

DRAFT

**BIODIVERSITY STRATEGY & ACTION PLAN
for
ANTIGUA & BARBUDA**

**Office of the Prime Minister
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DRAFT**

BIODIVERSITY STRATEGY AND ACTION PLAN (BSAP)
ANTIGUA AND BARBUDA

1. INTRODUCTION

1.1 Why a Biodiversity Strategy and Action Plan (BSAP)?

Both the activities of man in pursuit of economic development, and natural causes such as hurricanes and droughts, have drastically altered Antigua and Barbuda's biodiversity over the years. Biological Diversity [Biodiversity] means "the variability among living organisms from all sources, including *inter alia*, terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems." [Convention on Biological Diversity (Rio de Janeiro, 1992), Article 2 - *Use of terms*]

Historically, most of the natural vegetation of Antigua and Barbuda was cleared for the cultivation of sugar cane and cotton, while the economy is currently dominated by tourism, a sector that is also dependent on the quality of the environment. Inventories of the vegetation of Antigua and Barbuda suggest that a large percentage of plant species is classified as rare and endangered. Many terrestrial animals have become rare, endangered or extinct due to the loss and/or fragmentation of natural habitats such as mangroves, sea-grass beds and coral reefs. Some water-birds and several species of reptiles have become extinct; sea-turtles that are endangered world-wide are declining in numbers; while over-fishing has resulted in a decline in the variety and number of reef species of fish. In addition, exotic species such as the mongoose have been introduced.

This trend of the loss and extinction of biodiversity is worldwide, and the conservation of the Earth's biodiversity has become a major international issue. Biodiversity conservation is needed to conserve the Earth's vitality and diversity. Antigua and Barbuda is cognizant of the fact that its economic development is dependent on the protection and preservation of its natural resources. Globally, it is recognized that development must be protective of biodiversity if the structure, functions and diversity of the world's natural systems on which humans depend is to be protected.

Recognizing the threat posed to human survival by the continuing destruction of biodiversity, many countries have signed the Convention on Biological Diversity (CBD) that sets out a framework obligating countries to undertake measures to conserve and use their biodiversity in a sustainable manner.

The CBD represents an agreement between nations to act cooperatively to protect habitats, species and genes, to shift to sustainable patterns of resource use, and to guarantee that the benefits of natural resources are equitably shared across local, regional, national and global societies. The CBD affirms that individual States have sovereign rights over their own biological resources, and that States are also responsible for conserving their biodiversity and for using their biological resources in a sustainable manner. Antigua and Barbuda ratified the Convention in April 1993. In compliance with the Convention, this document presents a strategy and action plan to conserve what remains of Antigua and Barbuda's unique biodiversity. This draft Biodiversity Strategy and Action Plan (BSAP) provides an overview of the key environmental issues in Antigua and Barbuda. It attempts to present an integrated cross-sectoral approach that will provide the basis for a better understanding of how environmental, social and economic factors relate to each other. It puts forward a perspective on conserving biodiversity in Antigua and Barbuda. It seeks to provide a forum and context for a national debate on biodiversity conservation, and the articulation of a collective vision for the future. It also provides a framework for building consensus on priority issues, and the actions required to strengthen the values, knowledge, technologies and institutions needed to address these priority issues, as well as to develop the organizational capacities and other institutions required for biodiversity conservation in Antigua and Barbuda. Such an Action Plan is needed to overcome the many obstacles to the sustainable use and conservation of the country's biodiversity.

The BSAP reviews key environmental problems and their causes, formulates national environmental objectives and identifies actions to meet those objectives. It also spells out indicators by which the progress of environmental management, based on the implementation of the BSAP, can be monitored and measured. Implementation of the BSAP will be dependent on, among other things, the availability of financial resources from the financing mechanism of the CBD.

1.2 The Process of Developing the BSAP

The development of a national BSAP is a process: a participatory, iterative process leading to consensus and agreement on the aims, objectives and activities of the Plan, and the ways in which these will be achieved.

Traditionally, at the level of national planning and policy-making it is usual for only a small group of people to produce plans and policies that can influence the lives of everyone in the whole country. Because the BSAP is a

plan for the biodiversity of the whole country, and because it will therefore influence the lives of everyone in the country, efforts have been made to ensure that the BSAP planning process was as participatory as possible. This participatory process ensured that the Plan benefited from the different knowledge, skills and resources of interested people. In this way, stakeholders enhanced their awareness of problems, resources and opportunities at a national level, and share their ideas and suggestions for solutions to the problems.

Biodiversity not only has an intrinsic value of itself, it also has ecological, social, economic, scientific, educational cultural, recreational and aesthetic implications. The issues involved in biodiversity are complex, inter-related issues that are cross-sectoral and inter-sectoral in nature. Therefore, consultation between and among the different sectors is critical. However, it must be recognized that participatory processes require commitment over time, and that time and resources are needed to reach a good level of communication between all interested people. Therefore, the adaptive and iterative planning process takes time.

Unfortunately, as the Report on the Stakeholder Consultation on the BSAP [Williams, 2000] suggests, most Antiguan are unaware of what biodiversity means, or that Antigua and Barbuda has joined the international community in committing the country to the sustainable use and conservation of its biodiversity through ratifying the Convention on Biodiversity in 1993. Therefore, the process also entailed an educational aspect so that discussions were as wide as possible, and so that an informed general public was included in the participatory process.

Much work has been carried out in the process of developing the BSAP for Antigua and Barbuda. In terms of documentation, a Biodiversity Stocktaking and Inventory of Existing Information has been prepared [Horwith, 1999]; a paper on the Identification and Analysis of Options for Biodiversity Management in Antigua and Barbuda has been completed [Joseph, 2000]; a Stakeholder Consultation for a National Biodiversity Strategy and Action Plan has been conducted [Williams, 2000]; and a first draft of the Antigua and Barbuda: Biodiversity Strategy and Action Plan has been prepared [Jeffery and Henry, 2000]. These documents have been disseminated for discussion and feedback, and two National Consultations have been convened for discussion of the draft BSAP. Finally, a Working Draft was prepared to invite comments before the draft BSAP was finalized. The Working Draft summarized the previous work in the format of an action plan so that all of the suggestions for activities made in previous documents

were included there. In addition, all of the valuable recommendations made during the national consultations and the individual interviews that followed, have also been included and an attempt has been made to address the concerns expressed at those times.

Thus, the BSAP has been developed through a process of participation including individual consultations with experts and stakeholders, and national consultations. All relevant ministries, governmental departments and agencies at all levels, non-governmental organizations, business and industry, professional societies, educational institutions, advisory councils and interested individuals have been invited to participate in these consultations and to comment on the drafts of the BSAP. This final BSAP should also be circulated for consultation and it is recommended that this consultation should include those who depend on the country's biodiversity for their livelihood e.g. farmers, livestock owners, fisher-folk, charcoal burners, herbalists, crafts persons, tour operators, and others who are involved in the conversion of land from its natural state, like developers, real estate agents, surveyors and any others whose decisions and plans will greatly influence how land is used and habitats are preserved or degraded/destroyed. In this way, the participatory, iterative process followed in the development of the BSAP will be continued in its implementation.

2. THE IMPORTANCE OF BIODIVERSITY

Because of its small size, its vulnerability to natural hazards like hurricanes, and the density of human settlement, Antigua and Barbuda's environment is generally fragile. However, the economic development of Antigua and Barbuda, based primarily upon tourism, is highly dependent upon the quality of this fragile environment. In turn, this quality is determined by the health of the inter-related ecological functions and physical processes that are the country's biodiversity. These processes include the creation and preservation of soils, the storage and distribution of water including the effect on water quality, and the regulation of coastal and atmospheric conditions. They also store and cycle nutrients essential for life, e.g. carbon, nitrogen and oxygen; re-charge groundwater, protect catchment basins and buffer extreme water conditions; produce soil and protect it from excessive erosion; absorb and break down pollutants, including organic wastes, pesticides, heavy metals; and provide the basis for all improvements to domesticated plants and animals.

In Antigua and Barbuda, the inter-relationships of these ecological functions and physical processes result in a number of ecosystems that range from evergreen forests, xerophytic (dry) forests, scrublands and grasslands to

mangrove forests, herbaceous swamps, salt ponds, sandy beaches, rocky shores, coastal lagoons, sea grass beds, coral reefs and oceanic islands and rocks. Ecosystem variety is enhanced by the presence of caves in many sections of the island, and by natural seasonal drainage channels and ponds. Barbuda is unique with its coastal lagoon, extensive tidal flats, sand bars, underwater sand dunes, salt ponds, cliffs, caves, 'blue holes' and "highlands", all providing special habitats for wildlife. Wildlife species associated with these natural ecosystems have developed physical, behavioral and physiological adaptations. The small isolated, precipitous and rocky island of Redonda is likewise unique and, at present, its biodiversity is untroubled by the activities of man. Many seabirds nest abundantly on its shores, and goats, rats, hermit crabs, and lizards are also plentiful. The Burrowing owl, *Speotyto cunicularia*, that became extinct in Antigua following the introduction of the mongoose, still resides in Redonda.

Man uses the biodiversity of these ecosystems in many ways – in short, biodiversity provides the basis of all human development. The values of biodiversity are usually categorized as direct and indirect. Direct values include the ways in which biodiversity is used or consumed by man e.g. fishery and forestry products, as well as the ways in which it affects mankind through its ecological processes e.g. watershed protection or the role of vegetation in the carbon and water cycles. The use of coastal ecosystems for tourism development, or sand-mining for construction are well known by Antiguans and Barbudans.

Indirect values are more difficult to define in monetary terms, but take into account both aesthetic values, and future, as yet unknown monetary values. For example, the search for new antibiotics is carried out among fungi and bacteria. Most bacteria remain unidentified globally and certainly in Antigua and Barbuda, but it is known that many exist in ecosystems that are usually considered useless and unattractive to humans, like the curled up, dried pieces of vegetation that are seen on "scrappy rock environments" or the temporary wetlands that come into existence after heavy rains. When these ecosystems are destroyed, their potential for the welfare of mankind is destroyed with them. In aesthetic and spiritual terms, biodiversity has value simply by existing: Antiguans and Barbudans appreciate and enjoy the beauty of nature and natural landscapes and get immense pleasure from watching flocks of birds like the frigate bird in the Codrington Lagoon in Barbuda.

3. THE CURRENT SITUATION: Biodiversity at risk

Reference has already been made to the trend towards the loss and extinction of biodiversity globally, and to the loss of most of the original natural vegetation of Antigua and Barbuda through the clearing of vegetation for the cultivation of sugar cane and cotton. This trend towards exploitative uses of the biodiversity and of unsustainable use of resources, and short-term approaches to development in Antigua and Barbuda has continued. The main trend is that the biodiversity of the country, on which its economy depends, is being destroyed by the unsustainable use of the resources. The purpose of development is to improve the quality of human life through the utilization and access to the resources provided by biodiversity. If this biodiversity is used in non-sustainable ways, then the quality of human life both in the present and the future is being compromised.

Antigua and Barbuda's marine biodiversity is increasingly threatened by habitat destruction, overexploitation, and destructive fishing methods. Mangroves that function as nurseries, breeding grounds and habitats for both marine and terrestrial wildlife are being destroyed for coastal development, especially that associated with the tourist sector. The sustainable use and protection of the Codrington Lagoon and its mangroves are critical to the biodiversity of Barbuda, particularly the conservation of the Frigate Bird Sanctuary. The sea turtle is being depleted through the destruction of its habitats by coastal construction, sand mining and pollution, and over-fishing and the regulatory mechanisms to protect nesting and foraging turtles and their habitats are inadequate. Sea grasses that provide food for fish and turtles and that function as nurseries for young conch, spiny lobsters, shrimp and a variety of fish are being destroyed. Coral reefs are in very poor condition, stressed by high sedimentation, and activities like over-fishing, destruction by the anchoring of boats, improper placement of fish traps, garbage, breakage by recreational diving, and the release of partly treated sewage from coastal holiday developments directly into the sea.

In general, fishing and tourism are the main activities that are adversely affecting Antigua and Barbuda's marine biodiversity. However, sand mining still constitutes a significant threat to coastal properties and resources. Agro-diversity is being destroyed through the over-use and misuse of herbicides and pesticides, while the number of different kinds of pesticides and the amount of pesticides used continue to increase. One concern is the disposal of obsolete chemicals and other hazardous wastes.

The threats to biodiversity in Antigua and Barbuda that result mainly from the changes brought about by human action can be summarized as follows:

- **The loss of habitat** primarily through the sub-division of lands for housing, tourism development, agriculture and the mining and dredging of sand.
- **Fragmentation of natural communities** by road-ways, and other man-made features that form a barrier to the movement and dispersal of species.
- **The introduction of non-native species**, like the mongoose or lemon grass, that have a detrimental effect on native wild species by acting as predators, parasites or competitors.
- **Overgrazing by livestock** mainly goats, sheep, cattle and donkeys that pose a serious threat, particularly in upper watershed areas.
- **Pollution** as a result of excessive nutrients or sewage discharge into coastal waters, as well as the unregulated and excessive use of pesticides.
- **Natural and anthropogenic activities** that stress coral reefs through direct destruction and over-fishing and
- **Droughts and hurricanes** that have severely impacted the bird population, as well as vegetative communities and their dependent fauna.

This BSAP is aimed at the sustainable use and conservation of biological diversity in Antigua and Barbuda. The plan outlines a strategy and a clear set of objectives, along with activities designed to achieve them.

4. THE STRATEGY

The strategy envisaged for the BSAP is a four-pronged strategy encompassing:

- i. The sustainable use, protection and conservation of Antigua and Barbuda's biodiversity;
- ii. The coordination of all efforts and activities involving the sustainable use, protection and conservation of this biodiversity;
- iii. The enforcement of all policies, regulations and legislation affecting these efforts and activities; and
- iv. The knowledge and understanding of the processes governing biodiversity, and the information required to guide and coordinate the activities involving the sustainable use, protection and conservation of this biodiversity.

Together, these four aspects of the strategy address the obstacles to biodiversity planning including institutional obstacles, scientific obstacles and obstacles in the legal and policy arena. They are aimed at improving and maintaining the well-being of the people of Antigua and Barbuda as well as the productivity and diversity of the country's ecosystems. In fulfilling this aim, they cover the full scope of the CBD.

5. THE BSAP:

GOAL , OBJECTIVES, INDICATORS, ASSUMPTIONS AND ACTIVITIES

Overall Goal: The biological diversity of Antigua and Barbuda is sustainably and equitably used, protected and conserved so that it contributes positively to the social and economic development of the country.

Objective 1: A national system, including protected areas, for the management and conservation of biodiversity conservation is developed and established.

Objective 2: The capacity of governmental natural resources management institutions, as well as non-governmental organizations, to support the objectives and achieve the overall aim of the BSAP is strengthened.

Objective 3: Ecological legislation that provides adequate protection of biological diversity is developed, improved, enacted and enforced.

Objective 4: Public awareness of environmental issues, ecological education and public participation in decision-making is strengthened.

OBJECTIVE 1

A national system, including protected areas, for the management and conservation of biodiversity conservation is developed and established.

This Objective encompasses, *inter alia*, the following areas that are included under the CBD: Articles # 7 (Identification and Monitoring), # 8 (“*in-situ*” conservation), # 9 (*ex-situ* conservation), #10 (Sustainable Use of Components of Biodiversity), # 14(Impact Assessment and Minimizing Adverse Effects), and # 15 (Access to Genetic Resources).

Indicators for Objective 1:

Indicators for Objective 1 relate to the health and maintenance of the country's biodiversity. The Environment Unit already possesses a list of indicators developed by the CARICOM Secretariat and UNSD that includes indicators for the coastal zones, the land/soil, the forest, biodiversity, fresh water, minerals, waste, air/climate, natural disasters, energy, and tourism. The essential elements that need to be included so that the biodiversity can be monitored are:

- Status and trends of the country's use of terrestrial, aquatic, coastal and marine resources, habitats, species, populations, genes, biodiversity.
- Shifts in selected social, political and economic factors
- Shifts in human, institutional, facility and funding capacity, including cultural practices and norms, technology, training and education, information availability, management, and monitoring capacity
- Changes in the policy and legal framework for natural resources, including protected areas, access to genetic resources, land tenure, property rights, benefit and cost sharing, trade and environmental impact assessment
- Changes in the use of biological resources and their sustainability, including natural resource-based industries, and exploitation of resources for subsistence.
- Trends in the monetary and non-monetary values of biodiversity and current expenditures and investments.
- Impacts of implementing the activities and policies of the BSAP as they relate to conservation, sustainability and equity.

Assumptions for Objective 1:

Assumptions relate to conditions that must be realized for an Objective to be achieved, but these conditions do not fall under the control of the implementing agency. Nevertheless, the implementing agency must be aware of them so that it can do all that it can to influence these conditions to its advantage. Critical Assumptions for the achievement of Objective 1 follow. Some of these Assumptions will also apply to the other objectives:

- The political directorate accepts the need to protect Antigua and Barbuda's biodiversity.

- Resources, both human and financial, are both made available nationally, and mobilized externally, for the implementation of the activities required to achieve Objective 1.
- Relevant individuals and agencies are committed to the protection and sustainable use of Antigua and Barbuda's biodiversity and sustain their support for the implementation of the activities required to achieve Objective 1.
- The capability of relevant individuals and agencies to manage the protection and sustainable use of Antigua and Barbuda's biodiversity is enhanced.

Activities Required to Achieve Objective 1:

1.1: Establish a Protected Areas System for terrestrial and marine conservation in Antigua and Barbuda.

The aim of this activity is the protection of Antigua and Barbuda's unique habitats from the exploitative uses that have resulted in the destruction of habitats and the extinction of biodiversity that has characterized the past. Ideally, no human activity should be included in these protected areas in the initial stages, unless it is determined that these areas can be considered areas for sustainable use (see 1.2 below). The biodiversity that should be assessed should include microbes, algae, and fungi that have been overlooked in existing inventories [Horwith, 1999]. However, it is recognized that unique habitats for birds, fish and animals would probably be unique for microbes as well. Special attention should be paid to "scrappy, rocky, unattractive" areas where fungi especially would be found. In carrying out this activity, it is likely that the existing inventories will be augmented, especially those for Barbuda and Redonda, including wetland assessments, as well as an inventory of Barbuda's "sink holes" with their unique patterns of vegetation. For example, Barbuda's salt tolerant grass is being harvested and this harvesting must be carefully monitored so that this grass is not lost. Ideally, a map of the types of vegetation cover for the whole county should be made. However, in the initial stages of the implementation of the BSAP, given Antigua and Barbuda's limited resources and capabilities, this mapping and listing of additional biodiversity

should be secondary to the main purpose of establishing a national Protected Areas System.

- **Identify critical habitats and species for conservation and limited sustainable use in Antigua and Barbuda (terrestrial and marine)**
 - Review available information to identify the individual species, habitats and ecosystems that are most vulnerable to human disturbance and develop recommendations for their protection, both within and outside protected areas.
- **Identify, map and characterize areas to be included in a Protected Areas System (terrestrial and marine)**
 - Conduct inventories and select priority areas to be protected
 - Map areas to be protected
 - Submit recommendations of areas to be accorded protected area status to the relevant Authorities, for declaration under the appropriate Acts
 - Rehabilitate and restore degraded areas
- **Develop and implement management plans for protected areas (terrestrial and marine)**
 - Develop and implement guidelines for the management of protected areas with emphasis on the protection of biological resources
 - Establish an Integrated Pest Management Programme

1.2: Identify, and develop management plans for, critical habitats and species (terrestrial and marine) that may be used sustainably in Antigua and Barbuda

Many of the sub-activities of 1.2 can be carried out together with the sub-activities of 1.1, since the ultimate aim is to distinguish between those areas that need to be protected with limited sustainable use, and those in which sustainable use can be allowed. This activity will identify those areas for sustainable use, establish guidelines for this sustainable use, and determine the parameters of this sustainable use.

- Review available information to identify the individual species, habitats and ecosystems that can be used, and develop recommendations for their sustainable use
- Undertake relevant investigations to determine sustainable levels of use of biodiversity
- Develop and implement plans for fisheries, agriculture and eco-tourism development, and establish appropriate limits (carrying capacity) for the sustainable use by these activities
- Develop and implement, where appropriate, pilot projects to demonstrate sustainable practices that are compatible with biodiversity conservation
- Initiate a Mariculture Development Programme to re-establish over-fished areas, and to increase the use of available and not fully utilized natural species
- Adopt measures to prevent over-fishing including a ban on destructive fishing gear and spear-gun fishing
- Promote collaboration with the private sector to develop eco-tourism

1.3 Develop and implement a system for monitoring changes in use patterns and the status of the ecosystems (terrestrial and marine)

Activities 1.1 and 1.2 have to be enforced if the biodiversity of Antigua and Barbuda is to be sustainably used and protected. This enforcement has to be based on a system of scientific and objective monitoring of the areas selected. This activity ensures that such a monitoring system is developed and implemented. However, it should be recognized that this activity is a critical component of enhancing the capability to manage protected areas and their associated biodiversity (Activity 2.1)

- Identify/Select appropriate parameters, criteria and methods of monitoring biodiversity
- Collect relevant baseline and other data on relevant biodiversity components

- Conduct periodic surveys of threatened species of flora and fauna
- Establish and maintain a national bio-geographic (ecosystem) database
- Evaluate and mitigate the activities that threaten biological diversity.
- Provide accurate and timely information on the specifics of population size and trends especially of threatened species
- Take appropriate legal and regulatory action when the measures governing the protection and sustainable use of the areas selected under Activities 1.1 and 1.2 are infringed.

1.4: Conserve, protect and/or sustainably use the genetic resources of Antigua and Barbuda

The aim of this activity is the establishment of mechanisms that will protect the unique genetic resources of Antigua and Barbuda and provide security measures against disasters and extinction. Ideally, a structure should be built to maintain these genetic resources: a secure, strong room(s) with controls and back-ups for the storage of any important land race that needs to be protected e.g. the local eggplant, table squash, local pumpkin, herbs and shrubs. Tissue culture should also be encouraged and Antigua and Barbuda needs to establish intellectual property rights for certain genetic resources, for example for the Antigua Black pineapple.

- **Conserve medicinal plants**
 - Undertake an investigation into the occurrence and use of local medicinal plants, including the potential for bio-prospecting. The collection housed at the Museum is a good starting point.
 - Catalogue and improve the recording of such uses of medicinal plants, and make the information more readily available to the general public

- Protect representative samples of the country's vegetation communities, which provide habitat to numerous medicinal plants (as well as invertebrate and other fauna)
- Conserve natural enemies of endemic pest species
- **Maintain viable populations of local crop and livestock races**
 - Survey and document all traditional crop and livestock varieties
 - Develop the infrastructure, and technical and managerial base for seed banks, gene banks, museum collections and similar mechanisms
 - Develop guidelines for the collection of materials for the seed banks
 - Collect seed material from specified crops for the seed banks
 - Establish plant nurseries, in particular a forest and agricultural nursery, for the propagation of, and research on required planting stock – improving existing facilities where appropriate
 - Re-establish the Botanical Garden, to include expanded collection of plants
 - Rejuvenate and continue to expand the herbarium that was initiated by the Environmental Awareness Group (EAG) in collaboration with the Forestry Division. Begin a collection programme for microorganisms.
- **Develop and implement guidelines for controlling access to genetic resources**
 - Identify and access information from other countries with successful policies and mechanisms for controlling the exploitation of genetic resources
 - Promote, to the extent possible, a regional approach to controlling access to, and control of, genetic resources

- Develop appropriate policies, laws and enforcement mechanisms, and the institutional framework necessary to regulate access to genetic resources

OBJECTIVE 2

The capacity of governmental natural resources management institutions, as well as non-governmental organizations, to support the objectives and achieve the overall aim of the BSAP is strengthened.

This Objective encompasses, *inter alia*, the following areas that are included under the CBD: Articles #11 (Incentive Measures), # 12 (Research and Training), and # 16 (Access to and Transfer of Technology).

The point is made throughout this BSAP that the multi-sectoral nature of biodiversity requires a highly coordinated management system. The key features of effective environmental management are:

- Integrated management together with appropriate internal management structures within the coordinating unit
- Clear and measurable environmental outcomes based on environmental indicators
- A systematic monitoring regime, and maintenance of the necessary capability to monitor and mitigate based on the information generated by the monitoring
- A critical mass of skills and financial resources
- The development and maintenance of appropriate and effective relationships with all stakeholders.

These key features determine the activities required to achieve this capacity-building Objective.

Indicators for Objective 2:

- An integrated, coordinated and participatory framework with the capacity for managing the country's biodiversity and implementing the BSAP is operative.
- Trained personnel in relevant agencies and organizations implement the BSAP through the integrated, coordinated and participatory framework.

- Information and research required for implementing the BSAP is available on a timely basis.
- Antigua and Barbuda submits reports for compliance with international treaties and conventions as required.
- Regional and international agreements to facilitate technical cooperation with national, regional and international organizations in an equitable manner are honoured.

Assumptions for Objective 2:

- Suitable and receptive candidates for training are identified and available for training.
- Resources for training can be mobilized.
- Other countries and external organizations and agencies are willing to share their technological resources in an equitable and acceptable manner.

Activities Required to Achieve Objective 2:

2.1: Develop and enhance the capability to manage protected areas and areas identified for sustainable use, together with their associated biodiversity (*Activities under Objective 2 are closely related to those under Objective #3*)

This activity, required to achieve Objective 2, addresses the management of the protected areas. It is imperative that a policy, legal and institutional framework for the management, sustainable use and protection of the country's biodiversity is developed. As has can be indicated above, the multi-sectoral nature of biodiversity requires a highly coordinated management system to guide the collaboration of the many agencies and institutions that are involved in areas that need to be protected.

Although they are closely related, and in fact one management system will probably perform both tasks, a distinction must be made between the management of protected areas together with their associated biodiversity, and the management of the implementation of the BSAP itself (See Activity 5 below). Activity 2.1 focuses on the establishment of an appropriate

institutional framework for the management of protected areas and the sustainable use of non-protected areas together with the capacity building required to make this framework function effectively and efficiently. It addresses the key features of effective environmental management listed above.

In particular, effective environmental management entails on-going communication and consultation between different people and agencies, especially Non-Governmental Organizations (NGOs) and Community Based Organizations (CBOs), the private sector, and other stakeholders, together with the coordination and integration of their activities. The capacities and mandates of the agencies involved in biodiversity-related activities will need to be assessed so that their needs are identified and their personnel are included in the capacity-building programmes.

Training – human resource development - is one of the key elements of institutional strengthening and environmental management. Training should be at all levels, and training at degree level should include basic environmental management. This is particularly crucial for personnel of agencies and organizations with regulatory functions.

- **Establish an appropriate policy and institutional framework including capacity building, for the management and protection of the country's biodiversity**

See also Activity 3.1 and Section 6: Managing the BSAP.

- Promote, encourage and facilitate a general policy statement/decision from Cabinet/Parliament regarding the protection of the environment that would serve to guide all agencies
- Carry out an analysis of institutional strengthening needs of all relevant institutions, governmental and non-governmental, to establish the activities and resources required to enable these institutions to participate effectively in coordinated management of the environment of Antigua and Barbuda
- Based on the institutional review, establish an appropriate institutional framework for the

management of the national system for the management and conservation of biodiversity established under Objective 1

- **Provide training to facilitate the conservation and sustainable use of the country's biodiversity**
 - Explore and provide opportunities for improving the capabilities of local technicians, through appropriate training

2.2: Conduct research on the inter-relationships between abiotic, biotic and anthropogenic factors affecting biodiversity, and develop recommendations for the mitigation of these effects

Reliable information is critical to monitoring the country's biodiversity. Therefore, training should also include the capabilities, including equipment, to collect, process and utilize data on processes and activities that are likely to have an adverse impact on biological diversity, always recognizing that data collection is not an end in itself, but a tool for decision making. A good foundation exists in the form of the Horwith Inventory and the databases housed at the Museum.

- Identify gaps in current information required for making conservation management decisions, and recommend appropriate research programmes to address these
- Collect the additional baseline data required
- Conduct research on the ecological requirements of priority species and communities, especially those that are rare or endangered
- Provide a forum where researchers, conservation managers and decision makers can share information and determine the type of information that is most useful for improving the conservation of biodiversity
- Identify the current and future risks associated with biotechnology and make recommendations for policy development

2.3 Facilitate national financing for biodiversity conservation

Financial resources have to be mobilized for the implementation of the BSAP. The aim of this activity is to maximize existing resources and to seek assistance from the private and NGO sectors for the implementation.

- Review sectoral as well as national budgets for biodiversity conservation in the context of proposed institutional changes required to implement the BSAP
- Examine options for cross-budget schemes to promote the conservation and sustainable use of biodiversity by other agencies
- Maximize resources by bringing projects that have the same objectives together to coordinate and synchronize their activities and objectives.
- Seek assistance from the private and NGO sectors to finance specific aspects of the BSAP
- Consider the feasibility of the introduction of user fees for at least some aspects of eco-tourist activity
- Conduct training for key ministry employees and NGOs in project development and grants applications suitable for national and international donors
- Continue to seek international assistance for the conservation and sustainable use of the country's biodiversity

2.4 Develop and implement policies to promote sharing of appropriate technologies

- **Identify options and develop national policies aimed at promoting equity and fairness in the sharing of appropriate technologies and the benefits arising from their use**
- **Promote international and regional cooperation and exchange of technology**

- Develop international and bilateral agreement, where appropriate, to facilitate the sharing of appropriate technologies
- Develop appropriate protocols to facilitate technical and scientific cooperation
- Ratify other Conventions that complement the implementation of the BSAP (e.g. CITES, RAMSAR, TRIPS Agreement and the Bonn Conventions, etc.)
- Utilize the monitoring regime established at 1.3 to facilitate the country's reporting obligations under a number of international conventions, treaties and agreements (including equipment and training)
- Develop and implement protocols to regulate the import and export of endangered species, in line with international agreements (CITES)
- Develop and formalize regional agreements relating to cooperation in conservation of biological resources

OBJECTIVE 3

Ecological legislation that provides adequate protection of biological diversity is developed, improved, enacted and enforced.

This Objective encompasses, *inter alia*, the following area that is included under the CBD: Article #19 (Handling of Biotechnology and Distribution of its Benefits).

Indicators for Objective 3:

- A policy on biotechnology is developed and implemented
- Personnel in relevant agencies and departments are sensitized and/or trained to enforce environmental legislation
- Updated and new environmental legislation, including the use of EIAs, is enforced
- Direct incentives and disincentives are provided to promote the conservation and protection of Antigua and Barbuda's biodiversity

Assumptions for Objective 3:

- Personnel in the relevant departments accept the need for an integrated, coordinated and participatory framework
- Personnel in the public, private and NGO sectors “buy in” to the concept of integrated planning and programmes

Activities Required to Achieve Objective 3:

As indicated above, Activity 3.1 is very closely related to Activity 2.1. Although the activities are separated here in order to emphasize the policy, legal and regulatory aspects of the framework required for the implementation of the BSAP, this close relationship should be borne in mind during the implementation.

3.1: Establish the necessary policy and legal framework to facilitate the management, sustainable use, and protection of the country’s biodiversity

Inter alia, enforcement requires sensitization and training of personnel and the upgrading of law enforcement structures. This activity addresses these two aspects of the legislative framework.

- **Review, update and enact legislation to support the general policy statement/decision from Cabinet and Parliament regarding the protection of the environment developed under Activity 2.1**
 - Review and update the Draft Forestry and Wildlife Act (1988) and other related laws, for example the Pesticide and Toxic Chemicals legislation
 - Enact appropriate policies, legislation and management regimes that target specific threatened or endangered species e.g. sea turtle, Antiguan Racer etc
 - Provide legal protection to Great Bird Island and selected off-shore islands
 - Review current policies and make recommendations for improving the protection of beaches

- Develop mechanisms to enforce levels of use of biodiversity including the inclusion of sanctions and penalties against environmental crime sites
 - Regulate activities in areas of environmental sensitivity, or areas that support important ecological systems
 - Provide sensitization, awareness raising and training for all those involved in the legislative and regulatory aspects of the management framework (e.g. legal draftsmen, lawyers, the judiciary, policemen, planning) re the need for environmental enforcement.
- **Review impact assessment procedures to take into account specific impacts on biodiversity**
 - Review the process for conducting Environmental Impact Assessments (EIA) to take full account of impacts on biodiversity
 - Draft, enact and enforce appropriate legislation to implement the EIA requirements
 - Provide sensitization, awareness raising and training for all those involved in the preparation, consideration and enforcement of EIAs.
- **Provide direct incentives to promote positive biodiversity conservation**
 - Through a process of consultation, develop a package of incentives to promote the conservation and sustainable use of biodiversity
 - Identify options for, and if appropriate, implement tax privileges policy for businesses undertaking environmentally friendly methods of operation
 - Develop and implement an annual competition for nationally recognized awards for environmentally friendly management by business, service organizations etc, to be given wide publicity

- **Establish disincentives relating to negative impacts on biodiversity**
 - Review legal mechanisms by which financial responsibility for pollution and negative environmental impacts rest with the polluter
 - Develop and implement mechanisms for the enforcement of disincentives, including capacity building within the relevant agencies
 - Develop regulations to curb the importation of potentially invasive species that may pose a danger to biodiversity

3.2 Develop the legal and institutional framework necessary to ensure the safety of biotechnology as well as to ensure that maximum benefits accrue to Antigua and Barbuda from the exploitation of its biological resources

Biotechnology can be both a threat and a challenge. Antigua and Barbuda has to decide what its response is going to be to genetically modified organisms (GMOs). This activity will facilitate the development of policy towards GMOs for Antigua and Barbuda.

- Consult with competent authorities in countries with similar biological resources, on successful policies and mechanisms being used to ensure maximum benefits from the exploitation of those resources
- Through a process of consultation, seek advice from relevant expert technicians, the judiciary, other stakeholders including the public at large on ways to ensure safety and equitable sharing
- Develop a policy to address biotechnological issues within the framework of relevant international instruments.
- Develop and put in place the legal and institutional framework to govern the safety of biotechnology and the equitable sharing of benefits

- Promote the adoption of a regional approach to establishing appropriate policies and legislation to ensure bio-safety and fair distribution of the benefits

OBJECTIVE 4

This Objective encompasses, *inter alia*, the following areas that are included under the CBD: Articles # 13 (Public Education and Awareness), # 17 (Exchange of Information), and # 18 (Technical and Scientific Cooperation).

Indicators for Objective 4:

- Collaborative environmental public education programmes are carried out in Antigua and Barbuda
- Selected target audiences are sensitized to the importance of biodiversity in Antigua and Barbuda
- Relevant personnel in the legal field and the judiciary are sensitized to environmental laws and regulations
- Environmental information is freely shared among all relevant sectors

Assumptions for Objective 4:

- Agencies carrying out environmental public education programmes agree to collaborate
- Adequate resources are mobilized for the development of innovative materials and the conduct of environmental public education programmes
- Relevant agencies and institutions are committed to making information accessible, and to sharing information

Activities Required to Achieve Objective 4:

- 4.1 Increase public awareness of the benefits to be derived from biodiversity**

This Activity aims at the development of an educated public, a crucial component of the sustainable use and conservation of biodiversity.

- **Develop collaborative public education programmes and campaigns to increase public awareness of the importance of biodiversity to everyday life**
 - Maximize resources and impact by organizing collaborative, targeted programmes that utilize the capacities of all agencies that carry out environmental education programmes.
 - Provide support for NGOs, community groups and service organizations that contribute to public education and stakeholder awareness.
 - Develop special programmes targeting specific groups of stakeholders such as tour operators and their guides, charcoal burners and land clearers
 - Research the connotations of words used by Antiguans in normal speech to describe the environment
 - Based on this research, develop innovative public education materials that take advantage of the cultural and spiritual side of biodiversity. For example, Antiguans perceive the sea as being clean and cleansing. They probably also have attitudes towards other ecosystems. A project could be developed to elicit some of these attitudes so they can be used to good effect in public educational programmes.
 - Provide information, advice and resources relating to environmental education to the Ministry of Education
 - Allocate and mobilize adequate resources for the effective implementation of this component.

- **Develop public awareness of policies and laws relating to biodiversity**

- Conduct workshops, radio and television programmes, as well as use printed media spots to educate resource users and the society at large, about the laws, regulations and procedures relating to the management and conservation of biological resources

4.3 Develop mechanisms for inter-sectoral biodiversity information sharing

- Review and make recommendations relating to the accessibility and sharing of biodiversity and related information among agencies and with the public
- **Repatriate information held within other nations**
 - Develop protocols and submit request for the repatriation of information about biodiversity in Antigua and Barbuda currently held within other nations by organizations or individuals
 - Develop and implement protocols to clarify rights of accessibility to, and ownership of, biodiversity information and specimens that are collected by foreign agents

5. MANAGING THE BSAP

Because effective environmental management requires a highly coordinated management system, one of the main aims of the BSAP is the achievement of an integrated, coordinated and inter-sectoral approach to biodiversity policy planning and management. At present, however, there is no holistic institutional system, with adequate structures and mechanisms, in place for environmental management in Antigua and Barbuda. Nevertheless, some initiatives are in place. There is a National Coordinating Mechanism (NCM) for Environment Conventions, but this is limited in scope. Planning has established a sectoral committee for the Environment, and is preparing a log frame strategy based on documentation for the implementation of the National Strategy Development Plan. The Development Control Authority is in the process of having an Act drafted to enable the Physical Development Plan. In addition, an Environment Unit has been established in the Ministry of Tourism and the Environment with various environmental management and coordinating roles.

In order to achieve an integrated, coordinated and inter-sectoral approach, an entity capable of taking the lead in planning and programming, of soliciting inputs from stakeholders, and of implementing the BSAP and taking preventive actions, needs to be established. Such a coordination mechanism will also provide a forum for debate and consensus-based policy decisions. In order to avoid duplication, this coordinating mechanism should not focus only on the BSAP, but should coordinate environmental management generally since all environmental matters need to be managed in a coordinated way.

Consideration should be given to the structure of the defunct Historic Conservation and Environment Commission (HCEC). Although its mandate was never legally defined, it was assumed that it would advise on environmental policy, and provide a forum for discussion and resolution of major environmental issues. Unfortunately, although an Environmental Desk or secretariat was established to support it, the HCEC was not really provided with adequate budget support, staffing and a clear definition of its mandate. The HCEC functioned under the Ministry of Economic Development and thus had a direct link to Cabinet. It was a large committee, as any such coordinating mechanism must, of necessity, be. However, it is possible that its activities could be carried out through the establishment of various sub-committees for specific purposes.

In this context, the following activities are recommended to establish and sustain an institutional structure for effective environmental management in Antigua and Barbuda:

5.1 Establish a coordinating mechanism or entity for environmental management and the implementation of the BSAP.

- Clearly define the role and functions of this mechanism and establish its mandate and terms of reference.

The functions should include coordinating the formulation and implementation of national biodiversity policies, provision of public education and sensitization, and the monitoring the implementation of the BSAP. It could also serve as a focal point for compliance with international treaties that deal with the environment.

- Include all major stakeholders in the coordinating mechanism, and in the planning and policy formulation in which it engages. The emphasis should be on meaningful consultation, and wide participation.
- Support the coordinating entity with a technically competent secretariat.
- Rationalize the use of available manpower at the technical level, from the public, private and NGO sectors to support the coordinating mechanism and the changes that will need to be made in the legal and institutional structures.

5.2 Monitor and report on the implementation of the BSAP

- Conduct annual reviews and monitoring of the plan in relation to established targets, and with a view towards making appropriate adjustments
- Produce national and other reports to fulfill reporting requirements, including compliance with environmental treaties and conventions that have been ratified by Antigua and Barbuda

5.3 Carry out periodic evaluations of the implementation of the BSAP and other environmental strategies and action plans.

ANNEX 1: ENVIRONMENTAL GLOSSARY

This Environmental Glossary defines in non-technical language the more commonly used environmental terms appearing in the BSAP, as well as in publications, news releases, and other environmental documents generally available to the general public.

A

Agricultural Pollution: Farming wastes, including runoff and leaching of pesticides and fertilizers; erosion and dust from plowing; improper disposal of animal manure and carcasses; crop residues, and debris.

Agro-ecosystem: Land used for crops, pasture, and livestock; the adjacent uncultivated land that supports other vegetation and wildlife; and the associated atmosphere, the underlying soils, groundwater, and drainage networks.

Algae: Simple rootless plants that grow in sunlit waters in proportion to the amount of available nutrients. Algae produce oxygen during sunlight hours and use oxygen during the night hours, therefore they can affect water quality adversely by lowering the dissolved oxygen in the water. They are food for fish and small aquatic animals.

Algal bloom: Sudden, massive growths of algae, such as green or bluegreen algae, which can affect water quality adversely and indicate potentially hazardous changes in local water chemistry.

Algicide: Substance or chemical used specifically to kill or control algae.

Anti-Microbial: An agent that kills microbes.

Aquifer: An underground geological formation, or group of formations, containing water. Are sources of groundwater for wells and springs.

Asbestos: A mineral fiber that can pollute air or water and cause cancer or asbestosis when inhaled. Used extensively decades ago, most countries have now banned or severely restricted its use in manufacturing and construction.

Asbestosis: A disease associated with inhalation of asbestos fibers. The disease makes breathing progressively more difficult and can be fatal.

B

Bacteria: (Singular: bacterium) Microscopic living organisms that can aid in pollution control by metabolizing organic matter in sewage, oil spills or other pollutants. However, bacteria in soil, water or air can also cause human, animal and plant health problems.

Best (management) practices (BMPs): Structural, nonstructural and managerial techniques that are recognized to be the most effective and practical means of management.

Biodegradable: Capable of decomposing under natural conditions. The ability of a substance to be broken down physically and/or chemically by microorganisms. For example, many chemicals, food scraps, cotton, wool, and paper are bio-degradable; plastics and polyester generally are not.

Bio-chemicals: Chemicals that are either naturally occurring or identical to naturally occurring substances. Examples include hormones, pheromones, and enzymes. Bio-chemicals function as pesticides through non-toxic, non-lethal modes of action, such as disrupting the mating pattern of insects, regulating growth, or acting as repellants. Bio-chemicals tend to be environmentally compatible and are thus important to Integrated Pest Management programs.

Biodiversity: Refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequencies. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the biochemical structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species, and genes.

Biological Control: In pest control, the use of animals and organisms that eat or otherwise kill or out-compete pests.

Biological Treatment: A treatment technology that uses bacteria to consume organic waste.

Biologicals: Vaccines, cultures and other preparations made from living organisms and their products, intended for use in diagnosing, immunizing, or treating humans or animals, or in related research.

Biosphere: The portion of Earth and its atmosphere that can support life.

Biome: Entire community of living organisms in a single major ecological area.

Biota: The animal and plant life of a given region.

Biotechnology: Techniques that use living organisms or parts of organisms to produce a variety of products (from medicines to industrial enzymes) to improve plants or animals or to develop microorganisms to remove toxics from bodies of water, or act as pesticides.

Biotic Community: A naturally occurring assemblage of plants and animals that live in the same environment and are mutually sustaining and interdependent.

Botanical Pesticide: A pesticide whose active ingredient is a plant-produced chemical such as nicotine or strychnine. Also called a plant-derived pesticide.

C

Carrying Capacity: The maximum number of people, animals, buildings or activities that an area can support during a given period.

Cells: The smallest structural part of living matter capable of functioning as an independent unit.

Chlorinated Hydrocarbons: Chemicals containing only chlorine, carbon, and hydrogen. These include a class of persistent, broad-spectrum insecticides that linger in the environment and accumulate in the food chain. Among them are DDT, aldrin, dieldrin, heptachlor, chlordane, lindane, endrin, Mirex, hexachloride, and toxaphene. Other examples include TCE, used as an industrial solvent.

Chlorination: The application of chlorine to drinking water, sewage, or industrial waste to disinfect or to oxidize undesirable compounds.

Chlorofluorocarbons (CFCs): A family of inert, nontoxic, and easily liquefied chemicals used in refrigeration, air conditioning, packaging, insulation, or as solvents and aerosol propellants. Because CFCs are not destroyed in the lower atmosphere they drift into the upper atmosphere where their chlorine components destroy ozone.

Climate Change (also referred to as 'global climate change'): The term 'climate change' is sometimes used to refer to all forms of climatic inconsistency, but because the Earth's climate is never static, the term is more properly used to imply a significant change from one climatic condition to another. However, this term is now commonly used interchangeably with "global warming" and "the greenhouse effect", and refers to the buildup of man-made gases in the atmosphere that trap the sun's heat, causing changes in weather patterns on a global scale. The effects include changes in rainfall patterns, sea level rise, potential droughts, habitat loss, and heat stress. The greenhouse gases of most concern are carbon dioxide, methane, and nitrous oxides. If these gases in our atmosphere double, the earth could warm up by 1.5 to 4.5 degrees by the year 2050, with changes in global precipitation having the greatest consequences.

Coastal Zone: Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its ecology, or whose uses and ecology are affected by the sea.

Coliform Index: A rating of the purity of water based on a count of fecal bacteria.

Coliform Organism: Microorganisms found in the intestinal tract of humans and animals. Their presence in water indicates fecal pollution and potentially adverse contamination by pathogens or disease-causing microorganisms.

Compost: Decomposed organic material that is produced when bacteria in soil break down garbage and biodegradable trash, making organic fertilizer. Making compost requires turning and mixing and exposing the materials to air. Gardeners and farmers use compost for soil enrichment.

Composting: The controlled biological decomposition of organic material in the presence of air to form a humus-like material. Controlled methods of composting include mechanical mixing and aerating, ventilating the materials by dropping them through a vertical series of aerated chambers, or placing the compost in piles out in the open air and mixing it or turning it periodically.

Conservation: The use, protection, and improvement of natural resources according to principles that will ensure their highest economic or social benefit over the longest period of time..

Contaminant: Any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil.

Contamination: Introduction into water, air, and soil of microorganisms, chemicals, toxic substances, wastes, or wastewater in a concentration that makes the medium unfit for its next intended use. Also applies to surfaces of objects, buildings, and various household and agricultural use products.

Contingency Plan: A document setting out an organized, planned, and coordinated course of action to be followed in case of a fire, explosion, or other accident that releases toxic chemicals, hazardous waste, or radioactive materials that threaten human health or the environment.

Coral reef degradation: Caused by natural and man-made events including hurricanes, earthquakes, volcanic eruptions, disruptive invasion by marine organisms, turbidity caused by silt and sedimentation, dumping trash, chemical pollution, pesticide pollution, the practice of collecting shells and corals, and destructive fishing methods such as dynamiting.

Cost/Benefit Analysis: A quantitative evaluation of the costs which would have incurred by implementing an environmental regulation versus the overall benefits to society of the proposed action.

Cost Recovery: A legal process by which potentially responsible parties who contributed to contamination at a Superfund site can be required to reimburse the Trust Fund for money spent during any cleanup actions by the federal government.

Cost Sharing: A publicly financed program through which society, as a beneficiary of environmental protection, shares part of the cost of pollution control with those who must actually install the controls. In Superfund, for example, the government may pay part of the cost of a cleanup action with those responsible for the pollution paying the major share.

D

DDT: The first chlorinated hydrocarbon insecticide chemical name: Dichloro-Diphenyl-Trichloroethane). It has a half-life of 15 years and can collect in fatty tissues of certain animals. DDT was banned in the United States in 1972 for virtually all but emergency uses because of its persistence in the environment and accumulation in the food chain.

Decomposition: The breakdown of matter by bacteria and fungi, changing the chemical makeup and physical appearance of materials.

Defoliant: An herbicide that removes leaves from trees and growing plants.

Deforestation: The loss of tropical forests due to collection of fuelwood, commercial logging, shifting cultivation, grazing, road construction, ranching, mining and fire. Leads to soil erosion and flooding and endangers wildlife through habitat destruction.

Desertification: A process whereby the productivity of the land is reduced through deforestation, water-logging and salinization, chemical degradation by nutrient leaching, range mismanagement such as overgrazing, soil erosion and aridity and semi-aridity.

Detergent: Synthetic washing agent that helps to remove dirt and oil. Some contain compounds that kill useful bacteria and encourage algae growth in water that receives wastewater that contains them.

Direct Runoff: Water that flows over the ground surface or through the ground directly into streams, rivers, and lakes.

Discharge: Flow of surface water in a stream or canal or the outflow of ground water from a flowing artesian well, ditch, or spring. Can also apply to discharge of liquid effluent from a facility or to chemical emissions into the air through designated venting mechanisms.

Disposal Facilities: Repositories for solid waste, including landfills and combustors intended for permanent containment or destruction of waste materials. Excludes transfer stations and composting facilities.

Disposal: Final placement or destruction of toxic, radioactive, or other wastes; surplus or banned pesticides or other chemicals; polluted soils; and drums containing hazardous materials from removal actions or accidental releases. Disposal may be accomplished through use of approved secure landfills, surface impoundments, land farming, deep-well injection, ocean dumping, or incineration.

Distillation: The act of purifying liquids through boiling, so that the steam or gaseous vapors condense to a pure liquid. Pollutants and contaminants may remain in a concentrated residue.

Drainage Basin: The area of land that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel.

E

Ecological/Environmental Sustainability: Maintenance of ecosystem components and functions for future generations.

Ecological Impact: The effect that a man-caused or natural activity has on living organisms and their non-living (abiotic) environment.

Ecological Indicator: A characteristic of an ecosystem that is related to, or derived from, a measure of biotic or abiotic variable, that when measured, quantifies the magnitude of stress, habitat characteristics, degree of exposure to a stressor, or ecological response to exposure. It can provide quantitative information on ecological structure and function and can contribute to a measurement of integrity and sustainability.

Ecological Integrity: A living system exhibits integrity if, when subjected to disturbance, it sustains and organizes self-correcting ability to recover toward a biomass end-state that is normal for that system. End-states other than the pristine or naturally whole may be accepted as normal and good.

Ecological Risk Assessment: The application of an analytical process to estimate the effects of human actions(s) on a natural resource and to interpret the significance of those effects.

Ecology: The relationship of living things to one another and their environment, or the study of the relationships between all living organisms and the environment, especially the totality or pattern of interactions

Ecosystem: The interacting system of a biological community and its non-living environment: every plant, insect, aquatic animal, bird, or land species that forms a complex web of interdependency. An action taken at any level, for example the use of a pesticide, has a potential domino effect on every other occupant of that system.

Effluent: Wastewater--treated or untreated--that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

Emission: Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts.

Endemic: Something peculiar to a particular people or locality, such as a plant or animal, or disease which is always present in the population.

End User: Consumer of products or services.

Endangered Species: Animals, birds, fish, plants, or other living organisms threatened with extinction man-made or natural changes in their environment.

Enforcement: Legal actions to obtain compliance with environmental laws, rules, regulations, or agreements and/or obtain penalties or criminal sanctions for violations. Enforcement procedures may vary, depending on the requirements of different environmental laws and related implementing regulations.

Environment: The sum of all external conditions affecting the life, development and survival of an organism.

Environmental Impact Assessment (EIA): An environmental analysis prepared to determine whether a development or action would significantly affect the environment. A tool for decision making, it describes the positive and negative effects of the undertaking and cites alternative actions.

Environmental Audit: An independent assessment of the current status of a party's compliance with applicable environmental requirements or of a party's environmental compliance policies, practices, and controls.

Environmental/Ecological Risk: The potential for adverse effects on living organisms associated with pollution of the environment by effluents, emissions, wastes, or accidental chemical releases; energy use; or the depletion of natural resources.

Environmental Equity/Justice: Equal protection from environmental hazards for individuals, groups, or communities regardless of race, ethnicity, or economic status. This applies to the development, implementation, and enforcement of environmental laws, regulations, and policies, and implies

that no population of people should be forced to shoulder a disproportionate share of negative environmental impacts of pollution or environmental hazard due to a lack of political or economic strength levels.

Environmental Indicator: A measurement, statistic or value that provides a proximate gauge or evidence of the effects of environmental management programs or of the state or condition of the environment.

Environmental Sustainability: Long-term maintenance of ecosystem components and functions for future generations.

Erosion: The wearing away of land surface, and the loss of surface soil, by wind or water, intensified by land-clearing practices related to farming, residential or industrial development, road building, or logging. Leads to sedimentation and siltation of water, which destroy aquatic and marine habitats, make water undrinkable and clog water-dependent industrial machinery and other intake equipment.

Exotic Species: A species that is not indigenous to a region.

Ex situ: Moved from its original place; excavated; removed or recovered from the subsurface.

Enzyme: (a) any of numerous proteins or conjugated proteins produced by living organisms and functioning as biochemical catalysts. (b) a protein that a living organism uses in the process of degrading a specific compound. The protein serves as a catalyst in the compound's biochemical transformation.

F

Feasibility study: Analysis of the practicability of a proposal; a small-scale investigation of a problem to ascertain whether a proposed research approach is likely to provide useful data.

Fecal Coliform Bacteria: Bacteria found in the intestinal tracts of mammals. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

Filling: Depositing dirt, mud or other materials into aquatic areas to create more dry land, usually for agricultural or commercial development purposes, often with ruinous ecological consequences.

Fluorocarbons (FCs): Any of a number of organic compounds analogous to hydrocarbons in which one or more hydrogen atoms are replaced by fluorine. They are now found mainly in coolants and some industrial processes. FCs containing chlorine are called chlorofluorocarbons (CFCs). They are believed to be modifying the ozone layer in the stratosphere, thereby allowing more harmful solar radiation to reach the Earth's surface.

Fumigant: A pesticide vaporized to kill pests. Used in buildings and greenhouses.

Fungicide: Pesticides that are used to control, deter, or destroy fungi.

Fungistat: A chemical that keeps fungi from growing

Fungus (Fungi): The fungi include mushrooms, yeast, molds, and smuts. Most fungi are saprophytes, obtaining their nourishment from dead organic matter. Along with bacteria, fungi are the principal organisms responsible for the decomposition of carbon in the biosphere. Some grow in soil, others attach themselves to decaying trees and other plants from which they obtain nutrients. Some are pathogens, others stabilize sewage and digest composted waste. Fungi have two ecological advantages over bacteria: (1) they can grow in low moisture areas, and (2) they can grow in low pH environments.

G

Garbage: Animal and vegetable waste resulting from the handling, storage, sale, preparation, cooking, and serving of foods.

Genetic Engineering: A process of inserting new genetic information into existing cells in order to modify a specific organism for the purpose of changing one of its characteristics. Organisms modified in this way are usually referred to as **Genetically Modified Organisms (GMOs)**.

Geographic Information System (GIS): A computer system designed for storing, manipulating, analyzing, and displaying data in a geographic context.

Germicide: Any compound that kills disease-causing microorganisms.

Global Warming: An increase in the near surface temperature of the Earth. Global warming has occurred in the distant past as the result of natural influences, but the term is most often used to refer to the warming predicted

to occur as a result of increased emissions of greenhouse gases. Scientists generally agree that the Earth's surface has warmed by about 1 degree Fahrenheit in the past 140 years. The Intergovernmental Panel on Climate Change (IPCC) recently concluded that increased concentrations of greenhouse gases are causing an increase in the Earth's surface temperature and that increased concentrations of sulfate aerosols have led to relative cooling in some regions, generally over and downwind of heavily industrialized areas.

Gray Water: Domestic wastewater composed of wash water from kitchen, bathroom, and laundry sinks, tubs, and washers.

Greenhouse Effect: The warming of the Earth's atmosphere attributed to a buildup of carbon dioxide or other gases. Some scientists theorize that in time this could create a hothouse effect, raising the temperature of the earth, causing glaciers to melt and the sea level to rise.

Greenhouse Gas: A gas, such as carbon dioxide or methane, which contributes to potential climate change.

Ground Water: The supply of fresh water found beneath the Earth's surface, usually in aquifers, which supply wells and springs. The top of the zone of saturation called the water-table. Because ground water is a major source of drinking water, there is growing concern over contamination from leaching agricultural, industrial and landfill pollutants or leaking underground storage tanks.

H

Habitat: The sum total of environmental conditions of a specific place where a population (human, animal, plant, microorganism) lives and its surroundings, both living and non-living.

Hazard: Potential for radiation, a chemical or other pollutant to cause human illness or injury.

Hazard Assessment: Evaluating the effects of a stressor or determining a margin of safety for an organism by comparing the concentration which causes toxic effects with an estimate of exposure to the organism.

Hazardous Chemical: A designation for any hazardous material that is capable of producing fires and explosions or adverse health effects like

cancer and dermatitis. Hazardous chemicals are distinct from hazardous waste.

Hazardous Waste: A subset of solid waste that can create a risk to the safety or health of people or the environment. Any solid waste that is ignitable, explosive, reactive or toxic and which may pose a substantial or potential hazard to human health and safety or to the environment when improperly managed.

Hazardous Waste Landfill: An excavated or engineered site where hazardous waste is deposited and covered.

Herbicide: A chemical pesticide designed to control or destroy plants, weeds, or grasses. Almost 70% of all pesticide used by farmers are herbicides. These chemicals have wide-ranging effects on non-target species i.e species other than those the pesticide is meant to control.

Household Hazardous Waste: Hazardous products used and disposed of by residential as opposed to industrial consumers. Includes paints, stains, varnishes, solvents, pesticides, and other materials or products containing volatile chemicals that can catch fire, react or explode, or that are corrosive or toxic.

Household Waste (Domestic Waste): Solid waste, composed of garbage and rubbish, which normally originates in a private home or residence. Domestic waste may contain a significant amount of toxic or hazardous waste.

Hydrocarbons (HC): Chemical compounds that consist entirely of carbon and hydrogen.

I

In Situ: In its original place; unmoved unexcavated; remaining at the site or in the subsurface.

Incineration: A treatment technology involving destruction of waste by controlled burning at high temperatures producing residues of safe, non-burnable ash that can be disposed of safely on land, in some waters, or in underground locations.

Incinerator: A furnace for burning waste under controlled conditions.

Indicator: In biology, any biological entity or processes, or community whose characteristics show the presence of specific environmental conditions

Industrial Waste: Unwanted materials from an industrial operation; may be liquid, sludge, solid, or hazardous waste.

Insecticide: A pesticide compound specifically used to kill or prevent the growth of insects.

Integrated Pest Management (IPM): A mixture of chemical and other, non-pesticide, methods to control pests.

Integrated Waste Management: Using a variety of practices to handle municipal solid waste; can include source reduction, recycling, incineration, and landfilling.

L

Landfills: A method for final disposal of solid waste on land. The refuse is spread and compacted and a cover of soil applied so that effects on the environment (including public health and safety) are minimized. Usually, landfills are required to have liners and leachate treatment systems to prevent contamination of ground water and surface waters. A municipal landfill disposes of domestic waste including garbage, paper, etc. This waste may include toxins that are used in the home, such as insect sprays and powders, engine oil, paints, solvents, and weed killers. An industrial landfill disposes of non-hazardous industrial wastes. Secure chemical landfills are disposal sites for hazardous waste, selected and designed to minimize the chance of release of hazardous substances into the environment.

Leaching: The process by which soluble constituents are dissolved and filtered through the soil by a percolating fluid.

Leachate: The liquid, usually rainwater, which percolates through a landfill and which frequently is contaminated by materials dissolved from the waste in the landfill.

Litter: The highly visible portion of solid waste (usually packaging material) carelessly discarded outside the regular garbage and trash collection and disposal system, usually in the streets and other public areas.

M

Management Plan: A document describing all activities planned and undertaken to comply with objectives and regulations for operations and maintenance programs of specific areas.

Microorganisms: Bacteria, yeasts, simple fungi, algae, protozoans, and a number of other organisms that are microscopic in size. Most are beneficial, but some produce disease. Others are involved in composting and sewage treatment.

Microbial Pesticide: A microorganism that is used to kill a pest, but is of minimum toxicity to humans.

Mitigation: Measures taken to reduce adverse impacts on the environment.

Molecule: The smallest division of a compound that still retains or exhibits all the properties of the substance.

Monitoring: Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.

Montreal Protocol: Treaty, signed in 1987, governs stratospheric ozone protection and research, and the production and use of ozone-depleting substances. It provides for the end of production of ozone-depleting substances such as CFCs. Under the Protocol, various research groups continue to assess the ozone layer. The Multilateral Fund provides resources to developing nations to promote the transition to ozone-safe technologies.

N

Nitrate: A compound containing nitrogen that can exist in the atmosphere or as a dissolved gas in water and which can have harmful effects on humans and animals. Nitrates in water can cause severe illness in infants and domestic animals. A plant nutrient and inorganic fertilizer, nitrate is found in septic systems, animal feed lots, agricultural fertilizers, manure, industrial waste waters, sanitary landfills, and garbage dumps.

Nutrient: Any substance assimilated by living things that promotes growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

Nutrient Pollution: Contamination of water resources by excessive inputs of nutrients. In surface waters, excess algal production is a major concern.

O

Oil Spill: An accidental or intentional discharge of oil which reaches bodies of water. Can be controlled by chemical dispersion, combustion, mechanical containment, and/or adsorption. Spills from tanks and pipelines can also occur away from water bodies, contaminating the soil, getting into sewer systems and threatening underground water sources.

Organic: 1. Referring to or derived from living organisms.

Organic Matter: Carbonaceous waste contained in plant or animal matter and originating from domestic or industrial sources.

Organism: Any form of animal or plant life.

Over-fishing: The practice of commercial and non-commercial fishing which depletes a fishery by catching so many adult fish that not enough remain to breed and replenish the population. Over-fishing exceeds the carrying capacity of a fishery.

Overgrazing: The practice of grazing too many ruminants on land unable to recover its vegetation, or of grazing ruminants on land not suitable for grazing because of its slope. Overgrazing exceeds the carrying capacity of a pasture.

Ozone Depletion: Destruction of the stratospheric ozone layer that shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.

Ozone Hole: A thinning break in the stratospheric ozone layer, e.g. that appearing each year over the Antarctic for a few weeks in October, each time larger. Designation of amount of such depletion as an "ozone hole" is made when the detected amount of depletion exceeds fifty percent. Seasonal ozone holes have been observed over the Antarctic and Arctic regions, part of Canada, and the extreme northeastern United States.

Ozone Layer: The protective layer in the atmosphere, from 6 to 35 miles above the ground, that absorbs some of the sun's ultraviolet rays, thereby reducing the amount of potentially harmful radiation that reaches the earth's surface. It is composed of a form of oxygen with three atoms to the molecule, O₃. A potential effect of the loss of this protective layer could be a sharp rise in the incidence of skin cancer.

P

Parameter: A variable, measurable property whose value is a determinant of the characteristics of a system; e.g., temperature, pressure, and density are parameters of the atmosphere.

Pathogens: Microorganisms (e.g., bacteria, viruses, or parasites) that can cause disease in humans, animals and plants.

Pest: An insect, rodent, nematode, fungus, weed or other form of terrestrial or aquatic plant or animal life that is injurious to health or the environment.

Pesticide: Substances, or mixture thereof, intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.

Pollutant: Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems..

Pollution: Generally, the presence of a substance in the environment that because of its chemical composition or quantity prevents the functioning of natural processes and produces undesirable environmental and health effects.

Protocol: A series of formal steps for conducting a test.

R

Raw Sewage: Untreated wastewater and its contents.

Recycle/Reuse: Minimizing waste generation by recovering and reprocessing usable products that might otherwise become waste (i.e. recycling of aluminum cans, paper, and bottles, etc.).

Risk: A measure of the probability that damage to life, health, property, and/or the environment will occur as a result of a given hazard.

Risk Assessment: Qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants.

Rodenticide: A chemical or agent used to destroy rats or other rodent pests, or to prevent them from damaging food, crops, etc.

S

Sewage: The waste and wastewater produced by residential and commercial sources and discharged into sewers.

Sewer: A channel or conduit that carries wastewater and storm-water runoff from the source to a treatment plant or receiving stream. "Sanitary" sewers carry household, industrial, and commercial waste. "Storm" sewers carry runoff from rain or snow. "Combined" sewers handle both.

Sewerage: The entire system of sewage collection, treatment, and disposal.

Solid Waste Disposal: The final placement of refuse that is not salvaged or recycled.

Solid Waste: Non-liquid, non-soluble materials ranging from municipal garbage to industrial wastes that contain complex and sometimes hazardous substances. Solid wastes also include sewage sludge, agricultural refuse, demolition wastes, and mining residues. Technically, solid waste also refers to liquids and gases in containers.

Solid Waste Management: Supervised handling of waste materials from their source through recovery processes to disposal.

Species: 1. A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2. An organism belonging to belonging to such a category.

Species extinction: Elimination of any species of living thing as a result of habitat destruction, hunting for sport and trophies and collection and hunting for food, pleasure, research and trade.

Stakeholder: Any organization, governmental entity, or individual that has a stake in, or may be impacted by, a given approach to environmental regulation, pollution prevention, energy conservation, etc.

Standards: Norms that impose limits on the amount of pollutants or emissions produced.

Surface Runoff: Precipitation or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of non-point source pollutants in rivers, streams, and lakes..

Surface Water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.)

Surveillance System: A series of monitoring devices designed to check on environmental conditions.

Sustainable agriculture: Environmentally friendly methods of farming that allow the production of crops or livestock without damage to the farm as an ecosystem, including effects on soil, water supplies, biodiversity, or other surrounding natural resources. The concept of sustainable agriculture is an "intergenerational" one in which we pass on a conserved or improved natural resource base instead of one which has been depleted or polluted. Terms often associated with farms or ranches that are self-sustaining include "low-input," organic, "ecological," "biodynamic," and "permaculture."

Sustainable development: **The concept of using resources in an ecologically sound manner so that they will be sustainable over the long term. It is an approach to progress that meets the needs of the present without compromising the ability of future generations to meet their needs.**

T

Toxic Dose: The dose level at which a substance produces a toxic effect.

Toxic Pollutants: Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.

Toxic Substance: A chemical or mixture that may present an unreasonable risk of injury to health or the environment.

Toxic Waste: A waste that poses a substantial present or potential hazard to human health or the environment when improperly managed. A waste that can produce injury if inhaled, swallowed, or absorbed through the skin.

Toxicity: The degree to which a substance or mixture of substances can harm humans or animals. Acute toxicity involves harmful effects in an organism through a single or short-term exposure. Chronic toxicity is the ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism. Subchronic toxicity is the ability of the substance to cause effects for more than one year but less than the lifetime of the exposed organism.

Treatment: Methods used to change the biological character or composition of any regulated waste so as to substantially reduce or eliminate its potential for causing disease.

U

User Fee: Fee collected only from those persons who use a particular service, as compared to one collected from the public in general.

W

Waste: 1. Unwanted materials left over from a manufacturing process. 2. Refuse from places of human or animal habitation.

Wastewater: The spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter.

Water Pollution: The introduction of substances that make water impure. Usually this comes from soil erosion, introduction of poisonous chemicals from industries and spills and introduction of domestic sewage or industrial and agricultural wastes.

Water Table: The surface level of groundwater.

Watershed: The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point.

Wetlands: Areas that are soaked or flooded by surface or ground water frequently enough or for sufficient duration to support plants, birds, animals, and aquatic life. Wetlands generally include swamps, marshes, bogs, estuaries, and other inland and coastal areas. Wetlands frequently serve as recharge/discharge areas and are known as "nature's kidneys" since they help purify water. Wetlands also have been referred to as natural sponges that absorb flood waters, functioning like natural tubs to collect overflow. Wetlands are important wildlife habitats, breeding grounds, and nurseries because of their biodiversity. Many endangered species as well as countless estuarine and marine fish and shellfish, mammals, waterfowl, and other migratory birds use wetland habitat for growth, reproduction, food, and shelter. Wetlands are among the most fertile, natural ecosystems in the world since they produce great volumes of food (plant material).

Wildlife Refuge: An area designated for the protection of wild animals, within which hunting and fishing are either prohibited or strictly controlled.

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