

5.0. ASSESSMENT AND ANALYSIS OF BIOLOGICAL RESOURCES

Introduction

The GOB identified seven thematic areas or sectors to be addressed within the National Biodiversity Strategy and Action Plan: Legal and Policy Framework, Forestry and Wildlife, Coastal and Marine Resources, Agriculture, Tourism, Environmental Planning and GIS, and Medicinal Plants. Before these topics can be properly addressed within the Biodiversity Strategy, it is necessary to determine exactly how much is known about the diversity and exploitation of biological resources in Belize. Once diversity and exploitation levels have been assessed, then a detailed analysis of all available information can be conducted, with the objective of identifying gaps, constraints and needs, in order to develop policy guidelines for the sustainable use of Belize's biological resources.

This section presents the highlights of an assessment and analysis of the seven sectors identified above, and sets the basis upon which the Biodiversity Strategy and Action Plan have been developed.

5.1. Status of Biodiversity and Biological Resources

5.1.1. Flora

5.1.1.1. Forests

Vegetation in Belize has been classified in several ways. Hartshorn *et al.* (1984) subdivided the country into six major life zones: Subtropical Moist, Subtropical Wet, Lower Montane Moist, Lower Montane Wet, Tropical Moist and Tropical Wet. More recently, Iremonger and Brokaw (1996) based on a system adopted by UNESCO, classified vegetation as forest, scrub, and herbaceous formations.

Forests dominate the Belizean landscape. Mainland forests have been divided into different classes and are listed below (Land Information Center, 1994).

<u>Forest Class</u>	<u>Area(sq.km)</u>	<u>% of Land Area</u>
Broad leaf Forest	14,190	65.12
Open broadleaf forest	120.31	0.55
Pine forest	576.25	2.64
Open pine forest	73.07	0.34
Thicket and other degenerated broadleaf forest	848.38	3.89
Herbaceous and scrub, secondary after clearing	188.59	0.87
Bamboo and riparian vegetation	115.27	0.53
Coastal Strand vegetation	24.83	0.11
Mangrove, medium and tall	78.20	0.39
Mangrove, dwarf	234.60	1.08
Saline swamp, vegetation with palmetto and mangrove	344.87	1.58
Marsh	419.63	1.63
Total Forest Areas	17,213.98	79.00

Forests cover 79% of the mainland area of the country, and 82% of the total land mass, including coastal cayes.

Non-Timber Forest Products warrant special mention as they have great potential for exploitation. They have been important in the past notably in the form of 'chicle', the chewing gum base produced from the latex of sapodilla (*Manilkara zapota*) and from the poorer quality crown gum 'chicle macho' (*Manilkara chicle* and *Manilkara staminodella*). The range of non-timber forest products is very wide and varied in nature. Apart

from chicle, they include honey, materials for handicraft, thatch from both the Sabal leaf and cohune leaf, Xate (*Chamedorea* spp.) leaf as an ornamental, house-plants, spices, oils, pharmaceutical products, seeds, tree seedlings, orchid plants, poles, palmetto and fruits.

5.1.1.2. Flowering Plant Species and Medicinal Plants

Belize is estimated to have roughly 4,000 species of native flowering plants (Dywer and Spellman, 1981). The broadleaf composition is highly diverse with small areas (1 ha.) containing as many as 73 species. Recent figures from the Forest Department Herbarium indicate that the known number of species in Belize is 3,409, with 1,219 genera in 207 families. The collection represented in the herbarium are 2,054 species with 824 genera and 155 families, indicating that only 60.25% of the known species, 67.59% of the known genera, and 74.88% of the known families, have been collected.

Belize's diverse ethnicity and varied ecosystems, give rise to a rich culture with respect to medicinal plants. Over 600 of the 3,409 higher plants found in the country are reported to have medicinal use. The preservation of medicinal plant diversity has been fostered by the maintenance of over 70 % of the country under forest cover and the establishment of Protected Areas that cover 40 % of the land mass. Local traditional healers and collaborating Government and Non-Governmental Organizations, have made significant contributions to the management and use of medicinal plants. However, the resources are faced with certain threats, and in many cases, the development of this sub-sector occurred before the establishment of supporting legal and policy framework (O'Brien, 1998).

Various studies, surveys and plant collection expeditions have been conducted in Belize, the earliest and most extensive collection being that of Morton E. Peck in 1905 - 1907. From these studies, a total of 3,409 plant species have been recorded. Apart from species listings, there is very little quantitative data available. In addition, the distribution of plants show a clear bias towards sites where collection efforts have been concentrated. A non-representative amount of information exist on medicinal plants in the north-west and extreme north-east of Belize, the higher peaks of the Maya Mountains, and the Bladen area. Medicinal plant diversity is a valuable resource to both traditional healers and the pharmaceutical industry. The monetary value of medicinal plants that can be harvested from one hectare of forest in Belize was assessed to be US \$ 726 - 3,327 (Balick & Mendelsohn, 1992). More important is the relatively untapped pharmaceutical value of tropical plants in treating both known and unknown diseases.

Annex 2 is an inventory of the plants that are reported in Belize. The number of plants that have medicinal use, both locally and regionally, is also provided. Annex 3 indicates the IUCN category of medicinal plants that are considered threatened.

5.1.1.3. Coastal and Marine Plants

Belize's coastline consist of extensive mangroves and littoral forests. Mangroves in Belize are classified into six community types identified on a physiographic basis: Overwash mangroves, Fringe mangroves, Riverine mangroves, Basin mangroves, Hammock mangroves and Saltmarsh with sparse mangrove (Zisman, 1992). In excess of 1,061 cayes of sand and mangroves can be found along Belize's coast. Mainland and coastal mangroves occupy 78,093 hectares, while the coastal strand vegetation covers 2,482 hectares, of which the coastal littoral forest forms a part. Mangrove represent 3.4% of the land area and littoral forests 0.114% (McField *et al.*, 1996). Mangrove and littoral forests are probably the most biologically diverse habitats in Belize after the reef system; a clear distinction in species diversity between these habitats might not even be possible due to the permanent bi-directional flow of biomass from one to the other. Over 590 genera and in excess of 1,040 species of living organisms are known to inhabit mangrove communities, littoral forests, lagoons and watersheds of coastal Belize (Annex 4).

The predominant plant species within the mangrove and littoral forests communities are the red mangrove (*Rhizophora mangle*), the white mangrove (*Laguncularia racemosa*), the black mangrove (*Avicennia germinans*), buttonwood (*Conocarpus erectus*), the saltwort (*Batis maritima*), the glasswort (*Salicornia*

perennis), cord grass (*Spartina cynosuroides*), the tebox (*Myrica cerifera*), the cocoplum (*Chrysobalanus icaco*), the matapalo fig (*Ficus glabrata*), red gumbo limbo (*Bursera simaruba*), black poison wood (*Metopium brownii*), the wild seagrape (*Cocoloba uvifera*), and the coconut (*Cocos nucifera*) (Jacobs, 1998). Though sometimes classified as a mangrove species, *Conocarpus erectus* is loosely associated with saline conditions and is better considered a mangrove associate as it occurs inland behind the other mangroves and is intolerant to flooding.

The seagrass community of Belize covers an extensive area all along the coastline, in mangrove channels, lagoons, atolls and estuaries. Five species are known to occur in Belize: the turtle grass (*Thalassia testudinum*), the manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), and the midrib grasses (*Halophila ballionis* and *Halophila beaudetti*) (McField *et al.*, 1996). The turtle grass is by far the most dominant species, occurring in most areas between mangroves and coral reefs. Seagrass beds act as a transition point and energy bridge between mangrove communities and the reef system. Many juvenile fish species can be found along the mangrove-seagrass fringe in the nektonic community. Many reef carnivores venture off into seagrass beds in search of food; a perfect example is the great barracuda. Threatened species such as the marine turtles and the manatee also depend on healthy seagrass communities as a food source. The health status of seagrass beds in Belize is not known, however, at least three permanent monitoring stations have been established and data collection has begun (Jacobs, 1998). In addition to seagrass, 66 genera and in excess of 300 species of marine algae are known to occur in Belize (Annex 3).

5.1.2. Fauna

5.1.2.1. Terrestrial Fauna

Belize has a high diversity of fauna. This is due to its geographic location in Mesoamerica, the presence of extensive areas of intact natural habitats, relatively low levels of human disturbance, and Belize's location within the natural migration routes of many species. Belize's Interim First National Report (NBC, 1998) describes the country's terrestrial fauna as follows.

Mammals

A total of 163 species of terrestrial mammals have been recorded included in some 30 families. More than eighty of these species are bats. Eight species are endemic to middle America, which include 2 rats, 2 bats, 1 monkey, 1 cacomistle and 1 squirrel. Five species are endemic to the Yucatan Peninsula only, which include 1 mouse, 1 rat and 3 squirrels. Forty-seven species are in some way endangered, threatened, rare, and hunted throughout their ranges. Of these, fifteen are officially designated under CITES appendices and are thus of international concern. Five species of cats are known to occur in Belize. The population of all five species appears healthy. There is concern about the increasing incidence of reported domestic livestock kills. It has been shown that with proper management of domestic livestock such incidents can be minimized (Rabinowitz, 1986; Quigley and Crawshaw, 1992). In NW Belize, where the natural prey base of large cats has not been hunted out, there have been no reported livestock problems. Northwest Belize is an area with perhaps the largest population of medium and large cats (ocelot, puma and jaguar) in Belize and are doing well in conjunction with several large cattle ranching operations. This indicates that proper livestock management and elimination of hunting of natural prey items does work to alleviate such problems (Miller in lit., 1998).

Birds

Some 571 species of birds have been recorded and perhaps these are the best known of the fauna population in the country as they receive yearly attention in bird counts. The country lies in migration routes for both Nearctic and Neo-tropical species, and perhaps for this reason, migrant birds account for some 20% of the species recorded. Birds migrate to Belize from both North America and South America. A total of 81 species of birds are listed as of special conservation concern including the colony – nesting sea and shore birds, vulnerable to disturbance, including that from tourist visitation. Of immediate concern in Belize include the Jabiru, *Mycteria mycteria*; the Scarlet Macaw, *Ara macao*; the Singing Quail, *Dactylortyx thoracicus*; and the Muscovy Duck, *Carina moschata*. The Yellow-Headed Parrot, *Amazona oratrix*, a local endemic to Belize and

one of the better "talking parrots" is under considerable pressure for the local pet trade. The Ocellated Turkey, *Agriocharis accolade* is also of major concern due to its limited range as a regional endemic and sensitivity to hunting pressure. This also negatively affects populations of the larger game birds including the Crested Guan, *Penelope purpurascens* and the Great Curassow, *Crax rubra*. Birds are the best known of all taxa in Belize (Miller and Miller, 1995).

Reptiles

The reptile population recorded covers 121 species included in four groups: snakes, lizards, crocodiles and turtles. Of the snakes, three coral and six vipers are known to be poisonous. Only one reptile is endemic to Belize, from the lizard group called the Gecko, *Phyllodactylus insularis*, that is known only from the cayes on Lighthouse and Glovers Reef. Another lizard, *Anolis allisoni*, is a Caribbean endemic, known only from the Belize cayes and Cuba. There are several regional mainland endemic species mostly from Yucatan, which are present in northern Belize.

Amphibians

Some 42 species of amphibians have been recorded to date, but remains a tentative list for the country. Two known species, *Rana juliani* and *Eleutherodactylus sandersoni* are endemics from the Maya Mountain/Mountain Pine Ridge area. A new species *Eleutherodactylus psephosypherus* was recently discovered in the Maya Mountains. Two species *Hyla bromeliaca* and *Hyla minera* are only known from the Gloria Spring area of the Columbia Forest Reserve and is suspected of housing a distinct amphibian community, but more information is required before this can be confirmed.

Invertebrates

Information on most invertebrate groups is very scanty in Belize with the exception of the Odonata and some Lepidopteran groups. Two Odonata species are endemic to Belize. *Erpetogomphus leptophis* is known only from the Blue Creek area of the Toledo District and *Epigomphis maya* is limited to the Maya Mountain/Mountain Pine Ridge area. Fourteen species are rare regional endemics. These groups are dependent on the quality of very specific types of water bodies and thus are very sensitive to habitat alteration. Five of the better known of the Lepidopteran group is endemic to Yucatan, but can be found in northern Belize. A Yucatan endemic sub-species *Battus philenor acuada*, considered vulnerable in Mexico, occurs in Shipstern at the southern limit of its range. The WCS Belize Biodiversity Information System has recorded the following summary of terrestrial invertebrates:

Mollusks	157	Odonata	176
Crustaceans	1	Butterflies	288
Insects	10	Other Terrestrial	2

The paucity of information is evident. There is much work that needs to be done to describe the invertebrate species of Belize.

Agriculture and Biodiversity

Some agricultural practices make important contributions to the status of biodiversity in Belize (Briggs, 1998). Headland and boundary areas along with hedges and wetland (natural and manmade pond) areas support diverse communities of plant and animal life. The cultivation of rice on flat lands along with some flood irrigation also supports a different diverse wildlife population. Some plant species, which are rare in natural vegetation, become common in such "disturbed" areas - eg. wild castor bean. Mixed-farms commonly cultivate a mixed vegetable garden including sunflowers, herbs and the commonly eaten vegetables for household consumption. Small orchards of mainly fruit trees also support quite diverse wildlife populations. Farm-yards with miscellaneous buildings, stored old machinery, wood etc provide habitats for several ground dwelling species, voles, rats, mice, snakes, frogs etc as well as nesting places for several bird species. Generally mixed farming operations cultivate several varieties and species and support a diverse wildlife population in a combination and balance not found in natural vegetation.

Cattle Ranching results in a unique combination of grass/legume/forage species which can support cattle

grazing of varying intensity. Once grazing stops, there is relatively rapid encroachment by miscellaneous woody species. Such natural pastures can support large populations of plant species including ground orchids and other flowering plants which are not found in such abundance in the original natural vegetation of the area (Briggs, 1998). They also support sizable populations of wildlife - birds, small mammals, insects etc. The encouragement of leguminous forage trees along the boundaries of pastures provides additional habitat variation to support wildlife. It is important to mention, however, that while agricultural systems add to species richness, these are often secondary or exotic and can actually be deleterious to biodiversity in the long-term (Miller, pers. comm.).

Small holders commonly have alternate sources of income apart from the farm. Small holders grow a wide range of crops and livestock as well as a number of different varieties/strains of those crops and livestock, thus retaining genetic diversity. The relatively low input level and multiple cropping supports considerable biodiversity of wildlife in and around farms.

There is the need to document and act on the relevant issues linking agriculture and biodiversity, particularly; total area dedicated to agricultural activities, rate of deforestation due to agriculture frontier, crops cultivated and level of exploitation(technologies), major pests per crop and their geographical distribution(including actual/alternate management and control practices including the option for integrated pest management programmes), threat of entry by quarantine pests and ex-situ conservation in agriculture.

5.1.2.2. Aquatic Fauna

Freshwater

There are few references available on the freshwater species in Belize. Miller (1966) and Tomerson and Greenfield (1972) have compiled a list of inland fishes known to occur or having reported ranges that include Belize. This list divides the fish into primary, secondary and peripheral fishes. The primary category is strictly or obligatory freshwater fish, the secondary can tolerate salt water and the peripheral is marine derived species entering freshwater and becoming permanent freshwater residents. The WCS Belize Biodiversity Information System (BBIS) has recorded 117 species of freshwater fish. It is reported that several species are endemic to Belize and of limited distribution within the country. The Blind Catfish, *Rhamdia typhla* is known only from the underground spring in the cave at Las Cuevas in the Chiquebul Forest Reserve. Terry's Molly (*Poecilia teresae*) is endemic to the Mountain Pine Ridge. The Live Bearer *Carthubbia stuarti* is known only from the Dump, a water body surrounded by agricultural activities in the Toledo District. Both the Golden Cichlid, *Cichlasoma aureum* and the Check Mark Cichlid *Chichlasoma godmani* are of very limited distribution in Belize and again restricted to the Toledo District. This is in keeping with the fact that both the primary and secondary freshwater fish groups have relatively restricted ranges whereas the peripheral species have extensive ranges.

Traditionally, few freshwater fish species, mainly cichlids, have been exploited through subsistence fishing by rural communities on river banks. However, recently there have been reports of intensive net fishing for commercial purposes in many rivers and lagoons of Belize, and once common freshwater species are becoming increasingly scarce. Tilapia (*Oreochromis niloticus*) has been observed in growing numbers in rivers and lagoons, as well as in pet shops. Its mode of entry is uncertain, but there are two possible entry routes: through escape from aquaculture activities or 'natural' entry from Guatemala and Mexico through shared rivers and creeks. Efforts must be made to control tilapia population growth, in an effort to minimize competition with native species for space and food. Once this is not addressed quickly, species displacement and extinction may be imminent (Jacobs, 1998).

There is only one species of freshwater crocodile, the Morelet's crocodile (*Crocodylus moreleti*). This species is limited to Central America and is listed as endangered by IUCN. Its limited range makes the Belizean population important for the conservation of the species in a global context. The Wildlife Protection Act which protects this species has assisted in recovering the population and it can now be found in most water bodies to the extent that potential exists for human/animal conflict near inhabited areas (NBC, 1998). Nine species of turtles are said to be vulnerable to hunting in Belize. The Central American River Turtle or Hicatee

(*Dermatemys mawii*) is a regional endemic; the sole representative of its family is under exploitation pressure due to heavy net fishing and is likely to become endangered in the near future (Jacobs, 1998). Also, the Iguana (*Iguana iguana*) is hunted for its meat and eggs. This is a species of tourist interest and is not considered threatened, but vulnerable (NBC, 1998).

Coastal and Marine

The Coastal Zone of Belize is one of the most diverse ecosystems in the Western Hemisphere with an astonishing degree of complexity. Seven principal habitats make up the Coastal Zone: coral reefs, seagrass beds, mangroves, littoral forests, watersheds, wetlands and estuaries. More specifically, the Coastal Zone has been defined in the State of the Coastal Zone Report Belize 1995 to include the shoreline, coastal alluvial plains, coastal watersheds, lagoons, estuaries, the cayes, the atolls, the subtidal area within the twelve mile territorial limit, and the two hundred mile Exclusive Economic Zone (EEZ)(McField *et al.*, 1996).

One of the most biologically diverse ecosystems in Belize is the Barrier Reef, which runs from north to south and extends 230 Km along the coastline from the border with Mexico to just before the border with Guatemala. Three offshore coral atolls can be found east of the barrier reef, that are associated with multiple sand and mangrove islands enclosing a lagoon with sparse coral formations, except Glover's Reef Atoll which has frequent and well developed structures. According to information available within the files of the Coastal Zone Management Unit (CZMU) a total of 65 coral species have been positively identified in Belize, 53 of which are classified as reef-building corals. Additional work is needed to determine the occurrence of other species which may have been excluded in previous studies.

A large number of coral reef species have not yet been positively identified as endemic to Belize. Available information on the distribution of coral reef species seem to suggest that as many as 113 coral associated species may occur Belize. However, this needs to be confirmed by qualitative and quantitative assessments. Fish species, crustaceans, mollusks and numerous other invertebrates inhabit Belize's reef system. Much effort has been invested in describing the fish species of Belize, especially within the Hol Chan Marine Reserve, the Bacalar Chico Marine Reserve, the South Water Caye Marine Reserve including mangrove channels near Twin Cayes, mangrove channels in the Pelican Cayes, within the Glover's Reef Marine Reserve, and along multiple transects near and within Tobacco Caye Range. Biological inventories are either presently being conducted or are programmed for Turneffe Atoll, Laughing Bird Caye National Park, and near Carrie Bow and Tobacco Cayes. Crustaceans, mollusks and other invertebrates have been poorly described in Belize, with the exception of sponges and ascidians which have received much attention in the area of systematics by the Caribbean Coral Reef Program (CCRE) of the Smithsonian Institution (Jacobs, 1998). Geographic distribution data suggest that, apart from corals, as many as 343 species of other invertebrates may occur in Belize (Jacobs, 1998).

Available information suggest that there are 634 genera and 1,302 species which have been described in marine areas. Birds, plants and insects represent the bulk of these species, followed by fish and invertebrates. Many native species of birds nest on our cayes and coastal forests, and at least 18 species of marine birds are known to be seasonal transients (Jacobs, 1998)

The predominant animal species within coastal and marine habitats of Belize include the boa constrictor, the american crocodile (*Crocodylus acutus*), the jaguar (*Felis onca*), the gibbon (*Agouti paca*), the white tailed deer (*Odocoileus virginianus*), the manatee (*Trichechus manatus*), plus juveniles of numerous fish and invertebrates (Meerman, 1995). Special note must be made of the subtidal and intertidal communities of the mangrove root system, in which a large diversity of sponges, mollusks, crustaceans and algae can be found. Of increasing interest, but frequently unknown are the ecotones in the mangrove canopy. Much work is being done in this area under the CCRE of the Smithsonian Institution. Numerous marine worms and crustaceans live within the sediment among seagrass stipes, while gastropods of commercial importance can be found on the sediment among seagrass blades. Seagrass epiphytes (organisms that live attached to seagrass blades) include a wide variety of microscopic algae and mollusks that are an important source of food for many transients between mangroves and the reef (Jacobs, 1998).

In excess of 50 species of aquatic animals are under exploitation pressure either for export, local consumption

or for recreational purposes (Annex 5). Of special concern is the trawl shrimp fishery, with a by-catch composition of 72 species (Annex 6), most of which are discarded, either because of their small size or due to poor market acceptability. Most fishing effort concentrates on the lobster (*Panulirus argus*) and the conch (*Strombus gigas*), including few finfish species, with total landings in excess of 3 million pounds (farm shrimp included) and a value of over 24 million dollars (Annex 7a & b) (Jacobs, 1998).

Twenty-two coastal and marine species are considered to be threatened, 15 of which have some form of protective status, but enforcement is lacking and protective measures are ineffective. Species requiring special attention are listed in Annex 8. An assessment of endangered species in Belize is also listed in Annex 9.

The actual health of the Belize barrier reef is unknown. However, the once commonly used 'pristine' description is becoming less common when the reef is being referred to, and is probably due to the increased occurrence and distribution of coral bleaching and dead corals along the reef. Broken corals and damaged coral heads are also much more visible when snorkeling or diving in frequently visited areas. Little is known about the many estuaries, lagoons and watersheds that lie on coastal Belize. What is quite evident, however, is the fact that the seagrass beds, the mangroves and broadleaf forests that are in association with them, provide critical habitats for many sensitive species such as birds, manatees, crocodiles, turtles and fish. A considerable amount of subsistence fishing occur in these systems as well as sand mining for construction purposes. Industrial and residential developments have been minimal or absent in most of these habitats, with the exception of those around Belize City, South Stann Creek River, Monkey River, Sennis River and the Placencia Lagoon. In addition, the Chetumal Bay and the Sarstoon-Temash regions are known recipients of 'transborder' pollutants, and are areas of particular concern.

5.2. Legal and Policy Framework for Biodiversity Conservation

A specific legal and policy framework addressing biodiversity conservation, *per se*, does not exist in Belize. However, there are laws, regulations, and policies which impact on biodiversity. Existing laws and policies are described below, however, an assessment of existing laws and legal constraints are presented in Annex 10 a-c.

5.2.1. Environmental Protection

Environmental Protection Act

This Act is administered by the Department of the Environment in the Ministry of Natural Resources and Environment. An Environmental Impact Assessment is mandatory under this Act before certain development projects can be executed. Subsidiary legislation including the Environmental Impact Assessment Regulation, 1995, Effluent Limitation Regulations 1996 and Pollution Regulations 1996, have been passed to support the Act. Under the Environmental Impact Assessment Regulations, developments over 500 acres require a full Environmental Impact Assessment (EIA), including projects with proposed mangrove clearance, coastal watersheds and waterworks, depending on the scale of the project (Ellis, 1998). However, 'scale' has not been defined in terms of units and thus present a troublesome loophole in the implementation of these regulations. The Effluent Limitations Regulations address the installation of treatment facilities, limitations on effluent parameters, monitoring of effluents and approval for points of discharge. These are important regulations for controlling the deposit of pollutants in low relief areas on the coast. The Pollution Regulations under the EPA complement the Public Health Act, which has general provisions for the control of land, air and sea pollution (Jacobs, 1998).

As with all sectors, the Environmental Protection Act has over-riding legal authority on all tourism development. Resorts, hotels and tourist or recreational facilities are all listed on Schedule II of the EPA i.e. may require a partial or full Environmental Impact Assessment depending on size and location. Fiscal incentives are offered to tourism related developments by the Ministry of Economic Development. The procedures followed in granting such incentives require input by the Department of the Environment (Ellis,

1998).

Public Health Act

Administered by the Public Health Department, this Act provides the regulatory power for the control of pollution in the air, water and on land as it affects the quality of human life. The Public Health Act also addresses the disposal of solid and liquid waste, and the contamination of water for human consumption. More specifically, the Public Health Department through the Public Health Act, has responsibility for public health matters related to construction of buildings (drainage and ventilation), regulations in connection with wash houses, swimming pools etc, food preparation and service, sanitation and effluent disposal, pollution and health "nuisances" and the removal of refuse (Ellis, 1998).

Pesticide Control Act

This Act is to regulate and control the sale and use of pesticides under a Pesticide Control Board, which sets standards for monitoring this activity. The Board is under the responsibility of the Ministry of Agriculture and Fisheries. While the Pesticide Control Act seeks to control the importation and sales of pesticides, it does not specifically control disposal of excess quantities or expired chemicals and there are no provisions for responsibility in case of inappropriate use and damages to the environment (Jacobs, 1998).

Water and Sewerage Act

This Act regulates and controls all matters pertaining to the monitoring and use of drinking water, sewage disposal and maintenance of sewage systems. It also contains provisions for the avoidance of pollution to water bodies. It is administered under a Water and Sewerage Authority established under the Act and is under the Ministry of Natural Resources (Ellis, 1998).

Solid Waste Management Authority Act

This Act, within the mandate of the Department of the Environment, is intended to govern the collection and disposal of solid waste but has not yet become operational.

The Belize Tourist Board Act

This Act contains provisions for the development of tourism policies, which would in turn need to consider the effects and roles of all the sectors in the development of tourism, especially effects to the environment (Ellis, 1998).

5.2.2. *In-Situ* Ex-Situ Conservation and Natural Resource Management.

5.2.2.1. *In-situ* Conservation

The main Acts which govern the establishment and management of Protected Areas are the Forest Act which creates Forest Reserves, the National Parks Systems Act which creates Wildlife Sanctuaries, Natural Monuments, Nature Reserves, and National Parks (Rosado, 1998) and the Fisheries Act which provides for the management and conservation of fisheries resources and creates Marine Reserves (Jacobs, 1998). Declared and proposed coastal and marine Protected Areas are presented in Annex 11 a-b. The National Lands Act regulates the issuing and management of land within the national estate as well as for the development of regulations to improve conservation of national lands. A key provision under the Act is the requirement that a sixty-six foot riparian strip be reserved along riverbanks, streams and the seashore for conservation purposes. Finally, the Act provides continuing protection of Bird Sanctuaries created under the now repealed Crown Lands Ordinance. The Lands Utilization Act also provides a limited measure of protection through the creation of Special Development Areas (SDAs) which control use through management plans. Sections of the SDAs may be zoned as reserves. The Lands Utilization Act also controls subdivision and provides for the development of regulations which control the use of land. Finally the Housing and Town Planning Act, provides for zoning within urban areas and this can be a useful tool where specific species or sites requiring protection occur within already developed areas (Tillett, 1998).

The broad legislative framework outlined above ensures that there is a range of protection varying from strict protection to multiple use. The National Parks Systems Act provides for the creation of Protected Areas to

be kept mainly in their natural state, with use being limited to scientific study, education, tourism and recreation with fishing permitted under special license. Forest Reserves established under the Forest Act provides for more extractive use and has also allowed for leasing arrangements within the Reserves as well as the creation of special enclaves for the development of tourism in particular cases. These substantive clauses are further developed in the Forest Rules which regulates such activities as squatting, building, cultivation, grazing or hunting in Forest Reserves, as well as the control of forest fires (Rosado, 1998).

The present legislative framework provides for moderate management of Protected Areas, however it has been recognized that improvement in the legislation could more effectively address the aims of biodiversity conservation. Under the Forest Act, Fisheries Act and the National Parks Systems Act, Protected Areas can be de-reserved by the Minister through the signing of a Statutory Instrument. If the Protected Areas are identified along the lines set by specific criteria in order to conserve biodiversity and to attain national objectives, then the power to dereserve should be carefully exercised and the legislation should make provision for discussion and consultation at the national level before de-reservation occurs. Legislation allowing uncontrolled de-reservation of Protected Areas should be amended to secure conservation objectives and to limit the power of the Minister to dereserve these areas (Ellis, 1998).

A comprehensive review of the National Protected Areas Systems Plan (1996) indicated that the site designations under the National Parks Systems Act have been applied somewhat arbitrarily and in several cases do not reflect the characteristics of the site nor the best management approach (Ellis, 1998). The report recommend a review of the National Parks Systems Act to allow for an array of management regimes best suited to site-specific circumstances. This recommendation should be considered along with amending the National Parks Systems Act to provide for other types of use.

Other gaps in existing legislation which addresses Protected Areas relate to the absence of legal mechanisms for addressing such issues as mineral exploration and extraction rights, rights of extraction of plant material, and the use of Protected Areas for tourism purposes. Because sustainable use is an important element of the Convention on Biodiversity, these rights and benefits of use need to be more clearly defined in policy or legislation. There are no regulations yet established to regulate such important issues as co-management and the preparation of management plans (Ellis, 1998).

It is recommended that a review of the National Parks Systems Act and the Forest Act include guidelines for the sustainable use of resources within the reserve. This may be addressed by a clause which ensures that all Protected Areas must have management plans prepared before they are declared (Ellis, 1998). At present, a management plan is prepared after designation and there are many which have not undergone this process. Such amendments could allow for the legalizing of management plans as well as the formalization of co-management or other management arrangements.

The Forest Act is presently under review. However the existing legislation does not adequately address the issues relating to the extraction of non-timber forest products within Forest reserves and other Protected Areas (Ellis, 1998). This relates in particular to the growing issue of bio-prospecting. Given the complex nature of this subject, bio-prospecting should be the subject of specific policy and legislation with inputs being drawn from the Private Sector and other Government agencies.

There are several legal and policy issues that need to be addressed with respect to Marine Reserves in order to improve their contribution to biodiversity conservation. There needs to be a clearly defined procedure for ensuring the smooth management of Marine Reserves that have marine and terrestrial components protected under different legislation.

The Environmental Protection Act also provides a blanket protection for flora and fauna; however the Department of the Environment's implementation of this is subject to the jurisdiction of other agencies such as the Ministry of Natural Resources and the Environment and the Fisheries Department which also have similar functions (Ellis, 1998)

5.2.2.2. Private Reserves/ Community Initiatives

It has been recognized and accepted that much of the biodiversity in Belize remains on land which is held under private ownership. Some of the owners have chosen to voluntarily commit their land to management regimes of various sorts and of unofficial categorization with the aim of fulfilling conservation objectives. One example of this is the Shipstern Nature Reserve. Whilst there is some debate as to how these Private Reserves are carrying out their stated functions, there is little doubt that there is an increasing trend for the development of such private initiatives. As such, there exists a window of opportunity for the Government agencies to provide a legislative framework for these initiatives which will further the conservation and sustainable use of biodiversity. Another area of growing concern is the community management of national lands which have not yet achieved formal Protected Area status, but which have some ecological importance. For various reasons, communities are becoming increasingly anxious to manage areas which are adjacent to them and which fall under Protected Areas status. One of the challenges of the Biodiversity Strategy will be therefore to provide guidance on the future direction of these trends in a way that will firmly harness them in function of national priorities and clear-cut standards of conservation and sustainable use (Ellis, 1998).

The legislative and institutional framework as it presently exists is not appropriate to address the requirements of biodiversity conservation. The traditional vision of the state being the sole owner and manager of Protected Areas still provide the basis which guide the establishment of Protected Areas. There is a need for new thinking to prevail in the designing of policies and legal tools for the establishment and management of Protected Areas.

In Belize, the only Private Reserve to have a formal relationship with the state is the Rio Bravo Conservation and Management Area (RBCMA) presently managed by a local NGO, Programme for Belize (PfB). The Programme for Belize has signed a Memorandum of Understanding in 1991 with the Government of Belize which ensures that, "the land will be held in perpetuity as a Public Trust for the purposes of protection of the natural and cultural heritage and the conservation of natural resources through the development of sustainable approaches to utilization." The land cannot be alienated from this purpose. If the PfB must for any reason relinquish control, it must pass the area on to an organization of similar intent. There is the need to design policies which provides direction on the role of Private Reserves in the conservation and sustainable use of biodiversity. There is also a need for the definition of the legislative and institutional framework for the involvement of communities and NGOs in the management of Protected Areas, as well as a need to further explore the development of legal mechanisms for providing incentives to communities for the management of national land to meet biodiversity conservation objectives (Ellis, 1998).

At the regional level there are initiatives which seek to explore such legal arrangements which could be strengthened and developed within each country's legal system for the formalization of relationships between Private Reserves and the state. These include Land Trusts, Conservation Easements and Binding Agreements such as Memorandum of Understanding. Public Trusts are created under the Trusts Act and can exist in perpetuity. These trusts specify objectives that are general in nature and which devolve the benefits of the trust to a wide cross-section of the public. Conservation Easements are legal agreements through which the landowner voluntarily restricts the type and amount of development that may take place on his land. The agreement is carried out with an entity, such as a Government agency which could enforce it and force the landowner to respect the restrictions placed on the use of the land. There is no current legislation in Belize to regulate Conservation Easements. Memorandum of Understandings are not as strong legal documents as they imply. The enforcement of such agreements would depend on what measures the parties had established to address breaches of the Agreement (Ellis, 1998). It is recommended that these and other measures be explored to identify which are most applicable to the Belizean situation.

In addition to the above, the existing legislation relating to Protected Areas such as the Forest Act and the National Parks Systems Act could be amended to allow private landowners to donate their land to the Government in order to have it managed as a Protected Area (Ellis, 1998). Suggestions have also been made that the National Parks Systems Act could be amended to give recognition to those private Protected Areas that are considered to fall within the framework of a National Protected Areas Systems Plan. Consistent with this, is the fact that Belize is involved in the Mesoamerica Biological Corridors Project which has proposed

the Belizean in-country linkages required to better conserve biodiversity at a country and regional level. These linkages are needed, but must incorporate the inclusion of private lands as recommended in the National Protected Areas System Plan. There is a need for a mechanism to provide legal support to these initiatives and to offer incentives to private landowners to participate in the conservation process.

The Protected Areas Conservation Trust (PACT) Act provides limited opportunity for providing financial support to community initiatives in relation to Protected Areas and does not appear to limit itself to statutory Protected Areas.

5.2.2.3. *Ex-situ* Conservation

There are limited examples of *ex-situ* conservation in Belize. These include small plants, orchids, iguana and butterfly collections as well as the popular Belize Zoo which houses some selected wildlife species in captivity. In addition, the Government has established a herbarium and there are plans to create a National Botanical Garden in the near future (Ellis, 1998). There are also three iguana breeding projects and attempts will be made to produce other species such as the Gibnut (*Agouti paca*). The trend is for such *ex-situ* collections to increase in numbers, size and scope. They are perceived in some instances as an important tourist attraction and in other cases as biodiversity conservation measures. The Wildlife Protection Act presently regulates to some extent, those collections which deal with animals from the wild and a Permitting System has been developed which seeks to provide some measure of control and management of the *ex-situ* conservation of wild animals. There is, however, a gap in the legislative framework in that there is no adequate provision for maintaining the integrity of these *ex-situ* collections and to fulfill the obligations under Article 9 of the Convention on Biodiversity (Ellis, 1998). Only one attempt to conduct captive breeding of a marine species has been conducted. The Queen Conch (*Strombus gigas*) was grown in captivity during an eight year project, in an effort to produce juveniles for stock replenishment purposes. Results were inconsistent and were generally below average expectations. The reasons for the limited success of that project are unclear, but is probably due to inappropriate management and poorly trained technical staff (Jacobs, pers. comm.).

Flora and fauna that are not within the Schedule of the Wildlife Protection Act remain relatively unprotected. The Convention on Biodiversity intends to provide for the adequate maintenance of the components of biodiversity through *ex-situ* conservation; it also requires that the contracting parties regulate and manage collections of biological resources so as not to threaten ecosystems and *in-situ* populations. However, captive management of any species is very costly and is not sustainable without a large influx of financial and human resources. To attempt to breed animals in order to preserve biodiversity as a genetically viable population is even more difficult. *Ex-situ* efforts to maintain viable genetic populations of Belize's fauna should be looked upon as an absolute last resort (Miller in lit., 1998).

If selected as an option for biodiversity conservation, *ex-situ* efforts must be examined to determine such measures as are necessary to regulate the collection of any plant or animal species. A policy should be developed to address all issues related to *ex-situ* conservation including the maintenance of adequate representation of species, repatriation of species held outside of national boundaries, registration of collections and other issues which provide effective management of this aspect of biodiversity conservation (Ellis, 1998).

5.2.2.4. *Natural Resource Management*

The Forest Act

The original legislation dates back to 1927 and deals with the protection of forests and mangroves. The collection of medicinal plants for local use or for research purposes (ie. identification and cataloguing) is regulated by the Forest Act. However, a scientific collection/research permit for medicinal plants can also be issued under the Wildlife Protection Act, an is a clear example of legislative overlap.

Both of these permits are valid for one (1) year and prohibit the collection of medicinal plants in Protected

Areas. These permits have been used for medicinal plant collection in National Parks and private lands, but the legal circumstances surrounding these permits are not clearly established. Until recently \$ 50.00 was charged to obtain a plant collection permit. At least one (1) copy of any report resulting from any study must be lodged with the Forest Department as a condition to obtain a scientific collection/research permit. A separate export permit is issued by the Forest Department and a \$ 0.50 duty is charged for the export of any plant collected. In 1996, the Conservation Division, in consultation with NGOs and CBOs, realized that these two (2) permits were too basic and needed to be revised. This led to the appointment of a task force in 1996; by the end of 1997, the revision of this permitting system was completed. To date, the revised scientific collection/research permit is being used, but the revised medicinal plant collection permit is yet to be implemented. The revisions corrected some of the weaknesses in the previous permitting system by:

- i. Restricting the commercialization of the resource until suitable agreement is reached that does not compromise our obligations under the CBD, Central American Convention on Biological Diversity and other relevant agreements.
- ii. Clearly establishing Belize's ownership over the resource being collected.
- iii. Requiring that a biological transfer agreement be signed between collaborating institutions.
- iv. Making provisions for the collection of restricted volumes.
- v. Making provisions for local counterparts.
- vi. Ensuring that research agencies provide evidence of their credibility.
- vii. Increasing the application fee to \$ 200.00.

The management of medicinal plants in Belize has been promoted by a deep respect for the culture of local traditional healers. This has resulted in the establishment of Ix-chel Tropical Research Foundation (Ix-chel), an NGO devoted to promoting the culture of traditional healing in Belize, an Association of Traditional Healers (BATH) and a Traditional Healers Foundation (THF). A fairly strong educational programme characterized by displays, seminars, youth camps, school competition, field trips, and guest lectures is conducted annually mostly by Ix-chel. This makes an important contribution towards the management of medicinal plants. One of the most significant outputs of these programmes was the establishment of Terranova, one of the first Forest Reserves established in the world that is dedicated to the conservation of medicinal plants.

The management of natural resources within Forest Reserves also falls under the Forest Act. Presently there are nineteen forest reserves of which only three have completed draft management plans: Maya Mountain, Columbia River and Terranova. Management plans are in process for the Chiquibul and Fresh Water Creek Forest Reserves. Harvesting plans exist for Maya Mountain, Columbia River, Chiquibul and Fresh Water Creek Forest Reserves. There are eighteen other types of protected area. To date, only six of these areas have management plans completed and in draft: Blue Hole, Five Blues Lake, and Guanacaste National Park, Tapir Mountain and Bladen Nature Reserve, and Half Moon Caye Natural Monument. It is expected that these draft plans will be approved in July of this year. Plans are in preparation for two other areas: Crooked Tree Wildlife Sanctuary, and Cockscomb Basin Wildlife Sanctuary. The Forestry Department has had the support of non-governmental organizations in the development of these plans (Ellis, 1998).

There are provisions in the management plans for Forest Reserves, which address conservation, environmental issues and sustainable use. These plans call for zoning of the reserves where specific activities are recommended, including the harvesting of timber on a sustainable level. This is achieved by dividing the area suitable for logging into 40 blocks, one block being cut per year, over a 20-year rotation period. This allows the blocks to recover before the rotation is repeated. The plan specifies the diameter of the trees to be removed and the size and number of trees to be left to serve as seed trees. The management plan through the zoning process, provides for the multiple use of the area, allowing for watershed protection, areas where tourism can be allowed, and areas for the extraction of timber. Through the licensing system being issued for 20-year periods, other specific measures are imposed for biodiversity conservation; the imposition of the 20-m. reserve along main watercourses and along main roads is one of these measures (Ellis, 1998).

The BAS has an agreement with the Forest Department for the management of six of these parks. The

Friends of Five Blues manages one. Additionally, the Department benefits from technical support for forest planning from the Forest Planning and Management Project (FPMP). The FPMP is assisting with the development of models to guide future development of management plans for the other Forest Reserves. In these plans, forest are managed for multiple use: forest protection, water supply, wildlife and biodiversity, timber, tourism, research, and other forest products (Columbia Forest Management Plan, 1994).

Other Policy Issues Related to the Management of Forest Resources

With respect to timber production, there is a need to revisit the Annual Allowable Cut (AAC). This has been called for by the Forestry Industry and in a recent report by the FPMP. In 1993 it was estimated that the Annual Allowable Cut (AAC) of 90000m³. At that time the uptake was 61,000m³ but this included around 20,000m³ of mahogany and cedar which was then being cut at three times the ACC for these two species of 6,000m³. Production figures for January 1 to September 30, 1997 recently released show total production of 47,584.9m³ including 5,564.9m³ for mahogany and cedar, thus indicating that the over cutting of mahogany and cedar has come closer to the recommended figure given in 1993. It may appear from these figures that the present level of cutting is sustainable. This is, however, unlikely to be the case. The 1993 figures for AAC are based on the assumption that all the forests, which are accessible and are not protected, are being selectively harvested in any given year. In fact, there are many areas of productive forests on private land, which are not being logged and areas of national land and Forest Reserves, which are not under licenses. The production for 1997 probably comes from an area significantly smaller than used to calculate the AAC and is therefore unlikely to be sustainable (Rosado, 1998).

Another aspect to consider is that only 14% of forest area are available or suitable for forestry activity. This represents some 303,000 ha and is divided almost equally between the productive zones of the Forest Reserves, forested national lands and forested private lands. The question is where is the timber coming from, if the area is so small and the available cut is below what one major enterprise had been cutting. The answer is that the immediate future for the Belizean forest industry is one of radical and undoubtedly painful, restructuring, with the need for the industry to internalize its operational costs. The establishment of plantations would need to be considered as a cost of the overall operations and in an effort to secure future timber supplies (Rosado, 1998).

The Forests (Protection of Mangrove) Regulations prohibits any alteration of mangroves (this includes cutting and defoliating) of mangroves on any land without a permit. In most cases a permit to clear mangroves is issued after a multi-agency assessment is conducted and may be denied if the proposed cutting is in proximity to areas known to be of high ecological value or where the cutting may undermine current efforts to protect critical habitats for certain species. However, enforcement is difficult and fines for unauthorized clearance are insignificant. Illegal clearance of mangroves is frequently encountered along Belize's coast despite educational programs in schools and public awareness campaigns. This Act includes the establishment of Forest Reserves which may include mangroves, littoral forests and water bodies. However, no specific regulations exist under this Act that address littoral forests. The Forest Act is currently being revised. Management of mangroves is the responsibility of the Forest Department and a draft mangrove management plans has been prepared. Mangroves in Belize, unlike other countries, is not being used extensively for fuel, however substantial cutting has occurred to accommodate tourism and residential development projects along the coastal zone (Ellis, 1998).

Forest Fire Protection Act

The Act empowers the Forest Department to deal with fire situations in times of extreme fire hazard, to declare fire control areas and prepare fire plans for areas so declared. Its weakness is in the lack of provision for enforcement of fire protection through the recovery of general costs and damage resulting from fire (Rosado, 1998).

Private Forests (Conservation) Act

Prohibits felling of any mahogany and cedar tree on any private land without a permit, with the exception of small trees when clearing for agricultural purposes. This Act is under the Forestry Department of the Ministry of Natural Resources and the Environment (Rosado, 1998).

Wildlife Protection Act

Wildlife in Belize is mainly governed by the Wildlife Protection Act which provides for the conservation, restoration and development of wildlife in Belize. It seeks to regulate hunting and protects many species from harassment (Ellis, 1998). Many coastal and marine species are protected under this Act, and includes two species of crocodiles, the manatee, all birds with the exception of six species, whales dolphins and the Caribbean monk seal (Jacobs, 1998). Enforcement of this Act is poor. There is no scientific information available on habitat and species distribution, species abundance or population dynamics of wildlife species. It is difficult therefore to determine what has been the effect of the Wildlife Protection Act (Ellis, 1998).

Now that the moratorium previously imposed under the Wildlife Protection Act has been lifted, there are options for the better management of wildlife resources. It had long been pointed out that this moratorium was counter productive (Rosado, 1998). However, it is not being suggested that hunting should be permitted for trophy or sports hunting, but rather should remain as it has been since the introduction of the Act in 1981, for subsistence only and where it is not illegal to hunt (Rosado, 1998).

The Wildlife Protection Act as it presently exists, does not protect a large number of species and sub-species which have been identified as important to biodiversity conservation in Belize. A major revision of the Act has been proposed and it is presently under review. One important change would be to list in the Schedule only those species of Wildlife which could be legally hunted and then provide blanket protection to all other species not mentioned in the Act. It is recommended that the draft revised Wildlife Protection Act be finalized and that it be adopted as quick as possible (Rosado, 1998).

The Fisheries Act

The Act seeks to control all aspects of commercial fishing by establishing regulations controlling minimum sizes and types of fishing equipment used. The territory of enforcement is marine, but extendable to the inland waters and rivers by order of the Minister. There is conflict in legislation between this Act and the Wildlife Protection Act in that the Fisheries Act is responsible for the commercial aspects of all or any of the varieties of marine or fresh water animal or plant life. This Act places the Fisheries Department in charge of crocodile farming and whaling while the Wildlife Protection Act specifically prohibits hunting of any species of wildlife under the schedule which includes whales and dolphins (Rosado, 1998).

The Act consists of multiple amendments and orders that seek to address the management of all aquatic resources in Belize's rivers, coastal watersheds, inland waters and the sea. Fisheries Regulations under this Act include size and weight restrictions and closed seasons for conch, lobster and turtles. Prohibition of SCUBA equipment, the use of nets, weirs, wire mesh traps, mesh size and the use of explosives. No regulations for deep-sea fishing, the collection of aquarium fish or aquaculture exists under this Act. Species-specific regulations are few and much more needs to be put in place. Aquaculture operations are conducted under a license by the Minister. This license consists of a list of guidelines developed as part of a Fisheries Department's policy. Effective enforcement of the Regulations under the Fisheries Act is poor. A revision of the Fisheries Act is currently underway (Jacobs, 1998).

Policies and new legislation need to be developed to protect and the Coral Reef System which still remains relatively unprotected under present legal instruments. The proposed Revised Fisheries Act has a clause making damage to coral an illegal activity, however the Act does not otherwise provide for the management and monitoring of other issues related to the coral reefs as an ecosystem. Such new legislation could include provisions for the control of salvage operations near or on coral reefs and provisions for Environmental Impact Assessments on all major development activities impacting on coral reefs. In addition, there is a need for Regulations to protect watersheds, estuaries and wetlands especially since many of these occur outside of Protected Areas (Ellis, 1998). The proposed Coastal Zone Management Authority and Coastal Zone Management Institute may have crucial roles to play in the promotion of those changes in the legislation which would provide for greater conservation and management of coastal and marine resources (Ellis, 1998; Jacobs, 1998).

Mines and Minerals Act

This Act addresses the exploration and extraction of all non-renewable resources. It controls dredging and quarrying activities and is administered by the Ministry of Natural Resources and the Environment. It also addresses dredging and sand mining, and is essential in avoiding destruction to coastal habitats such as seagrass beds and the coral reef. One major loophole in this Act is the fact that EIAs are discretionary and not mandatory (Jacobs, 1998).

Petroleum Act

This Act governs the exploration and exploitation of petroleum and related products in terrestrial, coastal and offshore environments. The Ministry of Natural Resources and the Environment administers the Act. The Petroleum Act controls oil exploration in offshore areas. Of particular concern is the potential for oil spills and its consequential catastrophic effects. In realistic terms, however, oil exploration has been known to have caused very few and minor spills (Jacobs, 1998).

Of greater concern should be the Harbours and Merchant Ships Act and the Port Authority Act, since the probability for oil spills from tankers and bilge disposal is very high. Many marine exotic species that uses the ships' bottom as a substrate are introduced. Some may also be introduced through ballast water and should be addressed under the Registration of Merchant Ships Act (Jacobs, 1998).

Coastal Zone Management Act

This Act, within the mandate of the Ministry of Agriculture, Fisheries and Cooperatives, will provide for the implementation of coastal zone management in Belize through the establishment of a Coastal Zone Management Authority and a Coastal Zone Management Institute. It will provide for the establishment of a Coastal Zone Management plan and mechanisms to improve the monitoring of various activities within the coastal zone.

5.2.3. Land Use Planning

National Lands Act

This Act deals governs the distribution of national lands outside of Forest Reserves. It provides for some management, control and development of land by requiring an EIA to be conducted for lands over 500 acres (202 ha). The Lands Department administers the Act (Ellis, 1998; Tillett, 1998).

Land Utilization Act

This Act is administered by the Land Utilization Authority (LUA) which makes recommendations on subdivision applications. This Act deals with the subdivision and utilization of land both in the urban and non-urban areas. The sections covering land subdivision are sufficiently robust to withstand litigation. However, the sections dealing with land utilization are very weak. According to McCalla (1995), the Act does not contain any specific statutory provisions for the establishment of a comprehensive regime for the control of land use. The clause that speaks about land use planning is very general. Essentially, it empowers the Minister to "demarcate areas as special development areas (SDAs) and stipulate the type of development that will be permitted within these areas" (McCalla, 1994).

SDA divides an area into different zones with their respective subdivision densities. The standard zonation used includes: urban high density, urban low density, commercial and industrial, government and institutional, rural high density, rural low density, reserve, and forest reserve (McGill, 1994). Furthermore, extra categories may be developed in response to the specific needs of an area. As an example, a category labeled "hawksbill turtle nesting area" was developed for the Manatee SDA (McGill, 1994). The general types of land use permitted in an SDA includes: agriculture, residential, commercial, tourism, forestry, wildlife reserve, and environmental protection (McGill, 1994).

The SDA program provides much opportunity for biodiversity conservation. The "reserve" zone stipulates no subdivision or clearing of vegetation. Traditionally, the SDA process has been based on the 'best use' of land and so environmental concerns have been a factor guiding the plan development. The SDA plans provide a good first guide to regulate land development. However, there are some obvious limitations. Essentially,

the SDA program was only intended as a provisional measure to provide some guide to the Land Subdivision and Utilization Authority (LUA) in their screening of applications for subdivisions (Tillett, 1998). The substance of SDAs is their control of sub-division density (McGill, 1994). SDAs were not intended to address the comprehensive needs of planning. Moreover, they are not robust enough to withstand litigation, as the intention of the clause addressing SDA was not meant to carry so much weight (McGill, 1994).

Planning areas are defined by the local socio-economic condition; land ownership defines the actual boundaries. SDAs are essentially physical plans, providing guidelines in the first instance to the LUA in their decisions for subdivision approval. The second audience served by SDAs is the leasing process in the Ministry of Natural Resources. These plans may be used to identify locations where leases may be issued for different uses and the size limits of these leases. Together, these two processes provide the primary and secondary avenue for SDA implementation (Tillett, 1998). However, it is expected that plan implementation be supported by all the other relevant bodies including: Government departments and permitting agencies, non-governmental organizations, business community and developers, and the public and local community. To date, SDAs have not had much success with implementation outside of the LUA. This practice restricts the use of SDAs for the guidance of subdivision only. While this was the main objective of the SDA program, the resulting plans can be used to guide other development, even if only provisionally (Tillett, 1998). McGill (1994) states that the regulation of subdivision provides only a small opportunity to regulate land use and that together, the various permitting agencies have a more significant impact on land use. This lack of plan compliance by the permitting agencies is the fundamental problem reducing the effectiveness of SDAs in regulating land use (Tillett, 1998).

Ten SDAs have been declared so far (Annex 12), for which seven plans have been completed: Boom Ladyville Hattieville, Cayo West, Manatee West, Manatee East, Monkey River, Mango Creek, and Corozal East. Plans are in process for Belize District Northeast, Orange Walk East, and Corozal North. There are plans to declare another SDA for the Belize River Valley area. Together, these SDAs provide a very good coverage of the areas along the coast and areas farther inland experiencing development pressure. However, a key gap exists for the vulnerable Stann Creek Valley area, which is surrounded by many Protected Areas (Tillett, 1998). Additionally, areas that falls in the New River catchment represent areas of concern as these were rated as the second "highest risk catchment" after the Belize River (Lee et. al., 1995).

Even though an EIA is expected to be completed for all leases of more than five hundred acres of National Lands, all other agricultural projects fall under Schedule II which may require an EIA to be completed. The majority of these have been as a result of environmental clearance being required under other procedures of benefit to the developers eg. fiscal incentives, subdivision approval. Because of the Ministerial discretion under most legislation, large projects passing through the Aliens Landholding Act procedures, the Land Utilization Authority procedures or National Lands leasing procedures, occasionally avoid contact with the Department of the Environment (DOE) and the requirements for EIAs or checklists for assessment. There is a likelihood that such projects could totally avoid the attention of the DOE until chance contact perhaps, after complete development of the project (Tillett, 1998).

There is no provision in any legislation to prevent any land owner converting natural vegetation to agriculture (or any other use) in a piecemeal fashion over a period of time to the detriment of the biodiversity of the area. There is thus a need for an all encompassing "planning" legislation, as found in more developed countries, to require permission from a "planning authority" before any change in use of any land countrywide. The introduction of zoning would alleviate the majority of the small-holder agricultural development from seeking such planning permission. The situation in relation to shifting cultivation is more complex, especially in relation to the various Reserves. A mechanism needs to be found to mitigate the impact of shifting cultivation, especially on slopes and on mature forest (Briggs, 1998).

The enforcement of existing legislation and guidelines in relation to clearing of steep slopes and clearing alongside streams and creeks would considerably reduce biodiversity loss. However, clarification of the requirements for leaving vegetation alongside all streams, creeks, rivers, ponds and other open water etc. is needed. The use of a standardized distance of 66 ft as a buffer zone appears arbitrary and places excessive

limitation on areas with many small streams. There is provision for Ministerial discretion which is rarely utilized. Consideration might be given to the introduction of restrictions on clearing land within a graduated distance related to the size of the waterway. The introduction of penalties for non-compliance with such guidelines or regulations should be considered. The existing mechanism for the Government of Belize to claim compensation for damage due to willful act or gross negligence is cumbersome (Briggs, 1998).

Monitoring of tourism activities includes issuance of hotel licenses and collection of the hotel tax. Under the hotel licensing legislation, hotel owners make application usually close to completion of construction, following an inspection and approval procedure the hotel is registered and a license to operate is issued. Under the existing legislation, there is no requirement for environmental clearance of the project prior to construction or even after construction as a pre-requisite for registration and issuance of the license (Briggs, 1998). In practice, there is coordination between the Belize Tourist Board and Environment Department and environmental clearance is normally obtained before registration of a new hotel. However, this is frequently after construction in the case of smaller rural hotels (Briggs, 1998).

The Housing and Town Planning Act

This Act is administered by the Ministry of Housing and Urban Development. It calls for the establishment of the Central Housing and Planning Authority (CHPA) to carry out the duties of the Act. This is the most comprehensive planning legislation for the country. As such it carries significant litigative powers. It authorizes for the development of planning schemes (Tillett, 1998). "Schemes" may include housing scheme, re-development scheme, town planning scheme, or a regional scheme (McCalla, 1995). This Act provides opportunities for environmental, cultural, archaeological and historical preservation.

Reconstruction and Development Corporation Act (RECONDEV)

Under the Ministry of Finance, this Act provides authority for RECONDEV to plan and regulate development for urban areas. The Act gives the Corporation the power to make By-laws to fulfill the provisions of the Act. However, the power of RECONDEV has been focused primarily on Belmopan (Tillett, 1998).

5.2.4. Existing Policy Framework

Forest and Wildlife

In the Forestry Sector there have been policy guidelines as outlined by Hummel since 1922. Formal forest policy was first published in 1947, which placed more emphasis on the protection of watersheds and mentions conservation of wildlife. One notable omission from this policy was the creation of a Forest Estate, although at that time several Forest Reserves were in existence. This was replaced by the 1954 Forest Policy which emphasized the necessity to establish, preserve and develop the forest estate. This policy has been revised and updated in 1994, but has not been formally adopted.

Coastal and Marine Resources

A draft Cayes Development Policy has been developed which seeks to guide development on Belize's cayes with the objective of minimizing degradation to the environment and maintaining the integrity of critical habitats. Based on this Cayes Development policy are the Turneffe Islands Development Guidelines and the Belize City Cayes Development Guidelines. Guidelines for Caye Caulker are also being developed (Jacobs, 1998). The Belize Mineral Resources Policy and Marine Dredging Guidelines seek to address the environmental issues related to mining and dredging. A Cruise Ship Policy and Environmental Compliance Guidelines for cruise ships have been in effect from 1994 and a National Oil Spill Contingency Plan has been designed. Both of these seek to combat pollution of marine and coastal areas. However, these policies need to be reviewed to better address biodiversity conservation (Ellis, 1998).

Several committees are involved in policy and decision making on matters affecting coastal and marine resources. The Coastal Zone Technical Committee (CZTC) provides technical advice before decisions are made by competent authorities regarding permits and development concessions in coastal areas. The Coastal Zone Steering Committee (CZST) is a higher level committee which operates at the policy level. The National Environmental Appraisal Committee (NEAC) conduct detailed analysis and screening for most

development projects before environmental clearance is considered. The Fisheries Advisory Board (FAB) provides advice to the Ministry of Agriculture and Fisheries on projects in the Fisheries Sector of national interest. The Belize Barrier Reef Committee (BBRC) is the central body which ensures that Belize's interests are properly addressed under the Meso-American Reef Initiative (Jacobs, 1998).

Agriculture

Since 1980 the Government's agricultural policy has been outlined in four main documents of which the 1997 Draft Policy document is the most recent. In summary, the mission statement of the MAF&C is to enhance food security, income generation and gainful employment whilst conserving and improving the natural environment. Various programmes and policy measures are recommended, both macroeconomic and sector-specific, including price controls, import licensing, regulation and fiscal incentives and support services.

The Food and Nutrition Security Policy and action plan for Belize established in 1997 includes agriculture as a major component. Neither policy makes mention of the impact on biodiversity or the environment nor mentions any mitigating measures to be undertaken in developing the Agriculture Sector in Belize. The policy framework within which the agriculture sector operates includes sugar, citrus and banana Board and a growers' associations, which addresses the Private Sector's interest in these industries (Briggs, 1998).

Land Use

There is no effective National Land Use Policy in place (Tillett, 1998). The closest to a national land use policy is the five-year National Development Strategy developed by the Ministry of Economic Development. This strategy sets the framework for the development of programs and projects to facilitate the development of country and people (MED, 1996). Basically, this document sets a series of goals and objectives for the various sectors: social, productive, financial, physical infrastructure, government administration, and environmental protection (MED, 1996). The strategy acts more as an informant to problems with a set of associated actions for their solution (Tillett, 1998).

Tourism

A new National Tourism Policy is being developed at the present time. The current Integrated Tourism Policy and Strategy Statement published in 1989 is being updated. Monitoring of the tourism industry is the responsibility of the Ministry of Tourism, either directly or through the Belize Tourist Board (Briggs, 1998).

5.2.5. International Conventions and Agreements

Belize is signatory or party to many international conventions and agreements, and is a member of many regional organizations involved in the management and protection of biological resources (Annex 13). Those that impact on biodiversity are listed below (Ellis, 1998; Jacobs, 1998):

- (i) United Nations Law of the Sea Convention (LOSC) (ratified 13 August, 1983).
- (ii) World Heritage Convention (ratified in 1990).
- (iii) Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) (ratified 1976).
- (iv) Convention on Biological Diversity (CBD) (ratified in December, 1993).
- (v) Central American Biodiversity Convention.
- (vi) Convention for the Conservation of Biodiversity and the Protection of Priority Areas in Central America.
- (vii) Agreement on Cooperation between Belize and Mexico for the Protection and the Improvement of the Environment and the Conservation of Natural Resources in the Border Zone (signed 20 September, 1991).
- (viii) Land-Based Sources of Pollution Protocol (LBSP).
- (ix) United Nations Framework Convention on Climate Change (ratified September, 1994).
- (x) Convention for the Prevention of Pollution from Ships (MARPOL 73/78) (ratified 12 May, 1995).
- (xi) International Convention for the Regulation of Whaling (signed 1982).

- (xii) Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (signed 1995).
- (xiii) Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) Toxins and their Destruction (signed 1980).
- (xiv) Western Central Atlantic Fisheries Commission (WECAFC) (1985).
- (xv) Latin American Organization for Fisheries Development (OLDEPESCA) (1997).
- (xvi) Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (The Cartagena Convention).
- (xvii) The Convention on Wetlands of International Importance Especially as Waterfowl Habitats (RAMSAR)(Signed 1971).

Belize's compliance with its commitments under the above mentioned conventions has been minimal due to the lack of appropriate enforcement mechanisms. Belize may soon become party or signatory to the following conventions and agreements (Jacobs, 1998):

- Inter-American Tropical Tuna Commission (IATTC).
- International Dolphin Conservation Program (IDCP).
- International Commission for the Conservation of Atlantic Tunas (ICCAT).
- Inter-American Convention for the Conservation and Protection of Marine Turtles.

Through Belize's involvement in the regional Central American Commission on Environment and Development (CCAD), several projects and initiatives have been developed including the Central American System of Protected Areas (CCAP), the Mesoamerican Biological Corridors Project and the proposed Mesoamerican Reef Initiative Project (NBC, 1998).

Worthy of special mention, and in addition to the CBD, under the United Nations World Heritage Convention the Belize Barrier Reef System has been designated as a World Heritage Site. The United Nations Convention on the Law of the Sea (UNCLOS), MARPOL Convention and the SPAW Protocol provide possibilities for the creation of "Special Areas" and "Particularly Sensitive Sea Areas" which, while not offering full Protected Area status, would enable international recognition of the need for protection of Belize's critical coastal and marine habitats. CITES is also worthy of mention, as there is need for existing legislation to be revised in order for Belize to fulfil its obligations under this Convention (NBC, 1998). There is a similar need for new and revised legislation for most of the Conventions and Agreements listed above (Jacobs, 1998).

5.3. Human and Institutional Capacity

5.3.1. Human Capacity

The term 'biodiversity' is a rather new term in Belize and there is no specific law that addresses biodiversity, therefore no one institution is charged with the responsibility of protecting biodiversity. Government, quasi-government and non-governmental institutions share responsibilities and legal mandates for developing and protecting Belize's biological resources. The Private Sector has also been seen to be more proactive in the protection of natural resources. The institutions involved in the management of Belize's biological resources are the Fisheries Department and its Coastal Zone Management Unit, The Forest Department and its Conservation Division, the Department of the Environment, the Office of Petroleum and Geology, the Department of Hydrology, the Lands Department, the Agriculture Department, the Health Department, the Water and Sewerage Authority, the National Meteorology Service, the Belize Audubon Society, Friends of Five Blues Lake and Programme for Belize (Jacobs, 1998).

Human capacity within Government for managing biological resources is very limited. The Forest Department in the Ministry of Natural Resources and the Environment, has a total of nine (9) Forest Rangers, twenty-four (24) Forest Guards, three (3) persons are involved in Forest Management and Research, two (2) in

Conservation Management, and twenty-seven (27) supporting personnel (Rosado, 1998). The present staff level at the Forest Department is way below what is required. The Tropical Forestry Action Plan 1989 recommended a staff size twice that presently employed. The Forest Rangers and Forest Guards are charged with the task of monitoring and enforcing the laws relating to the National Parks Systems Act, the Forest Act and the Forest (Protection of Mangroves Regulations). They are responsible for seventeen (17) Forest Reserves, two (2) wildlife sanctuaries, one (1) Natural Monument, ten (10) National Parks, and four (4) Nature Reserves. It is a monumental task given that approximately half of these reserves are more than fifty thousand (50,000) acres in size. The present number of rangers and officers are way below what is needed to carry out effective enforcement (Rosado, 1998).

Archaeological Reserves are declared and managed by the Archaeology Department. The Archaeological Commissioner heads this Department, and is assisted by archaeologists and other personnel, a total of fourteen persons at this time. Staff limitation in this Department is characterized by gaps in the availability of technically trained staff (Rosado, 1998).

The LUA, also within the Ministry of Natural Resources and the Environment, is lacking of personnel in the environmental profession. Presently, the people who sits on the LUA includes: the Lands Commissioner, Chief Forest Officer, MNR Physical Planner, Assistant Secretary of the Ministry of Natural Resources, Ministry of Works Chief Engineer, Chief Agricultural Officer, and a member from the Private Sector. Inputs from the environmental bodies is entirely informal and discretionary. The Physical Planning Unit, also under this Ministry, has assumed the responsibility for planning in rural areas through the implementation of the Special Development Area (SDA) program. However, the level of human resources available severely limits its effectiveness. There is only one full-time trained planner on staff and the responsibility of the personnel extends beyond the SDA program (Tillett, 1998).

Of major importance and also under the Ministry of Natural Resources is the Land Information Centre (LIC). The existing capacity of the LIC does not reflect its massive mandate. There are gross shortages of staff and key training needs, particularly in the area of spatial analysis techniques (Fairweather, pers. comm.). In particular, the CEDS component is suffering from a lack of dedicated expertise in fields of environmental information management and system administration for the network. The role of the LIC in planning and monitoring of environmental resources has mostly been reactionary, i.e., responding to request for information for site specific applications, due to insufficient human capacity to take on these additional duties (Tillett, 1998).

The enforcement of the Fisheries Act pertaining to Marine Reserves is carried out by seven (7) Rangers employed by the Fisheries Department. Four are stationed at Hol Chan Marine Reserve, two (2) at the Bacalar Chico Marine Reserve and National Park, and one (1) at Glovers Reef Marine Reserve (Jacobs, 1998). The Management of the Half Moon Caye National Monument is conducted by the Belize Audubon Society, which has one (1) ranger employed. Of the eight Marine Protected Areas, four have on-site enforcement. An additional eight (8) officers are engaged in the enforcement of the Fisheries Regulations to ensure compliance with size restrictions, closed seasons, and gear restrictions. The extent of marine area to be monitored is way too big for only eight persons to patrol. Present patrolling and enforcement activities to address the provisions of the Fisheries Act are non-representative and ineffective (Jacobs, 1998).

The human resources dedicated to the EIA procedure at the DOE do not reflect the importance of such an instrument for biodiversity management. The NEAC provides much technical expertise to the process, but its efforts are focused on the preparation of guidelines for EIA preparation, procedure and decision-making. The crucial task of compliance monitoring is left solely to the DOE. The DOE does not have the manpower or the technologies necessary for effective compliance monitoring. Until such capabilities are established within the DOE, the EIA process will serve only as an information tool (Tillett, 1998).

The limited human resources of the Housing and Planning Department cannot match the massive responsibility and planning needs in the country. Presently there are only two planners plus one trainee planner. In the spirit of efficiency and limitations in human resources, the CHPA has decentralized the powers

for plan implementation and planning approval for several areas: Dangriga, Corozal, Ambergris Caye and St. George's Caye. Currently, the CHPA only accepts planning applications for Belize City and Vista Del Mar. This situation, while good in concept, has experienced much practical implementation problems. Primary in this are the issues of accountability and local technical expertise. Similarly, the Coastal Zone Management Project which will eventually be converted into the Coastal Management Authority/Institute, currently has only one planner on staff and training is required in Marine Studies and Coastal Zone Planning (Tillett, 1998).

Several non-governmental organizations are involved in some way or another with biodiversity conservation. The Belize Audubon Society (BAS) presently manages six Protected Areas under a formal agreement with the Ministry of Natural Resources (Rosado, 1998). The present staff level is 29 including 22 field staff allocated to the six areas being managed, the balance being at headquarters in Belize City. BAS is not contemplating assuming new areas to manage; in fact, only recently it shed responsibility for Shipstern Reserve. Programme for Belize (PFB) manages the Rio Bravo Conservation and Management Area (RBCMA) of some 98,282 ha in northwest Belize. The PFB has a staff of 34, of which 24 are based at the RBCMA. There are an additional 20 persons which are involved in projects and are not full time. The Belize Zoo and Tropical Education Center (BZOO/TEC) conducts in-situ conservation activities and has a staff of 26. The Friends of Five Blues a community based organization manages the Five Blues Lake National Park, but it is barely functional at the moment with one volunteer staff. Other areas included under private management include Shipstern Reserve, Slate Creek Preserve and Monkey Bay Wildlife Sanctuary. The Terranova initiative which was spearheaded by BATH, is now being considered for co-management between the Ministry of Natural Resources and the Environment and Belize Enterprise for Sustainable Technology (BEST). At least eight other non-governmental organizations (Annex 14) are associated with the conservation of medicinal plants and are described in Section 5.3.2. Skilled and unskilled human resources available in these organizations are in excess of 75, but these personnel are not all dedicated the conservation and use of medicinal plants (O'Brien, 1998).

Very few institutions can boast of enough and well trained staff, aggravating the difficulties of enforcement and sustainable development. For example, the Department of the Environment, one of the major players in ensuring habitat integrity, has only five technical persons. The Fisheries Department, which is responsible for managing the third highest foreign exchange earner, is seriously under-budgeted with a technical staff of only seven people. The Coastal Zone Management Project (CZMP) has provided both short-term and University Degree training to personnel of the Fisheries Department, the Department of the Environment and the Forest Department (Jacobs, 1998). The Agriculture Department is unable to conduct effective extension services to farmers due to limited numbers of field staff, as well as reduced numbers of trained staff. Training needs are very much the same for most agencies (Government, non-government, Academia) directly involved in natural resource management in Belize. Much more staff recruitment and training are needed before commitments under the CBD can be properly addressed. In an effort to contribute to these training needs, the University College of Belize has recently launched a new course in Natural Resources Management at the Associate's Degree level (Jacobs, 1998).

5.3.2. Institutional Capacity (Financial and Infrastructural Support)

The Land Information Center (LIC) is the largest established institution in Belize for the management of GIS related data to guide land management. It is recognized as the national focal point for matters relating to spatial data. It was established in 1992 under the Ministry of Natural Resources. The LIC operates primarily on UNIX based platform with the ORACLE relational database management system linked to Arc/Info GIS. There are other packages such as archive, ERDAS and IDRISI. The LIC's key aim is to guide all aspects of land allocation in Belize (Fairweather, 1993). It is intended to form the central repository for land-related information and to assist in physical planning, environmental management, and improvement in land administration in the Lands and Surveys Department. The LIC has three components:

1. The Land Information System (LIS), implemented since 1996 under a USAID funded project, is to manage and regulate the land allocation process through the automation and improvement of the existing legal and fiscal aspects of land administration in the Lands and Surveys Department.