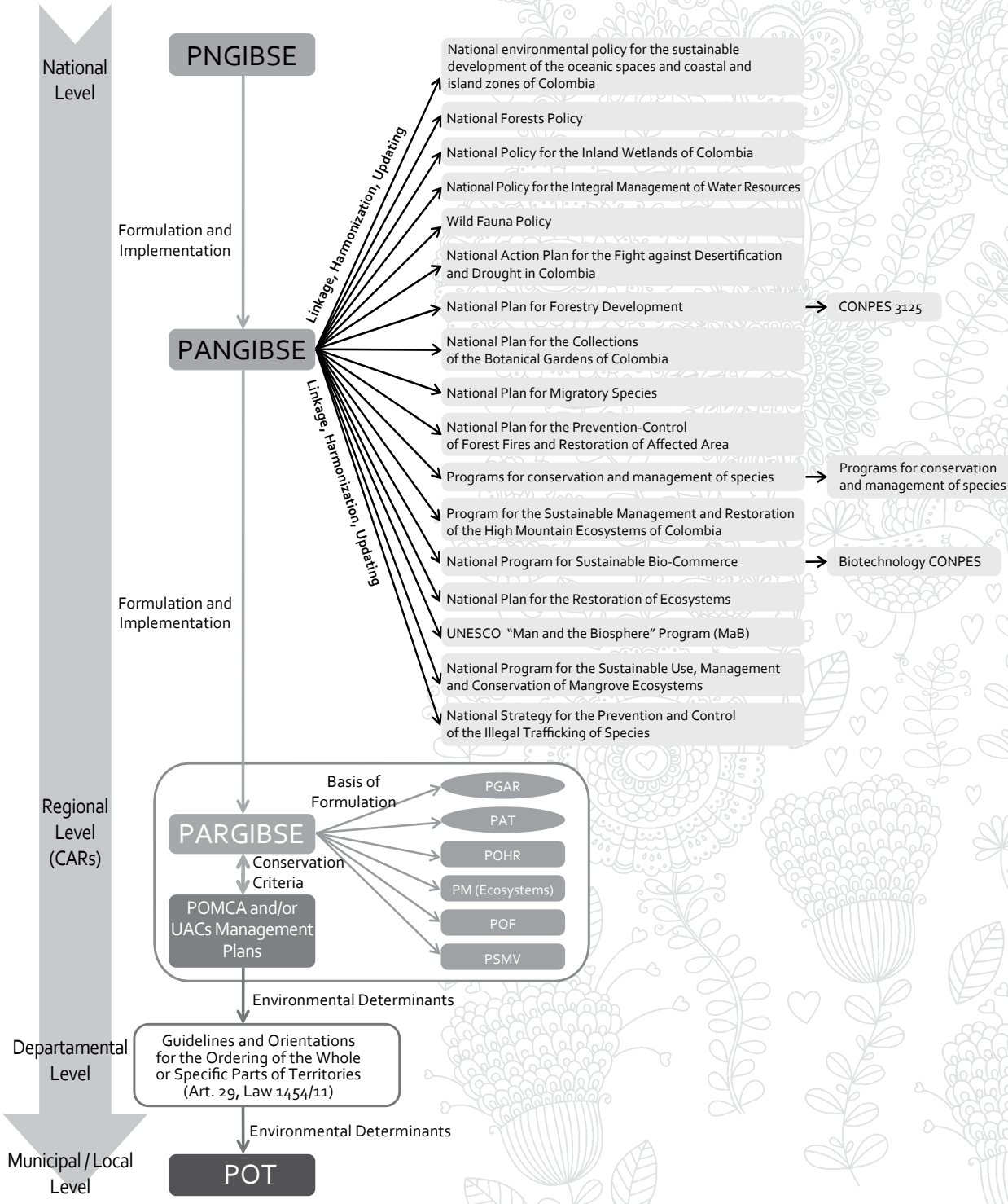

Figure 12. Diagram of the relationship of scale and linkage between the PNGIBSE and the PARGIBSE and the territorial management of the Autonomous Regional Corporations, Municipalities and Departments.

STRATEGIC DIAGNOSIS OF THE PROBLEMS ASSOCIATED WITH THE MANAGEMENT OF BIODIVERSITY

IDENTIFICATION OF FACTORS AND ANALYSIS OF THEIR RELATIONS

With the use of a problem-tree analysis (which led to the identification of loss and transformation as the main problems for biodiversity and its ecosystemic sevices in Colombia), along with inputs generated by and systematized through a participatory study undertaken with productive sectors, universities, environmental NGOs, ministries, regional environmental authorities, indigenous and Afro-Colombian communities and the civil society, plus the support of the German International Cooperation Agency, GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit), an exercise in identifying and establishing priorities for factors was carried out (that is, areas which take up and synthesize several of the sets of the problems on the problem tree), with the aim of identifying those which are most important in terms of their degree of influence on and interrelation with the other factors and which determine the trend and/or the current state of biodiversity and its ecosystemic services in Colombia. To develop this process, a mental map of problem sets was built, using the Frederic Vester Matrix (or "paper computer") and the Axial Scheme. The processing of the information was done through use of Mic Mac software, Version 6.1.2 – 2003 –2004.

The analysis of the relations between the identified factors allowed the study to establish the degree of influence of those located in the zones of power, work and linkage on the factors of the result and of the latter on each other (Figure 12) in a way that enabled these relations to guide the structuring of the strategic diagnosis and inspire the objectives and strategic lines of the policy. There follows a description of each of the zones of influence, the variables identified in each one and the current state of the problems associated with those factors in Colombia.

FACTORS OF THE ZONE OF POWER

These factors are characterized by being little dependent and strongly influential, which turns them into key factors (decisive in the system) for strengthening the PNGIBSE. Any action which is taken on these factors will have repercussions on the whole system (Figure 12). The factors found in this zone were:

ACCESS TO AND QUALITY OF INFORMATION AND KNOWLEDGE (ACIC)

The efforts which the country has taken to encourage Activities of Science, Technology and Innovation (ACTI) continue to be insufficient and concentrated in the big cities. For example, while Colombian investment in ACTI between 2000 and 2008 rose from 0.31% to 0.37% of the GDP, the average in Latin America and the Caribbean rose from 0.75% to 1.07% (Universia 2011). Nevertheless, the country currently has 351 research groups registered with Colciencias (the Colombian Institute of Sciences), which are working on subjects related to biological sciences, 254 working on subjects related to agricultural sciences and 138 biotechnology research groups. The latter are especially working on species of coffee, forage, cassava, sugar cane, roses and potatoes (De Peña 2008).

Additionally, there is an important group of journals specializing in dissemination, as well as other media which spread knowledge of biodiversity and its state. There stand out "Caldasia" (of the Institute of Natural Sciences – ICN), "Biota Colombiana" (IAvH, INVEMAR and the Missouri Botanical Garden) and the bulletin of the Colombian Academy of Exact, Physical and Natural Sciences. These three periodical publications published 80.7% of the 142 articles on flora between 1998 and 2008. Another journal important for scientific dissemination is "Pérez Arbelezia", published by the Bogotá Botanical Garden, as well as "Ornitología Colombiana", the first indexed scientific publication exclusively devoted to Colombian birds.

However, the number of such Colombian publications continues to be very low. According to the "Knowledge for Development" data base of the World Bank –K4D – (consulted 03/2011), the annual number of scientific articles published by Colombia in indexed magazine between 2003 and 2007 was 401.3 on average, while in countries like Mexico it was 3930.6 and in Germany 44, 181.4. The average number of articles in indexed publications per million inhabitants between 2003 and 2007 was 9.3 in Colombia, while it was 38.13 in Mexico and 535.7 in Germany (Ordúz-Medina 2010). Moreover, Colombia´s capacity for innovation on the level of invention is one of the lowest in the hemisphere, where the number of patent applications made by non-residents (for example, multinational companies which seek patenting in several countries at the same time) is considerably higher than the number of patent applications by Colombian residents (Ordoñez). Between 2003 and 2007, the average annual number of Colombian patents granted by the USPTO (The United States Patent and Trademark Office) was only 8.8, while the number of German patents was 10,477 and Korean patents, 5,433 (Ordúz-Medina 2010).

It turns out to be paradoxical that while the area of biodiversity is always present in the ACTI´s diagnoses, when it comes to developing strategy lines for policy tools, the inclusion and harmonization of priorities for research into biodiversity and its ecosystemic services disappear and their importance for improving competitiveness and aiding the productive transformation of the country (CONPES 3582 of 2009, Decree 2370 of 2009) is never made clear, nor its aid to sustainable development and the improvement of human welfare. In that manner, while current efforts in the field of access to and types and quality of information and knowledge have mostly focused on trying to characterize and understand the complex relationships at the heart of ecological systems, or between those and society (factors placed in the Results Zone – Figure 12), and without losing sight of the fact that knowledge of biodiversity which is useful for its preservation and sustainable use has considerably increased in the country, much of the information still does not manage to enter into decision-making in a way that would allow for improved management and meanwhile, biodiversity continues to diminish and degrade and be little valued by the civil society and the productive sectors. In this sense, although large advances have been made in the consolidation of the Biodiversity Information System (SIB), which is an integral part of the SIAC as an open network for access to information, in general its development has been oriented towards the environmental and academic sector, and it has not managed to position itself as a tool for or enter into decision-making about biodiversity, especially in other sectors.

This "broken bridge" between access to, kinds and quality of information and knowledge, on the one hand, and institutional management capacity, on the other, may be due, among other factors, to the fact that a large part of the information and knowledge which is produced appears in a wording, language and format that seems to be intended, almost exclusively, to satisfy the needs of the scientific community and thus is not adjusted to the needs and capacities of decision makers (Meijaard and Scheil 2007; Pendergast *et al.* 1999; Sayer 2009; Murcia and Kattan 2009; Mendoza *et al.* 2010). This situation is also partly responsible for the fact that the State continues to focus all its capacity on establishing, following and enforcing norms or in the worst case, continues to make a number of mistakes in implementation, due to a weak feedback from the system for managing knowledge headed by the research institutes of the SINA. To this situation is added the little recognition, in national, regional and local management, of other systems of knowledge, different to the scientific-academic kind, as valid sources which contribute to local actions for territorial planning, the conservation of biodiversity and its ecosystemic services and adaptation to environmental change.

In its efforts at an inventory and characterization of biodiversity, the country has been progressing, especially at the level of ecosystems and species (Chaves and Arango 1997, Chaves and Santamaría 2006, Romero and Ortiz 2008, IDEAM 2004, IDEAM and Institutes 2007, IAvH 2008, Rangel Ch. 1995, 1997, 2000, 2004, 2007a, 2007b, 2008, 2009, 2010a and 2010b, Maldonado *et al.* 2008, Etter 1998, Etter *et al.* 2008; Fandiño and Van Wijngaarden 2005, Rodríguez *et al.* 2006, Romero *et al.* 2004, Invemar 2007, Díaz *et al.* 2000, Díaz and Garzón 2006, SINCHI 2007, Villarreal *et al.* 2004, Maldonado *et al.* 2005, among others), although it still has a long way to go before the inventory can be regarded as complete. In the face of the enormous challenges represented by the advance of economic activities regarded as "engines of development" (DNP 2011) and the management

aimed at maintaining the resilience of socio-ecological systems (territories) in a manner that guarantees the conservation of biodiversity and its ecosystemic services, the elaboration of maps of ecosystems at detailed scales (1:100,000 up to 1:25, 000 or higher) is fundamental for the spatial management of biodiversity on all scales. It is also important to strengthen knowledge and information about the functional relations between the components of biodiversity, patterns of distribution, habitat use, the movement of species through the landscape and the potential thresholds of stability or change (Renjifo 1999, Mendoza et al. 2006, Numa et al. 2005, Renjifo 2001, among others). In the latter case, national experiences are still meager and are limited to some academic ones (Mendoza 2007). Likewise, the country knows very little about the supply of ecosystemic services (their intensity, magnitude, frequency and temporality) and the ecological processes and assemblages of species/ecosystems which support those services. The information gathered in the country during the processes of elaborating environmental impact studies (EIA) and Strategic Environmental Evaluations (EAE) is not compiled, validated and incorporated in a manner that would contribute to the process of making a national inventory of biodiversity.

By the same token, knowledge about the genetic and molecular patrimony of the nation, in terms of its potential for strategies for the use, preservation and restoration of biodiversity, is still limited, generally due to normative and cultural barriers to access to genetic material. This is the case with decision 391 of the CAN (1996). The knowledge required for the effective use of these kinds of resources in the country is limited, despite the fact that in this area there has been a significant advance in human capital, the establishment of laboratories specializing in genetic research and the creation and implementation of protocols for their study.

THE MANAGEMENT CAPACITY OF PUBLIC INSTITUTIONS (CGIP)

The management capacity of institutions shows strengths and weaknesses which have enabled them, on the one hand, to strengthen the positioning of the nation´s environmental concerns on the agendas of development, but evidences, on the other, an exacerbation of the drivers of loss and transformation, as well as expressions of different socio-environmental conflicts about the use of and access to resources, equitable distribution of benefits, incoherence of norms and environmental deficits left by productive activities, among others. Unfortunately, the management capacity of public institutions in Colombia is regarded as and oriented almost exclusively to a scheme of governability based on the creation of and compliance with norms, that is, a model based almost exclusively on command and control, which tries to confront the problems found in the Results Factors (Practices of Use and Management; State and Conservation, Use and Occupation of Territory) with the expectation of changing their behavior, without taking the real, underlying causes into account, which lie in other factors of the system (Zones of Power and Work) and productive sectorial activities (Figure 12). In terms of practices, the above has been causing a "divorce" between productive activities and the conservation of biodiversity and an increase in the risks associated with the loss of biodiversity and the supply of ecosystemic services.

Another aspect to be taken into consideration is the environmental institutions´ weak capacity to adapt to change: they take too long to respond to territorial (socio-ecosystemic) changes, so that their management seems to be slow, insufficiently flexible, and resistant to change and with a low capacity for innovation.

Additionally, the absence of systems of evaluation and follow-up in the different tools of environmental management (Table 2) prevents them from knowing, with scientific certainty, the extent to which the implementation of these tools has resulted in success or failure. This situation has also meant that there is very little progress in the implementation of many of the actions outlined in them. For example, despite the fact that the Regional Biodiversity Action Plans (PRABs) were the main tool designed for the implementation of the PNB (1996), most of the Autonomous Corporations did not come up with one. Nevertheless, these have been valuable exercises in biodiversity planning on a regional scale for the seven regions where the PRABs were formulated and implemented (Orinoco basin, southern Amazon, Nariño, Cauca Valley, Quindío, Córdoba and North Santander) and have enabled them not only to establish agreements among the actors but also define the actions which are a priority for the conservation of regional biodiversity. For example, the inter-institutional panel of the Orinoco region and the technical

committees of Nariño and the southern Amazon are entities which have been created to ensure the continuity of the processes of planning and action, and to commit the regional institutions to enter into a process of coordination crucial for the development of the Plans. In this sense, the PARBs are tools which have sought to guide the actions not only of the CARs but also all the actors responsible for actions in regional development, with the aim that this will be a continuous and sustainable process (Aldana). However, the PRABs which have been formulated are still weak, especially with regard to the mechanisms of follow-up and adjustment, where only in the Plans of Nariño and the southern Amazon do we see advances in the establishment of criteria for the selection of indicators, drafting of guiding questions and preliminary selection of some indicators (Aldana 2011).

In addition, although the ecosystemic approach[12] of the CBD is what guides the management of biodiversity in the country (Law 165 of 1994), in Colombia this management has not been focused on managing the resilience of territories (socio-ecosystems), but, on the contrary, has been especially focused on the declaration of certain zones as protected areas or areas of special management, which, while it is a strategy very important for conservation, only covers a portion of the territory where biodiversity is distributed and makes it difficult to attain an integral management of a heterogeneous mosaic of zones where every coverage and use of land supplies a number of ecosystemic services which contribute to territorial sustainability to a lesser or greater extent. More recently, initiatives which seek to incorporate criteria for the conservation of biodiversity into the heart of productive systems have been implemented in the country, through the use of ecological restoration and the implementation of tools for the management of the terrain (Rivera and Sinisterra 2006; Calle 2003; Lozano-Zambrano 2010; MAVDT 2008, among others), although there is still a need to go more deeply into the follow-up of the contributions made by these tools to the conservation of species and populations.

In the case of the conservation of transformed landscapes, the map of ecosystems (IDEAM and Institutes 2007) marks an advance, by recognizing them to be areas which shelter biodiversity -- an aspect which is not often taken into account in the areas of the national parks system (Franco *et al.* 2006) – and provide important ecosystemic services and thus support production. However, they need to be continually updated and refined into more detailed scales, for example: 1: 100,000 and higher.

In the area of *ex situ* conservation, while the country has advanced in the formation of the National Network of Colombian Botanical Gardens (which groups together 26 of the country´s botanical gardens and acts as an advisory council and consultative council for the government), the National Program of *ex situ* Conservation for Colombian Zoos and Aquariums and the creation of a System of Germplasm Banks for Food and Agriculture, the linkage between *in situ* and *ex situ* conservation actions remains very weak. In the area of *ex situ* conservation, most accessions to germplasm banks in the country are aimed at the genetic improvement of cultivated varieties. Thus, according to the FAO´s WIEWS system (2011), 30 germplasm banks are reported for Colombia, with 1253 reported species and 128, 319 reported accessions.

In the area of access to genetic resources, the management capacity of the institutions shows that we need to strengthen the activities and institutional framework surrounding the conservation of biological and genetic resources, their derivatives and the associated traditional knowledge, as well as create clear tools and mechanism which allow for and make practical the fair and equitable distribution of the benefits deriving from those resources. Thus, between 2004 and 2011 only 45 access contracts were signed, all for research purposes. This situation will have to be substantially improved, within the framework of Colombia´s implementation of the Nagoya Protocol of the CBD, which aims at "at sharing the benefits arising from the utilization of genetic resources in a fair and equitable way, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding, thereby contributing to the conservation of biological diversity and the sustainable use of its components". (CBD 2011).

With reference to the conservation of species, this has not been as successful as that of areas (ecosystems), although significant advances

12 The 12 principles of the ecosystemic approach are compiled and developed through the socio-ecosystemic approach of this policy, where the human being and his or her culture interact in an interdependent manner with ecological systems, constituting territories

have been shown, based on the adoption of policies for the management of wild fauna and flora. In that respect, the need to establish indicators for the follow-up of the situation of some endangered species stands out, through changes in the categories laid down in the Red Books of the country´s endangered species, always within an ecosystemic context which does not encourage an independent management of species. Despite advances in the identification of biological invasions, institutional efforts to manage and control the problem have been weak so far.

Furthermore, the management capacity of the institutions is frequently put to the test, due to the incoherent management of the themes of international conventions and agreements, since international negotiations on such themes, many of which have aspects in common (desertification, climate change, biodiversity, forests), are carried out in a disorganized way and the matters agreed on in one convention rarely serve as a basis for defining the country´s positions in negotiations of other international conventions and scenarios. This disorganized approach to such subjects often limits the country´s capacity to define and focus its needs for international cooperation for the conservation of biodiversity and its ecosystemic services. What is more, management of the conservation of the trans-frontier biodiversity shared with neighboring countries or the region can only be worked out in the Andean Community (CAN) or the Amazonian Cooperation Treaty Organization (OTCA) at the present time. Taking into account that the Colombian Andes is the source of most of the main tributaries of important rivers like the Amazon and Orinoco, there is a need to strengthen joint international actions with neighboring countries aimed at the conservation of ecosystems strategic for the region, such as the *páramos* (high Andean moors), mist forests, savannas and humid tropical forests.

Finally, it is necessary to underline the importance of exerting an influence on the management capacity of the institutions as an input variable which may have repercussions on the improvement of social valuation, as well as the activities undertaken in the territory to maintain and improve the state of biodiversity. It will be very difficult for the system to improve, measured in terms of the performance of the variables in the Result Zone (Figure 12), so long as management capacity is not applied in an integral and co-responsible manner.

AVAILABILITY OF AND CRITERIA FOR THE ALLOCATION OF FINANCIAL RESOURCES (DCARF)

The analysis of the factors showed that the State does not destine sufficient economic resources for the management of the public institutions directly responsible for environmental policy and the management of biodiversity. The financial resources allocated by the State are mainly concentrated on strengthening and developing economic and sectorial policies which promote activities like mining, energy development, agriculture and infrastructure, among others, enabling these sectors to be strengthened, often to the detriment of the ecological basis of the territories. Nevertheless, the insufficiency of financial resources for the conservation of biodiversity and its ecosystemic services may be worsened by the deficient assigning of priorities for and channeling of resources into investment, which strengthens the feeling, among the actors associated with environmental management, that the resources are too meager to produce an important positive effect on the Result Factors (Figure 12). Additionally, this financial allocation does not take into account the valuation that society might make of biodiversity, with the aim of establishing priorities, an aspect which encourages a situation where the sectors which make use of biodiversity still do not measure its strategic value, nor integrate this value into their processes for planning, production, management and allocation of resources.

In numerical terms, the main contribution to the financing of environmental management has been that of the different national sources --the national government, the regional and municipal environmental authorities and the territorial entities – which represents a little more than 90% of the country´s spending in this field of policy in the past decade. Spending on the functioning of and investment in State environmental agencies between 2002 and 2008p, seen in terms of government spending on environmental protection (GPA), rose from 3.394 billion pesos in 2000 to 6.436 billion pesos in 2007, which means that it rose from 0.33% of the GDP in 2000 to 0.42% in 2007 (DANE 2010). In addition, total public spending (current and investment) on environmental protection in Colombia rose from 695.237 billion pesos in 2000 to 1, 791.183 billion in 2007 (DANE 2010). However, Colombian public spending on the environment continues to fall below international standards; for example, environ-

mental spending represents 1% of the GDP in Mexico and Brazil. Nevertheless, with the new allocation of resources from the National Royalties Fund (10%) to finance projects of science, technology and innovation, the country´s investment in these areas may rise and come very close to 1% of the national GDP.

In Colombia environmental investment between 2006-2010 represented 12% of the resources allocated by the Nation´s General Budget (PGN) to the sector of Environment, Housing and Territorial Development, now the sector of Environment and Sustainable Development (MAVDT 2010c). Total environmental investments for the period were 579.786 billion pesos, having risen from an investment of 76.512 billion in 2006 to 146.244 billion in 2010. In this sense, the effort to protect the environment is ever more strong, insofar as regional and local bodies work at it too, which implies diverse imbalances in their capacities of response, in a context of decentralization and autonomy but with strong budget restrictions on all levels of government and complex dynamics in the reconstitution of territoriality and regional development in the country (Galán and Canal 2002).

The budget allocated by the Nation to research institutes affiliated and linked with the MADS were 112.387 billion pesos between 2006 and 2010 (rising from 14.945 billion in 2006 to 29.248 billion in 2010), which means that total investments in the management of these Institutes in the quadrennial period were 246.453 billion pesos (MAVDT 2010c). In the case of the National Parks Unit (UAESPNN), the total budget for the quadrennium represented a 50% increase, rising from 20.015 billion to 46.821 billion, while the investment budget tripled during the same period, rising from 9.425 billion to 30.278 billion pesos (MAVDT). 3.9 trillion pesos were administered by the Autonomous Regional Corporations between 2007 and 2010. 78% of these resources ($3.1 trillion) were destined for investment programs, with an emphasis on the prevention and control of environmental degradation, strengthening of the SINA in the areas of environmental governability and environmental planning for territorial management (MAVDT 2010c).

Other sources of environmental financing are the National Royalties Fund (FNR) and the Environmental Compensation Fund (FCA). In the first case, the resources allocated to the environmental sector have considerably risen since 2006, going from 246 million pesos to $103.513 billion pesos in 2010. However, most of the resources are focused on coastal protection (6 projects, valued at 47.639 billion pesos, corresponding to 46% of the resources of the FNR) and reforestation projects (52 projects, valued at 33.297 billion pesos, corresponding to 32.2%). Areas like strategic ecosystems, territorial ordering and desertification only received 9.9%, 5.8% and 0.8%, respectively of these resources (MAVDT). The FCA, as a system of redistribution which has allowed for the financial strengthening of the 15 Corporations with small resources, had a budget allocation of $139.712 billion pesos between 2006 and 2010, which were assigned to expenses of functioning (31.264 billion pesos – 24%) and financing 383 projects in 18 Corporations at a cost of 108.737 billions (228 of them Sustainable Development projects and 155 Autonomous Regional ones) (MAVDT 2010c).

In the case of the municipalities, the main resources which they administer that are destined for environmental spending come from the 3% surcharge on the gross earnings of hydroelectricity plants and 1.5% of the gross earnings of thermoelectricity plants. 1% of the municipalities´ current income goes on the purchase and improvement of properties to protect micro-river basins which supply municipal aqueducts (Art. 111, Law 99/93, modified by Art. 210 of Law 1450 of 2011).

With regard to the latter, Rudas (2010) reports that the investment by 447 municipalities and 7 departments, for which information is available on the implementation of the norm since it was established 15 years ago, has had an approximate value of 159 billion pesos (at their current value), whereas if these territorial entities had fully complied with their legal obligation in this matter, the investments should have been 1,27 trillion pesos. That is, these territorial entities only invested 0.12% of their total incomes, according to the available information, as opposed to the 1% laid down by the law (Rudas 2010). With regard to transferences from the electricity sector, they rose to 382.433,4 billion between 2005 and 2009, while the earnings from charging the retributive tax and the tax on water use was 245.567,1 billion pesos and 60.851,8 billion, respectively.

In Colombia one of the most important sources of resources to support the management of

biodiversity conservation is international cooperation. In that regard, the Netherlands, Germany, the European Union (through NGOs), the United States (NGOs) and Finland (through the CAN) appear as the country´s most important collaborators in this field in recent years. As of April 2011, the country had 26 such environmental projects in operation, located in 24 departments, with a value of 54,647,526 U.S. dollars, corresponding to 7.36% of total cooperation (Acción Social 2011). Among the most outstanding expressions of this cooperation in recent years we find the Program for Sectorial Focus of the Embassy of the Netherlands, aimed at strengthening the SINA (at a value of $43.2 billion pesos between 2007 and 2010) in such important areas as environmental planning for territorial management; the integrated management of water resources; knowledge, conservation and use of biodiversity; the promotion of competitive and sustainable processes, and the prevention and control of environmental degradation.

In addition, the Global Environment Fund (FMAM –GEF), which was created to grant donations to developing countries for the realization of projects which benefit the global environment, promote the establishment of sustainable means of life in local communities and support the implementation of the CBD, UNCCD, UNFCCC conventions and the Stockholm Convention on Persistent Organic Pollutants (POPs) has, since 2002, co-financed a total of 29 projects in Colombia, with a total contribution of 100, 245, 929 US dollars. The focal area most represented has been biodiversity, with 19 projects, which received a total contribution from the Fund of $77,339,029 dollars, with national counterpart funds on the order of $123,872,642 dollars.

ECONOMIC AND SECTORIAL POLICIES (PES)

In the relationship between environmental policies and sectorial policies there has been a "breach of practice" between activities for the progress and development of the productive and extractive sectors, on the one hand, and activities for the conservation of biodiversity and its ecosystemic services, on the other. In that sense, the annual report on the "State of Natural Resources and the Environment" (2008) of the General Comptroller´s Office (Contraloría General de la República) points to the reduction of and low budget for the agriculture/stock-rearing sector, which fell from 0.691% (5.762 billion pesos) of environmental spending in 2006 to 0.37% (5.241.7 billion pesos) in 2007. It likewise speaks of the profound deficiencies of the agriculture/stock-rearing sector in establishing indicators that would allow it to determine the state of natural resources and agro-ecosystems. Nevertheless, this report singles out Corpoica´s advances in the development of projects which benefit biodiversity, among them 38 undertaken between 2007-2008, which include agro-forestry, slvopastoral ones, the integral management of soils and water, bio-physical processes, germplasm banks and the integrated management of pests (CGR 2008).

The perception that biodiversity is an obstacle to development, or a "luxury" which must only be considered when the country´s economic growth permits it, is still evident in persons and sectors in Colombia, instead of recognizing that, as the provider of ecosystemic services, it is the essential foundation of productive and extractive activities. In that sense, strategies for recognizing the importance of biodiversity and positioning it in the productive and consumer sectors of society continue to be mainly based on ethical beliefs and/or personal convictions instead of functional and strategic quantitative and qualitative arguments that would provide evidence for its contribution to the economic and social welfare of the country.

In the areas of sectorial planning and territorial ordering, although some advances have been made in the zoning of current land uses, the determination of areas apt for a given productive activity and the identification of the conflicts associated with use, the efforts are still meager and only limited to a few sectors. For example, in 2002 the IGAC and Corpoica published a "Map of Conflicts on Land Use", using as a criterion for analysis the "*over- and sub-utilization of soils*" (IGAC and Corpoica 2002 a and b). These conflicts, however, are defined under agrological criteria, which partly regard the ecological dynamic as a planning criterion, which means that the "Map of the Ecosystems of Colombia" (IDEAM 2007) is not compatible with this effort. In addition, for the palm-growing sector, a map of areas apt for palm cultivation was made, using socio-environmental, productive and economic factors which facilitated the identification of areas of the country that are suitable for the development of these productive activities (IAvH, WWF, Fedepalma, Cenipalma, IGAC and IDEAM). In the hydrocarbons sector, the IAvH has provided an accompaniment for the ANH in the identification of

conservation and zoning areas, based on criteria like the sensitivity and vulnerability of terrestrial and marine areas of interest for the exploration and exploitation of hydrocarbons. These kinds of initiatives should be applied to other sectors and productive activities, since they are a valuable input for territorial planning and harmonize conservation and production in specific territories and thus guide the processes of sectorial planning and territorial ordering aimed at the maintenance of ecosystemic services.

Related to above is the fact that efforts to incorporate criteria and actions for the conservation of biodiversity into the heart of productive systems, especially those which are known as "engines" of development (DNP 2011), are still meager and are limited to the development of specific projects, generally led by the environmental sector or international cooperation. In that regard, we still lack a real understanding of the problem associated with the loss and transformation of biodiversity and its ecosystemic services that would allow for the promotion of initiatives fitted to the different sectors in order to reduce their vulnerability to a shortage of the key ecosystemic services which uphold their activities. Among the initiatives which have been successful, a mention might be made, for example, of the projects co-financed with resources from the Global Environment Fund (FMAM/GEF), which have promoted strategies for the environmental planning of territories and include actions within private properties, with the aim of conserving and sustainably using biodiversity, taking into account the needs and interests of the population and the potentials of the territory (IAvH 2006). Other experiences undertaken through the GEF directly involve the trade bodies of the productive sectors, as co-implementers of the project, as in the case of Fedepalma, Fedecafé and Fedegan. The implementation of silvopastoral systems in which the latter has cooperated has shown its economic advantages for cattle production: it has improved dairy and meat production and per hectare cattle load, and reduced soil loss and the use of herbicides, among other indicators (BM 2010). In all of these projects the design and implementation of Landscape Management Tools (HMP) stands out (Lozano-Zambrano). These tools enable regional productive systems to be compatible with the conservation of biodiversity and its ecosystemic services. In the case of the Natural National Parks, the encouragement given to Sustainable Systems for Conservation (SSC) has led to its influencing the processes of ordering the territory, so that impacts within the park are minimized and pressures on biodiversity found in the protected areas are reduced. This SSC strategy has allowed for the direct involvement in conservation activities in Colombian national parks of nearly 1400 families which belong to ethnic and peasant-farmer groups.

In the area of environmental licensing, between 2002 and 2011, 590 environmental licenses were granted to projects in the electricity, hydrocarbons, infrastructure, mining and special projects sectors (ANLA 2012). The creation of the new National Environment Licenses Agency (ANLA) as a special administrative unit shows the need to strengthen the technical capacity for supporting the licensing processes and at the same time signifies a change in the administrative procedures and management of environmental permits and licenses due to its sharing of functions with the MADS[13].

In addition, with the aim of mitigating the impacts and effects on biodiversity of the productive sectors, several management tools have been developed, among which are found environmental impact studies (EIA) and more recently and with a scope that is important for the country, the strategic environmental evaluations (EAE). The EAEs have been promoted by the MADS, as a tool for sectorial planning aimed at the prevention of the risks and effects of public and private policies, plans and programs (Amaya and Bonilla 2007; MAVDT- TAU 2008). The EAEs are still not a juridical requirement. However, some of their principles have been applied since 1990 and entities like the DNP and MADS, with the support of the World Bank, have worked to develop them with strategic sectors (González and Palacios 2007).

As for environmental indemnifications for biodiversity loss, the MADS, along with the TNC, WWF and Conservation International have designed a scheme for the incorporation of environmental and biodiversity factors into the cycle of decision-making in the planning and development of sectorial megaprojects in Colombia, which includes a proposal for mechanisms to assess and award environmental

13 Processes like the ending of the protection of certain parts of the areas of forest reserves established in Law 2, the lifting of bans and permits for access to genetic and CITES resources, continue to be the responsibility of the MADS

indemnifications associated with licensing activities in the country and aimed at sectorial megaprojects. While pilot programs (in coal and gold mining, road infrastructure, hydrocarbons and ports) have been implemented, this new scheme is still very provisional and its effectiveness has still not been evaluated.

EFFECTIVENESS OF THE PLANNING TOOLS (EIP)

In planning and territorial ordering, Colombia bases its work on a conceptual and practical differentiation between the territorial ordering – OT (Law 388 of 1997) and the environmental ordering of territory – OAT – (Law 99 of 1993, Art. 5 and 7), which has made territorial management confusing in that it gives the impression that the subjects associated with biodiversity should be ordered separately from the process of ordering and defining land uses in a given municipality. Thus, the OAT is almost invisible on local scales and the guidelines which the central government has laid down for its realization by the regional environmental authorities are not sufficient. In this sense, it is very important that we rise above this division towards an integration of the concepts of biodiversity (an environmental concern) and territorial ordering, so that territories are understood to be adaptive, resilient and complex socio-ecosystems, with their own structure and functioning, which provide a number of ecosystemic services and put the culture or cultures which develop there into context.

In the case of marine and coastal areas, the OAT drafted by the PNAOCI proposes the establishment of Integral Units of Planning and Territorial Environmental Ordering to guide the planning of the integral development of the coastal zone (Pacific coast, Caribbean and Caribbean islands) and, within these 12 Environmental Units, the establishment of some of a coastal and others of an oceanic nature –UAC – which, taken as a whole, would cover oceanic areas and the National Coastal Zone. However, to date none of these UACs has a management plan.

Additionally, the country is still not clear about what the environmental determinants of ordering (Law 388/93, Art. 10) should be. As things currently stand, in some cases each of the CARs and AAUs has chosen its own environmental guidelines of ordering as determinants, a situation which worsens the confusion about their identification and implementation. Thus, for example and despite being included as an environmental determinant in the processes of territorial ordering by Decree 3600 of 2007, at the current time the definition and implementation of a national ecological structure[14] has not gone beyond conceptual developments (van der Hammen and Andrade 2003; Márquez and Valenzuela 2008). Currently, there have been few exercises in this on a regional scale in the country and in every case they follow different guidelines, in accordance with the institution which identifies and implements it (IAvH 2008; Remolina 2010).

The Capital Region (Bogotá-Cundinamarca), for example, has achieved some interesting advances in defining a regional ecological structure that would be the axis to integrate and guide the ordering of the municipalities it embraces. In Bogotá, the Main Ecological Structure of the Capital District (EED) was defined in Decree 190 of 2004 (Art. 17) as "*the system of areas and corridors which guarantee the generation, protection and connectivity of ecological processes and environmental services throughout the urban and rural territory*". The EED, the structuring axis of the Bogotá POT, is included in the area of protective lands (Decree 462 of 2008) and is made up of the System of Protected Areas of the Capital District; the urban parks; the ecological corridors; the Special Management Area of the River Bogotá; the eastern ridges (*cerros orientales*) and the waters system. Following the example of Bogotá, other municipalities near the Capital have defined and incorporated their Ecological Structures into their ordering plans, as in the case of Sopó, Gachancipá, Cajicá, El Rosal, Fusagasugá, Facatativá and Cabrera (Remolina 2010). Additionally, Medellín is starting to define its main ecological structure as well.

In recent years, as was mentioned above, advances have been made in taking biodiversity into account in the ordering and planning processes of some productive sectors. However, there are no studies which evaluate the "trade offs" (page 41) between conservation and production in the maintenance of ecosystemic services in a manner that would enable

14 The Main Ecological Structure is defined as "the group of biotic and abiotic elements which support the essential ecological processes of the territory, whose main aim is the preservation, conservation, restoration, use and sustainable management of renewable natural resources which provide the capacity to support the socio-economic development of the populations" (Decree 3600 of 2002).

us to guide the making of decisions about territorial intervention and transformation and ensure the resilience of socio-ecosystems (territories).

In addition, while the country has made significant progress in consolidating its National System of Protected Areas (SINAP) (CONPES 3680 of 2010, Decree 2372 of 2010), the representation of ecosystems in and financial sustainability of the SINAP are still not guaranteed. In that respect, the country has established a portfolio of conservation priorities which identify nearly 40 million hectares as a priority, on the basis of 33 studies of conservation priorities undertaken on different scales which seek to determine strategic sites for the SINAP and have achieved an increasingly better representation of the ecosystems which characterize the country and make up its national natural patrimony. Moreover, the ordering and environmental zoning of Forest Reserves laid down in Law 2 of 1959 has advanced in six of them (Cocuy, Motilones, Magdalena, the Central zone and, in part, the Pacific and the Amazon). In the latter two, along with the Sierra Nevada de Santa Marta, the process will have been finished in early 2012. Finally, through the processes for delimiting the *páramos* and wetlands and the demarcation of wetlands, the MADS seeks to define the precise borders of these strategic ecosystems and thus protect them from the ecosystemic transformation linked to productive and extractive activities. To date the work of mapping the country´s *páramos* has advanced to a scale of 1:100,000, with three windows of 1:25,000 (Santurbán, Pisba, Rabanal). In the case of the wetlands, work is being done on the regulation of Article 202 of Law 1450 of 2011, while the process of delimitation and demarcation is linked to the drafting of the respective POMCAs. All of these processes must be regarded as aspects which integrate and are fundamental to the process for the ecological structuring of territory which the MADS is currently carrying out, with the support of the research institutes of the SINA and the UAESPNN.

In addition, the forestry ordering of the natural forests of Colombia (with a total of 61,246,659 hectares) has advanced in the formulation of Forestry Ordering Plans in the jurisdiction of 17 corporations which cover an area of 42, 178,019 hectares, of which 6,858,435 hectares have been adopted by means of administrative acts by the CARs.

FACTORS OF THE WORK ZONE

These are the factors which play an important (key) part in the system, which is why they must be taken note of in any action. They have a strong influence and at the same time are strongly dependent, which gives them a great deal of instability. The decisions which are taken about these factors will have to be analyzed with great care in order to achieve the desired effects with regard to the GIBSE (Figure 12).

VALUATION OF BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES FOR ECONOMIC DEVELOPMENT (VBD&SEDE)

In general terms, the social and sectorial actors do not regard Colombian biodiversity as a public value. This has meant that they have not understood the co-responsibility which allows conservation actions to be undertaken by all the actors who, in a direct or indirect way, are associated with the management of biodiversity, and not just the environmental sector. This situation, in which each of the actors associated with biodiversity assumes the role which corresponds to him in the GIBSE, is intended to ensure the resilience of the socio-ecosystemic systems in maintaining and improving the supply of ecosystemic services while they use the different territories. In other words, to help the country significantly advance towards sustainable development. On the contrary, biodiversity is currently perceived as a public good, which easily leads Colombian biodiversity into the dilemma known as the "tragedy of the commons" (Hardin 1968), that is, when various actors or individuals, motivated only by personal interest and acting in an independent but rational manner, wind up destroying a shared and limited resource, even though the occurrence of such destruction does not suit any of them, whether as individuals or as a group (Hardin op. cit.). This situation has led to the worsening, in the country, of the different drivers of the transformation and loss of biodiversity, which has gone beyond the thresholds of many territories and heightened, for example, the problems of environmental deficits and social and sectorial vulnerability to the loss of ecosystemic services.

Therefore, it is necessary that the management of biodiversity give priority to, among other actions, the social appropriation of biodiversity, through participation, co-responsibility and governance, so that the relations among actors are strengthened and there

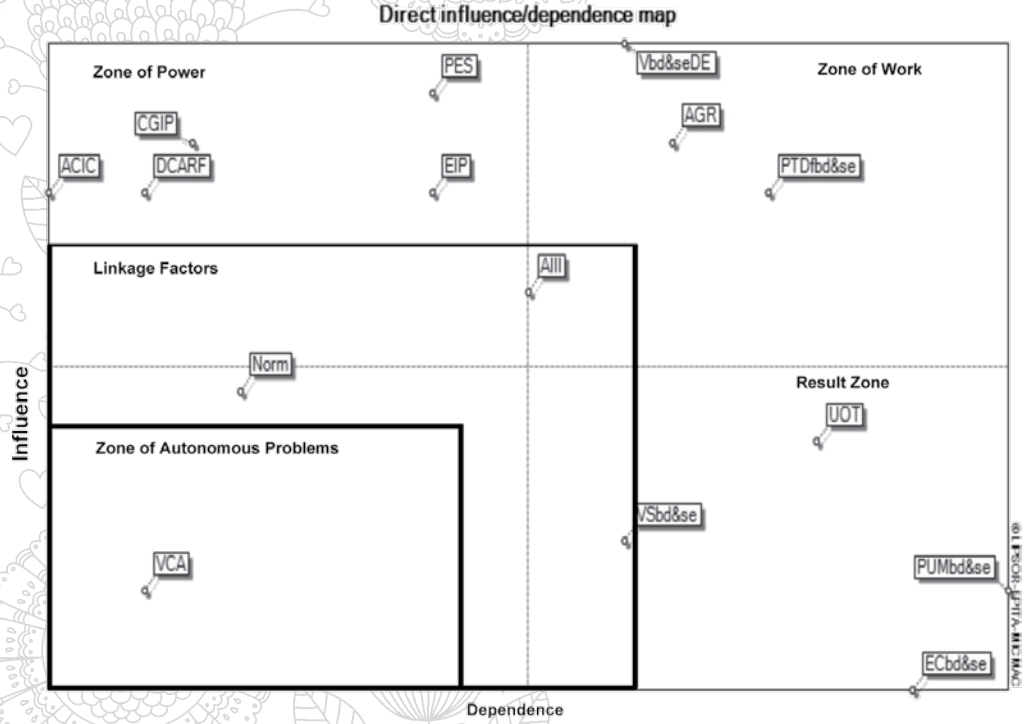

Figure 12. Results of the axial scheme analysis of the influence of the chosen factors on each other. The factors located in the Power zone are: Access to and quality of information and knowledge (ACIC), Management Capacity of the public institutions (CGIP), Availability and criteria for the allocation of financial resources (DCARF), Economic and sectorial policies (PES) and Effectiveness of the planning instruments (EIP). In the zone of work are found: Valuation of Biodiversity and its ecosystemic services for economic development (Vbd&seDE), Analysis and management of risk (AGR) and Participation in decision-making about biodiversity and its ecosystemic services (PTDfbd&se). The Willingness and commitment of the actors factor (VCA) is found in the zone of autonomous problems. The factors of the Use and occupation of territory (UOT), Practices of the use and management of Biodiversity and its ecosystemic services (PUMbd&se) and the State and conservation of Biodiversity are found in the Result zone. Finally, the factors of Intra- and inter-institutional linkage (AIII), Norms (Norm) and the Social Valuation of Biodiversity and its ecosystemic services (VSbd&se) are found in the linkage zone.

is an optimization of the capacity of response, juridical security, social responsibility and the derivative and collateral benefits which result from its conservation, and thus effectively contribute to the objectives of reducing inequality and poverty (Kelly and Muers 2003).

Closely related to the above is the need to valuate Colombian biodiversity by using the different available methods and mechanisms that will guarantee an integral valuation. In this respect, although economic valuation is the one with the most force in the country, it must used as a tool which, in combination with other ones, will enable it to begin to improve society´s perception, valuation and knowledge of the existence of biodiversity and its ecosystemic services per se as guarantees of human welfare. In this regard, Colombia has undertaken several pilot exercises in the economic valuation of biodiversity, although in the great majority of cases their results have not been substantially employed in guiding decision-making about the conservation of biodiversity. In addition, the work of non-economic valuation is still very incipient and in fact, this type of approach is rarely taken into consideration in the planning of valuation exercises.

As for advances in areas related to the valuation of biodiversity and its ecosystemic services as a fundamental part of the development of the country´s productive activities, it is worth underlining the process of establishing a promising inter-sectorial dialogue, especially with the trade bodies in agriculture/stock-rearing and certain energy subsectors (electricity generation and transmission, and hydrocarbons). A good example of this are the Interministerial Agendas which have been signed since 1999 and are conceived of as working agreements

between the MADS and other Ministries to promote an inter-institutional environmental management through mechanisms of coordination on a national level. These agendas have included subjects related to the management of biodiversity that are the responsibility of each sector and have been identified as priorities for inter-institutional coordination. In the framework of these agreements, the involved public and private entities have been developing joint and coordinated actions which have contributed to the continual improvement of environmental management in these sectors (MAVDT 2008).

In addition, in recent years, important economic stimuli for environmental investment by the private sector have been developed. Tax benefits are tools aimed at the protection of biodiversity, while at the same time they promote economic growth, technological innovation and competitiveness. These benefits constitute an important variable in companies´ decisions, since they allow them to reduce the initial cost of investment in cleaner production and the monitoring and control of contamination. There have been important advances in consolidating the legal framework for economic incentives in the country, by means of which it seeks to conserve biodiversity and guarantee the provision of ecosystemic services. Among these incentives is found the forestry incentive certificate (CIF) for reforestation and conservation, which was created by Law 139 of 1994 and represents the State´s acknowledgment of external social and environmental factors that are positive for reforestation and the maintenance of natural forests. The reforestation CIF, which seeks to encourage investment in new protective-productive plantations, has increased its budget in recent years, which has risen from 5 billion pesos in 2003 to 35 billion pesos in 2008 (MADR). Nevertheless, in the case of the conservation CIF, which recognizes the direct and indirect costs a landowner will incur for the conservation of natural forests on his property, the measure has still not been implemented, despite having been regulated under Decree 900 of 1997. In addition, there are other tax exemptions on the earnings from the exploitation of new forestry plantations and the renovation of plantations of timber trees (Decree 2755 of 2003).

Other incentives developed in recent years are twenty-year tax exemptions on the earnings from ecotourism services (Decree 2755 of 2003), which also have a tax incentive created by Law 788 of 2002. Equally, there are exemptions on the sale of electricity generated on the basis of wind resources, biomass or agricultural wastes (Decree 2755 of 2003) and deductions for investments in the control and improvement of the environment (Decree 3172 of 2003).

Between 2002 and 2007 investments in environmental certificates by the MAVDT (now MADS) in the form of exclusions from VAT and tax deductions amounted to more than 151 billion pesos and promoted investments of nearly 480 billion pesos in environmental areas, the past three years being the most dynamic. Between 2005 and 2007, the value of the incentives granted to 272 companies amounted to investments of 307 billion pesos. Likewise, a growth in environmental investments motivated by tax benefits rose, from 80.870 billion pesos in 2005 to 116.750 billion in 2007 (MAVDT).

Despite the above, it is worth mentioning that while the country has set into motion incentives to support agriculture/stock-rearing and mining producers, as a stimulus to investment in those sectors, it should be taken into account that their exclusive aim is to increase productivity and expand planted or exploited areas, without considering such aspects as the conservation of biodiversity (heterogeneity, wealth, endemisms, among others). In that regard, tools like the Incentive for Rural Capitalization (ICR)[15], for slow-yielding crops, may encourage both current producers and new investors to increase the areas of palm-oil plantations and thus replace vegetal covers as different as the humid tropical forest and pastures (IAvH 2000). Other incentives harmful to the conservation of biodiversity are related to the use of pest-killers and other agrochemicals in the agricultural/stock-rearing sector (PNUD-NCSA, 2010). A further problem is the lack of tools to, for example, discourage the use of mercury in gold mining or to promote the grouping together of small miners who exploit subterranean or alluvial deposits (IASvH 2000).

Among other developments in the field of incentives in the country is the advance in the certification of products under standards of quality. In that regard, Colombia has been advancing towards more integral certifications, which take into account

15 The ICR writes off up to 40% of the loans granted by FINAGRO to agricultural/stock-rearing producers, depending on the kind of producer.

not only the product but also the social and environmental systems involved in its production. For example, the country has the Colombian Environmental Seal, the Single National Seal for Ecological Food (MADR 2007) and the Rainforest Alliance Certificate, among others. Nevertheless, despite the advances made, the IAvH points to some important gaps in this field, among them, that the opportunities created in different national, regional and international markets have not been sufficiently taken advantage of; production on too small a scale; deficient quality, the lack of business and management capacities; a shortage of information about markets and the high costs of certifying the sustainability of production.

In the development of payment schemes for ecosystemic or environmental services (PSE or PSA), some of the cases developed under this scheme in the country do not meet all of the criteria which define this mechanism. For example, in the case of CIPAV, it is the project and not the beneficiaries who pay the supplier for the provided service, which threatens the sustainability of the tool over time. An opposite case, in the basin of the Río Cane-Iguaque, are the beneficiaries who pay the suppliers for the maintenance of the quality of water (Blanco *et al.* 2007). The long-term nature of these kinds of tools has allowed for the adjustment of aspects related to fairness and methods which facilitate an analysis of whether or not the services which are paid for are in fact supplied, as well as if the activity for which the incentive is given is the one which makes possible the supply of the service. It is very important that the spectrum of ecosystemic services considered for the PSE be widened, since the emphasis has mostly been on ecosystemic services related to water.

ANALYSIS AND MANAGEMENT OF RISK (AGR)

From the standpoint of risks, biodiversity has become a theat to the human communities of the country, because the single or combined action of the drivers of transformation and loss – environmental change (Table 7) – alter the intensity, magnitude and frequency of ecosystemic services and affect human well-being in such aspects as: an increase in mortality and morbidity; reduction of alimentary security; increased vulnerability to landslides, floods and droughts; a reduction of the sustainability of production and with it, impacts on the national economy and competitiveness; a reduction of the supply of raw materials; an increase in conflicts over access to and the use of natural resources, among many other problems. In that regard, the institutional framework for the prevention and management of natural risks in Colombia should recognize the importance of incorporating the analysis of vulnerabilities related to environmental change at different scales (national, regional, local and trans-frontier), so that measures for the mitigation of and adaptation to the phenomena caused by this may be created.

The management of risk may be a key factor in intra- and inter-institutional and inter-sectorial linkage and the mobilization of management within economic and sectorial policies to confront the risks associated with environmental change and thus reduce the social and sectorial vulnerability associated with the deterioration of biodiversity and its ecosystemic services. In the current situation, the country falls short of this approach. The response which has been given to the loss of ecosystemic services seems slow, because, while the system recognizes the effect which risk management has on the linkage of economic and sectorial policies, the effect of the respective feedback has not been seen. This illustrates how the public and private sectors´ efforts at dealing with the risks associated with their activities are still incipient and the few efforts that have been made are only focused on some areas, like, for example, Climate Change and deforestation, and ignore the risks associated with the shortage of ecosystemic services caused by other engines of transformation and loss, like the fragmentation and degradation of ecosystems (especially non-forest ones); biological invasions; contamination and over-exploitation.

Among the weaknesses seen in this field is that the processes responsible for biodiversity loss in Colombia are still not clearly recognized and as a result strategies for action are not set forth with more certainty. This limitation may be the result of the lack of technical capacity and information on the part of the environmental authorities, the weak functionality or complementarity of environmental and sectorial policies, the generalized lack of attention paid to the relationships between biodiversity and social groups or the poor understanding of critical ecosystemic processes. We may equally regard as insufficient the methods and capacities of those responsible for dealing with, regulating and overseeing these processes of the alteration and degradation of biodiversity and its

ecosystemic services. For example, the biodiversity associated with marine and fluvial ecosystems has been gravely deteriorated by contamination, over-exploitation and the construction of macro-projects. In addition, the country has no knowledge of the risks to native biodiversity associated with the introduction-liberation of Modified Live Organisms (OVM). This aspect represents the current limit of the country´s environmental management capacity and is evident in the growing social and economic costs of natural disasters in the face of which it does not have integrated risk management strategies to avoid unwanted effects on the quality of life and welfare of the whole of Colombian society.

Additionally, the integrated management of environmental risk (Wilches – Chaux 2006) is deficient in the country and shows a failure to tie risk management to Territorial Ordering Plans. By the same token, the subject of biodiversity conservation should be included in risk management policies and in the national implementation of the Hyogo Action Plan (SIGPAD) in a way that makes clear how biodiversity loss has an influence on increasing the vulnerability of territories and communities to natural disasters.

Thus, the country continues to register an alarming reduction and deterioration of ecosystemic services due to the loss of biodiversity and the transformation of ecosystems, which are replaced by production systems that are little sustainable and guided by criteria of efficiency aimed at meeting very short term human needs or simply to produce earnings. This failure to include fundamental considerations of biodiversity in the decisions of all the productive sectors and the development of infrastructure and macro-projects is a grave and still unrecognized threat, as a factor that affects the apparatus of production and the national economy.

Finally, in the face of the increased consequences of environmental change, the country must analyze the possibility of creating, along with private enterprise, mechanisms and tools for the transference of the risk associated with the shortage of ecosystemic services caused by the action of the drivers of the transformation and loss of biodiversity (Table 7). In this way, the State will not be left with the sole responsibility for assuming the costs associated with the resulting impacts. As follows, we present some evidences of the actions of the different drivers in the country:

DRIVER 1. CHANGES IN THE USE OF TERRITORIES (CONTINENTAL OR AQUATIC), THEIR OCCUPATION AND FRAGMENTATION OF THEIR ECOSYSTEMS

According to Etter *et al.* (2008), the trend of the change in Colombian continental ecosystems from 1500 to 2000 shows that cattle-rearing has been the main driver of change in land use in Colombian territory and has been a driving force in the reduction of the area of the country´s native ecosystems, especially in its dry forests (mainly after 1900), Andean forests and humid tropical forests (with a moderate decline between 1800 and 1959 and a rapid one since 1950). Thus, other authors, like Villareal and Romero *et. al* (2008) report that the Caribbean and the Andes, including the inter-Andean valleys, show the highest levels of transformation (72% and between 59% and 67% of transformation, respectively). In the Caribbean, the most stunning case is that of the dry ecosystems (forests and other formations), since there only survive a few isolated remnants in the midst of an intensely transformed matrix. In the Andean region, the most affected ecosystems are the mist forests (humid Andean and high Andean forests). Additionally, the most recent and dramatic trends of this change show an alarming deforestation of the humid forests of the low jungle, especially in the Amazon and Pacific (Etter *et al.* 2008). In these cases, rivers continue to be the main access routes (Etter *et al.* 2006a; Armenteras *et al.* 2006). In addition, it has been found that this deforestation seems to be positively influenced by soil fertility and negatively influenced by accessibility (Etter *et al.* 2006b and c).

In academic studies, there is still no agreement about the state of the transformation of the natural continental ecosystems of the country. Table 9 presents a summary of some of figures available for Colombia (Chaves and Santamaría 2006).

On a national level, the reported deforestation rates fluctuate between 600,000 hectares/year (IGAC and ICA 1987) and the 91,932 ha/year reported by the IDEAM in 2002. Nevertheless, the latest estimates of the country´s deforestation rates by the IDEAM (2011) show, for the periods 1990-2000, 2000-2005 and 2005-2010, 279,757 ha/year, 314,991 ha/year and 238,273 ha/year, respectively (Table 10). For the latter period the regions with the highest defo-

Table 9. Degree of transformation of the country's ecosystems and regions, according to different authors. Source: Chaves and Santamaría 2006.

Scale	Non-transformed (%)	Transformed (%)	Source
National	68.7	31.3	IDEAM, *et al.* 2007
	48	52	IGAC-Corpoica, 2002
	47.8		FAO 2001, 2005
	---	39.1	Márquez 2000
	65.7	34.3	Etter 1998
	59	41	IDEAM 2000, 2001
Andes	-	59.2	Fandiño and van Wingaarden 2005
	39.5	60.5	Rodríguez *et al.* 2004
	33.2	66.8	Etter *et al.* 1999, Etter and van Wyngaarden 2000
Orinoco region	82.2	17.8	Romero *et al.* 2004
Caribbean	-	72.4	Fandiño and van Wyngaarden 2005
Pacific	-	21	
Inter-Andean Valleys	-	78.9	

restation rates were the Andes, with a rate of 87,090 ha/year and the Amazon, with 79,797/year (IDEAM 2011). The main causes in Colombia are the expansion of the agricultural/stock-rearing frontier (73% of deforestation), timber extraction (11.7%), the consumption of firewood (11%) and forest fires (2%) (DNP 2007), added to which are the construction of infrastructure works, illegal crops and the illegal felling of trees.

For the period 2000 – 2005, the changes in forests caused by deforestation show a strong degradation of forest ecosystems (a transition from forest to secondary vegetation in 521, 559 hectares, equivalent to 38.2%), followed by deforestation for the purposes of establishing productive activities, pastures (495, 044 ha, equivalent to 36.2%) and heterogeneous agricultural areas (201, 294 ha, 1.5%) (IDEAM 2011).

Unfortunately, efforts to follow-up the changes in non-forest ecosystems like wetlands, *páramos* and savannas are still scarce in the country. In that respect, McAlpine *et al.* (2009) estimate a conversion rate of 50,000 ha/year for tropical savannas, while Morales *et al.* (2007) estimate that 24% (463, 929 ha) of the country´s *páramo* areas have been transformed by agricultural, stock-rearing and mining activities, especially in some sectors of the Eastern and Central Cordilleras, which puts at risk the supply of ecosystemic services from these ecosystems. Furthermore, marine and coastal ecosystems have also been widely transformed.

Table 10. Reported rates of deforestation in Colombia at different periods and from different sources. The data are not directly comparable due to technical or methodological divergences in the estimates.

Reported Period	Deforestation rate estimated for Colombia	Source
2005 – 2010	238,273 hectares/year	IDEAM 2011
2000 – 2005	314,991 ha/year	IDEAM 2011
1990 – 2000	279,757 ha/year	IDEAM 2011
1994 – 2001	101,303 ha/year	DNP 2007
2002	91,932 ha/year	IDEAM 2002
1970 – 2000	232,277 ha/year	Etter *et al.* 2008
1991	380,000 ha/year	WRI 1991
1987	600,000 ha/year	IGAC and ICA 1987
1981-1990	367,000 ha/year	FAO 1993

In the case of mangrove forests, their total coverage in 2007 evidenced a general reduction of 12,191 ha, mainly in the Colombian Pacific (17, 390 ha lost), and an increased coverage of 5,199 hectares in the Caribbean (Invemar 2009). As of 2009, the areas rehabilitated after having been degraded rose to 33,601 hectares, while another 39,328 ha are areas for sustainable use. Some specific data show that the average rate of deforestation for Cauca and Nariño (1996-2006) is 3,000 ha/year (Invemar), while a recuperation of the area of mangrove swamps of the river Sinú was reported, rising from 8,861.7 ha in 2000 to 9,504 ha in 2009 (Invemar 2010).

In general terms, the state of coral reefs is worrying, since both in the Caribbean and the Pacific the coverage of hard corals has fallen between 1997 and 2007, with the exception of Urabá, where a slight rise is reported, while the coverage of algae seems to be rising (Invemar 2009). The effect of diseases has generally been low in all the monitored years and areas, with historical fluctuations which do not indicate any special or clear change over time. Although the values are very low, the area of San Andrés has shown the greatest occurrence of diseases, while conserving the highest relative values with the passage of time and in comparison with other monitored areas. It is important to underline the occurrence of diseases in the Islas del Rosario in the past year, dominated by the White Plague coral disease (Invemar 2009).

Other marine ecosystems like rocky shorelines, sea grass prairies and soft sea beds have also suffered transformations associated with human activities. In the case of rocky shorelines, the effect of activities like compaction, the extraction of sand and stones, building works in inter-tidal zones and the growth of urban development and tourism in areas of cliffs cause an increase in the erosion rate of shorelines, aggravated by biophysical erosion (Invemar 2009). The impact of human activities on rocky shorelines has been especially noticeable in Santa Marta, Cartagena (Tierra Bomba) and San Andrés, areas strongly affected by the presence of urban and tourist centers.

Additionally, and linked with this transformation, the fragmentation of ecosystems resulting from human activities is another of the major impacts on Colombian biodiversity, since it generates profound changes in the structure of landscapes, especially continental and coastal ones. Thus, behind the front line of deforestation there remain mosaics of transformed lands made up not only of productive areas, but also fragments of mature forest and patches of secondary vegetation (Etter *et al.* 2006b). In Colombia this process has meant that the only representatives of many strategic ecosystems and endangered and endemic species survive almost exclusively immersed in cultural matrixes and private properties (Mendoza *et al.* 2007) and are not represented in any kind of category of protected area of the country (Franco *et al.* 2007). Analyses of fragmentation in the Eastern Cordillera show that the most fragmented ecosystems are the sub-Andean forests (302 patches) and dry Andean forests (135 patches), while the ecosystems with the fragments of largest size are the high-Andean forests and the *páramos* (Armenteras *et al.* 2007).

The degradation of ecosystems is another important factor of change, related to processes for the use or transformation of natural or semi-natural ecosystems which do not cause their total change but modify their natural regimes of functioning. In some cases their consequences are transitory and amount to an indirect cause of the total transformation of the ecosystem. In Colombia it is estimated that nearly 16, 136, 983 hectares are degraded. Covers of crops, pastures and secondary vegetation represent the highest degree of disturbance (45.6%). Moreover, natural covers show a 12.2% rate of degradation, corresponding to 9, 615, 845 hectares. Among these, natural forests account for the greatest number of affected hectares: 6,498, 855 (MAVDT 2010d).

The processes of the degradation of ecosystems associated with fires show that between 2002 and 2008 the surface area affected by fires was 281,350 hectares, caused by 6650 outbreaks of fire. The Andean region is the one most affected by fires, especially the departments of Huila (1,256), Valle del Cauca (985), Cundinamarca (740) and Tolima (529). (IDEAM 2010a). The savannas and pastures appear as some of the kinds of covers most affected by these phenomena on a national level (57, 564 ha). For the same period between 2002 – 2008, the burnt area in national parks rose to 97, 390 ha (IDEAM 2010a). A recent evaluation of the susceptibility of the nation´s territory to fires estimates that the areas with the lowest susceptibility are the largest, with a size of 668,938 km² (58.99%), followed by those with a high susceptibility, at 210, 494 km² (18,44%). The categories of very high, moderate and very low, with areas de 57,625 Km²,

79,676 Km² and 75,582 km², respectively, are the category of least size on a national level (IDEAM 2010a).

DRIVER 2. REDUCTION, LOSS OR DEGRADATION OF ELEMENTS OF NATIVE ECOSYSTEMS AND AGRO-ECOSYSTEMS.

In Colombia the illegal felling of trees is estimated to be 42% of the total extracted (IDEAM and Ecoforest 2008) and has become a serious problem which endangers the populations of wild species of fine timber like caoba (*Swietenia macrophylla*) and cedar (*Cedrela odorata*), which were widely exploited in the first half of the previous century and exported to the United States (Cárdenas and Salinas 2007). Nowadays such species are exhausted and practically extinct: the former completely and the second in broad sectors of Colombian territory. Of 54 species of forestry value use which have been evaluated in an analysis of the risk of extinction, 34 are in some endangered category (Cárdenas and Salinas 2007), which is symptomatic of the way how these species are used. The state of conservation of some species, like the *abarco* (*Cariniana pyriformis*), the *almanegra* (*Magnolia plyhypsophylla*), the abovementioned caoba, the *comino* (*Aniba perutilis*), the *chanul* (*Humiriastrum procerus*), the *guayacán negro* (*Guaicum officinale*) the *palo de rosa* (*Aniba roseodoroa*) and the *yumbé* (*Caryodaphnosis cogolloi*), places them in the category of critically endangered (CR) species. The regions with the most endangered species of timber trees are the Magdalena (15 endangered species), followed by the Chocó-Darién and the Western Cordillera (13 endangered species in each) and also the dry and montane forests of the Eastern Cordillera (each with 10 endangered species). Timber exploitation in Colombia (2000 – 2006), measured on the basis of the exploitation permits granted by the CARs, is on average 1,581,540.11 m³/year. Between 2000 and 2009 the North Andean region (Corpoguavio, Corponor, CAS, Corpochivor, CDMB, Cornare, Corpoboyacá and Corantioquia) granted the biggest number of permits (11, 616), followed by the South Andean region (CAR, Corpocaldas, Cortolima, Carder, CRQ and CAM) with 8,201 permits (IDEAM 2010a). The areas with the largest demand for timber lie in the jurisdictions of Corponariño; CRC; Cornare and Corpoboyaca, since their permits surpass 1´000,000 m³. Between 2000 and 2006 the biggest volume of exploitation was of species introduced but with a commercial value like eucalyptus (*Eucalyptus* spp.) and pines (*Pinus* spp.) Since 2007, when the responsibility for registering the management and exploitation of plantations of a productive nature was transferred to the Ministry of Agriculture and Rural Development, the CARs report that the species for which the largest number of exploitation permits have been granted are acacia (*Acacia* sp.), *sajo* (*Campnosperma* sp., *Campnosperma panamensis*), *abarco* (*Cariniana pyriformis*), *otobo* or *cuángare indio* (*Dialyanthera* sp.), *lechero* (*Brosimum utile*) and *Cuángare* (*Otoba gracilipes*) (IDEAM 2010a). Many of the species have been placed in some endangered category.

Thus, more than 50% of the Autonomous Regional Corporations identify illegal forest exploitation as the activity which most affects their regional protected areas (CGR 2008). In that regard, there are a significant number of sawmills which live off remnants of timber from ever more distant and inaccessible zones and logging is aimed at trees of smaller size or "promising" species and thus prevents the gradual recuperation of forests. The total or partial elimination of forests jeopardizes the subsistence of other subsystems and affects the inhabitants who have turned from timber extraction to the incipient development of agriculture/stock-rearing practices.

A subject which is often underestimated as a factor in biodiversity use is the use of wood as a dendro-energetic fuel (firewood or charcoal), for which there is a strong demand in some of the country´s municipalities for industries like bakeries, sawmills, brickyards and the production of sugar-cane blocks (*panela*). According to the IDEAM (2010a), the production and consumption of firewood in Colombia fell between 2000 and 2008, though it maintains a level of around 21,000 kilotons/year. However, in some areas of the country, its consumption may be higher, for example in the municipality of Encino, Santander, where it is reported that 79% of families there exclusively cook with firewood and there is an estimated average consumption of 6.2 t/ year and a per capita one of 2.9 Kg/day (Aristazabal 2010).

Additionally, there are numerous activities in the country based on the extraction of products derived from biodiversity in the form of fibers, medicinal plants, fruits and ornamental plants. However, in these experiences the volumes of the harvest and the handling of the species have been based on market

requirements instead of following ecological criteria (Ramos 2011; Becerra 2003). This has led to situations like, for example, the disappearance of many wild populations of several orchid species and even the extinction of some of them in the wild, due to extraction for the purpose of growing or export. Thus, at the current time it is estimated that 10.5% of the country´s orchids (some 3,500 species) show some level of risk of extinction, due to the destruction of forests and, in a direct way, their excessive extraction for commercial aims (Calderón 2007).

Furthermore, wildlife fishing in the country shows an alarming situation. The state of the exploitation of aquatic marine and fresh-water species shows that of the 25 marine species (fishes, crustaceans and gastropods) which are most fished, 12 (corresponding to 48%) are in an over-exploited state (Barreto and Borda 2008). In the river Magdalena, catches have fallen, from 79,000 t/year in 1973 to 6,044 in 2006 (Mojica *et al.* 2002; INCODER-CCI 2006 and 2007) and species like the *bagre rayado* (*Pseudoplatysoma fasciatum*), *bocachico* (*Prochilodus magdalenae*), *blanquillo* (*Sorubim cuspicaudus*), *doncella* (*Ageneiosus caucanus*) and *pataló* (*Ichthyoelephas longirostris*) have been exploited practically to the point of disappearing (Mojica *et al.* 2002). In the Colombian Caribbean species from rocky shores like the *Cittarium pica* winkle (Osorno and Díaz 2006), spiny lobster (*Panulirus* spp.), squids, chitons and fishes like groupers, sea bass and snappers (Osorno and Agudelo 2007) are also endangered by over-exploitation.

The use of fauna is also seen, in general, as a factor in biodiversity loss, especially in the absence of studies of the phenomenon. In recent times, there has been a boom in study of subsistence hunting by different rural human groups (Campos and Ulloa), whereas hunting for other ends, like commercial (legal and illegal) and scientific ones, has not been wholly evaluated. The illegal traffic in wild species is regarded as one of the main causes of the reduction of populations of natural organisms (Gómez-Cely 2009). As of 2009, the Regional Environmental Corporations reported the seizure of 211, 571 individuals subject to illegal trafficking in the country: reptiles, birds and mammals are the most affected biological groups (Table 11) (MAVDT 2011).

In Colombia there is no consolidated inventory of genetic diversity that would allow for a clear determination of the loss of its wild or cultivated species. The changes in the traditional practices and knowledge of ethnic and peasant-farmer groups, due to processes of acculturation and deculturation, have been favoring this loss.

DRIVER 3. THE INTRODUCTION AND TRANSPLANTING OF SPECIES

Biological invasions have been recognized as the second global cause of the loss of biodiversity (Vitousek 1994, Vitousek *et al.* 1997; Everett 2000; Wilcove *et al.*, 1998). In Colombia, intentional introductions associated with trade are predominant and 176 exotic species have been identified, of which 17 are on the list of the planet´s 100 most invasive species (MAVDT 2010a). According to Baptiste *et al.* (2010), 42 species with a high risk of invasion are reported in the country, which correspond to 36 genera and 19 families. The family with the largest number of species which present a High Risk of Invasion is the Poaceae (gramineae) with 19, with the *Cynodon*, *Urochloa Guagua* and *Pennisetum* genera standing out. Other important families are the Fabaceae, Hydrocharitaceae, Lemnaceae, Mimosaceae and Salviniaceae, all with two species each. In addition, most of the species which present a High Risk of Invasion correspond to grasses (31 species), followed by trees (5), bushes (4) and vines and palms, with one species (Baptiste *et al.* 2010). As for the risk of invasion from vertebrate species of birds, mammals, reptiles and amphibians (introduced and transplanted native ones), a study of 73 species by Baptiste *et al.* (2010) classified 21 species in the category of high risk of invasion (mainly birds and mammals), 29 in the moderate risk category and four in the low risk one.

Additionally, 137 species of fishes are reported in Colombia (82 introduced and 57 transplanted) from continental and salt waters. These belong to 9 orders and 29 families, of which the Cichlidae, Cyprinidae and Characidae familes show the highest number of species with 33, 24 and 18, respectively (Baptiste *et al.* 2010). 28 species of fish, 5 of crustaceans and 1 mollusk show a high risk of invasion. In Colombian marine waters, 26 introduced species have been identified; one (1) reptile, two (2) fishes, eight (8) decapods, one (1) crustacean, eight (8) bivalve mollusks, one (1) annelid, two (2) bryozoans, two (2) corals and one (1) algae. The large majority of species introduced

Table 11. General figures on the illegal trafficking of wild fauna, reported by the CARs for the period 2005-2009. The data includes seizures of introduced exotic species. Source: MAVDT 2011

CLASS	MOST TRAFFICKED SPECIES	MOST TRAFFICKED FAMILIES	Number of individuals	Sum total of Eggs	Sum total of Hides (units)	Sum total of Meat (Kg)	Sum total of Stuffed Animals	Sum total of Indeterminate Seizures
REPTILES	*Trachemys callirostris callirostris* (icotea turtle), *Caiman crocodylus fuscus* (babilla caiman), *Iguana iguana* (Green Iguana)	Emydidae, Alligatoridae, Iguanidae, Testudinidae, Podocnemididae, Boidae, Kinosternidae, Colubridae, Teiidae, Geoemydidae	169,352	149,100	7,092	6,946.75	880	540
BIRDS	*Brotogeris jugularis* (orange-chinned parakeet), *Amazona ocrocephala* (Yellow-headed Amazon parrot), *Sicalis flaveola* (common canary)	Psittacidae, Emberizidae, Mimidae, Icteridae, Thraupidae, Turdidae, Anatidae, Strigidae, Columbidae, Phoenicopteridae	29,005	34	24	76	31	308
MAMMALS	*Sciurus granatensis* (Squirrel), *Saguinus leucopus* (gray tití monkey), *Dasypus novemcinctus* (armadillo)	Sciuridae, Cebidae, Dasypodidae, Hydrochaeridae, Cebidae, Megalonychidae, Bradypodidae, Procyonidae, Aotidae, Cuniculidae	7,613	0	171	16,862.185	465	432.75
INVERTEBRATES	*Helix aspersa* (garden snail), *Megalobulimus oblongus* (giant South American snail), *Anodonta* sp. (mussel)	Helicidae, Orthalicidae, Unionidae, Theraphosidae, Helicidae, Gecarcinidae, Scarabeidae, Bulimuilidae, Pseudothelphusidae, Fulgoridae	5,163	0	0	18.6	1	105
AMPHIBIANS	*Hyla* sp. (Tree frog). *Pipa pipa* (toad), *Oophaga auratus* (poisonous frogs)	Hylidae, Pipidae, Oophagidae, Pipidae, Bufonidae, Ambystomidae	315	0	0	0	0	0
FISHES	*Oncorynchus mykiss* (rainbow trout), Potamotrygonidae (unspecified stringray), Selachimorpha (unspecified sharks)		123	0	0	138.2	1	5
TOTAL			**211,571**	**149, 134**	**7287**	**24, 41.735**	**1378**	**1390.75**

and transplanted to the country come from Asia, for ornamental purposes, aquaculture, consumption and restocking (Baptiste *et al.* 2010).

Furthermore, the impact of invasive species on marine and coastal waters is being aggravated by the shedding of ballast waters by ships before they arrive at port. 86 non-native marine species have been reported in Colombia, corresponding to 44 taxa of phytoplankton, 16 of zooplankton, 2 of nekton and 24 of benthos (Ahrens *et al.* 2011). The absence of a strategy for the management and control of ballast waters (in ships and in port) has helped to spread this problem. To this is added the lack of trustworthy taxonomic information (many are juveniles of other species) and the scarcity of qualified taxonomists. The latter two problems apply to studies of many other taxonomic groups of flora, fauna and microorganisms in the country.

Furthermore, the commercial and experimental planting of transgenic crops, as well as the sale of transgenic products for human consumption, is more and more widespread. Nevertheless, very little is known about how the release of such plants affects native biodiversity. Notwithstanding the above, studies in other parts of the world warn about the possible negative effects on wild biodiversity, due to the processes of hybridization and introgression which cause genetic contamination and erosion, as

well as impacts on herbivorous species, pathogens and other plants of vegetal communities (Pilson and Prendeville 2004). This is the case with the genetic flow, detected in both a theoretical and experimental manner, between transgenic and Creole varieties of maize in Mexico (CCA 2004).

Thus, in 2002, the country, through the ICA, authorized the release and planting of 2000 hectares of BT (Bollgard) cotton in the Caribbean region. As of 2010, the number of hectares sown with transgenic cotton rose to 37, 657 ha (Agrobio). Up to 2009, cotton had been the main genetically-modified crop planted in the country. In 2010, however, it was surpassed, in numbers of hectares, by maize (from 18, 784 ha in 2009 to 38, 896 ha in 2010). The controlled planting of transgenic maize was approved in 2007 and 2008, under ICA resolutions 2201 and 878, which authorized the use of the BT maize varieties YieldGard® (MOM 810) + Roundup Ready® (NK 603), Herculex I (TC 1507) + Roundup Ready in the departments of Córdoba, Sucre, Huila and Tolima. At the current time 6 varieties of cotton are commercially sown in the Caribbean, Upper Magdalena, Orinoco and Valle del Cauca (Agrobio 2011). Additionally, between 2006 and 2008, the ICA authorized the use of several types of transgenic maize, rice and soy beans as the raw material for the production of foods for consumption by domestic animals, under resolutions 3746, 3745, 308, 309, 2367 and 2942, and it has given permission for the importing of reproductive material and the commercial sowing of roses and blue carnations in Cundinamarca (Agrobio 2011; Arias 2007).

There are currently 17 foodstuffs derived from genetically modified plants (GM) in the country which have been approved for human consumption by the Ministry of Social Protection (Agrobio 2011).

DRIVER 4. CONTAMINATION AND TOXIFICATION

Among the sources of biodiversity it is necessary to distinguish discharges by their source and kind, and the affected ecosystem. In general, they may be put into the following categories: a) the discharge of particulate material, b) sonic and luminic contamination, c) organic and inorganic discharges and d) the use of fertilizers and agrochemicals, at times in an indiscriminate form.

Municipal discharges are one of the main sources of contamination in surface waters in Colombia (Pan American Health Organization – OPS and OMS 1993), responsible for nearly 65% of the total contaminating load of BOD (IDEAM, 2010b). Thus, in 2008 the total BOD load was estimated at 819, 235 tons/year, of which only 11% was removed by the treatment of waste waters, resulting in a daily average of discharges of 2026 tons (IDEAM 2010b). 76% of this load is produced by only 56 municipalities, among which are the country´s big cities. Furthermore, the load of COD shed into bodies of water in 2008 was estimated at 1, 618, 200 tons (4,500 tons/day), with the domestic sector again the one which produced most (58%), followed by the industrial sector (39%) (IDEAM 2010b). The load for suspended solids in 2008 was 1,114, 700 tons (3097 tons/day) (IDEAM 2010b).

According to the IDEAM (2004) the rivers Bogotá, Medellín, Chicamocha, alto Cauca, Lebrija and Chulo show the greatest deterioration in the quality of their waters, since the greatest social and economic activity is concentrated in their basins. In the country the flow rate of waste waters generated by the urban centers is 67m^3/s, of which Bogotá is responsible for more than 15.3%, Antioquia 13%, Valle del Cauca 9.87% and the other departments less than 5% (IDEAM 2004). The variables in the indexes which have the biggest influence in harming water quality result from the meager availability of dissolved oxygen and the high total levels of suspended solids, coliforms, hydrocarbons and orthophosphates, variables which affect most departments(MAVDT 2009).

The river basins most affected by the excessive organic contamination caused by the addition of phosphorus and/or nitrogen to fresh waters are those of the rivers Magdalena, Cauca, Guarapas, Suaza, Páez, Neiva, Fortalecillas, Cabrera, Prado, Saldaña, Recio, Opia, Totaré, Gualí, Cimitarra, Quinamayo, Palo, Amaime, Cerrito, Guabas, Guadalajara, Mediacanoa, Tuluá, Bugalagrande, La Miel and Chinchiná (MAVDT 2009). Thus, in 2008 the shed load of nitrogen (N) reported was 117,000 tons and of phosphorus (P) 29, 400 tons (IDEAM 2010b). In addition, the organic material generated by industrial activities in 2008 was 639, 765 tons (1, 752 metric tons/day), which corresponds to 17.5 million inhabitants. The manufacture of paper, cardboard and paper products, foodstuffs and beverages, and chemical products

and substances generated the largest loads (MAVDT 2009). This kind of contamination is now recognized to be one of the most important factors in the loss of ecosystemic services (Rockström *et al.* 2009), since it produces the eutrophication of fresh waters, reduces the oxygen in water and causes drastic changes in the form of acidity, bad odors, the uncontrolled growth of aquatic plants or toxicity due to the presence of toxic cy*anophycean algae.*

The index of water quality which refers to the function of preserving flora and fauna (ICAMPFF) has declined between 2001 and 2008, with a clear seasonal pattern where low values predominate in rainy seasons, especially in estuarine waters (INVEMAR 2009). In 2001, the ICAMPFF showed that 26.7% of the monitored stations (51 stations) had a poor or inadequate rating, which indicates a risk of water contamination, mainly of the estuarine kind. Although the general trend of the ICAMPFF shows an environmental recuperation, there are sites which remained in inadequate conditions during the eight years of monitoring by the Network for the Vigilance of Marine Environmental Quality – REDCAM (2001 – 2008).

Furthermore, chemical contamination not only affects fresh-water, marine and coastal systems, producing highly negative effects on the biodiversity of those systems, but it also affects the soil and air. Among the main causes of this kind of contamination a mention may be made of industrial wastes (like heavy metals or petroleum), discharges of human wastes from domestic activity, the shipping which spills several kinds of hydrocarbons and especially petroleum spills which cause serious ecological damages to socio-ecosystems.

The use of pest-killers is an integral part of the process of producing crops like bananas, African Palm, grasses, rice, cotton, sugar cane, flowers and potatoes and they have mainly affected the basins of the rivers Magdalena and Cauca, as well as the Zapatosa and Ciénaga Grande de Santa Marta marshes; the upper and middle basin of the river Meta, the basins of the rivers Saldaña and Coello, the lower and middle basin of the river Cesar, the wetlands of the cundiboyacense high plain and bodies of water in the Amazon (Benavides 2006). Thus, for example, in 1990 imports of herbicides, insecticides and fungicides in the country amounted to 33.6 million dollars, while it was 80 million dollars in 1999, that is, a rise of 237% (Vélez). As of 2008, it was estimated that the use of agrochemicals in the agricultural sector was nearly 2.6 million tons of solid substances and 20,695 liters of liquid formulations, especially NPK compounds (45%). (IDEAM 2010b).

The impacts of coal and gold mining are seen in the increased sedimentation of bodies of water; emission of gases; particulate matter and noise; the generation of sterile wastes and rubble; and the contamination of the soil by heavy metals and other chemicals. In gold-mining activities, the processes of chlorination, cyanide lixiviation and mercury amalgamation, the pyrometallurgical process and the disposal of tailings generate toxic residues that have repercussions in the form of increased risks associated with the loss and transformation of biodiversity which these wastes may be causing. In 2008 the use of mercury was estimated to be around 178 tons (IDEAM 2010b). In addition, Silva *et al.* report that the levels of mercury in the water of a complex of wetlands in the Mompox Depression reached levels of 0.08 and 0.09 mg/L in the municipalities of Barranco de Loba, Hatillo and San Martín de Loba and in the marshes of El Sapo and Colombia, levels which are much higher than the admissible ones laid down in decree 1594 of 1984, which sets the limit of mercury in water at 0.002 mg/L. The same decree sets the admissible levels of mercury in sediments at 0.0001 mg/Kg, a value which is widely surpassed in some mining sectors of the lower Cauca, where levels of up to 0.25 mg/Kg are reported. In the same region high levels of mercury in fish which people widely consume is reported, with concentrations in their tissues oscillating in a range of 0.02 and 2.67 mg/g. The species in whose tissues mercury was found included the *comelón* (*Hoplias malabaricus*), *doncella* (*Ageniusus pardalis*), *dorada* (*Brycon moorei*), *blanquillo* (*Sorubin cuspicaudus*), *mojarra* (*Caquetaia kraussi*), *viejito (Cyphocharax magdalenae*) and *bocachico (Prochilodus magdalenae*) (Silva *et al.* 2010). The same study reports the presence of cyanide in the water of the Mompox Depression at levels higher than the admissible ones for the maintenance of flora and fauna (0.05 mg/L), with values rising to 0.12 mg/L in the El Sapo and Colombia marshes.

With regard to the potential soil contamination caused by the extraction of hydrocarbons, in the areas where activities of petroleum exploitation are currently being developed, nearly 1,819,

999 hectares, there is a high probability that contaminated sites exist. However, there are currently no studies of soil contamination which consolidate and quantify the impacts on the country´s soils of productive agricultural/stock-rearing and extractive industrial activities. Thus, the management of contaminated sites runs into the difficulty that the direct impacts on soils of mining activities have still not been evaluated in the country. In that area the studies have focused on discharges into surface waters, since that means of spreading contaminants is regarded as one of high risk.

The consequences for biodiversity of the country´s armed conflict have not been studied in detail. Nevertheless, the contamination it has caused is alarming. Between 1986 and 1991 guerrilla groups are reported to have blown up oil pipelines more than 1,000 times, which spilt nearly 2 million barrels of crude oil into natural ecosystems and although Ecopetrol cleaned nearly 2000 km of rivers and 1516 hectares of land affected by the spills, the effects on fauna and flora have been devastating (Bernal 2000). Furthermore, the impact on soils and water sources in the jungle areas of the country caused by the production of illicit drugs has still not been quantified, but it is evidently worrying.

Finally, it has been assumed that atmospheric contamination does not have a significant effect on biodiversity due to its localized impact; however, there are still no specific evaluations of the problem. This contamination is mainly produced in the industrialized areas of major cities, located in industrial corridors. It is estimated that a little more than 4 million tons/year of atmospheric contaminants are emitted in Colombia, of which 60% come from mobile sources (2,477,400 tons/year) and the remaining 39.7% from fixed sources (1, 634,233 tons/year) (Chaves and Santamaría). Furthermore, the country´s consumption of ozone-depleting substances (CFCs, HCFCs, Halons, Carbon Tetrachlorides, Methyl Chloroform and Methyl Bromide) shows a considerable increase, from 998 tons in 1999 to 2788.92 tons in 2009 (MAVDT 2010e).

With all this, the social costs mainly related to air and water contamination, inadequate clean-up and hygiene practices and the degradation of soils are estimated to be nearly 5.3 trillion pesos annually (around 2.8% of the GDP) (DNP 2007).

DRIVER 5. CLIMATE CHANGE

In Colombia the total volume of greenhouse effect gases for the period 2000 – 2004 was 180,008.18 Gg CO2eq. In the same period the share of the different modules in total emissions of such gases were (IDEAM 2010d): Energy (36.65%), Industrial Processes (5.10%), Agriculture (38.09%), land use and change in land use and sylviculture – USCUSS – (14.45%) and wastes treatment (5.71%). In accordance with that figure, in 2004 Colombia´s share of total world emissions (49 gigatons) was 0.37% (0.18 gigatons). A breakdown of the weight or representation of the contribution of each of the greenhouse effect gases shows that nearly 99% of Colombian emissions, in CO_2 equivalent units, were made up of carbon dioxide (50%), ,methane (30%), nitrous oxide (19%), with the remaining 1% of greenhouse effect gases not listed in the Montreal Protocol (halocarbons and sulfur hexafluoride) (IDEAM 2010d).

Related to the above is that the evaluation of the part played in greenhouse gas emissions that result from the transformation of native ecosystems is still incipient. However, in the Colombian Orinoco, nearly 20 million hectares are grazed, of which between 7 to 15% are burnt each year, emitting nearly 14.5 tons of CO2/year (Rodriguez and Etter 2009). It is estimated that nearly 27 million heads of cattle are reared in Colombia, which emit methane equivalent to 55.2 million tons of CO_2/year and thus contribute to greenhouse gas emissions (McAlpine *et al.* 2009; Rodriguez and Etter 2009).

Nevertheless, the effects of climate change on Colombian biodiversity are still not widely known and many of the conclusions made today depend on indirect sources of information, cases in other regions of the planet and/or academic reasoning. In most cases, the approach to the subject involves building models of future climate changes and of changes in the distribution of a number of species. So far there have been few studies of the potential impacts of climate change on patterns of distribution. For example, Urbina-Cardona and Castro (2010) found that at least three species of potentially invasive amphibians and reptiles whose presence has been proven in 10 to 30% of the country´s territory may be benefited by climate change, due to the broadening of their ecological niches, and may come to occupy between 33% and 75% of the country.

The models of the effects on the distribution of species show that the reduction of the potential area of distribution of species is the predominant pattern (Pedraza and Zea). The patterns of current and projected wealth are concentrated in the mountainous zones of Colombia, the Andean Cordilleras and the Sierra Nevada de Santa Marta. The variation in the distribution patterns of the potential wealth resulting from climate change suggests that by 2080 the zones with the highest species wealth might shift to higher altitudinal ranges with respect to current potential patterns (Pedraza and Zea 2010).

The evaluation of the vulnerability of ecosystems to climatic threats shows that high-mountain ecosystems (high-Andean forests, *páramos*, glaciers and wetlands), dry zones and marine-coastal and island areas are the most vulnerable kinds of ecosystems in the country (IDEAM). In that sense, the evaluation of vulnerability for the period between 2011 and 2040 shows that in mountain ecosystems the areas that will potentially be most affected by climate change would reach to nearly 70% of them (4,300,300 hectares), with impacts on areas in Boyacá, Nariño, Tolima, Cauca and Cundinamarca (IDEAM 2010d). In addition, the vulnerability of woody ecosystems will be higher in the departments of Boyacá, Valle del Cauca, Bolívar, Magdalena and Antioquia.

In sea coast and island areas, a one meter rise in sea level would permanently flood nearly 4,900 km^2 of low coasts and cause the flooding of 5,100 km^2 of continental coastal areas. On the island of San Andrés, the situation may be critical, since, with a one-meter rise in sea level, more than 10% of the island could be flooded and 3.8% of the islands of Providence and Santa Catalina. These floods would affect a population on the order of 1.4 to 1.7 million inhabitants (IDEAM 2010d).

In the *páramos* the effects of climate change on biota, in the same conditions of rising temperatures, are rather alarming, because the change will lead to the altitudinal modification of the conditions responsible for the development of their biota, with a shift of between 140 and 800 meters that will unleash processes that acutely affect them. An annual loss of approximately 3% to 5% in the area of glacier ecosystems is reported, with an average retreat of their lower edges of between 15 and 25 meters annually, values which show their strong dynamic and response to atmospheric changes, and presage their total disappearance by around 2050 (IDEAM 2010d). It is estimated that while Colombia had 108.5 km2 of glaciers in 1950, by 2006 this area had shrunk to only 76 km^2 , with short-term variations reported, like accelerated reductions during periods of El Niño and lower rates of loss or even small gains in periods of La Niña (IDEAM 2010d).

Desertification is a problem involving the deterioration of soils which is accentuated by climate change and mainly affects the dry zones of the country, which cover 21.5% of its territory. Currently, 78% of the dry zones show desertification, mainly resulting from phenomena like erosion, salinization, compaction and contamination. 42% of the zones with desertification processes are found in the Caribbean region, 32% in the Orinoco region (the savannas of Meta, Arauca and Vichada), 24% in the Andean zone (inter-Andean valleys of the rivers and Magdalena and Cauca, the two departments of Santander and the high plains of Cundinamarca/Boyacá and Nariño) and 1% in the Amazon. The gravity of the problem lies in the fact that it fundamentally affects the main agricultural and stock-rearing zones of the country and the soils with the highest supply of nutrients for a sustainable industrial agriculture. The scenarios of climate change show a trend towards higher aridity in the dry zones, which would not only have a direct effect on species and ecosystems, but some of these changes may also enter into a synergy with modifications of the regimes of disturbance, such as the frequency or intensity of fires.

PARTICIPATION IN THE MAKING OF DECISIONS ABOUT BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES (PTDFBD&SE)

Valuation of the importance of biodiversity in the economic development of some sectors might seem to encourage a greater social valuation of it. However, this type of valuation seems to have little influence on the management capacity of Colombian environmental institutions, where interests are still concentrated on making a direct impact on the Result Factors (Figure 12), which in itself only has a relatively minor impact on the conservation of biodiversity and its ecosystemic services in comparison to what it would mean to act in a parallel way on the underlying causes (Factors of power and work -- Figure 12) that lead those factors into a desirable state. Thus, this social valuation may positively go beyond that to strengthen the actors´ willingness and commitment to attain a stronger and better participation in decision-making

that may have a positive impact on the resource, since the higher the social valuation, the lower the degradation of the state and conservation of biodiversity, due to the fact that practices of use and management will take into account the need to maintain biodiversity and will be expressed in better planned and more sustainable patterns of use and occupation of territory.

Furthermore, the scenarios of participation which allow for strengthening dialogue and reflection, as a support for the management actions which the State develops, are meager or do not fulfill the role of promoting appropriation and thus make it difficult to increase and improve the social valuation of biodiversity and its ecosystemic services. This situation occurs despite the fact that some scenarios for participation are well developed in Colombian legislation. The analysis of the system enables us to understand that the Social Valuation Factors of Biodiveristy and Its Ecosystemic Services are closely linked through participation, which, if it were strengthened, would reinforce the schemes of governance and in that way come to generate and recognize biodiversity as a public value. In this sense, tools for participation in conservation, like the prior consultation of ethnic minorities when undertaking intervention in their territories, show that despite nearly 63 such processes up to 2007 (in the hydrocarbons, energy, infrastructure, mining and agrochemicals sectors), their application should be strengthened in order to support a truly effective participation (Londoño 2000, in Hernández 2007).

Additionally, the process of consolidating the SINAP has allowed for advances in the legal and institutional framework and experiences which allow for the inclusion of different types of actors and forms of government in the system, as well as the creation of public awareness about the importance of conservation and protected areas for the sustainable development of the country. In the same sense, in 2005 the Ministry of Environment held an extensive consultation with the traditional communities (Indigenous, Peasant-farmer, Afro-Colombian, Romani and *Raizal*) on the needs of their peoples in relation to the protection of traditional knowledge (MAVDT 2005). The occasion served to bring advances in the establishment of the needs to protect the traditional practices and knowledge associated with the conservation of biodiversity, as well as the construction of a proposal for guidelines for the design of a National Policy for the protection of bodies of traditional knowledge.

However, there are unfortunate cases in which social participation seems to be more conditioned by the availability of economic resources than a fully coherent process. The existing resources are aimed at supporting specific exercises in a given planning or policy tool, to carry out an urgent task, without a conception of the true dimension of sustainability. This makes it evident that in certain cases the importance of participation is not viewed with the aim of going beyond that to a greater and better social awareness and acknowledgment of biodiversity. In these cases, participation is slanted towards opportunism and the need to obtain short-term benefits.

FACTORS OF THE RESULT ZONE

The related factors are the result of the functioning of the other factors that form part of the system. They are highly dependent and little influential. They are factors that may be associated with objectives (Figure 12).

THE USE AND OCCUPATION OF TERRITORY (UOT)

Although there are norms which regulate territorial ordering in the country, the real situation shows a lack of planning and inter-sectorial linkage when it comes to transforming a given territory. The ordering plan is often subordinated to national measures which promote and provide incentives for a given productive activity without considering the municipal planning of land uses. Evidences of the above are seen in the description of the drivers of the transformation and loss of biodiversity in the Analysis and Management of Risk factor.

In the case of the agricultural/stock-rearing sector, the establishment of protective and protective-productive commercial forestry plantations is an economic activity which shows a direct effect on biodiversity, since it helps to increase diversity on the scale of landscape in the transformed area (Mendoza *et al.* 2006) and may provide complementary and supplementary resources for fauna (Renjifo 1999, 2001; Durán and Kattán 2005; Medina *et al.* 2002). Nevertheless, on some occasions, depending on the objectives, the kind of ecosystem where the activity is established and the species which are utilized, forestry plantations may have negative effects, especially those related to the invasion of species and loss of habitat. This situation

is especially delicate when plantations are established in areas covered by natural forests, natural savannas, *páramos* and wetlands. Commercial reforestation in the country rose to approximately 296,072 hectares in 2010 (MADR 2010). The goal for the protective reforestation of the country between 2006 and 2010 was 120,000 hectares, 75.13% of which was met, that is, 90,155.4 hectares were reforested (SIGOB 2011). In another area, the relation between the systems of bovine stock-rearing and biological diversity has been generally regarded as negative due to the strong effects of this activity on natural ecosystems and the biological impoverishment seen in cattle-rearing landscapes. According to information of the IGAC and Corpoica (2002), 40 million hectares are devoted to this activity in the country, even though the areas of potential use for the same barely amount to 10 million hectares. Cattle-rearing is a highly profitable economic activity due to high sales prices, on the one hand, and low input and manpower costs, on the other. The areas affected by illegal crops enter into the dynamics of cattle-rearing, since the establishment of pastures that cattle graze on is the final step in the processes of transformation which begin with coca (*Erythroxylum coca*) (Álvarez 2002; Álvarez and Price 2003). Among the main impacts of the activity of cattle-rearing on biodiversity there stand out the felling and burning of forests and savannas; the erosion and compaction of the soil; genetic uniformity when the mono-cultivation of grasses is favored; the elimination of vegetal succession by chemical (herbicides) or physical means; the drying up of wetlands; the construction of access roads; the growing demand for timber for fences, corrals and cattle trucks; the contamination of the water and soil by synthetic fertilizers and pest-killers, as well the emission of gases produced by enteric fermentation and the burning of fuels for the terrestrial and fluvial transport of live animals or their products (Murgueitio and Calle 1999).

The impact of mining on Colombian landscapes is not a new phenomenon. In fact, between 1600 and 1850 this activity dominated the Colombian economy, in which agriculture and stock-rearing played a relatively minor role (Etter *et al.* 2008). However, the impacts on biodiversity were limited to specific areas and relatively low. Just the opposite has been occurring in recent decades. Applications and grants for mining titles involving such activities as the extraction of coal increased by 87% between 2004 and 2007, mostly in the departments of Antioquia, Boyacá, Cesar, Cundinamarca, Norte de Santander and Santander, resulting in a 77% increase in this activity between 2000 and 2007. The number of applications for titles to gold deposits quintupled between 2003 and 2007 (CGR 2008).

In the area of hydrocarbons, several situations have arisen in recent years which merit attention. As of February 2011, the total area assigned to petroleum activities in the country (exploration, in production, under technical evaluation and reserved areas) had risen to 66, 498,313 hectares (41% of the total area of the country´s sedimentary basins), of which 21, 476, 379 hectares are continental and 45, 021, 934 are marine (ANH 2011).

The processes of urbanization, "metropolization", conurbation and the consolidation of urban regions produce dramatic changes in biodiversity that may be regarded as highly complex and beyond the specific effects of loss in a site with some conservation value. The central phenomenon in these cases is the ever greater concentration of the human population in urban settlements which brings with it an increase in direct local impacts due to changes in land use and an increase in wastes or contamination which affect both the different structural components of biodiversity and the ecosystemic services which guarantee the quality of life of those who live there. Data from the 2005 census show that 76% of the Colombian population lives in urban areas (cities and regional capitals), while 23.6% live in rural areas (DANE 2005). By way of example, the growth of the urban perimeter of Bogotá and its localities rose from 28,153 hectares in 1990 to 36,232 hectares in 1999, mainly due to population growth in the city, with the resulting change in the density of inhabitants and the square meters per inhabitant rate. Thus, at the beginning of the 20th century, Bogotá had 100,000 inhabitants and an average annual growth rate of 1.34%, which rapidly increased thereafter from 6.6% between 1951 and 1964, so that its population surpassed one million inhabitants. Between 1985 and 1996, the annual increase was 114, 219 people per year and by 2010 the city´s population had risen to a little more than 8 million inhabitants (approximately 166, 000 inhabitants per year). The rate for 2010 may be an underestimate, due to the high rate of rural migration in the country (Pérez 1999). Population density in the city has also risen significantly, from 132 inhabitants / hectare in 1938 to 210 in 1999, which amounts to 47.62 m^2 per inhabitant (Pérez 1999).

In the same manner, the development of the road and port infrastructure of Colombia has caused profound transformations due to the cutting up, deforestation and subsequent colonization of areas. In the Amazon, for example, distance from roads appears as an important variable in explaining the pattern of transformation and shows a positive correlation between the presence of roads and deforestation for the purposes of commercial and intensive agriculture and stock-rearing (Etter *et al.* 2006a). Thus, a large part of intensive productive activities are found in an area of 10 kilometers around roads, whereas the productive covers of land characteristic of recent colonization are more dispersed and lie in an area of 50 kilometers around roads. In the cases of the Amazon and Pacific Regions the pattern of transformation encountered (deforestation – fragmentation) follows the colonization and development associated with rivers and clearly differs from the "herringbone" pattern linked with the advance of the road infrastructure which is found in other Amazonian areas of Brazil and Ecuador (Armenteras *et al.* 2006; Etter *et al.* 2006a).

Additionally, the enlargement of the national road network, which currently measures 141, 374 kilometers, foresees the construction of 1,478 kilometers of new roads, the improvement of 4,824 kilometers and the paving of 3, 457 kilometers. Likewise, the plan for port development foresees the building of the port of Aguadulce in the Pacific (with an environmental license since 2000) and the port of Contecar in the Caribbean and the possibility of three further ones (Puerto Nuevo, with a license since 2009; Tribugá, pending approval of the application for a license; and Turbo, still without an environmental license). For the enlargement of the current railway network, which currently measures 1169 kilometers, there are plans to build 328.13 kilometers of new lines and rehabilitate 125.5 kilometers of existing ones (DNP 2011). Despite legal and technical reforms aimed at mitigating the impacts of and repairing the harms caused by these activities, there are very few studies of the effects of infrastructure works on biodiversity, especially after the works are built (Santamaría *et al.* 2005).

Furthermore, Colombia currently has 33 dams which cover 56, 042 hectares, equivalent to 6% of the lentic bodies of the country, with a volume of water storage higher than 9831 Mm^3 (IDEAM). However, the long-delayed but now growing interest in the biodiversity and ecosystemic services of continental aquatic systems is giving a new prominence to the problem of the transformations and eventual losses produced by the damming of rivers and the regulation of their courses and flood plains. This situation acquires a special relevance now that the development of hydroelectricity projects is being encouraged, since they are thought to have a positive environmental effect as a renewable energy source (in 2009, the effective hydroelectricity generating capacity of the country was 8,525 MW and total electricity generation, 13,495.81 MW , UPME 2009). Nevertheless, the alteration of hydrological regimes in Colombia has impacts on the life cycles of aquatic species, whose populations may go through dangerous fluctuations that jeopardize their survival and the maintenance of a stable supply of fish. The effects on Colombian biodiversity of the damming of the main arms of rivers are: a) the loss of populations of migratory species, b) the reduction of fish resources in important stretches of the rivers and c) negative effects on ecological systems located in lowlands and flood plains.

The biggest concentration of dams in the country lies in the Magdalena-Cauca basin (22), covering an area of 40, 287.8 hectares (IDEAM 2010b). In the case of the Urrá dam, nearly half of the reported fish species are subjected to fishing and although some migratory species like the *yalúa* (*Cyphocharax magdalenae*) and *barbul* (*Pimelodus clarias*) have established themselves there, other migratory species, like the *bocachico* (*Prochidolus magdalenae*), *dorada* (*Brycon sinuensis*), *bagre* (*Sorubium cuspicaudus*), *liseta (Leporinus muyscorum*) and *rubio* (*Salminus affinis*) have not shown signs of reproducing themselves there due to the fragmentation of their populations. In the same manner, an analysis of the relative biomass in the dam between 2001 and 2005 shows a homogenization of the values in each layer and a significant reduction in the populations of *mojarra amarilla* (*Caquetaia kraussii*), *cacucho (Panaque gibbosus), dorada, liseta* and *agujeta (Ctenolucius hujeta).* In the composition of species, the appearance of dams seems to benefit the establishment of omnivorous species with a preference for insects and detritivorous and phytivorous ones, as has been seen in Urrá, Betania and El Prado (Valderrama *et al.* 2006; INCODER 2005).

Finally, a way to evaluate the impact which human activities, especially those related to economic development, have on biodiversity, is to calculate the ecological footprint. In 2010 the Global

Footprint Network estimated Colombia´s ecological footprint of consumption to be 85 million global hectares or 1.9 hectares per inhabitant. National bio-capacity was calculated at 176 million global hectares or 3.86 hectares per capita. In comparison, the world ecological footprint for consumption is 17.1 trillion global hectares or 2.6 hectares per inhabitant, while world bio-capacity is estimated at 11.9 trillion global hectares or 1.8 hectares per capita.

PRACTICES OF THE USE AND MANAGEMENT OF BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES (PUMBD&SE)

In general terms, socio-environmental conflicts in Colombia are not clearly identified, acknowledged and managed in a way that would promote the social valuation of biodiversity. Unfortunately, the word "conflict" in Colombia is still associated, almost exclusively, with scenarios of armed violence. However, socio-environmental conflicts refer to any tension, disagreement, confrontation and/or clash arising from the opposition between actors who pursue different objectives with regard to the access to, use, management and protection of biodiversity and its ecosystemic services (page 19).

Although the idea of promoting the sustainable use of biodiversity as a strategy for conservation has been central to the aims of the CBD, this subject does not seem to have entered into the country´s management of biodiversity in an effective manner. Given the regulatory functions of the MADS, it is evident that the management of use seems to be in the hands of the productive sectors, with whom there has been an intermittent flow of dialogue. Notwithstanding the above, the fact that some of the sectorial actors have begun to recognize the role of biodiversity in increasing productivity and competitiveness makes it possible to identify advances in the incorporation of criteria for the management of biodiversity into some systems of extraction and production. The MADS has been working out different strategies to promote sustainability and incorporate the environmental variable into the planning and management of the productive and services sectors, including the institutions responsible for decision-making in this area. Under these premises, the main strategies which have been promoted are: i) Inter-ministerial agendas, ii) the incorporation of the environmental dimension into sectorial policies and iii) cleaner production.

In the case of the agricultural/stock-rearing sector, the increase of sustainable production systems seen in the past few years has been the result of recognizing the non-sustainability with which these productive activities were carried out for many years. As a response to these signs, criteria for the agro-ecology of the country´s productive systems are being established and adopted. Their application has been characterized by an ever greater complexity, moving from the level or scale of components to the scale of the farm, the sector and the region (Corrales 2002). Thus the MADR has begun to work in the promotion and strengthening of this activity, based on the criteria of the non-use of chemical fertilizers, herbicides or pesticides or other toxic substances that have an impact on human health and the environment, as well as the concept of sustainable production and competitiveness (MADR 2007).

In the forestry sector, initiatives have been developed to undertake processes for the sustainable management of the forest resource, through the training of technical personnel and beneficiaries, support for the organization of users, the development and application of the sustainable exploitation and management of forests and linking regional management of the forestry sector with the PNDF. Thus, regional forest plans have been promoted, along with the development of technical and juridical tools for forest management, the interchange of experiences and the encouragement of a dialogue between the actors linked to the forestry sector. However, it is very important that these processes continue to be promoted, so that they extend to more areas of the country, especially those where the illegal felling and non-sustainable management of forests threatens the supply of ecosystemic services.

In the case of fishing and hydro-biological resources it is necessary to implement drastic measures of planning which will permit us to sustain species over time and space (Barreto and Borda 2008). The MADS underlines that there is no action line for hydro-biological resources, nor a base of clear information on these resources. On a local level, the IAvH and the UAESPNN have been carrying a project with ornamental fishes in Puerto Inírida, since their commercialization is one of the main sources of income for the communities of that region (Castellanos *et al.* 2008. The same applies to the Omacha Foundation within the framework of the Pijiwi Orinoko project undertaken in the El Tuparro World Biosphere Reserve, where work is being done

on a value chain for ornamental fish through improved practices of extraction, storage and transport; business development and social organization; strategic alliances and the opening of new markets.

The UAESNPNN has established different agreement on ecotourism with national and international institutions, with the aim of strengthening, promoting and encouraging the financial sustainability of ecotourism (international and with a community emphasis) in the different protected areas of the SINAP (Source: Virtual Bulletin on Parks -- *Boletín virtual de Parques* – No. 14, November 24, 2008).

Few advances have been seen in other systems of the use, extraction and sustainable exploitation of fauna and flora in ecosystems and agro-ecosystems, despite initiatives towards this end through a dialogue with communities about bioprospecting or building a bridge between scientific knowledge and their traditional knowledge. There have been advances in characterizing subsistence hunting activities, mainly with indigenous communities and on some occasions with peasant-farmer ones, in which biological, ecological and socio-cultural data are obtained on the techniques which are employed and the uses given the hunted fauna. Despite that, this information has not been incorporated in those studies in a manner that would allow one to determine the sustainability of such activities with the required precision (Chaves and Santamaría 2006).

With regard to the legal commerce of species, CITES permits are one of the main tools for regulating the import and export of species which are endangered by this business. Although the country issued 2,168 CITES permits for import, export and re-export in 2011, out of a total of 2,259 applications (MADS 2012a), the need to institutionally strengthen these procedures is evident. Colombia has shown important advances in aspects of the breeding of wild animals, especially in a closed cycle, while at the same time it is in the process of adjusting Resolution 1367 of 2000, which regulates the processes of importing and exporting other species not included in the CITES appendices, in order to optimize the permit-application procedures and include aspects hitherto not considered.

In addition, Colombia is one of the pioneers, on a world level, in adopting the principles of international trade with regard to establishing a line of Sustainable Bio-Commerce [16]. The support given to this activity by the IAvH allowed for the promotion of value chains in natural ingredients for the cosmetic and pharmaceutical industries, natural ingredients for the foodstuffs industry, tropical flowers and foliage, Amazonian fruits, craftwork and ecotourism (IAvH 2008). Since then, with the creation of the Bio-Commerce Fund and the Bio-Commerce Monitoring agency (Observatorio de Biocomercio -Obio), the country has been able to advance even further in the granting of credits, factoring and risk capital to companies devoted to bio-commerce in the country (Taken from: www.fondobiocomercio.com). Recently, with the adoption of the National Policy for Competitiveness and Productivity (CONPES 3527 of 2008), bio-commerce has been recognized as an aspect of competitiveness, facilitating the setting into motion of the National Bio-Commerce Program, whose general aim is to promote the development of innovative and competitive businesses in the field of bio-commerce which contribute to the conservation of biodiversity, its ecosystemic services and the welfare of Colombian society within the framework of the GIBSE (MADS 2012b).

The approbation of Conpes document 3533 (2008) "Foundations of an action plan for the adjustment of the intellectual property system to national competitiveness and productivity: 2008-2010" opens the possibility of establishing the foundations in the country for a policy which regulates aspects of intellectual property and facilitates the production of patentable knowledge, the protection of intellectual property rights and a recognition of the opportunities provided by biodiversity for the development and application of knowledge (Colombian Ministry of Foreign Relations *et al.* 2008).

Finally, and though the subject embraced and linked different aspects of the PNB (1996), Colombia still lacks clear tools and mechanisms to promote a fair and equitable distribution of the benefits deriving from the use of biological diversity, especially its genetic resources. However, the country has

16 Sustainable bio-commerce refers to the set of activities of gathering and/or production, processing and commercialization of the goods and services derived from native biodiversity, under criteria of environmental, social and economic sustainability. The term was adopted at the 6th Conference of the Parties to the CBD in 1996 and its definition was accepted by the National Bio-commerce Programs, the CAN, the UNCTAD and the CAF in 2004.

advanced in the development of a Technical Proposal for a Policy for the Access to and Sustainable Exploitation of Genetic Resources and Derived Products in Colombia (produced by the Humboldt Institute in 2004) and the integration of the problems of the use and exploitation of their natural base into the institutional analysis of this subject in order to strengthen the design of policy instruments and economic incentives (IAvH 2008).

THE STATE AND CONSERVATION OF BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES (ECBD&SE)

The state of the conservation of national biodiversity has historically been threatened by the action of the drivers of the transformation and loss of biodiversity (Table 7). A review of their effects is presented in the description of the Analysis and Management of Risk Factor (page 63).

Additionally, native agro-biodiversity receives little recognition as a part of national biodiversity. In that regard, the conservation of cultivars, **autochthonous** races and wild relatives of domesticated species is mainly undertaken through germplasm banks. Nevertheless, actions for the *in situ* conservation of agro-biodiversity and associated traditional practices are limited to local programs, in specific communities, rather than being a clear policy led by the central government. It is important that these initiatives be promoted, especially because of their value as a strategy for adaptation to climate change.

Finally, it is necessary to recognize and explicitly communicate to all levels of society that the country´s megadiversity enables it to sustain ecosystemic processes on continental and global scales. The role of the Amazon region and the Chocó bio-geographic region as photosynthesizing "machines" for the world (which produce oxygen and act as carbon stores and sinks) and as regulators of the region´s climate; the supply of waters by the *páramos* to the basins of the rivers Amazon and Orinoco; the coastal ecosystems´ role in the spawning and reproduction of a large number of species which are important to fishing in the Caribbean and the Pacific, among many other ecosystemic services of global importance, are examples of how activities for the management of the conservation of national mega-diversity will contribute to the achievement of world objectives in dealing with climate change through actions like the reduction of greenhouse gas emissions caused by deforestation, degradation and LULUCF; the reduction of the processes of desertification; and the protection of genetic variability. Additionally, many of the actions which are currently carried out in Colombia to protect biodiversity, such as the control of the illegal trafficking of species, the fight against biological invasions and bio-security protocols are also opportunities to contribute to the fulfillment of global goals to reduce the loss and deterioration of biodiversity which have been laid down in the new action plan for 2011-2011 of the CBD and the Aichi targets.

FACTORS OF THE LINKAGE ZONE

These are factors which turn into the "stopcock and control valve" for connecting the factors found in the zone of work. The evolution of these factors must be regulated, to a greater or lesser extent, to aid the fulfillment of the system´s objective (Figure 12).

INTRA- AND INTER-INSTITUTIONAL AND INTERSECTORIAL LINKAGE (AIII)

On the basis of the analysis of the conflicts among the actors associated with the management of biodiversity (page 19), evident, among other conflicts, is the failure to coordinate actions not only within but also among the institutions both of the environmental sector and the different sectorial ones. In some cases this situation leads to the duplication of efforts (at times using different methodologies, which greatly complicates the unification and harmonization of information), the realization of processes without counting on the participation of institutions or entities which work in the same fields, or contradictory norms or tools which the sector which promotes them may regard as positive but are negative by virtue of the potential environmental impacts caused by their implementation

In addition, this lack of linkage is also seen in the management and implementation of international environmental agreements and conventions directly or indirectly related to biodiversity and its ecosystemic services (for example, the Hyogo Protocol, FAO Convention, UPOV Convention, and WIPO WTO and ITTO agreements, among many others). Discussions, activities of implementation and reports are handled in an independent manner and rarely are activities undertaken which produce strategies for preparing negotiations for other, related conventions,

in order to give coherence to the country´s positions (for example, the CBD, UNFCC, UNCCD, UNFF). Clearly, strengthening the internal articulation of the implementation of all these international commitments will help to identify and guide the areas where international cooperation (financial and technical) may be taken better advantage of and thus effectively help to achieve the objectives of conserving biodiversity and its ecosystemic services.

NORMS (NORM)

The regulatory framework acts as a Factor of Linkage with other factors in the zones of power, work and result (Figure 12). In our country, the tendency has been to regard it as the reason for being of public management and intra- and inter-institutional and inter-sectorial linkage. In other words, the functioning of the country´s public institutions is linked in order to produce norms or because there is a norm which requires such linkage and thus the management capacity of the State is undervalued. Unfortunately, despite institutional efforts, the regulatory framework, as the maximum management strategy, does not lead the social and sectorial actors to appropriate or sufficiently value their responsibility for and commitment to the maintenance of biodiversity and its ecosystemic services, added to which is the fact that the application of much of the current regulatory framework is not effective. Additionally, the current regulatory framework does not have a strong influence on the formulation and implementation of economic and sectorial policies, which means that the environmental dimension is not taken into account as rigorously as it should be.

THE SOCIAL VALUATION OF BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES (VSBD&SE)

As was mentioned above, biodiversity and its ecosystemic services in Colombia suffer from the "tragedy of the commons" (Hardin 1968). This ignorance of its importance for the maintenance of human well-being encourages the idea that biodiversity is something that is not necessary and thus its social valuation is low, being limited to ethical aspects and/or personal convictions which are not often decisive factors in the decisions revolving around the country´s economic growth.

At the present time, the country has not significantly advanced in the recognition and strengthening of biodiversity as a public value on a national level. For that reason, the strategies which are beginning to be implemented on an international level to position Colombia as a State where biodiversity has a strategic role must be strengthened by national actions which promote and secure the maintenance of biodiversity and its ecosystemic services.

FACTORS IN THE ZONE OF AUTONOMOUS PROBLEMS

The Willingness and Commitment of the Actors factor (VCA) lies in the autonomous problems zone. It is a factor of little significance within the system and acts in an isolated manner. Not many efforts should be focused on it, due to its weak influence and dependence. The analysis of this factor shows that it depends on the intrinsic characteristics (characteristic traits) of the actors who participate in the management of biodiversity, not the GIBSE system made up of the other factors which have been identified (Figure 12).

RELATIONSHIP BETWEEN THE IDENTIFIED FACTORS AND THE GIBSE

On the basis of the above diagnosis, there is a clear need to go beyond current arrangements towards a model of management which integrates all the actors in society and is based on the inclusion of different systems of knowledge, participation and social and sectorial co-responsibility, in order to strengthen the adaptive capacity of institutions to facilitate and promote the strengthening of the governance of biodiversity and its ecosystemic services so that they may be recognized and accepted as public values. Thus, the conservation of biodiversity may come to be understood and managed as the foundation of the country´s territorial ordering, so that the resilience of its socio-ecological systems is maintained and the supply of ecosystemic services fundamental for human well-being is secured and at the same time socio-ecosystemic vulnerability to the risks associated with climate change is reduced.

In that way, the needs which have been identified with regard to undertaking an integral management of biodiversity and its ecosystemic services (GIBSE) are contextualized through the diagnostic elements which the development of the key factors identified provide (Table 11).

Table 11. Description of the general needs involved in undertaking the integral management of biodiversity and its ecosystemic services (GIBSE) and the factors which contribute diagnostic elements to its strategic contextualization.

REQUIREMENT FOR THE REALIZATION OF THE GIBSE	KEY FACTORS WHICH SUPPLY DIAGNOSTIC ELEMENTS
Need to undertake actions for *in situ* and *ex situ* conservation, both in wild areas[17] (protected or not) and transformed continental, marine, coastal and island landscapes, so that viable populations of flora and fauna and the resilience of socio-ecological systems are maintained and the supply of ecosystemic services on national, regional, local and trans-frontier scales is upheld.	Economic and sectorial policies (PES) Effectiveness of planning instruments (EIP) Availability and allocation of financial resources (DCARF) Use and occupation of territory (UOT) Practices of use and management of Biodiversity and its ecosystemic services (PUMbd&se) State and conservation of Biodiversity and its ecosystemic services (ECbd&se).
Need to strengthen the relationship between the State and citizens (urban and rural) to integrally manage biodiversity and its ecosystemic services on the basis of participation in and co-responsibility for conservation actions, so that the maintenance of biodiversity in explicit socio-ecosystemic contexts may be socially assumed and perceived as an irreplaceable benefit which maintains and improves the quality of life on national, regional, local and trans-frontier scales.	Management capacity of public institutions (CGIP) Availability of and criteria for the allocation of financial resources (DCARF) Social valuation of Biodiversity and its ecosystemic services (VSbd&se) Regulatory framework (Norm) Intra- and inter- institutional and inter-sectorial coordination (AIII) Participation in the making of decisions about biodiversity and its ecosystemic services (VSbd&se) Willingness and commitment of the actors (VCA)
Need to incorporate biodiversity and the supply of ecocystemic services into planning and the making of sectorial decisions so that it creates co-responsibility in undertaking actions of conservation and integral valuation (economic and non-economic) and thus helps to maintain the sustainability of actions of production, extraction, settlement and consumption and the improvement of the quality of life on national, regional, local and trans-frontier levels.	Economic and Sectorial Policies (PES) Effectiveness of planning tools (EIP) Availability of and criteria for the allocation of financial resources (DCARF) Intra- and inter-institutional and inter-sectorial linkage (AIII) Regulatory framework (Norm) Valuation of Biodiversity and its ecosystemic services for economic development (Vbd&seDE) Use and occupation of territory (UOT) Practices of the use and management of Biodiversity and its ecosystemic services (PUMbd&se) State and conservation of Biodiversity and its ecosystemic services. (ECbd&se)
Need to promote, strengthen and coordinate the generation, recuperation, linkage and dissemination of information, knowledge and technological developments deriving from different systems of knowledge which facilitate the nourishment and orientation of the Integral Management of Biodiversity and Its Ecosystemic Services at national, regional, local and trans-frontier scales.	Access to and quality of information and knowledge (ACIC) Availability of and criteria for the allocation of financial resources (DCARF) Intra- and inter-institutional and inter-sectorial linkage (AIII) Regulatory framework (Norm
Need to undertake actions to confront the threats related to environmental change (loss and transformation of biodiversity and its ecosystemic services + variability and climate change) in order to maintain socio-ecosystemic resilience and reduce its vulnerability, in line with the ecosystem-based approach[18] to mitigation and adaptation, so that the quality of life on national, regional, local and trans-frontier scales is not jeopardized.	Analysis and management of risk (AGR) Availability of and criteria for the assignation of financial resources (DCARF) Social valuation of Biodiversity and its ecosystemic services (VSbd&se) Use and occupation of territory (UOT) Practices of use and management of Biodiversity and its ecosystemic services (PUMbd&se) State and conservation of Biodiversity and its ecosystemic services (ECbd&se)
Need to undertake actions to strengthen the country´s international position as a megadiverse one which supplies ecosystemic services of global importance and at the same time undertakes national actions to help in the world fight against the climatic-ecological challenges (environmental change) which threaten the stability of the planet.	Valuation of Biodiversity and its ecoystemic services for economic development (Vbd&seDE) Use and occupation of territory (UOT) Practices of use and management of Biodiversity and its ecosystemic services (PUMbd&se) State and conservation of Biodiversity and its ecosystemic services (ECbd&se)

17 Wild areas refer to the areas of the country which have been little transformed by human activities and where the ecological dynamic predominates in the definition of its structure, function and change. These areas may be in some protected category (protected areas or areas that may be included in the Portfolio of Conservation Areas) or they may not.

18 The ecosystem-based approach to mitigation and adaptation is comprised of proven, complementary, sustainable and cost-effective solutions based on the maintenance of biodiversity and its ecosystemic services in order to complement national and regional measures for mitigation and adaptation based on technology (World Bank 2009; Andrade 2010), thus reducing societies´ vulnerability to environmental change. The adaptation to and mitigation of environmental change are measures which may be complementary, interchangeable or independent. However, as replacements they are never perfect, since mitigation is always necessary to avoid dangerous and irreversible changes in the climatic system (IPCC 2007).

STRATEGIC FRAMEWORK

GUIDING PRINCIPLES

a. **The vital priority of biodiversity:** Life is the supreme value. The survival of life and the planet depend on the protection of the tangible and intangible components of biodiversity and the understanding of its dynamic character.

b. **The well-being of the population and the improvement of its quality of life:** The quality of life of the population is reciprocally and indissolubly related to the conservation of biodiversity and its ecosystemic services.

c. **Biodiversity is the source, foundation and guarantee of the supply of ecosystemic services,** indispensable for the sustainable development of the country, its adaptation to global environmental changes and the well-being of Colombian society.

d. **The principle of the integral and complementary nature of biodiversity:** Biodiversity must be understood from an integral standpoint, which means incuding internal and external aspects of institutions and individuals.

e. **Co-responsibility:** The management of biodiversity is a shared but differentiated responsibility of all the members of society. The distribution of the risks and benefits deriving from environmental management must be democratic, just and equitable.

f. **The precautionary principle:** When management faces situations of uncertainty, the precautionary principle should be followed.

g. **The recognition of and respect for cultural differences:** Biological diversity is closely linked with ethnic and cultural diversity. The recognition of these and respect for cultural differences are fundamental in the design of local strategies of conservation and must be linked with policies for the development and ordering of territory in order to guarantee its sustainable use.

h. **Sustainability:** Living systems have a dynamic character and are in permanent transformation, while they also require the preservation of the natural base which upholds them and the rational use of their components to ensure the viability of human life and its endurance over time.

i. **Adaptation to change:** The management of biodiversity must take advantage of the margins of variability of the system so that management capacity and the use of resources will be permanently adjustable and based on a continuous study of its dynamic.

j. **The territorial dimension:** The socio-ecosystemic dimension finds its expression throughout the cycles which are developed in concrete territorial scenarios, thus, its management must de done in harmony with territorial ordering policies.

k. **Decentralization:** The ecosystemic approach requires a management of biodiversity on national, regional, local scales and trans-frontier scenarios, which implies adequate levels of decentralization and social participation in its management.

l. **Competitiveness:** Biodiversity is the foundation of the natural and economic wealth of the country and is one of its main comparative advantages over other nations of the world.

m. **The inter-sectorial character of management:** The efficient management of the components of biodiversity requires the agreement of all the sectors and public and private actors who live off the economic, social and cultural activities associated with its use and protection.

n. Fairness: As biodiversity is a national patrimony and a source of ecosystemic services and benefits for society in general, and all Colombian citizens have the same constitutional rights, the integral management of biodiversity must be based on securing an equitable social balance among the different sectors, actors and individuals who inhabit this territory.

PURPOSE

To guarantee the conservation[19] of biodiversity and its ecosystemic services and the fair and equitable distribution of the benefits derived from it, in order help improve the quality of life of the Colombian population.

GENERAL OBJECTIVE

To promote the Integral Management of the Conservation of Biodiversity and its Ecosystemic Services so that the resilience of socio-ecological systems is maintained, on national, regional and local scales, taking into account scenarios of change and through the joint, coordinated and concerted action of the State, the productive sector and civil society.

THEMATIC AXES AND STRATEGIC LINES

AXIS 1. BIODIVERSITY, CONSERVATION AND THE CARE OF NATURE

This refers to the need to undertake actions of *in situ* and *ex situ* conservation, both in wild areas (protected or not) and transformed[20] continental, marine, coastal and island landscapes, so viable populations of flora and fauna and the resilience of socio-ecological systems are maintained and the supply of ecosystemic services is upheld on national, regional, local and trans-frontier scales.

Strategic Lines

1. To strengthen and link actions of the *in situ* and *ex situ* conservation of biodiversity through preservation, restoration and sustainable use linked to traditional, non-detrimental practices, both in wild areas and transformed landscapes, in order to maintain the resilience of socio-ecological systems and the supply of ecosystemic services on national, regional, local and trans-frontier scales.

2. To identify and implement processes for the ecological restructuring of territory on national, regional and local scales, linked to the processes of consolidating the National System of Protected Areas(SINAP) [21]; the environmental ordering and zoning of protective national forest reserves; giving priority to the conservation of the ecosystems of *páramos* and wetlands; the ordering of natural forests and other *in situ* conservation actions (previous numeral), in order to guide territorial ordering and maintain the resilience of socio-ecological systems as well as the supply of ecosystemic services.

3. To promote and strengthen activities for the recuperation, protection and *in situ* and *ex situ* conservation of wild species in danger of extinction.

4. To promote and strengthen activities for the recuperation, protection and *in situ* and *ex situ* conservation of

19 Conservation is the result of undertaking actions in the territory of preservation, sustainable use, restoration and the generation of knowledge.

20 Transformed landscapes are areas of the country which evidence a historic modification caused by human activities. This term groups together rural, conurban and urban landscapes. They are characterized that way because the dominant matrix of the landscape is a mosaic made up of manmade covers and productive ecosystems (agro-ecosystems) and native natural and semi-natural ecosystems.

21 According to Decree 2372 of 2010 and CONPES document 3680, the process for the Consolidation of the National System of Protected Areas (SINAP) of the country must be undertaken on the basis of activities which allow for a complete, ecologically representative and effectively managed system.

autochthonous varieties of domesticated animals and cultivated plants and their wild relatives, and also traditional practices of biodiversity use, to maintain alimentary security and adaptation to climate change.

5. To strengthen the activities and national, regional and local institutional framework for the control, monitoring and vigilance of the exploitation, trafficking and illegal commercialization of wild species, as well as the post-confiscation management of flora and fauna.

6. To strengthen the activities and institutional framework related to the conservation of biological and genetic resources, their derivatives and the associated traditional knowledge, as well as a better knowledge of them, in order to improve the quality of life through the fair and equitable distribution of the benefits derived from these resources.

AXIS II. BIODIVERSITY, GOVERNANCE[22] AND THE CREATION OF PUBLIC VALUE

This refers to the need to strengthen the relationship between the State and citizens (urban and rural), in order integrally manage biodiversity and its ecosystemic services through participation in and co-responsibility for conservation actions, so that the maintenance of biodiversity in explicit socio-ecosystemic contexts may be assumed and socially perceived as an irreplaceable benefit which maintains and improves the quality of life on national, regional and local scales.

Strategic Lines

1. Strengthening the mechanisms and opportunities for social participation in the making of decisions on the local level to increase the adaptive capacity of institutions[23] in territorial management.

2. Intra- and inter-institutional and inter-sectorial linkage to improve the effectiveness and guidance of decision-making related to the Integral Management of Biodiversity and its Ecosystemic Services.

3. Improvement of the management capacity of public institutions for the conservation of Biodiversity and its ecosystemic services, starting with the creation of public value.

4. Conceptual and methodological development to incorporate the Integral Management of Biodiversity and its Ecosystemic Services into the different tools for planning and territorial ordering.

5. Updating of and/or linkage between existing and future management tools (policies, norms, plans, programs and projects) related to the different levels of the organization of biodiversity, so that they may be consistent with the conceptual and strategic outlines of this policy.

6. Strengthening, linkage and accompaniment in the implementation of the regulatory framework for the Integral Management of Biodiversity and its Ecosystemic Services.

7. Development and strengthening of local systems for the transformation of socio-environmental conflicts associated with the Integral

22 Governance is understood to be comprised of the interactions among structures, processes and traditions which determine how power is exercised, how decisions are made about subjects of public interest and how citizens and other actors participate (Graham *et al.* 2003), for the achievement of a lasting economic, social and institutional development, and a healthy equilibrium between the State, the civil society and the market economy (Cano 2007).

23 The adaptive capacity of institutions refers to the capacity which institutions have to give flexibility to their management mechanisms in the face of social, economic, ecosystemic and political changes, through learning, experimentation and innovation.

Management of Biodiversity and its Ecosystemic Services.

8. Recognition and incorporation of traditional bodies of knowledge and practices into all the levels of the Integral Management of Biodiversity and its Ecosystemic Services.

AXIS III. BIODIVERSITY, ECONOMIC DEVELOPMENT, COMPETITIVENESS AND QUALITY OF LIFE

This refers to the need to incorporate biodiversity and the supply of ecosystemic services into the planning and taking of sectorial decisions so that co-responsibility is created for undertaking actions for conservation and integral valuation (economic and non-economic) and thus allows for the maintenance of the sustainability of the actions of production, extraction, settlement and consumption and the improvement of the quality of life on national, regional and local scales.

Strategic Lines

1. Develop schemes and instruments for the integral valuation (economic and non-economic) of biodiversity and its ecosystemic services, related to production, extraction, settlement and consumption, in order to guide territorial ordering and recognize its importance in guaranteeing the sustainability of production and national competitiveness.

2. Maintain systems for the conservation of biodiversity and incorporate them into productive and extractive systems, as a strategy for maintaining and increasing the supply of ecosystemic services which are fundamental for the quality of life.

3. Strengthen alliances between the public and private sectors, as well as intra- and inter- institutional and inter-sectorial linkage, in order to position biodiversity as a strategic element in the country´s economic and sectorial policies.

4. Identification and evaluation of the long term economic, ecological, cultural and social costs and benefits derived from the relationship between productive activities and the maintenance of the ecosystemic services derived from biodiversity ("trade offs").

5. Strengthen the activities of and institutional framework for the legal commerce of wild species (specimens, parts and/or derivatives) for national and international markets.

6. Strengthen the activities of and institutional framework for the evaluation of environmental impacts, the recuperation of environmental deficits and the allocation of environmental indemnities for environmental loss linked to projects that may receive environmental licenses, on a national, regional and local scale, to maintain the resilience of socio-ecological systems and the supply of ecosystemic services fundamental for the quality of life.

7. Identification of the areas apt for the development of productive and extractive activities as well as activities of environmental compensation linked to environmental licensing, for the guidance of territorial ordering and to maintain the resilience of socio-ecological systems and the supply of ecosystemic services fundamental for the quality of life.

AXIS IV. BIODIVERSITY AND THE MANAGEMENT OF KNOWLEDGE, TECHNOLOGY AND INFORMATION

This refers to the need to promote, strengthen and coordinate the generation, recuperation, linkage and dissemination of information, knowledge and technological developments arising from different systems of knowledge which help to nourish and guide the taking of decisions for the realization of an Integral Management of Biodiversity and its

Ecosystemic Services on national, regional, local and trans-frontier scales.

Strategic Lines

1. To strengthen and encourage the management of knowledge and information to guide and uphold the taking of decisions about the Integral Management of Biodiversity and its Ecosystemic Services and also increase its integral valuation (economic and non-economic) by economic, environmental and social[24] sectors.
2. The inclusion and harmonization of priorities for research into biodiversity and its ecosystemic services in the national policies and plans related to science, technology and innovation.
3. Strengthening of the processes for undertaking an inventory and monitoring of biodiversity and its ecosystemic services, through cartography on adequate scales, collection and the evaluation of the components, structures and functions of biodiversity.
4. Undertake the identification of the thresholds of stability and change in socio-ecological systems at different scales in order to guide decision-making about territory, especially those related to the use of biodiversity on its different levels of organization.

AXIS V. MANAGEMENT OF RISK AND SUPPLY OF ECOSYSTEMIC SERVICES

This refers to the need to undertake actions to confront the threats related to environmental change (loss and transformation of biodiversity and its ecosystemic services + variability and climate change), in order to maintain socio-ecosystemic resilience and reduce its vulnerability, following an ecosystem-based approach to mitigation and adaptation, so that the quality of life on national, regional, local and trans-frontier scales is not jeopardized.

Strategic Lines

1. To promote and strengthen management capacity and intra- and inter-institutional and inter-sectorial linkage in order to identify, prevent and mitigate the risks associated with environmental change (loss and transformation of biodiversity and its ecosystemic services + variability and climate change) on a local, regional and national scale.
2. Promote and strengthen management capacity and intra- and inter-institutional and inter-sectorial linkage to increase socio-ecosystemic adaptive capacity so that the supply of ecosystemic services is maintained on a regional and national scale and the turning of the measures developed into poor adaptations[25] is avoided.
3. Strengthen and implement schemes for evaluating risks and early warning systems to prevent potential effects of environmental change on socio-ecosystems.
4. Development of mechanisms of risk transference[26] in the face of events

24 In this area it is important to underline the need to strengthen and more effectively operationalize the Environmental System for Colombia (SIAC) and its sub-systems, so that they deliver more and better information to support decision-making

25 "Poor adaptation" is defined as a "development of the traditional viewpoint, which, by not taking the effects of climate change into account, unwittingly increase exposure and/or vulnerability to environmental change" (adapted from OCDE 2008). "Poor adaptation" may occur when there is no evident need for adaption in current circumstances but existing practices of development yield short-term benefits and at the same time increase long-term risks (e.g. agricultural expansion in zones which are currently humid but which will become too dry according to scientific projections, and thus will not support agriculture in the long-term) (UNDP 2009).

26 Risk transference refers to situations where one confronts risks which are difficult to manage and/or are unlikely to occur but may be very severe and, due to their characteristics, cause grave impacts on a community, city or nation. In these cases, one may choose to transfer the risk to a third party who helps with restoration, rehabilitation and/or reconstruction. Examples of mechanisms for the transference of risk may be found in the insurance industry and capital markets (Cardona 2005; Menéndez 2007).

related to environmental change, so that the supply of ecosystemic services is maintained and recovered.

AXIS VI. BIODIVERSITY, CO-RESPONSIBILITY AND GLOBAL COMMITMENTS

This refers to actions which the country should develop to strengthen its international positioning as a megadiverse country which supplies ecosystemic services of global importance at the same time that it undertakes national actions to help in the world fight against the climatic-ecological challenges (environmental change) which threaten the stability of the planet.

Strategic Lines

1. Linkage on a national level of the international commitments signed and ratified by Colombia (pag.12-13) to strengthen the integral management of the conservation of Biodiversity and its ecosystemic services.
2. Positioning and strengthening of the conservation of biodiversity and its ecosystemic services as a distinguishing feature of the country which is strategic in international negotiations.
3. Promote coordinated and joint actions with neighboring countries for the conservation of biodiversity and their common and trans-frontier ecosystemic services.
4. Strengthening of the international position of the country in the field of biodiversity to optimize strategies and improve the mechanisms of international cooperation.
5. Development of national actions which contribute to the achievement of global objectives for confronting global environmental change, especially in relation to climate change (including the fight against desertification and drought), the supply of ecosystemic services, biosafety, invasive exotic species and the illegal trafficking of species.

PROCESS OF FORMULATING THE NATIONAL ACTION PLAN FOR THE INTEGRAL MANAGEMENT OF BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES (PANGIBSE)

The National Policy for the Integral Management of Biodiversity and its Ecosystemic Services (PNGIBSE) will have, for its implementation, a National Action Plan for the Integral Management of Biodiversity and its Ecosystemic Services (PANGIBSE), which will specifically define programs, projects, responsible parties, goals and indicators for the fulfillment of each of the strategic lines set forth in the Policy. For the formulation of the PANGIBSE, the country will apply for resources from the Global Environment Fund (FMAM/GEF), through the Enabling Activity for the formulation of national biodiversity strategies and action plans (NBSAP). This Plan will have to be based on a strategy for assigning priorities to the subjects and the implementation of the same, where actors on the national, regional and local scales participate and which will be periodically reviewed and evaluated (every four years approximately), so that its integral management may be more focused, agile and effective and thus facilitate knowledge of the extent of the Plan´s implementation, the taking of necessary corrective measures and the emphasizing, adjustment and re-programming of national priorities in accordance with the results of the evaluation. In addition, the National Action Plan will have to count on a system of continuous follow-up through indicators for state, pressure and response, so that it may be an integral management tool – adaptive, flexible and innovative – which allows for the management of change in socio-ecological systems and promotes social and sectorial co-responsibility in conservation actions and the recognition of biodiversity and its ecosystemic services as a public value.

As was explained in the section on the operationalization of the GIBSE (page 43), the Autonomous Regional Corporations (CARs) and Corporations of Sustainable Development (CDSs) and the Urban Environmental Authorities (AAUs) will have to formulate and/or update their Regional Biodiversity Action Plans (PARGIBSE), in order to conceptually and strategically link them with this Policy and its National Action Plan. These Regional Plans will also be formulated in a participatory manner and periodically evaluated (every four years approximately) and will turn into the "road map" for guiding the management of these institutions, so that the conservation of biodiversity and its ecosystemic services on regional and local scales is guaranteed. Like the National Plan, the Regional Plans will have to count on a system of continuous follow-up through indicators of state, pressure and response.

The formulation of the National Action Plan, as well as its evaluation and follow-up, must be the result of a concerted and participatory process which the Ministry of Environment and Sustainable Development will carry out through the Directorate of Forests, Biodiversity and Ecosystemic Services, with the technical support of the National Parks Unit, the research institutes affiliated and linked with the Ministry, the National Planning Department and also representatives of all the groups of actors identified with (page 17; Figure 2) and involved in the Integral Management of Biodiversity and its Ecosystemic Services. In this process of participation and coordination, regional characteristics and priorities will have to be taken into account, in the awareness that those efforts must help to achieve the objectives and national goals of the National Policy for the Integral Management of Biodiversity and its Ecosystemic Services.

Since the specific actions will be defined in the National Action Plan, it is there that the costs and sources of funding for its implementation will be defined. However, the State, headed by the MADS, counts on resources from the General Budget of the Nation which are allocated for the technical and regulatory orchestration of this Policy. Additionally, measures will be taken to broaden the financial framework and the framework for middle-term spending in order to guarantee the fulfillment of the objectives set forth. Nevertheless, it is fundamental that other actors from the public and private sector contribute funds to the implementation of this Policy, since they are direct and indirect users and beneficiaries of biodiversity and its ecosystemic services.

Additionally, the Ministry, with the support of the Ministry of Foreign Relations and the Colombian Presidential Agency for International Cooperation (APC), will apply to international cooperation bodies and the multilateral banks to obtain the resources needed for the development of the National Action Plan.

FOLLOW-UP, MONITORING AND EVALUATION

Taking into account that the Policy will count on a National Action Plan for the Integral Management of Biodiversity and its Ecosystemic Services (PANGIBSE), through which the actions for each of the specific objective set forth will be developed, that will be the instrument which defines the indicators for undertaking the monitoring, evaluation and follow-up of the activities which are defined in accordance with the targets which are agreed on, so that sufficient and trustworthy information may be counted on, both on the base line for the state of biodiversity and its ecosystemic services, and the areas related to the integral management of the same.

The follow-up of the Policy through the National Action Plan for the Integral Management of Biodiversity and its Ecosystemic Services (PANGIBSE) will be led by the Ministry of Environment and Sustainable Development (MADS), with the support of the research institutes affiliated and linked with it, as well as the sectorial, regional and territorial governmental agencies which the MAVDT takes into consideration.

THE CBD STRATEGIC PLAN: 2010-2020 AND THE AICHI TARGETS

After the 10th Meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD), held in Nagoya, Japan in October 2010, a new Strategic Plan was defined, with 5 strategic objectives and 20 targets known as the Aichi targets (Table 12). The vision of this new Strategic Plan is "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people."

Table 12. Aichi strategic goals and targets, defined by the Convention on Biological Diversity under resolution UNEP/CBD/SBSTTA/REC/XV/1; December 7, 2011

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use
Target 1 By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably. **Target 2** By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems. **Target 3** By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions. **Target 4** By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	**Target 5** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced. **Target 6** By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits. **Target 7** By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity. **Target 8** By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity. **Target 9** By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment. **Target 10** By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services.
Target 11 By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes. **Target 12** By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained. **Target 13** By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	**Target 14** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable. **Target 15** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification. **Target 16** By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building	
Target 17 By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan. **Target 18** By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels. **Target 19** By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied. **Target 20** By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	

NATIONAL POLICY FOR THE INTEGRAL MANAGEMENT OF BIODIVERSITY AND ITS ECOSYSTEMIC SERVICES AND THE AICHI TARGETS FOR BIODIVERSITY: 2020

The Convention of Biological Diversity, through its Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) has been working on the definition of a set of indicators to evaluate the advance and fulfillment of the Aichi targets (Document: UNEP/CBD/SBSTTA/REC/XV/1; December 7, 2011). Although there is no agreement on the adoption of these indicators, the SBSTTA recommends that the Parties regard both the Aichi Targets for Biological Diversity and the proposed framework of indicators as a flexible foundation that should be adapted by the member countries in line with their different circumstances and national capacities. Thus, it urges the Parties to consider utilizing the flexible framework and suggested list of indicators in its national strategies and actions plans on biological diversity.

In the case of Colombia, the Aichi targets and their indicators will be adjusted and defined for the national level, during the formulation phase of the National Action Plan (PANGIBSE). Nevertheless, national fulfillment of the 2020 Aichi targets is a very good reference point for the integral management of biodiversity, in that it enables the country to attain the desired long-term situation in each of the thematic axes of the PNGIBSE (Table 13). The follow-up of the activities laid down in the PANGIBSE should be annual, while the evaluation will have to be every four years.

Table 13. Aichi targets which each of the thematic axes of the policy contribute to and the desired situation for each thematic aspect in the long term (2032)

Thematic Axis	Situation Desired in 2032 with the PNGIBSE	Aichi Targets for 2020 to which each thematic axis of the PNGIBSE for 2020 contributes	
BIODIVERSITY, PROTECTION AND CARE OF NATURE	For the country, the *in situ* and *ex situ* conservation of biodiversity is the basis for maintaining socio-ecosystemic resilience in wild and protected areas and transformed landscapes on national, regional, local and trans-frontier scales, so that ecosystemic services which are crucial for human well-being are abundant and of high quality.	**Target 2** **Target 5** **Target 6** **Target 7** **Target 11**	**Target 12** **Target 13** **Target 14** **Target 16**
BIODIVERSITY, GOVERNANCE AND THE CREATION OF PUBLIC VALUE	Colombian society recognizes biodiversity and its ecosystemic services as a public value that must be conserved to maintain the quality of life of present generations and its enjoyment by future ones and it integrally manages it on the basis of models of governance.	**Target 1** **Target 2** **Target 4** **Target 11** **Target 13**	**Target 14** **Target 16** **Target 18** **Target 19** **Target 20**
BIODIVERSITY, DEVELOPMENT, COMPETITIVENESS AND QUALITY OF LIFE	The public and private productive sectors are actively involved, in a co-responsible manner, in the actions which allow for the realization of an Integral Management of Biodiversity and its Ecosystemic Services, so that the role which it plays in the maintenance of the country´s productive sustainability and competitiveness is integrally recognized and valued.	**Target 2** **Target 3** **Target 4** **Target 7**	**Target 11** **Target 12** **Target 13** **Target 20**
BIODIVERSITY, AND THE MANAGEMENT OF KNOWLEDGE, TECHNOLOGY AND INFORMATION	The country has increased investments in the areas of biodiversity and its ecosystemic services in the national agendas and CT&I (scientific research, promotion of traditional knowledge, publication and innovation –national patents-), and this knowledge and information is a constant and sufficient input which supports the taking of decisions of concern to the GIBSE	**Target 11** **Target 14** **Target 18** **Target 19**	
BIODIVERSITY, RISK MANAGEMENT AND THE SUPPLY OF ECOSYSTEMIC SERVICES	The country has reduced its vulnerability to the effects of environmental change, by reducing biodiversity loss and mitigating and adapting itself to variability and climate change and by maintaining socio-ecosystemic resilience on national, regional, local and trans-frontier scales, so that the supply of ecosystemic services fundamental to the quality of life is not at risk.	**Target 5** **Target 6** **Target 8** **Target 9**	**Target 10** **Target 11** **Target 15** **Target 18**
BIODIVERSITY, CO-RESPONSIBILITY AND GLOBAL COMMITMENTS	On the basis of its recognition of biodiversity as a public value, the country continues to effectively comply with its international commitments and thanks to its being a supplier of ecosystemic services of global importance, it has positioned itself in the world as an attractive target for sustainable development and as an actor who assumes co-responsibility for global environmental challenges.	**Target 10** **Target 11**	**Target 15** **Target 16**
PNGIBSE AND NATIONAL ACTION PLAN	Effective implementation of the PNGIBSE through the National Action Plan, which is constantly adjusted on the basis of a periodical evaluation (every 4 years) and a continuous follow-up.	**Target 17** **Target 20**	

ACTIONS WHICH ARE PRIORITY IN THE SHORT TERM (2014) IN THE REALIZATION OF THE GIBSE

Although the first step in the implementation of this policy will be the formulation of the PANGIBSE, Table 14 presents the actions for the integral management of biodiversity and its ecosystemic services which are a priority for the country in the short term (2014). These targets are aligned with the proposals in the National Development Plan: 2010 – 2014.

Table 14. Actions and targets which are a priority in the short term (2014) for the realization of the integral management of biodiversity and its ecosystemic services. These targets are consistent with the proposals for the National Development Plan: 2010-21014.

Key subjects of the GIBSE to be applied	Strategic line or lines which aim at the activities (Axis/line)	Action which is a priority for 2014	Target proposed for 2014	Estimated Budget for the period (COP)[1]
Biodiversity as the foundation of Territorial Ordering Socio-ecosystemic Focus Maintenance of the resilience and adaptive capacity of the socio-ecological systems Dynamic Connectivity Between Scales of Time and Space. Recognition and Integration of the Different Systems of Knowledge	I/2 I/3 I/4 II/2 II/4 II/6 II/7 III/2 III/3 III/4 III/6 III/7 IV/4 V/1 V/2 V/3 VI/3	Ecological Structuring of Territory	100% of the Main Ecological Structure of the Nation defined on a national scale (1: 100,000 to 1: 500,000) 1,186, 343 hectares of *páramo* and wetland systems demarcated on an adequate scale. 51, 376, 621 hectares of forest reserves defined by Law 2 of 1959 territorially ordered and zoned.. 3,000,000 hectares incorporated into the SINAP which, as a priority, comprise ecosystems typical of the Orinoco, dry forests, marine-coastal and oceanic areas. 15,000,000 hectares of natural forest ordered and adopted through norms	$ 17,652,140,000
Implementation of measures to confront Environmental Change	I/3 IV/3 I/4 IV/4 II/7 V/1 III/2 V/2 III/4 VI/5 III/6	Restoration, recuperation and rehabilitation of ecosystems	280,000 hectares restored or rehabilitated for protective aims, including biological corridors for connectivity and the prevention of deforestation.	$ 224,749,000
	I/1 II/7 II/2 V/1 II/3 V/2	Prevent the deforestation of 200,000 of the 61 million hectares of natural forest	Prevent the deforestation of 200,000 of the 61 million hectares of natural forest	

Key subjects of the GIBSE to be applied	Strategic line or lines which aim at the activities (Axis/line)		Action which is a priority for 2014	Target proposed for 2014	Estimated Budget for the period (COP)[1]
Strengthening of the Adaptive Capacity of Institutions	I/1 I/3 II/2 II/3 II/4 II/5	III/3 III/6 IV/3 IV/4 V/2	Implementation of a new scheme of environmental indemnities for biodiversity loss	--	$ 10,841,290,300
	I/2 II/2 II/3 II/4 II/5	II/6 III/1 III/3 III/4 III/7	Design a strategy for including environmental considerations in the private taking of decisions about the location of industries and productive activities.	Strategy Designed	
	II/2 II/3 II/5	III/1 III/3 III/5	Promote the implementation of the inter-sectorial pact for legal timber	20 regional agreements for legal timber signed.	
	V/1 V/2 V/3 VI/5		Implement the national plan for the control of invasive, exotic and transplanted species	12 plans formulated for the same number of invasive, exotic and transplanted species	
	I/5		National strategy for the prevention and control of the illegal trafficking of wild species implemented	10 plans formulated for the same number of species subject to illegal trafficking	
	II/6 II/7 III/1 III/3 V/1 VI/5		Formulate the national REDD strategy with co-benefits, which facilitates the economic development of communities and ethnic groups on entering into the global carbon market	Strategy formulated	
	II/1 II/3 V/1	V/2 V/3 VI/5	Formulate and develop the strategy for social co-responsibility in the fight against forest fires	Strategy formulated	
	I/6 II/3 II/5		Harmonize the regulatory framework for access to genetic resources	100 contracts for access to genetic resources signed	
	VI/2 VI/4		Design and implement an international strategy for promoting Colombia as a mega-diverse and environmentally attractive country	Strategy Formulated	
	IV/3		Continue with the inventories of biodiversity	--	

Key subjects of the GIBSE to be applied	Strategic line or lines which aim at the activities (Axis/line)		Action which is a priority for 2014	Target proposed for 2014	Estimated Budget for the period (COP)[1]
	II/1 II/2 II/3 II/4	II/5 II/6 II/7	Improve the effectiveness of the management of the areas of the national natural parks system	--	
	II/1 II/3 II/4	II/6 II/7	Obtain agreements with ethnic groups on special strategies for the management of protected areas.	--	
	I/3 IV/1 IV/2		Promote the formulation of programs for the development of technologies for the restoration, recuperation and rehabilitation of ecosystems and the sustainable use of biodiversity, in coordination with the National System of Science and Technology	--	
	I/1 I/3 I/4 II/1 II/2 II/3 II/5 II/7		Policy guidelines for the integral management of the biodiversity of the Colombian Orinoco and Amazon regions and the Colombian Massif National Environmental Policy for soil resources formulated Formulation of the national policy for hydro-biological resources. . National policy for the environmental management of wild fauna adjusted and implemented.	Guidelines and policies formulated	
	IV/3		Updated map of continental, coastal and marine ecosystems	Map updated (coverages 2007-2010), scale 1:500,000 and coverages 1: 100,000	
Integral Valuation of Ecosystemic Services	II/1 II/2 II/3 III/1		Design and implement tools for the identification and valuation of ecosystemic services and their links with human welfare	3 strategic ecosystems, with their ecosystemic services, identified and valued.	$ 3,856,000,000
	III/1 III/3 III/4 III/5 VI/2		Promote schemes to characterize national production, adding the value of the associated ecosystemic services and recognizing this factor as a comparative advantage in international markets	--	
	II/1 II/2 II/4	III/1 III/3 III/4	Promote the inclusion of the principle of co-responsibility in sectorial plans	--	

1 Amounts estimated on the basis of the National Government´s "Inventory of Projects and Sources" for the period 2012-215. The estimated amounts are based on the amounts estimated for 2014.

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GLOSSARY

Adaptability and adaptive capacity: Capacity to adapt to change. It is also the actors´capacity to influence the system´s resilience.

Adaptation: The adjustment of natural or huam systems to new or changing surroundings. Different kinds of adaptation can be distinguished, including preventive and reactive adaptation, private and public adaptation and autonomous and planned adaptation (Millennium Ecosystem Assessment 2005).

Alternative State: Identified by a change in the dominant organisms or the structure of the system and the processes which reinforce a particular state.

Ancestral or traditional knowledge: Cumulative set of bodies of knowledge, practices and beliefs which have evolved through adaptive processes in human groups and been transmitted over generations. Traditional knowledge is not always exclusive to indigenous or local communities: it is distinguished by the way it is acquired and used through social processes of learning and the exchange of knowledge (Millennium Ecosystem Assessment 2005).

Backcrossing: refers to the crossing of a first-generation hybrid descendant with one of their parents or with a genotype identical to the parental one.

Biodiversity: According to the Convention on Biological Diversity: "biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems".

Biological resource: individuals, organisms or parts of these, populations or any biotic component of real or potential value or utility which contains the genetic resource or its derived products (Andean Community decision 391).

Bio-prospecting: Exploration of biological diversity to identify genetic and biochemical resources of social and commercial value (Millennium Ecosystem Assessment 2005).

Biotechnology: Any technological application which uses biological systems, live organisms or their derivatives with the aim of creating of modifying products or processes for specific uses (Millennium Ecosystem Assessment 2005).

Bottlenecks: Refers to a situation when, as a result of ecosystemic loss, indiscriminate hunting or other processes, the number of members of a population or species drastically falls, reaching the edge of extinction in some cases. As a result of these bottlenecks, later generations have a meager genetic variability.

Climate change: "Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" United Nations Framework Convention on Climate Change).

Complex system: The representation of an outline of that reality, conceptualized as an organized whole (hence it is termed a system), in which the elements which make it up are not "separable" and therefore cannot be studied or handled in an isolated manner (Carcía 2008).

Conservation of biodiversity: An implicit factor or quality which results from the realization of actions of preservation, sustainable use, the generation of knowledge and restoration. It is the main aim of the integral management of biodiversity and its ecosystemic services.

Cultural ecosystemic services: Non-material benefits obtained from ecosystems through spiritual enrichment, cognitive development, reflection, creation and aesthetic experiences.

Derived product: molecule, or combination or mixture of natural molecules, including raw extracts of live or dead organisms of biological origin, derived from the metabolism of live beings.

Disturbance: In ecological terms a disturbance is an event, relatively discrete in time, which comes from without and alters ecosystems, communities or populations, changes the availability of resources and creates opportunities for the establishment of new individuals or colonies.

Driver or Driving force of biodiversity transformation or loss. Every natural factor or one induced by human beings which causes a direct or indirect change in an ecosystem (Millennium Ecosystem Assessment 2005).

Ecological footprint: A measure of mankind´s demands on the biosphere, in terms of the biologically productive area of earth and sea required for a constant supply of renewable resources and the absorption of the wastes produced by its consumption. Its unit of measurement are global hectares.

Ecological recuperation (reclamation): its objective is to restore the utility of an ecosystem without having a pre-disturbed state as a reference point. In this process, a degraded ecosystem is replaced by another, productive one, but these actions do not restore the original ecosystem. Includes techniques like stabilization, aesthetic improvement and in general, restoring lands to what may be regarded as a useful purpose within the regional context.

Ecological rehabilitation: A process which does not imply returning to the original state and is focused on the reestablishment, in a partial way, of the structural or functional elements of the deteriorated ecosystem, as well as the productivity and environmental services which the ecosystem provides, through the application of certain techniques. It is possible to recuperate the ecosystemic function without completely recuperating its structure, that is, one may rehabilitate the ecosystemic function, even with the replacement of the species which compose it (Samper, 2000). On occasions, the planting of native trees or dominant pioneering species of ecological importance may initiate rehabilitation.

Ecological resilience: The capacity of a system to absorb perturbations, maintain its identity (basic structure and manners of functioning) and continue to supply ecosystemic services of a magnitude and frequency needed to sustain human needs and the ecological processes of biophysical systems. Resilience depends on the ecological dynamic, as well as the organization and capacity of institutions to understand, manage and respond to this dynamic (Millennium Ecosystem Assessment 2005).

Ecological restoration: a focused or at least deliberate process by which actions are undertaken to help an altered ecosystem recuperate its initial state or at least reach a point of good health, integrity and sustainability (SER, 2002).

Ecosystem: "dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit." (Convention on Biological Diversity). Community or type of vegetation, understanding community as an assemblage of populations of species that occur together in time and space.

Ecosystemic approach: Strategy for the integrated management of lands, areas of water and live resources in which conservation and sustainable use are promoted. This is based on the application of adequate scientific methodologies which are focused on the levels of biological organization which cover essential structures, processes, functions and the interactions between organisms and the environment. In this approach human beings, with their cultural diversity, are recognized as an integral component of many ecosystems (Millennium Ecosystem Assessment 2005).

Ecosystemic degradation: Persistent reduction of the capacity of ecosystems to supply services (see "***Ecosystemic services***") (Millennium Ecosystem Assessment 2005).

Ecosystemic services: Those processes and functions of ecosystems which human beings regard as direct or indirect benefits (of an ecological, cultural or economic kind). They include those of supply, like water and food; regulation, like the regulation of floods, droughts, degradation of terrains and diseases; sustenance, like the formation of the substratum and recycling of nutrients; and cultural ones of a spiritual, religious or recreational kind or other intangible benefits.

Ecosystemic services of regulation: Benefits resulting from the regulation of ecosystemic processes, including the maintenance of the quality of air, the regulation of climate, the control of erosion, the control of human diseases and the purification of water.

Ecosystemic services of supply: Goods and products obtained from ecosystems, like foods, fibers, timber, water and genetic resources.

Ecosystemic services of support: Ecological services and processes necessary for the supply and existence of the other ecosystemic services, inclu-

ding primary production, the formation of soil and the cycling of nutrients, among others.

Endangered species: Refers to a group of species which have been placed in a category of risk of extinction, like "Critically Endangered", "Endangered" or "Vulnerable", following the definitions of the Red Lists of the IUCN (2001).

Endemic species: Species or higher taxonomic unit restricted to a specific geographic area (Millennium Ecosystem Assessment 2005).

Environmental services: Services related to the environment which are not necessarily created by the functioning and management of ecosystems, but are related to the supply of environmental resources or environmental cleanups provided by industries and social organizations, like sewage services, the collection and disposal of garbage, cleanups and similar services, as well as services which reduce vehicle emissions or noise.

Exotic species (Introduced species): Species introduced outside of their normal range of distribution (Millennium Ecosystem Assessment 2005).

Ex situ conservation*:* Conservation of the components of biological diversity outside of their natural habitats (Convention on Biological Diversity)

Ex situ Conservation Center: Institution authorized by a responsible national authority to conserve and collect genetic resources, components or products derived from biodiversity outside of their range of distribution (Andean Community of Nations – CAN).

Functional group diversity: Group of organisms which carry out different functions in a system (pollination, predation, nitrogen fixing, etc.) (Folke *et al.* 2004).

Functional response diversity: Variety of responses which are possible in an ecosystem in the face of environmental changes.

Genetic resource: All material of a biological nature which contains genetic information of real or potential utility (Andean Community decision 391).

Global change: The result of a set of atmospheric, climatic, ecological and bio-geochemical changes accelerated and accentuated by human activities of settlement; production and extraction, which, on their own or together, lead to multi-scale changes in the functioning of the terrestrial system (Duarte *et al.* 2006) in a way that directly affects human well-being and survival.

Within environmental change one detects climatic – atmospheric processes (for example, climate change, climatic variability, acid rain, the deterioration of the ozone layer); biodiversity loss (e.g. the transformation of covers – ecosystems – and soil uses, the breaking of bio-geographical barriers, species invasion, overexploitation) and the modification of biogeochemical cycles (e.g., changes in N, P, K, C cycles); contamination). (Vitousek 1994; Steffen *et al.* 2004).

Governability: Governability is the group of political conditions which mediate interests and achieve the political support required to govern. Governability depends on the dynamic equilibrium between society´s right to make legitimate demands and the institutional system´s capacity to deal with them in an effective manner (Fontaine, Van Vliet and Pasquis, 2007).

Governance: Interactions among structures, processes and traditions which determine how power is exercised, how decisions are taken on subjects of public interest and how citizens and other actors participate (Graham *et al.* 2003). It is the set of social, administrative and financial conditions needed to implement and apply political decisions adapted with the aim of exercising authority (Fontaine, Van Vliet and Pasquis, 2007).

Hybridization: The formation of a hybrid, that is, the offspring of two genetically dissimilar individuals (Schmidt, 1997).

In situ conservation: The "on site" conservation of the genetic resources of selected species within the natural or original ecosystem in which they appear or in the place formerly occupied by that ecosystem. Although the concept is usually applied to naturally regenerated species, *in situ* conservation may also be understood as artificial regeneration, always provided that the plantation or sowing is done without a deliberate selection and in the same area where the seeds or other reproductive material were gathered.

Institutional adaptive capacity: Refers to the ability of institutions to be flexible in their management mechanisms in the face of social, economic,

ecosystemic and political changes, through learning, experimentation and innovation.

Integral Management of Biodiversity: Process by which one plans, executes and monitors the actions required for the conservation of biodiversity and its ecosystemic services (knowledge, preservation, use and preservation), in a defined social and territorial scenario, with the aim of maximizing social welfare through the maintenance of the adaptive capacity of socio-ecosystems on local, regional and national scales.

Introgression: The movement of genes from one species to another as the result of a process of inter-specific hybridization, followed by backcrossing.

Modified Live Organisms: any organism which has a novel combination of genetic material obtained from the use of modern biotechnology (Cartagena Protocol on Biosafety 2000).

Political awareness: Understood as a social aptitude for interpreting the emotional currents of a collectivity and its relations of power. It should be regarded as a relevant factor, linked to political behavior, in organizations. Through it, people with that social skill interpret, with precision, the basic relations of power, use their social perception to find networks which are crucial to the relations among persons and are able to understand the strengths of groups and organizations in order to shape the visions and actions of followers and competitors.

Precautionary principle: A management concept which states when there is a danger of grave or irreversible harm, the lack of absolute scientific certainty will not be used as a reason to avoid the implementation of measures to prevent the degradation of the environment (Millennium Ecosystem Assessment 2005).

Preservation of biodiversity: Refers to the maintenance of the natural state of biodiversity and ecosystems through the limitation or prevention of human interventions in them.

Protected areas: Surface of the land or sea especially set aside for the protection and maintenance of biological diversity, as well as associated natural and cultural resources managed through juridical or other effective means (International Union for Conservation of Nature, IUCN, at the 4th World Congress on National Parks and Protected Areas, Caracas, 1992).

***Public awareness*:** The subject of public education and awareness is dealt with in Article 13 of the Convention on Biological Diversity, which states that "The Contracting Parties shall:

a. Promote and encourage understanding of the importance of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programmes; and

b. Cooperate, as appropriate, with other States and international organizations in developing educational and public awareness programmes, with respect to the conservation and sustainable use of biological diversity.

Public policy: Public policies are governmental decisions shaped into plans, programs, projections, actions or omissions which seek to manifest ideas about the order of society, solve problems and harmonize the conflicting demands which arise from the relations of power between different social groups. These decisions are adopted within legitimate fields of jurisdiction, in accordance with previously established legal procedures and are a means to attain the objectives and aims of an organized society (Aguilar Villanueva, 1996). Public policies assume or imply open deliberations, the circulation of opinions, argumentation and the creation of consensuses. They recognize that politics is the ambit where one decides which problems are most important for society as a whole, how these problems should be dealt with, how many resources should be invested and who, how and what they should be spent on. In this context, public policies will be the instrument through which these decisions are realized and where one defines the set of actions which allow for the achievement of the objectives which the policy sets forth. In this process political discussions are taken into account; problems and solutions are specifically distinguished; controversies and confrontations are determined; the subjects are linked to broader or more sequential solutions; joint efforts are proposed and mechanisms are established for the actors to participate in the proposed solutions, in accordance with their powers (Lahera 2003).

Regime: an identifiable configuration of the system. A regime has characteristic structures, functions and feedbacks.

Regime Change: The rapid reorganization of a system from a relatively unchanging state or from one regime to another.

Revegetalization: a process which is normally a component of recuperation. It may mean the establishment of only one or a few vegetal species.

Risk: The probability that a disaster may occur. It will depend both on the threat produced by a natural or human phenomenon, capable of unleashing a disaster, and the vulnerability of a socio-ecological system to being affected by the threat. This relationship between threat and vulnerability to the creation of risk can expressed by the formula: Risk= Threat * Vulnerability.

Scalarity: Influences between the dynamics of the systems on one scale and the dynamics of those which are integrated into the system or outside of it.

Scale: Any measurable dimension. For the evaluation and management of resilience, the scale of a socio-ecological system is determined by: landscape/local, subcontinental/subregional, continental/regional and global scales, respectively.

Socio-ecological system: A system which integrates ecosystems and human society with reciprocal and interdependent feedbacks. The concept stresses human perspectives on nature. It is the system in which the cultural, political, social, economic, ecological, technological, etc. interact.

Species diversity: Biological diversity on the level of species, which often combines aspects of wealth (number of species), relative abundance and their dissimilarity (Millennium Ecosystem Assessment 2005).

States in which biodiversity is encountered: Referring to the different states within the cycle of adaptive renovation (Resilience Alliance 2007; Matteucci 2004) in which a given ecological system is found and reflect its structure, composition and functioning. These states are:

a. *State of Maintenance:* In this state ecosystems are characterized by going through the time of greatest structural and functional complexity, when the system is most stable (but not static) and resistant to change. For example, a mature forest in a good state of conservation, which reached its "maturity" in terms of structure, composition and functioning, or an area which has undergone many years in a state of degradation and where it was necessary to carry out actions to break that state of stability. In the cycle of ecological succession this is the state in which ecosystemic services are supplied with the greatest and best intensity, magnitude and frequency.

b. *State of collapse:* state after a disturbance, when the structure, composition and/or functioning of the system change, liberating matter and energy. It is a phase in which there is a significant reduction in biomass, connectivity falls and the influence of exogenous factors increases. Though undesirable in themselves as effects of the system´s degradation when the changes are too big, these changes are opportunities for innovation and may lead those systems into desirable states through measures of management and control.

c. *State of Reorganization:* state of recuperation after collapse. It is a state in which the structure and composition of the ecosystems/coverages change, through the initiation of ecological succession or the inclusion of new elements (species). In this state abundances and ecological relations change. In many cases it is the time when emerging ecosystems begin to appear (secondary vegetation and reforestations and very early restorations). d. *State of Growth:* state of growth and succession, that is, when the system has already reorganized itself after the disturbance, vegetal succession advances and incorporates secondary

elements, biomass grows, the innovations made to the system are put to the test, connectivity increases, the influence of exogenous factors declines, short-term predictive capacity grows, and the system becomes more rigid at the same time that its vulnerability to exogenous and stochastic events increases.

Sustainable Use: Human use of an ecosystem with the aim that it may produce a benefit for present generations and at the same time maintain its potential for satisfying the needs and aspirations of future generations (Millennium Ecosystem Assessment 2005).

Synthesized product: Substance obtained through an artificial process on the basis of genetic information or from other biological molecules. Includes the semi-processed extracts and substances obtained through the transformation of a derived product by means of an artificial process (hemi-synthesis).

System: A combination of elements which interact to form a more complex entity.

Thresholds of stability and/or change: Critical values or ranges of a given social or ecological variable which the system keeps within during a given phase or state, or which, when they are surpassed, lead the whole system to rapidly and abruptly change from one state to another, different one where the magnitude, intensity and frequency of the supplied ecosystemic services change.

Tools for management of the landscape: Choice of the kinds of changes that will be introduced into the landscape to achieve the desired changes, such as increasing the coverage of forests, connectivity and the conservation of water resources and biodiversity. Different kinds can be identified:

a. *Biological corridors:* Areas of native forest of a variable length and width which are constructed through jobs of ecological restoration based on secondary succession. In these, one seeks to imitate the structure and composition of native forests in accordance with an ecosystem that serves as a reference point. Activities to enlarge the area of already existing fragments of native forest are included in this category.

b. *Enrichments:* Planting native species in more advanced stages of vegetal succession in areas which provide connectivity on the scale of the landscape and which have been naturally recovering due to isolation or abandonment.

c. *Live vegetative barriers:* Strips of vegetation, a few meters wide, of variable width, with many strata and a mixed composition of forest species which increase the diversity of the landscape.

d. *Isolation of fragments of native forest:* Enclosure with a wire fence of fragments of native forest which already exist in the landscape, to protect them being thinned out or invaded by cattle and thus allow for natural regeneration.

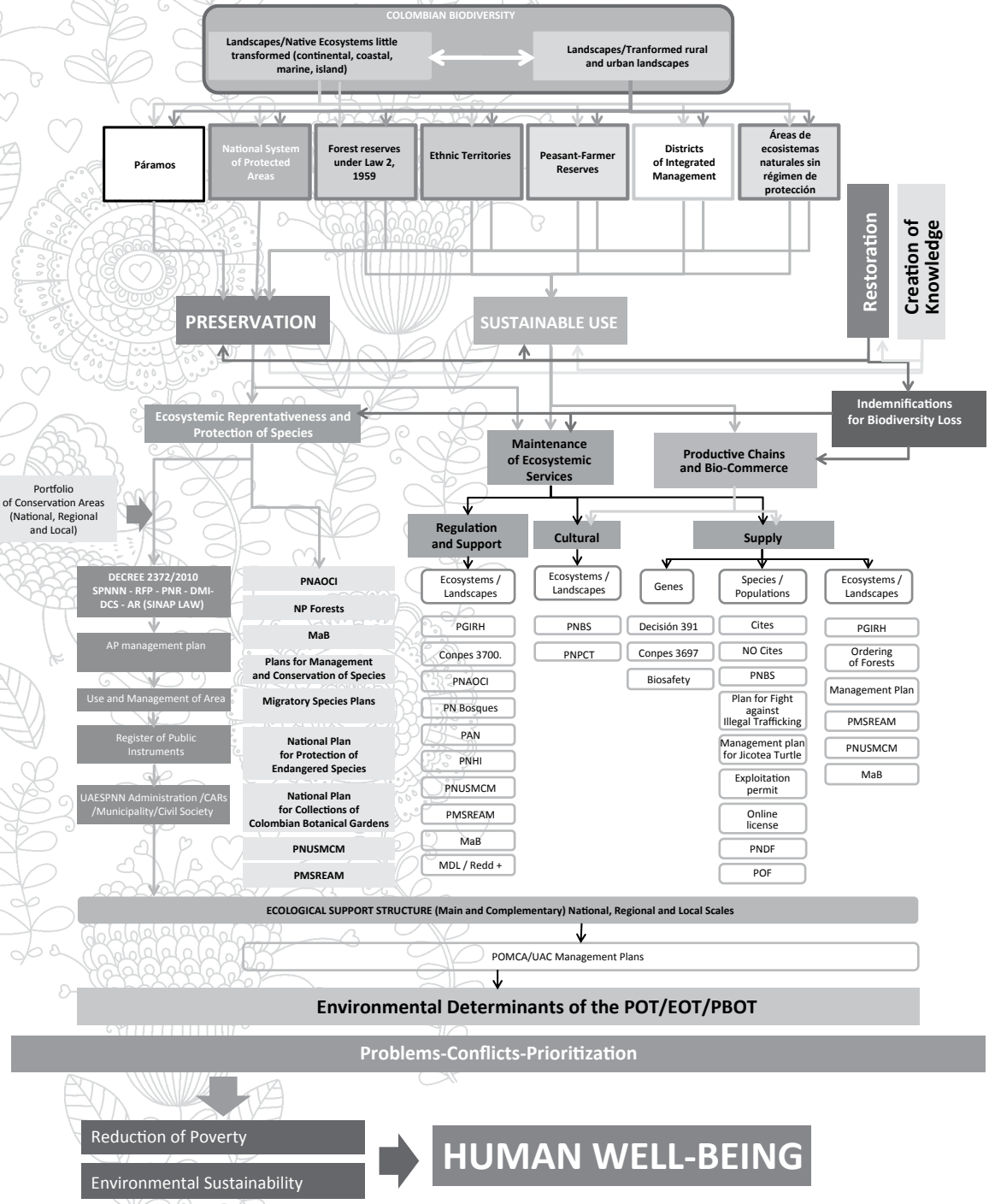
e. *Protective reforestation, agro-forestry systems:* The combination in time and space of tree species with agricultural crops or cattle-rearing, with the aim of harmoniously integrating agricultural/stock-rearing activities with forestry ones in order to guarantee the sustainability of the productive system.

Trade-off: Relation between variables which arises when the extraction and use of an ecosystemic service has a negative impact on the benefit which may be obtained from another ecosystemic service (Neville *et al.* 2010).

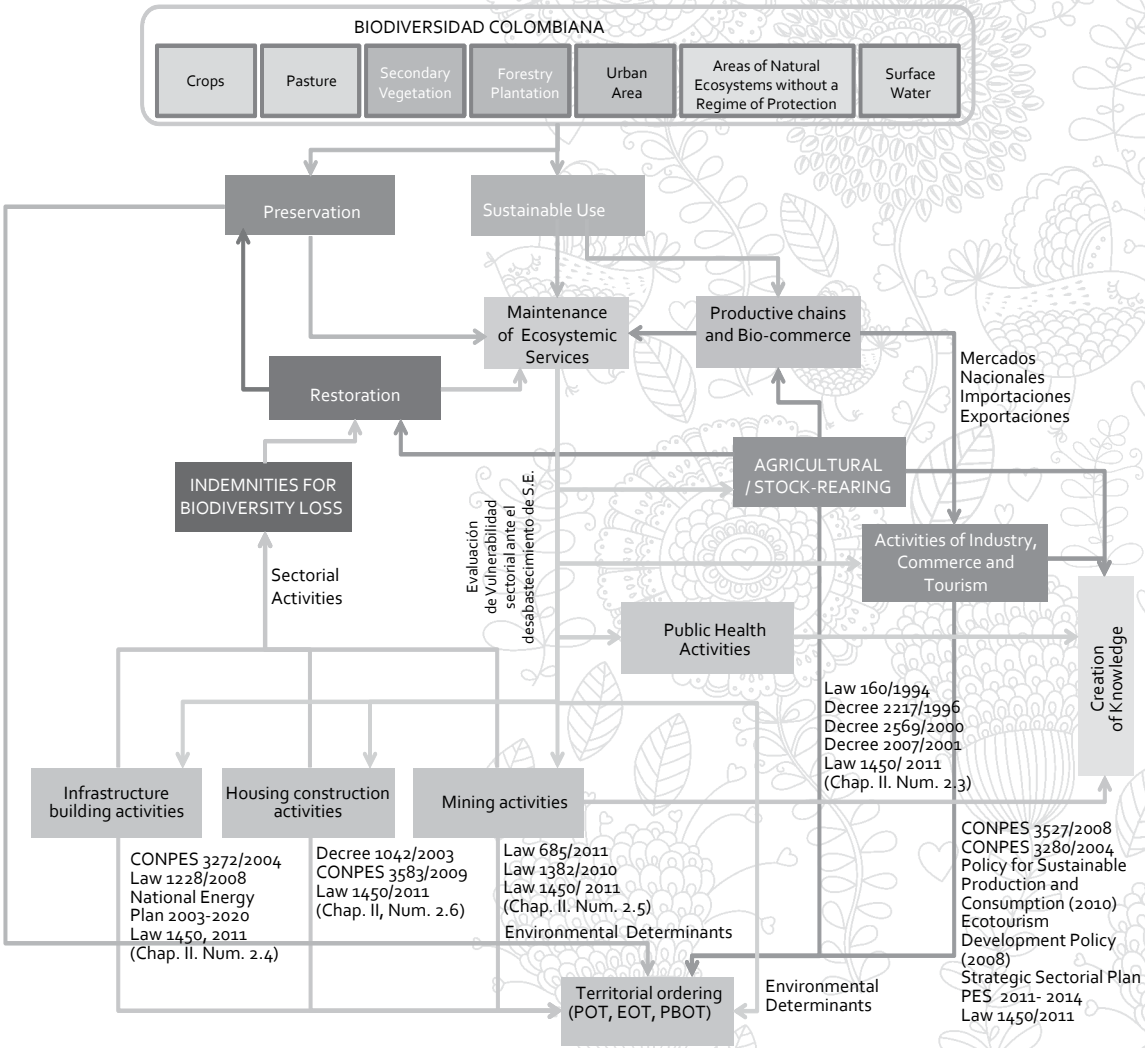
Uncertainty: An expression of the degree to which a future condition (for example, of an ecosystem) is unknown. Uncertainty results from lack of information or disagreement on what is known or will be known. Uncertainty may be represented by quantitative measurements (e.g. a series of values estimated by diverse models) or qualitative ones (e.g. reflecting the judgment of a group of experts) (Millennium Ecosystem Assessment 2005).

Vulnerability: Result of the intrinsic characteristics of the objects of conservation which make them more or less susceptible to disappearance, deterioration or other effects. (IAvH, Glossary of terms).

ANNEX 1 –DIAGRAM OF THE RELATIONS FOR THE ACTION OF THE INTEGRAL MANAGEMENT OF BIODIVERSITY, ON A NATIONAL SCALE



ANNEX 2 – DIAGRAM OF THE RELATIONS FOR THE ACTION OF THE INTEGRAL MANAGEMENT OF BIODIVERSITY, ON A NATIONAL SCALE (Sectorial Aspects)



ANNEX 3 – PARTICIPATING INSTITUTIONS

We present, as follows, a list of the institutions which participated in the process of revising and adjusting the National Policy for the Integral Management of Biodiversity and its Ecosystemic Services (2008 – 2011)

Institutions which participated in the process of the updating/formulation of the National Policy for the Integral Management of Biodiversity and its Ecosystemic Services

ACIVA CP-Asociación de Cabildos Indígenas del Valle Costa Pacífica

ACOLGEN-Asociación Colombiana de Generadores de Energía Eléctrica

ACOPI-Asociación Colombiana de Medianas y Pequeñas Industrias. Bogotá

Acosemillas

Aeronáutica Civil de Colombia

AHH-Asociación Hispánica de Humanidades

AICO-Autoridades Indígenas de Colombia

Alcaldía de Rioacha (Asuntos indígenas)

Analac-Asociación Nacional de Productores de Leche

Andesco-Asociación Nacional de Empresas de Servicios Públicos Domiciliarios

ANDI-Asociación Nacional de Empresarios de Colombia

Anglo American Colombia

ANH-Agencia Nacional de Hidrocarburos

ANUC -Asociación Nacional de Usuarios Campesinos de Colombia

ASOBA (Indígenas)

Asocaña-Asociación de cultivadores de caña de azúcar

Asocars-Asociación Colombiana Autoridades Ambientales

Asociación Calidris

Asociación de Cabildos Indígenas del Trapecio Amazónico ACITAM

Asociación de Veterinarios de Vida Silvestre

Asociación Shaquiñan (Indigenas)

Asocolflores

Asocreto-Asociación Colombiana de Productores de Concreto

Asogravas-Asociación Colombiana de Productores de Agregados Pétreos

Asoporcicultores

AUGURA-Asociación de Bananeros de Colombia

CAEM-Corporación Ambiental Empresarial

Cámara Asomineros

Cámara colombiana de la infraestructura

Cámara de Comercio de bogotá

Cámara Minera de Colombia

Cancillería

CAR-Corporación Autónoma de Cundinamarca

Cardique-Corporación Autónoma Regional del Canal del Dique

CAS-Corporación Autónoma de Santander

Cercapaz-GTZ

Cerrejón

CGR-Contraloría General de la República

Checsa S.A. E.S.P -Central Hidroeléctrica de Caldas

CIAT-Centro Internacional de Agricultura Tropical

CIDEIM-Centro Internacional de Entrenamiento e Investigaciones médicas

CIEBREG - Universidad Tecnológica de Pereira

Codechocó

Colciencias-Departamento Administrativo de Ciencia, Tecnología e Innovación

Comisión Colombiana del Océano

Comisión Consultiva San Andrés y Providencia

Comunidad Indígena Wayu

Comunidad resguardo alta y media Guajira

Conalgodon

Concejo Comunitario El Cedro

Concejo Comunitario Yurumanguí

Concejo Curbaradó

CONIF-Corporación Nacional de Investigación y Fomento Forestal

Conservación Internacional

Contraloría Distrital de Bogotá

Copoguavio

Corantioquia-Corporacion autónoma regional del centro de Antioquia

Cormacarena

Corpoboyacá-Corporación Autónoma de Boyacá

Corpoguajira

Corpoica

Corponor-Corporación Autónoma Regional de Norte de Santander

Corporación Cromatophoro

Corporación Kotzala

Corporinoquía

Cortolima-Corporación Autónoma Regional del Tolima

CREG-Comisión de Regulación de Energía y Gas

CRIC-Concejo Regional Indígena del Cauca

CVC-Corporación Autónoma Regional del Valle del Cauca

Defensoría del Pueblo

DIMAR-Portal Marítimo Colombiano

DNP-Departamento Nacional de Planeación

EAAB- Empresa de Acueducto y Alcantarillado de Bogotá

Ecofondo

Ecopetrol

Embajada de Holanda

Emgesa

Empresa de energía del Pacífico -EPSA

Fedearroz-Federación de productores de arroz

Fedebiocombustibles-Federación Nacional de Biocombustibles de Colombia

Fedecacao

Fedecaucho

Fedefique

Fedemaderas-Federación Nacional de Industriales de la Madera

Fedepalma-Federación Nacional de Cultivadores de Palma de Aceite

Fedepanela-Federación Nacional de Productores de Panela

Fedepapa-La Federación Colombiana de Productores de Papa

Federriego-Federación Nacional de Usuarios de Distritos de Adecuación de Tierras

FENAVI-FONAV-Federación Nacional de Avicultores de Colombia

Florverde

Fondo de Biocomercio

Fondo para la Acción Ambiental y la Niñez

Fundación Biocolombia

Fundación Biodiversa Colombia

Fundación ESC-Ecosistemas secos de Colombia

Fundación GAIA Amazonas

Fundación Horizonte Verde

Fundación humedal La Conejera

Fundación Maconde

Fundación Malpelo

Fundación Marviva

Fundación Natura Colombia

Fundación Omacha

Fundación Panthera

Fundación Proaves

Fundación Prosierra

Fundación Tropenbos

Fundación Universitaria San Martín

Fundación Yubarta

Fundación Zoológico de Cali

IAvH-Instituto Alexander von Humboldt

ICA-Instituto Colombiano Agropecuario

ICANH-Instituto Colombiano de Antropología e Historia

ICETEX-Instituto Colombiano de Crédito y Estudios Técnicos en el Exterior

IDEAM-Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia

IGAC-Instituto Geográfico Agustín Codazzi

IIAP-Instituto de Investigaciones Ambientales del Pacifico

INCODER-Instituto Colombiano para el Desarrollo Rural

INCO-Instituto Nacional de Concesiones

Indígena de Colombia

Ingeominas

INGETEC S.A

Instituto Colombiano de Derecho Ambiental

Instituto de Investigaciones del Pacífico

Instituto Nacional de Concesiones

Instituto Sinchi

Invemar

INVIAS-Instituto Nacional de Vías

Isagen

Lideres de la organización Ascainca (Indígenas)

Ministerio de Agricultura

Ministerio de Ambiente, Vivienda y Desarrollo Territorial

Ministerio de Cultura

Ministerio de Defensa

Ministerio de Industria, Comercio y Turismo

Ministerio de Justicia, Interior y de Justicia

Ministerio de Minas y Energía

Ministerio de Transporte

Ministerio del Interior y de justicia

MPS-Ministerio de la Protección Social

Obapo-Chocó

ONIC- Organización Nacional

OPAIN S.A-Aeropuerto Internacional de Bogotá D.C.

OPIAC-Organización de los Pueblos Indígenas de la Amazonía Colombiana

Organización Camawa (Indigenas)

Organización Gonawindua Tayrona

Organización Regional Indígena del Quindio

OZIP-Organización Zonal de Indígenas del Putumayo

PNUD Colombia

Policía Ambiental Nacional

Policía Nacional de Colombia

Pontificia Universidad Javeriana

Presidencia de la República de Colombia

Procuraduría General de la Nación, República de Colombia

Proexport Colombia

Recompas

Resguardo Indígena Zenú

Resnatur-Asociación Red Colombiana de Reservas Naturales de la Sociedad Civil

RNOA-Red Nacional de Observadores de Aves

SAC-Sociedad de Agricultores de Colombia

Secretaría Distrital de Ambiente

SINCHI-Instituto Amazónico de Investigaciones Científicas

TNC-The Nature Conservancy (Colombia)

UAESPNN-Parques Nacionales Naturales de Colombia

UDCA-Universidad de Ciencias Aplicadas y Ambientales

UNICEF-Fondo de las Naciones Unidas para la Infancia. Colombia

UNINCCA-Universidad Incca de Colombia

Universidad Central

Universidad de Córdoba

Universidad de la Amazonía

Universidad de la Salle

Universidad de los Andes

Universidad de los llanos

Universidad del Bosque

Universidad del Chocó

Universidad del Rosario

Universidad del Valle

Universidad Distrital de Colombia

Universidad El Bosque

Universidad Icesi

Universidad Jorge Tadeo Lozano

Universidad Libre Bogotá

Universidad Manuela Beltrán

Universidad Nacional de Colombia

Universidad Nacional de Colombia-Sede Medellín

Universidad Tecnologica del Choco

UPME-Unidad de Planeación Minero Energética

USAID-Agencia de Estados Unidos para el Desarrollo Internacional

Varichem de Colombia

Ventana Gold Corp

WCS- Wildlife Conservation Society (Colombia)

WWF-World Wildlife Fund (Colombia)

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