Ministry of
Land & Environment

National Strategy and Action Plan on Biological Diversity in Jamaica

National Environment
& Planning Agency

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FOREWORD

Jamaica is a small island developing state, faced with the constant challenge of balancing the needs of development and economic activity with sustainable use of its natural resources. This National Strategy and Action Plan for Biological Diversity is one of Jamaica's initiatives towards sustainable development, which focuses on knowledge of and sustainable use of biological resources.

The needs of humanity, depends as it always has, on essential goods and services being provided by the natural environment. Studies done globally however, have shown that the current, rapid decline in biological diversity and the resulting decline or loss of ecological services, is as a result of human activities. It is the loss of these resources and services that is the greatest threat to human health and development. The provision of good quality and sufficient quantity of water is one example of an ecological service.

Jamaica is rated fifth in the islands of the world in terms of the presence of endemic plants and many of these plants are found in our forests. Many of the modern medicines are made from extracts from plants found in places like Jamaican forests. One example of this is the Rosy Periwinkle, first identified in Jamaica. It is the source of a drug used to treat some forms of cancer. Loss of some kinds of forests in Jamaica could mean loss of this cancer-treating chemical for the world.

A number of critical activities are taking place and others are planned for to deal with Jamaica's biodiversity. These include rehabilitation programmes, public education programmes, and consistent and integrated efforts to understand the intrinsic and economic value of the country's biological resources. These activities must take place if we are to have the means to make informed choices about resource use.

We owe it to ourselves and the rest of humanity to conserve and sustainably use our biodiversity. In doing so the heritage and patrimony of Jamaica will be assured.

Dean Peart, M.P.
Minister of Land and Environment

LIST OF ACRONYMS

AIA	Advance Informed Agreement
CARICOM	Caribbean Community
CASE	College of Agriculture Science and Education
CBD	Convention on Biological Diversity
CBO	Community Based Organisation
CDC	Conservation Data Centre
CHM	Clearing-House Mechanism
CIDA	Canadian International Development Agency
CITES	Convention on International Trade in Endangered Species
COP	Conference of Parties
CPACC	Caribbean Planning for Adaptation to Climatic Change
CWIP	Coastal Water Quality Improvement Project
EIA	Environmental Impact Assessment
ENACT	Environmental Action Programme
EAST	Environmental Audits for Sustainable Tourism
FOS	Friends of the Sea
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographical Information System
GOJ	Government of Jamaica
HFCS	High Fructose Corn Syrup
IABIN	Inter American Biodiversity Information Network
IOJ	Institute of Jamaica
IUCN	World Conservation Union
JANEAP	Jamaica National Environmental Action Plan
JBS	Jamaica Bureau of Standards
JCDT	Jamaica Conservation and Development Trust
JHTA	Jamaica Hotel and Tourist Association
JNPTF	Jamaica National Park Trust Fund
LDUC	Land Development and Utilisation Commission
LMO	Living Modified Organism
MLE	Ministry of Land and Environment
NBC	National Biosafety Committee
NBS	National Biodiversity Strategy
NBSAP	National Biodiversity Strategy and Action Plan
NCST	National Commission on Science and Technology
NCU	Northern Caribbean University
NEPA	National Environment and Planning Agency
NEST	National Environmental Societies Trust
NGO	Non-Government Organisation
NPEP	National Poverty Eradication Programme
NRCA	Natural Resources Conservation Authority
NWC	National Water Commission
OAS	Organisation of American States
PIOJ	Planning Institute of Jamaica
RAMSAR	Convention on Wetlands of International Importance Especially as Waterfowl Habitats
SPS	Agreement on the Application of Sanitary and Phytosanitary Measures
SRC	Scientific Research Council
TBT	Technical Barriers to Trade
TPD	Town Planning Department
TRIPS	Trade Related Intellectual Property Rights
UDC	Urban Development Corporation
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

USAID	United States Agency for International Development
UTECH	University of Technology
UWI	University of the West Indies
WECAN	Wildlife and Environment Conservation Action Now
WMC	Water Management Unit
WTO	World Trade Organisation

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Special thanks are offered to the photographers who have given permission for the use of their work in this document. They have brought to light and life many of the indigenous and endemic species about which this document was written.

EXECUTIVE SUMMARY

Introduction to Jamaica

The earliest known inhabitants of Jamaica were the Tainos, who lived mainly in villages along the coast. Their main diet was fish, cassava, maize, fruits, birds, coneys, iguanas and manatees. Later came the Spanish and the British who introduced crops such as citrus, banana, sugar cane, cocoa, tobacco, breadfruit and otaheite apple. They also introduced horses, goats, chickens, pigs and cattle, which were selected for their ability to adapt to the local climate. Natural resources have played an important role in Jamaica's economic development, however, agricultural development, along with urbanization, has contributed to the destruction of biological resources.

The cultural attitudes and religious beliefs of the migrant people, which make up Jamaica's population, significantly influence the traditions and rituals involving the use of plants, animals, land and water. The majority of Jamaica's population is of African descent. These descendants, found mainly in rural communities, still practice their African traditions, which include the use of herbal medicines and the utilization of plants and animals in ceremonial events. This strong African traditional knowledge is also apparent in agricultural practices, for example, the use of moon phases in order to determine the time to plant certain crops, pest control, crop rotation, and in the use of economic plants as contour barriers. These practices have helped to promote conservation and the sustainable use of biodiversity over the years.

The majority of Jamaica's population lives on the coastal plains and consequently, this is where most economic activities occur. Natural resources have played a critical role in economic development throughout Jamaica's history, in both pre and post-colonial periods. The island's major economic sectors, agriculture, tourism and mining, are all based on the natural resources found in Jamaica. Much of the agricultural development was, and in some sectors, still is ecologically destructive, and has in many instances had detrimental effects on the products and services provided by the natural environment.

Jamaica's biodiversity and other natural resources

Jamaica has a tropical maritime climate, which is influenced by the northeast trade winds, and land and sea breezes. Rainfall is marked by monthly, annual, and spatial variability, with the average annual rainfall for the country being approximately 200 cm.

The country's topography consists of a highland interior formed by a backbone of peaks, hills and plateaux running the length of the island, with over 60% of the island having an altitude of over 230m. The plateaus are dissected by faults and have been karsified to varying degrees. The most developed karst topography is the Cockpit Country. This is an important ecological area of the country, which is still relatively undisturbed.

Approximately 70% of the island's surface area is covered by limestone. The remaining 30% is covered by igneous and metamorphic rocks, shale and alluvial cover. The topography and land formations give rise to surface drainage through a network of streams and rivers.

Limestone aquifers provide the main source (84%) of Jamaica's freshwater resources, while the remaining 16% is provided by surface drainage. Several watershed/ecosystem rehabilitation programmes are being undertaken to increase and improve the quality and quantity of water for human consumption and to assist in the conservation of biodiversity.

The wide range in microclimates, soils, and physical features in the country give rise to a variety of forest types. These are: lower montane mist, montane mist, dry limestone, wet limestone, mangrove, woodland, herbaceous swamp and marsh forest. Jamaica's forests are the main repositories of biodiversity, especially endemic flora and fauna. As a result, conservation and sustainable use of forest resources is a crucial component of the overall biodiversity conservation strategy. The most recent assessment of forest cover was carried out in 1998. Nearly 30.1% of the total land area (approximately 336,000 ha) is classified as forest.

Jamaica has been rated fifth in the islands of the world in terms of endemic plants. There is also a high level of endemism for many species of animals' including snails, terrestrial grapsid crabs, amphibians, reptiles and land birds. At least six species of terrestrial vertebrates are thought to have become extinct in Jamaica in the last 150

years and many more are considered endangered, threatened, or rare.

Current estimates indicate that at least 3,304 species of vascular plants occur in Jamaica, of which 27.9% are endemic. Knowledge of Jamaica's flora is incomplete and the abundance of some species is unknown. The only published status of levels of threat to Jamaica's terrestrial plant species is based on the World Conservation Union (IUCN) data, which is now almost 12 years old.

Jamaica's freshwater resources are quite extensive and support several diverse faunal and floral communities. There are 10 hydrological basins throughout the island containing over 100 streams and rivers, in addition to a multitude of subterranean waterways, ponds, springs and blue holes. Jamaica depends on water from these sources for domestic, agricultural and industrial purposes. The flora and fauna of these waters also serve as a food source and as a commercial activity for rural and inland communities.

There are three endemic freshwater fish species found in Jamaica. However, little is known about the ecology of these species or Jamaica's freshwater ecosystems. One endemic freshwater turtle has been identified, the Slider Turtle, but the status of its population is unknown.

Wetlands were at one time estimated to cover 2%of Jamaica's total surface area. The total area has declined due to developmental pressures, including reclamation for road construction, port and harbour development etc. Wetlands are found mainly in low-lying coastal areas particularly along the south coast. There are 2 main classifications: swamps and marshes. Wetlands are habitats for some species of turtles, as well as fish, oysters, birds, crocodile and the endemic pond turtle.

The largest wetland areas are the Negril Morass in Westmoreland, the Great Morass in St. Thomas, and the Black River Upper and Lower Morass in St. Elizabeth. The Black River Lower Morass was declared a 'Wetland of International Importance' under the Ramsar Convention in 1998.

The irregular coastline of Jamaica is 891 km long and has diverse ecosystems including sandy beaches, rocky shores, estuaries, wetlands, seagrass beds and coral reefs. The majority of living marine resources is found on the island shelf and on the nine oceanic banks that cover an area of 4,170 sq. km. The island shelf is much wider on the south coast, with a maximum width of about 24 km, in comparison to the north coast, which is on average, 1.6 km wide.

Jamaica enjoys a rich diversity of marine species, which includes species of fish, sea anemones, black corals, stony corals, sea fans, molluscs, turtles, and marine mammals including whales, dolphins and manatees. The main fishery resources include: coral reef fish, Spiny lobsters, Queen Conch, small coastal pelagic finfish and large offshore pelagic fish. There is also recreational fishing for Marlin and other finfish. The dominant marine plant species are sea grasses, calcareous algae and mangroves. Sea grasses (also known as sea weeds) are found in shallow coastal waters and are important sources of food for turtles, manatee, and for Jamaican folk medicine.

Coral reefs are of major social, economic, and biophysical importance to Jamaica. Reefs act as natural barriers by protecting coastlines from erosion, are a source of food and income for local communities, support tourism, and recreational activities. In the late 1970's, nine reefs on the north coast had coral cover averaging 52% at a depth of 10m. However, by the late 1990's, this declined to 3%.

Wild species of flora and fauna make a significant contribution to the Jamaican economy. In agriculture, animals act as pollinators and seed dispersers to name a few. Genetic resources from wild animals and plants improve domestic breeds and varieties respectively. Most of Jamaica's agricultural crops come from imported genetic resources, however, there are a number of indigenous (e.g. pineapple) and endemic plants being used. Special breeds of cattle have been bred for local conditions, including the Jamaica Hope for milk production and the Jamaican Brahman for meat production. Efforts continue to improve the contribution of livestock to the local economy and to enhance food security.

Jamaica has been involved in biotechnology since the 16th Century, producing rum and vinegar from sugar cane by fermentation. Current research and developmental activities using modern biotechnology are ongoing at the Scientific Research Council and the University of the West Indies. There is a tissue culture unit at the Scientific Research Council, which houses the largest in-vitro germ plasm collection of banana in the Western Hemisphere. The unit also houses orchids, anthuriums, African violets and other ornamentals.

Legal and Policy Framework

Jamaica's current environmental legislation provides a basic framework for the conservation and sustainable use of biodiversity. Although there are approximately 52 pieces of legislation that impact on the environment, none of these comprehensively address the protection, conservation and sustainable use of biodiversity. A new and more comprehensive framework is needed that recognises the components of biodiversity and will ensure its sustainable use. In this regard, several pieces of legislation are being reviewed and others are being developed in order to address this deficiency. These include the amendments of the Wild Life Protection, Fisheries and Watershed Acts, regulations under the Endangered Species (Protection, Conservation and Regulation of Trade) Act (2000) and the development of legislation for Biosafety.

Many of the national policies impacting biodiversity are sectoral in nature. The Jamaica National Environmental Action Plan (JNEAP), which is updated triennially, outlines major environmental problems and emphasises the necessary corrective measures to be undertaken by ministries, agencies, private sector and civil society organisations. There are also species recovery plans developed by the National Environment and Planning Agency (NEPA) in collaboration with partners, for selected species such as the Giant Swallowtail butterfly (endemic), the Jamaican Iguana (endemic) and Crocodiles (indigenous).

There are gaps in the policy framework, including the areas of Biosafety, traditional knowledge, access and benefit sharing to name a few. However, ongoing projects and programmes, draft policies and plans will address some of these areas.

As a small island developing state, Jamaica's biodiversity is vulnerable to pressures from many areas. Factors which contribute to the loss of biodiversity in Jamaica includes poverty; over-consumption by some sectors of society; lack of public awareness and education; habitat/ecosystem conversion and degradation; unsustainable harvesting of some species; pollution; and the spread of alien invasive species. Successful implementation of the NBSAP and therefore the CBD will depend on the country overcoming several gaps and challenges, which are highlighted.

National Biodiversity Strategy and Action Plan

Jamaica's exceptional biodiversity and rich biological resources are major contributors to its economic growth and stability and support agriculture, tourism and several other industries. Conservation and sustainable use of Jamaica's biodiversity will require the commitment and collaboration of the Government, civil society, including local communities, environmental organisations and the private sector. The Vision Statement, principles, goals and strategic directions of this document, provide a framework to achieve and fulfil Article 6(a) of the Convention.

The biodiversity vision for the people of Jamaica includes the idea of the importance of biodiversity for past, present and future generations, the need to secure the resources for their intrinsic as well as other more well-known values, and to ensure the fair and equitable sharing of the benefits derived from biodiversity.

The Principles guiding the implementation of the Strategy and Action Plan are critical to the successful implementation of the Strategy. The Principles show commitment to:

I. Transparency in decision-making processes and opportunities for participation;
II. Behavioural change towards sustainable practices and use;
III. Respect for local and traditional knowledge;
IV. Protection of habitats, ecosystems, species and genetic resources;
V. Encouragement of local management in implementation;
VI. Ensuring that the precautionary approach is widely applied;
VII. Use of environmental economic tools and technology; and
VIII. Sectoral integration.

The broad goals of the Strategy, under which there are many areas of strategic directions, are to:

I. Conserve Jamaica's biodiversity;
II. Promote sustainable use of biological resources;
III. Facilitate access to biological resources to promote developments in biotechnology and to ensure benefit sharing;
IV. Ensure safe handling and use of Living Modified Organisms;
V. Enhance resource management capacity;
VI. Promote public awareness and education, and community empowerment; and

VII. Promote regional and international cooperation and collaboration in support of the implementation of the CBD.

The strategic directions enunciated under each goal are the basis for the actions identified as being necessary to fill the gaps, deal with the challenges and meet the goals, thereby achieving the implementation of the biodiversity strategy and the CBD.

In an effort to ensure that the strategic directions are taken and the goals achieved, the Action Plan proposes 37 projects, of which 17 have been identified as priority projects, for implementation over the next five to seven years. Eight of these have been designated highest priority for implementation over the next two years. The projects have been categorised under the seven goals in the NBSAP. Several other projects are also being proposed, many resulting from the various consultative workshops. It is expected that the National Biodiversity Secretariat will be responsible to assist with identifying and accessing funds for implementing these projects.

PREFACE

A Global Call for Action: Conserving Biodiversity and Achieving the Sustainable Use of Biological Resources

Jamaica acknowledged the importance of biodiversity and made a commitment to the conservation and sustainable use of its biodiversity by ratifying the Convention on Biological Diversity (CBD) on January 6, 1995.

The Convention's objectives are:

- Conservation of biological diversity;
- Sustainable use of its components; and
- Fair and equitable sharing of the benefits arising out of utilisation of genetic resources.

Article 6 of the Convention requires that each contracting party:

(a) Develop or adapt national strategies, plans or programmes for the conservation and sustainable use of biological diversity; and
(b) Integrate as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

Biological Diversity or biodiversity is a collective term, which embraces "Life on Earth" and encompasses the variety of all plants, animals and micro-organisms.

Biological resources are those components of biodiversity that are either used by humans, or have potential for use, in the production of food, medicines, manufactured goods, and other essential products.

In recognition of the importance of biodiversity and to fulfil international obligations, the development of a National Biodiversity Strategy and Action Plan (NBSAP) was started in 1998, culminating in this final document in 2003. A number of workshops and meetings were held to ensure the widest possible input of the private sector, government agencies, environmental non-governmental organisations, community based organisations, and the general public, in the development of the strategy and action plan.

The Strategy and Action Plan will guide the national efforts for conservation and sustainable use of the island's resources. A blueprint for cooperation and collaboration among the stakeholders has been created in the form of project concepts which seeks to chart the priority actions for monitoring, managing and sustainably using biological resources.

The document is in three major sections: Assessments, Strategy and Action Plan. The first section entails assessments of the characteristics of the Jamaican landscape and people, species diversity, abundance of biological and other natural resources and ecosystem health. These assessments include the legal and policy framework that exists, and that are necessary to support the strategy. They also include the major gaps and challenges affecting the conservation and sustainable use of biological diversity in Jamaica.

Section two of the document contains goals and strategic directions based on the findings of the assessments regarding the status of Jamaica's resources at this time. It includes also the challenges of implementing this strategy, including the challenge of integrated decision-making across organisations and sectors.

Action items from within the strategy were extracted and developed into the Action Plan which forms section three. The Action Plan speaks to the most important areas of action necessary for Jamaica in the form of project concept outlines. Priorities have been assigned to the project concepts to indicate areas of critical importance, foundation work, such as data collection, or greatest need. The project outlines include the lead and supporting agencies and entities, objectives, specific activities and outputs.

Within the document there is planned review and monitoring of the implementation of the strategy and action plan. Through the periodic reviews, assessments will be made about the effectiveness of the strategy and actions, and changes will be made where necessary to effect the goals outlined.

PART I: ASSESSMENTS

Species of Jamaica
*Hot lips, *Cephaelis elata* (SW) = *Phsychotnia elata* (SW), ©Institute of Jamaica
**Trimezia martinicensis*, ©Institute of Jamaica
*Black-billed Parrot, *Amazona agilis*, ©Andrew Smith

1. INTRODUCTION

1.1 The People of Jamaica - Land of Wood and Water

Jamaica is the third largest island in the Caribbean, with a land area of 10,981 sq. km[1]. Located at 17º 22' North latitude and 77º 30' West longitude, the island lies 145 km south of Cuba and 161 km west of the island of Hispaniola (see Map 1).

1.1.1 People and Culture

The original inhabitants of Jamaica, the Tainos, arrived on the island around 600 AD. The Taino population was greatly decimated within 50 years of the arrival of Columbus in 1494 and by the begining of the 17th century, fewer than 100 were left. Today, the people of Jamaica are descendants of several migrant cultures including African, Chinese, Indian, European, Jewish, and Middle Eastern. This diversity gave rise to the island's motto, "Out of Many, One People", which is inscribed on Jamaica's Coat of Arms.

Cultural attitudes to natural resources reflect the influence of the various migrant populations and the differences associated with rural and urban lifestyles. Religious beliefs also influence the island's diverse cultures, and its numerous traditions and rituals involving the use of plants, animals, land, and water. These religious beliefs include Christianity, Judaism, Rastafarianism, Islam and Hinduism.

The majority of Jamaica's population is of African descent. Most Jamaicans practise their African traditions in one form or another, for example, in speech, foods eaten, folklore, customs, music and dance, as well as in family and community life. The Maroons, who have been designated indigenous people by UNESCO, live in western and eastern Jamaica. They, along with other Jamaicans, possess traditional knowledge on the use of herbal medicines and utilise plants in ceremonial events. The Maroons of Accompong in St. Elizabeth are owners of land in the Cockpit Country, which is rich in biodiversity.

Many rural communities continue to use their traditional knowledge and cultural practices, for example, using phases of the moon to aid in determining optimal timing for planting of crops; implementing traditional agriculture practices including pest control, crop rotation, mulching, mixed cropping; and using economic plants as live contour barriers. These practices have helped to promote soil fertility and conservation over the years.

1.1.2 History of Jamaica

Prior to 1494, Jamaica was occupied exclusively by Tainos who favoured living in coastal villages. The Tainos called the island "Xaymaca" - *Land of Wood and Water*. They enjoyed a varied diet including fish and shellfish, cassava, maize, fruits, birds, hutia (coneys), iguanas, snakes and manatees.

The arrival of Christopher Columbus and his ships in 1494 marked the first recorded visit of Europeans to the island. Spanish settlers followed, introducing a variety of crops, which resulted in many changes to the physical landscape. They established plantations of exotic crops such as citrus, bananas, sugar cane, cotton, cocoa and tobacco and brought horses, goats, chickens, pigs and cattle, which, like the plantation crops, were selected for their ability to adapt to the local climate.

The British arrived in 1655 and fought Spain for control of Jamaica until the treaty of Madrid, which gave governance to the British in 1670. The British introduced other fruits including breadfruit (*Artocarpus altilis*) and otaheite apple (*Jambosa malaccensis*). Ackee (*Blighia sapida*) was introduced by slaves and mangoes (*Mangifera indica*) were probably initially introduced from fruits taken off a captured French ship.

The majority of Jamaica's population still lives on the coastal plains and consequently this is where most economic activities occur. This concentration of people and the resulting developments has impacted significantly on marine and coastal resources.

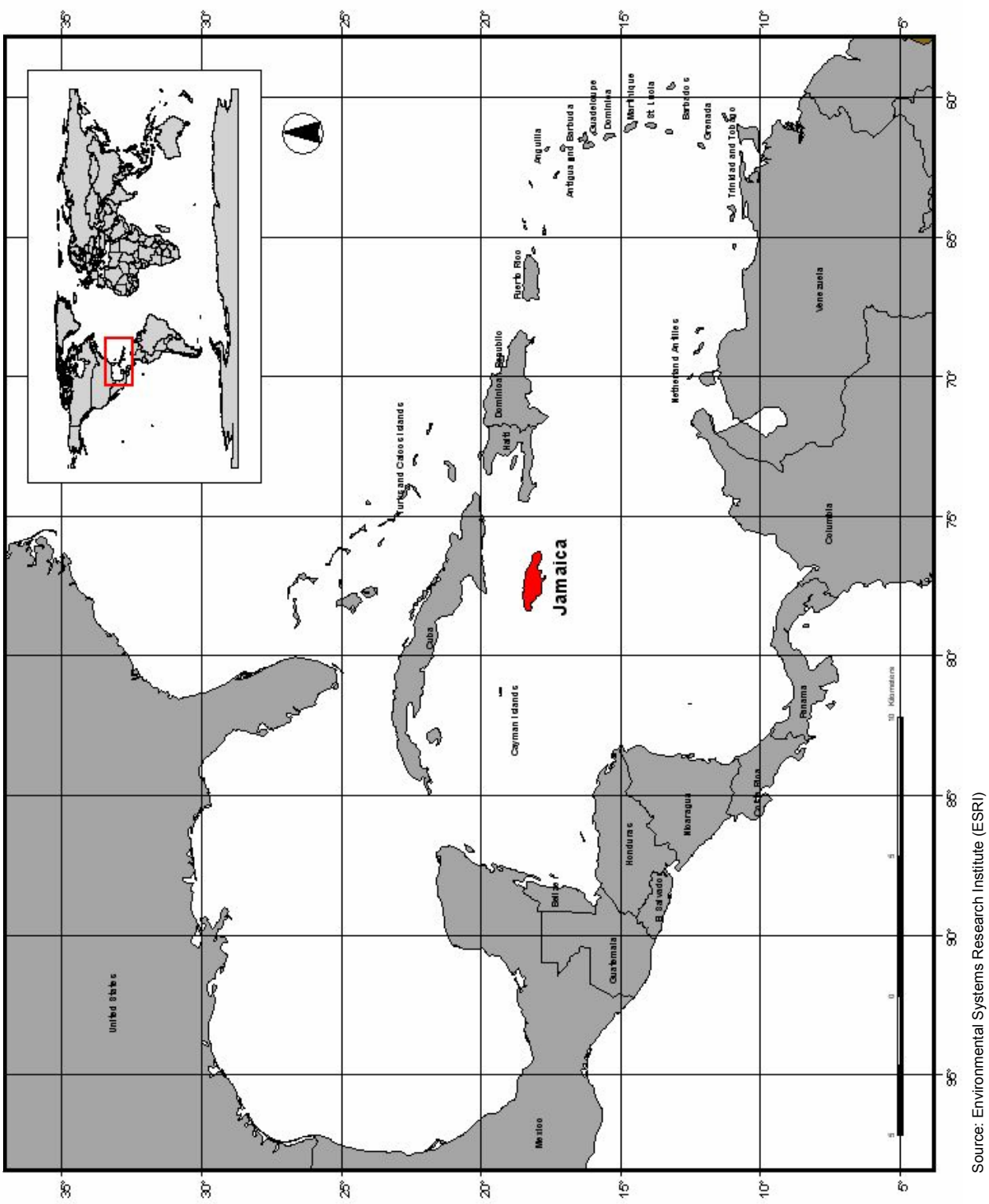
At the end of 1998, the population of Jamaica was estimated at 2,576,300. An increasing percentage of the population lives in urban areas (Map 2). Kingston, the capital, is situated on the seventh largest natural harbour in the world, and is the country's major trade centre.

The island is divided into three counties, and further sub-divided into fourteen parishes. Eleven of the

[1] The National Atlas of Jamaica, 1989

parish capitals are located along the coast and represents the main population centres.

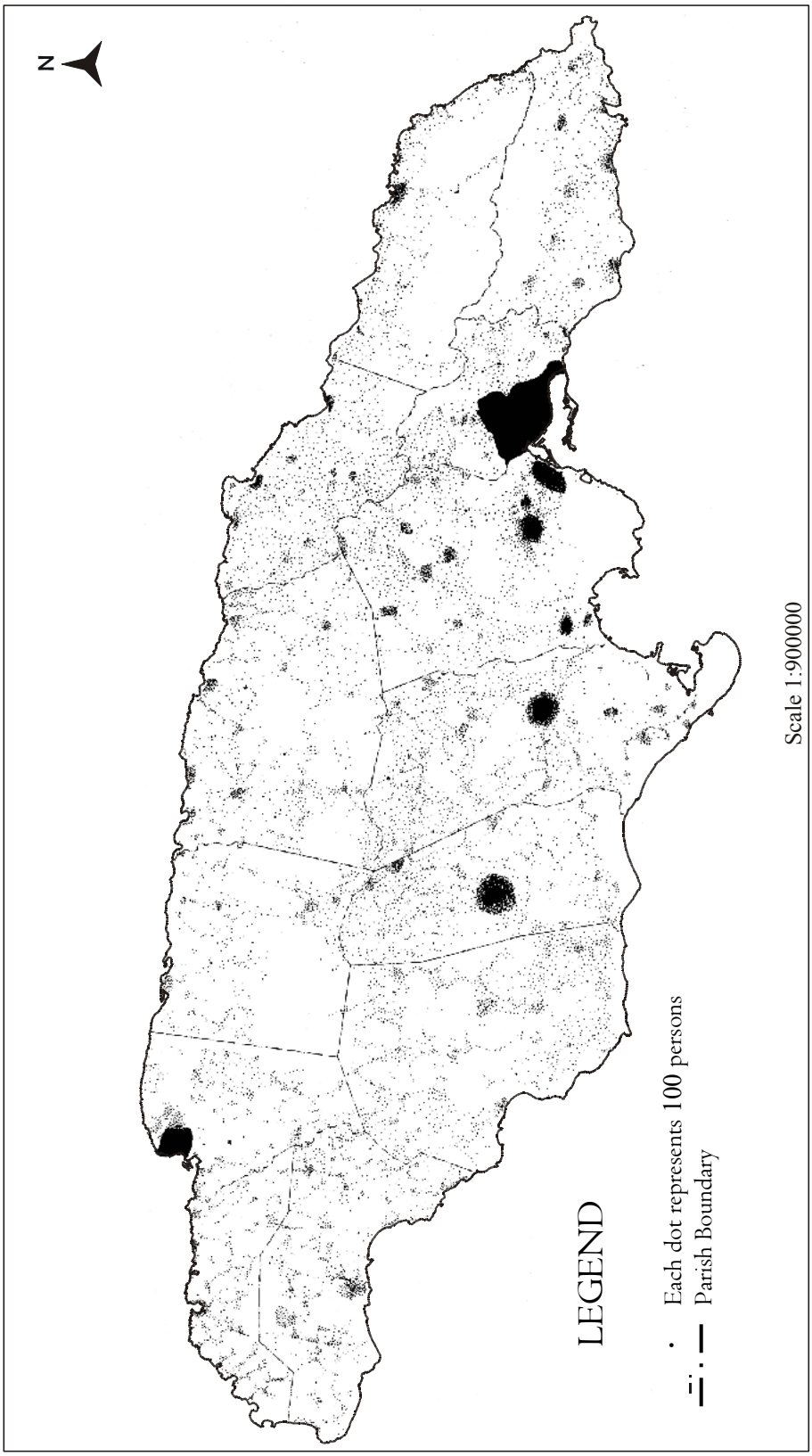
MAP 1 LOCATION MAP OF JAMAICA



Source: Environmental Systems Research Institute (ESRI)

MAP 2

POPULATION DISTRIBUTION MAP



Source: National Atlas of Jamaica, 1989

1.1.3 Economic Development

Natural resources have played an important role in Jamaica's development in both the pre - and post-colonial periods. The island's major economic sectors, agriculture, tourism and mining, are all based on natural resources.

The pattern of economic development and urbanisation has contributed substantially to the destruction of biodiversity. Initially, the increasing demand (in Europe) for sugar led to the development of estates for the cultivation of sugar cane in the lowland areas of the island. Later, agricultural production expanded to include crops such as bananas, coconuts, coffee and citrus. This agricultural development required the clearing of primary forests and was ecologically very destructive.

While the main impact of sugar cane and banana cultivation may have been confined to lowland areas, coffee cultivation has caused substantial deforestation of the upland areas mainly as a result of the felling and clearing of forest vegetation in preparation for planting coffee. In addition, the effects of chemical fertilisers and pesticides used in crop production have implications for the viability of non-target populations including crop pollinators. The impact of harmful agricultural chemical residues in surface and ground water on coral reefs is also of concern.

The discovery of commercial deposits of bauxite in the 1950s triggered a major change in the pattern of resource exploitation. Large areas of vegetation were cleared to allow ore extraction and construction of the necessary physical infrastructure to support mining operations and transport of products. Mining and processing of bauxite ore also contribute to land degradation, and air and ground water pollution.

During the 1950s, the Government provided incentives to encourage foreign investments through the "Industrialisation by Invitation" programme. By the 1970s, this led to the transformation of the main urban areas into centres with industries of considerable size. Hotel construction proceeded rapidly in coastal locations such as Montego Bay and Ocho Rios. The need for land to support the growing manufacturing and tourism sectors contributed to the destruction of forest and mangrove biodiversity. Air, ground and coastal water pollution also occurred.

The negative impact of tourism and manufacturing on biodiversity has been exacerbated by the unprecedented urban growth and unplanned developments in the coastal areas between 1943 and 1975. Planned and unplanned urbanisation and informal (squatter) settlement construction have resulted in the loss of prime agricultural land. In addition, alteration and destruction of coastal and marine ecosystems are jeopardising biodiversity in these areas and beyond.

1.2 Jamaica's Biodiversity-Biological and Other Natural Resources

Jamaica's biodiversity is influenced by a variety of physical factors such as topography, geology, terrain and climate.

1.2.1 Physical Diversity

Jamaica has an exceptionally broad diversity of topography, geology and climate (Map 3).

1.2.1.1 Topography

The country's topography consists of a highland interior, formed by a backbone of peaks, hills and plateaux running the length of the island, which is surrounded by flat coastal plains. The highest peaks are to the east, with the Blue Mountain peak reaching a maximum height of 2,256 m. The central and western parts of the island are mainly limestone hills and plateaux.

The plateaux are dissected by faults and have been karstified to varying degrees. The most developed karst topography is in the Cockpit Country. It is an important ecological area of the country and is still relatively undisturbed.

Elsewhere, the karst is less developed and the terrain generally comprises rolling hills, sinkholes, ridges and caves.

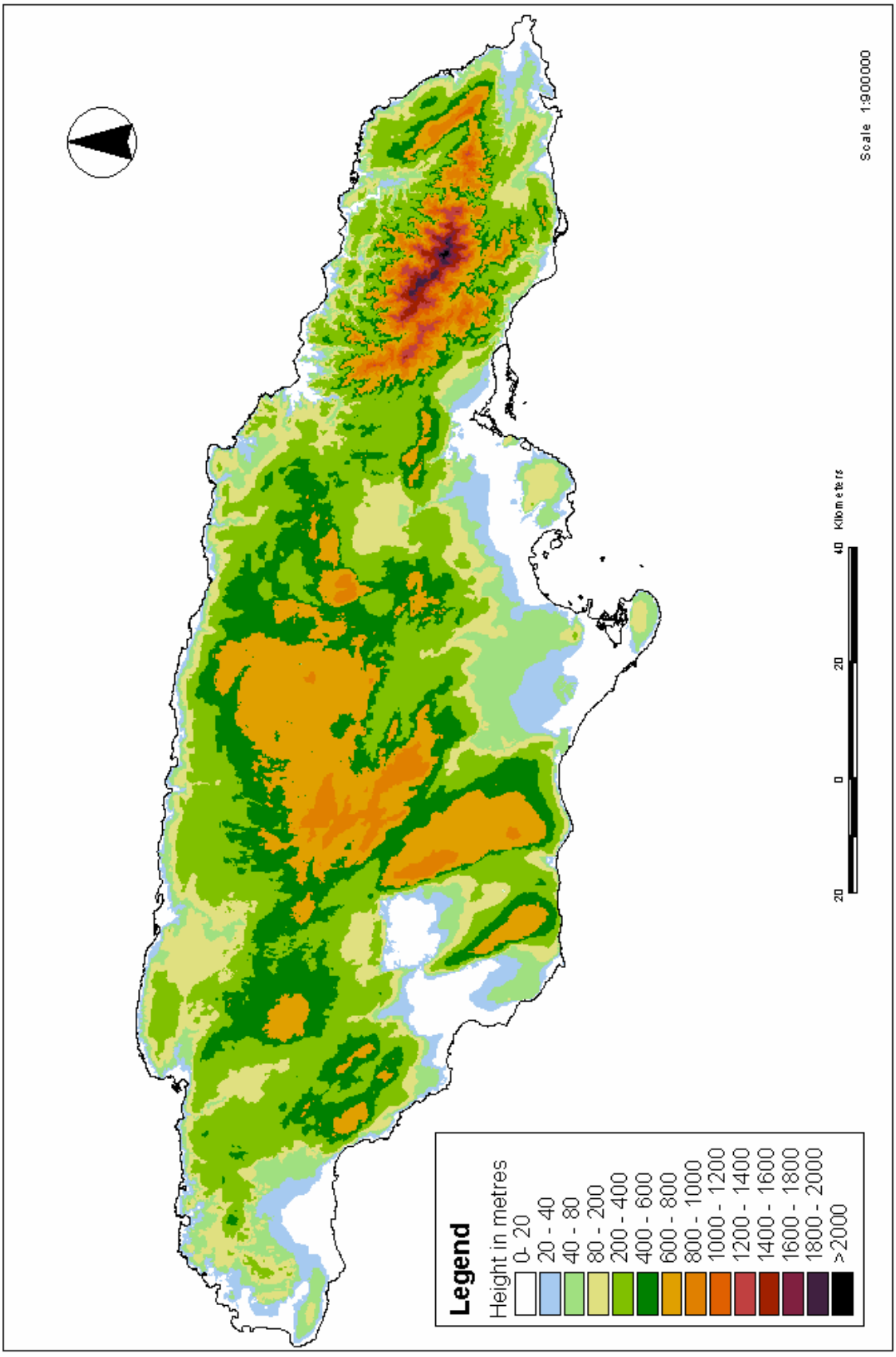
The coastal plains are narrow on the north coast and tend to be wider along the south coast. These include alluvial areas such as the plains of Clarendon, St. Catherine and St. Andrew. There are some extensive wetlands on the coastal plains. These include the Black River Upper and Lower Morasses, the St. Thomas Great Morass, West Harbour and the Negril Morass. In addition to coastal lowlands, there are three interior valleys. The coastal plains and the interior valleys are the prime agricultural areas.

1.2.1.2 Geology

Jamaica has an igneous and metamorphic core, covered to a great extent by limestone deposited during periods of marine submergence.

MAP 3

TOPOGRAPHY MAP OF JAMAICA



Source: Information Technology Branch, National Environment and Planning Agency

Approximately 70% of the island's surface area is covered by limestone. The remaining 30% is covered by igneous and metamorphic rocks, shale, and alluvium cover.

The soils of the country are a reflection of the geology. In the upland plateaux for example, soils are formed from weathered limestone and constitute approximately 64% of the island's soil, while the alluvial soils of the flood plains, river terraces, inland valleys and coastal plains, constitute approximately 14%.

1.2.1.3 Climate

Jamaica has a tropical maritime climate which is influenced by northeast trade winds and land and sea breezes. In the cooler months of January and February, the average temperature is approximately 25° Celsius (C). Temperatures in the warmest months, July and August, range from 28°C to 30°C. Temperature is significantly affected by altitude. In the higher elevations of the Blue Mountains and some plateaux, temperatures may be as much as 15 degrees cooler.

Rainfall is marked by monthly, annual and spatial variability, with the average annual rainfall for the country being approximately 200 cm.

The northeast portion of Jamaica receives the highest annual rainfall, which is in excess of 330 cm. Areas in the southern coastal plains receive less than 127 cm annually and water shortages are common occurrences, especially along the southern coastal plains. The rainfall pattern is bimodal with peaks in May and October. Heavy rainfall associated with passing storm systems may also occur during the annual hurricane season (June to November). Other natural phenomena, which affect the island's biodiversity, include hurricanes, earthquakes, floods and droughts.

1.2.2 Species Diversity

Jamaica has been rated fifth in islands of the world in terms of endemic plants. As illustrated in Table 1, there is also a high level of endemism for many species of animals including snails, terrestrial grapsid crabs, amphibians, reptiles, and land birds.

The status of species of fungi, bacteria, viruses and some invertebrates is not yet well known. According to Jamaica's Conservation Data Centre database (CDC), at least 221 endemic species are classified as 'critically imperilled' and 'especially vulnerable to extinction'. However this database is incomplete.

Banded Coral Shrimp (*Stenopus hispidus*)

1.2.2.1 Terrestrial Animal Species

At least six species of terrestrial vertebrates are thought to have become extinct in Jamaica in the last 150 years, and many more species are considered endangered, threatened or rare. Species diversity in Jamaica is well documented for vertebrates, as shown in Table 1.

Table 1 Species richness and endemism of selected invertebrates and vertebrates (excluding fish) of Jamaica

Terrestrial Fauna	Total Number of Indigenous Species	Number of Endemic Species	% Endemic Species
Rotifers	211	<21	<10
Land Snails	514	505	98.2
Grapsid Crabs	9	9	100.0
Jumping Spiders	26	20	76.9
Fireflies	48	45	93.8
Butterflies	133	20	15.0
Ants	59	6	10.3
Amphibians	22	22	100.0
Reptiles	43	33	76.7
Shore and Sea Birds	39	1	2.6
Land Birds	67	30	44.8
Bats	21	2	9.5
Other Mammals	2	2	100.0

Source: Terrestrial Animal Assessment Report, 1999

1.2.2.2 Marine Animal Species

Jamaica enjoys a rich diversity of marine species which includes species of fish, sea anemones, black corals, stony corals, sea fans, molluscs, turtles, and marine mammals including whales, dolphins and manatees.

The main fisheries resources include: coral reef fish, Spiny Lobsters, Queen Conch, small coastal pelagic finfish, and large offshore pelagic finfish.

The reef fish of major economic importance in Jamaica include representatives from the families: Mullidae (goatfish), Haemulidae (grunt), Serranidae (grouper), Acanthuridae (doctorfish), Lutjanidae (snapper), Carangidae (jack), Holocentridae (squirrelfish), Holacanthidae (angelfish), Balistidae (triggerfish), and Scaridae (parrotfish).

Several finfish species provide recreation for individuals and groups that engage in various types of sporting activities. The annual Marlin (Istiophoridae) tournament for example, is extremely popular.

© Krishna Desai

Magnificent Feather Duster (*Sabellastarte magnifica*) attached to coral

1.2.2.3 Freshwater Animal Species

There are three endemic freshwater fish species: *Cubanichthys pengellyi*, *Limia melanogaster* and *Gambusia wrayi*. Little information is available on the ecology of these endemic species or on Jamaica's freshwater ecosystems.

Two families of freshwater shrimp are found in Jamaica, Atyidae, which includes eight species, and Palaemonidae which has six species. The early life cycle stages of these shrimps require a saline environment. Artisan and subsistence fisheries utilise these resources which are of considerable economic importance to communities.

There is one endemic freshwater turtle, *Trachemys terrapen* (Slider Turtle) in Jamaica. The status of its population is unknown.

1.2.2.4 Terrestrial Plant Species

Current estimates indicate that at least 3,304 species of vascular plants occur in Jamaica, of which 923 (27.9%) are endemic. Knowledge of Jamaica's flora is incomplete and the number of species in some families is unknown.

Research results in several new species of plants being discovered each year. Species richness and endemism are shown in Table 2.

The status of Jamaica's terrestrial plant species is poorly documented as the only published assessment of levels of threat is based on the World Conservation Union (IUCN) system, which is more than ten years old.

Species thought to be extinct in Jamaica

- Monk Seal (*Monachus tropicalis*);
- Giant Galliwasp (*Celestus occidus*);
- Black Racer (*Alsophis alter*);
- Jamaican Rice Rat (*Orysomyz antillarum*);
- Jamaican Parauque (*Siphonorhis americana*); and
- Black-capped Petrel/Blue Mountain Duck (*Pterodroma hasitata caribaea*)

1.2.2.5 Marine/Wetland Plant Species

The dominant marine plant species are sea grasses, calcareous algae and mangroves.

Wetland vegetation includes: Swamp Cabbage Palm (*Roystonea princeps*),Red Mangrove (*Rhizophora mangle*), Black Mangrove (*Avicennia germinans*), Button Mangrove (*Conocarpus erectus*), White Mangrove (*Laguncularia racemosa*), and Anchovy Pear (*Grias cauliflora*). Saline marshes are dominated by Sawgrass (*Cladium jamaicensis*).

Table 2 Species richness and endemism in plants

Terrestrial Flora	Total Number of Indigenous Species	Number of Endemic Species	% Endemic Species
Bromeliads	60	22	36.7
Orchids	230	60	26
Ferns	579	67	11.5
Cacti	20	10	50
Palms	10	7	70
Grasses	~200	1	0.5

Source: Institute of Jamaica, 2000

1.2.2.6 Freshwater Plant Species

Freshwater plants consist of rooted emergent vegetation such as the Reed (*Phragmites* sp.) and the Bullrush (*Typha* sp.); rooted, floating vegetation such as the Water lily (*Nymphaea* sp.); and floating plants such as the Water hyacinth (*Eichhornia* sp.) and *Salvinia* sp.

Nuns-hood Orchid (*Phius tancarvilliae*)

1.2.3 Forest Resources

The wide range in microclimates, soils and physical features give rise to a variety of forest types. The major forest types in Jamaica are: lower montane mist forest, montane mist forest, dry limestone forest, wet limestone forest, mangrove woodland, herbaceous swamp and marsh forest.

Jamaica's forests are the main repositories of biodiversity, especially of endemic flora and fauna. Forests play an important function in air purification, conservation of water supplies, soil formation, climate modification and protection of the coastal lowlands and marine ecosystems from the effects of flash flooding and sedimentation.

Jamaica's forests provide diverse economic employment opportunities. Products extracted from the forest include: fuel wood; medicinal plants; yam sticks; lumber for construction and furniture; fence-posts; wood for fish pots; and wicker and other materials for craft items.

Wood and charcoal provide the energy used in the popular jerk food industry as well as being used for domestic purposes.

Many of Jamaica's rare and threatened animals depend on the forest for their survival, thus the conservation and sustainable use of forest resources are a critical component of Jamaica's overall biodiversity conservation strategy.

The most recent assessment of forest cover in Jamaica was carried out in 1998. Nearly 30.1% of the total land area or approximately 336,000 ha, is classified as forest (Table 3).

Within the forest class, approximately 90,000 ha (8% of the island's area) is classified as *closed broadleaved forest* with minimal human disturbance. Most of the remaining 260,000 ha is classified as *disturbed broadleaved forest* or *dry open forest*, having varying degrees of human disturbance. The latter is often referred to as woodland or scrub, however the dry open forests are important components of Jamaica's forest ecology.

The area of Forest Reserves and Crown lands (land owned by Government) managed by the Forestry Department amounts to approximately 109,500 ha. Most of this area is protected as forest reserves, protected areas or national parks. Approximately 35% of all forests are designated as protected areas and over 73% of closed broadleaf forests (natural forest) have protected status.

The Forestry Department has established 3,309 ha of hardwood plantations throughout Jamaica. Blue Mahoe (*Hibiscus elatus*) and Honduras Mahogany (*Swietenia macrophylla*) account for 40% and 45% respectively of trees planted. Other species include West Indian Cedar (*Cedrela odorata*), Caribbean Pine (*Pinus caribbea*), Santa Maria (*Calophyllum calaba*), Teak (*Tectona grandis*), Broadleaf (*Terminalia latifolia*) and West Indian Mahogany (*Swietenia mahogani*).

Table 3 Forestry inventory assessment

Land Use	Thousands of Hectares	% of Total Land Area
Natural forest (Primary Forest)	88.2	8%
Other Forest	247.7	22.6%
Total Forest	**335.9**	**30.6%**
Mixture of forest and other cultivation	332.9	30.4%

Source: National Forest Management and Conservation Plan, March 2001

1.2.3.1 Forest Types

The soils of the Blue and Port Royal Mountains are derived from volcanic rocks and as such their montane forests are quite different from the limestone mountains in the other areas of Jamaica. The forest in these two mountains is mainly classified as closed broadleaved showing minimal disturbance. Of the 59 tree species identified there, 24 are considered endemic locally or nationally.

The John Crow Mountains support one of the largest expanses of natural forests remaining in Jamaica. Undisturbed broadleaved forests are found from altitudes of about 380 m upwards. The

lower reach of this forest type is typical lower montane 'rain forest', with a canopy of about 24 to 28 m high.

This forest is a rich mixture of species with the Santa Maria often dominating. The ground flora abounds with ferns and there is a wealth of 'mechanically dependent' species or epiphytes. Endemic species are high in number and are localised; in the Hog House Hill area, nearly 40% of forest species are endemic to Jamaica and 10% of these are apparently confined to the eastern end of Jamaica.

The John Crow Mountains along with the Blue Mountains were gazetted as a forest reserve in 1950 and were declared a National Park in 1993.

The Cockpit Country, characterised by its well developed, conical or "cockpit" karst topography, supports a high degree of biodiversity and species endemism. At least 1000 species of vascular plants, two species of tree frogs, one gecko and one galliwasp are found only in this area. The hillsides and tops usually have little or no soil, while the depressions or 'cockpits' contain deposits of highly fertile soil, which when undisturbed, support the growth of very large trees.

The much shorter dense forests of the rocky hills remain in a more pristine condition and are richer in species than the cockpits which have often been cleared for agriculture. Valuable timber trees have been extensively cut throughout Cockpit Country. This area is being proposed as a National Park.

The dry limestone forests of Jamaica are found mainly along the south coast in the Hellshire Hills, Portland Ridge, Brazilletto Mountains, and Kemps Hill though there are remaining areas on the north coast, particularly in Trelawny and St. James.

These dry limestone forests have a high degree of endemism of both plant and animal species, and several species require special protection including species of Orchidaceae, Cactaceae and the Jamaican Iguana (*Cyclura collei*). Many of the hillsides that appear as intact forests are in fact secondary forests. Only 8% of Jamaica's forests remain in an undisturbed state.

1.2.4 Watersheds

Jamaica is primarily a mountainous country with over sixty percent of the island having an altitude of over 230m. The mountains are characterised by a central ridge that transverses the length of the island. The Blue Mountain Range is composed of igneous and metamorphic rocks and the topography is characterised by steep-sided ravines. This type of land formation gives rise to surface drainage through a large network of streams and rivers. The remainder of the island is composed of limestone with a few scattered occurrences of igneous and metamorphic rocks. Surface drainage in the form of rivers is far less dominant in these limestone areas.

Limestone aquifers provide the main source (84%) of Jamaica's freshwater resources, while the remaining 16% is provided by surface water.

The island is divided into 26 Watershed Management Units (WMUs) containing over 100 streams and rivers. These WMUs are essentially composites of watersheds that fall within 10 hydrological basins (regions). Ten watersheds have been deemed in critical condition: Rio Grande, Hope, Swift, Wag Water, Rio Cobre, Yallahs, Rio Minho, Buff Bay, Oracabessa and Morant Rivers. Rehabilitation of these watersheds has been designated as high priority by the Government.

Several ecosystem rehabilitation programmes are being undertaken to increase the quality and quantity of water for human consumption and assist in the conservation of Jamaica's biodiversity.

View of a waterfall in Cascade, Hanover

1.2.5 Freshwater Resources

Jamaica's freshwater resources are quite extensive and support several diverse faunal and floral communities. There are ten hydrological basins throughout the island containing over 100 streams

and rivers, in addition to a multitude of subterranean waterways, ponds, springs and blue holes.

Jamaicans depend on water from these sources for domestic purposes, as well as for agricultural irrigation and industrial processes. In addition, the natural fauna and flora supported by these lotic and lentic habitats are a major food source for rural, inland communities and also support commercial activities such as shrimp, fish and snail harvesting for sale as food or ornamental items.

1.2.6 Coastal and Marine Resources

Jamaica's irregular coastline is 795 km long and has diverse ecosystems including sandy beaches, rocky shores, estuaries, wetlands, seagrass beds and coral reefs. The majority of living marine resources are found on the island shelf and nine oceanic banks which cover an area of 4,170 sq. km. The island shelf is much wider on the south coast with a maximum width of approximately 24 km. On the north coast the island shelf averages only 1.6 km in width.

On the south coast, fringing coral reefs extend almost continuously along the edge of the shelf from Negril to Morant Point. The greater part of the shelf is actually devoid of major coral reefs, except on the eastern portion between Kingston and Portland Bight (Old Harbour Bay) and at Alligator Reef (off Alligator Pond), where larger reefs and numerous coral cays exist. On the western section of the south coast, the reefs tend to be small, patchy and undeveloped, possibly due to the freshwater discharge from several large rivers.

A section of the Font Hill beach in St. Elizabeth

1.2.6.1 Wetlands

Wetlands were at one time estimated to cover approximately 2% of Jamaica's total surface area. The total area of wetlands has declined over the years due to reclamation, for activities such as road construction, port and harbour development, housing and other development projects.

Jamaica's wetlands are found mainly in low-lying coastal areas particularly along the south coast. The role of coastal wetland ecosystems in maintaining shoreline stability and preserving biodiversity is well established and includes the protection of the shoreline from erosion by wave action; protection against flooding by acting as a sponge; functioning as a sediment trap and providing a habitat for wildlife.

There are two main classifications for wetlands in Jamaica: swamps and marshes. Swamp wetlands are dominated by woody vegetation and can be subdivided into saline swamps, which are composed mainly of mangroves, and freshwater swamps, which are either swamp forest or palm swamps.

Marsh wetlands include saline marshes and freshwater marshes. These wetlands provide habitats for a large number of animal species such as fish, oysters, birds, the crocodile, the endemic pond turtle (*Trachemys terrapen*) and lizards.

The largest wetland areas are the Negril Morass in Westmoreland, the Great Morass in St. Thomas, and the Black River Upper and Lower Morasses in St. Elizabeth. The Black River Lower Morass was declared a wetland of international importance under the Ramsar Convention in 1998. Biological, social and economic data were gathered on the area during the project entitled "Towards the Management of the Black River Morass".

1.2.6.2 Marine Plants

Sea grasses are found in the shallow coastal waters around Jamaica. These include: Turtle grass (*Thalassia testudinum*), Manatee grass (*Syringodium filiforme*) and Shoal grass (*Halodule wrightii*). They provide important feeding areas for endangered marine turtles and manatees, as well as nursery areas for important commercial fish, including herring (Clupeidae) and jacks (Carangidae).

Seaweeds are also important to many Jamaicans as they are used in traditional or folk medicine. Examples include: *Udotea* sp., *Microdictyon* sp., *Caulerpa racemosa, Dictyophaeria cavernosa* and *Polycavermosa debilis.*

1.2.6.3 Coral Reefs

Coral reefs are of major social, economic and biophysical importance to Jamaica. Reefs act as natural barriers by protecting coastlines from erosion,

are a source of food and income for local communities and support tourism and recreational activities.

In the late 1970s, nine reefs on the north coast had a coral cover averaging 52% at a depth of 10 m. However, by the late 1990s this declined to 3%. At the same time the fleshy macroalgae on reefs increased from 4% to 92%[2].

1.2.7 Agro-biodiversity Resources

Wild species of flora and fauna make a significant contribution to Jamaica's economy. In agriculture, animals act as pollinators, seed dispersers and reducers of dead organic material. Major pollinators include bees, butterflies, nectarivorous bats and moths and hummingbirds. Fruit-eating birds and bats and seed-eating birds are important seed dispersers.

Genetic resources from both wild animals and plants are used to improve domestic breeds and varieties respectively.

1.2.7.1 Domestic Plants and Crops

Jamaica is primarily an agricultural country. The vast majority of Jamaica's farmers exist on relatively small farms in the hilly interior. The 'small farm' sector supports an estimated 150,000 rural families and is the country's largest source of employment. Agricultural plant resources comprise two principal groups: traditional and non-traditional crops. Traditional crops, which dominate the export market, include sugar, bananas, coffee, cocoa and citrus. Non-traditional crops include a variety of tubers, of which yam (*Dioscorea* spp.) is the most important. Also in this group are herbs, spices, fruits, vegetables and horticultural crops.

Most of Jamaica's agricultural crops come from imported genetic resources. However, there are also a number of indigenous and endemic plants being used, such as pineapple and *Zamia* sp. respectively.

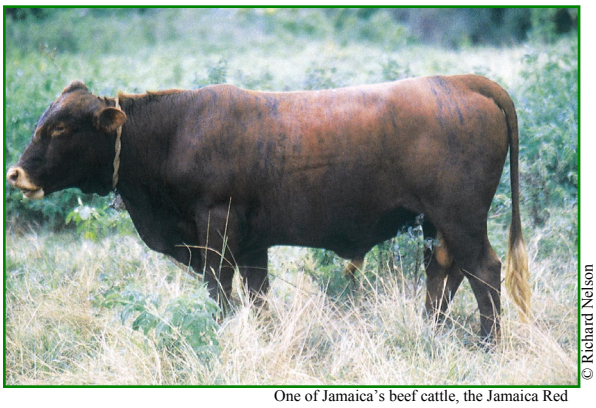
1.2.7.2 Domestic Farm Animals

Livestock make an important contribution to Jamaica's economy. Several breeds of cattle have been bred for local environmental conditions including the Jamaica Hope for milk production and the Jamaican Brahman for meat production. Jamaica also has a long history of breeding horses, mules and donkeys. There is a large domestic market for poultry, pigs, and goats. Sheep have been introduced but are less popular as there is a local preference for goat meat.

Some of Jamaica's livestock breeds have been exported to other Caribbean and Latin American countries.

Efforts continue to improve the contribution of livestock to the local economy and to enhance food security. These include further development of the Jamaica Hope; preservation and maintenance of three Jamaican beef cattle breeds (the Jamaican Red, Jamaican Black and the Jamaican Brahman); and improved breeds of goats and pigs.

Bees (*Apis* sp.) were introduced to Jamaica by British settlers and have been crossed with other imported breeds. Honey is locally produced.



© Richard Nelson

One of Jamaica's beef cattle, the Jamaica Red

1.2.8 Genetic Resources and Biotechnology

Jamaica has been involved in traditional biotechnology since the 16th century, producing by fermentation rum and vinegar from sugar cane. Current research and development activities using modern biotechnology for conserving and utilising biodiversity are currently being carried out by agencies such as the Scientific Research Council and the Biotechnology Centre at the University of the West Indies (UWI). Other organisations, which utilise biotechnology, are the Forensic Laboratory and the Jamaica Broilers Group of Companies.

A tissue culture unit was established at the Scientific Research Council in 1982 with financial support from the World Bank and the Organization of American States (OAS). The primary aims of the Unit are to preserve rare, endangered and economically important species; increase the competitive edge of the agricultural sector by promoting the use of tissue culture; and provide farmers with commercial quantities of high quality, disease-free planting material at reasonable prices.

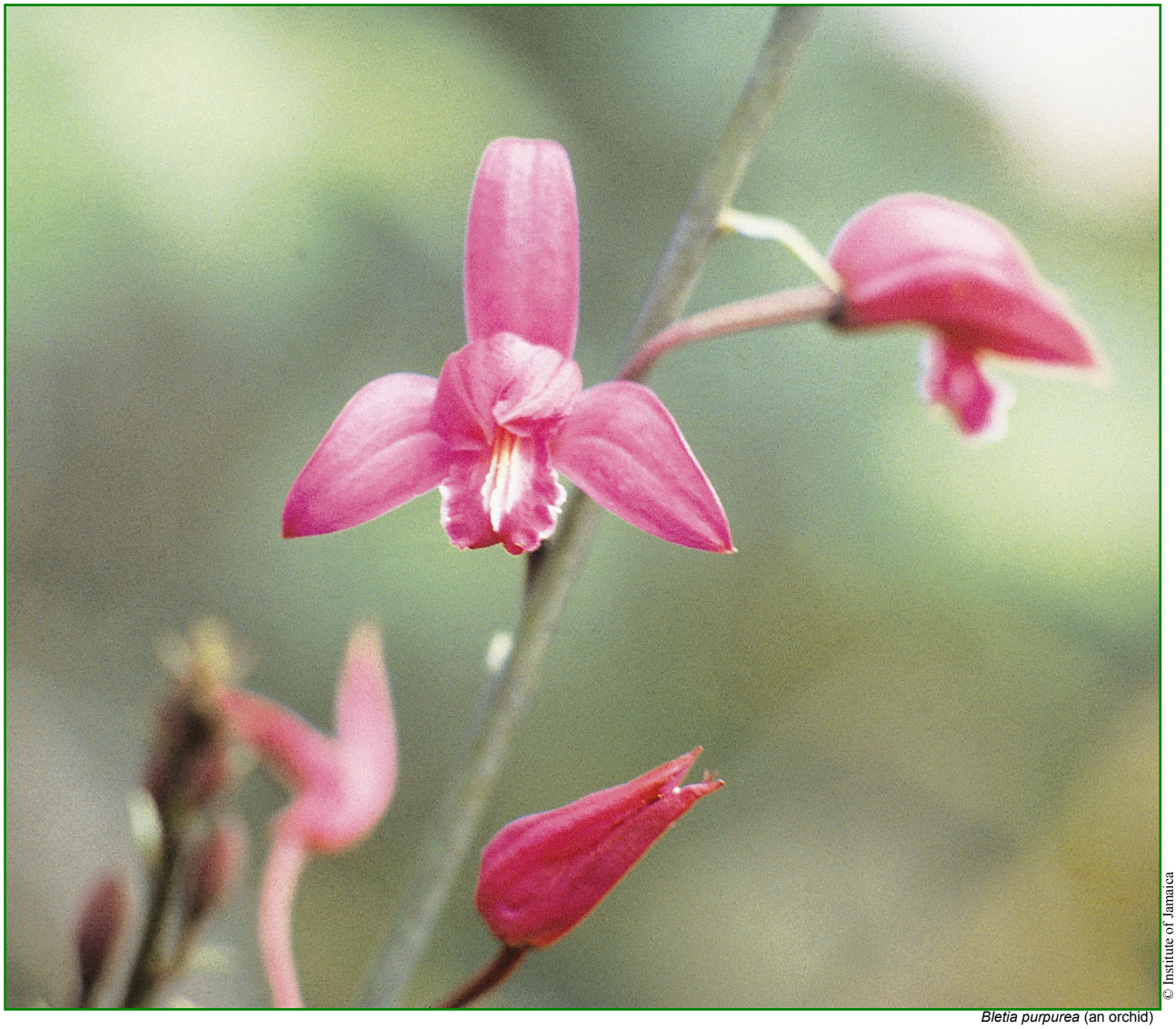
[2] Status of Coral Reefs of the World, 1998, pg 150

The Unit maintains one of the largest *in-vitro* germplasm collections of banana (*Musa* sp.) in the Western Hemisphere. The gene bank also houses, among other collections, many species of Anthurium, orchids, African violet (*Saintpaulia ionantha*) and other ornamentals.

A growing collection of root and fruit crops is also being established to facilitate the planting of hybrid varieties with the required characteristics for processing.

Potential biological resources:

- Rosy Periwinkle, which was first identified in Jamaica, is a source of a drug used to treat some forms of cancer;
- Red Nickel is being used to develop a commercial drug;
- Sea Urchin (*Lytechinus variegatus*) is being tested as an anti-cancer drug; and
- The Mustached Bat's (*Pteronotus parnellii*) ultrasound capabilities are being used in physiological and anatomical studies to better understand hearing loss in humans.



Bletia purpurea (an orchid)

2. LEGAL AND POLICY FRAMEWORK FOR THE CONSERVATION AND SUSTAINABLE USE OF BIODIVERSITY

2.1 Legislation Governing Biodiversity

Jamaica's current environmental legislation provides a basic framework for the conservation and sustainable use of biodiversity. There are at least 52 pieces of legislation which have aspects that directly relate to the management of the environment. However, very few of these statutes deal comprehensively with the protection, conservation and sustainable use of biodiversity, as they are primarily sectoral in nature.

In becoming a Party to the Convention on Biological Diversity, Jamaica bound itself to implement specific obligations under the Convention. The Convention *inter alia* places obligations on State Parties to:

- Put in place measures to develop or maintain the necessary legislative and or regulatory provisions for the protection of threatened species and populations.
- Take legislative, administrative or policy measures to facilitate access to genetic resources by national legislation.
- Regulate and manage the collection of biological resources from natural habitats for *ex-situ* conservation purposes.
- Subject to national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity.
- As far as possible introduce appropriate procedures requiring environmental impact assessments of proposed projects which may have a significant adverse effect on biodiversity and where appropriate allow public participation.
- Take such legislative, administrative or policy measures to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology, and provide for the effective participation in biotechnological research, and fair and equitable sharing of benefits arising from the commercial utilisation of genetic resources, especially by countries providing genetic resources.

The Convention only binds Parties and therefore implementation of the provisions of the Convention at a national level requires private individuals, universities and other institutions to have their rights and responsibilities clarified under national law or policy.

The legislative framework in Jamaica does not comprehensively protect ecosystem diversity, species diversity or genetic diversity. A new framework is needed that recognises the components of biodiversity and ensures the sustainable use of biodiversity in Jamaica. In this regard, Jamaica is in the process of reviewing or developing several pieces of legislation that are relevant to the conservation of biodiversity and its sustainable use. These include the review of the Forest Act (1996); the creation of a new Wild Life Protection Act, a new Fisheries Act and a new Watershed Act; and the creation of regulations under The Endangered Species (Protection, Conservation and Regulation of Trade) Act (2000). There are, however, still some gaps in the framework, which are described in Section 3.

2.1.1 The Natural Resources Conservation Authority Act, 1991

The Natural Resources Conservation Authority Act created the Government's environmental agency, the Natural Resources Conservation Authority (NRCA). Under this Act, the NRCA may take the necessary steps to:

- Effectively manage the physical and natural resources of Jamaica so as to ensure their conservation, protection and proper use; promote public awareness of Jamaica's ecological systems and their importance to the social and economic life of Jamaica; manage national parks, marine parks, protected areas, public recreational facilities; and advise the Minister on general policies relevant to the management, development, conservation and care of the environment.
- Develop, implement and monitor plans and programmes relating to the management of the environment, conservation and protection of natural resources and conduct research into such matters.
- Regulate and control development so as not to cause injury to public health or to any natural resource.

Under the Natural Resources Conservation (Prescribed Enterprise, Construction and Development) Order, 1996, the island of Jamaica was prescribed, subject to special controls to minimise adverse environmental and health impacts of development. A list of prescribed types of enterprises, construction or development is contained in the Order e.g., reclamation of wetlands, construction of roads, hotel development, clear-cutting of forested areas. A permit is required to undertake any of the prescribed developmental activities. The Permit and Licensing System became effective in January 1997.

Under the NRCA Act, a licence is required to discharge any poisonous, noxious or polluting substance into waters or the ground. Licences are also used to control the quality of effluent discharged. Regulations and Standards governing the discharge of wastewater are soon to be completed.

The NRCA Act is the only legislation in Jamaica that includes a requirement to conduct Environmental Impact Assessments (EIAs). Section 10 of the Act stipulates that the Authority may require an EIA:

- By notice in writing to an applicant for a permit or a person responsible for undertaking any enterprise, construction or development in a prescribed area, or of a prescribed description or category where it is of the opinion that the activities of such enterprise, construction or development are having or are likely to have an adverse effect on the environment.

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Hawksbill Turtle (*Eretmochleys imbricata*) in the Palisadoes/Port Royal Protected area

2.1.2 The Wild Life Protection Act, 1945

The Wild Life Protection Act is the only statute in Jamaica that specifically protects designated species of animals and regulates hunting in Jamaica. The main provision that ensures the protection of animals is found in Section 6 of the Act, which makes it a criminal offence for any person to be in possession of any protected animal, or part thereof. A person may be liable on summary conviction to a fine of one hundred thousand dollars.

The Act includes a list of fourteen animals that are designated as protected in the Third Schedule of the Act. All birds in Jamaica except those in the second part of the Second Schedule of the Act are protected.

The Act also regulates the hunting of game birds and provides for the declaration of game sanctuaries and games reserves in which no hunting is allowed. The First Schedule of the Act declares all Forest Reserves as Game Reserves.

Specific provisions are also in place for the protection of fish and the protection of turtles including the taking of turtle eggs.

2.1.3 The Watershed Protection Act, 1965

The Watershed Protection Act provides a framework for the management of watersheds in Jamaica. There are 26 watershed management units declared under the Act. The Act governs the entire island of Jamaica and makes provisions for the intervention of the Government in regulating uses of private land including the clearing of land and implementing appropriate agricultural practices. There are also provisions for intervention through assisted improvement agreements whereby improvement works can be carried out on land to protect watersheds.

No regulations have ever been prepared under this Act and therefore voluntary compliance and training have been the only measures available to ensure appropriate management practices in watersheds in Jamaica. Proposed amendments to the Watershed Act have been completed to remedy the deficiencies in the Act, as there is currently no legal framework for appropriate soil conservation and land use management measures that can be implemented.

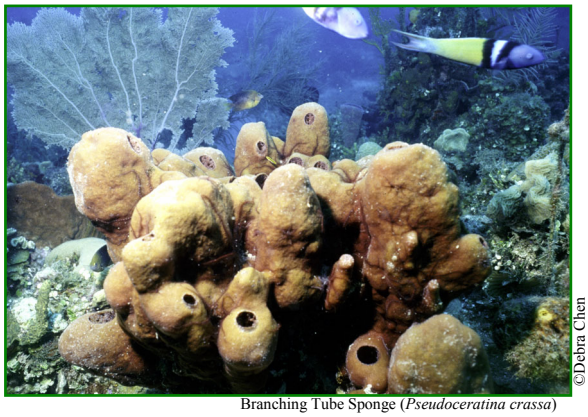
2.1.4 The Beach Control Act, 1956

The Beach Control Act regulates rights to the foreshore and the floor of the sea in Jamaican waters. Provisions contained in the Act govern commercial and recreational activities; the control and management of development on the beach through licensing provisions and the protection of the marine ecosystem. Marine protected areas may be declared under the Act to:

- Control the disposal of rubbish or other waste matter;

- Control dredging or disturbance in any way of the floor of the sea;
- Prevent or control the destruction or removal of sea fans and sedentary marine animals; and
- Control the searching for or removal of any treasure or artefact from the floor of the sea.

This Beach Control Act is limited in its mandate to govern development and commercial activities on the foreshore and floor of the sea, and does not appropriately address larger issues of the proper management of the coastal zone and marine resources.



Branching Tube Sponge (*Pseudoceratina crassa*)

2.1.5 The Forest Act, 1996

The Forest Act is the only piece of legislation in Jamaica that uses the word 'biodiversity'. This Act sets out the role and function of the Forestry Department and the Conservator of Forests.

The Act vests responsibility in the Conservator of Forests for developing and maintaining an inventory of forests and lands suitable for the development of forests.

The Forestry Department is required to make an assessment of forestry lands to determine their potential for maintaining and enhancing biodiversity. Provisions have been made in the Act for the controlled utilisation of forest resources in a rational manner.

Jamaica has over 100 gazetted forest reserves. Under the Act private lands may be acquired for declaration as forest reserves. One of the purposes of forest reserves is to protect and conserve endemic flora and fauna.

The Act calls for the creation of forest management plans, which stipulate the allowable annual cut where appropriate, conservation and protection measures and the roles of other Government departments. The purpose of forest management plans is to ensure the protection and conservation of forests, soil, water, wildlife, and forest products.

The Act makes it an offence to: destroy trees, cause damage, light fires, carry axes, kill or injure wild birds or animals in a forest reserve or forest management area.

2.1.6 The Fishing Industry Act, 1975

The taking and catching of fish are regulated by the Fishing Industry Act. A licence is required to catch fish utilising one of the prescribed methods under the Act.

The Act provides for the protection of fish through the designation of fish sanctuaries and the declaration of open and closed fishing seasons (for conch and lobster). Two Fish Sanctuaries have been declared under this Act.

Regulations are being created for the management of the conch fishery. For the lobster fishery, the Act stipulates the size of lobsters to be caught and mesh size for nets. The fines under this Act are extremely low ranging from one hundred to one thousand Jamaican dollars.

A Fisheries Bill has already been drafted to replace the Fishing Industry Act (1975); the 1976 Regulations; sections of the Wild Life Protection Act dealing with fish; and the Morant and Pedro Cays Act. The Morant and Pedro Cays Act provide a licensing system for fishing and prohibit the killing of turtles and birds on the Cays.

The Fisheries Bill addresses fishery management plans, declaration of fishery management areas around the island and the establishment and operation of aquaculture facilities. It will also include provisions for conservation and management measures and licensing of all fishing activities to ensure enforcement of the controls. This Bill is currently being reviewed.

2.1.7 Endangered Species (Protection, Conservation and Regulation of Trade) Act, 2000

The Endangered Species Act provides for the conservation, protection and regulation of trade in endangered species. The Act was prepared to allow the Government of Jamaica to fulfil its obligations under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

There are four Schedules. The First Schedule governs endangered species that are threatened with extinction and which may be affected by trade. The Second Schedule governs species which could become extinct if trade is not regulated. The Third Schedule governs species which any contracting party wishes to regulate within its own jurisdiction. The Fourth Schedule is particular to Jamaica and lists Jamaican indigenous species. Domestic trade in these endangered species is controlled under the Regulations.

2.1.8 Other Legislation Relating to Biodiversity

There are several other Acts that relate to the preservation/conservation of Jamaica's biodiversity (see Table 4).

2.1.8.1 Town and Country Planning Act, 1948 (amended in 1999)

Substantial amendments were made to the Town and Country Planning Act in 1999 to provide for effective enforcement. The Act is currently being revised to provide a more comprehensive control over planning in Jamaica.

The objective of this Act is to ensure the orderly development of land. This is achieved through Development Orders which are legal documents used by the planning authorities to *inter-alia* provide for protection of amenities and conservation and development of the resources of the prescribed area. Development Orders are the main means of control of land use in Jamaica.

Presently the entire island is not covered by Development Orders. Existing orders are not updated regularly. In areas covered by a Development Order planning permission is required from the local authority or from the Town and Country Planning Authority if the area is "called in" or if the development does not conform to the zoning in the Development Order. In considering development applications the planning authorities take into account the Development Order and other material consideration.

The Act also provides for the making of Tree Preservation Orders (Section 25) whereby a local authority may seek to preserve trees or woodlands in their area and prohibit wilful damage or destruction of trees, or require the replanting of trees. The Act provides for notification of, designation, and the right to submit objections to the declaration of such an Order including provisions for compensation. These Orders are not widely used.

2.1.8.2 The Mining Act, 1947 (amended in 1988)

The Mining Act regulates mining activities in Jamaica and establishes that the rights to minerals belong to the Crown. Licences to extract minerals from Jamaica are granted by the Mines and Geology Division. Under the Act and its associated Regulations, the holder of a mining lease is required to restore all mined lands to at least the level of agricultural or pastoral productivity or of suitability for afforestation, which existed before mining. However, the penalties for non-compliance are low and this has affected the performances of mining licensees.

Under Section 9 of the Mining Act, the Minister by Gazette may declare an area, for which there is no existing licence or mining lease, to be closed to prospecting and mining. Such areas or sections of the area may be re-opened by Gazette, with terms and conditions related to prospecting or mining.

2.1.8.3 The Quarries Control Act, 1983

The Quarries Control Act was amended in 1994. The Act provides for the establishment of a Quarries Advisory Committee (Section 6) to designate quarrying zones and to license operators. It makes provisions for written notices to be served on persons operating quarries if the operation is detrimental to the fauna and flora of the neighbourhood (Section 29). Where illegal quarrying activities exist the Court may order that any fine imposed under the Act may be directed towards the rehabilitation of the illegally operated quarry.

2.1.8.4 Water Resources Authority Act, 1995

The Water Resources Authority Act was promulgated to regulate and manage the abstraction and allocation of water resources through the establishment of the Water Resources Authority. The Act also governs the preservation of water quality and the conservation of such resources. The Authority is required to gather data on the quantity and quality of water in above ground and underground resources. A Master Plan, as required under the Act, has been developed to allow the proper management of such resources. It evaluates and recommends how Jamaica should use its water resources. A licensing system is in place to govern the allocation of water resources.

2.2 The Jamaican Constitution

The Constitution protects property rights and establishes the principles on the ownership of property in Jamaica. The legal status of owned

property applies to the ownership of flora and fauna in Jamaica. The proprietor owns all flora on his/her property and if he/she catches wildlife on his/her property (subject to the Wild Life Protection Act) then he/she owns these wild animals.

The Constitution prohibits the taking of property by compulsory acquisition. However, it provides exceptions including taking possession of property to prevent activities injurious to the health of animals and plants and, where necessary, for carrying out an investigation for the conservation of natural resources.

Table 4 Other biodiversity related legislation

Other Legislation	Impact on Biodiversity
Animals (Disease) and Importation Act, 1969	Allows for controlling the spread and treatment of diseases within the island via importation controls on animals, and the eradication and disposal of infected animals or where such infection is suspected.
Black River (Upper Morass) Reclamation Act, 1941	Empowers the Black River Drainage and Irrigation Board to regulate and maintain water courses and damming structures; keep the Black River clean, clear and navigable to a certain point; and can require landowners to clean canals, trenches, etc. located on their lands.
Clean Air Act, 1964	Makes provision for the prevention of the discharge of noxious or offensive gases into the air including fumes and dust from alumina, cement, lime, petroleum and gypsum works.
Harbours Act, 1874	Regulates activities within harbours through the Marine Board by regulating the movement of boats and vessels in harbours, channels or approach thereto; the placement of buoys and removal of sunken structures from harbours; penalties for depositing refuse and waste matter from vessels; and removal of sand, stone, ballast, etc., from harbours, reefs or shoals.
Institute of Jamaica Act, 1978	Promotes Literature, Science and Art, with responsibility for national museums.
Jamaica National Heritage Trust Act, 1985	Establishes a statutory body to protect Jamaica's national heritage, including any place, animal or plant species or object/building.
Litter Act, 1985	Defines what constitutes litter on private and public property and prescribes penalties for offences against the Act and the provision of receptacles for proper disposal.
Local Improvements Act, 1914	Governs all development of lands within Kingston or other such Ministerial prescribed areas via the requirement for subdivision approval from the relevant local authority.
Morant and Pedro Cays Act, 1907	Affirms the status of the Morant and Pedro Cays and prohibits fishing inside certain limits, slaying or catching of birds on the Cays or the catching of turtles within the territorial limits of the Cays.
Petroleum Act, 1979	Vets all petroleum in the State and makes provisions for the creation of Regulations which prevent pollution and orders remedial action where this takes place, as well as the protection of fishing, navigation, etc.
Plants (Importation) Control Regulation, (1997)	Outlines the role of the National Biosafety Committee in monitoring and regulating the importation of Living Modified Organisms for research only.
Plant Quarantine Act, 1993	Provides protection for Jamaica's flora from imported diseases or pests transported via plants, plant products, and soil or via other means as well as the course of action to be taken when these are discovered within the island.
Public Health Act, 1985	Allows for the establishment of Local Boards to regulate activities carried out in private or public buildings or properties where such activities prove injurious to public health
Urban Development Corporation Act, 1968	Establishes the Urban Development Corporation as a statutory body, which has amongst its functions the duty to carry out construction, maintain public parks, car parks, etc. in such manner to ensure preservation of architectural or historical objects or sites.

Source: Natural Resources Conservation Authority, 1999

2.3 International Agreements

Environmental management in Jamaica is guided not only by national policies and legislation but also by several international and regional agreements. The island's commitment to a number of international agreements relating to biodiversity is shown in Table 5.

2.3.1 Convention on Biological Diversity

The Convention on Biological Diversity creates the framework for Parties to implement national legislative, policy and administrative measures. The Government of Jamaica intends to fully implement the provisions of this Convention by carrying out the necessary legislative changes required to fulfil our obligations.

Table 5 International/regional agreements to which Jamaica is a Party*

Instrument	Status
International Plant Protection Convention, Rome, 1951	Accession: 24 November, 1969
United Nations Convention on the Law of the Sea, Montego Bay, 1982	Ratification: 21 March, 1983
Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1983	Acceptance: 14 June, 1983
Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, Cartegena de Indies, 1983	Ratification: 1 May, 1987
Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region	Entry into Force: 1 May, 1987
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (as amended), London, Mexico City, Moscow [Washington], 1972	Ratification: 22 March, 1991
International Convention on the Prevention of Pollution from Ships, London, 1973	Ratification: 13 June, 1991
Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, London, 1973	Ratification: 13 June, 1991
London Amendment to the Montreal Protocol on Substances that Deplete the Ozone layer, London	Ratification: 31 March, 1993
Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985	Accession: 31 March, 1993 Entry into Force: 29 June, 1993
Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1989	Instrument of Accession Deposited: 6 January, 1995 Effective: 5 April, 1995
United Nations Framework Convention on Climate Change, New York, 1992	Instrument of Accession Deposited: 6 January, 1995 Entry into force: 5 April, 1995
Convention on Biological Diversity, Rio de Janeiro, 1992	Instrument of Accession Deposited: 6 January, 1995 Entry into force: 5 April, 1995
Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)	Accession: 23 April, 1997 Entry into Force: 22 July, 1997
The Copenhagen Amendment to the Montreal Protocol on Ozone Depleting Substances.	Accession: 7 November, 1977 Entry into Force: 4 February, 1998
Convention on Wetlands of International Importance especially as Waterfowl Habitats (RAMSAR Convention)	Accession: 7 October, 1997 Entry into force: 7 February, 1998
Convention to Combat Desertification	Accession: 12 November, 1997 Entry into Force: 16 March, 1998

*Source: Ministry of Land and Environment, 1999

2.4 National Policies and Strategies

The policies and strategies that guide Government action in the conservation and sustainable use of biological resources are outlined in the following sections.

2.4.1 Jamaica National Environmental Action Plan

The first Jamaica National Environmental Action Plan (JANEAP) was prepared by the GOJ in 1995. The Plan highlights the major environmental problems facing the country, as well as emphasising and establishing the necessary corrective measures to be undertaken by various Government agencies, ministries and non-governmental organisations.

The Action Plan recognises that there are increasing threats to Jamaica's biological resources due to habitat degradation, pollution and unsustainable levels of utilisation. It states specific actions that have been and will be undertaken by Government and the private sector towards the development and management of a system of protected areas and sustainable use of biological resources.

The Sustainable Development Planning and Policy section of the JANEAP focuses on integrated watershed system, forest, marine and terrestrial resources, and the economic sectors such as agriculture, industry, mining, and tourism.

The JANEAP is updated every three years and status reports are prepared annually. Three Status Reports have been prepared and JANEAP 1995 has now been updated to JANEAP 1999-2002.

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Jamaican Swallowtail (*Papilio thoas melonius*)

2.4.2 Jamaica National Industrial Policy, 1996

The National Industrial Policy was developed by the GOJ to focus on issues of investment, productivity and growth. After an extensive consultation process, this document was presented to the nation to provide the necessary basis for a clear, coherent and consistent set of policies to guide the economy on a path of renewed growth and development into the 21st century. The Policy states that environmental management plays an important role in industrial development by ensuring the implementation of cleaner production and the appropriate standards.

2.4.3 Jamaica National Land Use Policy 1996

The comprehensive National Land Use Policy was developed after an assessment of the physical resource and socio-economic needs of the country. This assessment underscored the need for a more complete understanding and appreciation of the finite nature of land resources and advocacy for its sustainable use.

This Policy establishes the framework for the planning, management and development of Jamaica's resources. It takes into consideration that Jamaica, including the foreshore, territorial waters and exclusive economic zone is a finite resource and a national asset. This asset must be used for sustainable development of the island.

2.4.4 Policy for Jamaica's System of Protected Areas, 1997

After an extensive consultation process, this Policy was adopted by the GOJ as the official policy framework for the establishment of a National System of Protected Areas. The Policy is of paramount significance to the implementation of the CBD, since the establishment of protected areas may be one of the most effective mechanisms to support the conservation of Jamaica's biodiversity.

The goals of the Protected Areas Policy encompass issues related to sustainable resource use, public education, environmental conservation, economic development, recreation, public participation, local responsibility and financial sustainability.

The successful implementation of the Protected Areas Policy will depend on the co-ordination of policy, planning and implementation among the agencies with responsibility for the different types of protected areas. The following documents have been prepared for implementation: Black River Protection Area Management Plan; St. Elizabeth Environmental Policy Framework; Palisadoes/Port Royal Environmental Policy Framework and draft guidelines.

A flock of Royal Terns (*Thalasseus maximus*) in the foreground and Sooty Terns (*Sterna fuscata*) on the background and in the air on the Middle Morant Cays.

2.4.5 National Physical Plan, 1978

The National Physical Plan was developed to foster orderly development in the country. It focuses on physical planning, settlement, conservation, income generators (i.e. forestry and fisheries, agriculture, mineral industries, tourism and manufacturing) and public utilities through the use of Development Orders.

There are six Confirmed Parish Development Orders, four Confirmed Development Orders, six Confirmed Coastal Orders and thirteen Petroleum Filling Station Orders.

Parish Development Orders are still required for Hanover, St. Catherine; Kingston and St. Andrew; St. Mary; Portland; St. Thomas; and St. Elizabeth.

2.4.6 Forest Policy, 2001 (updated Forest Land Use Policy, 1996)

The Forest Policy was completed in March of 2001 and approved by Cabinet in July of that year. The preceding Policy dealing with forest issues, the Forest Land Use Policy of 1996 was revised as a result of the realisation that it needed to be updated to fall in line with the tenets of the National Forest Management and Conservation Plan of 2001. The Forest Policy attempts to ensure the sustainable management of the island's forests by concentrating on certain priority areas namely the conservation and protection of forest areas, the sustainable management of the island's forestlands and by extension its watershed areas. It goes further to outline the strategies and tools required for implementation as well as incorporating the state run agencies whose mandates include forestland management. This list included but was not limited to the Forestry Department, the National Environment and Planning Agency, the Commissioner of Lands, the Water Resources Authority and the Rural Agricultural Development Authority. The Policy recognised that planning and monitoring of the sector is a necessity and concludes that this can best be achieved through the implementation of the National Forest Management and Conservation Plan.

2.4.7 Ocean and Coastal Zone Policy

The Ocean and Coastal Zone Management Policy for Jamaica was finalised in 2002. The policy recognizes the need for integration of all stakeholders in the decision-making processes for the sustainable use and management of national coastal and ocean resources.

The aim is to enhance the contribution of economic sectors to the integrated management of coastal areas and to integrate sectoral policy and planning into coastal area management. The approach taken includes enhancing national institutional capacities for integrated coastal management, integrating planning and management of fisheries, agriculture and forestry into coastal area management; and preventing and controlling environmental degradation in coastal areas.

The Action Plan, appended to the Policy, provides an outline of necessary actions, within the next 5 years, towards the implementation of the policy priorities.

2.4.8 National Forest Management and Conservation Plan (NFMCP)

The NFMCP was approved by Cabinet in March 2001. Though similar in some respects to the Forest Policy, the NFMCP sought to provide a more detailed outline of all facets of forestry in Jamaica. The Plan was divided into three sections; the first part provide a background to Jamaica's forestry sector examining land use and ownership issues, the forestry productive sector, and the various forest management constraints that affect the functioning of the Forestry Department. Part two addressed the forest values to society, while Part three dealt with the strategies for implementation of the NFMCP. Implementation of the plan will require the involvement of the public in general and more specifically the communities bordering the forested areas, forest research, forest protection, forest production and the impact that investment and the provision of incentives could have on the

sector, as well as the role of the Forestry Department.

2.4.9 Management and Recovery Plans for Endangered Species

Management and recovery plans for endangered species have been completed over the last few years. These include: the Crocodile Action Plan; the Giant Swallowtail Butterfly Recovery Action Plan; the Jamaican Iguana Conservation Strategy; the Sea Turtle Recovery Action Plan; the Jamaica Coral Reef Action Plan; and the Plan for Managing the Marine Fisheries of Jamaica. In addition, management plans have been developed for other, non-threatened species such as the Sooty Tern and the Brown Noddy.

These policies and action plans:

- identify projects and programmes to protect species which are endangered and threatened;
- seek to mitigate adverse impacts on and the destruction of habitats across the country;
- aim at changing behaviour and educating the public on aspects of biodiversity; and
- recommend increased means of protection under the law for our natural resources and the environment.

2.4.10 Access to Genetic Resources and Fair and Equitable Sharing of Benefits

Bioprospecting and the use of genetic resources in biotechnology open up a wealth of potential uses, particularly in agriculture, the pharmaceutical industry, botanical medicine, and the cosmetic industry. There are currently no legislative or policy measures on access and benefit sharing of genetic resources in Jamaica.

Recognition of the importance of genetic resources to local industries will give urgency to the conservation of these resources for future sustainable use. At present there is very little research being carried out on genetic resources in Jamaica.

2.4.11 Future Initiatives

2.4.11.1 Biosafety

The National Biosafety Committee (NBC) was formed in 1996 with a mandate to develop clear procedural guidelines for the importation of transgenic plants for experimental use. In 1997, through the efforts of the National Commission on Science Technology (NCST) and the NBC, regulations were gazetted under the Plant Quarantine Act to permit entry of transgenic plant material for contained experimentation.

The NBC is uniquely placed to monitor and control the importation and the use and handling of genetically modified organisms in Jamaica; however, to effectively fulfil its mandate, an appropriate national policy is necessary. The Government of Jamaica, through the NCST, has recently mandated the preparation of a National Biosafety Policy to guide the safe transfer, handling and use of the products of biotechnology.

2.4.11.2 Traditional Knowledge

Much traditional knowledge exists in Jamaica for the different uses and properties of local genetic resources. If this knowledge is not preserved and access regulated it might be lost or be entered into the public domain, which could diminish its value. However, the obligation to protect and preserve this traditional knowledge has not been addressed in any systematic manner and there is no standard definition of what traditional knowledge should include.

There is a need for the protection of traditional knowledge through national policy and legislation to ensure equitable access and benefit sharing.

2.4.11.3 Draft Policies and Guidelines

There are various draft policies that have been prepared concerning the conservation and sustainable use of Jamaica's biodiversity. These policies are primarily sectoral in nature and include:

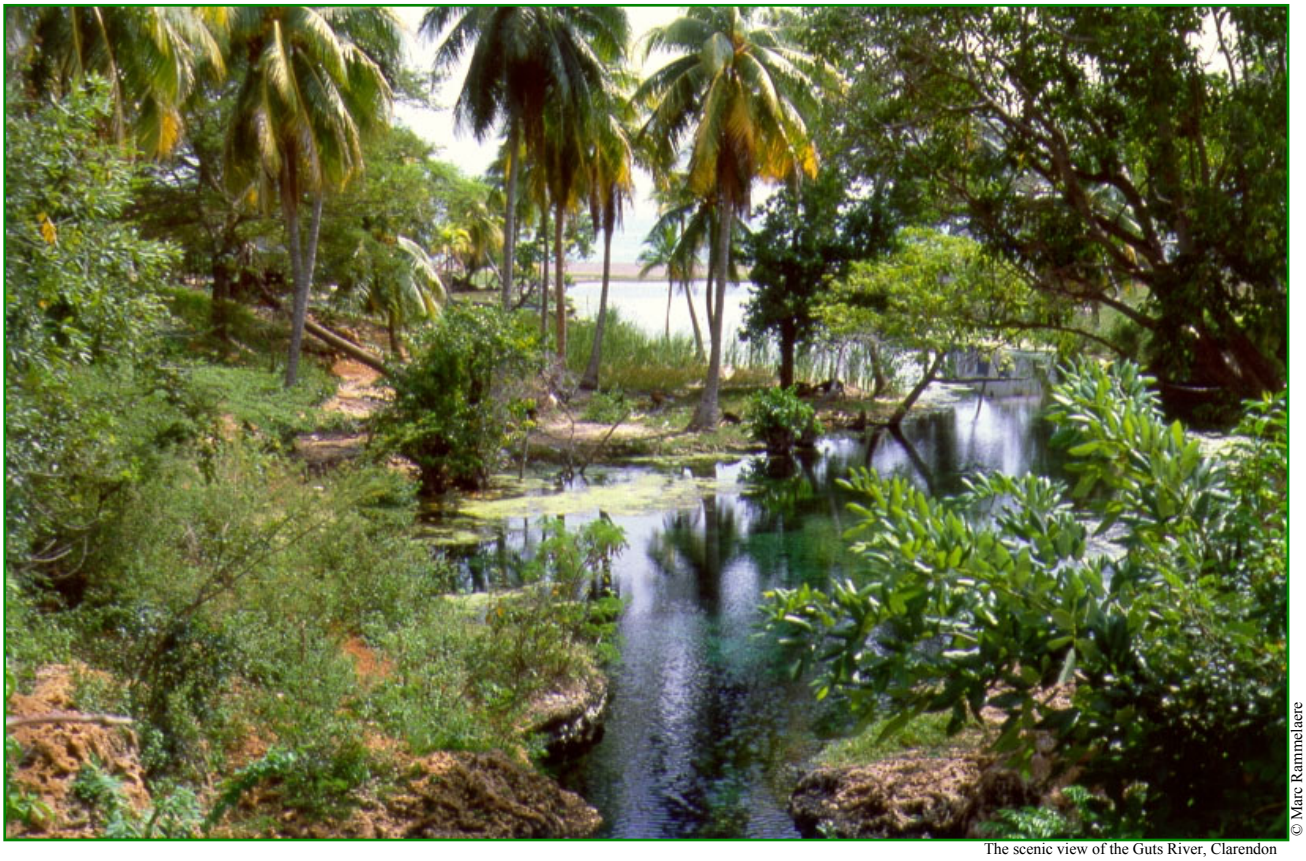
- Watershed Policy
- National Policy and Strategy on Environmental Management Systems
- Draft policies on mangroves and coastal wetlands, coral reefs, protected animals in captivity, orchids, seagrass protection, and mariculture.

Several draft guidelines are also being considered including:

- Protected Areas Management and Operation Plans
- Delegation and Compliance
- Integrated Pest Management
- Protection of Private Lands
- Disaster Preparedness and Natural Disaster
- Human Resources Management
- Fire Management
- Financing and Land Acquisition
- Resource Users and Special Users

- Research

There is currently no policy governing the protection of rivers and caves or offshore cays.



The scenic view of the Guts River, Clarendon

3. THE MAJOR GAPS AND CHALLENGES AFFECTING THE CONSERVATION AND SUSTAINABLE USE OF JAMAICA'S BIODIVERSITY

There are many factors that contribute to the loss of biodiversity in Jamaica. These include poverty, lack of public awareness about the importance of habitat/ecosystem destruction and degradation, conserving biodiversity, unsustainable harvesting of some species, pollution, habitat fragmentation, and the spread of alien species.

3.1 Socio-economic Factors

Historically, human activities have had a negative effect on biodiversity. This view is controversial, and in the case of Jamaica, needs closer examination.

3.1.1 Population Pressure

Jamaica's population growth rate averaged just over 1% between 1993 and 1998 (1998 Economic and Social Survey of Jamaica). The population growth rate has declined slightly since this period and the annual increment to Jamaica's population is just over 20,000. An estimated two-fifths of the population is less than 20 years old and this high concentration of people in and entering their reproductive years will ensure that total births will continue to rise.

3.1.2 Lack of Capacity of Local Communities

Rural migration has affected biodiversity in different ways. Over the past 30 years, labour has become the major cost of agricultural production. Farming methods that are appropriate for short-fallow cultivation can rarely be practised because of the high labour cost required to cultivate the land where most rural poor live.

Farmers therefore have to rely on inappropriate farming methods (slash and burn) that are not suitable for their specific fallow requirements but which were suitable for long-fallow systems. They are then forced to rely on high chemical fertiliser and pesticide inputs to reduce labour costs.

It thus can be argued that in Jamaica, it is not so much the amount of labour (excess population) that is contributing to biodiversity loss (both natural and agricultural), as it is the cost of that labour compared to other competing demands (real or imagined). This in turn leads to encroachment on forest areas and other sensitive or important biodiversity areas, as the rural poor seek ways to minimise their labour input and to survive.

3.1.3 Poverty

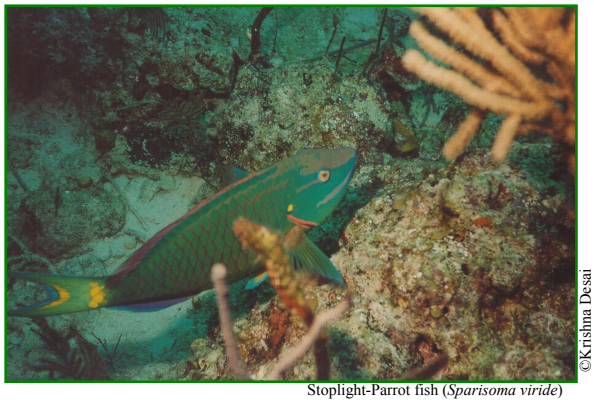
Poverty and over-consumption by certain sectors of the society are also contributing to the decline in biological resources. To address the problem of poverty, the Government of Jamaica in 1997 established the National Poverty Eradication Programme (NPEP). This programme outlines:

- Methods for the reduction of the poverty level;
- Human resource development;
- Social welfare;
- Environmental and natural resources protection;
- Community empowerment and community-based development; and
- The foundation for the eradication of absolute poverty.

Data for 1997 show that approximately 19.9% of Jamaica's population, or 13.6% of households, live in poverty; with 73% living in rural areas, 13.6% in the Kingston Metropolitan Area, and 13.1% in other towns.

The data revealed an increase in the percentage of poor living in rural areas.[3] In Jamaica, the communities closest to the most vulnerable biological resources are among the country's poorest. Not only do these communities depend on biodiversity for their own survival, they are also at risk from the same environmental problems that cause biodiversity loss, such as water pollution.

The relationship between poverty and environmental degradation requires an integrated planning approach in order to achieve economic development and environmental sustainability.



Stoplight-Parrot fish (*Sparisoma viride*)

[3] Section 22.2, Economic and Social Survey Jamaica, 1998

Socio-economic Gaps and Challenges:

- Developing effective mechanisms to actively engage communities in the decision-making process such as in the planning phases of development projects which may affect them and addressing existing environmental problems in their communities;
- Developing appropriate programmes and methods of communications which clearly indicate the role of biodiversity management in poverty alleviation;
- Providing alternate opportunities for income generation in rural communities which can encourage people to remain in their communities thereby decreasing urban drift;
- Identifying the social services provided by the environment and their value at the community and national level; and
- Expanding the agricultural services provided to farmers, particularly in the area of modern farming techniques.

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West Indian Whistling Duck (*Dendrocygna arborea*)

3.2 Public Awareness, Education, and Community Responsibility and Empowerment

There is an urgent need to heighten awareness and understanding among Jamaicans of the need to conserve biodiversity and to sustainably use biological resources. Environmental education is an essential tool to build support for biodiversity conservation and to change attitudes and behaviour, as well as to encourage public support for biodiversity related policies, strategies, plans and programmes.

Despite substantial investments in this area, awareness of environmental issues in Jamaica remains at a relatively low level. However, recent increases in membership in, and the number of, environmental organisations are encouraging and indicate increased concern for environmental issues. This growing membership will also greatly assist with increasing public awareness of environmental issues and responsibilities.

A number of public awareness, education and community empowerment initiatives have already begun. These include:

- Establishment of a National Environmental Education Committee to spear-head the development of a National Environmental Education Action Plan for Sustainable Development;
- Environmental groups and communities working together to reduce the impact of development and to clean up degraded sites;
- Celebration of environmental days and occasions;
- A biennial environmental green exposition;
- Print and electronic media campaigns; and
- Publication of the State of the Environment Report.

Public Awareness Gaps and Challenges:

- Developing public education programmes to: a) explain the socio-economic benefits of protected areas, species and micro-organisms; and b) increase understanding of ways and means to reduce negative impacts on biodiversity;
- Increasing support for non-government and community environmental education and projects; and
- Networking/coordination at the national level to avoid duplication thereby promoting greater efficiency the delivery of public environmental education programmes.

3.3 Enhancing the Legislative Framework for Biodiversity

While the current legislation creates a basic framework for the conservation of biodiversity, it does not comprehensively protect ecosystems, species, or genetic diversity.

In this regard, Jamaica is in the process of reviewing or developing several pieces of legislation that are relevant to the conservation of biodiversity and sustainable use of biological resources. These include the NRCA Act, 1991; a new Watershed Act; a new Wild Life Protection Act; a new Fisheries Act; and Regulations under the Endangered Species (Protection, Conservation and Regulation of Trade) Act, 2000.

Legislative Gaps and Challenges:

- Determining the mechanism to modify the Constitution to support biodiversity conservation, sustainable use of biological resources, and ownership of genetic resources;
- Determining the need to incorporate into legislation alternative regulatory instruments, such as economic incentives to promote sustainable use of biodiversity and ways and means to empower and support NGO's involved in environmental projects;
- Developing legislation concerning scientific research and collection;
- Developing appropriate legislation with regards to the commercial use of living modified organisms;
- Ensuring adequate protection through legislation for various ecosystems e.g. rivers, coastal areas, wetlands, coral reefs, cays, and caves;
- Creating memoranda of understanding between departments and agencies of Government to clarify roles and responsibilities in the management of biodiversity;
- Establishing mechanisms to ensure awareness by the judiciary of the status of Jamaica's biodiversity, especially threatened species; and
- Including mechanisms within legislation to make it easier to prove environmental crimes and recover costs for remedial action.

3.4 Land Use Planning and Environmental Impact Assessments

Jamaica, like other small island states, is particularly vulnerable to species extinction because island species often have smaller geographical ranges and total population sizes in comparison to mainland species. This makes them more susceptible to significant population declines due to factors including habitat loss and alteration, environmental degradation, introduced predators and competitors, and disease outbreaks. Sound land use planning and environmental impact assessments (EIA) are essential to ensure that developments do not significantly affect Jamaica's biodiversity.

Population growth, coupled with agricultural, industrial and commercial expansion, has resulted in intense competition for land. The resultant effect is less than optimum land use resulting in a number of problems which negatively impacted on biodiversity. Some recent progress has been made towards addressing land control issues. Chief among these are: the new Lands Policy drafted in 1996 and the Land Information Council of Jamaica established in 1997. The Land Information Council is mandated to harmonise Geographical Information System development to support environmental and physical planning. The Government has also been focussing on harmonising the functions of the Land Development and Utilisation Commission (LDUC), Town Planning Department (TPD) and the NRCA.

The loss of flora and fauna is not adequately addressed nor monitored through the present EIA process. For example, a system to identify critical habitats has not been established (this is needed to allow for the modification of development plans). There is also no requirement to identify threatened species on proposed development sites and ensure appropriate conservation measures. In addition, monitoring of the construction process and subsequent activities on the site is often not comprehensively addressed.

Although guidelines have been developed by the NRCA for the conduct of EIA's and for public presentation, there is no legal requirement to ensure public participation in the EIA process. The NRCA has tried to facilitate transparency in this process but regulations are required to govern the EIA process and the requirements for public presentation.

Improved land use planning and environmental impact assessments are critical to conserving Jamaica's biodiversity.

Land Use Planning and Environmental Assessment Gaps and Challenges:

- Preventing uncontrolled or poorly planned human settlement in areas not conducive to such development, like steep hillsides and in watersheds;
- Preventing development and expansion of farming on steep slopes and on low productivity lands;
- Preventing further deforestation and destruction of watersheds and wetlands;
- Addressing land tenure issues;
- Establishing incentives for private landowners to conserve biodiversity;
- Improving the EIA process to better protect flora, fauna and their habitats, and especially threatened species and ecosystems; to ensure monitoring of the construction and operation processes; and to ensure public participation in the EIA process; and
- Strengthening and enforcing existing laws against trespassing and illegal developments.

Jamaican Cup and Saucer/Jamaican Rose (*Blakea trinervia*)

3.5 Agricultural Sustainability

Much of the land occupied by small farmers is located on steep slopes where inappropriate farming practices result in soil erosion and loss of biodiversity. To increase income and food production, farmers often advance further up hillsides clearing forested areas which further impacts negatively on biodiversity.

Under the recently introduced Domestic Food Crop Project of the Ministry of Agriculture, efforts are being made to optimise the use of agricultural lands by determining the most suitable crops for particular soil types and other conditions.

Further research into crop zoning and implementation of other methods of land use are necessary to optimise the use of agricultural lands, achieve agricultural sustainability, and significantly reduce impacts to biodiversity by maintaining or increasing crop production without expanding the agricultural land base.

Agricultural Sustainability Gaps and Challenges:

- Developing and implementing improved agricultural policies and planning systems to provide a basis for sustainable use of resources and to integrate agriculture polices and programmes with conservation policies and programmes;
- Obtaining financial resources to support training and extension services in order to provide farmers with the support they need;
- Increasing technical and scientific capacity within the agricultural sector;
- Developing land use zoning and control and enforcement measures to protect sensitive landscapes and species from inappropriate agriculture use and development;
- Increasing use and development of locally adapted genetic resources; and
- Increasing control over the importation of agricultural plants and animals to prevent the introduction of harmful alien species.

3.6 Mining and Quarrying

Jamaica's mining industry is comprised mainly of the bauxite/alumina sector (bauxite mining and the production of alumina) and the industrial mineral sector (various forms of quarrying).

Mining and quarrying represent important areas of contemporary economic activity. Bauxite mining and the processing of bauxite ore into alumina are major sources of export earnings for Jamaica and has been for several decades. Both mining and processing place serious and sustained burdens on the environment. On an annual basis, an average of almost 100 hectares of land are disturbed for bauxite mining while only 76 ha are restored (Table 6). The industrial minerals sector accounts for an annual average of 7.5 to 9.0 ha of land disturbed for mining.

Table 6 Disturbed lands resulting from mining

Disturbed Lands	Ha	%
Area Disturbed for Mining	4,312.82	100
Area completely mined out	3,945.40	90.7
Original pit area restored and certified	2,533.33	54.6
Fringe and marginal lands restored and certified*	1,047.20	
Total area restored and certified	3,580.53	
*44.5% more than actually disturbed		

Source: Ministry of Mining and Energy, 2000

Some of the backlog of mined areas waiting restoration dates back to the 1970s. All the bauxite/alumina companies have extensive agricultural programmes geared towards the reuse of restored mined lands. However, restored land is normally less productive than the original and although the application of fertilisers can raise yields above original levels, the yield/cost ratio is generally not economical under the present range of crops and agricultural practices. The long-term effects of bauxite mining and alumina processing have not been fully assessed.

Limestone, marl and gypsum are widely used in the construction industry and road building. Limestone and gypsum are also used extensively in the local production of cement. Limestone, in the form of burnt lime (Calcium Oxide), is one of the major raw materials in the Bayer process for the manufacture of alumina. It is also exported in the form of crushed limestone and limestone whiting. Production of gypsum for export peaked in the late 1950s when almost 600,000 tonnes were produced annually.

Sand and gravel mining are important economic activities. Unfortunately, extraction of these materials is often being carried out illegally and great harm is being done to the country's rivers, beaches and coastal areas.

Clay and shale mining is conducted on a relatively small scale and its environmental impact is not as severe as the other mining activities. Clay is used mostly in the craft industry for pottery and ceramics and for roofing tiles. A large amount is also used in the production of cement. Some clay bricks are also produced, primarily for decorative purposes.

Other mineral industries such as marble are not yet developed, although Jamaica has extensive reserves of high-quality marble. Although marble has been extracted since the 1960s, output remains limited due to difficulties associated with vehicular access into the high mountainous areas where the best deposits are located. Jamaica is also known to have some gold of potential commercial value.

Mining Gaps and Challenges:

- Preventing or reducing loss of habitat for endemic and threatened species;
- Obtaining adequate detailed descriptions of geophysical, climatic, vegetative and ecological characteristics as part of planning mine site developments;
- Overcoming gaps in understanding the regenerative capacity of the various flora and fauna communities affected by mining activities;
- Overcoming gaps in understanding and ranking of areas or sites with respect to biodiversity, or their degree of threat;
- Increasing understanding of the long-term impact of pollution on species and ecosystems; and
- Including biodiversity issues in the overall planning of mining operations to prevent or prevent or minimize negative impacts.

3.7 Tourism

The tourism industry, which is the largest foreign exchange earner for Jamaica, is directly dependent on the natural environment such as the white sand beaches, rivers, mountains and forests. There are six designated tourist resort areas in Jamaica. These are Port Antonio, Montego Bay, Ocho Rios, Negril, Kingston, and the South Coast.

The diversity of Jamaica's geography and landscape presents unique vacation opportunities, and it is essential that the natural resources that sustain tourism are conserved. Tourism development must be well planned to ensure that it is ecologically sustainable over the long-term.

Biodiversity is being used to market aspects of tourism in Jamaica. Several companies offer tours of natural areas including the Black River, Cockpit Country, and the Blue Mountains. A number of tourism companies use native animals in their logos and advertisements, and have made small grants to support the work of environmental NGOs.

Several initiatives that will support efforts to conserve biodiversity and reduce impacts to the environment are underway in the tourism sector. These include:

- Preparation of a draft Sustainable Tourism Master Plan;
- Environmental Audits for Sustainable Tourism (with 20 hotels and one attraction audited to date);
- The Ministry of Industry and Tourism has conducted carrying capacity assessments for three major resort areas (Montego Bay, Ocho Rios and Negril) and river-based attractions;
- A manual has been produced by the Jamaica Hotel and Tourist Association called "Environmentally Conscious Hotel Operations";
- A programme of greening of the tourism industry was established. In 1998, four hotels in Jamaica became the first in the world to be certified by Green Globe International as Green Hotels.

Sustainable Tourism Gaps and Challenges:

- Developing a comprehensive "Green Tourism and Ecotourism Policy";
- Developing guidelines, standards and codes of conduct to prevent negative impacts to biodiversity such as incentive measures for remedial activities and the adoption of eco-friendly standards by tourism operations;
- Improving collaboration among all sectors to reduce conflicts;
- Improving disposal and management of sewage and solid wastes in watersheds, marine areas and coastal;
- Conducting biodiversity risk assessments and determining carrying capacity for protected and sensitive areas; and
- Improving awareness among tourism operators and tourists of potential negative impacts of their activities on biodiversity.

Dunns River Falls in Ocho Rios, St. Ann

3.8 Parks and Protected Areas

Parks are defined under the NRCA Act as "any area of land to be maintained for the benefit of the public". Protected areas are defined as "any area of land or water in which may be preserved any object (whether animate or inanimate) or unusual combination of elements of the natural environment that is of aesthetic, educational, historical or scientific interest". A Marine Park is defined as "any area of land lying under tidal water and adjacent to such land or any area of water".

Regulations were passed in 1992 to govern the management of Marine Parks under the Natural Resources (Marine Parks) Regulations and in 1993 the Natural Resources (National Parks) Regulations were promulgated. These Regulations treat the following activities within the parks as offences:

- fishing without a licence;
- discharging polluting matter;
- destruction of coral and other natural formations and marine life;
- collection of specimens of flora and fauna;
- lighting of fires; and
- conducting commercial activities without a licence.

Regulations are to be prepared for five (5) types of protected areas under the NRCA Act. Jamaica plans to adopt the system used by the World Conservation Union (IUCN) to declare specific categories of protected areas. Regulations are to be developed for the categories: Habitat/Species Management Areas, Natural Landmarks/Monuments, National Nature Reserves, Managed Resource Protected Areas, and National Protected Landscapes and Seascapes.

To date, Jamaica has declared three (3) marine parks (Montego Bay, Ocho Rios and Negril); one National Park (the Blue and John Crow Mountains National Park); and three (3) protected areas (Palisadoes, Coral Springs and Portland Bight).
The entire Negril Watershed area has been declared an Environmental Protection Area under the NRCA Act to ensure the protection of the environment and natural resources in that area. This declaration was followed by the preparation of an Environmental Protection Plan, which provides a framework for sustainable development within the area. Regulations for Environmental Protection Areas have almost been completed.

Over 150 areas identified in the "Policy for Jamaica's System of Protected Areas" as being of national significance need some type of protection. Further planning and development of Jamaica's system of protected areas are crucial to achieving the conservation of biodiversity.

A financial mechanism to pay for the management of all types of parks and protected areas in Jamaica is still to be developed. Although there is a National Park Trust fund in place, it does not have the necessary capital to provide funding for all parks and protected areas presently declared. User Fees Regulations are currently being developed for all national parks. However, additional cost recovery schemes and financing for protection and conservation will have to be created in order to supplement the income of parks and protected areas to ensure availability of funds for research and management.

Parks and Protected Areas Gaps and Challenges:

- Continuing to build partnerships among governments, NGOs, local communities, and private sector interests to establish and maintain protected areas;
- Completing regulations for five types of protected areas including the category that offers the highest protection, the Nature Reserve;
- Obtaining the necessary financial resources to undertake assessments in order to determine the status of many of the 100 areas that are scheduled to be declared as protected areas, and putting into place interim measures to ensure their conservation;
- Working with communities to create buffer zones for Marine and National Parks;
- Determining appropriate incentives to promote conservation on private lands; and
- Ensuring a sustainable financial framework for the protection and management of parks and protected areas.

3.9 Conservation of Freshwater Resources

Despite the abundance of potential freshwater resources, the actual obtainable capacity, i.e. the quantity of freshwater that can actually be utilised, has been significantly reduced due to the direct and indirect effects of three main causes:

- forest degradation in watershed areas which interrupts the natural water cycling process and reduces the soil's ability to absorb and retain water;
- sand mining and damming which compromises river bed integrity as well as alter natural river courses; and
- discharge of waste effluent from industrial and agricultural processes into rivers and streams influencing *in-situ* conditions.

Freshwater Resources Gaps and Challenges:

- Increasing research to ascertain the nature and extent of our freshwater resources, as well as the threats to these resources;
- Implementing and enforcing legislation with regards to the monitoring of effluent released into rivers and other inland water bodies;
- Implementing management strategies with a view to freshwater biodiversity conservation;
- Public awareness of freshwater ecosystems and their importance needs to be promoted; and
- Regulating and monitoring the harvesting of freshwater resources.

3.10 Conservation of Coastal and Marine Biodiversity

Coastal and marine resources are essential components of Jamaica's economy and cultural diversity. The high concentration of people living on the coastal plains has resulted in increased pressure on the coastal resources. Many marine resources are over-utilised and marine ecosystems are being degraded. Recognition of problems has resulted in improved policies and programmes.

The Fisheries Division in collaboration with the CARICOM Fisheries Resources Assignment and Management Programmes will be conducting a five-year programme aimed at developing a management plan for economic marine resources. A Council on Ocean and Coastal Zone Management was established in 1998 by the Government of Jamaica to effectively integrate the management of the coastal zone. Other conservation initiatives for coastal and marine resources include:

- Preparation of a manual for integrated coastal zone planning and management;
- Draft Fisheries Bill and Draft Beach Policy;
- An assessment of pelagic and reef species including fish catch and effort;
- Operational licensing and registration system for fishermen and vessels;
- The Coastal Water Quality Improvement Project;
- Participation in the Caribbean coral reef monitoring programme;
- Environmental audits for sustainable tourism;
- The Ridge-to-Reef Project, which began in the year 2000 and is expected to design and develop environmentally and economically sustainable eco-tourism related enterprises;
- Coastal Zone Atlas and draft Fisheries Atlas;
- Jamaica's Coral Reef Action Plan;
- Construction, maintenance and monitoring of underwater pipelines and cables in the Coastal Zone;
- Draft Wetlands, Coral Reef and Mariculture Policies;
- Planning and execution of coastal and estuarine dredging works and disposal of the dredged materials;
- Planning, construction and maintenance of facilities for enhancement and protection of shorelines; and
- Standards for the development and operation of nature attractions.

Coastal and Marine resources Gaps and Challenges:

- Developing legislation, monitoring and enforcement mechanisms to prevent over-fishing, poaching and accidental entanglement in gill nets;
- Improving planning and legislation to prevent the loss of threatened and sensitive species, and to prevent destruction of their habitats;
- Preparing and implementing recovery plans for threatened species;
- Increasing the understanding by resource users, tourists and developers of the need to conserve marine resources, and of their responsibilities;
- Establishing additional marine protected areas;
- Establishing mechanisms to resolve conflicts among resources users through greater community involvement and responsibility;
- Overcoming gaps in data, information and knowledge required to manage coastal and marine resources; and
- Increasing efforts to reduce sedimentation and land-based pollution from developments and illegal sand mining operations.

3.11 Conservation and Sustainable Use of Forest Biodiversity

Conservation of forests and sustainable use of forest biological resources are essential to achieving the objectives of the CBD. Jamaica was once covered with forests but are now restricted to areas least suitable for agriculture and human settlement such as those at high altitudes on steep and rocky slopes, and in rugged limestone areas without surface water. Today, more than 30% of Jamaica has retained some form of forest cover, but only about 8% of the remaining forests can be classified as undisturbed natural forests. Estimates of the deforestation rate in Jamaica have fluctuated over the years between 0.1% to 11.3% due to a number of reasons including objectives of the study, type of forest classification used, type of study and precision of estimates. In 2000, based on a classification system derived from the interpretation of LANDSAT imagery and 1:100,000 maps, the deforestation rate was estimated at 0.1% per annum.

Forests are being utilised for a variety of uses. Although precise data is not available, fuelwood and charcoal production are probably the largest users of forest biomass in Jamaica. The decentralised nature of the sawmilling industry in Jamaica makes it difficult to collect lumber production figures. The most recent estimate indicates annual production at approximately 59,000 cubic metres of hardwoods and 3,000 cubic metres of softwoods. Annual yam stick production has been estimated at 15 million sticks, which translates to an annual roundwood consumption of 150,000 cubic metres.

For most forest areas, the major cause of deforestation is agriculture expansion from both small-scale farming operations and larger-scale operations producing export crops. Unsustainable harvesting of trees for charcoal production is degrading lowland forests.

Terrestrial animals have responded in varying ways to conversion and degradation of their habitats. Some species have been able to survive despite the disturbances and have either maintained or increased their population in agricultural and residential areas. Other species are able to tolerate moderate levels of forest disturbance but are generally absent in highly disturbed areas. Several animal species are very sensitive to habitat alteration, including endemic species. They exhibit strong forest ecosystem dependency and become rare or disappear from forested landscapes that are intensely influenced by humans.

Sensitivity to habitat disturbance among invertebrate species is poorly understood but is thought to be significant for many species. For example, the endangered Giant Swallowtail Butterfly (*Papilio homerus*) is mainly restricted to well-developed wet forests. Recent research indicates that this species suffers high mortality due to parasitism when there are high levels of disturbance at the forest edge, their primary breeding sites.

About half the amphibian and reptile species found in Jamaica depend on relatively undisturbed habitats, including forests, rivers, wetlands and beaches. Forest ecosystem dependency is pronounced in endemic land birds. Over 60% of these species are rare or absent in open disturbed areas, and about 30% rely on well-developed forests at least during the nesting period. For non-endemic land birds, these figures amount to about 40% and 20%, respectively.

The Jamaican Hutia or coney (*Geocapromys brownii*), Jamaica's only endemic land mammal, depends on forest cover for survival. Several bat species occur on the island and occupy forest, caves and other ecosystems. Their habitat requirements are not fully understood.

A National Forest Management and Conservation Plan for Jamaica was approved by Cabinet in 2001. The purpose of the Forest Plan is to promote and improve the conservation and sustainable use of the forest resources of Jamaica to meet local and national needs, through protecting, managing and restoring the resource for the benefit of present and future generations.

One of Jamaica's endemic parrots, the Yellow-billed Parrot (*Amazona collaria*)

Forest Biodiversity Gaps and Challenges:

- Protecting Jamaica's remaining forest from encroachment by cultivators, livestock and timber cutters;
- Changing public attitudes to overcome indifference to: forest degradation, destruction and theft of forest resources, unsustainable land use practices, illegal occupation and livestock grazing on forest lands;
- Enforcing environmental laws, and commitment to implement plans and policies;
- Securing financial resources to overcome gaps in knowledge of the forest resource base and ensure the sound management of forest resources, especially to be able to determine sustainable harvest rates and to enforce them;
- Increasing the number of trained personnel in the public and private forest sector to ensure the sound management of forest resources;
- Increasing understanding of habitat needs for non-harvested forest species to ensure their conservation;
- Increasing the understanding of the roles and values of forest resources for biodiversity conservation, watershed protection, carbon sinks and other values; and
- Ensuring cooperation and collaboration among government departments, resources users and other stakeholders, to prevent or resolve conflicts and integrate multiple objectives for forest areas and resources.

3.12 Conservation of Watersheds

Landslides and slope failures are very common in the non-limestone watersheds due to the presence of steep slopes and thin or erosive soils. This is further compounded in all the watersheds by heavy and high intensity rains in the upper watershed areas, soil erosion, and susceptibility to earthquakes. These natural conditions of instability are aggravated by the inappropriate use of steep slopes. Farming activities on the slopes have long been recognised as the single most important cause of the degradation of watersheds in Jamaica. Upwards of 170,000 farmers cultivating just less than 245,000 ha and using unsuitable agricultural practices have contributed to massive soil loss through erosion, siltation of drains and rivers and destructive flooding downstream.

Growth in industrial and agricultural activities, population and increasing urbanisation has placed demand for and pressure on land and water resources. Water pollution has significantly increased due to the increased use of industrial and agro-chemicals, urban run-off and the improper disposal of sewage effluents.

The large-scale removal of trees for mining, quarrying, industrial and residential developments, squatter settlements, and the illegal removal of forest cover for lumber, charcoal production and yam sticks have greatly contributed to deforestation. Forest fires have been contributing more and more to deforestation due to extended periods of drought.

These factors have resulted in heavy siltation of rivers, reservoirs, irrigation canals and water intakes, as well as harbours.

3.13 Conservation of Species and Their Habitats

Conservation and sustainable use of Jamaica's wildlife species present many challenges. Habitat loss and overuse of resources have resulted in an increasing number of plants and animals that are threatened, or are extremely sensitive to further change their numbers or habitat conditions.

Animals are hunted and collected for sport, food, research, and trade. Using traditional capturing techniques, persons opportunistically, illegally and accidentally capture turtles, manatees, crocodiles and birds to supplement food or income.

Pig hunters trap the Jamaican Hutia accidentally or deliberately. The Yellow-billed Parrot (*Amazona collaria*) and Black-billed Parrot (*Amazona agilis*) are illegally captured and sold locally in the pet trade.

Plants, especially orchids, are harvested from the forest for local sale or export. Other plants species are collected for the purpose of scientific research and private use.

The mandate for the management of species and their habitats is carried out by various agencies and organisations. These include the NRCA/NEPA, Forestry Department, Fisheries Division, Institute of Jamaica, BirdLife Jamaica, Southern Trelawny Environmental Protection Agency, Hope Zoo, Montego Bay Marine Park Trust, Jamaica Conservation and Development Trust, Negril Area Environmental Protection Trust, Caribbean Coastal Area Management Foundation and Portland Environmental Protection Association.

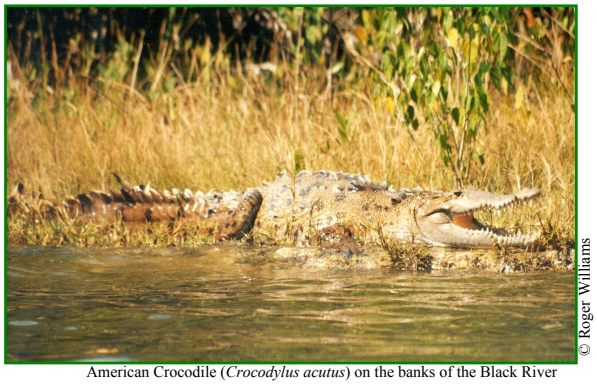
Committees and networks affiliated with the National Environment and Planning Agency (NEPA) are presently implementing components of recovery plans for the conservation of: sea turtles, the West Indian Manatee, several game birds, the American Crocodile, the Jamaican Iguana, Queen Conch, the Jamaican Petrel (possibly extinct), coral reefs, forests, fisheries stock and the Giant Swallowtail Butterfly. These groups have alliances with various institutions.

Management and recovery plans seek to mitigate adverse impacts and the destruction of habitats across the country, aim to change behaviour and educate persons on aspects of biodiversity and identify the need for increased means of protection.

Ex-situ conservation measures have been implemented for some species, such as the establishment of captive breeding for the Jamaican Iguana at the Hope Zoo. There are four botanical gardens (Hope, Bath, Castleton, and Cinchona) that could be developed as centres of *ex-situ* conservation for threatened plant species.

Conservation and Sustainable Use of Jamaica Wild Flora and Fauna Gaps and Challenges:

- Completing amendments to the Wild Life Protection Act to protect plants, invertebrates and micro-organisms;
- Continuing to establish protected areas to conserve species and their habitats;
- Securing financial resources and expertise to continue the development and implementation of recovery plans for threatened species and to ensure enforcement of legislation controlling the harvesting of species and habitat protection;
- Establishing incentives for the conservation and protection of wildlife to prevent species from becoming threatened;
- Overcoming gaps in knowledge to determine sustainable harvest rates;
- Overcoming gaps in knowledge of the ecology, taxonomy and systematics, and status of species, and overcoming gaps in capacity for these scientific; and
- Increasing public awareness of the need to conserve and sustainably use wild flora and fauna to gain support for necessary conservation measures.



American Crocodile (*Crocodylus acutus*) on the banks of the Black River

3.14 Access to Genetic Resources and Fair and Equitable Sharing of Benefits and Traditional Knowledge

Currently there is no legal means to protect traditional knowledge. A policy and legislation on access and benefit sharing is required to establish the role of the Government to authorise access; state the types of activities that require prior informed consent, and from whom; and regulate *ex-situ* access to collectors. The policy and legislation should set out the requirements for access to genetic resources both for species found *in-situ* and *ex-situ*. Establishment of effective measures to share benefits arising from the use of genetic resources will provide positive incentives for conservation and sustainable use.

At present the Government regulates the access to Jamaica's biodiversity through the use of collection permits and Material Transfer Agreements.

Access to Genetic Resources and for Benefit Sharing Gaps and Challenges to facilitating:

- Establishing a process to identify and build consensus on national objectives and priorities in the form of a policy on access and benefit sharing; and
- Establishing a sound legal framework for governing access to Jamaica's genetic resources.

3.15 Harmful Alien Species

A large number of alien plant and animal species and micro-organisms have been introduced into Jamaica. Some were brought to Jamaica as domesticated animals, as exotic pets (birds and fish), as ornamental plants, and as pest control agents. Some of the most intrusive alien species are described below.

The White-tailed deer (*Odocoileus virginianus*) escaped into the hills of Portland when their enclosures were destroyed by hurricane Gilbert in 1988. The deer survived and have established populations in Portland, St Ann and St Mary.

The Indian Mongoose (*Herpestes auropunctatus*) was brought to Jamaica in 1872 to control rats that had previously been introduced. It became a well-established alien species. Not only did the mongoose fail to control rat populations, but it is also believed to be the factor for the decline and possible extinction of five endemic vertebrate species, two birds (Jamaican Paruraque and Jamaican Petrel), a lizard (Giant Galliwasp), a snake (Black Racer), and a mammal (Jamaican Rice Rat). In addition, it is a major threat to several rare and endangered animals including the Jamaican Iguana, other diurnal ground-dwelling lizards, and probably the Jamaican Boa.

Other alien species such as dogs, cats, and the rat (*Rattus rattus)* have very likely contributed to the decline of some of these species.

Feral populations of pigs were established in the early years of Spanish colonisation of Jamaica. They are now found in some of the natural forests, including the Hellshire Hills, Blue Mountains and John Crow Mountains. The pigs compete with native herbivores such as the Jamaican Iguana and the Jamaican Hutia. Feral pigs are hunted with dogs, which in turn attack native animals they encounter during hunting. Such attacks pose a threat to the survival of some endangered species, such as the Jamaican Iguana.

Two cultured species of shellfish have been introduced, the Freshwater prawn *Macrobrachium rosenbergii*) and the Red-claw (*Cherax quadricarinatus*). The extent to which these species exist in the wild and their impact on other freshwater species have not been investigated.

There are increasing numbers of alien plant species spreading in Jamaica's forests and along riverbanks. Species of particular concern include the Mock Orange (*Pittosporum undulatum*) and the Wynne Grass (*Melinis minutiflora*) which are taking over large areas on the disturbed periphery of the Blue and John Crow Mountains National Park and spreading inwards. Wynne Grass prevents the regeneration of forests by competing with tree seedlings for space. Its propensity to ignite and burn increases the potential for bush fires, particularly in the drier months. The Mock Orange is a small, fast growing tree whose seeds are spread by birds. Control programmes for these species are urgently needed.

Alien Species Gaps and Challenges:

- Obtaining adequate information on the biology, distribution, and the ecological and economic impacts of introduced alien species;
- Increasing capacity to implement alien species control programmes, including obtaining the necessary financial resources for prevention, control, and eradication programmes; and
- Overcoming gaps in legislation to control introductions of species of flora, fauna and genetic material. No legislation currently exists for the eradication of alien species.

3.16 Biosafety

Advancements in biotechnology are making it possible to better use and develop genetic resources resulting in the creation of many new products and services. However, there is also growing concern that living modified organisms (LMO) could pose risks to humans and to the environment.

An international framework for the use, safe transfer, and handling of living organisms resulting from biotechnology that may have an adverse impact on biodiversity and human health has been negotiated and adopted by the Parties to the Convention. This protocol is the only Protocol to be developed under the Convention on Biological Diversity since it came into force.

It is important that Jamaica establishes a domestic biosafety policy and legislation to protect biodiversity and human health, while optimising benefits that can be accrued from biotechnological developments.

National Biosafety Policy and Legislation Gaps and Challenges:

- Overcoming the lack of both human and technical capacities to safely handle LMOs; and
- Developing risk management and assessment capabilities.

3.17 Water Pollution

At present, approximately 24% of the reliable safe yield of water resources is being used and it is projected that by the year 2015, 41% will be used. Continued deforestation, contamination of aquifers, and saline intrusion will diminish the amount of useable potable water available. Already, about 10% of available groundwater has been contaminated and is unsuitable for human consumption.

Water pollution poses a serious threat to the biodiversity of Jamaica. Pesticides, fertilisers and industrial wastes are major sources of pollution. The water quality of some rivers has deteriorated and is now not suitable for sustaining a freshwater fishery due to discharge of untreated domestic wastewater, contamination from grazing and watering of livestock, agricultural runoff, and the discharge of industrial effluents.

Current initiatives to address water pollution include: NRCA/USAID Coastal Water Quality Improvement Project, which is being executed in Negril, Ocho Rios and Westmoreland; licensing system for new domestic and industrial effluent discharges into rivers and stream; and routine water quality monitoring throughout the island. Many challenges remain; for example, there is no policy to guide the utilisation, management and protection of rivers.

Water Pollution Control Gaps and Challenges:

- Licensing of existing facilities that discharge municipal and industrial effluents into rivers and streams;
- Developing hazardous substances regulations to control the import, transportation, manufacture use and disposal of hazardous substances;
- Establishing community based groups to address water pollution issues (potential community programmes would include, adopt-a-river or –stream programme and water pollution control plan); and
- Amending the Watershed Act to enhance protection of rivers.

3.18 Climatic Change

It is predicted that the change in global climatic conditions will result in increased temperatures, rainfall and sea level rise and more frequent hurricanes.

Jamaica's biodiversity could be adversely affected by climate change which may affect species population size, distribution, composition, geographical extent of habitats and ecosystems, and increase the rate of species extinction.

Jamaica has been proactive in responding to climate change issues. In this respect, the country has been a Party to the United Nations Framework Convention on Global Climate Change since 1995. At the regional level, as part of the Caribbean Planning for Adaptation to Climate Change Project (CPACC), the NRCA in conjunction with the Centre for Marine Science, University of the West Indies, Mona, will be undertaking the monitoring of coral reef sites in Discovery Bay, Port Royal Cays and the Pedro Banks.

As an active participant in the Caribbean Community initiative, funding has been provided through the Global Environment Facility and the World Bank for the CPACC. This project supports preparations by Caribbean countries for the potential adverse effect of climate change, particularly sea level rise. The focus is on preparation of vulnerability assessments, adaptive planning, capacity building and institutional strengthening.

Typical vegetation found on the Palisadoes strip in the Palisadoes/Port Royal Protected Area

PART II: STRATEGY

Endemic Species of Jamaica
Mountain Pride, *Spathelia sorbifolia*, ©National Environment and Planning Agency

4. NATIONAL BIODIVERSITY STRATEGY

4.1 Biodiversity and Jamaica's Future

Jamaica's rich biological resources have supported families and communities for generations. These resources continue to provide a foundation for economic growth and stability by supporting agriculture, tourism, fishing, craft manufacturing and a host of other activities.

The country's diverse ecosystems perform ecological functions including the production of soil; prevention or reduction of soil erosion; absorption and breakdown of pollutants such as organic waste and pesticides; and storage and recycling of elements essential for life, such as carbon, nitrogen and oxygen.

The conservation and sustainable use of Jamaica's biodiversity will require commitment by, and collaboration between the private sector, civil society, the Government, community-based and environmental organisations. The following vision statements, principles, goals and strategic directions are intended to provide a framework to obtain the necessary commitment, and to provide a basis for cooperation and collaboration.

4.2 A Biodiversity Vision for the People of Jamaica

Mindful of the importance of our natural heritage to the well being of present and future generations, recognising that sustainable use of biodiversity is the only way to secure its availability to future generations, and being conscious of the intrinsic value of biological diversity, we accept our responsibility to conserve and protect Jamaica's biodiversity through sustainable use and fair and equitable sharing of the benefits derived from this biodiversity.

4.3 Principles to Guide the Implementation of the NBSAP in Jamaica

The principles are intended to provide guidance to decision-makers, developers, and citizens in support of efforts to achieve the stated vision for biodiversity in Jamaica.

To fulfil the requirements of the CBD and to ensure that current and future generations of Jamaicans have biological and other resources available to meet their needs and aspirations, the Government of Jamaica, NGOs, business interests, private sector companies, communities and individual citizens will uphold the following principles:

- ***Principle I - Transparency***

Affirm their commitment to open and transparent decision-making processes and provide opportunities for the participation of all citizens in the development of strategies, plans and programmes aimed at addressing biodiversity issues.

- ***Principle II - Acknowledge the need for behavioural change***

Address the underlying causes of the loss and decline of biodiversity by promoting the necessary societal changes through policies, laws, public education and awareness.

- ***Principle III - Local and traditional knowledge***

Respect local and traditional knowledge when developing and implementing policies, programmes and plans related to biodiversity.

- ***Principle IV - Protect habitats, ecosystems, species and genetic resources***

Adopt comprehensive biodiversity strategies and plans as part of efforts to conserve Jamaica's habitats, ecosystems, species and genetic resources.

- ***Principle V - Local management***

Encourage NGOs and community groups to manage protected areas; operate rescue centres; captive breeding and other artificial propagation facilities; and to implement species management and recovery plans.

- ***Principle VI - Precautionary approach***

Ensure that the precautionary approach (Principle 15, Rio Declaration 1992) is applied as widely as possible to avoid or minimise environmental degradation and the loss of biodiversity.

- ***Principle VII - Environmental economic tools and technology***

Invest adequate financial capital in resource management tools, including biophysical inventories, monitoring, research, enforcement, environmental education and other activities to ensure the conservation of

biodiversity and the sustainable use of biological resources.

- ***Principle VIII*** **- *Sectoral integration***

Ensure that economic, social and environmental objectives are integrated, and policies, strategies, plans and programmes are co-ordinated to effectively use scarce human and financial resources to ensure their greatest positive impacts.

Principle 15, Rio Declaration 1992

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

4.4 Goals of the NBSAP

1) Conserve Jamaica's biodiversity.
2) Promote sustainable use of biological resources.
3) Facilitate access to biological resources to promote developments in biotechnology and to ensure benefit sharing.
4) Ensure safe transfer, handling and use of Living Modified Organisms (LMOs).
5) Enhance resource management capacity.
6) Promote public awareness and education and community empowerment.
7) Promote regional and international co-operation and collaboration in support of the implementation of the CBD.

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Blue-faced Booby (*Sula dactylatra*) on the Pedro Cays

4.5 Goals and Strategic Directions

4.5.1 Goal 1: Conserve Biodiversity

An integrated management approach will be required to conserve Jamaica's biodiversity. The following conservation measures are proposed for *in-situ* and *ex-situ* conservation.

4.5.1.1 *In-situ* Conservation

4.5.1.1.1 Establish and Manage Protected Areas

Article 8(a)
Establish systems of protected areas or areas where special measures need to be taken to conserve biological diversity.

Article 8(b)
Develop, where necessary, guidelines for the selection, establishment and management of protected areas where special measures need to be taken to conserve biological diversity.

The Convention states that *in-situ* conservation, that is, conservation within natural habitats, is a fundamental requirement for the conservation of biodiversity. The establishment and management of protected areas is an important element in the conservation of biodiversity conservation in Jamaica. Areas to be conserved include unique or vulnerable ecosystems and critical habitats for rare, threatened, endangered and endemic species, as well as species and genetic resources that are of economic or scientific interest. To advance the establishment of protected areas, the following strategic directions are proposed:

Strategic Directions

- Expand the system of protected areas to ensure that it encompasses the country's diversity of natural resources, landscapes and seascapes. Priority areas for conservation include the Mason River Reserve, Cockpit Country, Dolphin Head Mountains, and offshore cays.

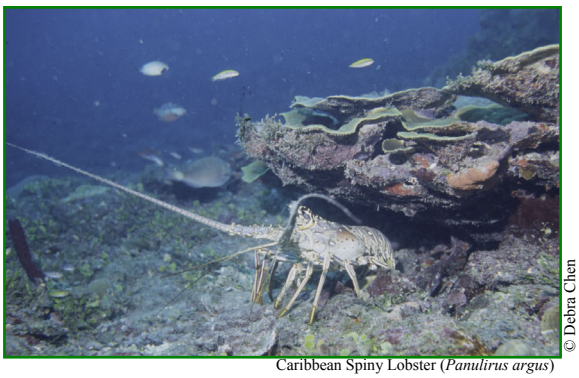
- Finalise and implement guidelines for the establishment and management of protected areas.

- Increase the investment in the Jamaica National Parks Trust Fund.

- Continue to support and promote partnerships between government and local and indigenous communities, property owners and private corporations for the voluntary allocation of land for conservation purposes using a variety of conservation mechanisms including easements and covenants.

- Implement interim protection measures to ensure that candidate protected areas are not compromised by proposed developments while their establishment is being considered.

- Continue to decentralise the management of protected areas using local environmental NGOs or community-based organisations.



Caribbean Spiny Lobster (*Panulirus argus*)

4.5.1.1.2 Rehabilitate Degraded Ecosystems and Promote Recovery of Threatened Species

Article 8(f)
Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, *inter alia* through the development and implementation of plans or other management strategies.

To meet the obligations of the Convention, rehabilitation in some areas may be necessary, as well as the recovery of threatened species. The proposed strategic directions for rehabilitation of ecosystems and the recovery of threatened species are:

Strategic Directions

- Evaluate progress and continue to implement ecosystem rehabilitation programmes for degraded areas, including forests, species habitats, watersheds, and coastal and marine areas.

- Implement education and awareness programmes to reduce or prevent further ecosystem degradation resulting from human activities.

- Develop and implement recovery plans for threatened plant and animal species using multi-disciplinary teams, and ensure that recovery plans are prepared using transparent processes that provide opportunities for the involvement of stakeholders.

- Examine the need to compensate landowners and resource developers in order to conserve critically endangered components of Jamaica's biodiversity.

- Promote research to establish best management practices for rehabilitation efforts and species recovery; restore degraded ecosystems; and ensure the recovery of populations of over-harvested species.

- Strengthen measures to reduce and eliminate the release of harmful substances that degrade ecosystems and destroy wildlife.

4.5.1.1.3 Manage and Maintain Wild Species and Their Habitat

Article 8(d)
Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings.

The following strategic directions to enhance the management of wild species and their habitat are proposed:

Strategic Directions

- Promote research and inventory programmes to increase knowledge of species diversity; understanding their biology and ecology; and the impacts of human activities on species and their habitats.

- Implement identification and monitoring programmes to determine and establish sustainable harvest levels for wild flora and fauna and establish threshold levels which, when exceeded, result in remedial actions.

- Develop guidelines for species re-introduction and for removal of species from the wild.

- Ensure that both ecological and economic objectives are considered when designating pests and implementing pest management strategies.

4.5.1.1.4 Control and/or Eradicate Invasive Introduced Species

Article 8(h)
Prevent the introduction of, control and/or eradicate those alien species which threaten ecosystems, habitats, or species.

Recognising the severe impacts that have, and can result from introductions of alien species on ecosystems, habitats and native species, the following strategic directions are proposed:

Strategic Directions

- Undertake research and assessments of introduced species that now threaten Jamaica's biodiversity,

with a view to identifying appropriate measures to reduce further impacts.

- Develop guidelines for the eradication and monitoring of alien invasive species.
- Require risk assessment of species prior to granting an import permit and institute management assessments for importation.
- Improve management and strengthen enforcement capacity to implement quarantine control measures in order to control unintentional introductions at ports of entry.
- Develop contingency plans and action programmes to ensure rapid eradication of newly established and undesirable alien species.

4.5.1.2 *Ex-situ* Conservation

Article 9(a)
Adopt measures for *ex-situ* conservation of biological diversity, preferably in the country of origin of such components.

Article 9(b)
Establish and maintain facilities for *ex-situ* conservation of and research on plants, animals and micro-organisms, preferably in the country of origin of genetic resources.

Article 9(c)
Adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions.

Article 9(d)
Regulate and manage collection of biological resources from natural habitats for *ex-situ* conservation purposes so as not to threaten ecosystems and *in-situ* populations of species, except where special temporary *ex-situ* measures are required under sub-paragraph (c) above.

Ex-situ conservation means the conservation of components of biodiversity outside their natural habitats in institutions such as gene banks, botanical gardens, zoos, museums and herbaria. These types of institutions make a valuable contribution to the conservation of biodiversity and also increase public awareness of biodiversity issues. Research is often conducted at *ex-situ* facilities increasing understanding of the biology of species. Recognising the important contribution of *ex-situ* conservation, the following strategic directions are proposed:

Strategic Directions

- Conduct research to identify, inventory and document the genetic resources of Jamaica and store this information in a national database.
- Prepare a national *ex-situ* conservation plan involving Government agencies, *ex-situ* experts, researchers, representatives of conservation organisations, private sector groups, and other stakeholders to identify priorities, resource requirements and opportunities for national and regional collaboration and action, taking into account the need for various types of gene banks and rescue centres.
- As part of the national *ex-situ* conservation plan, determine national requirements for *ex-situ* facilities, and identify financial resources for the management of existing facilities and the development of new facilities.
- Ensure the inclusion of *ex-situ* conservation experts in the development of recovery plans for endangered species where appropriate and in the preparation of biodiversity policies and programmes.
- Provide, develop and use appropriate incentives as a means of promoting cultivation of local varieties of food crops and locally adapted breeds of livestock and undertake artificial propagation and captive breeding of threatened species.

4.5.2 Goal 2: Sustainable Use of Biological Resources

Article 10(a)
Integrate consideration for conservation and sustainable use of biological resources into national decision-making.

Article 10(b)
Adopt measures relating to the use of biological resources to avoid or minimise adverse impacts on biological diversity.

Article 10(c)
Protect and encourage customary use of biological resources with cultural practices that are compatible with conservation and sustainable requirements.

Article 10(d)
Support local populations to develop and implement remedial action in degraded areas where biodiversity has been reduced.

Article 10(e)
Encourage co-operation between government authorities and the private sector in developing methods for the sustainable use of biological resources.

The CBD defines "s*ustainable use"* as “the use of components of biological diversity in a way and at a rate that does not lead to long term decline of

biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations".

The sustainable use of biological resources and ecosystems is essential to the well being of present and future members of society. The concept of sustainable use and development, as applied in this strategy, is that the basic living standards of the people of Jamaica should be improved without depleting renewable natural resources and degrading the environment.

The practice of sustainable use of biological resources is difficult to achieve in developing countries such as Jamaica where poverty remains an underlying cause of unsustainable land use practices and utilisation of natural resources. Lack of access to suitable land for housing and farming results in communities settling and farming on forest lands. Without the capacity to access alternative sources for energy, the poor will continue to utilise forest resources for fuelwood and charcoal.

Achieving the sustainable use of Jamaica's biological resources and its diverse ecosystems will require the development and implementation of a broad range of management practices. The following overall strategic directions are proposed:

Strategic Directions

- Develop a baseline biological inventory and monitor harvested species to determine sustainable harvest levels.
- Prepare, implement and enforce harvesting quotas and guidelines.
- Develop codes of practice and provide incentives to ensure resource use occurs at sustainable rates.
- Improve education and training for resource harvesters.
- Promote mechanisms to better assess the value of biological resources.

4.5.2.1 Sustainable Agriculture

The transition to sustainable agriculture production is essential if food security is to be achieved ensuring long-term economic and social benefits. To achieve the integration of sustainable agriculture production and conservation of biodiversity, the following strategic directions are proposed:

Strategic Directions

- Review current agricultural policies to determine any impediments to sustainability.
- Review existing agricultural extension services, increase training, and initiate education and awareness campaigns on the need for conservation and sustainable use of biological resources.
- Explore the benefits of maintaining and using locally developed crops and livestock breeds.
- Establish and enforce land zoning and control measures to prevent expansion of agriculture into inappropriate areas thereby protecting watersheds, forests and other relevant areas.
- Strengthen national agricultural research to support efforts to address agricultural sustainability and to reduce negative impacts of agriculture on biodiversity.
- Promote better communication, co-ordination and information sharing among research and development agencies both locally and regionally.
- Provide incentives for farmers to conserve and sustainably use biological resources in nearby ecosystems and to implement *ex-situ* conservation measures where necessary.
- Encourage the adoption of integrated pest management approaches emphasising the benefits of natural fertilisers/composting and biological control methods while avoiding the introduction of fertile non-native species.
- Integrate biodiversity conservation into programmes of agro-forestry, watershed rehabilitation and soil conservation.

4.5.2.2 Sustainable Use of Marine Resources

Given the importance of marine resources to biodiversity and the economy, the following strategic directions are proposed:

Strategic Directions

- Increase understanding of fishermen and others involved in the harvesting of marine resources of the need for sustainable use of marine

resources, through extension services, education, training and technology transfer.

- Develop and implement codes of conduct and guidelines for sustainable use of marine resources.
- Investigate further options in the area of mariculture as alternatives to traditional fishing.
- Conduct a management audit of the Fisheries Division, to assess its management capacity with a view to determining and implementing the necessary reforms to overcome gaps and deficiencies.
- Institute an Integrated Coastal Zone Management Programme through relevant agencies, local communities and conservation organisations.
- Enhance the work of the Jamaica Coral Reef Action Plan Committee to identify and implement measures to prevent damage to sensitive marine resources including reefs, mangroves, lagoons, wetlands, and seagrass beds.
- Implement pollution mitigation measures to reduce pollution from ships and land-based activities taking into consideration existing initiatives.
- Increase efforts to monitor and prevent the introduction of alien species into the marine ecosystem.
- Promote training opportunities for managers of marine protected areas.
- Secure the involvement of local communities and individuals who possess traditional knowledge in the effective management of marine resources.
- Strengthen local and regional collaboration to ensure effective monitoring and enforcement of fisheries conservation rules and management programmes.
- Participate in regional and global initiatives on the management of marine biological resources and seek financial and technical assistance to increase capacity to manage these resources.
- Promote awareness of the impacts of collecting or damaging marine resources, particularly to tourism operators and beach users.
- Promote and raise awareness of the impact of land-based activities on marine biodiversity.

The flowers of the Dogwood (*Piscidia piscipula*)

4.5.2.3 Sustainable Use and Management of Forest Resources

Forests are one of the main repositories for Jamaica's biodiversity. To ensure their viability to maintain this function the following strategic directions are proposed:

Strategic Directions

- Implement the National Forest Management and Conservation Plan as required under the Forest Act, with stakeholder participation, to ensure that loss of forest biodiversity is reversed.
- Continue to update the inventory and description of forest lands, including inventories of non-timber resources and forest biodiversity.
- Assess the potential ecological impacts of fast growing alien/exotic trees species before they are introduced and after introduction.
- Strengthen enforcement to better control illegal harvesting of timber and other forest products and to prevent the illegal conversion of forested areas to non-forest use.
- Investigate ways and means to add value to forest resources after they have been harvested.
- Use EIA, where appropriate, to assess and mitigate adverse impacts from proposed development projects and policies affecting forest lands.
- Improve and expand programmes to rehabilitate degraded forest areas and ensure the implementation of an effective system of reforestation.

4.5.2.4 Ecologically Sustainable Tourism

Tourism has become the largest sector of Jamaica's economy. The rapid growth of the sector highlights

the need to prevent and/or reduce the effects on biodiversity resulting from tourism activities. The following strategic directions are proposed:

Strategic Directions

- Determine eco-tourism opportunities available in Jamaica.
- Ensure that sustainable use of biodiversity is incorporated in the draft Sustainable Tourism Master Plan.
- Continue the development and implementation of guidelines and codes of conduct for eco-tourism attractions and the "greening" of the tourism industry.
- Explore ways and means to obtain financial assistance and economic instruments needed to implement corrective measures to address pollution resulting from tourism activities.

4.5.2.5 Regulating Collection and Harvesting of Wild Flora and Fauna

Unregulated harvesting and collection of wild flora and fauna will have severe consequences to the long-term sustainability of Jamaica's biodiversity, therefore, the following strategic directions are proposed:

Strategic Directions

- Develop and implement guidelines for the ecologically sustainable use of species and genetic resources, taking into consideration the needs of different socio-economic groups.
- Apply the precautionary approach to harvesting and collecting biological resources.
- Explore ways and means to provide alternative sources of income for communities who depend on wild flora and fauna for their livelihoods.
- Encourage bioprospecting to better utilise or develop new uses for Jamaica's biological resources.
- Formulate policy and draft regulations to facilitate controlled access to biological resources and genetic material which take into account intellectual property rights.
- Determine the most appropriate quota system for regulating the harvesting of wild species for domestic and export purposes.

4.5.2.6 Sustainable Land Use and Development

4.5.2.6.1 Land Use Planning

Recognising the importance of effective land use planning in achieving sustainable use of biological resources and ecosystems, the following strategic directions are proposed:

Strategic Directions

- Continue efforts to improve land and resource mapping capabilities to support the establishment of land and resource zoning schemes.
- Renew efforts to prevent uncontrolled urban sprawl, ribbon development, squatting and agriculture development, especially in ecologically sensitive areas such as wetlands, watersheds and steep slopes.
- Secure a commitment to sustainable development by ensuring the participation of CBO's, parish authorities, local communities, private sector groups and NGOs in land use planning and monitoring processes.
- Ensure proper zoning of land to ensure only those most suitable for agriculture is so utilised.
- Ensure that land settlement programmes address environmental concerns, including impacts of public transportation and utilities infrastructure on wildlife habitats and ecosystems.
- Ensure that the construction of new roads and highways address the impacts on wildlife habitats and ecosystems.

4.5.2.6.2 Mining and Quarrying

Considering the economic importance of this sector and the environmental impacts that can result from mining and associated activities, the following strategic directions are proposed:

Strategic Directions

- Develop clear guidelines for the conservation of biodiversity and the sustainable use of biological resources in the mining sector and strengthen monitoring and enforcement activities.
- Ensure pre-mining impact assessment studies and inventories of flora and fauna are conducted in proposed mining and quarrying areas.

- Commit funding for the development and adoption of new and improved mining methods and technologies which reduce adverse impacts from mining and mineral processing.

- Increase efforts to prevent and reduce air and water pollution resulting from mining and quarrying activities and mineral processing.

- Increase efforts to control and prevent illegal mining activities and enforce regulations and conditions of mining permits.

- Establish and test emergency plans and response measures at sites where accidents associated with mining and the shipping of these products could pose significant threats to biodiversity, such as at marine ports.

- Formalise quarrying activities in traditional problem areas for greater control, monitor and maintain buffer zones around mining and quarry areas.

- Institute site-specific approval for blasting.

4.5.3 Goal 3: Facilitate Access to Biological Resources to Promote Developments in Biotechnology and Benefit Sharing

Article 15(2)
Each Contracting Party shall endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and not to impose restrictions that run counter to the objectives of this Convention.

Article 15(5)
Access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources, unless otherwise determined by that Party.

Article 15(6)
Each Contracting Party shall endeavour to develop and carry out scientific research based on genetic resources provided by other Contracting Parties with the full participation of, and where possible in, such Contracting Parties.

4.5.3.1 Access to Genetic Resources

The following strategic directions are proposed:

Strategic Directions

- Declare a national focal point and a national authority to deal with matters relating to access to genetic resources.

- Develop mechanisms for stakeholder participation in all access and benefit sharing discussions to address concerns and establish policies and legislation governing access.

- Identify existing legal, policy and administrative measures and institutional constraints that could impede the establishment of an appropriate access and benefit-sharing regime for Jamaica, including intellectual property rights regimes to address ownership issues.

- Continue to develop Material Transfer Agreements for commercial and scientific research to facilitate access to genetic resources whilst ensuring equitable sharing of any benefits which may arise.

Jamaican Harlequin (*Antlantea pantoni*) in the Cockpit Country

4.5.3.2 Access to and Transfer of Technology

Article 16(2)
Access to and transfer of technology referred to in paragraph 1 of this Article to developing countries shall be provided and/or facilitated under fair and most favourable terms, including concessional and preferential terms where mutually agreed, and, where necessary, in accordance with the financial mechanism established by Articles 20 and 21. In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognise and are consistent with the adequate and effective protection of intellectual property rights.

Strategic Directions

- Increase capacity to use and develop appropriate technologies that will assist in implementing the requirements of the Convention.

4.5.4 Goal 4: Ensure Safe Transfer, Handling and Use of Living Modified Organisms (LMOs)

Article 19(3)
The Parties shall consider the need for and modalities of a protocol setting out appropriate procedures including, in particular, advance informed agreement, in the field of the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity.

This Article establishes the framework for a Biosafety Protocol.

Recognising the impact of biotechnology on the world to date, and the increasing role of LMOs in the agriculture, health, and food sectors, it is prudent that Jamaica minimises possible accompanying risks through the development of a domestic biosafety policy and legislation, while optimising benefits that can be accrued from the technology.

The following strategic directions are proposed:

Strategic Directions

- Finalise a national biosafety and biotechnology policy, and develop domestic legislation for the safe handling, use and transboundary movement of LMOs, taking into account risks to human health and to biodiversity.

- Strengthen institutional capacity in organisations involved in biotechnology to develop appropriate procedures and measures for conducting risk assessment and management concerning the use and release of LMOs.

- Provide public education on the uses of LMOs, especially in the area of agriculture, thereby increasing public understanding of potential benefits and adverse effects of LMOs.

4.5.5 Goal 5: Enhance Resource Management Capacity

4.5.5.1 Data Management and Information Exchange

Effective management of biological data and information is an urgent priority for Jamaica. Despite efforts to improve the management of data and information relevant to the conservation and sustainable use of biological resources, many barriers to access and use data and information still remain among Government agencies and scientific institutes.

The establishment by The Nature Conservancy of the now defunct Conservation Data Centre at, and with co-operation of, the University of the West Indies (UWI) was one attempt to collect biological data and information.

A national Clearing-House Mechanism (CHM) has been established at the Natural History Division of the Institute of Jamaica.

Strategic Directions

- Expand the CHM to accommodate national needs in the area of information sharing and to facilitate partnerships in the area of technology transfer.

- Establish a National Clearing-House Committee, including representatives from Government, non-government and academic environments, to improve collaboration and data sharing.

- Promote the creation of biological databases to facilitate use of Geographic Information System (GIS).

4.5.5.2 Identification and Monitoring

Article 7(a)
Identify components of biological diversity important for its conservation and sustainable use having regards to indicative list of categories set down in Annex 1.

Article 7(b)
Monitor through sampling and other techniques, the components of biological diversity identified pursuant to subparagraph (a) above paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use.

Article 7(d)
Maintain and organise by any mechanism, data derived from identification and monitoring activities.

To ensure the proper identification and monitoring of components of Jamaica's biological diversity the following strategic directions are proposed:

Strategic Directions

- Strengthen institutional capacities to undertake inventories.

- Design a comprehensive biodiversity monitoring programme, which should include standards, methodologies and monitoring intervals.

- Promote collaboration with national, regional and international institutions involved with biodiversity identification and monitoring.

4.5.5.3 Incentive Measures

Article 11
Each Contracting Party shall, as far as possible and as appropriate, adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity.

Incentive measures can be extremely effective in achieving biodiversity conservation and sustainable use objectives, therefore the following strategic directions are proposed:

Strategic Directions

- Develop a policy on economic incentives for the conservation of biodiversity.
- Incorporate economic values of ecological services provided by biological resources into planning processes.
- Provide incentives to communities to promote biodiversity monitoring, conservation, and sustainable use activities.
- Encourage private sector participation in the conservation and sustainable use of biological resources by developing economic incentive schemes.
- Promote the adoption of the Government-wide Environmental Stewardship Strategy, developed under the Canadian International Development Agency (CIDA) funded Environmental Stewardship of Government Operations Project, for national stewardship, conservation and sustainable use.

4.5.5.4 Research and Training

Article 12(a)
Establish and maintain programmes for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity and its components, and provide support for such education and training for the specific needs of developing countries.

Article 12(c)
Promote and cooperate in the use of scientific advances in biological diversity research in developing methods for conservation and sustainable use of biological resources.

Research and training are essential to develop technical capacity in the various areas of resource management in order to achieve the requirements of the CBD, therefore, the following strategic directions are proposed:

Strategic Directions

- Encourage collaboration among education institutions, resource management agencies, and the private sector to improve training programmes in monitoring, ecological and resource management, biophysical inventory, data management, multidisciplinary research, environmental education, management of protected planning.
- Seek local and/or international collaboration in identifying training opportunities.
- Expand the use of resource management technologies, especially GIS, to assist in the conservation and sustainable use of biological resources, for example, in mapping and monitoring.

4.5.5.5 Environmental Impact and Risk Assessment

Article 14(a)
Introduce appropriate procedures requiring environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, with a view to avoiding or minimising such effects and, where appropriate, allowing for public participation in such procedures.

Article 14(b)
Introduce appropriate arrangements to ensure that the environmental consequences of the programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account.

Article 14(e)
Promote national arrangements for emergency responses to activities or events, whether caused naturally or otherwise, which present a grave and imminent danger to biological diversity, and encourage international cooperation to supplement such national efforts and, where appropriate and agreed by the States or regional economic integration organisations concerned, to establish joint contingency plans.

To strengthen Jamaica's capacity to conduct EIAs and to promote national arrangements for emergency responses, the following strategic directions are proposed:

Strategic Directions

- Increase capacity and human and capital resources to prepare, evaluate and implement environmental impact and risk assessments.
- Develop a comprehensive disaster prevention and emergency response plan for biodiversity, in collaboration with other states where necessary.

Flamingo tongue (*Cyphoma gibbosum*)

4.5.6 Goal 6: Public Awareness and Education and Community Empowerment

Article 13(a)
Promote and encourage understanding of the importance of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in education programmes.

Article 13(b)
Cooperate, as appropriate, with other States and international organisations in developing educational and public awareness programmes with respect to conservation and sustainable use of biological diversity.

Promoting awareness and understanding of the roles and values of Jamaica's biodiversity issues and desired public actions are essential to achieve the effective implementation of the CBD and NBSAP, and therefore the following are proposed:

Strategic Directions

- Secure adequate funding to properly implement the National Environmental Education Action Plan for sustainable development island wide.
- Promote the inclusion of conservation and sustainable use of biological resources issues in the educational curricula at all levels of the education system.
- Promote understanding of the need to conserve biodiversity to increase public support for enforcement of legislation.
- Promote and support informal environmental education initiatives to increase community awareness of the roles and value of biodiversity and conservation and sustainable use issues, using a variety of means including media announcements and public displays at local libraries, botanical gardens, national parks, community centres, museums and other locations.
- Develop specific biodiversity education and awareness messages for personnel in the major economic sectors.
- Continue to document and publish knowledge (including traditional knowledge and practices) which promotes sustainable use of biological resources, taking into account the need for compensation of the owners of traditional knowledge.
- Strengthen existing co-ordinating mechanisms in order to facilitate a "network approach" to environmental education and public awareness.

One of Jamaica's Anolis species (*Anolis garmani*)

4.5.7 Goal 7: Promote Local and Regional Co-operation and Collaboration in Implementing the CBD and the NBSAP

4.5.7.1 Exchange of Information

Article 17(1)
The Contracting Parties shall facilitate the exchange of information, from all publicly available sources, relevant to the conservation and sustainable use of biological diversity, taking into account the special needs of developing countries.

Article 17(2)
Such exchange of information shall include exchange of results of technical, scientific and socio-economic research, as well as information on training and surveying programmes, specialised knowledge, indigenous and traditional knowledge as such and in combination with the technologies referred to in Article 16, paragraph 1. It shall also, where feasible, include repatriation of information.

Sharing among Parties to the CBD of data and information is essential in supporting efforts to implement the provisions of the Convention. Clearing-House Mechanisms (CHM) are an essential means for the exchange of information.

To enhance the exchange of data and information, the following strategic directions are proposed:

Strategic Directions

- Institute an information deposition agreement between researchers and/or organisations that have been granted permission to conduct research on biodiversity within the region.
- Maintain links among regional organisations and institutions that collect information on biodiversity using national CHM.

- Continue participation in regional initiatives such as Inter American Biodiversity Information Network (IABIN) to increase sharing of data and information.

- Identify priorities for technology transfer and financial assistance.

- Support the development of a meta-database of biological data within the CBD Clearing-House Mechanism.

4.5.7.2 Technical and Scientific Co-operation

> **Article 18(1)**
> The Contracting Parties shall promote international technical and scientific cooperation in the field of conservation and sustainable use of biological diversity, where necessary, through the appropriate international and national institutions.
>
> **Article 18(5)**
> The Contracting Parties shall, subject to mutual agreement, promote the establishment of joint research programmes and joint ventures for the development of technologies relevant to the objectives of this Convention.

Regional collaboration can be a cost-effective way to implement training programmes implement some aspects of monitoring, research and inventory management, protect transboundary endangered species, establish sustainable harvest quotas and to control or prevent the spread of alien species.

The CBD recognises the need for co-operation and collaboration among countries. The Convention states that countries should collaborate in areas of mutual interest (Article 5) and also states the need to co-operate in sharing resources, including financial resources and expertise, for example, co-operation in developing public education and awareness programmes (Article 13); arrangements for emergency responses to events that pose threats to biodiversity beyond national boundaries; access to genetic resources; and the transfer of technology.

Given the importance of regional collaboration to implement the CBD, the following are proposed:

Strategic Directions

- Working with other countries of the region, prepare a regional plan that outlines regional priorities and needs for research, inventory, and monitoring, and seek donor support for these activities.

- Increase regional activities and programmes to ensure that the sustainable harvest of common species is not exceeded.

- Investigate the potential for the establishment of a regional network of protected areas to conserve marine and other transboundary species.

- Increase activities to conserve transboundary endangered and threatened species, including preparation of regional species recovery plans.

- Continue efforts to develop regional responses to emergencies, such as oil spills.

- Increase efforts to address problems associated with transboundary pollutants and hazardous maritime traffic.

- Continue to develop a national biosafety policy and procedures and establish linkages with regional and international biotechnology committees to initiate a regional approach to the safe transfer, handling and use of living modified organisms resulting from modern biotechnology.

- Promote ecologically sustainable tourism in the region, including developing regional codes of conduct for tour operators, and convening appropriate training courses through the Caribbean Tourism Action Plan.

- Promote regional collaboration in the training of personnel, and the movement of personnel throughout the region to strengthen the regional planning capacity in all aspects related to implementation of the CBD.

Gungo Pea Stem Cutter, (*Oncideres canidia*)

PART III: ACTION PLAN

Endemic Species of Jamaica
Jamaican Iguana, *Cyclura collei,* ©Andrew Smith

5. ACTION PLAN

5.1 Introduction

In order to implement the strategic directions to achieve the goals of the National Biodiversity Strategy a number of specific projects are being recommended. A total of 37 projects have been identified, however the list is by no means exhaustive. The projects were designed to address the seven goals outlined in the Strategy. Seventeen projects have been identified for priority implementation within the next 5 to 7 years. Eight of the seventeen projects have been designated the highest priority for implementation within next two years (Appendix IV). A summary of the projects, categorised under the relevant goal, is shown in Section 5.7. The criteria used to prioritise project implementation are as follows:

- Projects/initiatives listed in existing national policies;
- Projects which have already been given some level of national or international exposure;
- Projects that address rehabilitation of degraded resources;
- Projects that undertake education and public awareness;
- Projects that fulfil Jamaica's requirements under international conventions;
- Projects that increase national capacity for implementation; and
- Projects that address the sustainable use of economic species.

5.2 Actions, Schedules and Budget

Each project outlines information on specific activities and/or policies required for implementation; partner organisations, institutions or agencies recommended for participation in the project; supporting Government agencies and other partners; the project's lead agency; and a timetable of outputs. The proposed duration of each project is given and represents the minimum time required to initiate implementation or, in some cases, to complete projects of short duration (see Appendix V). Some projects will require additional implementation time, particularly those under the portfolio of sustainable use which are long-term projects, the results of which may not be visible for several years.

5.3 Monitoring and Evaluation

Measures will be put in place for monitoring and on-going evaluation to ensure the success of the projects. These will also include monitoring changes in the economy, the environment and within the society to determine the impacts and implications of the projects. Monitoring and evaluation of all projects will be conducted by a body appointed by the project's Steering Committee working in collaboration with the National Biodiversity Secretariat (to be established). Project and evaluation reports will be made available to the public through the National Clearing-House Mechanism, as well as libraries and/or web sites of relevant partner organisations.

A review of the implementation of all projects will be carried out every two years and a National Evaluation Report of the Action Plan will be submitted to Cabinet every two years.

Overall success of the Action Plan will be measured by the following factors:

- Number of projects successfully developed for submission to funding agencies;
- Number of project applications which attract international/regional/local funding;
- Timely implementation of projects;
- Timely completion of projects; and
- Successful implementation of each project based on objectives and outputs achieved.

Changes in the environment will be measured by indicators based on international guidelines which include environmental, social and economic factors. Criteria for selecting these indicators include:

- Baseline data already exists;
- Collection of new data is not prohibitive in cost; and
- Allow for comparison with regional and/ or international data.

The components of project implementation such as project management, project approach and targets, public success and goal achievement will be measured by the criteria listed below.

5.3.1 Project Management

- Capacity of the lead agency, supporting agencies and other partners;

- Duration and levels of Government and local community support; and
- Rate of project implementation.

5.3.2 Project Approach

- Community-based and stakeholders (forestry, fisheries, wildlife) involvement;
- Government extension services;
- *In-situ* conservation (e.g. protected areas);
- *Ex-situ* conservation (e.g. plant propagation);
- Sustainable use of resources;
- Data gathering and research;
- Training and education;
- Public education and awareness; and
- Co-management.

5.3.3 Project Targets

- Internal deadlines;
- External deadlines;
- Submission of reports;
- Monthly or bi-monthly achievement; and
- Annual achievement.

5.3.4 Public Success

- Public awareness;
- Public participation; and
- Public acceptance.

5.3.5 Goal Achievement

- Conservation of biodiversity;
- Sustainable use of biological resources;
- Facilitation of access to biological resources to promote developments in biotechnology and benefit sharing;
- Safe transfer, handling and use of living modified organisms;
- Enhancement of resources management capacity;
- Public awareness and education and community empowerment; and
- Promotion of local and regional co-operation and collaboration in implementing the CBD and the NBSAP.

5.4 Funding and Promotion

Financial resources will need to be secured to implement the project concepts outlined in Section 5.8. It is envisaged that the body responsible for co-ordinating and implementing the National Biodiversity Strategy and Action Plan, the proposed National Biodiversity Secretariat (see the first project on page 51), will have financial sustainability as one of its fundamental goals. In support of this, the staff list for the proposed Secretariat includes two persons trained in financial resource identification and negotiation, who will be responsible for identifying and securing funding for implementation of projects in the Action Plan.

Potential funding sources include the Global Environment Facility; United States Agency for International Development; European Union Inter-American Development Bank; Caribbean Development Bank; World Bank, Swedish International Development Agency; Canadian International Development Agency; United Nations Development Bank; Department for International Development (U.K.); United Nations Environment Programme; United Nations Food and Agricultural Organisation; philanthropic groups; national donor agencies (e.g. Environmental Foundation of Jamaica); private sector companies; and the Government of Jamaica. In addition to financial and technical assistance, in-kind contributions will also be solicited (e.g. personnel sharing, office allocations).

Some projects already are under negotiation for funding and these are indicated within the project description.

5.5 Project Planning

The Action Plan provides the project concepts that are to be developed into project proposals by the lead agencies. Where there are areas for amalgamation, the lead agencies will collaborate in the project formulation and implementation.

5.6 Agencies

For each project a lead agency has been identified. This is a government body that will take responsibility for co-ordination and implementation of the project, in collaboration with the proposed National Biodiversity Secretariat. Supporting agencies have also been identified which include Government agencies, statutory bodies or educational institutions that will assist by giving logistical and implementation support. Partner organisations will assist in project implementation through co-management arrangements where appropriate. A list of the relevant agencies is given in Appendix VI.

5.7 List of Suggested Projects

GOAL	PROJECT TITLE	LEAD AGENCY	DURATION	PAGE
Conserve Biodiversity	**Establishment of the National Biodiversity Secretariat as a Supporting Mechanism to Implement and Monitor the NBSAP	NEPA	3 years	51
	*Financial Sustainability of Protected Areas	MLE	5 years	52
	Involvement of Private Landowners in Protected Area Management	NEPA	2 years	53
	**Preparation for the Declaration of Protected areas: Black River, Mason River, Port Antonio, Dolphin Head, Cockpit Country, and Rozelle/ Rozelle Falls	NEPA	4 years	54
	Declaration of Forest Reserves	Forestry Department	3 years	55
	*Rehabilitation of Degraded Forests	Forestry Department	5 years	56
	**Rehabilitation of Coral Reef Ecosystems	NEPA	10 years	57
	Regulation of Collection and Harvesting of Wild Fauna and Flora	NEPA	2 years	58
	**Reduction of Pollutants in Freshwater and Marine Environments	NEPA	2 years	59
	Establishment of Three Plant Rescue Centres	Ministry of Agriculture-Royal Botanical Gardens	2 years	60
	**Preparation of an Alien Invasive Species Management Strategy	NEPA	3 years	61
	Implementation of the Ocho Rios Marine Park Management Plan	FOS	2 years	63
	**Implementation/preparation of recovery strategies for critically endangered species	NEPA	5 years	64
Sustainable Use of Biological Resources	Development and Implementation of Criteria for Sustainable Use of Resources	NEPA	3 years	65
	*Development of Sustainable Fisheries	Fisheries Division	5 years	66
	*Development of Sustainable Forestry	Forestry Department	3 years	67
	Sustainable Management of Game Bird Populations	NEPA	2 years	68
	Sustainable Management of Bat and Dolphin Species	NEPA	4 years	69
	*Preparation of Ecological Zonation Plan and Land Use Plans for Declared Protected Areas	NEPA	3 years	70
	Promotion of Sustainable Tourism Practices	Ministry of Industry & Tourism	2 years	71
	Development of a Sustainable, Community Based Management Plan for the Yallahs Lagoon Ecosystem	SRC	2 years	72

* = Priority Projects
** = Highest Priority Projects

GOAL	PROJECT TITLE	LEAD AGENCY	DURATION	PAGE
Facilitate Access to Biological Resources to Promote Developments in Biotechnology and Benefit Sharing	*Development of Natural Products Industry, Sustainable Use of Medicinal and Aromatic Plants and the Establishment of *In-situ* and *Ex-situ* Collections	SRC	5 years	73
	**Preparation of Policies and Legislation to Facilitate Access to Biological Resources and Equitable Benefit Sharing	NEPA	3 years	74
	Protection of Traditional Knowledge and Creation of a Traditional Knowledge Register/Library	IOJ	3 years	75
Safe Transfer, Handling and Use of the Living Modified Organisms	Public Education on the Safe Handling and Use of Living Modified Organisms (LMOs)	NBC	3 years	76
	Institutional Capacity Building for Risk Assessment and Management of Living Modified Organisms (LMOs)	JBS	3 years	77
	*Development of Regulatory and Administrative Measures to Control the Safe Handling and Use of Living Modified Organisms (LMOs)	NCST	2 years	78
Enhance Resource Management Capacity	Human Resources Development in Identification, Conservation and Sustainable Use of Genetic Resources	UWI, NCU, CASE UTECH	3 years	79
	*Expansion of the National Clearing-House Mechanism	IOJ	3 years	80
	Establishment of the Jamaica Protected Areas Biological Database	IOJ	2 years	81
	Repatriation of Indigenous Biodiversity Information	IOJ	4 years	82
	*Development of Increased Resource Management Capacity	UWI	2 years	83
Public Awareness and Education and Community Empowerment	Protected Areas Public Education/Information Programme	NEPA	2 years	84
	**Sensitisation of the Judiciary and Training for Customs and Immigration Officers and the Constabulary	NEPA	2 years	85
	Develop and Expand Existing Environment Education Programmes and Exhibits in the Royal Botanical Gardens, including the Hope Zoo	Hope Zoo Royal Botanical Gardens (Public Gardens Division)	4 years	86
Promote Local and Regional Co-operation and Collaboration in Implementing the CBD and the NBSAP	Build on Existing Regional Data and Information Exchange Mechanism	IOJ	2 years	87
	Promotion of a Mechanism for Regional Technical and Scientific Co-operation	NEPA	2 year	88

* = Priority Projects
** = Highest Priority Project

5.8 Project Concepts

Goal 1 Conserve Biodiversity

Title: Establishment of the National Biodiversity Secretariat as a Supporting Mechanism to Implement and Monitor the National Biodiversity Strategy and Action Plan (NBSAP)

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Land and Environment, Forestry Department, Fisheries Division, Institute of Jamaica, Ministry of Foreign Affairs and Foreign Trade, Ministry of Mining and Energy, National Water Commission, Scientific Research Council, National Commission on Science and Technology, Planning Institute of Jamaica, Ministry of Agriculture

Other Partners: National Environmental Societies Trust, Private Sector Organisation of Jamaica

Duration: Three years **High Priority**

Objective: To establish a support mechanism for the NBSAP to ensure that projects outlined are implemented and monitored, thereby achieving the goals of the NBSAP.

Rationale: This project will enable the establishment of a support mechanism to ensure the successful implementation of the National Biodiversity Strategy and Action Plan. This mechanism will be in the form of a Secretariat housed at the National Environment and Planning Agency. The existing NBSAP Steering Committee (see Appendix I for a list of members) will be maintained to guide the Secretariat.

Specific Activities: The main functions of the Secretariat will be co-ordination of project implementation, provision of technical inputs, development of in-country skills in long-term project and programme development and implementation, as well as strategic planning and policy development. This will include training, establishment of project management information systems and promotion of co-management strategies. The National Biodiversity Strategy and Action Plan Steering Committee will be an integral part of this mechanism based on the experience of the members in the development of the process. The Secretariat will have dedicated personnel to identify, source and negotiate for funding to implement the projects outlined.

Requirements: The Secretariat will initially require five persons; the head will be a Programme Coordinator with skills in project management, environmental planning and policy development. The second member of staff will have skills in administration, communication, training and networking. Two persons are proposed with experience in financial resource identification and negotiation to secure funding for project implementation. The fifth person would provide technical and administrative assistance to the Secretariat as required. It is expected that nationals will fill all posts. Required specialised skills can be brought in for the short term, particularly in the area of project monitoring and evaluation.

OUTPUT	Year 1	Year 2	Year 3
Secretariat office established	x	x	x
Secretariat staff hired	x	x	x
Project management information established	x	x	x
Financial resources identified and negotiated	x	x	x
36 profiles for projects developed	x	x	x

Goal 1 Conserve Biodiversity

Title: Financial Sustainability of Protected Areas

Lead Agency: Ministry of Land and Environment

Supporting Government Agencies: National Environment and Planning Agency, Ministry of Finance and Planning, Ministry of Agriculture, Forestry Department, Fisheries Division, Tourism Product Development Company, Jamaica Tourist Board, Ministry of Industry and Tourism

Other Partners: Jamaica Conservation and Development Trust, Jamaica Protected Areas Network, Chief Parliamentary Counsel, United Nations Environment Programme/Regional Coordinating Unit, Attorney General's Department, Planning Institute of Jamaica

Duration: Five years **Priority**

Objectives: To identify and secure funding for the establishment and operation of protected areas; to develop and implement methods of revenue generation to assist in operational costs; and to develop an economic incentive scheme to encourage private sector/individual support for conservation of lands within protected areas as well as the protection of private lands.

Rationale: A number of protected areas are being managed by non-governmental organisations with little or no support from Government. The cost of establishing and operating such protected areas is very high and cannot be met without significant capital investment. Fiscal mechanisms such as user fees, taxes, levies and surcharges can only be supplemental. Some protected areas include private land holdings, as such, fiscal incentives will encourage private landowners to protect their properties.

Specific Activities: An aggressive campaign will be launched to identify potential sources of national and international funding. This could be effected through the National Biodiversity Secretariat, if established. The focus could be on increasing the investment in the existing Jamaica National Parks Trust Fund (JNPTF), and consequently increasing the number of areas currently served by the Fund. Specific activities include a critical evaluation of the mandate of the JNPTF; implementation of a Jamaica National Park Strategic Fundraising Plan; research on economic incentives; discussions with the Ministry of Finance and Planning regarding financial resources; preparation of a Cabinet submission on an economic incentive scheme; and development of recommendations regarding amendments to legislation to incorporate incentives.

OUTPUT	Year 1	Year 2
Mandate of JNPTF evaluated	x	--
Jamaica National Park Strategic Fundraising Plan implemented	--	x
Guidelines for the management of protected areas completed	x	--
User fee system implemented	--	x
Economic incentive schemes implemented	x	x
Protected Areas System Plan revised	x	--
Workshop conducted	--	x

Goal 1 Conserve Biodiversity

Title: Involvement of Private Landowners in Protected Area Management

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Chief Parliamentary Counsel, Attorney General's Department, Ministry of Land and Environment, Ministry of Agriculture, Forestry Department

Other Partners: Private Landowners

Duration: Two Years

Objective: To explore mechanisms for the voluntary involvement of private landowners in agreements related to conservation of lands in protected areas.

Rationale: The first protected area declared under the Natural Resources Conservation Authority Act of 1991, consisted primarily of Government owned lands. More recently, however, protected areas declared have included significant parcels of privately owned land and this has highlighted the need to develop agreements with private owners and organisations.

Specific Activities: Identification and mapping of lands**;** research regional and international voluntary mechanisms; and development of agreements and recommendations for amendments to existing legislation.

OUTPUT	Year 1	Year 2
Legal instruments prepared	x	--
Workshops conducted	x	x
Two agreements with landowners executed	--	x
Lands to establish easement and agreement surveyed	--	x
Private lands mapped	x	--

Goal 1 Conserve Biodiversity

Title: Preparation for the Declaration of Protected Areas: Black River, Mason River, Port Antonio, Dolphin Head, Cockpit Country and Rozelle/Rozelle Falls

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Land and Environment, Forestry Department, Fisheries Division, Institute of Jamaica, Petroleum Corporation of Jamaica

Other Partners: St. Elizabeth Environmental Protection Association, St. Elizabeth Homecoming Foundation, Parish Development Committees, University of the West Indies, Portland Environmental Protection Association, Dolphin Head Trust

Duration: Four years **High Priority**

Objectives: To continue the process of declaring four priority sites listed in the Policy for Jamaica's System of Protected Areas (1997) as well as two areas of significant biodiversity and to commence the management of these areas.

Rationale: The key management objectives for these areas include ecosystem protection, sustainable resource use, recreation and tourism and the protection of natural or cultural areas/features and endangered plants and animals.

The Black River Lower Morass has been recognised both locally and internationally as a site of ecological importance and was designated a Ramsar Site in 1998. Mason River, comprising an area of over 80 hectares, has for many years been recognised as a site of significant scientific and educational interest. The Institute of Jamaica, Natural History Division has managed this site for over twenty-five years as a scientific reserve. Declaration of the Port Antonio marine area is vital to conservation efforts for the marine biodiversity of the area, and also provides an opportunity for developing sustainable use projects. Dolphin Head consists of approximately 120 hectares of mesic limestone forest ecosystem and is considered to be of regional and global biodiversity significance because of its high level of plant endemism. Over 32 percent of plant species in Dolphin Head are endemic. The Cockpit Country is well known for its tropical karst geomorphology and is home to a relatively high percentage of endemic species of flora and fauna. Plant endemism is particularly high. Rozelle is the only known natural habitat for the endemic Blue Swallowtail Butterfly (*Protographium marcellinus*). Another endemic butterfly, *Heraclides therites*, can also be seen in the area. The scenic beauty of Rozelle Falls contributes to the aesthetic value of the area.

Specific Activities: Preparation of legal instruments for the declaration of the areas; identification of suitable organisations to manage the areas; preparation of co-management agreements with relevant stakeholders and preparation and review of the draft management plans for the protected areas.

OUTPUT	Year 1	Year 2	Year 3	Year 4
Land ownership assessed	x	x	x	--
Biological/socio-economic studies completed	x	x	--	x
Community consultations held	x	x	x	x
Existing management plan reviewed	--	x	x	x
Ecological zonation and land use plan developed	x	x	x	x
Management plans prepared	--	--	x	x
Legal instruments prepared	--	--	x	x
Protected areas declared	--	--	x	x
Socio-economic study for Rozelle conducted	--	x	--	x

Goal 1 Conserve Biodiversity

Title: Declaration of Forest Reserves

Lead Agency: Forestry Department

Supporting Government Agencies: Ministry of Agriculture, Ministry of Land and Environment, National Environment and Planning Agency

Other Partners: Suitable organisations in civil society

Duration: Three years

Objective: To declare as forest reserves all outstanding areas of Crown Lands not yet declared, and privately owned lands as appropriate.

Rationale: There are forest areas that are Crown Lands, currently managed by the Forestry Department, which have not yet been declared as forest reserves. The CBD states that *in-situ* conservation is a fundamental requirement for the conservation of biodiversity. Establishment of protected areas is a priority and the establishment of forest reserves will assist the conservation of essential forest resources by providing regulatory control over its use and development.

Specific Activities: Specific activities are required in sequence: identification of Crown Lands not yet declared forest reserves; assessment of areas to be declared as protected; assessment of privately owned unprotected natural forests; survey and demarcation of these areas; declaration of outstanding forested Crown Lands as forest reserves; declaration of privately owned natural forests, as appropriate; preparation of guidelines for declaring forest protected areas; identification of suitable partner organisations; preparation and signing of co-management agreements.

OUTPUT	Year 1	Year 2	Year 3
Crown lands and private forests reviewed	x	x	--
Lands surveyed and demarcated	x	x	--
Outstanding areas declared	x	x	x
Legal instruments prepared	--	--	x
Co-management agreements prepared	--	x	x
Guidelines for declaring forest protected areas developed	--	x	--

Goal 1 Conserve Biodiversity

Title: Rehabilitation of Degraded Forests

Lead Agency: Forestry Department

Supporting Government Agencies: National Environment and Planning Agency, Rural Agriculture Development Authority, National Irrigation Commission, National Water Commission, Fire Department

Other Partners: Suitable organisations in civil society, environmental non-governmental organisations, landowners groups and committees

Duration: Five years

Priority

Objective: To rehabilitate existing degraded forests including reserves.

Rationale: Many forest reserves have suffered from the effects of illegal settlement, clearing for small-scale agriculture, and unsustainable harvesting practices. It is essential that these areas are identified and an effective reforestation/rehabilitation programme be put in place to prevent further degradation of these areas.

Specific Activities: Identification of degraded areas; survey and assessment of degraded areas; prioritisation of degraded areas; preparation of a rehabilitative programme for degraded areas; systematic implementation of rehabilitative programmes.

OUTPUT	Year 1	Year 2	Year 3	Year 4	Year 5
Survey, assessment, identification and prioritisation of degraded areas	x	x	x	x	x
Community consultation held	--	x	x	x	--
Rehabilitative programme developed and implemented	--	--	x	x	x

Goal 1 Conserve Biodiversity

Title: Rehabilitation of Coral Reef Ecosystems

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Land and Environment, Fisheries Division, Ministry of Agriculture

Other Partners: Negril Coral Reef Preservation Society, University of the West Indies (Centre for Marine Sciences, Discovery Bay Marine Laboratory, Port Royal Marine Laboratory), Caribbean Planning for the Adaptation to Global Climate Change (CPACC), Jamaica Coral Reef Action Plan Steering Committee, Jamaica Hotel and Tourist Association, Tourism Products Development Company

Duration: Ten years **High Priority**

Objectives: To establish a rehabilitation programme for Jamaica's coral reefs and continue implementation of the mooring buoy, visitor awareness, tourism industry training programmes and reduction of coastal pollution and sedimentation programmes.

Rationale: Coral reefs are rich in biodiversity. They offer physical protection for the coastline, generate sand for beaches and provide one of the key resources on which our tourism industry is based. The percentage of living coral reef around Jamaica has declined to less than 10% of the reef structure. Causes of degradation include anchor damage, snorkel/diver damage, algal overgrowth due to high nutrient levels from sewage discharge and fertiliser residue runoff and high turbidity levels from increased sedimentation. The Negril Coral Reef Preservation Society has implemented a successful mooring buoy programme in an effort to reduce physical damage caused by anchors. An island-wide programme to halt physical and chemical damage to reefs needs to be put in place.

Specific Activities: Specific activities include an assessment of living coral on all reef systems in Jamaica; identification of sites where mooring buoys are required; installation of mooring buoys at new sites as required; reduction of pollution and sedimentation due to terrestrial run-off (this activity will tie in with the project to reduce pollutants to the freshwater and marine environment page 73); monitoring of water-sports activities; continued awareness programmes in hotels; and specific training for hotel staff.

OUTPUT	Year 1	Year 2	Year 3	Year 4	Year 5	Years 6-10
Assessment of reef systems undertaken	x	--	x	--	x	x
Priority sites identified	--	x	--	--	--	--
Installation of mooring buoys continued	--	--	x	x	--	--
Training for hotel staff	--	--	x	x	--	--
Rehabilitation of coral reef continued	--	--	--	--	x	x
Areas for water-sports activity identified and designated	x	--	x	x	--	--
User fee system for mooring bouys developed and established	x	x	--	--	--	--
Public education campaign implemented	--	x	--	--	--	--

Goal 1 Conserve Biodiversity

Title: Regulation of Collection and Harvesting of Wild Fauna and Flora

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Agriculture, Fisheries Division, Forestry Department, Ministry of Land and Environment

Other Partners: University of the West Indies, civil society

Duration: Two years

Objective: To reduce the current rate of unchecked harvesting of wild flora and fauna in order to conserve Jamaica's biodiversity.

Rationale: Jamaica has a high level of endemism in flora and fauna. Many species are valuable as collector items and are sold by poachers to nationals and visitors who take the items overseas. Highly sought after species include those protected by law such as the endemic Black-billed and Yellow-billed parrots, black coral, and sea turtle shells. Other popular items include bromeliads and orchids. Given the potential threat of harvesting and collecting to species survival, a programme must be developed to regulate and monitor all aspects of species trade.

Specific Activities: Specific activities include the development and implementation of guidelines for the ecologically sustainable use of species and genetic resources; application of the precautionary approach to harvesting and collection of biological resources; formulation of a policy and regulations to facilitate controlled access to biological resources; increased enforcement efforts and monitoring of collection; and launch a public education campaign.

OUTPUT	Year 1	Year 2
Guidelines prepared	x	--
Policy prepared	--	x
Regulatory framework established	--	x
Effective enforcement system in place		x
Public education campaign conducted	--	x

Goal 1 Conserve Biodiversity

Title: Reduction of Pollutants in Freshwater and Marine Environments

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Land and Environment, National Water Commission, Ministry of Health, Urban Development Corporation

Other Partners: Ministry of Agriculture, Water Resources Authority, community-based organisations, University of the West Indies

Duration: Two years **High Priority**

Objective: To reduce the current level of pollution in streams and rivers and the near-shore marine environment, by reduction and control of agricultural run-off and deliberate discharge of industrial waste, domestic waste (sewage) and other waste into these environments.

Rationale: High levels of agro-chemical residues; waste from agro-industries; discharge from shore-based industries and sewage disposal, all contribute to degradation of the aquatic environment and reduction of habitat quality for the organisms that live in these systems. In addition persons who depend on these systems for potable water sources are affected. Pollutants are introduced from terrestrial run-off or direct discharge into the marine environment, rivers or sinkholes. Discharges must be regulated and all effluent disposers licensed and monitored. This project builds on initiatives already in place which address the problem of polluted coastal waters, i.e., The Natural Resources Conservation Authority (NRCA) Coastal Water Quality Improvement Programme (CWIP), the Kingston Harbour Rehabilitation Project and the NRCA Permit and License System.

Specific Activities: Specific activities will include chemical analysis of selected rivers and streams and near-shore sites; licensing of all effluent disposers; regulation of disposal methods, sites and quantities; biomonitoring; preparation of a monitoring programme for chemical levels in conjunction with analysis of biological effects; and increased penalties and fines for offenders.

OUTPUT	Year 1	Year 2
Survey and analysis of rivers, streams and coastal sites conducted	x	--
Effluent disposers surveyed and licensed	--	x
Current disposal regulations reviewed, including establishment of increased penalties and fines for offenders	x	--
Monitoring programme developed and established	--	x
Disposal practices monitored	--	x
Major sources of pollution identified and assessed	x	--
Impacts of agro-chemical pollution identified	x	--

Goal 1 Conserve Biodiversity

Title: Establishment of Three Plant Rescue Centres

Lead Agency: Ministry of Agriculture-Royal Botanical Gardens

Supporting Government Agencies: Ministry of Land and Environment, Institute of Jamaica, Forestry Department

Other Partners: National Arboretum Foundation, Jamaica Horticultural Society

Duration: Two years

Objective: To establish three centres, at existing gardens, where threatened, endangered and endemic plant species can be relocated and rehabilitated as required.

Rationale: Jamaica has a high level of plant endemism. Habitat destruction/degradation due to development activities and illegal harvesting, threaten many of these plant species. The establishment of Plant Rescue Centres will provide a mechanism to prevent the loss of rare and/or endemic species. The Rescue Centres will be responsible for accommodation, rehabilitation and eventual repatriation of specimens as required. These specimens include plants confiscated from illegal harvesting and export, specimens identified on development sites for removal for their protection, and specimens damaged by construction site activities. Plant Rescue Centres are essential to assist in the conservation of Jamaica's threatened endemic flora. The Centres may also be able to generate income from private plant owners requiring flora rehabilitation services.

Specific Activities: Establishment of a Centre at three sites (Cinchona Botanical Gardens, Hope Botanical Gardens and Mason River Scientific Reserve) where rescued plants can be housed and treated; training of staff in plant rehabilitation techniques; and marketing of the Centres to increase public awareness of their existence, function and purpose.

OUTPUT	Year 1	Year 2
Plant rescue centre at Cinchona Botanical Gardens established	x	--
Plant rescue centre at Hope Botanical Gardens established	--	x
Plant rescue centre at Mason River Scientific Reserve established	x	--
Staff trained in plant rehabilitation	--	x
Marketing of centres commenced	--	x

Goal 1 Conserve Biodiversity

Title: Preparation of an Alien Invasive Species Management Strategy

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Forestry Department, Fisheries Division, University of the West Indies, Institute of Jamaica, National Commission on Science and Technology, Plant Quarantine Division, Veterinary Division, Customs and Immigration Division, Hope Zoo, Institute of Jamaica

Other Partners: Protected Areas management organisations, Jamaica Horticultural Society, Bird Life Jamaica, importers of animals and plants**,** non-governmental organisations responsible for managing the Blue and John Crow Mountains National Park, management organisation for the Portland Bight Protected Area, Jamaican Iguana Research and Conservation Group

Duration: Three years **High Priority**

Objectives: To conduct a pilot project on the impact of the White-tailed Deer, the effectiveness of the eradication of alien invasive species on Goat Island and the re-establishment of natural ecosystems in gaps overgrown on selected sites of two protected areas, with a view to developing an Alien Invasive Species Management Strategy.

Rationale: Jamaica's ecosystems are greatly threatened by alien invasive plants which have long been recognised as a major threat to the island's biodiversity. The most aggressive species include Wild Ginger (*Hedychium gardneranum*), Red Bush (*Polygonum chinense*) and several ferns. The control of these plants is challenging and management options need to be evaluated in pilot projects.

The apparent extinction of five vertebrate species, and the decline of several others over the last 150 years have been linked to the introduction of the Indian Mongoose. However, the impacts of alien invasive species in Jamaica remain poorly understood (e.g., the White-tailed Deer [*Odocoileus virginianus*]) and with few exceptions, no attempts have been made to control them. Presently, Jamaica's legislation does not address the threats to native species posed by these species.

Jamaica's dry forests harbour a number of rare and endangered species such as the Jamaican Iguana that are severely threatened by alien/exotic predators including mongooses, cats, dogs and rats. The complete eradication of predators on Great Goat Island will provide ideal conditions for the creation of a wildlife sanctuary for the Jamaican Iguana and other rare and endangered species.

Specific Activities: Specific activities will include an in-depth review, based on existing knowledge, of all introduced species currently in Jamaica's ecosystems, i.e., density, reproductive output, habitat use, potential effects of these species on native biodiversity and options for their control. Past and current experiences of their control in Jamaica and elsewhere will be evaluated. Alien/exotic vertebrates will be completely eradicated on Great Goat Island using techniques that have been effective on similar tropical cays in order to prepare it as a wildlife sanctuary. Based on local and international experience, the most promising methods of re-establishing natural ecosystems in areas overgrown by invasive plants will be identified. The effectiveness of these methods will be evaluated with field experiments in selected areas such as the Blue Mountains, Port Royal Mountains, Cockpit Country and Mason River. Negative side effects of control measures will be considered carefully. The economic costs of implementing control measures on a large scale will be estimated. Current legislation on import and internal trade of introduced species will be examined and legislative gaps facilitating their spread identified. The enforcement of existing legislation will also be evaluated. Based on a review of the pilot projects and best practices, a management strategy will be formulated addressing needs and priorities for research, education, legislation, pilot projects and long-term control measures.

OUTPUT	Year 1	Year 2	Year 3
Existing knowledge on alien invasive species and their potential impacts on native species and ecosystems reviewed	x	--	--
Trade in alien invasive species evaluated	x	--	--
Legislation and enforcement evaluated	x	--	--
Management options evaluated	x	--	--
Management strategy prepared	x	--	--
White-tailed deer Management options for control identified	x	x	--

OUTPUT	Year 1	Year 2	Year 3
Density and reproductive output estimated	x	x	--
Impact on native ecosystem evaluated	x	x	--
Eradication of alien species – Hellshire Hills, Goat Island, etc. Action plan prepared	x	x	--
Equipment, vehicle and boat prepared	x	--	--
Field camps and trapping system established	x	--	--
Alien invasive species removed and native species monitored	x	x	x
Gap Rehabilitation Management options identified	x	--	--
Management options in field trials evaluated	x	x	x
Action plan to manage alien invasive plants prepared	--	--	--

Goal 1 Conserve Biodiversity

Title: Implementation of the Ocho Rios Marine Park Management Plan

Lead Agency: Friends of the Sea

Supporting Government Agencies: National Environment and Planning Agency

Other Partners: Non-governmental organisations, community based organisations, University of the West Indies, Jamaica Protected Areas Network, OREAG, AMC, Fisheries Division, Maritime Authority, Tourism Product Development Company, Jamaica Tourist Board, Jamaica Hotel and Tourism Association, Scientific Research Council, National Council for Ocean and Coastal Zone Management, Discovery Bay Marine Laboratory

Duration: Two years

Objective: To implement the management plan developed by the local stakeholders and community.

Rationale: The boundaries of the marine park were declared in November 1999 and the management plan has been developed in accordance with NEPA draft guidelines in a fully participatory manner over the last two years.

Specific Activities: Implementing a permanent mooring system; initiating a comprehensive community and business education programme; training wardens and/or stewards for enforcement functions; zoning the area in accordance with community needs; continuing the schools education programme; monitoring water quality; implementing the Blue Flag initiative; establishing financial sustainability; disseminating information through brochures, newsletters and the media; organising community awareness and fund raising events; and promotion of merchandise.

OUTPUT	Year 1	Year 2
Area mapped and mooring sites identified	x	--
Moorings established	--	x
Marine Park zoned	x	
Wardens trained in enforcement functions		x
Training workshops for users conducted	x	x
Merchandising identified	--	x
Newsletters, brochures, posters produced	x	x
Community education conducted	x	x
Media networking	x	x
Water quality monitoring programme established	x	--
Fisheries management programme established	--	x
Fisheries data collected	x	x
Resource centre established	--	x

Goal 1 Conserve Biodiversity

Title: Implementation/preparation of recovery strategies for critically endangered species

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Land and Environment, Ministry of Agriculture, Hope Zoo

Other Partners: Sea Turtle Recovery Network, University of the West Indies, Jamaican Iguana Research and Conservation Group, American Zoo Association-Lizard Advisory Group, The World Conservation Union (IUCN), West Indies Iguana Specialist Group

Duration: Five years **High Priority**

Objective: To implement and prepare recovery strategies for critically endangered species and habitats.

Rationale: While there is qualitative information, limited quantitative data are available on the number of individuals, habitat status and movements of Jamaica's sea turtle population. While studies (genetic and nutritional) have been conducted on the Jamaican Iguana and twenty-six head start animals have been released into the Hellshire Hills, their natural habitat, the species has not been successfully bred in captivity. The head-start enclosure at the Hope Zoo needs to be improved and further biological research, including incubation mechanisms is needed. Finally, it is anticipated that other wild flora and fauna will be classified as endangered and as such strategies will need to be developed.

Specific Activities: Annual surveys will be conducted on the Hawksbill Turtle (*Eretmochelys imbricata*), Jamaica Iguana (*Cyclura collei*) and targeted plant and animal species. The activities for the sea turtles will include surveys, mapping of records and primary quantitative and qualitative data, monitoring of nesting beaches and expanding the public awareness programme. The Jamaican Iguana programme will seek to improve the existing breeding enclosures with a view to foster research and stimulate mating and reproduction of the captive population. The remaining endangered flora and fauna species will be determined based on secondary/primary scientific data. Where necessary further surveys will be commissioned.

OUTPUT	Year 1	Year 2	Year 3	Year 4	Year 5
Seven index sea turtle nesting beaches surveyed	x	x	x	x	x
Major sea turtle foraging areas identified	x	x	x	--	--
Jamaican Iguana enclosures upgraded	x	--	--	--	--
Research programme on captive breeding established	--	x	x	x	--
Endangered flora and fauna habitat determined	x	x	x	x	--
Endangered flora and fauna booklet prepared	--	--	--	--	x
Public consultation on management and recovery strategies developed	--	--	--	--	x
Rapid ecological assessment of floral and faunal species in freshwater ecosystems conducted	x	x	--	--	--
Data digitised and mapped	--	x	x	--	--
Management and recovery strategies formulated	--	--	--	--	x

Goal 2 Sustainable Use of Biological Resources

Title: Development and Implementation of Criteria for Sustainable Use of Resources

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Fisheries Division, Forestry Department, Ministry of Land and Environment

Other Partners: Civil society, University of the West Indies

Duration: Three years

Objectives: To determine criteria for the sustainable use of terrestrial and marine resources, and to implement these criteria in order to conserve biodiversity thereby ensuring long-term benefits from their use.

Rationale: The sustainable use of resources is essential to the well being of members of the society in both the short and long-term. Basic living standards can be improved without depleting renewable natural resources and degrading the environment. This project will assist in achieving the sustainable use of Jamaica's natural resources through the development and implementation of appropriate criteria for sustainable use.

Specific Activities: Specific activities will include development of a biological inventory for harvestable and non-harvestable resources; determination of current levels of stock; calculation of harvesting quotas; economic valuation of non-harvestable resources and regulation of collection and harvesting of wild stock.

OUTPUT	Year 1	Year 2	Year 3
Biological inventory completed	x	x	--
Stock assessment completed	x	x	--
Quota determined	--	--	x
Economic valuation conducted	--	x	--
System of regulation implemented	--	--	x

Goal 2 Sustainable Use of Biological Resources

Title: Development of Sustainable Fisheries

Lead Agency: Fisheries Division

Supporting Government Agencies: Ministry of Agriculture, National Environment and Planning Agency, Jamaica Defence Force (Coast Guard)

Other Partners: Montego Bay Marine Park, Caribbean Coastal Area Management Foundation, Negril Coral Reef Preservation Society, Negril Area Environmental Protection Trust, Bluefields Peoples' Community Association, Friends of the Sea, Portland Environmental Protection Association, University of the West Indies (Centre for Marine Sciences, Discovery Bay Marine Laboratory, Port Royal Marine Laboratory)

Duration: Five years **Priority**

Objective: To develop a sustainable fisheries industry in order to halt the current depletion of resources, degradation of the environment and loss of biodiversity.

Rationale: Fish harvesting practices range from traditional non-depletive methods such as line fishing to particularly destructive methods such as dynamiting and use of chemicals. The latter methods combined with over-harvesting, illegal catch of juveniles, and fishing during the closed seasons has resulted in severe depletion of stock and degradation of the environment. Fishing beaches are not managed and do not have adequate facilities to support the current level of activities. A Draft Policy on Ocean and Coastal Zone Management has been prepared to guide *inter alia*, the development of sustainable fisheries.

Specific Activities: Stock assessment of all fishable resources; determination of species-appropriate catch limits; setting of gear limitations; increase in the current level of enforcement; increase of fines and penalties to deter illegal practices; empowerment of fishers to manage fishing beaches; establishment of adequate facilities at fishing beaches; investigation of the mariculture industry; and increased capacity of the Fisheries Division to carry out its mandate. *Queen Conch*: Determine the maximum sustainable yield; establish a minimum shell size for the harvest of conch; revise the management plan, level of poaching and establish the management units;

OUTPUT	Year 1	Year 2	Year 3	Year 4	Year 5
Stock assessment conducted	x	x	x	x	x
Catch limits/quotas determined	x	x	x	--	-
Enforcement of regulations increased	x	x	x	x	x
Fishing beaches upgraded	x	x	x	x	x
Sustainability of mariculture industry investigated	--	--	x	x	--
Queen Conch abundance survey conducted	--	--	--	x	--
Mariculture policy completed	x	--	--	--	--

Goal 2 Sustainable Use of Biological Resources

Title: Development of Sustainable Forestry

Lead Agency: Forestry Department

Supporting Government Agencies: National Environment and Planning Agency, Ministry of Agriculture, Ministry of Land and Environment

Other Partners: Civil society

Duration: Three years **Priority**

Objective: To develop Jamaica's forestry industry with emphasis on the development of sustainable harvesting of resources.

Rationale: The forestry industry is important not only for economic gain but also because of the major role that forests play in the island's ecological balance. Forested areas are high in biodiversity, and Jamaica has a wide range of forest types including dry and wet limestone forests, upper and lower montane mist forests and wetland forests. Forests are important in watershed management and provide habitats for numerous species of flora and fauna.

Specific Activities: Implementation of the National Forest Management and Conservation Plan; continual updating of the inventory of forest lands; assessment of the ecological impacts of introduced species; increase enforcement and penalties as a means of controlling illegal harvesting practices; improvement and expansion of programmes such as forest rehabilitation; and assessment of Crown Lands and private properties. *Lignum vitae*: To educate a critical core of professionals (architects, planners, builders) who interface with trees while executing their remit, especially on the south coast; to plant four thousand seedlings annually; to activate the tree preservation order on Government lands; to look at distribution, population size and level of harvesting; to collect varieties and establish germplasm banks and commercial plots. *Wetlands*: Stock assessment of remaining mangroves; increased enforcement against illegal harvesting and dumping in mangroves, and development and implementation of a management plan for mangroves. *Orchid*: assess habitats and carry out survey; establish an orchid seed and germplasm bank.

OUTPUT	Year 1	Year 2	Year 3
Inventory of forest lands updated	x	x	--
Ecological impacts of introduced species assessed	x	x	--
Increased enforcement of regulations	x	x	x
Orchid survey conducted and habitat assessed	--	x	x
Orchid seed bank and germplasm repository established	--	--	x
Personnel trained in the area of orchid identification	x	--	--
Land ownership ascertained	x	--	--
Mangrove forest stock assessed and inventoried	x	--	--
Wetlands management plan developed	--	--	x
Wetlands policy finalised	--	--	x
Lignum vitae commercial plot established	--	x	--
Public education and awareness programme implemented	x	x	x

Goal 2 Sustainable Use of Biological Resources

Title: Sustainable Management of Game Bird Populations

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Land and Environment

Other Partners: Game bird hunting clubs, Bird Life Jamaica, University of the West Indies (Life Sciences Department), Game Birds Management Committee, Jamaica Sport Shooting Federation

Duration: Two years

Objective: To achieve the sustainable use of Jamaica's game bird population.

Rationale: There are many gun clubs in Jamaica. Although most hunters adhere to existing regulations for bag limits, shooting seasons and game species, there are infractions resulting in a decline of some populations. Additionally, loss of habitat due to developmental pressure and small-scale agricultural enterprises, result in an increased threat to game species. =

Specific Activities: Assessment of Game Sanctuaries/Reserves; stock assessment of game species; monitoring during game hunting season; preparation of game bird management plan; and increased enforcement through the provision of more Game Wardens.

OUTPUT	Year 1	Year 2
Survey of game reserves conducted	x	--
Stock assessment of game species conducted	x	--
Monitoring conducted	--	x
Additional Game Wardens trained and appointed	x	x
Species guides prepared	--	x
Public education campaigns conducted	--	x
Game Reserves on private lands declared	--	x
Management plan developed	--	x

Goal 2 Sustainable Use of Biological Resources

Title: Sustainable Management of Bat and Dolphin Species

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Land and Environment

Other Partners: University of the West Indies-Life Sciences Department, Non-governmental Organisations

Duration: Four years

Objective: To develop a sustainable management plan for Jamaica's bat and dolphin populations, particularly endemic bat species.

Rationale: Twenty-one bat species have been recorded in Jamaica, two of which are endemic. Little research has been conducted on local bat species, their habitat or their status. Current practices such as cave tours using kerosene torches, mining of bat guano for fertiliser, and clearing of forests surrounding caves are having detrimental effects on bat populations because of the sensitivity of the species to habitat change/loss. The Bottlenose dolphin (*Tursiops truncatus*) has been informally reported in Jamaican waters but no comprehensive census has been conducted. The first established dolphin attraction in Jamaica appears to be popular both locally and overseas and there are other requests to establish more dolphin attractions. In order to address the harvesting of dolphins from the wild, the population needs to be assessed and discussions held with relevant stakeholders.

Specific Activities: *Bats* **-** Complete assessment of all populations in all known bat caves, to identify species composition; research on the ecology of each species to determine breeding seasons and feeding grounds; identification and analysis of caves suitable for recreational tours, noting that all Jamaican caves with bat populations pose a health risk (Histoplasmosis) to visitors; determination of user capacity for each cave; determination of closed season for tours based on breeding season analysis; training and certification of tour guides; preparation of a brochure on bats and cave tours; an EIA, with particular reference to bats and cave-dwelling invertebrates, will be required for any bat guano mining operations. *Dolphins* **-** obtain preliminary information on their population at historically known areas; assess habitat conditions and factors affecting survival.

OUTPUT	Year 1	Year 2	Year 3	Year 4
Bat				
Feasibility study of guano mining conducted	--	x	--	--
Assessment of bat populations completed	--	--	x	
Cave tours identified	x	--	--	--
Cave tour guides trained and certified	--	x	--	--
Public information brochures prepared	--	--	x	--
Management strategy prepared	--	--	x	--
Dolphin				
Meetings with stakeholders convened	x	--	x	--
Review of literature and data completed	x	--	--	--
Boat and aerial survey conducted	--	x	x	--
Management strategy prepared.	--	--	--	x

Goal 2 Sustainable Use of Biological Resources

Title: Preparation of Ecological Zonation Plan and Land Use Plans for Declared Protected Areas

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Forestry Department, Fisheries Division, Ministry of Agriculture, Ministry of Land and Environment, Institute of Jamaica

Other Partners: St. Elizabeth Environment Protection Association, Portland Environment Protection Association, South Trelawny Environment Association, Windsor Research Station, Negril Area Environmental Protection Trust, University of the West Indies

Duration: Three years **Priority**

Objective: To determine ecological zonation and land use plans for proposed protected areas and produce an Ecological Zonation/Land Use Map.

Rationale: Many areas have been identified as priority areas for protection status under the Protected Areas Policy. These areas are recognised as having high ecological value, aesthetic appeal and/or recreational potential. The project will enable detailed mapping of ecological zones, habitats and location of rare and endemic flora and fauna. This information is essential to ensure that protected areas are managed in a manner that they will effectively contribute to Jamaica's overall biodiversity conservation strategy.

Specific Activities: Land use survey; determination of ecological zones; identification of habitats for rare and endemic flora and fauna; and preparation of digital maps.

OUTPUT	Year 1	Year 2	Year 3
Land use survey conducted	x	--	--
Habitat identified	x	--	--
Ecological survey conducted	x	--	--
Ecological zones determined and defined	--	x	--
Data digitised and mapped	--	--	x
Red Data Book prepared	--	x	x

Goal 2 Sustainable Use of Biological Resources

Title: Promotion of Sustainable Tourism Practices

Lead Agency: Ministry of Industry and Tourism

Supporting Government Agencies: Ministry of Land and Environment, Jamaica Tourist Board, Tourism Product Development Company, Ministry of Education, Youth and Culture, Ministry of Local Government, Community Development and Sports

Other Partners: National Environment and Planning Agency, civil society, Urban Development Corporation, Jamaica Promotions Corporation

Duration: Two years

Objective: To continue the development of all aspects of the tourism industry with emphasis on conservation of ecological resources and biodiversity; development of alternative types of tourism as outlined in the Master Plan for Sustainable Tourism in Jamaica, including heritage tourism, nature trails and eco-tourism, to reduce the current pressure on ecological resources from traditional tourism.

Rationale: The tourism industry is based on the beauty of Jamaica's resources and the natural environment, but in many ways it has contributed to the degradation of the environment and reduction of biodiversity because of unplanned development, over-subscription of users, lack of adequate infrastructure, destructive practices and lack of awareness. The development of the resort areas of Port Antonio, Oracabessa, Kingston and the South Coast, requires information on carrying capacity to avoid pressures on ecological resources. Promotion of alternative types of tourism will help to alleviate some of the pressures on ecological resources resulting from traditional tourism activities. Development of sustainable eco-tourism activities will also increase awareness of biodiversity issues and encourage supporting research.

Specific Activities: Development of heritage tourism, eco-tourism and other alternative activities; continue the development and implementation of guidelines and codes of conduct; continue the promotion of greening of the tourism industry; acceleration of the TEAM Jamaica Programme for staff in the accommodation and attraction sectors, with additional emphasis on environmental education; and the preparation of a video on the Jamaican environment for hotel television.

OUTPUT	Year 1	Year 2
Heritage and eco-tourism attractions developed	x	--
Carrying capacity studies conducted	--	x
Video on Jamaican environment prepared	--	x
Code of ethics prepared and implemented	x	x

Goal 2 Sustainable Use of Biological Resources

Title: Development of a Sustainable, Community Based Management Plan for the Yallahs Lagoon Ecosystem

Lead Agency: Scientific Research Council

Supporting Government Agencies: St. Thomas Parish Council, National Environment and Planning Agency

Other Partners: St. Thomas Environment Protection Association, Yallahs Pond Management Group, University of the West Indies (Life Science Department)

Duration: Two years

Objective: To develop and implement a sustainable community based management plan for the Yallahs Lagoon Ecosystem

Rationale: The Yallahs Lagoon in St. Thomas is the only permanent hyper-saline ecosystem in Jamaica. Its environs support a variety of shorebirds and is the only site where *Artemia* (brine shrimp) are known to occur naturally in the island. Along with community partners, the Scientific Research Council (SRC) has led the investigation into the commercial potential of the two salt ponds which make up the Yallahs Lagoons. Research has focused on the use of technology to produce *Artemia* cysts and biomass, used in the aquaculture industry world wide as an important component of feed for raising fish.

The full potential of the Yallahs Lagoon Ecosystem can only be realised in the framework of a comprehensive Management Plan. The formulation and implementation of such a plan will ensure the preservation of the ecosystem's unique characteristics while providing policies and guidelines to facilitate the exploration and sustainable use of the natural resource for a wide but complementary variety of activities, including *Artemia* and salt production, eco - and heritage tourism, and conservation activities and research.

Specific Activities: Contract the assistance of specialist consultant to develop a management plan for the ecosystem, through consultations with community groups and stakeholders, field investigations and review of available data at the SRC and in the parish; training and awareness building to enhance the capability of the community to implement the management plan on a sustainable basis.

OUTPUT	Year 1	Year 2
Community based management plan prepared	x	--
Community capacity strengthening to implement plan (training of wardens management group)	x	x
Management plan reviewed	--	x
Management plan implemented	x	x

Goal 3 Facilitate Access to Biological Resources to Promote Developments in Biotechnology and Benefit Sharing

Title: Development of Natural Products Industry, Sustainable Use of Medicinal and Aromatic Plants and the Establishment of *In-situ* and *Ex-situ* Collections

Lead Agency: Scientific Research Council

Supporting Government Agencies: Institute of Jamaica, National Commission on Science and Technology, Ministry of Agriculture, Ministry of Commerce, Science and Technology, National Environment and Planning Agency, Forestry Department, Jamaica Promotions Corporation

Other Partners: University of the West Indies, College of Agricultural Sciences and Education, Northern Caribbean University, Natural Products Institute, Environmental Foundation of Jamaica, Environmental non-government organisations, community based organisations

Duration: Five years **Priority**

Objectives: To determine pharmaceutical and nutraceutical properties of indigenous plants identified as having medicinal and other beneficial properties and to assist in the conservation and sustainable management of significant medicinal and aromatic plants

Rationale: Many plants of known medicinal value have been used in rural parts of Jamaica for centuries. Most of this information was informally transferred and not recorded until the Jamaica Memory Bank was formed. The information in the Memory Bank can now be used as a starting point for identifying priority species for focusing scientific research. Plants of known medicinal or other beneficial value must be targeted for more detailed scientific research and analysis. Medicinal and aromatic plants provide a vital contribution to the health system in Jamaica and many of these plants have not been scientifically studied for isolation of active compounds.

Specific Activities: Review of existing data particularly in the Institute of Jamaica; identification of priority species for analysis; collection of specimens and laboratory analysis and extraction; establishment of a gene bank for medicinal and aromatic plants consisting of field banks, seed banks and *in-vitro* banks; *ex-situ* propagation/conservation in selected areas; improvement of existing laboratory and technological systems; improvement of indigenous capacity to conserve plant species. The regulatory system required will be developed under another project.

OUTPUT	Year 1	Year 2	Year 3	Year 4	Year 5
Literature review conducted	x	--	--	--	--
Priority species identified	--	x	--	--	--
Specimens collected and laboratory extraction	--	--	x	x	x
Nutraceutical and pharmaceutical analyses conducted	--	--	x	x	x
Training conducted	--	--	x	x	--
Feasibility study for markets for bioprospected nutraceuticals and herbal remedies conducted	--	x	x	--	--
Genetic markers for economic plants identified	--	--	--	x	--
Gene bank established and maintained	--	--	x	x	--

Goal 3 Facilitate Access to Biological Resources to Promote Developments in Biotechnology and Benefit Sharing

Title: Preparation of Policies and Legislation to Facilitate Access to Biological Resources and Equitable Benefit Sharing

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Commerce, Science and Technology, Institute of Jamaica, Ministry of Land and Environment, Chief Parliamentary Counsel

Other Partners:

Duration: Three years **High Priority**

Objective: To ensure policies and legislation are in place to guide and regulate access to national biological resources and ensure that the benefits derived from their uses are equitably shared.

Rationale: Jamaica has a wealth of biodiversity and has traditionally granted access to both national and foreign researchers to our genetic resources and to traditional knowledge. Current legislation is insufficient to ensure that there is regulated access to genetic resources and traditional knowledge and appropriate benefit sharing. Many plants are being taken out of the country for scientific investigation to determine their potential value as pharmaceutical products. Policies and legislation are required to facilitate and control access to genetic resources, and to ensure equitable benefit sharing and conservation.

Specific Activities: Identification of existing legal, policy and administrative framework regarding genetic resources; development of a policy and relevant legislation for access and a benefit-sharing regime; establishment of intellectual property regimes addressing ownership issues, as appropriate; standardisation of Material Transfer Agreements for commercial and scientific research to facilitate access to genetic resources; on-going updating of the Jamaica Memory Bank.

OUTPUT	Year 1	Year 2	Year 3
Jamaica Memory Bank updated	x	x	x
Existing Material Transfer Agreements reviewed	x	--	--
Policy and legislation on intellectual property rights related to traditional knowledge and use of bio-resources prepared	--	x	x
Policy and legislation to control access to genetic resources and ensure benefit sharing prepared	--	x	x

Goal 3 Facilitate Access to Biological Resources to Promote Developments in Biotechnology and Benefit Sharing

Title: Protection of Traditional Knowledge and Creation of a Traditional Knowledge Register/Library

Lead Agency: Institute of Jamaica

Supporting Government Agencies: National Environment and Planning Agency, Jamaica Intellectual Property Organisation, Ministry of Commerce, Science and Technology, Ministry of Agriculture, Ministry of Local Government, Youth and Culture

Other Partners: UNESCO

Duration: Three years

Objectives: To protect traditional knowledge in order to ensure equitable access to and benefit sharing for its use, preserve traditional lifestyles and practices useful to conservation of biodiversity and promote appropriate use of this knowledge.

Rationale: Traditional knowledge is quickly becoming lost in Jamaica. This knowledge is usually accessed without appropriate benefit sharing or prior informed consent and needs to be protected, collected and preserved in a manner acceptable to local communities. One means of protecting traditional knowledge and allowing benefit sharing to local communities is through the creation of a traditional knowledge register.

Specific Activities: Conduct assessment of traditional knowledge store in Memory Bank; obtain appropriate consent from owners of traditional knowledge to be stored in Traditional Knowledge Register; develop the means of accessing traditional knowledge and mechanism for benefit sharing from its use; conduct assessment needs for the protection of traditional knowledge by a *sui generis* system; seek protection of some forms of traditional knowledge under current Intellectual Property Right System with consent of holders; introduce appropriate legislative framework to protect traditional knowledge

OUTPUT	Year 1	Year 2	Year 3
Traditional knowledge collected in Memory Bank assessed	x	--	--
Traditional knowledge register developed and maintained	--	x	--
Consultation held with persons with traditional knowledge	x	x	--
Protection mechanism from traditional knowledge developed	--	x	--
Legislation framework for traditional knowledge developed	--	x	x
Sui generis system for traditional knowledge developed	--	x	x

Goal 4 Safe Transfer, Handling and Use of Living Modified Organisms

Title: Public Education on the Safe Handling and Use of Living Modified Organisms (LMOs)

Lead Agency: National Biosafety Committee

Supporting Government Agencies: National Commission on Science and Technology, Ministry of Agriculture, Ministry of Land and Environment, Ministry of Foreign Affairs and Foreign Trade, Institute of Jamaica

Other Partners: Civil society

Duration: Three years

Objective: To sensitize the public on the essential principles of the safe handling and use of products of biotechnology, through a Public Education Programme in Biosafety.

Rationale: The increasing application of modern biotechnology in the agricultural, health and industrial sectors has made it essential that countries institute regulatory frameworks for assessing and monitoring the importation, handling and use of genetically modified organisms and their derived products. The benefits of genetic engineering have fuelled the production of transgenic crops and it is predicted that by 2002 nearly all corn and soya grown in the United States will be genetically modified. The CBD requires that efforts be made to ensure safety for consumers and the environment when transgenic material is imported or developed.

Specific Activities: Preparation of information brochures and fact sheets; administration of baseline survey of knowledge and attitudes; presentation of information to target groups; participation in media interviews; hosting of a schools' debate; administration of a post-sensitization survey; publication of current international activities; hosting of public fora; and promotion of the Clearing-House Mechanism on Biosafety.

OUTPUT	Year 1	Year 2	Year 3
Brochures prepared	--	x	x
Baseline survey on knowledge and attitudes conducted	x	x	--
Campaign to present biosafety information to public and media launched		x	x
Schools' debate held	--	--	x
Public fora held	--	x	x
Post-sensitisation survey conducted	--	--	x

Goal 4 Safe Transfer, Handling and Use of Living Modified Organisms

Title: Institutional Capacity Building for Risk Assessment and Management of Living Modified Organisms (LMOs)

Lead Agency: Jamaica Bureau of Standards

Supporting Government Agencies: National Commission on Science and Technology, Ministry of Agriculture, Scientific Research Council, National Environment and Planning Agency

Other Partners: National Biosafety Committee

Duration: Three years

Objective: To increase institutional capabilities of all agencies involved with biotechnology in order to develop adequate procedures and measures for risk assessment and management.

Rationale: Increasing application of modern biotechnology necessitates proper knowledge and use of living modified organisms. It is the role of Government to minimize associated risks to human health and the environment.

Specific Activities: Training through recognised programmes in specified institutions overseas; establishment of a programme of local training workshops for staff of key institutions; and purchase of the necessary equipment to enable institutions and agencies to carry out research, data gathering and monitoring of LMOs in the country.

OUTPUT	Year 1	Year 2	Year 3
Overseas training in risk assessment and management of LMOs conducted	x	x	x
Local workshops conducted	--	x	x
Capacity for monitoring LMOs increased	--	--	x

Goal 4 Safe Transfer, Handling and Use of Living Modified Organisms

Title: Development of Regulatory and Administrative Measures to Control the Safe Handling and Use of Living Modified Organisms (LMOs)

Lead Agency: National Commission on Science and Technology

Supporting Government Agencies: Ministry of Foreign Affairs, Ministry of Health, Jamaica Bureau of Standards, Ministry of Agriculture, Chief Parliamentary Counsel, Ministry of Land and Environment, National Environment and Planning Agency

Other Partners:

Duration: Two years **Priority**

Objective: To develop national measures for the regulation and administration for the control and safe handling and use of Living Modified Organisms.

Rationale: The existing National Biosafety Committee has a key role to play in the development of biosafety issues at the national level. However the National Biosafety Committee requires institutional strengthening to enable it to effectively perform this function.

Specific Activities: Preparation of a policy on biosafety and biotechnology; strengthening the institutional capacity of the National Biosafety Committee; and development of relevant legislation and training.

OUTPUT	Year 1	Year 2
Biosafety policy prepared	x	--
Capacity of National Biosafety Committee strengthened	x	--
Biosafety legislation developed	x	--
Capacity building conducted through training	x	x
Biotechnology policy prepared	--	x

Goal 5 Enhance Resource Management Capacity

Title: Human Resources Development in Identification, Conservation and Sustainable Use of Genetic Resources

Lead Agencies: University of the West Indies, Northern Caribbean University, College of Agriculture Science and Education, University of Technology

Supporting Government Agencies: Scientific Research Council, National Commission on Science and Technology, Institute of Jamaica, Ministry of Agriculture

Other Partners: Civil Society, National Environmental Societies Trust, Orchid Society of Jamaica, Natural History Society of Jamaica, Jamaica Horticultural Society

Duration: Three years

Objective: To increase the number of trained personnel in conservation, biodiversity, taxonomy, biotechnology and genetics.

Rationale: Graduate training is required to increase the number of dedicated specialists, especially in some areas where no national specialist now exists.

Specific Activities: Post-graduate training in biotechnology, taxonomy, and biosafety for key personnel in relevant institutions and agencies; identification of suitable programmes or courses locally and/or overseas; and organise training workshops targeting Environmental Non Government Organisations and Community Based Organisations (CBOs) for training in data collection and conservation techniques and training of para-taxonomist.

OUTPUT	Year 1	Year 2	Year 3
Specialist trained (biotechnology)	x	--	--
Specialist trained (taxonomy)	--	x	--
Specialist trained (biosafety)	x	x	x
Training workshops conducted	x	x	x

Goal 5 Enhance Resource Management Capacity

Title: Expansion of the National Clearing-House Mechanism

Lead Agency: Institute of Jamaica

Supporting Government Agencies: National Environment and Planning Agency, Scientific Research Council, Forestry Department, Fisheries Division, National Commission on Science and Technology, Ministry of Land and Environment

Other Partners: University of the West Indies, United Nations Environment Programme and United Nations Development Programme

Duration: Three years **Priority**

Objective: To expand the existing national Clearing-House Mechanism (CHM) to meet national needs in the area of information sharing and exchange, both nationally and regionally.

Rationale: Effective management of biological data and information remains an urgent priority despite recent initiatives to improve access to and management of biological data. In 1991, the Conservation Data Centre-Jamaica was established at the University of the West Indies as a biological data unit to assist in the establishment and development of National Parks. The Centre was closed several years ago. A national biodiversity information network, the National Clearing-House Mechanism has been established at the Institute of Jamaica to support the implementation of the Convention on Biological Diversity through the promotion and facilitation of scientific and technical co-operation. Biological, agricultural and biochemical data and information are urgently needed to meet this goal.

Specific Activities: Establishment of a national Clearing-House Mechanism Committee with representatives from key Government agencies, civil society and the academic community to provide a framework for strengthening the existing national CHM; assessment of the value of existing data at the Conservation Data Centre and transfer of relevant data and literature to the national CHM at the Institute of Jamaica; establishment of systems of consistent transfer of quality controlled data to the national CHM; creation of biological data in digital format to facilitate the use of Geographical Information Systems utilizing a format that is widely applicable; and participation in a regional metadata project developed by the Inter-American Biodiversity Information Network, which develops national capacity for more efficient and precise searches for information than the World Wide Web, identifies available information on biodiversity at the national level, identifies in-country information providers, and develops a national infrastructure for the exchange of biodiversity information.

OUTPUT	Year 1	Year 2	Year 3
National Clearing-House Mechanism Committee established	x	--	--
Existing biodiversity information from the closed Conservation Data Centre assessed and transferred	x	x	x
Workshops to identify data providers and data at the national level conducted	x	x	x
System of data transfer to the CHM established	x	x	x
Creation of digital format for data gathered (e.g. purchase of GIS software)	x	x	x
Development of meta-data bases	x	x	x

Goal 5 Enhance Resource Management Capacity

Title: Establishment of the Jamaica Protected Areas Biological Database

Lead Agency: Institute of Jamaica

Supporting Government Agencies: Ministry of Agriculture, Fisheries Division, Forestry Department, National Environment and Planning Agency

Other Partners: Jamaica Protected Areas Network, Jamaica Conservation and Development Trust, Negril Area Environmental Protection Trust, Montego Bay Marine Park, Negril Coral Reef Preservation Society, Windsor Research Station, Southern Trelawny Environmental Agency, Portland Environment Protection Association, Dolphin Head Trust

Duration: Two years

Objective: To provide a referenced source of information to evaluate the role, extent and status of protected areas in Jamaica.

Rationale: Protected areas are vital for biodiversity conservation. Areas already declared as well as those proposed for declaration will require detailed biological surveys to assist in preparation of management plans, preparation of zonation maps and identification of species and habitats for priority protection. The integration of isolated data from each protected area into a national database will provide the basis for a coherent, integrated conservation programme. Information compiled by the Conservation Data Centre, Jamaica, opened in 1991 and closed in 1998, needs to be reviewed and integrated. The Institute of Jamaica, host for the national Clearing-House Mechanism (CHM), will be the appropriate institution to host the Protected Areas Biological Database. The CHM will co-ordinate the development of the protected areas databases to ensure use of standardised methods, compatibility of data, efficient data exchange as well as support for NGO's with limited capacity. This project will be implemented after declaration and establishment of new protected areas, following the completion of the required inventories for these areas.

Specific Activities: Compilation of; i) biological aspects of protected areas (information should be available after implementation of other projects listed herewith); ii) lists of protection mechanisms for each protected area; iii) lists of infrastructure and species protected by each area; iv) list of threats to species; development of i) metadata for the protected areas and species; ii) metadata for bibliographic references, organisations, experts and geo-spatial information.

OUTPUT	Year 1	Year 2
Management information system developed	x	--
Staff trained	x	--
Metadata base developed	x	x
Links to CHM established	x	x

Goal 5 Enhance Resource Management Capacity

Title: Repatriation of Indigenous Biodiversity Information

Lead Agency: Institute of Jamaica

Supporting Government Agencies: National Environment and Planning Agency

Other Partners: University of the West Indies

Duration: Four years

Objective: To gain access to all Jamaican biodiversity information currently housed in museums, research institutions and universities overseas.

Rationale: A considerable amount of research has been conducted on Jamaican flora and fauna with specimens collected and housed in overseas institutions. The aim would not be to physically return specimens and holdings to the island but to identify all relevant holdings, produce a catalogue of biodiversity information, and create electronic access to the information through the Clearing-House Mechanism at the Institute of Jamaica. This knowledge should be readily accessible to all Jamaicans, particularly decision-makers, so that resources are not wasted on research efforts where information may already exist. The information will also be used to enhance the existing knowledge base in the island.

Specific Activities: Identification of institutions that house information relevant to Jamaican biodiversity; analysis of the type of information and its relevance to various areas of biodiversity conservation; establishment of a dedicated web-page hosted by the Institute of Jamaica to provide an electronic link to databases of identified institutions.

OUTPUT	Year 1	Year 2	Year 3	Year 4
Institutions and holdings identified	x	--	--	--
Information collected from overseas institutions	--	x	x	x
Web-page established	--	--	--	x

Goal 5 Enhance Resource Management Capacity

Title: Development of Increased Resource Management Capacity

Lead Agency: University of the West Indies

Supporting Government Agencies: National Environment and Planning Agency, Ministry of Land and Environment

Other Partners:

Duration: Two years **Priority**

Objective: To increase the professional capacity of resource managers in the areas of economic evaluation of biodiversity, financial resources identification and project monitoring and evaluation

Rationale: The ecological resources of Jamaica provide the basis of many key industries, including top foreign exchange earners such as tourism. Many of these industries contribute to the loss of the very resources on which they are dependent. The development of policies that encourage users to account for the economic cost of natural resource depletion/degradation into their financial cost would transfer the burden of conservation from Government agencies, increase awareness by the industries of the resources on which they are dependent and are depleting, and seek to generate additional funds which can be targeted directly to biodiversity conservation. Project managers and environmental non-governmental organisations need to be trained in project monitoring and evaluation in order to provide effective reporting on projects.

The identification of international financial resource agencies (e.g. non-governmental organisations, philanthropic groups, financial institutions) interested in funding biodiversity projects; the preparation of targeted proposals and negotiation with representatives are all specialised skills currently lacking in Jamaica. Jamaica is therefore unable to access many potential sources of financial assistance. This project will train two persons to source and secure financial assistance for projects in the Action Plan whose services will be available to the National Biodiversity Secretariat.

Specific Activities: Training of five persons currently working in the field of environmental management or natural resources assessment, who already have a first degree (or higher) in economics or environmental management, at recognised educational institutions; training workshops, organised by the University of the West Indies, for other relevant personnel not requiring a high level of training. Overseas training of two individuals currently working in the field of environmental management or economics to acquire specialised skills to source and secure financial assistance for biodiversity projects. The Ministry of Land and Environment will organise a short training course, aimed at professionals already working in the field and with some experience of project monitoring and evaluation, to be held locally by an internationally recognised educational organisation with relevant expertise.

OUTPUT	Year 1	Year 2
5 persons with specialised skills in environmental economics trained	x	x
Professional staff at NEPA and MLE trained in project monitoring and evaluation	x	x
2 persons with specialised skills in sourcing financial resources trained	--	x

Goal 6 Public Awareness and Education and Community Empowerment

Title: Protected Areas Public Education/Information Programme

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Ministry of Land and Environment, Institute of Jamaica, Ministry of Agriculture, Ministry of Education, Youth and Culture

Other Partners: Jamaica Protected Areas Network

Duration: 2 years

Objective: To provide readily understood and accurate information on the protected area system including protected areas, Fish Sanctuaries, Game Reserves, heritage sites and forest reserves.

Rationale: The National Environment and Planning Agency is responsible for the development of a national system of protected areas, and for promoting public awareness of the ecological systems of Jamaica and their importance to the social and economic life of the island. Information provided will assist in promoting an appreciation for and/or understanding of the concept of protected areas and encourage public interest, support for and participation in all aspects of protected area planning and management.

Specific Activities: Research on values/benefits of protected areas and preparation of pamphlets, brochures, fact sheets, CD-ROM on protected areas; and identification of specific community activities which negatively impact on protected areas such as fires.

OUTPUT	Year 1	Year 2
Research on values/benefits of protected areas conducted	x	x
Audio-visual material produced and distributed	x	x
Pamphlets, brochures, fact sheets, CD-ROM prepared and distributed	x	x
Information on wild fire management prepared	x	--
Community consultation conducted	x	x

Goal 6 Public Awareness and Education and Community Empowerment

Title: Sensitization of the Judiciary and Training for Customs and Immigration Officers and the Constabulary

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: University of the West Indies, Forestry Department, Fisheries Division, Attorney General's Department, Ministry of Foreign Affairs and Foreign Trade, Institute of Jamaica, Jamaica Constabulary Force, Ministry of Land and Environment, Ministry of Agriculture

Other Partners: Civil society

Duration: Two years **High Priority**

Objective: To sensitize the judiciary, staff of customs, immigration, and the constabulary to the importance and relevance of biodiversity including education on endemic and endangered species and habitats, conservation issues and threats to national biodiversity.

Rationale: Members of the judiciary and law enforcement officers are in a key position to assist in the conservation of biodiversity through their jobs in customs, immigration and in the courts. However, it is recognised that not enough emphasis has been placed on issues of biodiversity, conservation and environmental management as other issues in the society are pressing and demand attention. Sensitizing personnel in key agencies on biodiversity issues and regulations will significantly improve enforcement of environmental laws.

Specific Activities: Organise workshops for the judiciary which include topics: threats to biodiversity, key issues in conservation, valuation of natural resources and general enforcement and compliancy; organise workshops for enforcement, customs and immigrations officers and wardens which include topics: identification of endemic and endangered species, usual methods of export of such species, identification of harmful exotic species, usual methods of importation of such species, threats to biodiversity and key issues in conservation.

OUTPUT	Year 1	Year 2
Training workshop for Customs and Immigration officers conducted	x	--
Training workshop for Plant Quarantine and Veterinary Division conducted	x	--
Training workshop for Game Wardens along with NEPA and Forestry Wardens conducted	--	x
Training workshop for Jamaica Constabulary Force and Defence Forces conducted	--	x
Enforcement manual produced	x	--
Training Workshop for the Judiciary conducted	x	x

Goal 6 Public Awareness and Education and Community Empowerment

Title: Develop and expand existing environment education programmes and exhibits in the Royal Botanical Gardens, including the Hope Zoo

Lead Agency: Royal Botanical Gardens, Hope (Public Gardens Division), Hope Zoo

Supporting Government Agencies: Ministry of Agriculture, National Environment and Planning Agency, Forestry Department, Institute of Jamaica

Other Partners: University of the West Indies, Civil society, University of Technology, College of Agriculture, Science and Education, Tourism Product Development Company, Eboney Park, Jamaica Conservation and Development Trust, Private Sector, National Wildlife Foundation of Jamaica,

Duration: Four years

Objectives: To provide, through the Botanical Gardens, the public with readily understood and accurate information on a wide range of plants both in narrative, pictorial, and living exhibits and samples; provide information needed to conserve local herb and medicinal plants; enhance the existing public education and awareness programmes currently run by the Hope Zoo with effective displays at the exhibits, in conjunction with education material.

Rational: There is a need to increase the Jamaican public's appreciation of their endemic and local wildlife by providing the opportunity to see some of these plants and animals. The average person has limited knowledge of the importance of plants and basic horticultural practices. The development and implementation of an appropriate education programme will provide the information required to create awareness necessary for the improved appreciation of biodiversity and general environmental issues. The Public Gardens and Hope Zoo are the ideal venues to foster this programme. This will be done through showcasing endemic and local flora and fauna in improved exhibits which stimulate interactive learning and by reinforcing this experience with information packages and other literature.

Specific Activities: Establish a herb and medicinal garden for local plants which will be supported by a Gene Bank for endemic plants species; develop mechanisms to maintain the recently refurbished Hope Gardens Orchid House; organise workshops on propagation and growing techniques as it relates to grafting, stem cutting, mulching and composting to promote proper gardening techniques; establish a butterfly house for educational, research and conservation purposes; upgrade and enhance the existing Hope Petting Zoo facilities; improve local wildlife exhibits; establish nature trails with camping spots, animal feeding stations, bird watching and interpretive narratives; information packages for dissemination to the public and in particular students; and establish a biodiversity exhibit/nature trail based on the existing exhibit owned by the Jamaica Conservation and Development Trust.

OUTPUT	Year 1	Year 2	Year 3	Year 4
Local herb and medicinal gardens established	x	x	--	--
Workshop on propagation and growing techniques conducted	x	--	x	--
Gene bank on Jamaica's endemic species established	--	x	x	--
Butterfly house-Hope Gardens established and managed	x	x	x	x
Petting zoo and wildlife exhibit upgraded and enhanced	--	x	--	--
Biodiversity exhibit/nature trail established	--	x		
Prepare information packages	--	--	x	--
Butterfly House for the Giant Swallowtail Butterfly-Hope Zoo established	--	x	---	--
Biodiversity centre at Hope Zoo designed and constructed	--	--	x	--
Refurbishing Hope Botanical Gardens Orchid House continued	--	--	x	--

Goal 7 Promote Local and Regional Co-operation and Collaboration in Implementing the CBD and the NBSAP

Title: Build on Existing Regional Data and Information Exchange Mechanism

Lead Agency: Institute of Jamaica

Supporting Government Agencies: Forestry Department, Fisheries Department, Scientific Research Council, Ministry of Land and Environment, Institute of Jamaica, National Environment and Planning Agency

Other Partners: University of the West Indies (Centre for Marine Sciences/Centre for Environment and Development), IABIN, CARINET

Duration: Two years

Objective: To build on regional data exchange mechanisms with a view to initiating and promoting exchange of information.

Rationale: Article 17 of the CBD states that Contracting Parties should facilitate the exchange of information from public sources that are relevant to conservation, and that the information should include research on technical, scientific, socio-economic aspects, as well as on other areas including specialised and traditional knowledge. Information sharing is essential in supporting efforts to implement the provisions of the Convention. The National Clearing-House Mechanism, based at the Natural History Division of the Institute of Jamaica, in collaboration with other programmes and mechanisms will be instrumental in facilitating data and information exchange.

Specific Activities: Institute procedures and agreements for data and information access and use between relevant institutions and agencies in the region; continuing participation in regional initiatives such as IABIN and CARINET; identifying priorities and mechanisms for data transfer; and promoting development of a meta-database for biodiversity data within the Clearing-House Mechanism; collaboration between the National Clearing-House Mechanism and other organisations in the assessment and evaluation of national databases; greater collaboration between the National Clearing-House Mechanism and other organizations in the production of scientifically-sound resource material on biodiversity.

OUTPUT	Year 1	Year 2
Procedures and agreements for data access and use developed	x	x
Data and information priorities and needs identified	x	--
Indicators of information technology priorities, needs and impacts identified	x	--
Meta-data base developed	--	x
Directory of biodiversity research and management resource persons produced	x	--
Catalogues, CDs, etc. as a means of information exchange produced	--	x

Goal 7 Promote Local and Regional Cooperation and Collaboration in Implementing the CBD and the NBSAP

Title: Promotion of a Mechanism for Regional Technical and Scientific Co-operation

Lead Agency: National Environment and Planning Agency

Supporting Government Agencies: Institute of Jamaica, Forestry Department, Fisheries Division, Ministry of Land and Environment, National Commission of Science and Technology, Ministry of Agriculture, International Institute for Co-operation in Agriculture, Caribbean Planning for the Adaptation to Global Climate Change, CARICOM Fisheries Resource Assessment and Management Programme, Caribbean Agricultural Research Development Institute, CARINET

Other Partners: University of the West Indies, Civil Society

Duration: Two years

Objective: To promote regional technical and scientific co-operation in the field of conservation in order to facilitate implementation of the CBD and to derive benefits from co-operative agreements.

Rationale: Article 18 of the CBD promotes the establishment of joint research programmes and joint ventures for the development of technologies, and the promotion of international, and regional technical and scientific co-operation in the field of conservation.

Specific Activities: Collaborate with other countries in the Caribbean region to prepare a regional plan outlining the needs for research, monitoring, and inventory; increase the number of programmes and activities for conserving transboundary endangered and threatened species; participate in regional dialogue to establish guidelines to address problems associated with transport of pollutants and hazardous materials throughout the region; participate in regional development of guidelines regarding safe handling of living modified organisms; and promote ecologically sustainable tourism throughout the region.

OUTPUT	Year 1	Year 2
Collaboration in developing regional plan	x	x
Guidelines for conservation of transboundary species prepared	x	--
Guidelines for transportation of pollutants and hazardous materials prepared	--	x
Guidelines for safe handling of LMO's prepared	x	--
Regional sustainable tourism promoted	x	x

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APPENDIX I

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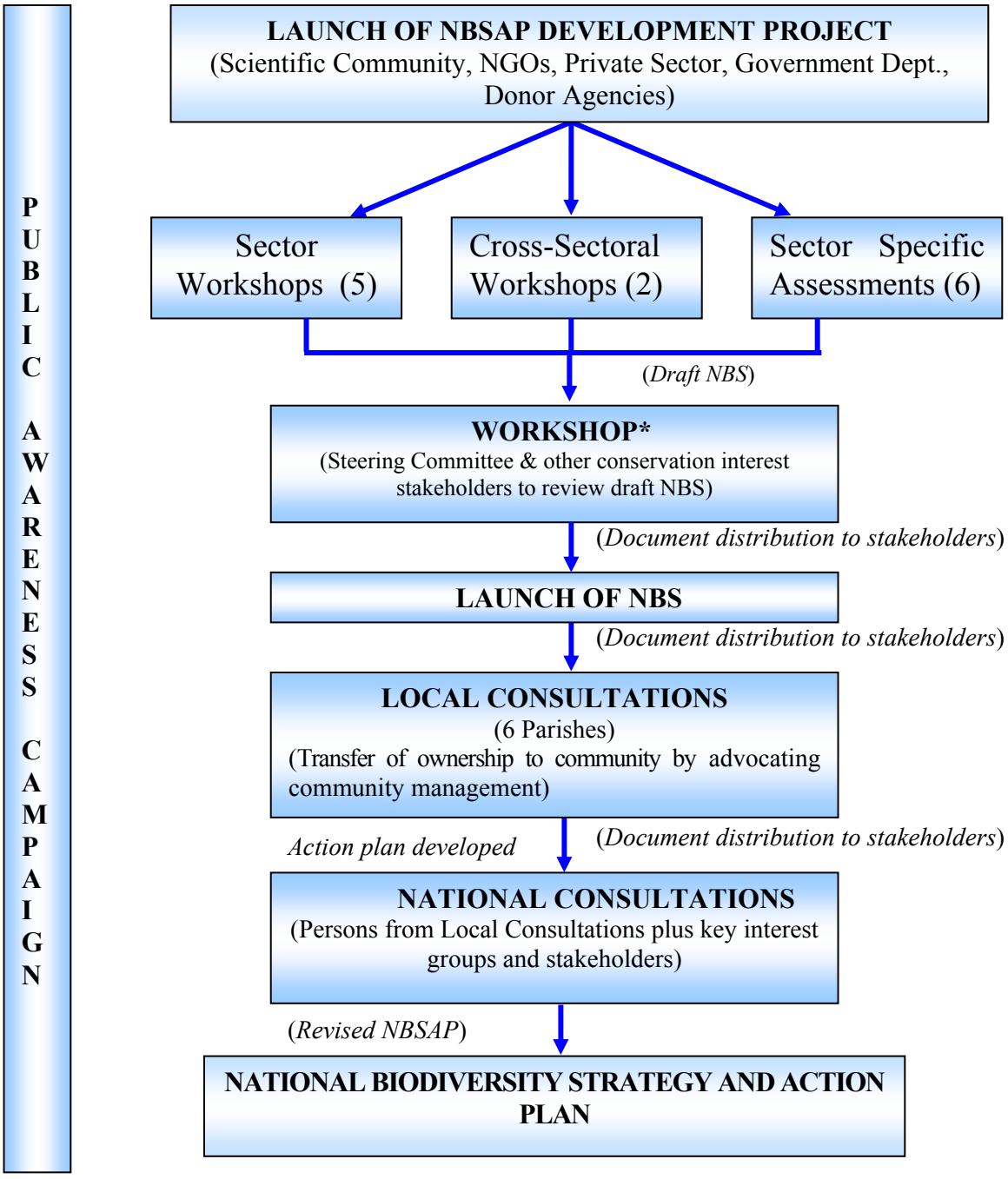
***The assessment reports are available on www.nepa.gov.jm or in the National Environment and Planning Agency Documentation Centre.**

APPENDIX III

National Biodiversity Strategy and Action Plan Development
(Schematic Representation)



***Workshop report available at National Environment and Planning Agency Documentation Centre.**

APPENDIX IV

List of the Proposed Highest Priority and Priority Projects

Highest Priority Projects

- Establishment of the National Biodiversity Secretariat as a Supporting Mechanism to Implement and Monitor the National Biodiversity Strategy and Action Plan
- Preparation for the Declaration of Protected areas: Black River, Mason River, Port Antonio, Dolphin Head, Cockpit Country and Rozelle/Rozelle Falls
- Rehabilitation of Coral Reef Ecosystems
- Reduction of Pollutants in Freshwater and Marine Environments
- Preparation of an Alien Invasive Species Management Plan
- Implementation/Preparation of Recovery Strategies for Critically Endangered Species
- Preparation of Policies and Legislation to Facilitate Access to Biological Resources and Equitable Benefit Sharing
- Sensitization of the Judiciary and Training for Customs and Immigration Officers and the Constabulary

Priority Projects

- Financial Sustainability of Protected Areas
- Rehabilitate Degraded Forests
- Development of Sustainable Fisheries
- Development of Sustainable Forestry
- Preparation of Ecological Zonation Plan and Land Use Plans for Declared Protected Areas
- Development of Natural Products Industry, Sustainable Use of Medicinal and Aromatic Plans and the Establishment of *In-situ* and *Ex-situ* Collections
- Establishment of *In-situ* and *Ex-situ* Collection
- Development of Regulatory and Administrative Measures to Control the Safe Handling and Transfer of Living Modified Organisms (LMOs)
- Expansion of the National Clearing-House Mechanism
- Development of Increased Resource Management Capacity

APPENDIX V

CHRONOGRAM

PROJECTS	DURATION					
	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6-10
Establishment NBS						
Financial Sustainability						
Private Landowners						
Preparation for declaration of PA						
Declare Forest Reserves						
Rehabilitate Degraded Forests						
Rehabilitation of Coral Reef						
Regulate collection						
Freshwater and Marine Ecosystems						
Establish Plant Rescue Centre						
Invasive Species Strategy						
Ocho Rios Plan						
Critically Endangered Species						
Criteria for Sustainable Use						
Sustainable Fisheries						
Sustainable Forestry						
Sustainable Game Birds						
Bat and Dolphin Population						
Ecological Zonation Plan						
Sustainable Toursim						
Yallahs Lagoon Ecosystem						
Natural Products						
Access & Benefit Sharing						
Traditional Knowledge						
PE Safe Handling						
Risk Assessment						
Regulatory and Control for LMOs						
HRD for Genetic Resources						
Clearing-House Mechanism						
PA Biological Database						
Repatriation Information						
Resource Management Capacity						
PA Public Education Programme						
Sensitisation of Judicary						
PE Botanical Gardens & Hope Zoo						
Regional Data & Information Exchange						
Technical and Scientific Cooperation						

APPENDIX VI

Lead Agencies, Supporting Agencies and Partners

The Partner organisations identified in the Action Plan are those organisations which have submitted project ideas or have been identified by the Steering Committee as having a role to play in the implementation and co-ordination of specific projects.

Government Ministries

Ministry of Agriculture
- Forestry Department
- Fisheries Division
- Hope Zoo
- Public Gardens Division
- Plant Quarantine Division
- Veterinary Division

Ministry of Commerce, Science and Technology
Ministry of Education, Youth and Culture
Ministry of Foreign Affairs and Foreign Trade
Ministry of Health
Ministry of Industry and Tourism
Ministry of Land and Environment
Ministry of Local Government, Community Development and Sports
- Fire Department

Ministry of Mining and Energy
Ministry of National Security
- Attorney General's Department
- Chief Parliamentary Council
- Immigration Division

Ministry of Water and Housing

Government Agencies

Institute of Jamaica
Jamaica Bureau of Standards
Jamaica Information Service
Jamaica Promotions Corporation
Jamaica Tourist Board
National Commission on Science and Technology
National Environment and Planning Agency
National Irrigation Commission
National Water Commission
Petroleum Corporation of Jamaica
Planning Institute of Jamaica
Scientific Research Council
Tourism Product Development Company
Urban Development Corporation
Water Resources Authority

Academic Institutions

College of Agriculture, Science and Education
Jamaica Maritime Institute
Northern Caribbean University
University of the West Indies
- Centre for Environment and Development
- Centre for Marine Sciences
- Discovery Bay Marine Lab

Port Royal Marine Lab
Caribbean Agriculture Research Development Institute
University of Technology

Non-governmental Organisations/Community-based Organisations
BirdLife Jamaica
Bluefields Peoples' Community Association
Buff Bay Development Action Committee
Caribbean Coastal Area Management Foundation
Dolphin Head Trust
Friends of the Sea
Jamaica Conservation and Development Trust
Jamaica Environment Trust
Jamaica Horticultural Society
Jamaican Iguana Research and Conservation Group
Jamaica National Parks Trust Fund
Jamaica Protected Areas Network
Jamaica Sport Shooting Federation
Montego Bay Marine Park Trust
National Arboretum Foundation
National Environmental Societies Trust
Natural History Society of Jamaica
Negril Area Environmental Protection Trust
Negril Coral Reef Preservation Society
Orchid Society of Jamaica
Portland Environment Protection Association
Southern Trelawny Environment Protection Agency
St. Ann Environment Protection Association
St. Elizabeth Environment Protection Association
St. Thomas Environment Protection Association
Windsor Research Centre

Private Sector/Other Organisations
Institute of Architects
Jamaica Hotel and Tourism Association
Masters Builders Association
Private Sector Organisation of Jamaica
St. Elizabeth Homecoming

International Organisations
American Zoo Association - Lizard Advisory Group
Caribbean Planning for the Adaptation to Global Climate Change
CARICOM Fisheries Resources Assessment and Management Programme
International Institute for Co-operation in Agriculture
The World Conservation Union (IUCN)
United Nations Development Programme
United Nations Environment Programme/Regional Coordinating Unit

APPENDIX VII

GLOSSARY

Alien species
Species introduced deliberately or unintentionally into areas outside their natural habitat, where they have the ability to invade, establish themselves, out-compete natives and take over their new environments.

Aquifer
An underground bed or layer of earth, gravel, or porous stone that contains water and releases it in appreciable amounts.

Biological Resources
Includes genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems, with actual or potential use or value for humanity (Source: Convention on Biological Diversity).

Bimodal
Having or exhibiting two contrasting forms.

Bio-prospecting
The practice of pharmaceutical firms sending scientists into natural habitats to gather samples for the purpose of testing to determine whether they have properties that may be patented for a profit.

Biosafety
Efforts put forward to reduce and eliminate the potential risks resulting from biotechnology and its products (Source: Biosafety Protocol).

Biotechnology
Any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use (Source; Convention on Biological Diversity)

Broadleaf Forest
A forest which consists mainly of trees with broad, flat leaves of many different shapes. They also called hardwood as broad leaved trees have harder woods.

Buffer zone
The region laying in immediate proximity to the border of a protected area or a transitional zone between areas managed for different objectives. Buffer zones may have land use controls that allow only activities compatible with protection of the of the core area, such as research, environmental education, recreation and tourism.

Calcareous algae
Algae that deposits calcium carbonate (limestone) in its tissue.

Called in
Provision under section 12(1) of the Town and Country Planning Act, which requires that any or all development applications within a prescribed area be referred to the Authority for determination, instead of the Local Planning Authority. Under section 12(1A) of the Town and Country Planning Act, all developments not in conformity with a Development Order are to be referred to the TCPA for determination.

Captive Breeding
The propagation or preservation of animals outside their natural habitat, involving the control by humans of the animals chosen to constitute a population as well as mating choices within that population.

Co-management
The sharing of some aspects of responsibility, and benefits between government, local communities and civil society organisations, in the management of natural resources.

Conservation
The management of human interactions with genes, species, and ecosystems so as to provide the maximum benefit to the present generation while maintaining their potential to meet the needs and aspirations of future generations; encompasses elements of saving, studying, and using biodiversity.

Critically endangered
A species which faces an extremely high risk of extinction in the wild in the immediate future.

Ecology
A branch of science concerned with the inter-relationships between organisms and their environment.

Ecosystem
A dynamic complex of plant, animal, fungal, and microorganism communities and their associated non-living environment, interacting as an ecological unit (Source: Convention on Biological Diversity).

Eco-tourism
Travel undertaken to witness sites or regions of unique natural or ecological quality, or the provision of services to facilitate such travel.

Endangered
Species or subspecies of fauna and flora that are considered to be at very high risk of extinction in the near future, provided present factors contributing to numerical decline or habitat degradation remain as they are or worsen over time.

Endemic
Refers to species or subspecies that are restricted in occurrence to a specified region or locality, and do not occur naturally in any other region.

Estuary
The part of the wide lower course of a river, where it's current is met by the tides. An arm of the sea that extends inland to meet the mouth of a river.

***Ex-situ* Conservation**
The conservation of components of biological diversity, outside their natural habitat (Source: Conservation on Biological Diversity).

Extinct
Species that are no longer known to exist in the wild, even after extensive searches within established habitats as well as other locations where they are likely to have occurred.

Gene bank
A facility established for the *ex-situ* conservation of individuals (seeds), tissues, or reproductive cells of plants or animals.

Germplasm
The genetic material that comprises the inherited qualities of an organism, especially its specific molecular and chemical constitution. Germplasm is living tissue from which new organisms can be grown (e.g. seeds or other plant parts such as leaves, pieces of stem, pollen or even just a few cells can be cultured into a whole plant).

Greenhouse gas
Man-made and naturally occurring chemical compounds found in the Earth's atmosphere (e.g. methane, water vapor, sulphur hexafluoride (SF_6), nitrous oxide, chlorofluorocarbons (CFCs), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and carbon dioxide) which allow sunlight, radiated in the visible and ultraviolet spectra to enter the atmosphere unimpeded, thus increasing temperature levels within the atmosphere and contributing to Global Warming.

Herbaceous
Relating to or characteristic of a herb, as distinguished from a woody plant.

Hydrological basin
A geographical area drained by a particular surface water and/or groundwater system. The basin boundaries are demarcated so that there is generally no flow from one basin into another.

Igneous
Rock produced under conditions involving intense heat, e.g. igneous rock is rock formed by solidification from a molten state, especially from molten magma.

Indigenous species
A species that occurs in multiple areas, but is confined to areas that it occupies naturally, unless directly or indirectly introduced and cared for by humans.

***In-situ* Conservation**
The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

Integrated Coastal Zone Management
Conscious management process that acknowledges the inter-relationships among inland and coastal uses, and the environment. Embraces upland watersheds, the shoreline and its unique landforms.

Invasive species
Any alien species that becomes established in natural or semi-natural ecosystems or habitats and is an agent of change and threatens native biological diversity (IUCN).

Karst
An area of irregular limestone in which erosion has produced fissures, sinkholes, underground streams, and caverns.

Lentic
Pertaining to standing water bodies, experiencing circular but not lateral flow, e.g. ponds, lakes, pools.

Living Modified Organism (Genetically Modified Organisms)
Any living organism that possesses a novel combination of genetic material obtained through modern biotechnology. A living organism is a biological entity, capable of transferring or replicating genetic material.

Lotic
Pertaining to water bodies experiencing lateral flow, e.g. rivers, streams, brooks.

Material Transfer Agreement
A legal agreement that is required whenever material is being transferred from provider to recipient. Material may be any form of biological materials, such as cultures, cell lines, plasmids, nucleotides, proteins, transgenic animals or plants, pharmaceuticals or any other chemical compounds.

Maroons
Taken from the Spanish word "cimarrones", meaning unruly, fugitive, and wild, this term was given to fugitive ex-slaves who settled in the mountains of Jamaica after escaping captivity from the Spaniards during the 18th century. The term is still used to describe the descendants of this group.

Metamorphic
Rock produced by, or exhibiting certain changes, that minerals or rocks may have undergone since their original deposition through the influence of heat and pressure.

Micro-climate
The climate of a small, specific place within an area as contrasted with the climate of the entire area.

Montane
Upper Montane: natural forests with greater than 30% canopy cover, above an altitude of 1800m, with any seasonality regime and leaf type mixture.
Lower Montane: natural forests with greater than 30% canopy cover, between an altitude of 1200 and 1800m, with any seasonality regime and leaf type mixture.

Mulch
A protective covering, usually of organic matter such as leaves, straw, or peat, placed around plants to prevent the evaporation of moisture, the freezing of roots, and the growth of weeds.

Nectarivorous
Relating to organisms that feed on the nectar of flowers; e.g. certain birds, bats and insects.

Rare
Of species that are infrequently occurring or thin in density.

Red Data Book
A compilation of data regarding the population status of species included in the Red List. Both the Red List and Red Data Book show the risk of extinction of species, based on the biological data.

Red List
A compilation of endangered wildlife species.

Saline
Referring to water containing salt as dissolved saline particles, as in seawater or brackish water.

Species
A group of interbreeding organisms that do not ordinarily breed with members of other groups.

Sustainable Use
The use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations (Source: Convention on Biological Diversity).

Swamp
A seasonally flooded bottomland with more woody plants than a marsh and better drainage than a bog.

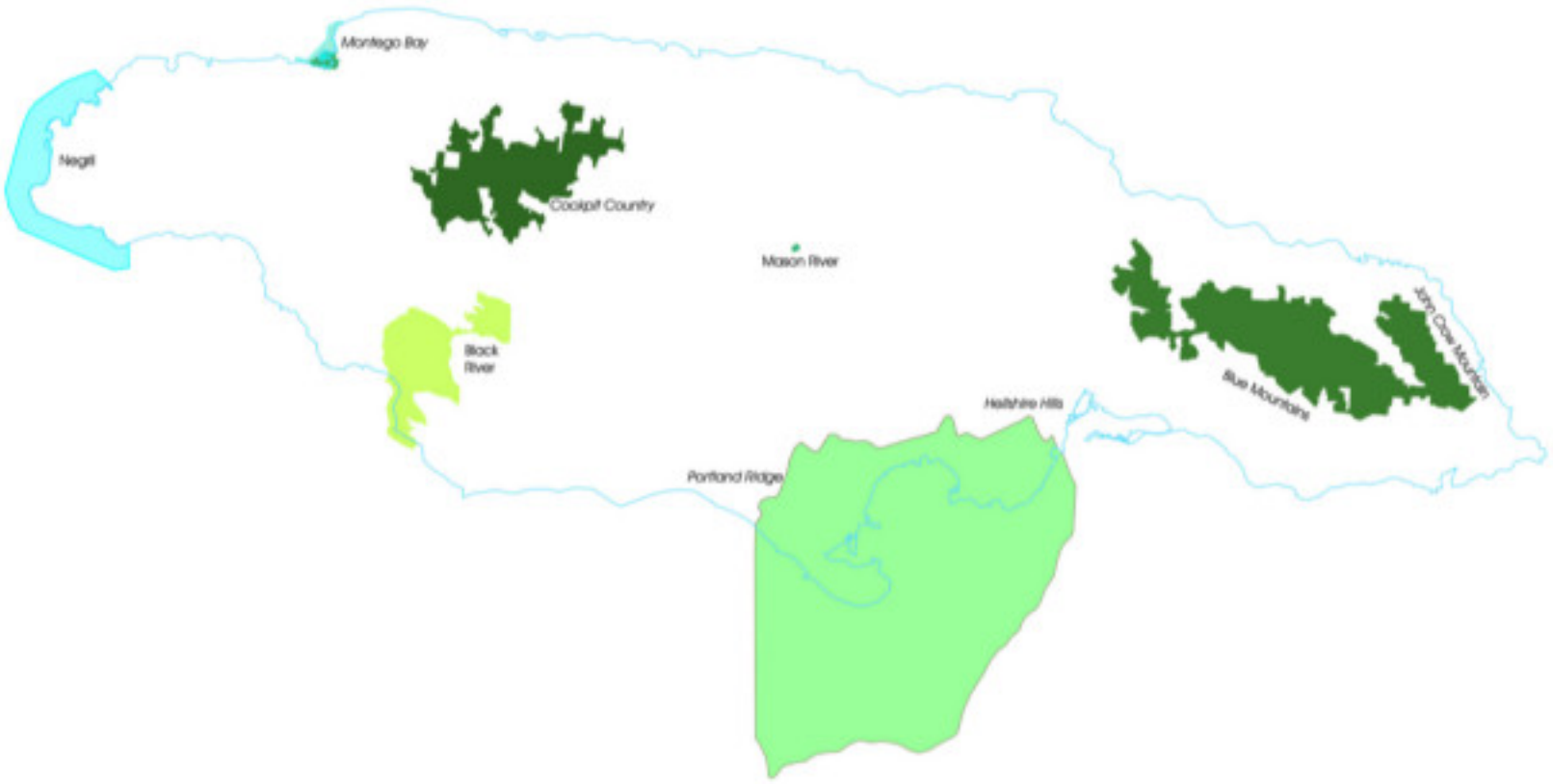
Threatened Species
Species or subspecies or their population that is likely to become endangered within the foreseeable future throughout all or a part of their range, if the factors causing numerical decline or habitat degradation continue to operate.

Transgenic plants
A transgenic crop plant contains a gene or genes, which have been artificially inserted instead of the plant acquiring them through pollination. The inserted gene sequence (known as the transgene) may come from another unrelated plant, or from a

completely different species. Plants containing transgenes are often called genetically modified or GM crops, although in reality all crops have been genetically modified from their original wild state by domestication, selection and controlled breeding over long periods of time.

Vascular plants
Plants that possess vascular tissue for transporting water, nutrients and plant photosynthetic products.

Wetland
An areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which, at low tide does not exceed six (6) metres.


Montego Bay
Negril
Cockpit Country
Mason River
Black River
Hellshire Hills
Portland Ridge
John Crow Mountain
Blue Mountains