Rationalization Exercise of the Belize National Protected Areas System

Wildtracks, January, 2013
ACKNOWLEDGMENTS

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Parallel exercises have provided valuable information and input – the National Land Use Policy and Integrated Framework, the Integrated Coastal Zone Management Plan processes Climate Change Adaptation planning for a number of protected areas and Managed Access meetings. Many people have contributed to validation of species-specific or ecosystem-specific data, made reports available on watershed prioritization, climate change issues, and a number of other priority areas for integration into the rationalization process.

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January, 2013
CONTENTS

Executive Summary 6

Introduction 13

1.0 Context 16
   1.1 National Protected Areas System Plan 16
   1.2 Administration
      1.2.1 Forest Department 22
      1.2.2 Fisheries Department 23
      1.2.3 Institute of Archaeology 24
   1.3 National Protected Areas System 24
      1.3.1 Forest Department Administered Protected Areas 24
      1.3.2 Fisheries Department Administered Protected Areas 27
      1.3.3 Archaeological Reserves 28
      1.3.4 Other Protected Areas 28
   1.4 Key Challenges 29

2.0 Ecosystem and Species Representation 31
   2.1 Primary Gaps in Coverage 33
   2.2 Representation of ecosystems of limited extent (<1000 acres nationally) 39
   2.3 Priority areas for key terrestrial biodiversity protection 40
   2.4 Species Specific Interventions 43
   2.5 Internationally Recognized Conservation Sites 49

3.0 Rationalization of the National Protected Areas System 50
   3.1 Responsibility for Protected Areas 50
   3.2 National Protected Area Categories 51
   3.3 Recommended Changes to Protected Areas
      3.3.1 Merging of Protected Areas 53
      3.3.2 Re-designation within the national protected area categories 54
      3.3.3 Boundary Realignments 55
      3.3.4 Dereservations 56
      3.3.5 Designation of Community Green Areas 57
      3.3.6 New Protected Area Designations / Extensions 58
3.4 Private Protected Areas 60
3.5 Consolidation of the National Protected Areas System 62
3.6 IUCN Categories 66
3.7 Other Recommendations 71

4.0 Connectivity 73
4.1 Background 73
4.2 Key Recommendations 74
4.3 Terrestrial Corridors 75
   4.3.1 What constitutes a functional terrestrial biological corridor? 76
   4.3.2 Establishing Belize’s Three Primary Biological Corridors 78
   4.3.3 Process for Corridor Development 83
   4.3.4 Key biodiversity features, challenges and opportunities of the three corridors 86
   4.3.5 Stepping Stones 94
4.4 Transboundary Connectivity 95

5.0 Climate Change 98
5.1 Analysis of predicted climate change 98
5.2 Climate Change predictions and the terrestrial environment 101
   5.3 Climate change predictions and the marine environment 107

6.0 Protected Area Prioritization 114
6.1 Protected Area Prioritization - Terrestrial 114
   6.1.1 Water Catchment 118
   6.1.2 Wetland Flood Sink Function / Protection 120
   6.1.3 River Bank / Coastal Protection 122
   6.1.4 Steep Slope Erosion Protection 124
6.2. Protected Area Prioritization - Marine 125
   6.2.1 Fisheries Management 127
   6.2.2 Connectivity and Ecosystem Health 128

References 131
### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>BAS</td>
<td>Belize Audubon Society</td>
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<td>BFD</td>
<td>(Belize) Fisheries Department</td>
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<td>BFREE</td>
<td>Belize Foundation for Research and Environmental Education</td>
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<td>CBO</td>
<td>Community Based Organization</td>
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<td>DoE</td>
<td>Department of the Environment</td>
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<td>FCD</td>
<td>Friends for Conservation and Development</td>
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<td>FD</td>
<td>Forest Department</td>
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<td>FR</td>
<td>Forest Reserve</td>
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<td>IoA</td>
<td>Institute of Archaeology</td>
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<td>MFFSD</td>
<td>Ministry of Forestry, Fisheries and Sustainable Development</td>
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<td>MPA</td>
<td>Marine Protected Area</td>
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<td>NAPA</td>
<td>National Authority for Protected Areas</td>
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<td>NBBCP</td>
<td>Northern Belize Biological Corridor Project</td>
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<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>NICH</td>
<td>National Institute of Culture and History</td>
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<td>NM</td>
<td>Natural Monument</td>
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<td>NPAC</td>
<td>National Protected Areas Commission</td>
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<td>National Protected Areas System</td>
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<td>National Protected Areas Secretariat</td>
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<td>NPASA</td>
<td>National Protected Areas System Act</td>
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<td>National Protected Areas Technical Committee</td>
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<td>NPS</td>
<td>National Parks Service</td>
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<td>National Parks System Act</td>
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<td>NR</td>
<td>Nature Reserve</td>
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<td>PA</td>
<td>Protected Area</td>
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<td>Protected Areas Conservation Trust</td>
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<td>PFB</td>
<td>Programme for Belize</td>
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<td>PPA</td>
<td>Private Protected Area</td>
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<td>RBCMA</td>
<td>Rio Bravo Conservation Management Area</td>
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<td>SATIIM</td>
<td>Sarstoon Temash Institute for Indigenous Management</td>
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<td>TIDE</td>
<td>Toledo Institute for Development and the Environment</td>
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<tr>
<td>TRIGOH</td>
<td>Tri-national Gulf of Honduras</td>
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<tr>
<td>WS</td>
<td>Wildlife Sanctuary</td>
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<tr>
<td>Ya’axché</td>
<td>Ya’axché Conservation Trust</td>
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Executive Summary

Vision

A strong National Protected Areas System simplified and consolidated into management units, with maintenance of environmental services and effective connectivity for biodiversity protection

National Protected Areas
Policy and System Plan, 2005

Belize can be proud of its National Protected Areas System (NPAS) – it provides the critical ecosystem service of water catchment to supply the national need for clean water, provides protection against storm impacts, is representative of the majority of the ecosystems present in the country, actively supports livelihoods in both the marine and terrestrial environments, and makes Belize a leader in the region in biodiversity conservation.

This report summarizes the major findings of the assessment conducted towards the Rationalization of the National Protected Areas System. These findings, and the recommendations developed from them, provide the foundation for building on the current network of protected areas, improving functionality, connectivity and socio-economic benefit as Belize moves into a future with increasing anthropogenic pressures, overshadowed by the need to adapt to current and predicted climate change impacts.

Also included are recommendations for building a workable administrative framework for the short, medium and long term, integrating the current and proposed system level management units, and strengthening the communication and collaboration needed between all protected area management partners.

The Annexes provide greater depth of information, from which the recommendations for strengthening the protected areas system were developed.

The National Protected Areas System faces a number of critical challenges, foremost of which is the limited awareness at all levels of society of the importance of the NPAS and the role it plays in economic development, providing water security, in maintaining health and social well-being, in protecting life and property, and providing economic opportunities.
Over the last thirty years, Belize has established a strong portfolio of both terrestrial and marine protected areas, ensuring continued critical ecosystem services of water catchment, and protection from storm flooding and life threatening mudslides. The protected areas still maintain viable populations of the majority of Belize’s wildlife, and have the potential to actively support livelihoods in both the marine and terrestrial environments.

In 2006, the Government of Belize ratified the National Protected Areas Policy and System Plan, providing the framework for the strengthening of the National Protected Areas System. In 2011, Belize embarked on a rationalization process towards effective implementation of the System Plan, including the identification of areas requiring further investment.

**Belize’s Portfolio of Protected Areas**

There are currently 98 protected areas within the National Protected Areas System. These include:

- 2 large forest nodes, regionally important for biodiversity conservation
  - Maya Mountains Massif
  - Part of the Selva Maya
- 2 RAMSAR sites, declared for their global importance in protection of wetlands
- The Belize Barrier Reef, a biodiversity hotspot that includes:
  - A globally important network of marine protected areas
  - 7 marine protected areas forming Belize’s World Heritage Site
  - 11 protected spawning aggregation sites, critical for regional fisheries viability
- 16 archaeological sites, managed under the Institute of Archaeology, protect the best of Belize’s Maya and post-Maya heritage
- A management regime that includes strong partnerships between the Government of Belize and co-management NGO / CBO organizations
**Ecosystem Representation**

- Over 90% of Belize’s 70 recognized ecosystems have greater than 10% representation within the National Protected Areas System (NPAS) – as per IUCN targets.

- 60% of ecosystems have greater than 30% representation within the NPAS - the creation of new national terrestrial protected areas to strengthen ecosystem coverage is not considered critical, though realignments to improve the representation of rivers and riparian vegetation are recommended.

- The greatest gaps are in the coastal and marine environments (Map 3).

- Both the marine and terrestrial protected areas of the system integrate features that provide some resilience to climate change.

- Whilst not an ecosystem in their own right, seamounts such as those between Turneffe and Lighthouse Atolls are also important features that are currently not represented within the NPAS.

**Environmental Services**

Belize, as a country, is heavily dependent on the environmental services provided by the National Protected Areas System.

- The protected areas of the Maya Mountains Massif provide water security for the communities and agricultural areas of the southern coastal plain and Stann Creek valley, and Guatemala.

- The coastal waters and reef provide marine resources, particularly conch and lobster, for over 2,700 traditional fishermen and their families, supporting an important national fishing industry.
- The tropical forests, colourful reef and archaeological sites draw tourists to Belize from all parts of the world, supporting much of the tourism industry, an important contribution to Belize’s foreign exchange earnings.

- The atolls, reef and coastal mangroves provide critical protection against tropical storm events, coastal flooding and erosion.

- Riparian vegetation provides important protection against erosion and increased sediment load in rivers, and low lying wetlands act as flood sinks, storing flood waters and releasing them slowly, preventing flooding downstream, and in so doing protecting human lives and helping to maintain reef health.

**Connectivity**

- Belize’s forest nodes are recognized for their regional importance in the maintenance of biodiversity in Mesoamerica. However, they are too small in isolation to conserve all biodiversity and retain full ecosystem service functionality without establishing connecting biological corridors.

- In the terrestrial context, ecosystem connectivity is critical for the maintenance of full species diversity and ecosystem services, preventing genetic isolation of populations and allowing migration of species and ecosystems over time, particularly for climate change adaptation.

- Belize has identified three primary biological corridors as critical for inclusion in Belize’s portfolio of tools for the maintenance of biodiversity and, and for the long-term viability of the National Protected Areas System (Map 2).

- These three priority biological corridors (Northern, Central and Southern) are critical for both national and regional connectivity, and need to incorporate principles of integrated landscape management and socio-economic benefit, with approved governance structures and policies.
These biological corridors need to be legislated and demarcated on the ground, with the development of tools such as conservation covenants and financial incentives to facilitate inclusion of private lands within the corridor routes.

Of the three, the Central Belize Corridor is considered the most critical for regional connectivity.

The second priority is the Northern Corridor, with climate change predictions indicating that the drier forests of northern Belize will migrate south, gradually replacing the more humid forests. Connectivity is essential if this to be facilitated without great loss of diversity.

Broad stakeholder participation needs to be ensured at all levels in corridor design, formation and management, and facilitation of access to socio-economic opportunities for sustainable development.

Connectivity is also important for maintenance of riparian and transboundary ecosystem connectivity, and in the marine environment between coral reef, seagrass and mangrove ecosystems.

**Protected Area Prioritization**

Belize, as a country, is heavily dependent on the environmental services provided by the National Protected Areas System. A prioritization exercise assessing all protected areas within the National Protected Areas System demonstrated that:

- Resilience to climate change requires replication in protection of ecosystems...as such, no protected area can be considered redundant within the system.
- Sites protected for very specific reasons – archaeological reserves, spawning aggregation sites, bird nesting colonies – are critical to maintenance of cultural heritage and biodiversity in Belize and need to be afforded effective protection.
- The six highest priority terrestrial protected areas (scoring > 3.00 out of 4.00) all fall within the Maya Mountains Massif:
  - Columbia River Forest Reserve
  - Chiquibul Forest Reserve
  - Cockscomb Basin Wildlife Sanctuary
  - Bladen Nature Reserve
  - Chiquibul National Park
  - Mountain Pine Ridge Forest Reserve

- The protected areas rating as lowest on the scale of priorities are those not linked directly to the main forest nodes of the National Protected Areas System. Some of these, however, are important for their educational values – Guanacaste National Park and St. Herman’s Blue Hole National Park.
Overall, Belize has a good marine protected areas network, spread out across the coast, reef and atolls, and covering the primary features required for resilience.

In the marine environment, already being heavily impacted by climate change, there is no redundancy in ecosystem protection within the MPAs. There is, however, the need for increased coverage of no take zones in key, high resilience areas, with improved surveillance and enforcement to ensure their functionality.

Seamounts, deep water banks and the Victoria Channel have been highlighted as potential gaps in coverage, with insufficient information for concrete recommendations. Investigation of the importance of these marine features should be prioritised, to inform future decisions.

It is recommended that Managed Access be adopted across the marine protected areas system to better manage resource extraction in the marine environment, increase food security, and strengthen long-term benefits to and from the fishing industry.

There is a need for inclusion of greater protection of a representative sample of the northern coastal lagoons, with their critical mangrove areas and nursery functionality for marine species.

**Species Specific Priorities**

A number of species-specific protected area priorities have been identified for the following species / species groups:

In some cases this may mean the need for creation of Special Management Areas.

- Prioritise protected areas that provide protection for increased viability for the Central American river turtle (*Dermatemys mawii*)
- Greater protection for protected areas that provide nursery habitat for the Critically Endangered goliath grouper (*Epinephalus itajara*)
- Strengthen protection of key nesting sites of the Critically Endangered Hawksbill turtle (*Eretmochelys imbricata*), and sites used by other turtle species

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<th>Species-Specific Priorities</th>
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<tr>
<td>Central American river turtle</td>
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<tr>
<td>Goliath grouper nursery areas</td>
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<tr>
<td>Key hawksbill, green and loggerhead turtles nesting sites</td>
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<tr>
<td>Yellow-headed parrot nesting areas</td>
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<td>Geoffroy’s spider monkey</td>
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<td>West Indian manatee priority use areas</td>
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<td>American crocodile nesting beaches</td>
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<td>Endemic Species</td>
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<tr>
<td>Spawning Aggregation Sites (particularly snapper and grouper)</td>
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<td>Shark nursery areas</td>
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<td>Bird nesting colonies</td>
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- Greater prioritization for protected areas essential to the viability of the yellow-headed parrot (*Amazona oratrix*) in Belize

- Strengthen protection of remaining Geoffroy's spider monkey populations (*Ateles geoffroyi*) in the Rio Bravo / Gallon Jug, Peccary Hills / Runaway Creek, and increased protection in the Maya Mountains Massif

- Strengthen protection of protected areas important to viability of the West Indian manatee (*Trichechus manatus*)

- Strengthen protection of the American crocodile (*Crocodylus acutus*) nesting beach at Cockroach Bay, Turneffe

- Prioritise maintenance and protection of key savanna representation for viability of endemic plant species

- Prioritise maintenance and protection of littoral forest on cayes, particularly those known to harbour Belize’s endemic gecko species (*Phyllodactylus insularis*)

- Prioritise protected areas that encompass spawning aggregation sites

- Strengthen protection of key bird nesting colonies

- Prioritize protection of known shark nursery areas
Introduction

Rationalization Exercise of the Belize National Protected Areas System

The Government of Belize received funding from the Global Environment Facility via the United Nations Development Programme to finance the project entitled “Strengthening National Capacities for the Operationalization, Consolidation, and Sustainability of Belize’s Protected Areas System”. The project is being implemented by the National Protected Areas Secretariat and is aimed at ensuring that Belize effectively develops legal, financial, and institutional capacities to ensure the sustainability for the existing National Protected Areas System (NPAS). This includes the current Rationalization Exercise of Belize’s National Protected Areas System.

Specific Objectives

The objectives of this consultancy were to conduct a rationalization exercise of the National Protected Areas System within the scope of a larger project focused on strengthening national capacities for the operationalization, consolidation, and sustainability of Belize’s Protected Areas System. This is one component of several that, together, are focused on ensuring that Belize effectively develops legal, financial, and institutional capacities towards the sustainability of the National Protected Areas System. This was achieved through the following activities:

a. Verify the elements of the existing protected areas network with the main focus being on ecosystem representation and interconnectivity of the various protected areas that comprise the NPAS with a view to consolidating the overall system, simplifying and ensuring that the overall system is comprehensive

Ecosystem Representation

- Review of gap analysis
- Identification of critical gaps / redundancies
- Implications of climate change
- Identification of socio-political implications of any recommended alteration to the pa system
- Potential for area trade-offs
- Identification of critical PPAS in maintaining / creating ecosystem representation

Connectivity

- Identification of critical corridors / gaps in connectivity
- Land tenure within corridors
- Identification of socio-political implications of maintaining/creating critical connectivity
- Potential area trade-offs
- Identification of critical PPAS in maintaining/creating critical connectivity

**b. Verify the recommendations of the National Protected Areas System Plan as it pertains to the establishment of an effective administrative structure for the NPAS.**

**Administrative Structure**

- Review of current administrative strengths and weaknesses
- Review of NPAPSP recommendations for an effective administrative structure
- Review of outputs of system level planning and recommendations for administration
- Identification of requirements for an effective administrative structure
- Consult with current administrative bodies and parallel planning consultants
- Develop recommendations for meeting requirements for an effective administrative structure
It is considered important for any effective National Protected Areas System to have five linked elements:

- **Representativeness, comprehensiveness and balance:**
  Goal: The National Protected Areas System includes high quality examples of the full range of environment types within Belize, with balanced sampling of the environment types they purport to represent.

- **Adequacy**
  Goal: The National Protected Areas System has the integrity, sufficiency of spatial extent and arrangement of protected areas, together with effective management, to support the viability of the environmental processes and/or species, populations and communities that make up the biodiversity of Belize.

- **Coherence and complementarity**
  Goal: Each protected area within the System makes a positive contribution towards the whole set of conservation and sustainable development objectives defined for Belize.

- **Consistency**
  Goal: Management objectives, policies and classifications are applied under comparable conditions in standard ways, so that the purpose of each protected area within the system is clear to all and to maximize the chance that management and use support the objectives.

- **Cost effectiveness, efficiency and equity**
  Goal: The National Protected Areas System has an appropriate balance between the costs and benefits, and appropriate equity in their distribution, with the minimum number and area of protected areas needed to achieve system objectives.

*Adapted from IUCN, 2008*
**1.0 Context**

The NPAPSP outputs sought to ensure that management of all protected areas be efficient, effective and focused on the best use of the land itself. It also sought to rationalise and optimise the National Protected Area System so that it serves its conservation function while delivering maximum economic and social benefit (NPAPSP, 2005). This has been further strengthened through the more recent Land Use Policy and Integrated Planning Framework, adopted in November, 2011.

**1.1 National Protected Areas System Plan**

Whilst the first protected area was declared several decades ago, the development of Belize’s National Protected Area System Plan took place over 2003-2005, and was overseen by the inter-ministerial Protected Areas Task Force. It sought to provide a coherent approach to protected area establishment and management on a national scale, and was based on widespread consultation, representing the consensus view among those stakeholders directly involved or affected by protected areas in Belize.

The National Protected Area Policy defines the role and management of protected areas, and is focused on creating a National Protected Areas System under one coherent framework, that meets all obligations under international agreements to which Belize is signatory, including the Convention on Biological Diversity. It seeks to ensure that the National Protected Areas System is:

1. **Comprehensive**, with representative examples of all ecosystems in the country and including areas providing important environmental services, providing critical habitat for species of conservation concern or economic importance, and possessing exceptional scenic values (NPAP, 2005).

**Comment:** The National Protected Areas System as it was in 2005 was considered relatively – but not completely – comprehensive in terms of ecosystem coverage. An assessment of protected area coverage demonstrated that six ecosystems were under-represented (Meerman, 2005):

- Tropical evergreen seasonal broad-leaved lowland forest on calcareous soils, Belize River variant
- Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant
- Tropical evergreen seasonal broad-leaved lowland swamp forest, Stann Creek variant
- Tropical coastal vegetation on recent sediments (including littoral forest)
- Caribbean open sea
- Rivers are included in some of the protected area layers but it is unclear whether rivers within protected areas are actually included within the protection
Since that assessment, 5 new protected areas have been declared:

- Hopkins Wetlands Nature Reserve
- Labouring Creek Jaguar Corridor Wildlife Sanctuary
- Peccary Hills National Park
- Melinda National Park
- Turneffe Atoll Marine Reserve

The Hopkins Wetland Nature Reserve incorporates representation of lowland swamp forest, Stann Creek variant, and on-going Government supported initiatives are also targeted at addressing the marine gaps. The recent incorporation of Turneffe Atoll and adjacent open sea into the National Protected Areas System will go a long way towards representation of the Caribbean open sea suite of ecosystems, reducing a number of significant gaps in the NPAS.

Although not mapped in the national ecosystem map, the Peccary Hills National Park incorporates important representation of Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant. The original ecosystem mapping (Meerman, 2004) is currently being revised, with some ecosystem variants (often considered different ends of a single ecosystem gradient) being merged to form a smaller number of more discrete ecosystems.

2. Integrated with regional and national approaches promoting biological connectivity (e.g. Meso-American Biological Corridors Project) and integrated with other national and regional development plans.

Comment: Belize has some of the most intact, forested areas remaining in Central America. The Maya Mountains Massif forms a regionally important forest node in its own right. Aguas Turbias National Park and the adjacent Rio Bravo Conservation and Management Area (one of eight private protected areas recognized as part of the National Protected Areas System) form part of the Selva Maya node, with trans-national linkages with Guatemala and Mexico. The Shipstern / Fireburn / Freshwater Creek node of north east Belize forms the third such node. These forested areas and their high biodiversity values and continuing low human impacts, place Belize as one of the most important biodiversity refuges remaining in Mesoamerica, critical for maintenance of biodiversity not only on the national scale, but also on the regional scale.

Unlike many of its neighbours, Belize still has significant connectivity between two of its three major forested nodes – the Maya Mountains Massif and the Selva Maya (Rio Bravo) nodes. Belize participated in the Mesoamerican Biological Corridor Programme (MBCP), developed through ALIDES (the regional development strategy, under CCAD (the Central American Commission for the Environment and Development), and designed to harmonise Central America's territorial priorities in terms of
conservation, whilst “balancing biodiversity protection with forest management and productive landscape restoration” (Herrera). In its design, it focuses on maintaining / creating forest connectivity for increased biodiversity viability.

Under this regional strategy, short and mid-term objectives have been outlined:

- By 2005, all the region's countries should have forest policies and national forest development programmes, resulting from a participatory process with the main social bodies and groups involved in forest management, conservation and sustainable development. Any relevant components of national biodiversity strategies should also be reviewed and incorporated;
- By 2010 the groundwork should be laid so that the region's forests can begin to help improve the economic and social situation of the region's countries, i.e. by reversing forest destruction, thereby reducing poverty in the rural areas.

Rodriguez, 2002

National initiatives towards consolidation of these corridors have included an in-depth assessment of the proposed Northern Biological Corridor (Meerman, 2000). However, progress has largely been confined to planning – with only limited implementation on the ground, and without the benefit of a legislative framework. Ridge to Reef connectivity has been largely accomplished in Toledo, spearheaded by the NGO community, but again without the benefit of policy implementation and a legislative framework. These and other similar initiatives in the past have been somewhat ad hoc and have often fallen short of their objectives.

Whilst not highlighted within the National Protected Areas Policy document, a parallel initiative has been implemented in the marine environment – the Mesoamerican Barrier Reef System project (MBRS). This increased communication and collaboration among the marine protected areas, and standardised data collection, resulting in the marine protected areas being supported by a more effective network than their terrestrial counterparts, and better integrated into the regional protected areas network through the Meso American Reef (MAR) regional initiative.

Whilst the National Protected Areas System is critical to the achievement of Belize’s Millennium Development goals and other similar national, regional and global initiatives, it has not been fully integrated into them. A significant barrier remains to the social and political recognition of the importance of the environmental services provided by the protected areas in maintenance of health and quality of life within Belize, and the sustainable development of the country.

The development of a National Land Use Policy and associated Integrated Planning Framework for Land Resource Development seeks to address this, with identification of mechanisms for improving communication, collaboration and integration for protected areas planning within the larger physical and political landscape.
3. Economically, socially and ecologically sustainable, and optimises socio-economic benefits, with equitable distribution, as far as these are compatible with maintaining biodiversity values and sustainable resource management. It also seeks to ensure public awareness of the importance of protected areas.

**Comment:** Few of the terrestrial protected areas of Belize are considered economically or socially sustainable, and few provide more than a limited range of socio-economic benefits beyond those of the important environmental services they provide. The current NPAS is underutilized in the way it is managed and the activities permitted, with limited incentive for investment in tourism infrastructure.

In the marine sector, Marine Reserves are seen as a fisheries management tool, supporting coastal communities and managed under the principles of ecosystem management. However they have limited focus on building resilience for climate change or strengthening protection of non-commercial species.

4. Managed in a transparent way, geared towards delivery of measurable benefits, with emphasis on public participation at all levels. This applies to the establishment, management, modification or de-reservation of all the protected areas included in the national network.

**Comment:** Political constraints still interfere with implementation of this objective, with only slow progress towards consensus on the policies and mechanisms for public participation in the management of the National Protected Areas System. Establishment of the National Protected Areas Secretariat is an important step in the right direction, but inter-ministerial differences of opinion and approach remain an obstacle to significant progress. The establishment, management, modification and de-reservation of protected areas have continued largely outside of the transparent mechanisms approved under the National Protected Areas Policy and System Plan.

### 1.2 Administration

“There exist a total of 94 protected areas in Belize (per January 1, 2005) including archaeological reserves and “accepted” private reserves). Several of these reserves, particularly in the marine realm have gazetted management zonation. When these zones are taking into account the number of “management units” increases to 115. There is also some overlap. Particularly the “Spawning Aggregations”, which are technically “Marine Reserves”, have often been created partly inside already existing marine reserves and should possibly best be considered a zonation category within these marine reserves”

(NPAPSP, 2005).
Comment: The number of protected areas in Belize has fluctuated since 2005, with both new reservations and dereservations, and a current total of 98. Three different Government Ministries have mandates for the creation and management of national protected areas within Belize – the Ministry of Forestry, Fisheries and Sustainable Development (through the Forest and Fisheries Departments), the Ministry of Tourism and Culture (Archaeological Sites, through the National Institute of Culture and History / Institute of Archaeology, and the Ministry of Natural Resources (under the Lands Department) (Figure 1).

52 protected areas lie under the administration of the Forest Department, with a further 9 Marine Reserves and 11 spawning aggregation sites (many of which overlap existing Marine Reserves), being administered by the Fisheries Department. These protected areas encompass nine different management categories, dependent on the legislative framework under which they were designated. There is also a single Mangrove Reserve. In addition, there are 7 bird colonies (few of which are actively monitored or managed) and four Public Reserves, both categories established under the Lands Act (Lands Department, Ministry of Natural Resources).

16 archaeological sites are also considered part of the National Protected Areas System, and administered under the Institute of Archaeology (under the National Institute of Culture and History). 8 private protected areas are also recognized by Forest Department as being part of the National Protected Areas System, though are not yet legally embedded within the national framework. Additional private lands in the Maya Mountains Marine Corridor are legally committed to conservation and are part of the NPAS.

Figure 1: Government Agencies with Legal Jurisdiction over Protected Areas, 2012
The NPAPSP recommends that the designation of protected areas within Belize be based on the following criteria:

**Biological Importance**
- The site contains a globally threatened ecosystem.
- The site contains globally rare, threatened or endangered species.
- The site contains regionally or locally rare, threatened or endangered species.
- The site has high levels of biological diversity.
- The site has a high number of endemic species.
- The site provides a critical landscape function.
- The site is large enough to support minimum viable populations of key species, or is relatively large for the region.
- The site contains exemplary and intact ecosystems.
- The site significantly contributes to the overall representativeness of the ecosystems or protected areas system.
- The site contains important, high quality habitat types for key species.

**Socio-economic Importance**
- The site provides economic opportunities for individuals within or near the site.
- The site demonstrates opportunities for sustainable development, consistent with the protected areas objectives.
- The site has a high level of subsistence and/or traditional use by local communities.
- The site has religious or spiritual significance.
- The site has unusual features of aesthetic importance (e.g. caves, scenic vistas, geoheritage areas).
- The site contains species of high social or economic value (e.g. medicinal value, food prototypes).
- The site has high value for education and or scientific research.
- The site has high recreation value.
- The site has high value for mineral or petroleum exploitation.
- The functions of the ecosystems within the protected area contribute significant social or economic benefits (e.g. water recharge area).
- The local community or economy is highly dependent, either directly or indirectly, upon the resources in the protected area.
Context

**Design and Planning Considerations**

- The layout and configuration of the area optimizes the conservation of biodiversity.
- The land use in the surrounding landscape enables effective site management (e.g. the site is surrounded by either a buffer zone of undeveloped area, or near the boundary of a neighbouring country or by a designated low-impact land use zone).
- The siting of the protected area is consistent with the objectives.
- The size is sufficient to meet the protected area objectives (e.g. large enough to support minimum viable populations of key species).
- The protected area is linked, either via a protected corridor or by direct proximity, to another area of conserved and/or protected land.

*NPAPSP / Homer, 2005*

An additional important consideration, not clearly articulated in the NPAPSP list of influential factors, is the role they play in the maintenance of primary biological corridor functionality.

1.2.1 Forest Department

The Forest Department lies within the Ministry of Forestry, Fisheries and Sustainable Development, and oversees the conservation, protection, management and utilization of Belize’s forest resources and its biodiversity, whilst ensuring that the productive capacity of the forests for both goods and services is maintained or enhanced for the sustainable development of the Belizian people. It has administrative responsibility for Forest Reserves, National Parks, Natural Monuments, Nature Reserves and Wildlife Sanctuaries.

**Mission:** The Forest Department, as a public oriented entity, fosters Belize’s economic and human development by effectively enforcing relevant policies and regulations for the sustainable management of its natural resources through strategic alliances and efficient coordination with relevant stakeholders.

The goals identified in the mission statement are met through the following programme areas: Protected Areas Management Programme, Forest Resources Planning and Management Program, Forest Revenue and Exploitation Control Program, Biodiversity Program, Law Enforcement Program, Wildlife Program, and National and International Partnership Program.
Legal Mandate: The Forest Department has the mandate to sustainably manage and develop Belize’s forest resources and biodiversity, under the Forest Act, Chapter 213, of 1927, the National Parks System Act, Chapter 215, of 1982 and Wildlife Act, Chapter 220 of 1982, and subsequent amendments and subsidiary legislation and revised in 2000. It is mandated to ensure the integrity of the protected areas system, and has recently completed an assessment of the impacts of agricultural incursions into the system, looking particularly at settlements adjacent to PAs, squatters, and land titles and grants allocated within the PAs. Areas where titles / leases have been granted have been identified, and a value placed on these incursions (dependent on the type of development (agricultural investments, milpas, bananas, citrus, and buildings). The Department is currently developing a series of recommendations as to how to move forward with these conflicting issues, in discussion with other Government stakeholders (Lands Department and Department of the Environment).

Where there are also traditional use regimes in conflict with the legislated regulations, Forest Department considers that these uses should be allowed to continue, if they can be managed sustainably. There is also a critical need to incorporate greater use in non-extractive protected area - particularly within National Parks - to increase access and public use, with long term concession agreements to encourage local socio-economic opportunities and tourism development. This will strengthen protected area contributions to national economic development, and at the same time strengthen appreciation and support by both political leaders and the general public.

1.2.2 Fisheries Department

The Fisheries Department lies within the Ministry of Forestry, Fisheries and Sustainable Development, and was established to manage the fisheries resources of Belize

Mission: “To provide the country and the people of Belize with the best possible management of aquatic and fisheries resources with a view to optimize the present and future benefits through efficient and sustainable management”.

The goals identified in the mission statement are met through the following programmes: Ecosystems Management Unit; Inland Fisheries Unit, the Capture Fisheries Unit, and Administration.

Legal Mandate: The Fisheries Department has the mandate to sustainably manage and develop Belize’s fishing sector, under the Fisheries Ordinance, Chapter 133, of 1948, and subsequent amendments and subsidiary legislation, revised in the Fisheries Ordinance, 2000, and complimented by the Fisheries Regulations of 2004. This is being significantly revised as the Aquatics Living Resources Bill.
1.2.3 Institute of Archaeology

The Institute of Archaeology is one of four Institutions administered by the National Institute of Culture and History (NICH), under the Ministry of Tourism and Culture. NICH is a statutory body governed by a Board of Directors appointed by the Minister of Culture and chaired by the President of NICH who serves as the Chief Executive Officer. As the CEO, the president is responsible for the overall management of NICH while the day to day operations are overseen by an Administrator. Management meetings are held bi-weekly and attended by the President, the Administrator and the four Directors of the NICH Institutions.

Mission: The Institute of Archaeology (IoA) is dedicated to the research, protection, preservation, and sustainable management of Belize’s cultural and archaeological resources.

The goals identified in the mission statement are met through the following programme objectives: Park Management, Planning, and Policy & Marketing; Research, Education and Communications.

Legal Mandate

The Institute of Archaeology has the mandate to manage archaeological sites, under National Institute of Culture and History Act, Chapter 331 of the Subsidiary Laws of Belize 2000, Revised Edition 2003.

1.3 National Protected Areas System

1.3.1 Forest Department Administered Protected Areas

The majority of the terrestrial protected areas were established under two Acts - the Forest Act (1927, revised 2000) (Forest Reserves) and National Parks Systems Act (1982) (National Parks, Natural Monuments, Nature Reserves and Wildlife Sanctuaries), under the mandate of the Forest Department (Table 1). The Forest Reserves are the only category under the mandate of the Forest Department that legally permit extractive use, with several being managed for timber extraction under long term (40 year) license agreements, and non-timber forest product. Protected areas managed under the National Parks System Act are non extractive. The Forest Department does, however, recognize traditional use, and does not intend to cause a shift in tradition through the non-extractive designation, but seeks to maintain the culture of buffer communities. Traditional extraction by sustainable methods is therefore allowed in some protected areas (e.g. Sarstoon Temash National Park, and Aguacaliente, Crooked Tree, Corozal Bay, Gales Point and Labouring Creek Wildlife Sanctuaries, though further work is required in all of these protected areas to ensure extraction is truly sustainable.
Five protected areas established under the National Parks System Act and under the mandate of the Forest Department are considered as part of the marine protected areas system (Laughing Bird Caye National Park, Blue Hole and Half Moon Caye Natural Monuments and Corozal Bay and Swallow Caye Wildlife Sanctuaries). Unlike the Marine Reserves under the Fisheries Department, these are legislated as non extractive areas, established for protection of physical / biological features of national significance, key species (manatees), and tourism resources.

**Annex One:** A full inventory of current protected areas

**Forest Reserves**

*For the protection of forests for management of timber extraction and / or the conservation of soils, watersheds and wildlife resources*

Eighteen Forest Reserves were identified under the NPAPSP (Meerman, 2005), of which six are managed directly by the Forest Department, ten are managed through long-term logging concessions, one is managed under a co-management agreement and three are considered to be defunct (Mango Creek (3), Grants Works and Monkey Caye).
National Parks

For the protection and preservation of natural and scenic values of national significance for the benefit and enjoyment of the general public

Of the seventeen National Parks administered under the Forest Department, fourteen are managed under co-management regimes. Of the three National Parks not under co-management agreements, two (Aguas Turbias and Honey Camp) remain under Forest Department management, with no immediate prospective co-managers, and Bacalar Chico National Park has on-site presence by Fisheries Department. Laughing Bird Caye National Park is considered as part of the marine protected areas system.

Natural Monuments

For the protection and preservation of national features of national significance

Of the five Natural Monuments under the national protected areas system, four are managed by Belize Audubon Society, the largest co-management organisation in Belize. One of these - Actun Tunichil Muknal – is currently the only FD administered protected area to be managed in a 3-way partnership between the Forest Department, the Institute of Archaeology and BAS. The fifth, Thousand Foot Falls, is managed directly by Forest Department, as part of the Mountain Pine Ridge Forest Reserve. Blue Hole and Half Moon Caye are considered part of the marine protected areas system.

Nature Reserves

For the protection of biological communities or species, and the maintenance of natural processes in an undisturbed state

The four Nature Reserves have the strictest designation of all categories within the Belize National Protected Areas System, with no extractive use or tourism access permitted. Two are managed directly by Forest Department (Hopkins Wetland and Burdon Canal), and two managed under co-management regimes (Bladen and Tapir Mountain).
Wildlife Sanctuaries

For the protection of nationally significant species, biotic communities or physical features

There are eight Wildlife Sanctuaries within the protected areas system, seven of which are managed under co-management regimes, whilst one (Labouring Creek) falls under the management of the Forest Department. Two Wildlife Sanctuaries – Corozal Bay and Swallow Caye Wildlife Sanctuaries - are considered to be components of the marine protected areas system.

Other Reserves

Two further reserves - St. George’s Caye Mangrove Reserve and Cockroach Bay Reserve - have been established by the Forest Department for specific conservation objectives, but are not yet fully integrated into the National Protected Areas System. Both are considered components of the management unit for that area.

1.3.2 Fisheries Department Administered Protected Areas

Marine reserves, utilized as a fisheries management tool, are one of the most important conservation tools available for ensuring the conservation of the marine environment, and, like the terrestrial protected areas, contribute towards global goals and standards laid out under the Convention on Biological Diversity.

The nine Marine Reserves are administered by the Fisheries Department, with five managed directly and the remaining three managed with co-management partners (Southern Environmental Association, and Toledo Institute for Development and Environment) (Annex One). Marine Reserves, established under the Fisheries Department, have clearly defined zones allowing for extractive and non-extractive use and conservation protection, with use concentrating on sustainable fishing, tourism, research and education.

Annex Ten: Breakdown of zone areas

Spawning Aggregation Sites

The Fisheries Department has also established eleven protected Spawning Aggregation Sites (SI 161 of 2003) – the majority of the sites currently known within Belize waters. There is a provision for continued fishing, with the exception of Nassau Grouper, by traditional fishermen under special license for only one site - Gladden Spit. A further two sites (Mauger Caye (Turneffe Atoll) and Northern Two Cayes (Lighthouse Reef)), whilst not having full protection, have seasonal protection for Nassau Grouper (SI 162 of 2003).
1.3.3 Archaeological Reserves

16 Archaeological Reserves have been established for the protection, conservation and study of archaeological and cultural sites, also afford legal protection to the biodiversity at those sites. Site management presence is generally relatively strong, and focussed on the primary mandate of archaeological conservation. The three largest reserves, Caracol, El Pilar and Lamanai also play important biodiversity conservation roles within the National Protected Areas System and collaborative efforts, such as those between the Institute of Archaeology (IoA) and the Friends for Conservation and Development (FCD), are directed towards strengthening biodiversity conservation management.

1.3.4 Other Protected Areas

Bird Colonies: The 7 Bird Sanctuaries were gazetted in 1977, under the Crown Lands Ordinance (1926), to protect critical nesting and roosting colonies (Table 10). There is no formal administration of these cayes within the National Protected Areas System unless they occur within other protected areas (e.g. Man-O-War Caye, which lies within South Water Caye Marine Reserve and is managed as part of the protected area, by Belize Fisheries Department staff). Other important bird colony nesting sites merit full protection, though designation as Bird Sanctuaries would be only the first step in that direction.

Private Reserves: The 7 recognized Private Reserves that are informally acknowledged by Forest Department as within the National Protected Areas System are lands held under private ownership either by conservation organizations or by private individuals. An eighth, Aguacate Lagoon has recently been removed at the request of the owners. A number of other ‘candidate’ protected areas play critical national and regional roles in conservation and are assessed for integration into the NPAS. At the request of the Forest Department and after extensive consultation with stakeholders, the Belize Association of Private Protected Areas (BAPPA) has drafted proposed amendments to the National Parks System Act to provide a legal framework for recognized PPAs to be integrated within the System. These proposed amendments are currently under review as part of the wider legislative review running parallel with this rationalization process.

Unlike those protected areas administered under the Forest and Fisheries Departments, the Archaeological Sites, Bird Sanctuaries and Private Protected Areas (PPAs), are poorly integrated into the National Protected Areas System, a weakness recognized under the National Protected Areas System Plan.

Annex One: Protected areas of the National Protected Areas System
1.4 Key Challenges

A few key over-arching issues must be recognized and addressed for many of the specific recommended actions to be effective once implemented:

**Water Security**

With the predicted changes in rainfall patterns and altitudinal shifts in ecosystem distribution, one of the biggest challenges ahead will be the maintenance of effective forested watershed catchment areas on the east-facing slopes of the Maya Mountains Massif – Columbia River Forest Reserve, Bladen Nature Reserve, Maya Mountains Forest Reserve, Cockscomb Basin Wildlife Sanctuary, Sittee River and Sibun Forest Reserves.

All these are critical for the maintenance of water security on the southern coastal plain for both communities and the large scale agricultural industries of the area. There will be an increasing demand for access to land within these protected areas, but removal of the forest cover, even on the lower slopes, has the potential to reduce water security, as has been demonstrated in similar situations in neighbouring Guatemala, where once flowing rivers have now run dry. Additionally, these forested slopes provide the best possible security against life-threatening mudslides that are prevalent elsewhere in the region.

**Climate Change**

Climate change adaptation is strengthened significantly by replication in ecosystem protection. Previous determinations of minimum dynamic areas for ecosystem coverage need to be revised upwards in view of increasing strength of tropical storm events and associated fire and flood impacts. As such, ecosystem coverages previously assessed as potentially being redundant are no longer so, with international guidelines recommending replication of ecosystems where feasible.

The need for biological connectivity between protected areas and across the system is critical if long-term species diversity is to be maintained through the predicted increase in climate change impacts.

**Management Effectiveness**

However well designed the protected areas system is to be fully representative and resilient to climate change, it will not succeed unless natural resource management is improved. This issue can be characterized by the following challenges.
Context

Terrestrial Protected Areas

- Transboundary incursions and issues beyond the scope of the pa co-management agencies to deal with, with very limited action by Government
- Often unregulated timber harvest, not based on sustainability
- Non prioritization of formalization of primary corridors – the most important tool for mitigation of climate change impact in the terrestrial system
- Lack of incentives for private sector participation
- Generally weak enforcement of conservation legislation
- Limited understanding amongst political leaders and the general public of the importance of the protected area system to national economic development and provision of critical environmental services for a healthy population

Marine Protected Areas

- Transboundary incursions, and very limited action by Government
- Bias / corruption in surveillance and enforcement teams, reducing buy-in by stakeholders
- Limited spill-over effect with no-take zones that are too small and are inadequately protected, as a result of weak surveillance and enforcement, reducing buy-in by fishermen, and significantly reducing maximum sustainable yield
- Lack of benefit seen by fishermen, expressed through lack of compliance with fishing regulations - poses a significant socio-economic threat to long term security and viability of both the marine protected areas and Belize’s fishing industry

Community Use

A number of protected areas currently designated as non extractive have long-standing traditional use that has been tacitly recognized by the Forest Department, but is in direct contradiction to the legal designation of the area. This is particularly true for some of the Wildlife Sanctuaries, and needs to be addressed.

There is also a need to allow greater access into some of the Forest Reserves, particularly in Toledo District, where natural resource extraction is socio-economically and culturally important. Access to areas such as Columbia River Forest Reserve needs to be facilitated, but also needs to be based on appropriate sustainable use plans, with the development of stewardship by local communities.
2.0 Ecosystem and Species Representation

Goal: The National Protected Areas System includes high quality examples of the full range of environment types within Belize, with balanced representation of the ecosystem types they represent.

Key Outputs

- Identification of critical gaps / redundancies
- Implications of climate change
- Identification of socio-political implications of any recommended alteration to the protected areas system
- Potential for area trade-offs
- Identification of critical private protected areas in maintaining / creating ecosystem representation

The International Union for the Conservation of Nature (IUCN) recommends a minimum of 10% representation per ecosystem within a National Protected Areas System, for it to be considered to be sufficient to maintain the viability of 50 - 70% of the species associated with that ecosystem. The Selva Maya, Zoque and Olmec Ecoregional Planning initiative used a minimum of 30%, considered sufficient for maintaining the viability of 65 - 85% of species.

The gap analysis conducted under the NPAPSP was based on the underlying theory that a minimum area of at least 30% will be required to maintain the viability of each ecosystem, with some smaller or more vulnerable ecosystems requiring larger percentage protection. Each ecosystem was allocated a threshold percentage required for representative coverage, and gaps identified in the ecosystem coverage of the National Protected Areas System based on these criteria (NPAPSP, 2005).

Since the NPAPSP, the initial ecosystem mapping for Belize has been revised, with the merging of some ecosystems considered to be the two ends of a single spectrum (Meerman, 2011). Bearing this in mind, the percentage per ecosystem within the National Protected Areas System was re-assessed for this review. Of the 68 natural ecosystems identified under the revised ecosystem mapping (Meerman, 2011), Seven ecosystems do not meet the 10% target recommended as the IUCN minimum (Table 2), and can therefore be considered under-represented, based on the IUCN minimum of 10% representation within
the National Protected Areas System. When using 30% as the minimum threshold for representation, a further 21 ecosystems would be considered under-represented (Table 3).

<table>
<thead>
<tr>
<th>Terrestrial Ecosystems with &lt; 10% protection</th>
<th>% within PA Network*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caribbean Open Sea – abyssal (&gt; 4000m)</td>
<td>0.0</td>
</tr>
<tr>
<td>Caribbean Open Sea – bathyal (1000 – 4000m)</td>
<td>0.3</td>
</tr>
<tr>
<td>Caribbean Open Sea – mesopelagic (200 – 1000m)</td>
<td>3.1</td>
</tr>
<tr>
<td>Eleocharis marsh</td>
<td>8.0</td>
</tr>
<tr>
<td>Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant</td>
<td>8.0</td>
</tr>
<tr>
<td>Caribbean mangrove forest; dwarf mangrove scrub</td>
<td>9.3</td>
</tr>
<tr>
<td>Caribbean Open Sea</td>
<td>9.9</td>
</tr>
</tbody>
</table>

**Table 2: Ecosystems with < 10% protection within the NPAS**

<table>
<thead>
<tr>
<th>Terrestrial Ecosystems with 10% - 30% protection</th>
<th>% within PA Network*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caribbean mangrove forest; riverine mangrove</td>
<td>11.0</td>
</tr>
<tr>
<td>Caribbean mangrove forest; coastal fringe mangrove</td>
<td>12.6</td>
</tr>
<tr>
<td>Tropical evergreen broad-leaved lowland forest, moderately drained, on calcareous soils</td>
<td>13.8</td>
</tr>
<tr>
<td>Tropical coastal vegetation on very recent sediments, moderately drained</td>
<td>14.4</td>
</tr>
<tr>
<td>River</td>
<td>16.8</td>
</tr>
<tr>
<td>Caribbean mangrove forest; freshwater mangrove scrub</td>
<td>17.4</td>
</tr>
<tr>
<td>Caribbean mangrove forest; mixed mangrove scrub</td>
<td>18.2</td>
</tr>
<tr>
<td>Tropical evergreen seasonal broad-leaved alluvial forest, occasionally inundated</td>
<td>18.5</td>
</tr>
<tr>
<td>Marine salt marsh</td>
<td>18.6</td>
</tr>
<tr>
<td>Tropical deciduous microphyllous lowland forest, well drained</td>
<td>20.2</td>
</tr>
<tr>
<td>Short-grass savanna with dense trees or shrubs</td>
<td>20.9</td>
</tr>
<tr>
<td>Deciduous broad-leaved lowland disturbed shrubland</td>
<td>23.1</td>
</tr>
<tr>
<td>Caribbean inner lagoon</td>
<td>23.4</td>
</tr>
<tr>
<td>Short-grass savanna with scattered trees and/or shrubs</td>
<td>24.4</td>
</tr>
<tr>
<td>Deciduous broad-leaved lowland riparian shrubland of the plains</td>
<td>25.0</td>
</tr>
<tr>
<td>Tall-herbs lowland swamp</td>
<td>26.5</td>
</tr>
<tr>
<td>Tropical evergreen seasonal broad-leaved lowland swamp forest, short tree variant</td>
<td>26.8</td>
</tr>
<tr>
<td>Deciduous broad-leaved lowland shrubland, poorly drained</td>
<td>27.0</td>
</tr>
<tr>
<td>Caribbean mangrove forest; basin mangrove</td>
<td>27.2</td>
</tr>
<tr>
<td>Tropical evergreen seasonal broad-leaved lowland forest on calcareous soils</td>
<td>27.4</td>
</tr>
<tr>
<td>Brackish lake of the Caribbean littoral plain</td>
<td>28.4</td>
</tr>
</tbody>
</table>

**Table 3: Ecosystems with 10% - 30% protection within the NPAS**
2.1 Primary Gaps in Coverage

The most prominent gaps are in the marine environment, under the various categories of *Caribbean Open Sea* (Map 4).

- **Caribbean Open Sea – Abyssal** lacks any representation within the national ecosystem coverage.

- Two other deep water ecosystems (*Bathyal* and *Mesopelagic*) have very poor coverage, 0.3% and 3.1% respectively.

- Whilst not an ecosystem in their own right, seamounts such as those between Turneffe and Lighthouse Atolls are also important systems that are currently not represented within the NPAS.

- Shallower, coastal shelf waters, still classified as *Caribbean Open Sea* also have just under 10% representation.

Also highlighted as under-represented within the system are:

- **Caribbean mangrove forests**, with only 9.3% of dwarf mangrove scrub within the NPAS.

- Coastal forests (littoral forests) and beach vegetation (Tropical coastal vegetation on very recent sediments, moderately drained), considered one of the most vulnerable ecosystems, lying in areas targeted for tourism development.

- Rivers are poorly represented, often being used to define protected area borders, but not being included within the protected areas themselves. This will impact effectiveness in protection of species such as the critically endangered Central American river turtle.

- Two seasonally inundated ecosystems of the coastal plain - *Eleocharis marsh* and *Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant* have less than 10% coverage.
Map 4: The Caribbean Open Sea complex of ecosystems, under-represented within the National Protected Areas System
Where there was some potential redundancy in ecosystem coverage, the protected areas fulfil other critical roles, such as watershed protection and other environmental services. Additionally, increasing risk of impacts from hurricanes and post-hurricane anthropogenic fire is thought to be having a profound impact on redundancy, with larger areas of coverage of greater geographical spread, with replication, now being considered necessary to fulfil minimum dynamic area and threat mitigation requirements. What may previously have been considered redundancy in coverage of some ecosystems is now insurance against potentially non-reversible impacts.

### Recommendations: Under-represented Ecosystems

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Justification</th>
<th>Barriers</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Marine Ecosystems</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1. Inclusion of at least 30% of <em>Caribbean Open Sea – Abyssal</em> in national waters within the NPAS</td>
<td>This ecosystem has 0% representation within the NPAS</td>
<td><strong>Barriers</strong></td>
<td></td>
</tr>
<tr>
<td>▪ 5 nm extensions of eastern boundaries of all BBR MPAs to encompass a greater proportion of the bathypelagic zones.</td>
<td></td>
<td>▪ Very hard to monitor</td>
<td></td>
</tr>
<tr>
<td>▪ <strong>Coastal shelf</strong>- 9.9%</td>
<td></td>
<td>▪ Limited knowledge of this ecosystem for defining an area</td>
<td></td>
</tr>
<tr>
<td>▪ <strong>Bathyal</strong> – 0.3%</td>
<td></td>
<td>▪ There is currently no use of the area and therefore limited direct conflict in park creation</td>
<td></td>
</tr>
<tr>
<td>▪ <strong>Mesopelagic</strong> - 3.1%</td>
<td></td>
<td>▪ Designation of Turneffe needs to balance protection and access for deep sea fishing – however there is also an extensive area of deep sea outside the Turneffe MR</td>
<td></td>
</tr>
<tr>
<td>▪ Declaration of Turneffe Atoll as a Marine Reserve (effected November 2012)</td>
<td></td>
<td>▪ Conflict with some fishermen, who want better management but have a misconception that they will be excluded if the area is declared a Marine Reserve</td>
<td></td>
</tr>
<tr>
<td>▪ Identification of other deep sea areas (Mesopelagic and/or Bathyal) that could be designated as MR in the future to increase coverage of these ecosystems</td>
<td></td>
<td>▪ Funding for effective management of Turneffe Atoll as a Marine Reserve, declared in November, 2012</td>
<td></td>
</tr>
<tr>
<td>▪ 5 nm extensions of eastern boundaries of all BBR MPAs to encompass a greater proportion of the bathypelagic zones.</td>
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</tr>
<tr>
<td>2. Increase protection to <em>Caribbean Open Sea – Coastal Shelf</em> (by at least 1%), <em>Caribbean Open Sea – Bathyal</em> (by 10%) and <em>Mesopelagic</em> (by 7%) to meet IUCN targets</td>
<td><strong>Caribbean Open Sea – Coastal Shelf, Caribbean Open Sea – Mesopelagic and Caribbean Open Sea – Bathyal, are identified as under-represented ecosystems within the NPAS</strong></td>
<td><strong>Barriers</strong></td>
<td></td>
</tr>
<tr>
<td>▪ Coastal shelf- 9.9%</td>
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<tr>
<td><strong>Eleocharis marsh</strong></td>
<td></td>
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</tr>
<tr>
<td>3. Increase representation and viability of <em>Eleocharis marsh</em> within the system,</td>
<td>• The high connectivity between the current protected ecosystem within Hopkins Nature Reserve and the remaining wetland area makes this system very vulnerable, as impacts in the unprotected area will affect the entire area</td>
<td>• Despite being wetland and unsuitable for development, some survey lines already extend into area</td>
</tr>
<tr>
<td></td>
<td>▪ Extension of Hopkins Wetland Nature Reserve (recommendation change in designation to National Park)</td>
<td><strong>Opportunities</strong></td>
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<tr>
<td></td>
<td></td>
<td>• Community supported initiative to protect environmental services</td>
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<tr>
<td><strong>Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant</strong></td>
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<tr>
<td>4. Increase representation of <em>Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant</em> within the NPAS</td>
<td>• Less than 8% of <em>Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant</em> is represented within the NPAS</td>
<td><strong>Barriers</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Investigate use of conservation covenant to protect the swamp forest contiguous with the TIDE private lands (Big Falls/Lou Morski)</td>
<td>• Part of the swamp forest lies outside (but adjacent to) the TIDE lands</td>
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<td></td>
<td>▪ Facilitate attempts to secure the Peccary Hills PPA</td>
<td><strong>Opportunities</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Much of the ecosystem lies within the TIDE private lands</td>
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<tr>
<td></td>
<td></td>
<td>• Area is within the Maya Mountains Marine Corridor landscape</td>
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<td></td>
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<td>• TIDE is an active co-manager in the area</td>
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<td>• Peccary Hills PPA includes a significant tract of this ecosystem (previously unmapped)</td>
</tr>
<tr>
<td><strong>Mangrove and Marine Salt Marsh Ecosystems</strong></td>
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<tr>
<td>5. Increase representation of all mangrove ecosystems within the NPAS</td>
<td></td>
<td><strong>Barriers</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Dwarf mangrove is significantly under-represented within the NPAS (&lt;10%)</td>
<td>• Coastal land is seen as having a high commercial value</td>
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<td>▪ Fringing mangrove is significantly under-represented within the NPAS (12.5%)</td>
<td><strong>Opportunities</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Coastal lagoons and saline mudflats, with associated dwarf mangrove are highly vulnerable ecosystems, frequently inundated and will become permanently so with climate change, and have low development potential</td>
<td>• Representative coastal lagoons within the Balam Jungle area may be available through tax default land exchange</td>
</tr>
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<td></td>
<td>▪ Inclusion of representative northern coastal lagoons and adjacent mudflats would also increase protection of <em>Marine salt marsh</em></td>
<td>• Northern Shipstern Lagoon and the surrounding saline savanna is seldom used by local community, and lies within a No Hunting area</td>
</tr>
<tr>
<td></td>
<td>▪ Would also protect critical fish nursery areas</td>
<td>• Some of the lagoon systems / dwarf mangrove north of Spanish Point may be National land Point is National land – secured against a tax default</td>
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<td></td>
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<td>• Integrated Coastal Zone Plan may inform land use decisions</td>
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</table>
### Recommendations: Under-represented Ecosystems

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Justification</th>
<th>Barriers / Opportunities</th>
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</thead>
<tbody>
<tr>
<td><strong>Tropical Evergreen Broad-leaved Lowland Forest on Calcareous Soils</strong></td>
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</table>
| 6. Increase protection of *Tropical Evergreen Broad-leaved Lowland Forest on Calcareous Soils* | ▪ This ecosystem is found predominantly in the Northern Lowlands, particularly in the Selva Maya/Rio Bravo node, and in Freshwater Creek FR and the North East corridor route | ▪ Yalbac and Gallon Jug are private properties, with a need for landowners to be fully engaged  
▪ The land east of Freshwater Creek is in private ownership, with large scale land clearance for agriculture by the Mennonites (‘Newland’) |
▪ Continued protection of Rio Bravo  
▪ Prioritise engagement / integration of Yalbac and Gallon Jug as PPAs  
▪ Maintain integrity of Freshwater Forest Creek and Honey Camp  
▪ Creation of North East Corridor  
▪ Ensure through the EIA process that any oil exploration or other activities within the ecosystem area has minimal impact on ecosystem |
▪ Barriers  
▪ Opportunities |
| **Tropical Coastal Vegetation on Very Recent Sediments, moderately drained (Littoral Forest and Beach Vegetation)** | | |
| 7. Increase protection of rapidly disappearing littoral forest and beach vegetation | ▪ Would provide important protection to rapidly disappearing littoral forest and turtle nesting beaches  
▪ Would increase the extent of fringing mangrove under protection  
▪ Would also increase protection for caye mangroves, particularly important for maintenance of reef health. Would ensure the maintenance of critical connectivity between mangroves, seagrass and reef  
▪ Also critical bird nesting colonies  
▪ May also increase viability for endemic gecko species | ▪ Cayes are seen as having a high commercial value  
▪ Few cayes still remain national lands despite moratorium on sale  
▪ Would require greater collaboration between Forest and Fisheries Department, as would include both terrestrial and marine – this would be achieved through the new administration structure |
▪ Inclusion of at least some national cayes within marine protected area protection  
▪ More specifically, inclusion of a number of national cayes and all inundated mangrove within Turneffe Atoll Marine Reserve  
▪ Increased protection and security for the Caye Caulker Forest Reserve |
▪ Barriers  
▪ Opportunities |
▪ National lands still exists at Turneffe Atoll  
▪ National cayes still exist within some other marine protected areas |
## Recommendations: Under-represented Ecosystems

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Justification</th>
<th>Barriers / Opportunities</th>
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</thead>
<tbody>
<tr>
<td><strong>River</strong></td>
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<tr>
<td>8. Increase representation of rivers within the NPAS</td>
<td></td>
<td><strong>Barriers</strong></td>
</tr>
<tr>
<td>▪ Inclusion of at least 2 miles each of New River and Rio Hondo (Belize side) from the river mouths within Statutory Instrument for Corozal Bay Wildlife Sanctuary</td>
<td>▪ Rivers are under-represented within the NPAS</td>
<td></td>
</tr>
<tr>
<td>▪ Inclusion of at least 2 miles of Deep River from the river mouth within Statutory Instrument of either Payne’s Creek NP or Port Honduras MR</td>
<td>▪ Strengthening of protected connectivity between freshwater and the reef</td>
<td></td>
</tr>
<tr>
<td>▪ Inclusion of a further 2 miles of Manatee River, particularly for protection of the critically endangered Central American river turtle</td>
<td>▪ The red mangroves at the mouth of the New River are amongst some of the best examples in Belize.</td>
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<td></td>
<td>▪ Would increase representation of riverine mangrove</td>
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<td></td>
<td>▪ Would strengthen ability to address pollution issues and clearance of riparian vegetation</td>
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<td></td>
<td>▪ Would strengthen binational initiatives focused on protection and monitoring of Rio Hondo</td>
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<td></td>
<td>▪ To be effective, would also need to include the 66’, or at least the vegetation directly bordering the rivers</td>
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<td>▪ Would need to allow for local access / traditional use – e.g. line fishing</td>
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<tr>
<td><strong>Opportunities</strong></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>▪ Natural riparian vegetation is largely intact</td>
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<tr>
<td></td>
<td>▪ Deep River forms boundary for national and private protected areas, so support for river protection</td>
<td></td>
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</table>

| **Tropical evergreen seasonal broad-leaved alluvial forest, occasionally inundated** | | |
| 9. Increase representation of Tropical evergreen seasonal broad-leaved alluvial forest, occasionally inundated within the NPAS | ▪ Found along the Rio Hondo and tributaries that cross Rio Bravo C&M Area and Gallon Jug | **Barriers** |
| ▪ Ensure continued protection of Rio Bravo | ▪ Found along the New River |
| ▪ Prioritise engagement of Gallon Jug as a PPA | | **Gallon Jug is a private property, with a need for landowners to be fully engaged to commit to PPA status** |
| ▪ Ensure through EIAs that any oil exploration or other activities within the ecosystem area has minimal impact on ecosystem | **Opportunities** |
| | ▪ Gallon Jug has shown interest through BAPPA in committing land to protection as private protected area |

**Annex Three:** Maps of under-represented ecosystems (<10% coverage within the National Protected Areas System).
2.2 Representation of ecosystems of limited extent (<1000 acres nationally)

Belize has good protection of the four ecosystems with a national extent of under 1,000 acres (Table 4), with three being fully represented within the NPAS. The fourth, swamp grassland without trees of shrubs, waterlogged currently has over 48% under protection. The remaining 52% is contiguous with the represented ecosystem within Crooked Tree Wildlife Sanctuary. With the limited extent of this ecosystem nationally, and the high connectivity of wetland ecosystems, it is recommended that protection be extended to include the total extent of this ecosystem (Annex Three).

<table>
<thead>
<tr>
<th>Ecosystems ≤1,000 acres nationally</th>
<th>National Acres</th>
<th>PA (&gt;10% coverage)</th>
<th>% per PA</th>
<th>Total % protected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swamp grassland without trees or shrubs, waterlogged</td>
<td>911.96</td>
<td>Aguacaliente WS Crooked Tree WS</td>
<td>13.54 34.76</td>
<td>48.30</td>
</tr>
<tr>
<td>Tropical evergreen broad-leaved shrubland on steep karstic hills</td>
<td>829.46</td>
<td>Bladen NR</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Tropical evergreen seasonal broad-leaved lowland swamp forest, Aguacaliente variant</td>
<td>327.76</td>
<td>Aguacaliente WS</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Tropical evergreen seasonal broad-leaved lower montane forest</td>
<td>281.32</td>
<td>Victoria Peak NM</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 4: Ecosystems under 1,000 acres

Recommendations: Representation of Ecosystems of Limited Extent (<1,000 acres)

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Justification</th>
<th>Barriers / Opportunities</th>
</tr>
</thead>
</table>
| 1. Improve protection of swamp grassland without trees or shrubs, waterlogged | ▪ This ecosystem has a limited extent of just under 1,000 acres  
▪ Any impacts in this ecosystem outside the protected area will threaten the viability of the entire ecosystem  
▪ The area is waterlogged for at least a part of the year, with limited development potential  
▪ Crooked Tree Wildlife Sanctuary is one of Belize’s two RAMSAR sites | ▪ There is a high probability that the land is privately owned  
▪ There is distrust and limited community support for the protected area |

Opportunities

▪ Part of the ecosystem already lies within a contiguous national protected area, managed by Belize Audubon Society  
▪ The draft Conservation Covenant Act provides a mechanism to secure conservation management without a change of ownership.
2.3 Priority areas for key terrestrial biodiversity protection

Priority areas for key biodiversity protection were identified under the Key Biodiversity Areas (KBA) Assessment (Map 5; Meerman, 2007) based on a Marxan analysis, with two outputs – the first focused on the presence of globally threatened species as per the IUCN redlist criteria; the second included species of national concern, such as birds that concentrate at highly vulnerable nesting colonies and sub species of national concern such as the scarlet macaw.

The identified highest priority biodiversity areas of global concern in Belize (Global Key Biodiversity Area 1) are adequately covered by the NPAS, occurring within the protected areas of the Maya Mountains Massif (Map 5, left), though it should be noted that this is with significant impacts from illegal Guatemalan incursions.

The second highest priority areas are also primarily within the Maya Mountains Massif, though there are significant area highlighted within the privately owned Gallon Jug and Yalbac areas as well. These areas are also highlighted in the National KBA prioritization, with Rio Bravo in particular encompassing a large percentage of the national KBA1 component.

On the national level, the North East Corridor and Balam Jungle rate as a National KBA 2, incorporating components of Shipstern Nature Reserve and Fireburn Reserve (both private protected areas), the proposed Kakantulix Archaeological Reserve, Freshwater Creek Forest Reserve and Honey Camp National Park. The Central Corridor, with Monkey Bay National Park, Monkey Bay Wildlife Sanctuary (private protected area) and Manatee Forest Reserve, also rates as National KBA 2, as do portions of the Southern Corridor and Sarstoon Temash National Park.
Based on IUCN Species of Concern

KBA Level 1
KBA Level 2

Based on IUCN / National Species of Concern

KBA Level 3
KBA Level 4

Belize

Map 5: Key Biodiversity Area outputs (Marxan outputs, Meerman, 2007)
# Recommendations: Priority Areas for Key Biodiversity Protection

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Justification</th>
<th>Barriers / Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Prioritise strengthened protection of the Maya Mountains Massif, to improve biodiversity viability</td>
<td>▪ The Maya Mountains Massif provides protection to Belize’s global Key Biodiversity Area 1 &lt;br&gt;▪ Also provides protection to a significant portion of Belize’s Key Biodiversity Area 2</td>
<td><strong>Barriers / Threats</strong>&lt;br&gt;▪ Increasing human footprint on the southern and central coastal plain may increase pressure for land within the Maya Mountains Massif&lt;br&gt;▪ Increasing demand for access to Global KBA for mineral exploration&lt;br&gt;▪ Over-riding Mining legislation&lt;br&gt;▪ Extensive impacts from transboundary incursions&lt;br&gt;&lt;br&gt;<strong>Opportunities</strong>&lt;br&gt;▪ KBA1 lies within protected areas&lt;br&gt;▪ Potential for inclusion of regulatory framework for mining activities within the NPAS&lt;br&gt;▪ Both the MMM and MMMC have Conservation Action Plans with wide stakeholder participation</td>
</tr>
<tr>
<td>▪ Critical need to prevent or effectively regulate mineral exploration within KBA1 (Bladen, Chiquibul NP, Columbia River)&lt;br&gt;▪ Critical need to establish central corridor to link MMM with the Selva Maya forest node for continued long-term national biodiversity viability&lt;br&gt;▪ Critical need to strengthen enforcement against transboundary incursions&lt;br&gt;▪ Implement the MMM and continue implementing MMMC Conservation Action Plans</td>
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<tr>
<td>2. Prioritise continued protection of the Rio Bravo / Gallon Jug / Yalbac forest node</td>
<td>The Rio Bravo / Gallon Jug / Yalbac forest node provides protection to a significant portion of Belize’s Key Biodiversity Area 2&lt;br&gt;Is also a part of the regional priority Selva Maya node</td>
<td><strong>Barriers / Threats</strong>&lt;br&gt;▪ Private landowners (Gallon Jug and Yalbac) are not yet committed to putting land into conservation&lt;br&gt;&lt;br&gt;<strong>Opportunities</strong>&lt;br&gt;▪ Private landowners have shown interest in committing their land to conservation through BAPPA</td>
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<tr>
<td>▪ Continue engaging landowners for commitment to private protected area status&lt;br&gt;▪ Investigate and implement tools such as financial incentives and conservation covenants</td>
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<tr>
<td>3. Prioritise continued protection of the Shipstern / Fireburn Node to maintain or improve biodiversity viability</td>
<td>▪ Would provide increased protection to National KBA 2&lt;br&gt;▪ Would strengthen connectivity between the Shipstern / Fireburn forest node and Freshwater Creek FR&lt;br&gt;▪ Increased protection for one of the few remaining areas in Belize to support white-lipped peccaries</td>
<td><strong>Barriers / Threats</strong>&lt;br&gt;▪ Much of the corridor passes through private lands – including Balam Jungle and new Mennonite community&lt;br&gt;&lt;br&gt;<strong>Opportunities</strong>&lt;br&gt;▪ North East Corridor Initiative has been on-going under Wildtracks, with establishment of Fireburn and Balam Na Reserves (PPAs) and proposed establishment of Kakantulix AR&lt;br&gt;▪ Balam Jungle has been relinquishing land in default of taxes – may be a suitable mechanism for protection&lt;br&gt;▪ The “Newland” DoE requirements call for non-development of the corridor route – community is interested in land-swap of this area</td>
</tr>
<tr>
<td>▪ Establish the North East Corridor, from Shipstern Nature Reserve (PPA) to Freshwater Creek FR / Honey Camp NP&lt;br&gt;▪ Establish legal commitment of Shipstern Nature Reserve and Fireburn Reserve as part of NPAS&lt;br&gt;▪ Support / facilitate establishment of proposed Kakantulix Archaeological Reserve</td>
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### Recommendations: Priority Areas for Key Biodiversity Protection

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<tr>
<td>4. Strengthening of secondary forest node – Runaway Creek / Peccary Hills</td>
<td>▪ Misaligned boundaries have resulted in a physical separation between Manatee FR and Runaway Creek PPA / Peccary Hills NP, reducing connectivity</td>
<td><strong>Barriers</strong>&lt;br&gt;▪ The Peccary Hills / Hwatchy property is privately owned, but is for sale&lt;br&gt;▪ Realignments of Manatee FR may have resulted in the allocation of land in the area separating the protected areas <strong>Opportunities</strong>&lt;br&gt;▪ There has been an initiative to provide private protection sustained by tourism in the Peccary Hills area, with investments in biodiversity assessment</td>
</tr>
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</table>
  ▪ Investigate potential to include the Peccary Hills / Hwatchy property within the NPAS and increase connectivity with Manatee FR.<br>▪ Integration of the private Peccary Hills property (Hwatchy property) if feasible<br>▪ Realign boundaries that have resulted in a physical separation between Manatee FR and Runaway Creek PPA / Peccary Hills NP, to increase connectivity<br>▪ Peccary Hills NP needs active management |

#### 2.4 Species Specific Interventions

A number of other species-specific interventions have been identified for the following national / global priority species / species groups:

- Central American river turtle
- Goliath grouper nursery areas
- Key hawksbill, green and loggerhead turtles nesting sites
- Yellow-headed parrot nesting areas
- Geoffroy’s spider monkey
- West Indian manatee priority use areas
- American crocodile nesting beach at Cockroach Bay, Turneffe
- Endemic Species
- Spawning Aggregation Sites (particularly snapper and grouper)
- Bird Nesting Colonies
- Shark Nursery Areas
The majority of critically endangered / endangered terrestrial species in Belize are amphibians, found in the upper elevations of the Maya Mountains Massif, and therefore considered well protected against many anthropogenic threats. Whilst chytrid fungus, is present, the greatest threats are identified as those factors that exacerbate the disease – agro-chemicals transported with orographic rainfall, and increasingly reduced rainfall / greater seasonality as a result of climate change.

### Recommendations: Priority Areas for Species Specific Protected Area Interventions

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<th>Recommendations</th>
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<tbody>
<tr>
<td><strong>Central American river turtle</strong></td>
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<tr>
<td>Prioritise protected areas that provide protection for increased viability for the Central American river turtle (<em>Dermatemys mawii</em>)</td>
<td>The Central American river turtle is Critically Endangered (IUCN, 2012), and has declined rapidly in Belize over the last 15 years. It is considered one of the top 25 most endangered turtles in the world. This species is still being hunted (both legally and illegally) in Belize despite its global and national status. Protected areas known to protect key populations of this species should be prioritised as a mechanism to maintain the viability of this species. The following areas have been highlighted for their importance for this species: Belize River, Irish Creek, Lower Sibun, Manatee River and Soldier Creek, Moho River, New River Lagoon / New River, Rio Bravo, Rio Grande, Rio Hondo, Temash River, Whitewater Lagoon</td>
<td>Key areas may be in private lands and lack of management. Few river systems have any form of protection. Transnational hunting incursions in Temash. Reluctance to afford full protection to this species.</td>
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<tr>
<td>Extension of Gales Point WS further up Manatee River</td>
<td></td>
<td>On-going Central American river turtle initiative.</td>
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<tr>
<td>Prioritization of Peccary Hills NP and Hwatchy property for their protection of Freshwater Creek</td>
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<td>Active conservation organizations in some key areas.</td>
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<td>Increased species-specific protection in Spanish Creek, Gales Point and Crooked Tree Wildlife Sanctuaries</td>
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<tr>
<td>Ensure Whitewater Lagoon is fully protected within the Labouring Creek Jaguar Corridor Wildlife Sanctuary</td>
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<tr>
<td>Ensure that any traditional fishing rights do not include the Central American river turtle</td>
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<tr>
<td>Extension of Corozal Bay Wildlife Sanctuary 2 miles up Rio Hondo and New River</td>
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## Recommendations: Priority Areas for Species Specific Protected Area Interventions

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<th>Recommendations</th>
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<th>Barriers / Opportunities</th>
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</table>
| **Goliath Grouper** | Greater protection for protected areas that provide nursery habitat for the Critically Endangered goliath grouper  
- Prioritization and strengthening of important nursery areas, including:  
  - Gales Point WS  
  - Payne’s Creek NP  
  - Corozal Bay WS | The goliath grouper (*Epinephelus itajara*) is Critically Endangered (IUCN, 2012), and has declined rapidly in Belize over the last 15 years  
- Protected areas known to protect key populations of this species should be prioritised as a mechanism to maintain the viability of this species  
- Goliath grouper isn’t a protected species, reducing ability to manage the population | **Barriers**  
- Goliath grouper isn’t a protected species, reducing ability to manage the population  
**Opportunities**  
- Management presence in several key areas  
- Potential for realignment of boundaries of Payne’s Creek to include lagoon |
| **Hawksbill, Green and Loggerhead Turtles** | Strengthen protection of key nesting sites of the Critically Endangered Hawksbill turtle, and other turtle species  
- Extension of Gales Point WS to include the 66’ of the Critically Endangered Hawksbill turtle nesting beach as an addition to Gales Point Wildlife Sanctuary, with revision of SI92 of 1998  
- Support PPA initiatives to strengthen turtle conservation  
- Inclusion of nesting cayes within marine protected areas where feasible  
- Continue and strengthen protection of Bacalar Chico nesting beach | The hawksbill turtle (*Eretmochelys imbricata*) is globally Critically Endangered (IUCN, 2012)  
- The nesting beach at Manatee Bar was once one of the largest in the region, and still supports a significant number of nests each year  
- The area is targeted for coastal development  
- Belize has few cayes under protection, and even fewer that are used by critically endangered and endangered turtles for nesting  
- Coastal land is private property  
- Cayes are considered of high monetary and development value  
- There is currently no development behind the majority of the nesting beach  
- One of the property owners is willing to set aside part of the beach  
- The beach lies within the 66’ ‘Queen’s Chain’  
- A limited number of cayes used as nest sites by hawksbill turtles, and within MPAs, are still national lands | **Barriers / Threats**  
- Coastal land is private property  
- Cayes are considered of high monetary and development value  
**Opportunities**  
- There is currently no development behind the majority of the nesting beach  
- One of the property owners is willing to set aside part of the beach  
- The beach lies within the 66’ ‘Queen’s Chain’  
- A limited number of cayes used as nest sites by hawksbill turtles, and within MPAs, are still national lands |
| Recommendations: Priority Areas for Species Specific Protected Area Interventions |
|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| **Yellow-headed Parrot**                      | **Justification**                             | **Barriers / Opportunities**                   |
| Greater prioritization for protected areas essential to the viability of the yellow-headed parrot (*Amazona oratrix*) in Belize | The yellow headed parrot is globally Endangered (IUCN, 2012), and has declined rapidly in Belize over the last 15 years | **Barriers / Threats** |
| • Potential for increased protection in savannas between Crooked Tree WS and Freshwater Creek FR, through the establishment of the North East Corridor | • Decline has been due to increased anthropogenic fires on pine savanna, destruction of old nesting trees and removal of chicks for the illegal pet trade | • Increased anthropogenic fires on pine savanna, destruction of old nesting trees and removal of chicks for the pet trade |
| • Prioritization of Rio Bravo C&MA, Mango Creek and Deep River Forest Reserves, Payne’s Creek NP for their role in species protection | | • Removal of chicks for the pet trade |
| • Protection agreements with logging concession holders in areas with yellow headed parrots – e.g. Mango Creek and Deep River | | **Opportunities** |
| • Partner with Belize Bird Rescue for concerted conservation programme focused on this species – confiscations and rehabilitation if feasible | | • The majority of recorded observations are within protected areas (BERDS, 2011) |
| **West Indian (Antillean) Manatee**           | **Justification**                             | **Barriers/ Threats**                          |
| Strengthening protection of protected areas important to viability of the West Indian manatee | Belize has the largest population of the Antillean manatee (*T. Manatus manatus*) – the endangered Caribbean subspecies of the West Indian manatee | **Protected area status may not be suitable for the mouth of the Belize River – may be better as a Special Management Area** |
| • Prioritise continued protection for the three manatee Wildlife Sanctuaries – Gales Point, Swallow Caye and Corozal Bay Wildlife Sanctuaries | The Belize River has been identified as the area of highest boat-caused mortality, particularly in the shallow waters at the river mouth | **Opportunities** |
| • Extend Hol Chan Marine Reserve westward to extend coverage to the manatee mating congregations | The three Wildlife Sanctuaries established as a conservation strategy for manatees are effective in terms of their coverage but manatee conservation would be enhanced with the protection of Placencia Lagoon | • There is broad stakeholder support for the protection of at least a portion of Placencia Lagoon, and interest from private landowners in protecting lagoon edge mangroves as private protected areas |
| • Identify a mechanism for protection of the mouth of the Belize River and Sittee River | | • Active monitoring programme through Sea2Shore Alliance at Belize River mouth |
| • Increase awareness of manatees in the Belize River, particularly in the cruise ship passengers; also in Sittee River | | |
# Recommendations: Priority Areas for Species Specific Protected Area Interventions

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<tbody>
<tr>
<td><strong>American Crocodile</strong>&lt;br&gt;Strengthening protection of the American crocodile (<em>Crocodylus acutus</em>) nesting beach at Cockroach Bay&lt;br&gt;- Integrate the Reserve into the management portfolio of Turneffe Atoll Marine Reserve&lt;br&gt;- Adjacent lands should be incorporated if feasible to provide full protection to the nursery lagoon&lt;br&gt;- Any development in these adjacent lands should integrate protection of the land adjacent to the nursery lagoon (through EIA's)</td>
<td>- There are only a limited number of known nesting sites for the American crocodile, and Cockroach Bay (Turneffe Atoll Marine Reserve) has been highlighted as a priority for the maintenance of a viable population of this species in Belize&lt;br&gt;- The key nesting beach is already protected as a Public Reserve&lt;br&gt;- Conservation covenants may be used to secure protection of critical private lands</td>
<td>- Not all the nursery lagoon habitat is included within the Cockroach Bay Reserve&lt;br&gt;- Adjacent lands are privately owned and may not become available, or owners may be unwilling to collaborate&lt;br&gt;- Some consider the American crocodile a potential danger <strong>Oppunities</strong></td>
</tr>
</tbody>
</table>

| **Endemic Species**<br>Endemic species and unique ecosystems of Belize<br>- Prioritise maintenance of key savanna representation – Mountain Pine Ridge FR, Deep River FR, Peccary Hills NP, Payne’s Creek NP, Rio Bravo C&MA (PPA)<br>- Prioritise maintenance of cayes known to harbour Belize’s endemic gecko species (*Phyllodactylus insularis*) in littoral forest | - Belize Pine Forest is one of the few examples of lowland and premontane pine forests in the Neotropics, and considered a global Critical / Endangered ecoregion (WWF, 2005)<br>- The coastal savannas face increasing fire impacts and de-reservation and allocation for agricultural lands<br>- Littoral forest on the cayes are considered one of the most threatened habitats with increased demand for caye development | - Pine forests under timber concessions are focused on resource extraction rather than ecosystem maintenance<br>- Limited awareness of impacts of fire on biodiversity<br>- High economic value of coastal land (littoral forest) **Opportunities** | - A large percentage of Belize’s pine forest ecoregion is under Forest Reserve status<br>- Finalization and implementation of the National Fire Management initiative |

| **Endemic species and unique ecosystem of the Pelican Cayes**<br>- Cayes should be prioritized as a national conservation target for their unique values within the NPAS, and as part of Belize’s commitment to its WHS<br>- Pelican Cayes should be protected if at all feasible, with inclusion in South Water Caye MR | - The Pelican Cayes have been highlighted for their unique ecosystem of oceanic mangrove and the associated high diversity of endemic species<br>- They lie within South Water Caye MR, but are not, themselves, protected | - Cayes are privately owned, and unsustainable mangrove clearance has already taken place in key areas of the Pelican Cayes |
### Recommendations: Priority Areas for Species Specific Protected Area Interventions

#### Spawning Aggregation Sites

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Justification</th>
<th>Barriers / Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prioritise protected areas that encompass spawning aggregation sites</td>
<td>The spawning aggregation sites are critical to the maintenance of Belize’s commercial fish stocks and sustainability of the fishing industry</td>
<td><strong>Barriers / Threats</strong>&lt;br&gt;• It is thought that not all spawning aggregation sites have been located&lt;br&gt;• Continued fishing of some of those sites that are protected, with a special license system is in place in some areas&lt;br&gt;<strong>Opportunities</strong>&lt;br&gt;• Many spawning aggregation sites are within or adjacent to marine protected areas</td>
</tr>
<tr>
<td>• Bacalar Chico MR&lt;br&gt;• Gladden Spit MR&lt;br&gt;• Glovers Reef MR&lt;br&gt;• Half Moon Caye NM&lt;br&gt;• Sapodilla Cayes MR&lt;br&gt;• Fully integrate spawning aggregation sites within MPAs&lt;br&gt;• Designation of Turneffe Atoll as a Marine Reserve (effected November 2012)&lt;br&gt;• Identify and prioritise MPAs with Lane Snapper aggregations – potential includes Port Honduras MR and Corozal Bay WS&lt;br&gt;• Designation of new spag sites as discovered – or designation of no take zoning within mpas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Bird Nesting Colonies

1. Strengthen protection of key bird nesting colonies<br>• Transfer Crown Bird Colonies from Lands Department to the new protected areas administrative body<br>• Reassessment and integration of the Crown Bird Colonies into the NPAS, and identification of gaps<br>• Integration of Man O’ War Caye into management portfolio for South Water Caye Marine Reserve<br>• Integration of Cayo Falso and other bird nesting cayes into management portfolio for Corozal Bay WS<br>• Extension of Hol Chan MR SI to include Los Salones and Little Guana Caye<br>• Designation of Bulkhead Lagoon wood stork colony as a protected bird colony | Bird nesting colonies are considered critical in the maintenance of colony nesting species such as magnificent frigatebirds, brown pelicans, herons and egrets, wood storks, roseate spoonbills, white ibis and more. These sites are very vulnerable to disturbance | **Barriers / Threats**<br>• Bird cayes may occur within privately owned areas (e.g. Bulkhead Lagoon wood stork colony lies within the Spanish Point lagoon system...however, there is debate as to whether cayes within coastal lagoons, or indeed the coastal lagoons themselves, are included within private property if they are open to the sea)<br>• Some bird cayes are being targeted for caye development (despite Crown Colony status - e.g. Little Monkey Caye)<br>• Bird cayes may occur within privately owned areas (e.g. Bulkhead Lagoon) |
### 2.5 Internationally Recognized Conservation Sites

Belize has two sites listed as Wetlands of International Importance under RAMSAR, the Convention on Wetlands of International Importance - **Crooked Tree Wildlife Sanctuary** and **Sarstoon-Temash National Park**. This convention came into force for Belize on 22nd August, 1998, and provides the framework for international cooperation in the wise and sustainable use of wetland habitats, through intergovernmental treaties.

Belize also has seven marine sites recognized as a serial World Heritage Site, the **Belize Barrier Reef Reserve System**, representing the unique and varied ecosystems of Belize’s reef environment.

<table>
<thead>
<tr>
<th>Recommendations: Global Priorities</th>
<th>RAMSAR Sites</th>
<th>World Heritage Site</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendations</strong></td>
<td>Strengthen Belize’s fulfilment of its commitments to protected areas recognised by the RAMSAR convention</td>
<td>Strengthen Belize’s commitments to the protected areas recognised by the World Heritage convention</td>
</tr>
<tr>
<td></td>
<td>Crooked Tree Wildlife Sanctuary</td>
<td>Bacalar Chico national Park and Marine Reserve</td>
</tr>
<tr>
<td></td>
<td>Sarstoon Temash National Park</td>
<td>Glover’s Reef Marine Reserve</td>
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<tr>
<td></td>
<td></td>
<td>Laughing Bird Caye National Park</td>
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<td></td>
<td></td>
<td>Sapodilla Cayes Marine Reserve</td>
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<td></td>
<td></td>
<td>South Water Caye Marine Reserve</td>
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<tr>
<td></td>
<td></td>
<td>Half Moon Natural Monument</td>
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<tr>
<td></td>
<td></td>
<td>Blue Hole Natural Monument</td>
</tr>
<tr>
<td><strong>Justification</strong></td>
<td>These sites have been declared for their global importance, yet do not always receive the commitment they should, as priority sites, at the national level</td>
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</tr>
<tr>
<td></td>
<td><strong>Barriers / threats</strong></td>
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</tr>
<tr>
<td></td>
<td>Economics often outweigh conservation, for short term gain vs. long term sustainability</td>
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</tr>
<tr>
<td></td>
<td>Ensure that oil drilling, if allowed within the STNP, is not permitted within the sphagnum bog ecosystem, or in adjacent inundated swamp forest.</td>
<td><strong>Opportunities</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PA status and management provides a framework for strengthened protection</td>
</tr>
</tbody>
</table>
3.0 Rationalization of the National Protected Areas System

Belize can be proud of its National Protected Areas System (NPAS) – it provides the critical ecosystem service of water catchment to supply the national need for clean water, provides protection against storm impacts, is representative of the majority of the ecosystems present in the country, and actively supports livelihoods in both the marine and terrestrial environments. This needs to be supported by effective management at all levels.

3.1 Responsibility for Protected Areas

- The revised National Protected Areas System Act will place ultimate responsibility for the development and management of the National Protected Areas System under the Ministry of Forestry, Fisheries and Sustainable Development.

- The mandate for responsibility for all recognized categories of protected area (with the exception of the Archaeological Reserves) should be realigned under the NPASA. This includes the Crown Bird Colonies, currently under the Lands Department, and special management areas not formally integrated into the national categories (e.g. St. George’s Caye Mangrove Reserve, Cockroach Bay Reserve).

- Realignment of Forest Reserves with the other protected areas of the NPAS is particularly important for strengthening the position of Forest Reserves within the system in relation to dereservation, and increasing their value for both biodiversity conservation and more effective resource use.

- Private protected areas need to be integrated into the National Protected Areas System, when they fit the criteria of adding to the viability of the NPAS, and where there is long term commitment (minimum of 30 years) on the part of the landowner.
3.2 National Protected Area Categories

It is recommended that all national protected area categories be retained with their regulations, and that two further categories be added, with the recognition of Private Protected Areas and the division of Wildlife Sanctuaries into two, to better regulate traditional use:

<table>
<thead>
<tr>
<th>Categories of Protected Areas under administration of National Parks Service</th>
<th>Purpose</th>
<th>Activities Permitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature Reserve</td>
<td>To protect biological communities or species, and maintain natural processes in an undisturbed state.</td>
<td>Research, education</td>
</tr>
<tr>
<td>National Park</td>
<td>To protect and preserve natural and scenic values of national significance for the benefit and enjoyment of the general public.</td>
<td>Research, education, tourism</td>
</tr>
<tr>
<td>Natural Monument</td>
<td>To protect and preserve natural features of national significance.</td>
<td>Research, education, tourism</td>
</tr>
<tr>
<td>Wildlife Sanctuary (1)</td>
<td>To protect nationally significant species, biotic communities or physical features.</td>
<td>Research, education, tourism</td>
</tr>
<tr>
<td>Wildlife Sanctuary (2)</td>
<td>To protect nationally significant species, biotic communities or physical features, and allow for traditional sustainable extraction of natural resource</td>
<td>Research, education, tourism, traditional sustainable natural resource extraction*</td>
</tr>
<tr>
<td>Forest Reserve</td>
<td>To protect forests for management of timber extraction and/or the conservation of soils, watersheds and wildlife resources.</td>
<td>Research, education, tourism, commercial natural resource management and extraction (timber and NTFP)**</td>
</tr>
<tr>
<td>Marine Reserve</td>
<td>To ensure, increase and sustain the productive service and integrity of the marine resources for the benefit of all Belizeans of present and future generations.</td>
<td>Research, education, tourism, commercial fishing</td>
</tr>
<tr>
<td>Private Protected Area</td>
<td>To complement the national lands through provision of connectivity, priority species protection, and improved ecosystem representation.</td>
<td>Research, education, tourism, sustainable extraction</td>
</tr>
</tbody>
</table>

**Other Designations**

<table>
<thead>
<tr>
<th></th>
<th>Purpose</th>
<th>Activities Permitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spawning Aggregation Site</td>
<td>To protect spawning aggregation sites</td>
<td>Research, education, tourism, commercial fishing</td>
</tr>
<tr>
<td>Special Management Area</td>
<td>To protect biological corridors, critical nesting, roosting or congregation areas requiring active management</td>
<td>Research, education, tourism</td>
</tr>
</tbody>
</table>

* See recommendations regarding up to 10% of area for supportive development / activities  
** Regulated under an approved Natural Resource Management and Extraction Plan  
*** It is strongly recommended that the traditional fishing of spawning aggregation sites be phased out for long term sustainability of snapper and grouper
“Special Management Area” is recommended as an additional designation to cover areas in the landscape or seascape requiring management interventions. These would include (but not necessarily be limited to):

- Biological Corridors
- Bird Nesting Colonies
- Turtle Nesting Beaches
- River mouths in areas of high boat / manatee conflict (Belize River, Sittee River)

Archaeological Reserves have not been included within the list of protected areas to be managed by the administrative body at this time, though this should be a goal for the future. However, they are included in the Management Units, for the contribution they play to protection of cultural heritage, and in the case of Caracol, Lamanai, and the proposed Kakantulix Archaeological Reserves to biodiversity protection.

Where feasible, cayes, inundated mangrove ranges and critical coastal fringing mangrove should be integrated within marine protected areas under the relevant site legislation, for the following reasons:

- Strengthening the critical role played by mangroves as nursery areas for commercial fish species – particularly in South Water Caye MR, Turneffe Atoll MR, Hol Chan MR, Corozal Bay WS, and proposed Placencia Lagoon, reducing the potential for mangrove removal through caye development
- The Pelican Cayes - the highest value mangroves in terms of unique and endemic species, with their adjacent deep water – are considered of particular importance in maintenance of endemic species, and merit serious investigation into the feasibility of incorporation into the World Heritage Site.
- The important role played by fringing mangroves in breaking the force of storm waves during storm events – particularly those in front of coastal communities and agricultural areas
- Protection of marine turtle nesting sites to ensure increasingly viable populations of these species
- Protection of littoral forest, the most threatened of Belize’s ecosystems. In some locations this will also provide habitat for Belize’s endemic gecko species
Protected Area Rationalization

- Protection of key colony bird nesting sites – e.g. Cayo Falso and Shipstern Caye in Corozal Bay Wildlife Sanctuary, Bulkhead Lagoon wood stork nesting caye

### 3.3 Recommended Changes to Protected Areas

A number of recommendations are presented for:

- Merging of protected areas
- Realignment of protected areas between national protected area categories
- Realignment
- Dereservation
- Community Green Areas
- Designation of new protected areas

The NPAPS recommendations concerning the realignment and dereservation processes should be fully adopted and implemented for any changes.

#### 3.3.1 Merging of Protected Areas

A number of protected areas should be merged to facilitate management and simplify the system. This would require amendments to the relevant statutory instruments.

- Merging of Victoria Peak Natural Monument and Cockscomb Basin Wildlife Sanctuary, to become Cockscomb Basin Wildlife Sanctuary. The management plan makes allowances for the Natural Monument, facilitating integration as a zone within the Wildlife Sanctuary.

- Merging of Sibun and Sittee River Forest Reserves to become the Sibun-Sittee National Park. These two protected areas are critical for water catchment, water security, and steep slope protection. Sibun Forest Reserve is also critical for connectivity to Manatee Forest Reserve, and both have scenic values. The remaining terrain in both Sibun and Sittee River Forest Reserves after past dereservations and realignments is too steep for agriculture or viable logging operations. National Park is considered the most apt designation, with the potential for tourism concessions either by local communities (e.g. Davis Falls) or through larger initiatives is recommended as a more appropriate designation and management regime.

- Merging of adjacent terrestrial and marine reserves into single management areas – Bacalar Chico National Park and Marine Reserve and Caye Caulker Forest Reserve and Marine Reserve (NB: It is recommended that Caye Caulker be re-designated as a Wildlife Sanctuary).
Integration of those **spawning aggregation sites** within marine protected areas is recommended through amended statutory instruments, reducing protected area overlap.

However, some spawning aggregation sites are not associated with marine protected areas, and require protection in their own right.

Integration of those **bird nesting colonies** within marine protected areas is recommended through amended statutory instruments.

Some bird nesting sites are not associated with marine protected areas, and require protection in their own right. eg the wood stork colony in Bulkhead Lagoon.

### 3.3.2 Re-designation within the national protected area categories

The majority of national protected areas align well with the national category to which they have been designated. A number, however, would benefit from re-designation at the national level. This is particularly true of Wildlife Sanctuaries. It is recognized under the rationalization process that, whilst this national designation is non-extractive, the reality is that a number of Wildlife Sanctuaries have on-going traditional fishing activities important for local communities.

**Corozal Bay, Gales Point, Aguacaliente** and **Crooked Tree Wildlife Sanctuaries** were established for specific species or species assemblages (the West Indian manatee or waterbird congregations). Traditional fishing has been on-going in all these areas prior to their establishment as protected areas, and all four draft management plans provide for continued local community extraction of fish through regulated traditional, sustainable methods. This is in conflict with the non-extractive Wildlife Sanctuary designation, but is recognized by Forest Department as a legitimate traditional activity of benefit to stakeholders. There is no current designation for protected areas managed under the Forest Department that permits this type of extraction, whilst still providing wider environmental protection. With the drafting of the National Protected Areas System Act, there is an opportunity for inclusion of these realities with necessary provisions such as zoning for these activities.

It is therefore recommended that the legislation be amended to permit two types of Wildlife Sanctuaries to align the designation with the reality:

**Wildlife Sanctuary (1):** non-extractive and fills the original objectives of the Wildlife Sanctuary designation

**Wildlife Sanctuary (2):** allows for continued traditional community use, but presence and active adoption and implementation of a sustainable use plan, based on adequate baseline knowledge and total allowable annual harvest, should be a pre-requisite as should a use agreement with the communities and permitting of users (Table 5).
Protected Area Rationalization

<table>
<thead>
<tr>
<th>Wildlife Sanctuary (1)</th>
<th>Wildlife Sanctuary (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non Extractive</td>
<td>Traditional community fishing</td>
</tr>
<tr>
<td>Cockscomb Basin</td>
<td>Aguacaliente</td>
</tr>
<tr>
<td>Swallow Caye</td>
<td>Crooked Tree</td>
</tr>
<tr>
<td>Caye Caulker*</td>
<td>Corozal Bay</td>
</tr>
<tr>
<td></td>
<td>Gales Point</td>
</tr>
<tr>
<td></td>
<td>Labouring Creek Jaguar Corridor</td>
</tr>
<tr>
<td></td>
<td>Spanish Creek</td>
</tr>
</tbody>
</table>

* recommended re-designation

Table 5: Division of Wildlife Sanctuary into two categories based on traditional use

It is also recommended that a number of other protected areas within the National Protected Areas System be transferred to other designations (Table 6).

<table>
<thead>
<tr>
<th>Protected Areas</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sittee River Forest Reserve</td>
<td>If not merged with Sibun FR, re-designate as a National Park</td>
</tr>
<tr>
<td>Caye Caulker Forest Reserve</td>
<td>Re-designate as a Wildlife Sanctuary (1)</td>
</tr>
<tr>
<td>Burdon Canal Nature Reserve</td>
<td>Re-designate as a National Park</td>
</tr>
<tr>
<td>Hopkin’s Wetlands Nature Reserve</td>
<td>Re-designate as a National Park</td>
</tr>
</tbody>
</table>

Table 6: Other Recommendations for Re-designation (See Annex Two)

3.3.3 Boundary Realignments

A number of Forest Reserves have boundaries that are in the process of being realigned as a result of the de-reservation of areas of active clearance of natural vegetation and on-going, active agricultural incursions, resulting from lack of or weak management and lack of coordination / collaboration between key governmental departments.

Other realignment recommendations are proposed to strengthen protection of watershed services (Billy Barquedier), or specific ecosystems, species or sites (Bladen, Hopkins and Corozal Bay) (Table 7; Annex 8).
Protected Area Rationalization

<table>
<thead>
<tr>
<th>Protected Areas</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bladen NR / Columbia River FR</strong></td>
<td>Re-align to include more of Belize’s primary Key Biodiversity Area in Bladen, following recommendations from CRFR Management Plan</td>
</tr>
<tr>
<td><strong>Mango Creek 1 FR</strong></td>
<td>Re-align in the Cabbage Haul Ridge area</td>
</tr>
<tr>
<td><strong>Vaca FR</strong></td>
<td>Ensure no further realignments after current excisions</td>
</tr>
<tr>
<td><strong>Manatee FR / Billy Barquedier NP</strong></td>
<td>Realign to include entire upper watershed within Billy Barquedier National Park</td>
</tr>
<tr>
<td><strong>Manatee FR / Peccary Hills NP</strong></td>
<td>Realign either or both protected areas if feasible to provide connectivity</td>
</tr>
<tr>
<td><strong>Crooked Tree WS</strong></td>
<td>Realign to include under-represented ecosystem</td>
</tr>
<tr>
<td><strong>Corozal Bay WS</strong></td>
<td>Realign to include part or whole of at least one of the extensive coastal lagoon systems that flow into Corozal Bay Wildlife Sanctuary Realign to include 2 miles of river ecosystem (Rio Hondo and New River) from the river mouths</td>
</tr>
<tr>
<td><strong>Hol Chan MR</strong></td>
<td>Realign to include Los Salones and Little Guana Caye (Crown Bird Colonies) Realign to extend westwards, to create coast to reef marine corridor, adjacent to southern boundary of Corozal Bay Wildlife Sanctuary (as per Ambergris Caye proposal)</td>
</tr>
<tr>
<td><strong>Payne’s Creek NP</strong></td>
<td>Realign to include part of the estuarine system of Deep River Realign, if feasible, the representative coastal ridges to the east – one of the features it was first established to protect</td>
</tr>
<tr>
<td><strong>Hopkins Wetland NR</strong></td>
<td>Re-align to include rest of swamp drainage, and northwards, if feasible, to incorporate Freshwater Creek and Commerce Bight Lagoons to increase protection of coastal lagoon systems.</td>
</tr>
<tr>
<td><strong>Gales Point WS</strong></td>
<td>Realignment to include Manatee Bar, if not established as a Special Management Area Realignment to continue another 2 miles up Manatee River</td>
</tr>
</tbody>
</table>

Table 7: Realignment Recommendations

3.3.4 Dereservations

Four Forest Reserves have been, or are in the process of being, dereserved:

- Commerce Bight Forest Reserve
- Mango Creek Forest Reserve 2
- Mango Creek Forest Reserve 3
- Grants Works Forest Reserve
These reserves have ceased in their functionality as the result of farming change incursions over a number of years. Whilst there was little choice for the Forest Department other than to de-reserve them, the trend and process is non-sustainable, eroding the NPAS.

**Any future consideration of dereservation must follow the due process outlined by the NPAPSP, and be approved by the protected area authority.**

### 3.3.5 Designation of Community Green Areas

- The assessment demonstrated that a number of protected areas currently within the NPAS do not play a critical role in Belize’s requirements for a national protected areas system.

- Public Reserves established under the Lands Department (e.g. Krooman Reserve, Dolphin Park and Seine Bight) to provide urban access to green environments, and managed by city, town or village councils, whilst having an important role in nurturing an appreciation of the environment, should not be considered part of the National Protected Areas System.

- It would be more appropriate to investigate the feasibility of ‘Community Green Areas’, to be created under the Lands Act or Ministry of Tourism and Culture, to provide a framework for community protected areas associated with urban areas / near rural communities, for recreational access and tourism. A number of smaller, isolated protected areas currently within the NPAS may also better fall within this category including:
  - Melinda National Park
  - Gra Gra Lagoon National Park
  - Rio Blanco National Park
### 3.3.6 New Protected Area Designations / Extensions

<table>
<thead>
<tr>
<th>Area</th>
<th>Justification</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| Turneffe Atoll| Turneffe Atoll has been identified as a significant management gap; includes deep sea ecosystems. There may also be potential for including cayes / littoral forest / sandy beach within the protective legislation – which should be acted upon to help maintain the ecological integrity of this critical area.  
*Note: Declared a Marine Reserve in November, 2012* | Would provide important protection to Caribbean Open Sea- Coastal Shelf, Caribbean Open Sea – Mesopelagic and Caribbean Open Sea – Bathyal, both gaps within the NPAS  
*Recommendations:*  
- Designate as a Marine Reserve  
- Ensure fishing stakeholders are adequately represented on the Board and other decision making processes  
- Integrate Cockroach Bay Reserve  
- Integrate spawning aggregation sites  
*Management Unit:* Central Coastal Waters and Atolls |
| Manatee Beach | For the protection of Belize’s largest Hawksbill turtle nesting site           | A priority Hawksbill turtle nesting beach, currently the focus of community conservation and monitoring activities  
*Recommendations:*  
- Protection of the 66’ of nesting beach as an extension to Gales Point Wildlife Sanctuary  
- Non-extractive zone  
*Management Unit:* Southern Coastal Plain |
| Placencia Lagoon | Placencia Lagoon is part of the Southern Belize Reef Complex, and an important mangrove / estuarine system and associated mangrove systems. Largest extent of the Vulnerable *Halodule ballonii* (Short, 2011) | Placencia Citizens for Sustainable Development (PCSD) have developed a concept focused on the Drunken Caye area. Wide community support, with potential for protection of lagoon-side mangroves by private landowners through BAPPA. Considered of value for manatees, though use of the lagoon fluctuates with changes in seagrass tied to aquaculture development. Interest from SEA in co-management. Secondary corridor functionality with Mango Creek FR (1) and (2) – stepping stones from Cockscomb across coastal plain  
*Recommendations:*  
- Protection of area of Placencia Lagoon, based on output from PCSD  
- Designate as Wildlife Sanctuary (2) to allow continued traditional fishing, but needs to be based on sustainable fishery plan  
- Non-extractive for all other biodiversity  
- Seek co-management partnership with SEA  
*Management Unit:* Southern Coastal Plain |
### New Protected Area Recommendations

<table>
<thead>
<tr>
<th>Area</th>
<th>Justification</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| Kakantulix       | Second largest Maya site in northern Belize, located adjacent to the Fireburn PPA. Located within the North East Corridor | Important cultural and ecosystem properties. Lies within the North East Biological Corridor  
**Recommendations:**  
- Establish Kakantulix as an Archaeological Reserve  
**Management Unit:** Northern Lowlands |
| Whitewater Lagoon| Long, narrow freshwater lagoon that is a widening and deepening of Freshwater Creek. The water of the lagoon is extremely clear, with high eutrophic macrophytic growth, and abundant and diverse aquatic fauna and flora...an ecosystem so far found nowhere else in Belize. This lagoon system is known for the red phase bay snook (*Petenia splendida*) found there, and the Central American river turtle. There is interest in ensuring the total lagoon area has some form of protection (Fisheries Department). | Whitewater Lagoon has been highlighted previously as a site of conservation interest, and recommended for designation because of its unique characteristics (de Rahm, 1990). Important for its role in protection of the critically endangered Central American river turtle (‘hicatee’).  
**Recommendations:**  
- Protection of the lagoon and floodplain  
- Extend Labouring Creek Jaguar Corridor WS to include all of this freshwater system and associated floodplain  
**Management Unit:** Northern Lowlands |
| Haulover Creek   | Culturally important from an historical standpoint; ecosystem importance in supporting mature mangrove and littoral forest, and associated wildlife within easy access of the City. Highlighted for its value as a tourism venue, with great revenue generation potential if the natural qualities can be maintained. |  
**Recommendation:**  
- Extend Burdon Canal to cover Haulover Creek and the 66’ riparian buffer vegetation from the north-west corner of Burdon Canal Nature Reserve to the confluence with the Belize River  
- Designate as a National Park, to protect the ecosystems, biodiversity and environmental services, whilst encouraging greater tourism and educational use.  
- Manage as a single unit with Burdon Canal  
- Seek co-management partnership with Belize Audubon Society for both Burdon Canal and Haulover Creek  
**Management Unit:** Northern Lowlands |
| Salt Creek       | Northern coastal lagoon thought to be unique in its estuarine qualities. Little knowledge of the area. |  
**Recommendation**  
- Investigate potential to protect Salt Creek area, identified as a unique estuarine system in Belize, and important in maintenance of fish stocks (Fisheries Dept.)  
**Management Unit:** Northern Coastal Complex. |
| Mata Rocks        | Diving areas used by the tourism industry of San Pedro |  
**Recommendation**  
- Potential for ‘special management area’ |
3.4 Private Protected Areas

7 Private Protected Areas are generally recognized as being part of the National Protected Areas System:

- Block 127
- Community Baboon Sanctuary
- Golden Stream
- Monkey Bay Wildlife Sanctuary
- Rio Bravo Conservation and Management Area
- Runaway Creek
- Shipstern Nature Reserve

Only two – Rio Bravo and Block 127 (TIDE) have legal commitments seen as being adequate. Several additional properties, collectively known as the “TIDE Private Lands” are however legally committed to conservation through a Debt for Nature Swap, though their presence within the NPAS is often overlooked in mapping exercises.

The Gallon Jug Estate, managed by the Bowen family has been a de facto reserve for many years, and one of the most effective in the country in terms of biodiversity protection. The future of it, and the adjoining Yalbac property, as private protected areas is uncertain. Their size, the health of the habitats and biodiversity there, coupled with their contribution to the Selva Maya / Rio Bravo forest node, highlights the need for formal commitment to, and integration into, the National Protected Areas System.

Shipstern Nature Reserve, established as Belize’s first private protected area in 1987, plays a critical role in the conservation of drier Yucatan forest types, from which species are predicted to migrate southwards in response to climate change impacts, yet it lacks formal commitment to the NPAS. This weakness was recognized in the National Protected Areas Policy and System Plan, but is yet to be addressed.

A number of other private protected areas have been established and managed for conservation for many years, but also lack legal commitment and are known as ‘candidate private protected areas’. Not all candidate PPAs will qualify for inclusion within the system, and the Belize Association of Private Protected Areas has developed a scoring system (adopted by the NPASP) to assist the Forest Department in evaluating their qualification.

Some PPAs provide a critical function in maintaining ecosystem connectivity – helping bridge the gaps as part of the national biological corridors. Given the roles played by recognized PPAs, and the investments made in them by their owners for conservation management, coupled with the restrictions imposed by
legal commitment to conservation, it is recommended that financial incentives be developed by the administrative body, and be made available to qualifying PPAs. These may be in the form of tax concessions, exemption from land tax or rent, or in the form of access to conservation / sustainable development financing mechanisms. Also required is a legal mechanism within the revised National Protected Areas legislation for legal commitment and integration of these areas into the National Protected Areas System.

Of the current candidate PPAs currently under consideration, the following are recommended as qualifying (once there is a legal commitment) for inclusion in the National Protected Area System, with justifications provided in Annex Two:

- Balam Na Reserve
- BFREE private reserve
- Boden Creek
- Fireburn Reserve
- Gallon Jug
- Hidden Valley
- Jaguar Creek
- John Spang property
- St. Martins
- TIDE Monkey River properties
- TIDE Big Falls / Lou Morski properties
- Yalbac

Candidate PPAs not qualifying for integration within the NPAS may still be of significant, though not critical, value for biodiversity conservation and the provision of environmental services. It is recommended that to be termed a reserve, preserve, or sanctuary they should meet basic standards set by the Forest Department and BAPPA and be committed to conservation management for a minimum of a renewable 10-year period.
3.5 Consolidation of the National Protected Areas System

The National Protected Areas Policy and System Plan recognizes that managing the current national protected areas as individual conservation management units is inefficient, leading to repetition and overlap, and not maximizing on the efficiencies of scale. It recommends the simplification of the existing protected area system by consolidating adjacent protected areas into larger management units – to create a smaller number of sites that are more firmly integrated into the landscape context, incorporating biological corridors and more coordinated management towards unified goals and visions.

The Plan seeks to rationalize administration of the National Protected Areas System, reduce duplication of management effort, and facilitate most appropriate use of the land within the protected areas system, whilst also increasing management effectiveness and financial sustainability. The most appropriate approach to consolidation is the development of national Management Units. This has already started with the Maya Mountains Massif (MMM) and the Southern Belize Reef Complex (SBRC) initiatives. The SBRC has been particularly successful at streamlining management and integrating the larger seascape into planning, with the integration of Management Unit activities into coordinated site level management programmes (Map 6).

It is recommended that the protected areas of the National Protected Areas System be consolidated into six national Management Units or areas - three terrestrial and three marine, each reflecting physiographic zones, broad ecosystem assemblages, and common management priorities and challenges (Map 7). Each unit will require a coordinating officer situated in the NPAS administrative structure, with the responsibility for coordination and communication with site-level co-management partners, private protected area managers and biological corridor development, integrated into national landscape planning.

**Terrestrial Management Units:**
- Northern Lowlands
- Maya Mountains Massif
- Southern Coastal Plan

**Marine Management Units:**
- Northern Coastal Complex
- Central Coastal Waters and Atolls
- Southern Belize Reef Complex
Recommended Changes to Current Management Units

- That the Maya Mountains Massif is rationalized from that defined in the Maya Mountains Massif Technical Assessment (Walker et al., 2008) to exclude the Deep River Forest Reserve (which is more representative of the Southern Coastal Plain) and to include the Manatee Forest Reserve and other smaller protected areas that lie within the upland and foothills of the Massif.

- That the Southern Belize Reef Complex is extended to the southern extent of Belize, and to include Port Honduras Marine Reserve

These Management Units, whilst focused on improving management of the National Protected Areas System, should complement NGO-driven landscape / seascape efforts such as the ridge-to-reef Maya Mountains Marine Corridor, which spans the Maya Mountains Massif, Southern Coastal Plain and Southern Belize Reef Complex, strengthening connectivity between Units.

An additional clause should be added to co-management agreements and private protected area commitment agreements, stating that co-management and private protected area partners will be operating within Management Units, and be required to collaborate fully with the administration structures in place. They would also be responsible for the integration and implementation of some system-level programme activities in collaboration with the administrative authority.
To achieve consolidation, the following steps need to be implemented:

**Step 1.** National Protected Areas System Act to be drafted and enacted and provide the legal framework for consolidation.

**Step 2.** Development of a ten-year Strategic Plan for the establishment of the Administrative Body\(^1\), National Protected Areas System, biological corridors, and consolidation and management of protected areas into Management Units, through a participatory process facilitated by the Authority, involving all co-management partners and key stakeholders, based on integrated landscape management principles.

**Step 3.** Engagement of co-management and other partners towards planning and implementation at Management Unit level.

**Step 4.** Development of approved five-year Workplans for each Management Unit, developed through a participatory process facilitated by the Administrative Body, involving all co-management partners and key stakeholders, and based on integrated landscape management principles, and principles of collaboration.

**Step 5.** Coordination with partners for integration of Strategic Plan and Workplan activities into site level management plans.

**Step 6.** Implementation of Strategic Plan and Workplans.

**Step 7.** Monitoring and evaluation of Workplan implementation.

---

\(^1\) The Administrative Body structure is currently under review
Protected Area Rationalization

Rationalization of the Belize National Protected Areas System

Terrestrial Management Units:
- Northern Lowlands
- Maya Mountains Massif
- Southern Coastal Plan

Marine Management Units:
- Northern Coastal Complex
- Central Coastal Waters and Atolls
- Southern Belize Reef Complex

Map 8: National Management Units
## Protected Area Rationalization

### Table 8a: Allocation of Recognized Protected Areas to System Level Management Units

<table>
<thead>
<tr>
<th>Northern Lowlands</th>
<th>Southern Coastal Plain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aguas Turbias National Park</td>
<td>Gra Gra Lagoon National Park</td>
</tr>
<tr>
<td>Guanacaste National Park P</td>
<td>Payne’s Creek National Park</td>
</tr>
<tr>
<td>Honey Camp National Park</td>
<td>Rio Blanco National Park</td>
</tr>
<tr>
<td>Monkey Bay National Park</td>
<td>Sarstoon Temash National Park</td>
</tr>
<tr>
<td>Peccary Hills National Park P</td>
<td>Melinda National Park</td>
</tr>
<tr>
<td>Burdon Canal Natural Monument</td>
<td>Hopkins Wetland Nature Reserve</td>
</tr>
<tr>
<td>Crooked Tree Wildlife Sanctuary</td>
<td>Aguacaliente Wildlife Sanctuary</td>
</tr>
<tr>
<td>Labouring Creek JC Wildlife Sanctuary</td>
<td>Gales Point Wildlife Sanctuary</td>
</tr>
<tr>
<td>Spanish Creek Wildlife Sanctuary</td>
<td>Deep River Forest Reserve</td>
</tr>
<tr>
<td>Freshwater Creek Forest Reserve</td>
<td>Machaca Forest Reserve</td>
</tr>
<tr>
<td>Altun Ha Archaeological Reserve</td>
<td>Mango Creek 1 Forest Reserve</td>
</tr>
<tr>
<td>Cerro Maya Archaeological Reserve</td>
<td>Mango Creek 3 Forest Reserve</td>
</tr>
<tr>
<td>El Pilar Archaeological Reserve</td>
<td>Monkey Caye Forest Reserve</td>
</tr>
<tr>
<td>Lamanai Archaeological Reserve</td>
<td>Swasey Bladen Forest Reserve</td>
</tr>
<tr>
<td>Santa Rita Archaeological Reserve</td>
<td>Seine Bight Public Reserve</td>
</tr>
<tr>
<td>Xunantunich Archaeological Reserve</td>
<td>Lubaantun Archaeological Reserve</td>
</tr>
<tr>
<td>Bird Caye (N. Lagoon) Bird Sanctuary</td>
<td>Nim Li Punit Archaeological Reserve</td>
</tr>
<tr>
<td>Dubloon Bank Bird Sanctuary</td>
<td>Serpon Sugar Mill Archaeological Reserve</td>
</tr>
<tr>
<td>Un-named (N. Lagoon) Bird Sanctuary</td>
<td>TIDE private lands (PPA)</td>
</tr>
<tr>
<td>Community Baboon Sanctuary (PPA)</td>
<td>Boden Creek Ecological Preserve (RPPA)</td>
</tr>
<tr>
<td>Monkey Bay (PPA)</td>
<td>John Spang (RPPA)</td>
</tr>
<tr>
<td>Rio Bravo CMA (PPA)</td>
<td>San Pedro Company (RPPA)</td>
</tr>
<tr>
<td>Runaway Creek (PPA)</td>
<td></td>
</tr>
<tr>
<td>Shipstern Nature Reserve (PPA)</td>
<td></td>
</tr>
<tr>
<td>Balam Na Reserve (RPPA)</td>
<td></td>
</tr>
<tr>
<td>Fireburn Reserve (RPPA)</td>
<td></td>
</tr>
<tr>
<td>Gallon Jug (RPPA)</td>
<td></td>
</tr>
<tr>
<td>Hwatchy property (RPPA)</td>
<td></td>
</tr>
<tr>
<td>Shu Property (RPPA)</td>
<td></td>
</tr>
</tbody>
</table>

**Acronyms**
- **PPA** Private Protected Area
- **RPPA** Recommended Private Protected Areas

Rationalization of the Belize National Protected Areas System 66
### Maya Mountains Massif

- Chiquibul National Park
- Billy Barquedier National Park
- Nojkaaxmen Eligio Panti National Park
- Five Blues National Park
- Mayflower Bocawina National Park
- St Herman’s Blue Hole National Park
- Bladen Nature Reserve
- Tapir Mountain Nature Reserve
- Thousand Foot Falls Natural Monument
- Actun Tunichil Muknal Natural Monument
- Victoria Peak Natural Monument
- Cockscomb Basin Wildlife Sanctuary
- Chiquibul Forest Reserve
- Columbia River Forest Reserve
- Manatee Forest Reserve
- Maya Mountain Forest Reserve
- Mountain Pine Ridge Forest Reserve
- Sibun Forest Reserve
- Sittee River Forest Reserve
- Vaca Forest Reserve
- Barton Creek Archaeological Reserves
- Cahal Pech Archaeological Reserves
- Caracol Archaeological Reserves
- Caves Branch Archaeological Reserves
- Nohoch Cheen Archaeological Reserves
- BFREE property (RPPA)
- Hidden Valley property (RPPA)
- Jaguar Creek properties (RPPA)

### Northern Belize Marine Complex

- Bacalar Chico Marine Reserve
- Bacalar Chico National Park
- Caye Caulker Marine Reserve
- Hol Chan Marine Reserve
- Corozal Bay Wildlife Sanctuary
- Swallow Caye Wildlife Sanctuary
- Caye Caulker Forest Reserve
- Dubloon Camp Bird Sanctuary
- Little Guana Caye Bird Sanctuary
- Los Salones Bird Sanctuary
- Rocky Point SPAG
- St. George’s Caye Mangrove Reserve

### Central Coast and Atolls

- Blue Hole Natural Monument
- Half Moon Caye Natural Monument
- Glover’s Reef Marine Reserve
- Turneffe Atoll Marine Reserve
- Dog Flea Caye SPAG
- Caye Bokel SPAG
- Emily / Caye Glory SPAG
- Sandbore SPAG
- S. Point Lighthouse SPAG
- South Point Turneffe SPAG
- Northern Grovers SPAG
- Cockroach Bay Reserve

### Southern Belize Reef Complex

- Laughing Bird Caye National Park
- Gladden Spit and Silk Cayes Marine Reserve
- Port Honduras Marine Reserve
- Sapodilla Cayes Marine Reserve
- South Water Caye Marine Reserve
- Gladden Spit SPAG
- Rise and Fall Bank SPAG
- Nicholas Caye SPAG
- Seal Caye SPAG
- Man of War Caye Bird Sanctuary
- Monkey Caye Bird Sanctuary

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**Table 8b: Allocation of Recognized Protected Areas to System Level Management Units**
### 3.6 IUCN Categories

- The national designations (Wildlife Sanctuary, National Park, Forest Reserve etc.) do not fully tie in with the internationally recognized IUCN categories. The two should therefore be considered as being separate.

- IUCN categories are summarized (Annex Four), and individual protected area alignments are detailed (Annex Two)

<table>
<thead>
<tr>
<th>IUCN Categories</th>
<th>Primary Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CATEGORY Ia</strong>: strictly protected areas set aside to protect biodiversity and also possibly geological /geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.</td>
<td><strong>Ia Primary Objective</strong>: To conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/ or geologically diverse features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact.</td>
</tr>
<tr>
<td><strong>CATEGORY Ib</strong>: Usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.</td>
<td><strong>Ib Primary Objective</strong>: To protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas.</td>
</tr>
<tr>
<td><strong>CATEGORY II</strong>: Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.</td>
<td><strong>Primary Objective</strong>: To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.</td>
</tr>
<tr>
<td><strong>CATEGORY III</strong>: Set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.</td>
<td><strong>Primary Objective</strong>: To protect specific outstanding natural features and their associated biodiversity and habitats.</td>
</tr>
<tr>
<td>Category</td>
<td>Primary Objective</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CATEGORY IV:</td>
<td>Protects particular species or habitats and management reflects this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category. <strong>Primary Objective:</strong> To maintain, conserve and restore species and habitats.</td>
</tr>
<tr>
<td>CATEGORY V:</td>
<td>A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values. <strong>Primary Objective:</strong> To protect and sustain important landscapes/seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices.</td>
</tr>
<tr>
<td>CATEGORY VI:</td>
<td>Conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area. <strong>Primary Objective:</strong> To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.</td>
</tr>
</tbody>
</table>
For a number of protected areas, realignments are recommended from the IUCN Categories proposed under the NPAPSP (Table 9), with justifications for these listed in Annex.

<table>
<thead>
<tr>
<th>Protected Area</th>
<th>NPAPSP designation (2005)</th>
<th>Recommended Realignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caye Caulker(^1)</td>
<td>VI</td>
<td>IV</td>
</tr>
<tr>
<td>Monkey Caye FR</td>
<td>VI</td>
<td>II</td>
</tr>
<tr>
<td>Sittee River FR</td>
<td>VI</td>
<td>II</td>
</tr>
<tr>
<td>Bacalar Chico NP</td>
<td>VI</td>
<td>II</td>
</tr>
<tr>
<td>Gra Gra Lagoon NP(^*)</td>
<td>II</td>
<td>IV</td>
</tr>
<tr>
<td>Guanacaste NP</td>
<td>II</td>
<td>IV</td>
</tr>
<tr>
<td>Sarstoon Temash NP</td>
<td>II</td>
<td>VI</td>
</tr>
<tr>
<td>St. Herman’s Blue Hole</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td>Half Moon Caye NM</td>
<td>III</td>
<td>II</td>
</tr>
<tr>
<td>Victoria Peak NM(^*)</td>
<td>III</td>
<td>Ib</td>
</tr>
<tr>
<td>Burdon Canal NM</td>
<td>Ia</td>
<td>II</td>
</tr>
<tr>
<td>Hopkins Wetland</td>
<td>Ia</td>
<td>II</td>
</tr>
<tr>
<td>Tapir Mountain NR</td>
<td>Ia</td>
<td>II</td>
</tr>
<tr>
<td>Aguacaliente WS</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Cockscomb Basin WS(^**)</td>
<td>IV</td>
<td>II or Ib</td>
</tr>
<tr>
<td>Corozal Bay WS</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Crooked Tree WS</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Gales Point WS</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Spanish Creek WS</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Bacalar Chico MR</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Caye Caulker MR</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Gladden Spit and Silk Cayes</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Glover’s Reef</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Hol Chan</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Port Honduras</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>Sapodilla Caye</td>
<td>IV</td>
<td>VI</td>
</tr>
<tr>
<td>South Water Caye</td>
<td>IV</td>
<td>VI</td>
</tr>
</tbody>
</table>

\(^1\) Re-designate as Wildlife Sanctuary  
\(^*\) Better redesignated as a Community Green Area  
\(^+\) Either designate as Ib or integrate fully into Cockscomb Basin Wildlife Sanctuary  
\(^**\) Cockscomb Basin should actually qualify as IUCN Category Ib, based on public use being within 10% or less of the protected area  

Table 9: Recommended realignments with IUCN categories from those suggested in the NPAPSP
3.7 Other Recommendations

- Adopt a policy of permitting up to 10% of a protected area be managed for activities that support and are compatible with the primary objective of the protected area in line with the IUCN recommendations, though at a reduced percentage of the area (IUCN suggests up to 25%). Use of these areas needs to be based on well designed, sustainable development plans, environmental impact assessments and environmental compliance plans, focused on protected area financial sustainability and increased stakeholder benefit.

- Provide and encourage long term concessionary agreements with protected area co-management agencies and/or private sector for the development of professional facilities (hotels, visitors centres etc.), with a tariff on profits being designated towards management of the PA.

3.7.1 Promoting Public Use

- There is a need to provide greater public access to the National Protected Areas System, with increased use of natural areas in Belize.

- This will not occur until there are provisions for secure investment in infrastructure that will attract people to the protected areas system.

- Key protected areas in Belize need to invest in visitor’s centres, interactive interpretive trails, play areas, accommodation, restaurants, gift shops – few protected areas provide visitors with activities beyond walking trails, few are really equipped for sharing information effectively, and few are able to develop sustainability from visitation.

- Protected areas currently earn little beyond the entrance fees - the majority of the revenue generated from international visitors goes primarily to the hotels and restaurants where they stay – little reaches the protected areas that have brought them to Belize.

- There is an urgent need for PA co-managers to facilitate increased economic returns, though integrating tourism development and business management skills/personnel into their management teams.

- For larger protected areas, or Nature Reserves (e.g. Bladen and Tapir Mountain), alignment with the IUCN recognition that a small portion of the protected area could be managed for activities that support and are compatible with the primary objective of the protected area is recommended. This would allow low impact, well regulated access to Nature Reserves for
financial sustainability and strengthened public support. It would also allow the construction of tourist lodges and camps in Category II protected areas.

- Few local communities see the protected areas as recreational and educational resources for them and their children. This is an identified gap that needs to be addressed.

- This, if coupled with long term concession agreements for services such as accommodation and food facility development, may encourage development of effective protected area visitor and educational infrastructure, encouraging greater visitation, whilst still maintaining and enhancing the biodiversity conservation and ecosystem services provided by the National Protected Areas System, through increased financial sustainability.

- Traditional extractive use (predominantly fishing) within a non-extractive protected area should only be allowed if the users are willing to develop and implement a sound sustainable use plan and work under monitored sustainable use agreements and permitting systems.

Five protected areas have, or have the potential to have, a key role to play in engaging the Belizean public, and should be prioritized for investment as tools for doing just this:

<table>
<thead>
<tr>
<th>Protected Area</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guanacaste National Park</td>
<td>▪ Location and ease of access is ideal for engaging populations in Belize City, Belmopan and Cayo District</td>
</tr>
<tr>
<td></td>
<td>▪ The biodiversity / conservation value of the pa is very low, permitting broad scale infrastructure development to enhance the visitor engagement value of the area</td>
</tr>
<tr>
<td></td>
<td>▪ Excellent venue for school groups – perhaps think of ‘adventure playground’ to encourage use of the area by families</td>
</tr>
<tr>
<td>St. Herman’s Blue Hole National Park</td>
<td>▪ A popular tourism stop on the Hummingbird Highway</td>
</tr>
<tr>
<td></td>
<td>▪ Location is good for engaging populations in Belize City, Belmopan and Cayo District</td>
</tr>
<tr>
<td>Cockscomb Basin Wildlife Sanctuary</td>
<td>▪ PA is one of the best known by the Belize public</td>
</tr>
<tr>
<td></td>
<td>▪ Investment in improved infrastructure would engage Belize visitors (e.g. high quality visitor centre, interpretive trail, upgraded access road and provision of cheaper transport services from Maya Centre).</td>
</tr>
<tr>
<td></td>
<td>▪ Capacity building of private sector tour guides for better service.</td>
</tr>
<tr>
<td>Burdon Canal Nature Reserve</td>
<td>▪ Location is ideal for engaging populations in Belize City</td>
</tr>
<tr>
<td></td>
<td>▪ Could play an important role in increasing awareness of mangroves and the environmental services they provide</td>
</tr>
<tr>
<td></td>
<td>▪ Location is excellent for developing sustainability mechanism based on cruise ship tourism</td>
</tr>
<tr>
<td>Hol Chan Marine Reserve</td>
<td>▪ Location in San Pedro is ideal for engaging Belizean and international visitors – would benefit from a higher profile visitor centre for providing accessible information on the marine environment</td>
</tr>
</tbody>
</table>

Placencia Lagoon, if declared as a protected area, would also fit this criterion.
4.0 Connectivity

Connectivity is critical in maintaining biodiversity and ecosystem services, whether biological corridors linking the primary forest nodes within Belize’s National Protected Areas System, as riparian corridors protecting hydro-ecological systems, or as transboundary linkages in both terrestrial and marine environments within the wider regional biological connectivity framework.

4.1 Background

- Terrestrial biological connectivity is critical for the maintenance of full species diversity and ecosystem services, preventing genetic isolation of populations and allowing migration of species and ecosystems over time (particularly important in the mitigation of impacts of climate change).
- It is more cost effective to maintain current connectivity, than to re-create connectivity in the future.
- Belize’s forest nodes are too small in isolation to conserve all biodiversity and retain full ecosystem service functionality (Walker et al., 2008).
- Three primary biological corridors have been identified as critical for inclusion in Belize’s portfolio of tools for the maintenance of biodiversity and climate change adaptation.
- Biological corridors, whilst ideally continuous, can be implemented through ecosystem patches, or stepping stones.
- Biological corridors need to be participatory, with socio-economic benefits to stakeholder communities, to facilitate a landscape of conservation and equitable sustainable use.
- Biological corridors need to be established as Special Management Areas under the administrative authority, and incorporate mechanisms for designation, demarcation and management.
- Biological corridors need to maintain natural vegetation cover and can be managed under an integrated land management regime, that maintains corridor functionality, by communities, private land owners, NGOs and Government.
Connectivity

- Establishing connectivity through biological corridors fulfils Belize’s regional commitment to CCAD to maintain forest connectivity as part of the Mesoamerican Biological Corridor, and its international commitment as a signatory to the Convention on Biological Diversity

4.2 Key Recommendations

Highest Priority: Maintenance of functional biological connectivity between the main forest nodes of the National Protected Areas System, though the permanent establishment of three identified primary biological corridors

- Develop / identify and implement legal mandate and mechanisms for management of land within the corridor routes
- Integrate and harmonize the legal establishment of primary corridor linkages with relevant national legislation and the Land Use Planning Framework
- Prioritize the maintenance of primary nodes and connectivity linkages in any future national protected areas system rationalization process and/or national land use planning
- Develop and implement a management framework for the creation and management of biological corridors within Belize, and mechanisms for integration of private lands critical for corridor functionality
- Implement national public consultation process with stakeholders for corridor formation
- Locate funding to engage, support and empower community-based and NGO corridor facilitation, management and monitoring

Primary Corridors: In the terrestrial landscape, three critical nodes and corridors have been identified within Belize for maintained forest connectivity:

- **North East Corridor**
  From: Shipstern / Fireburn Node
  To: Selva Maya / Rio Bravo Node

- **Central Corridor**
  From: Selva Maya / Rio Bravo Node
  To: Maya Mountains Massif Node

- **Southern Corridor**
  From Maya Mountain Massif Node
  To: Sarstoon Temash
In the terrestrial environment, biological, corridors can be defined as "managed and physically interlinked areas of land that are structured around existing natural, intact and functioning areas of vegetation and existing ecological processes, are managed for landscape resilience, and are supported through appropriate socio-economic institutions" (Parris et al., 2011). They mitigate the impacts of habitat fragmentation by facilitating genetic flow of plant and animal species, preventing population isolation and reducing the loss of biodiversity that would otherwise occur. Corridors are a cost-effective conservation mechanism that balances biodiversity and socio-economic needs. They are increasingly recognized as a critical tool for long-term sustainability of biodiversity, assisting in the mitigation of climate change impacts.

System level planning for the Maya Mountains Massif highlighted the regional importance of maintaining forest connectivity in the Central Belize Corridor, between the Maya Mountains Massif – Chiquibul - Montaña Mayas and the Selva Maya / Rio Bravo / Gallon Jug forest nodes for continued biodiversity viability in the long term (Walker et al., 2008). In the south, ridge to reef connectivity has been created by a matrix of national protected areas and private land purchase through initiatives under TIDE and Ya’axché Conservation Trust, encompassing the Maya Mountain Marine and Golden Stream Corridors. This facilitates the seasonal migration of larger mammal species such as white lipped peccary from the Maya Mountains to the Southern Coastal Plain, as well as providing protection for ecosystem functionality required for the migration of species such as mountain mullet upstream. All three proposed primary corridors have local and/or national organizations supporting corridor formation.

However, despite the identification of primary, secondary and even tertiary corridors up to 14 years ago, and the continued efforts of a number of conservation stakeholders to promote these on the ground, real progress towards the physical establishment of the national biological corridor system either on paper or on the ground has been very limited, with the exception of the TIDE / Ya’axché Conservation Trust initiatives, and changes in land use are increasingly dictating changes in preferred routes.

Three initiatives are currently on-going:

- **Southern Corridor:** Ya’axché Conservation Trust / TIDE
- **Central Belize Corridor:** ERI / Panthera / University of Southampton / Darwin Initiative
- **North East Corridor:** Wildtracks

With the North East Corridor also being the past focus of Programme for Belize and Shipstern Nature Reserve.
4.3.1 What constitutes a functional terrestrial biological corridor?

In Belize, the concept of the primary terrestrial biological corridor is as a landscape management tool that provides physical connectivity between protected area nodes in the national landscape. The vegetation structure is maintained, providing conditions for the largely unimpeded movement of wildlife and functioning of ecosystems to prevent ecosystem fragmentation / isolation and barriers to the genetic flow of plant and animal species. Biological corridors also allow ecosystem migration over time as climate change (particularly decreasing rainfall and increasing temperatures, along with increased intensity of hurricanes) and the associated impacts become more intense. Functional connectivity is also important along altitudinal gradients, as exemplified by the Ridge to Reef concept linking the Maya Mountains with the Southern Coastal Plain.
Map 6: Belize’s Potential Biological Corridor Routes
(NB: includes both recognized and candidate private protected areas)
What fulfils a corridor function for one species may not do so for another - some need uninterrupted forest cover to move from one location to another, whilst others are capable of moving from one forest patch to another across a largely agricultural landscape - a wide paved road will not be a complete barrier on its own to wind-dispersed seeds or large or more mobile species such as jaguar, but it may block the movement of many smaller species of mammals, birds, amphibians and reptiles. The larger species require connectivity to assure their basic survival, and the vegetation clearance on either side of large roads and associated human activity can block movement of even large mammals such as jaguars and pumas. Simple measures, such as allowing forest growth close to both sides of major roads for a 100m+ stretch of road, could greatly enhance biological connectivity against what otherwise would be an almost complete barrier (Walker & Walker, 2002) Conversely, small unpaved roads can act as corridors for movement of these mammals (Harmsen et al. 2010). Smaller, non-migratory species generally require less area to maintain viable populations, but need corridors for broader issues such as resilience from climate change.

Recommendations from broad community stakeholder consultations (Northern Belize Biological Corridor (NBBC) consultations, 1999) underlined the need for biological corridors to be legally defined, demarcated and monitored, to retain functionality in the long-term, particularly across human landscapes.

4.3.2 Establishing Belize’s Three Primary Biological Corridors

Biological corridors should be integrated within the landscape as part of the land use management planning process. Planning should be highly participatory, bringing together all stakeholders at local and national levels to identify and mitigate anthropogenic threats and pressures to maintain viability of target species and ecosystems, and management strategies for each corridor, and consider the need for resilience to climate change. Support needs to come from Government levels, and corridors be more strongly integrated into national land use planning initiatives.

- **Relevance for biodiversity conservation**

  **Target:** To establish and maintain functional biological corridors with existing natural vegetation, within the identified primary routes, allowing free genetic exchange between the main forest nodes and facilitating adaptation to climate change at ecosystem and species level, minimizing anthropogenic impacts where possible, and with some scope for habitat restoration where necessary.

  **Ecosystem Connectivity and Climate Change:** Biological corridors need to be located along logical vegetation gradients from dry to more moist vegetation types, and lower to upper elevations, to allow for the predicted migration of ecosystems in Belize (Anderson et al., 2008). Climate change has not occurred on the current scale since the end of the last ice age, and never
at the current rate. Evidence from past climate change indicates that migration has been the usual response of plants and animals, with evolutionary adaptation playing no more than a minor role (Huntley, 1991).

It is critical, therefore that natural linkages remain to permit these migrations to occur over both the short and long term, if Belize is to be able to retain its biodiversity and ecosystem services.

Climate change predictions for the western Caribbean dictate that changes will take place within the timeframe of a few decades, with increasing temperatures (Anderson et al., 2008), decreasing rainfall (Cherrington et al., 2011), increasing intensity of hurricanes and associated increased fire risk. Without connectivity between Belize’s forest nodes, the ability of forests to remain viable and continue providing critical environmental services to Belize’s human population – services such as water security and storm protection - and the associated societal health and economic wellbeing, will decrease.

**Minimum width for long-term functionality:** A width of 1-2km is considered a realistic and biologically functional target for corridor formation (and wider is preferable, wherever possible), with a minimum width of 500m to allow for edge effects penetrating up to 200m into forested systems (Laurance et al., 1997; Laurance, 2004). Within this range, forest edge effects, impacts of invasive (and domestic) species, human disturbance, etc., can be expected to be within acceptable limits to achieve and maintain long-term biological connectivity, and to mitigate climate change impacts. Below 500m in width, corridors are unlikely to have long-term sustainability if traversing a human landscape, with edge effects predictably eroding biological functionality. Where low-cost socio-economic options or opportunities exist for wider corridors, or corridor sections, they should be followed as should the feasibility of narrower corridors rather than no corridor. Where there are barriers to corridor functionality and direct connectivity is not feasible, ecosystem / forest patches or stepping stones should be established.

- **Low Social-cost routing**

  **Target:** To establish cost-effective, functional biological corridors with broad stakeholder support, whilst balancing this with ecological value and integrity, and socio-economic benefits.
**Community Participation and Ownership:** It is recognised that for corridors to be effective, stakeholder communities, non-governmental organizations, local landowners, and leaders at both local and national levels need to take ownership. This is best achieved through participation from the very start of the process, with the formation of a shared vision, participation in design, planning, decision making and implementation.

Lessons learnt from the Northern Belize Biological Corridors Project in the late 1990s showed that communities were receptive to the idea of corridor formation and community participation, particularly when coupled with incentives such as projects linked to biodiversity conservation. The project also demonstrated that follow-up beyond the initial project is critical for the formal adoption/establishment and maintenance of a given corridor.

A national biological corridor awareness campaign coupled with a broad stakeholder consultation and participation process is required to engage stakeholders and provide opportunities for effective input and participation from the early planning stages.

**Socio-economic implications:** Whilst biological corridors will provide a number of economic development opportunities (such as protecting and highlighting community tourism focal areas), and may provide important environmental services to local communities (including riparian erosion control or hurricane buffering / protection), they will also be perceived as obstacles to more traditional national development approaches – including agricultural expansion. In order to minimize real or perceived social costs of corridor establishment and management (including potential wildlife / human conflicts), preferred corridor routes have been identified to avoid areas of high human footprint, including intensive agricultural areas where rapid expansion is seen as a logical and necessary progression. Where feasible, they should ideally be routed through areas under, or with the potential for protection (private or national) for community tourism initiatives, watershed protection, or other highly compatible and synergetic land-uses, and be linked with socio-economic benefits including access to conservation / sustainable development funding for compatible projects within the adjacent buffer areas.

*The indirect economic benefits of corridor initiatives are likely to be small relative to regional economies. Hence, with the exception of the environmental sector, they are unlikely to generate substantive positive economic impacts in isolation from other initiatives.*

*Parris et al. 2011*
Inclusion of Private land: Whilst some corridor sections may be routed through national lands, in many or most instances they will have to include privately owned lands. Although the principles of the Community Baboon Sanctuary have demonstrated that it is possible to secure the cooperation of a large number of owners of small-holdings, as a general principle it will be more feasible to negotiate long term biological corridor establishment with a smaller number of owners of larger landholdings. In some instances, landowners are willing to commit portions of their lands for conservation purposes (as in the case of the members of the Belize Association of Private Protected Areas), some without expectation of financial remuneration.

In most cases, however the commitment to the implementation of a biological corridor formation will require some form of financial incentive for landowners, assessed as being more appropriate and economical than land-purchase. Incentives should be tied to legal commitments through conservation covenants, with investigation of mechanisms such as partially or wholly discounted land taxes for the portions of properties within the corridor footprint, or access to grant sources by landowners to offset conservation management costs and support compatible economic development activities, with mechanisms such as the sale of carbon credits through REDD / REDD+ with the potential to contribute to the financial sustainability of corridor maintenance.

- **Low economic-cost routing**

It is far more biologically and financially cost-effective to use existing forest corridors than the alternative of habitat restoration to re-create functional connectivity – as has had to happen in Costa Rica and elsewhere in the region. In Belize, there is still functional forest connectivity along the majority of the identified primary routes. However, the social and economic costs of biological corridor establishment in Belize are changing with the expanding human footprint – over the last fifteen years, there has been a significant increase in the extent of national land being allocated for private ownership. Implementing corridor establishment as a land-use planning tool through national lands fifteen years ago would have been considerably more cost effective than negotiating with the private land-owners now established in those same areas, and costs to the Government and conservation community will continue to increase and feasibility decrease if the investments in biological corridors are not brought to fruition within the next 5 years.

Where appropriate, the establishment of corridors should be linked with community-based livelihood projects, particularly those that create or strengthen recreational and tourism opportunities and agro-forestry initiatives that maintain the forest structure within the corridor, and integrate community agreements that follow and build on the Community Baboon Sanctuary model.
Balancing biological needs against the socio-economic considerations of national development

The concept of ‘Least Socio-economic Cost’ is an important consideration. Establishing biological corridors through an increasingly anthropogenically-altered landscape will always involve compromise – balancing the biological ‘ideal’ with the social and economic needs of national development. In Belize, primary and secondary corridor routes have been identified based on ‘best fit’, as an output of the Land Use Planning project.

They fill the requirements for biodiversity connectivity whilst balancing this against the current and future predicted requirements of adjacent communities, based on distance from population centres and the agricultural values of the land (Meerman, 2011).

Legal Framework

Terrestrial biological corridors would fall under the authority of the Administrative Body, and their implementation be overseen by this Authority, necessitating human and financial resources to assist in coordination, and prevention and /or resolution of human-wildlife conflicts.

Primary biological corridors should be defined and legally established as Special Management Areas either under the new National Protected Areas Act (currently being drafted, December 2012), under the Conservation Covenant Act once enacted, or both. The retention of natural vegetation and permissible activities compatible with the function of biological connectivity should be clearly stipulated, along with the roles and responsibilities of management bodies and/or landowners. These should also be integrated into planning and evaluation of Environmental Impact Assessment process.

The Administrative Authority would take on the coordination role, working with the managing NGOs, who work directly with the communities and landowners, maintaining communication and facilitation to keep them engaged, participatory and motivated, particularly during the formative years.

Parallel to a framework of permitted activities, incentive mechanisms need to be established – either in the form of tax concessions or access to conservation / sustainable development grants funding, or both. Access to such financing mechanisms should be tied to legal commitment through the mechanisms outlined above.
4.3.3 Process for Corridor Development

For effective establishment and implementation of corridors in Belize, an overarching biological corridor management framework needs to be produced, under which the three primary biological corridors can be established. This should constitute a programme under the Administrative Authority, tasked with developing and implementing the National Biological Corridors workplan and coordinating the different participating parties. A lead organization, or combination of organizations, needs to be identified and empowered for each of the three corridors, to provide direct coordination of the different corridor-level stakeholders - non-government conservation organizations, local leaders, grass roots community-based organizations, and private land owners, and be responsible for ensuring on-going communication and collaboration at site-and secretariat level.

Steps towards successful corridor formation:

1. Providing an enabling environment

- Develop and implement a legal mandate and management framework for the designation, delineation, recognition and management of biological corridors as Special Management Areas within Belize, to be implemented under the Administrative Authority, defining permitted / non-permitted activities

- Integrate and harmonize the legal establishment of primary corridors with relevant national legislation and the Land Use Planning Framework, and sensitize the relevant Government authorities (particularly Department of the Environment, Department of Geology and Petroleum, Land Use Planning)

- Establish a 5-year National Biological Corridors Workplan, aligned with the 10 year NPAS Strategic Plan and 5 year Management Unit Workplans that identify strategic management priorities, activities and requirements, with an integrated monitoring programme that measures success through monitoring both biodiversity and socio-economic benefits

- Develop and implement mechanisms for integration of private lands critical for corridor functionality within the national framework, legally committed under the Conservation Covenant Act once enacted and with potential incentives for private land owners

- Investigate integration of mapping and national recognition of southern corridor within the National Land Use Planning framework (this corridor is not included within the National Land Use Planning Framework)
Connectivity

- Identify and engage lead organizations and other key stakeholders within the primary corridor routes

- Support lead organizations in the implementation of a public awareness and participation process for stakeholder engagement towards corridor formation, within the stakeholder communities

- Locate funding to support and empower community-based and NGO corridor management and monitoring through Debt for Nature Swap funding or similar mechanism to fund incentives and for critical land purchases

- Ensure awareness of proposed biological corridors and participation in design, planning in relevant government departments: Forest, Fisheries, Agriculture and Lands Departments, Department of the Environment, Lands Information Centre, and Department of Geology and Petroleum.

- Develop biodiversity baseline and implement monitoring and measures of success

- Identify / develop low cost, transparent enforcement mechanisms

- Identify and implement conflict resolution mechanisms.

2. Physical establishment of primary corridors

- Finalise verification of broad primary corridor routes through re-evaluation and updating of information on site-level ecosystems, land use and land tenure, consultation with technical experts, protected area managers, community leaders and communities, facilitated through a fully participatory planning process per corridor

- Define precise routes for primary corridors through an informed and participatory planning process, with a minimum width of 0.5-2.0km, based on biological suitability, social acceptance / support and associated economic considerations

- Ensure continued implementation of communication, consultation and participation process with stakeholder communities and private landowners throughout corridor establishment and management
Connectivity

- Where private and community lands are involved, negotiate with landowners and communities to secure approval of corridor route and establishment and identify and implement suitable incentive mechanisms for long term commitment of lands to the corridor.

- For each corridor, establish management areas based on community influence and empower local stakeholder management committees to be responsible for specific corridor sections – acting under the Administrative Authority.

- Facilitate capacity-building, where necessary, for supporting effective local stakeholder management committees.

- Establish legal designation of primary corridors as Special Management Areas, and reinforce with conservation covenants where feasible.

- Work with local stakeholders to survey and demarcate corridors on the ground, and disseminate information to relevant stakeholders on the location, purpose and regulations of each corridor.

- Ensure effective surveillance and enforcement of regulations.

- Continue biodiversity monitoring and measures of success.

- Repeat steps for secondary and tertiary corridors where needed.
4.3.4 Key biodiversity features, challenges and opportunities of the three corridors

North East Corridor

The north east, or northern, corridor has been the focus of activities under Programme for Belize, Wildtracks and Shipstern Nature Reserve, through the Northern Belize Biological Corridors Programme, subsequent stakeholder engagement, and land protection in the Shipstern / Fireburn node.

**Biodiversity Features**

- Critical for the climate change-related migration of the drier forest ecosystems southwards – the Shipstern / Fireburn node provides the best connectivity for the drier Yucatan forest types (that are predicted to ‘migrate’ southwards with the impacts of climate change) particularly with the loss of natural vegetation in the sugar cane belt to the west
- Contribution towards national ecosystem goals, with increased protection for *Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant*, an under-represented ecosystem within the system
- Shipstern / Fireburn node has been identified as a critical refuge for game species in north east Belize, with good, extensive forest structure that still maintains populations of the nationally threatened indicator species - white lipped peccary
- Includes a natural, functional forest corridor that crosses saline savanna to link the Shipstern Fireburn node with Freshwater Creek

**Challenges**

- Establishment of new Mennonite community (‘New Lands Community’) in the broader corridor route, east of Freshwater Creek, with extensive forest removal of more than 3,000 acres for agriculture in 2012 alone
- Allocation of land within Freshwater Creek Forest Reserve and cutting of survey lines, leading to doubts as to future viability of this as a forest node stepping stone between Shipstern / Fireburn and the Selva Maya / Rio Bravo node
- Limited protection of forested areas in the Crooked Tree area

**Opportunities**

- Kakantulix, the second largest archaeological site in northern Belize, lies within the corridor route, with commitment from the Institute of Archaeology in designation as an Archaeological Reserve (survey completed in 2005 but never registered)
- Some of the corridor lies within national lands
- Interest of the Mennonites of the new community in a land exchange for the land identified within the corridor route (DoE has included a condition of maintenance of the corridor in their development permit)
- Potential for including Corozalito, the headwaters of Shipstern Lagoon, within the corridor, addressing concerns for the viability of connectivity of the Shipstern Lagoon system as the Mennonite farmlands of Little Belize encroach on and pollute the area
Map 7: The North East Biological Corridor Route (NB: includes both recognized and candidate private protected areas)
Central Corridor

The Central Belize Corridor, linking the Selva Maya / Rio Bravo node with the Maya Mountains Massif / Chiquibul – Montañas Mayas, is considered the most critical of three primary corridors, based on its regional importance. It has been recommended for incorporation as a priority in the operational framework for the implementation of the National Protected Areas System Plan (2011), and is the focus of investment in capital projects, research and monitoring by Panthera, Darwin Initiative, and the Environmental Research Institute (University of Belize).

Biodiversity Features

- Representation of lowland moist broadleaf forest
- Representation of lowland savanna, towards its most northerly extent in the Americas.
- Includes Whitewater Lagoon, recognized as an important freshwater body within Belize’s hydro-ecological system, known for its population of critically endangered Central American river turtles (*Dermatemys mawii*) and red phase bay snook (*Petenia splendida*)
- Includes the Peccary Hills – and Freshwater Creek, with important populations of the critically endangered Central American river turtle and the endangered Yucatan black howler and Central American spider monkeys (*Alouatta pigra* and *Ateles geoffroyi*)
- Includes regionally important representation of karst scenery, with endemic species

Challenges

- Width of Western Highway, which cuts through the corridor, and increasing traffic and human activity on the road, with no protection of forest adjacent to the Western Highway, to provide a key crossing point for wildlife
- Short term high fire risk during recovery after Hurricane Richard (2010), and after under brushing under power-lines along highway
- High fire risk in savanna ecosystems and forest edges that can erode corridor functionality
- Rapidly expanding agricultural landscape
- Uncertainty of stability of private protected areas within the corridor, including status of the Peccary Hills private lands, limited management of the Peccary Hills National Park and uncertainty of future of Runaway Creek Private Nature Preserve

Opportunities

- Interest from Environmental Research Institute and Panthera in continuing to conduct biodiversity monitoring and research in the area
- Commitment from Panthera to collaborate and support initiatives within the Central Corridor
- Recent designation of Labouring Creek Jaguar Corridor Wildlife Sanctuary, the only section of the Belize River that still retains riparian forest on both banks.
Map 8: The Central Biological Corridor Route (NB: includes both recognized and candidate private protected areas)
Southern Biological Corridor

The Southern Corridor, linking the Maya Mountains Massif / Chiquibul – Montañas Mayas with Sarstoon Temash, and includes a sub-corridor to Aguacaliente Wildlife Sanctuary.

Biodiversity Features

- Provides ridge to reef connectivity, allowing seasonal movement of larger mammals from karst slopes of the Maya Mountains Massif to the Southern Coastal Plain, and altitudinal migration of ecosystems required for climate change adaptation
- Maintains forest cover / water catchment properties, contributing towards water security for southern Belize
- Includes Belize’s only ridge to reef protected hydro-ecological and riparian corridor, along the Golden Stream
- Aguacaliente protects 100% of the ecosystem: tropical evergreen broad-leaved lowland swamp forest, Aguacaliente variant, and provides an important flood sink function protecting agricultural lands and settlements downstream

Challenges

- Rapidly expanding agricultural landscape
- A need for effective management of Aguacaliente Wildlife Sanctuary
- Potential impacts of water pollution in the riparian corridor and in Aguacaliente Wildlife Sanctuary
- Precise routing of the actual proposed corridor remains in question – better forest connectivity is available through an eastward shift of the southern portion

Opportunities

- Active NGO involvement in corridor establishment and management (TIDE and Ya’axché Conservation Trust)
- Panthera has conducted ground-truth surveys and analysis of data for southern corridor delineation; and has already committed to investing in this corridor, starting determination of land tenure
- Environmental Research Institute is committed to working in partnership with local NGOs on the biodiversity research and monitoring aspects of this corridor
Map 9: The Southern Biological Corridor Route
(NB: includes both recognized and candidate private protected areas)
### Connectivity

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>North East Corridor</th>
<th>Central Corridor</th>
<th>Southern Corridor</th>
</tr>
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<tbody>
<tr>
<td><strong>Communities in or within 2km of corridor</strong></td>
<td>Fireburn Maskall Crooked Tree May Pen LEMONAL Flowers Bank Isabella Bank Bermudian Landing Double Head Cabbage Rancho Dolores Willows Bank St. Paul's Bank Big Falls</td>
<td>Gracie Rock LA Democracia Franks Eddy St. Matthews Ringtail More Tomorrow, Jih Chan, Mahogany Heights</td>
<td>Tambran Golden Stream Laguna Jacinto Wilson Road Eldridge Tushville Boom Creek Barranco San Marcus Emery Grove Forest Home</td>
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<td><strong>NGO stakeholders</strong></td>
<td>Wildtracks Shipstern Nature Reserve Belize Audubon Society Programme for Belize</td>
<td>Programme for Belize Environmental Research Institute Monkey Bay Panthera</td>
<td>Toledo Institute for Development and Environment Ya’axché Conservation Trust Panthera Saving the howler in Toledo project</td>
</tr>
<tr>
<td><strong>CBO stakeholders</strong></td>
<td>Sarteneja Alliance for Conservation and Development Spanish Creek Community Baboon Sanctuary</td>
<td>Guardians of the Jewel</td>
<td></td>
</tr>
<tr>
<td><strong>National Protected Areas</strong></td>
<td>Corozal Bay Wildlife Sanctuary Freshwater Creek Forest Reserve Honey Camp National Park Crooked Tree Wildlife Sanctuary Spanish Creek Wildlife Sanctuary</td>
<td>Laboring Creek Jaguar Corridor Wildlife Sanctuary Peccary Hills National Park Manatee Forest Reserve</td>
<td>Aguacaliente Wildlife Sanctuary Machaca Forest Reserve</td>
</tr>
<tr>
<td><strong>Private Protected Areas</strong></td>
<td>Shipstern Nature Reserve Fireburn Reserve Balam Na Reserve Rio Bravo Conservation and Management Area Yalbac Gallon Jug</td>
<td>Runaway Creek Private Reserve Peccary Hills Monkey Bay Wildlife Sanctuary</td>
<td>Golden Stream TIDE private lands Big Falls Estate Belize Lodge and Excursions</td>
</tr>
<tr>
<td><strong>Nodes</strong></td>
<td>Shipstern / Fireburn node Selva Maya / Rio Bravo¹</td>
<td>Selva Maya / Rio Bravo¹ Maya Mountains Massif</td>
<td>Maya Mountains Massif Sarstoon Temash National Park</td>
</tr>
</tbody>
</table>

¹ Including the candidate private protected areas of Yalbac and Gallon Jug
Map 10: Communities in, or within 2km of, the proposed biological corridor routes
4.3.5 Stepping Stones

In some areas, corridors with full connectivity are not feasible. In this scenario, a series of forest patches within a corridor landscape may perform a next best role, acting as stepping stones for wildlife movement. Whilst not included as an option for primary corridors, such stepping stone connectivity has the potential to provide enough connectivity for the migration of many species, and may be appropriate for some secondary corridors where full connectivity is not feasible.

The Maya Mountain Massif / Placencia Lagoon Corridor is identified as one of these secondary corridors, and is considered particularly important for the maintenance of the rapidly declining yellow headed parrot and the pine savanna of the southern coastal plain – a key area for this species.

Private Protected Areas have an important role to play in the establishment of corridors, and will assist the establishment of national biological corridors – either as part of direct connectivities, or as stepping stones across anthropogenically impacted landscapes. Relatively small forested properties, committed for conservation management within the broader corridor routes may thereby still contribute significantly towards the maintenance of biological connectivity.
4.4 Transboundary Connectivity

Belize has two countries directly adjacent to its borders. Both have higher population pressures than Belize, and greatly reduced natural resources, resulting in increasing levels of transboundary incursions, both in the marine and terrestrial environments. Transboundary connectivity is considered an important aspect of natural resource management, particularly in the Selva Maya and Corozal Bay areas, with the use of protected areas as a tool to increase and strengthen transboundary communication and collaboration.

Belize / Mexico
Corozal Bay Wildlife Sanctuary / Sanctuario del Manati  
Bacalar Chico Marine Reserve / Parque Nacional Arrecifes de Xcalak

Belize / Guatemala
El Pilar (transboundary Peace Park)  
Maya Mountains Massif / Chiquibul-Montañas Mayas National Park  
Sarstoon Temash / Rio Sarstun Multiple User Reserve  
Southern Belize Reef Complex / Punta de Manabique Special Protection Area

Recommendations:

- Strengthening of transboundary mechanisms for enforcement of Guatemala / Belize border in the Vaca / Caracol / Chiquibul forest / Columbia River Forest Reserve area.
- Development of a transboundary Conservation Action Plan for the Belize / Mexico protected areas, to strengthen transboundary communication and collaboration, and to build on current initiatives between Mexico and Belize.
- Strengthening of Tri-national Gulf of Honduras (TRIGOH) as a mechanism for building transboundary communication and collaboration in the south.
## Integration of Biological Corridors with other National Initiatives

### National Protected Areas Policy and System Plan 2005
- Belize has an obligation to meet international agreements, and integration with regional and national approaches promoting biological connectivity (such as the Mesoamerican Biological Corridor Programme)
- **NPAPSP Policy Statements:**
  - Biological corridors shall be established and recognised as part of the system provided they contribute to the effectiveness and interconnectivity among the different protected areas.
  - Private protected areas shall be officially recognised provided the following: that the areas are essential ...for maintaining primary biological corridors; that the management goals and objectives of the private protected areas are compatible with and complementary to the national system, and that their establishment and use is permanent regardless of changes of land ownership that may occur
  - To fulfil the national protected area policy the system must be interconnected, linked by functional biological corridors both within Belize and across its frontiers.

### National Land Use Policy 2011
- **National Land Use Strategies:**
  - Biological corridors are being proposed to ensure the connectivity of protected areas across Belize. Necessarily, they include tracts of National Land as well as private land with no formal protection. The ease of implementation will depend on alternatives available to other potential land uses, and the collaboration of Lands and Surveys Department and private landowners.
  - Broaden the analysis of the vulnerability of ecosystems and species to the effects of climate change and, based on the findings, prioritise the configuration and management of protected areas and biological corridors to enable a greater bio-geographic scale and protect potential climate refugees.
  - This last has been a focus of the Rationalization process

### National Biodiversity Policy (not endorsed)
- The National Biodiversity Policy recognised the importance of biological corridors for addressing the issue of fragmentation of ecosystems (particularly forest ecosystems) within the landscape
- The Policy sought to integrate Belize with regional and national approaches promoting biological connectedness (such as the Meso-American Biological Corridors Project) and with other national and regional development plans.
- **Policy Statement:**
  - To support the concept of ‘Biological Corridors’ as an effective tool for restoration of habitats, the conservation of Biological Diversity, and to adopt and manage the areas defined by the Northern Biological Corridors Project, as an effective compliment to the system of Protected Areas in the terrestrial and marine domain
  - A companion to the Policy was the National Biodiversity Strategy and Action Plan, though this was not formally adopted
### Mesoamerican Biological Corridors Programme

- The Central American Commission on Environment and Development (CCAD) was created in 1987 to "establish a regional regime of cooperation for the optimal and rational use of the natural resources of Central America, control pollution and re-establish ecological equilibrium, in order to guarantee a high quality of life for the population of the isthmus"

- In 1994, a regional, open agreement produced the Alliance for Sustainable Development in the Americas (ALIDES), which called for a system of biological corridors to strengthen natural protected area systems.

- As part of this function, CCAD initiated the Mesoamerican Biological Corridor Programme in 1997 as part of a regional agreement with the challenge to establish “a system of land use, comprised of the interconnection of the Central American System of Protected Areas with their neighbouring buffer zones and multiple-use zones, which offers a set of environmental goods and services to Central American society and global society, and which promotes investment in conservation and sustainable use of natural resources; all through broad social consensus, in order to contribute to improving the quality of life of the region’s inhabitants” (CCAD, 2005)

- The Belize Government is a member of the CCAD and a participant in the Mesoamerican Biological Corridor Programme. Under this framework, a feasibility study was implemented in 2000 for the establishment of the Northern Belize Biological Corridor (Meerman, 2000)

- In its design, it focuses on maintaining / creating forest connectivity for increased biodiversity viability. Under this regional strategy, short and mid-term objectives have been outlined:
  - By 2005, all the region’s countries should have forest policies and national forest development programmes, resulting from a participatory process with the main social bodies and groups involved in forest management, conservation and sustainable development. Any relevant components of national biodiversity strategies should also be reviewed and incorporated;
  - By 2010 the groundwork should be laid so that the region’s forests can begin to help improve the economic and social situation of the region’s countries, i.e. by reversing forest destruction, thereby reducing poverty in the rural areas.

**Rodriguez, 2002**

- In Belize, the lack of a national coordinating mechanism and follow-on funding limited the success of initial steps taken towards corridor formation.
5.0 Climate Change

5.1 Analysis of predicted climate change

Protected areas are an essential part of the global response to climate change. They assist in addressing the cause of climate change by reducing greenhouse gas emissions, and assist society in coping with climate change impacts by maintaining essential services upon which people depend. Without these environmental services provided by protected areas, the challenges would be even greater, with protected areas providing a number of responses to the climate crisis.

Dudley et al. 2010

When planning for climate change, it is important to determine areas of vulnerability and resilience, and to identify strategies that can assist in maintaining the viability of biodiversity and increase resilience of individual protected areas, the protected areas system as a whole, and the socio-economic resilience of communities that depend on their environmental services.

In Belize, with the current environment of increasing sea surface temperatures, ocean acidification and tropical storm intensity, planning for climate change has become a fundamental necessity for long term viability of the National Protected Areas System. Mean monthly rainfall over Belize has decreased, with less dependability in the seasonal rainfall regimes. At the current rate of sea level rise, many of Belize’s coastal communities are at greater risk of future inundation. There are stronger tropical storms with associated forest fire risks, and increased water temperatures are stressing coral communities to the point of bleaching and beyond. These effects, combined with limited financial, technical and institutional capacity, are predicted to threaten water and food security, coastal settlements, health and infrastructure in Belize in the future. A number of climate change models exist that provide a range of scenarios for future climate change, varying primarily in the rate at which change is predicted to occur.

Climate change is happening in Belize and is already affecting Belize’s biodiversity. Whilst climate change adaptation strategies are not yet fully integrated into national governance, at the global scale it is recognized that protected areas play a critical role in the maintenance of ecosystems services - a role that will become increasingly important as climate change impacts increase. Belize is highlighted as highly vulnerable to climate change impacts, and this has been taken into account in the rationalization exercise for the National Protected Areas System.
Climate Change

Protected areas can contribute to the two main responses to climate change through:

**Mitigation**
- **Store**: Prevent the loss of carbon that is already present in vegetation and soils
- **Capture**: Sequester further carbon dioxide from the atmosphere in natural ecosystems

**Adaptation**
- **Protect**: Maintain ecosystem integrity, buffer local climate, reduce risks and impacts from extreme events such as storms, droughts and sea-level rise
- **Provide**: Maintain essential ecosystem services that help people cope with changes in water supplies, fisheries, disease and agricultural productivity caused by climate change

*Dudley et. al, 2010*

<table>
<thead>
<tr>
<th>Impact</th>
<th>Current Status – 50 years</th>
<th>100 yrs</th>
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</table>
| Sea level rise          | - Increased global average sea level rise rate of 1.8mm per year from 1961 – 2003 (IPCC, 2007).  
                         | - Current average increase in sea level rise in the Mesoamerican region is estimated at 3.1mm per year (IPCC, 2007).  | - Predicted increase of between 0.6m and 1.0m over next 100 years, though could be higher (up to 3.3m), dependent on the rate of melt of ice sheets (Simpson et al., 2009) |
| Sea surface temperature rise | - Water temperature has increased by 0.74°C between 1906 and 2005  
                         | - Current levels of increase are estimated at 0.4°C per decade (Simpson et al., 2009) | - Predicted regional increase of temperature by up to 5°C by 2080, with the greatest warming being experienced in the north-west Caribbean (incl. Belize) (WWF, 2009). |
| Increased intensity of storms | - Increased intensity of storms from 1999 onwards, with annual fluctuations. Stronger storms >Cat 4 / 5 | |
### Predicted Climate Change Impacts

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<tr>
<th>Impact</th>
<th>Current Status – 50 years</th>
<th>100 yrs</th>
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</thead>
</table>
| **Ocean acidification** | - Atmospheric CO₂ concentration has increased from 280 parts per million (ppm) in 1880 to 385 ppm in 2008 (Simpson et al., 2009).  
- 48% of all atmospheric CO₂ resulting from burning of fossil fuels has been taken up by the ocean (Hartley, 2010).  
25 – 50 years  
- Predicted atmospheric CO₂ levels of 450 by 2040 (Simpson et al., 2009)  
- Predicted 30% decrease in pH  
- Predicted decrease in calcification rate by 20 - 50% by 2050 | - Some experts predict a 35% reduction in coral growth by 2100 (Simpson et al., 2009) |
| **Decreased Precipitation** | - Mean monthly rainfall over Belize has decreased at an average rate of 3.1mm per decade since 1960 (NCSP/UNDP).  
25 – 50 years  
- Predicted ecological shifts up the altitudinal gradient of the Maya Mountains Massif may remove the quasi-cloud forest, and the catchment functionality important for maintaining rivers in dry season in the south of Belize, and providing nutrients to the reef environment.  
- Increased concentration and seasonality of agrochemical delivery / pollution | - Predicted decrease in precipitation of 9% by 2099 (IPCC, 2007), with significant fluctuations, attributed to El Niño  
- Some models predict a decrease of as much as 22% (IPCC 2007) |
| **Air Temperature** | - Mean annual temperature has increased in Belize by 0.45°C since 1960, an average rate of 0.10°C per decade.  
- Average number of ‘hot’ days per year in Belize (days exceeding 10% higher than current average temperature) has increased by 18.3% between 1960 and 2003 (NCSP/UNDP). | - Predicted mean annual temperature increase is 3.5°C by 2099 (UNDP, 2009). |
5.2 Climate change predictions and the terrestrial environment

The terrestrial environment is characterised by forests, savannas, wetlands and coastal ecosystems that will be affected by climate change. The changing temperature and rainfall regimes anticipated lead to predictions of drier forests – of a shift of “tropical wet” to “tropical moist”, and “tropical moist” to “tropical dry.” These broad changes across the terrestrial landscape will be further shaped by the increased intensity of storms, and the associated storm impacts, and by the rising sea level. In the coastal zone, the increased sea level may result in huge ecosystem shifts, particularly with the salination of low lying aquifers of the coastal zone, with the associated shifts to more salt-tolerant species. Should the barrier reef not be able to maintain growth rates equal to sea level rise, and Belize loses this protection against the force of the open sea waves, there will be greatly increased coastal erosion, with the loss of both minor and major cayes, and several of the coastal lagoons merging with the sea.

A number of broad adaptation measures can be used to help maintain the species diversity of the tropical ecosystems:

- Maintaining large blocks of forest cover, with priority given to the primary forest nodes, to buffer against climate change impacts and continue providing water security
- Maintaining lateral connectivity to facilitate ecosystem migration southwards, with priority given to the three primary corridors
- Maintaining altitudinal connectivity to facilitate ecosystem migration up altitudinal gradients
- Maintaining forest cover in the lowlands of the southern coastal plain to provide conditions conducive for orographic rainfall
- Maintaining the integrity of coastal mangrove systems, to protect coastlines from erosion
- Managing fire risk with effective planning and fire management
### Potential Climate Change Impacts

- Increasing temperatures will take some forest ecosystems and species outside their tolerance zone, with ecosystem shifts, and a general shift towards Yucatan species.
- Migration of species – a drying of forest conditions, with an increase in Yucatan composition.
- The humid end of the species spectrum will be lost.
- Decreased reliability of rainfall will have a direct impact on some fauna as well – amphibians will be first vertebrate taxon to show these impacts.
- Increased hurricane intensity will impact forest stature and structure and will remove some species less tolerant of landscape scale storm impacts, with decreased biodiversity.
- Decreased productivity, with loss of older fruiting trees and knock on effects.
- Increased vulnerability to local extinctions exacerbated by reduced connectivity and increased ecosystem fragmentation.
- Increased vulnerability to fire.
- In low lying coastal areas, saline intrusion into groundwater will reduce species diversity and cause changes in species composition – in these limestone areas, tree species rely having their roots deep in the aquifer, and will not be able to adapt to increasingly saline conditions.
- Increasing seasonality of rainfall / inundation of swamp forest – change in species composition.

### Resilience Features

- Forests have species arrays that cover a broad range of tolerances from the dry Yucatan to the more humid Petén forests. Existing forest ecosystems occur in an area where there has previously been significant shifts in sea level rise, and has adapted in the past.
- The large extent of forest in the Selva Maya node is many times over the minimum dynamic area, increasing resilience to climate change.
- Distance of Selva Maya node from coast buffers to some extent from the most severe impacts of hurricanes / tropical storm events.
- The North East and Maya Mountains nodes also have some buffering from climate change through size, current intact condition and connectivity.

### To increase resilience

- Maintain forest connectivity to facilitate ecosystem migration southwards, particularly from Shipstern / Fireburn node, with its Yucatan elements.
- Prevent further erosion of core forest nodes.
- Reduce external anthropogenic impacts – e.g. fire, illegal hunting and illegal logging, which could tip the balance for some species – hurricane damage is greater where canopy is interrupted by logging roads. Recommend integrate spatial planning for minimizing impact of logging roads into long term management planning for areas such as Rio Bravo.
- Increased prioritization of fire management / prevention, especially at the interface of forest and savanna.
- Formal integration of large private lands (e.g. Yalbac, Gallon Jug, Peccary Hills) where feasible, into national system to retain forest nodes.
### Potential Climate Change Impacts

- Increasing seasonality of rainfall / inundation has the potential to result in change in species composition.
- In low lying coastal areas, saline intrusion into groundwater will reduce species diversity and cause change in species composition towards a more mangrove dominated, haline ecosystem.
- Increased hurricane intensity will impact forest stature and structure and will remove some species less tolerant of landscape scale impacts, with decreased biodiversity.
- Decreased productivity, with loss of older seed-stock and fruiting trees, directly affecting frugivores, and indirectly impacting ecosystem functionality.
- Increased vulnerability to fire.
- Increased vulnerability to local extinctions exacerbated by reduced connectivity and increased fragmentation.
- Migration of species and ecosystems – a drying of forest with increased Yucatan composition.
- The humid end of the species and ecosystem spectrum will be lost.

### Resilience Features

- Forests occur in areas that are exposed to significant seasonal shifts in water regime – inners a degree of resilience.
- These ecosystems occur in areas where there has already been significant shifts in sea level rise, and has adapted in the past.
- Many areas have been exposed to frequent anthropogenic fires – remaining biodiversity has some resilience.
- Large area under protection under MMMC.

### To increase resilience

- Maintain forest connectivity to facilitate ecosystem migration from the north southwards, and from the Maya Mountains Massif to the coastal plain.
- Fire management / prevention, particularly in savannah / forest interface areas.
- Prevent further erosion of core forest nodes.
- Reduce external anthropogenic impacts – fire, hunting, illegal logging, which could tip the balance for some species – hurricane damage is greater where canopy is interrupted by logging roads.
| **Potential Climate Change Impacts** | ▪ Potential for significant change - coastal lagoons have the potential to become coastal bays, with erosion of coastal ridge, increased tidal flow and flushing of sediments.  
▪ May lose estuarine characteristics and species, but with a shift to increased seagrass and associated biodiversity and nursery functionality  
▪ Greater flushing, resulting in less turbid conditions, combined with increased depth may increase seagrass cover and ecosystem productivity.  
▪ Increased depth, so temperature cycling not as great, with greater buffering of dissolved oxygen shifts  
▪ Erosion of low lying coastal areas with loss of protective coastal ridge and increased tidal / wave action  
▪ Migration of inundated mangrove inland, and relocation of fringing mangroves to new coastline.  
▪ Increased severity of exposure for coastal forests.  
▪ Greater vulnerability to hurricane impacts.  
▪ Reduced annual freshwater input resulting in reduced estuarine conditions, with greater seasonality of freshwater input and rapid salinity changes during storm events of increasing intensity |
| **Resilience Features** | ▪ Mangroves have capacity to migrate up elevation gradient as sea level rises – will slow loss of land area – slow the erosion rate.  
▪ Coastal vegetation has a natural resilience to storms, with a high capacity to regenerate from severe tropical storm events. |
| **To increase resilience** | ▪ Maintain fringing mangroves and natural coastal vegetation to slow rate of loss of coastal ridges and erosion of lagoon shorelines  
▪ Zone coastal development to prevent exacerbation of climate change impacts in identified sensitive areas and prevent development in areas that will exacerbate the impacts of sea level rise and coastal erosion – coastal ridges.  
▪ Accept that dramatic changes will take place in the Belize coastline, and mitigation measures are unlikely to be effective in the long term...relevant to investment |
### Upland Forests of the Maya Mountains Massif

#### Potential Climate Change Impacts
- Migration of species and ecosystems along altitudinal and precipitation gradients.
- Reduction of orographic rainfall will affect viability of montane and submontane ecosystems, causing ecosystem shifts, drying of forests at all elevations, reducing river flow and water security for lowland communities.
- Decreased reliability of rainfall will impact fauna as well – amphibians will be first vertebrate taxon to show these impacts.
- Increasing temperatures will take some forest ecosystems and species outside their tolerance zone, with ecosystem shifts, and a general shift up altitudinal gradients.
- Increased vulnerability to fire

#### Resilience Features
- Altitudinal gradients ensure that the forests have species arrays that cover a broad range of tolerances from dry to more humid forests.
- The large extent of forest, many times over the minimum dynamic area for species and ecosystems, increases resilience.
- Geographically separated replication of ecosystems increases resilience to hurricane impacts.
- Rugged terrain normally decreases storm strength very rapidly, with mountainous ridges protecting forests on the leeward slopes.
- Very few of the anthropogenic impacts known to increase storm impacts – e.g. few wide roads, clearings, etc.

#### To increase resilience
- Increase enforcement against transboundary incursions, forest clearance.
- Re-establish forest cover over illegally cleared lands.
- Prevent further erosion of protected areas at periphery.
- Focus on agro-forestry initiatives in Southern Coastal Plain to maintain forest cover where feasible, to maintain orographic rainfall functionality where feasible.
- Fire management / prevention.
- Reduce anthropogenic impacts – fire, illegal hunting and logging, which could tip the balance for some species – hurricane damage is greater where canopy is interrupted by logging roads.
### Forest Ecosystems on Karst Hills

| Potential Climate Change Impacts | Increasing temperatures will take some forest ecosystems and species outside their tolerance zone, with ecosystem shifts, and a general shift towards Yucatan species.  
|                                 | - Increased vulnerability to fire  
|                                 | - Migration of species – a drying of forest with increase of Yucatan composition.  
|                                 | - The humid end of the species and ecosystem spectrum will be lost  
|                                 | - Decreased reliability of rainfall will impact fauna as well – amphibians will be first vertebrate taxon to show these impacts  
|                                 | - Increased hurricane intensity will impact forest stature and structure and will remove some species less tolerant of landscape scale impacts, with decreased biodiversity.  
|                                 | - Decreased productivity, with loss of older fruiting trees affecting frugivores and associated ecosystem functionality.  
|                                 | - Increased vulnerability to local extinctions exacerbated by reduced connectivity and increased ecosystem fragmentation. |

| Resilience Features | Forests have species and ecosystem array that covers a broad range of tolerances from dry to the more humid Petén forests. System occurs in areas where there have already been significant climatic shifts in the past, and has adapted.  
|                    | - Geographically separated replication of ecosystems increases resilience to hurricane impacts  
|                    | - Rugged terrain normally decreases storm strength very rapidly, with mountainous ridges protecting forests on the leeward slopes  
|                    | - Karst ecosystems are drought tolerant |

| To increase resilience | Maintain forest connectivity to facilitate ecosystem migration southwards and up elevational gradients  
|                       | Prevent further erosion of core forest nodes  
|                       | Reduce external anthropogenic impacts – fire, illegal hunting and logging, which could tip the balance for some species – hurricane damage is greater where canopy is interrupted by logging roads  
|                       | Fire management / prevention |
5.3 Climate change predictions and the marine environment

The health of the marine environment is critical to the social and economic health of Belize – however the state of the reef has declined significantly over the last twenty years. Local threats to the marine environment are over-shadowed by the impacts of climate change, already affecting the marine ecosystems of Belize. The condition of coral reef, the ecosystem on which much of Belize’s marine resource utilization is based, has been declining at an alarming rate and corals are already at the upper limit of their temperature tolerance. Coral bleaching, resulting from elevated water temperatures and mechanical damage from storms of increasing intensity and frequency, are rapidly reducing the resilience of the Belize reef. Whilst Belize cannot effectively influence global climate change itself, it can manage and reduce local pressures, with the potential to provide the reefs with a chance of being able to adapt to withstand this larger scale impact.

The health of the marine environment is critical to the economy of Belize through tourism and marine fisheries. The traditional fishing industry provides employment for over 2,700 fishers as well as processing plant personnel in Belize (Fisheries Dep., 2012). Capture fisheries export earnings totalled approximately Bz$20.5 million dollars in 2008, primarily from the traditional lobster and conch capture fisheries (Ministry of Agriculture and Fisheries, 2008). The predicted impacts of climate change include the loss of revenues generated from fisheries resources through loss of fishing grounds and reef-associated species (lobster, conch and finfish). There is the potential for focus to shift to off-shore species, requiring more sophisticated equipment and greater economic investment. The financial market is not favourable to small scale entrepreneurs, making access to the level of capital investment required difficult, and limiting the ability of local stakeholders to diversify, or invest in these options.

Tourism is the third ranking productive sector in Belize, contributing 28.2% (BZ$816.3mn) in 2009, with projections suggesting that this will increase to 31.4% (BZ$1,601.2mn) by 2020. The tourism sector provided an estimated 34,000 jobs in 2009, 28.3% of total national employment or 1 in every 3.5 jobs. This is predicted to increase to 53,000 jobs, 31.6% of total employment or 1 in every 3.2 jobs by 2020 (WTTC, 2010). Coral reef and mangrove associated tourism contributed an estimated US$150 million to $196 million to the national economy in 2007 (12 to 15 percent of GDP) (WWF, 2007), and approximately US$60–78 million of Belize’s tourism revenue per year stems from the presence of healthy mangroves.

The ecosystem services provided by the coral reefs and mangroves, in particular, cannot be over-estimated. The protection they provide to coastal communities throughout Belize from tropical storms and their support of the traditional fishing industries have been important in the development of Belize. Climate change places these ecosystem services at risk (Annex 6: Climate Change Impacts per Marine Protected Area).

Belize’s barrier reef provides the first defence against storm surges, breaking the force of the water before it enters the coastal lagoon. Predictions suggest that increased coral mortality and erosion of the
barrier reef over time, combined with sea level rise, will reduce its effectiveness in this role, whilst the intensity and frequency of storm events increases. This will result in increased erosion and damage to caye and coastal infrastructure, and flooding and destruction of cayes and coastal areas in the long term.

**Mangroves**, too, provide significant protection from storm events and coastal and caye erosion, as well as an important nursery area for many commercially important species – the predicted sea level rise will inundate existing mangroves, with the potential to cause loss of this important habitat from the cayes and lower lying coastal areas on the mainland. Mangrove is, however, very resilient, and will migrate inland as the coast is flooded and coastal aquifers become more saline.

Climate change implications also have the potential to include:

- the increased risk to coastline and caye infrastructure due to inundation
- potential long term loss of coastal protection functionality if reef growth can't keep up with sea level rise.
- decreased functionality of wave shadow protection from atolls has the potential to increase mechanical damage to the barrier reef, reducing its ability to act as a protective barrier to the mainland during storm events.
- increased lagoon - open sea water exchange resulting in reduced water temperatures.

The predicted socio-economic impacts of climate change include:

- the loss of tourism revenues (diving and snorkelling) as a result of the reduced aesthetic appeal of the reef and the loss of charismatic reef species (e.g. parrotfish, corals, colourful fish and sharks), through degradation of marine ecosystems.
- The potential collapse of the fishing industry that currently supports 2,700 fishers and their families.
- Increased storm activity, with increased beach erosion and loss of coastal / caye land, resulting in dredging activity for landfill for coastal and offshore tourism developments.
- Reduced productivity of the shallow-water marine environment would lead to a potential shift of sport fishing focus to deep sea species.

Declining tourism and fishing industries will affect local economies, resulting in reduced revenues, with the associated reduction of viable employment opportunities with an associated increase in fishing pressures, with increased illegal activities and conflict with mpas. With no national strategies in place to address this predictable increased unemployment, some community economies will be more vulnerable than others – but all will be affected.
Increased Sea Surface Temperature

- The shallow reef lagoon, with its limited circulation, is already seeing impacts of rising sea temperatures with three major coral bleaching episodes since 1995, resulting in increased coral vulnerability to disease, and coral mortality.
- Reduced live coral cover - at Laughing Bird Caye National Park, live coral cover has dropped from an estimated 60% twenty years ago to an average of 16.6% in 2007-2008, and 7% in 2010
- There is reduced hard coral density and diversity, resulting in reduced reef structure – with a shift from the elkhorns to the more opportunistic lettuce corals as dominant species
- Predicted changes in fish distributions, with fish moving offshore into cooler waters
- Predicted reduced protective value from the barrier reef following increased coral mortality and erosion, resulting in increased wave action, and greater storm damage, with destruction of littoral forests, mangroves and turtle nesting beaches
- Reproduction / growth in seagrass is temperature-driven, so may be affected.
- Possible impacts from increased algal blooms, reducing light penetration.

Sea Level Rise

- Loss of deeper water corals, with shift in distribution
- Changes in ocean and lagoon currents, with associated changes in dispersal and recruitment routes and sources for corals, fish and other marine biodiversity
- Inundation and loss of littoral forest, mangroves and nesting beaches on cayes
- Shift in range of seagrass and possible habitat loss
- Potential for reduction of functionality of atolls in providing a barrier to direct wave action on the central barrier reef, increasing wave impacts

Air Temperature Rise

- May alter phenological patterns of mangroves - timing of flowering and fruiting.
- At temperatures above 25°C, some mangrove species show a declining leaf formation rate.
- Temperatures above 35°C have led to thermal stress affecting mangrove root structures and establishment of mangrove seedlings.
- In mangroves, leaf temperatures of 38-40°C result in almost no photosynthesis (IUCN, 2006)
Ocean Acidification

- Decreasing rate of coral growth, with insufficient calcium for skeleton development in reef building corals
- Reduced survival of larval marine species, including conch, lobster and commercial fish species, on which the Belize fishing industry is based
- Reduction in coral reef health and resilience
- Reduction in functionality of barrier reef as a protection against storm surges

Increased Frequency of Storms

- Increased mechanical damage to corals
- Increased sedimentation, with reduced ability of colonies to re-establish after storm events
- Massive sediment movements uprooting or burying seagrass.
- Increased frequency of storms may increase turbidity, reducing light availability for deeper water seagrasses beyond their limits.
- Decreased salinity from increased storm events may adversely affect seagrass
- Increased frequency of high water events could affect mangrove health and composition due to inundation and changes in salinity
Climate Change Impacts on Marine Ecosystems

<table>
<thead>
<tr>
<th>Climate Change Impacts</th>
<th>Impacts on Ecosystem</th>
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<tbody>
<tr>
<td><strong>Sea level rise</strong></td>
<td>Coral reefs may be able to keep up with sea level rise, barring other impacts (anthropogenic impacts, bleaching, acidification, disease and erosion) - dependent on rate of sea level rise. Change in dispersal / recruitment routes / sources. There may be a loss of deeper corals, a shift in distribution, as light availability decreases. Increased sedimentation and reduced light availability due to shoreline erosion. After initial temperature rise, possible reduction in water temperature in inner lagoon resulting from increased water exchange with deeper waters as current barriers become inundated.</td>
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<td>Increases in water depths above present meadows will reduce light availability and changes in currents may cause erosion and increased turbidity of water column. Shifts in distribution of seagrass beds. Over the medium term, seagrass should be able to survive in increased water depth</td>
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<td>Inundation of lenticels in the aerial roots can cause the oxygen concentrations in the mangrove to decrease, resulting in death. Damage to coral reefs may adversely impact mangrove systems that depend on the reefs to provide shelter from wave action. If inland, migration cannot occur, then mangroves may disappear. Increase in saltwater intrusions may also affect distribution of mangroves. Potential for changes in dispersal patterns for mangrove propagules</td>
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<tr>
<td><strong>Sea surface temperature rise</strong></td>
<td>Increased coral bleaching, potential mortality and erosion, and eventual loss of ecosystem functionality. May affect symbiont type in corals. Increased prevalence of coral disease. Possible impacts from new invasive species and algal blooms. A shift towards more tolerant / opportunistic species, with reduced diversity. May alter localized current patterns – and associated larval dispersion patterns. Less tolerant species may settle only in cooler waters, but increased sea level rise may eventually balance increased water temperature.</td>
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<td></td>
<td>Temperature stress on seagrasses will result in distribution shifts, changes in patterns of sexual reproduction, altered seagrass growth rates, metabolism, and changes in their carbon balance. When temperatures reach the upper thermal limit for individual species, the reduced productivity will cause plants to die (above 35°C for <em>T. testudinum</em>). Higher temperatures may increase epiphytic algal growth, increasing shading and reducing available sunlight.</td>
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<td></td>
<td>Loss of reef may reduce protection from erosion and storm events, increasing risk to mangroves.</td>
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### Climate Change

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<thead>
<tr>
<th>Climate Change Impacts</th>
<th>Coral Reef</th>
<th>Ecosystem</th>
<th>Mangrove</th>
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<tbody>
<tr>
<td><strong>Increased frequency and intensity of storms</strong></td>
<td>Increased mechanical damage of corals, increased sedimentation. Reduced ability of colonies to re-establish after storm events. Removal of macro algae, resulting in more available substrate for recruitment. Fragmentation – dispersal and colonization of corals due to mechanical damage from storm impact.</td>
<td>Massive sediment movements that can uproot or bury seagrass. It may also become harder for seagrasses to become re-established. Would be exacerbated by anthropogenic impacts – primarily dredging and landfill.</td>
<td>Large storm impacts result in mass mortality inundation and changes in sediment dynamics. Possible increase in nutrients / growth. Projected increases in frequency of high water events, salinity and inundation could affect mangrove health and composition. Inundation is also projected to decrease the ability of mangroves to photosynthesize.</td>
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<tr>
<td><strong>Ocean acidification (corals, lobster / conch)</strong></td>
<td>Decreases in coral calcification rates, growth rates and structural strength. Weakening of reef matrix. If there are areas of high localised calcification, acidification will have a drastic impact., dependent on the ratio of accretion / dissolution changes.</td>
<td>Possible direct positive effect on photosynthesis and growth, as in some situations, seagrass is carbon limited. Higher CO₂ levels may also increase the production and biomass of epiphytic algae on seagrass leaves, adversely impacting seagrasses by causing shading. Acidification of seawater could counter the high pH formed by photosynthesis in dense seagrass stands, increasing seagrass photosynthesis and productivity.</td>
<td>Positive increase in growth. However, damage to coral reefs may adversely impact mangrove systems that depend on the reefs to provide shelter from wave action. May affect invertebrates and other organisms of mangrove root communities.</td>
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<tr>
<td><strong>Decreased Precipitation</strong></td>
<td>There is a hypothesis that the increased algal bloom in southern Belize may be attributed to reduced precipitation... decreased visibility might be positive, as it may shade the corals.</td>
<td>Seagrass has relatively high adaptation to shifts in salinity – particularly increasing salinity.</td>
<td>Reduction of freshwater lens, effect on carbon uptake, photosynthesis. Decreased precipitation results in a decrease in mangrove productivity, growth, and seedling survival, and may change species composition favouring more salt tolerant species. Projected loss of the inner cayes to unvegetated hypersaline flats.</td>
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## Climate Change

### Ecosystems Impact of Climate Change

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<tr>
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<th>Coral Reef</th>
<th>Seagrass</th>
<th>Mangrove</th>
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<tbody>
<tr>
<td><strong>Air Temperature</strong></td>
<td>Indirect – by increasing water surface temperatures</td>
<td>Indirect – by increasing water surface temperatures</td>
<td>May alter phenological patterns - timing of flowering and fruiting. At temperatures above 25°C, some species show a declining leaf formation rate. Above 35°C have led to thermal stress affecting. Mangrove root structures and establishment of mangrove seedlings. At leaf temperatures of 38-40°C, almost no photosynthesis occurs (IUCN, 2006). Possible localized changes in distribution.</td>
</tr>
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</table>
6.0 Protected Area Prioritization

With limited financial and human resource, it is important to be able to prioritize where investments are focused within the National Protected Areas System. A prioritization exercise was conducted with the development of a series of criteria considered to be of most importance – environmental and biodiversity values, socio-economic values and climate change resilience values. Each protected area was assessed based on these criteria, to provide a baseline prioritization to guide decisions. It is important to note, though, that some protected areas are critical in their own right for their values in providing water security or protection of human life, though may score relatively low in other factors.

6.1 Protected Area Prioritization - Terrestrial

Fifteen criteria were used to guide prioritization of the terrestrial protected areas system, allocated to four categories. These criteria were developed with input from Forest Department personnel and through feedback from protected area managers asked to ‘field test’ the assessment, to ensure it provided a valid output (Annex 8). Each of these criteria was rated out of a total possible score of 4, with scores then totalled and averaged per protected area. Prioritization scores ranged from 3.33 out of 4.00 for Columbia River Forest Reserve, considered the highest priority overall within the system, to the lowest score - 1.27 out of 4.00 for Melinda National Park (Figure 4; Annex 8: Prioritization Criteria: Terrestrial).

High (>3.00 out of 4.00)

- Columbia River Forest Reserve
- Chiquibul Forest Reserve
- Cockcomb Basin Wildlife Sanctuary
- Bladen Nature Reserve
- Chiquibul National Park
- Mountain Pine Ridge Forest Reserve

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<tr>
<th>Terrestrial Prioritization Criteria</th>
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<tr>
<td><strong>1.0 Environmental Values</strong></td>
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<tr>
<td>1.1 Watershed Catchment and Protection</td>
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<tr>
<td>1.2 Wetland Flood Sink Function</td>
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<tr>
<td>1.3 Coastal / River Bank Protection</td>
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<tr>
<td>1.4 Steep Slope Erosion Control</td>
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<tr>
<td><strong>2.0 Biodiversity Status</strong></td>
</tr>
<tr>
<td>2.1 Global Recognition for Biodiversity Values</td>
</tr>
<tr>
<td>2.2 Value for Under Represented Ecosystems or Ecosystems of Limited Extent</td>
</tr>
<tr>
<td><strong>3.0 Socio-Economic Value</strong></td>
</tr>
<tr>
<td>3.1 Value for Commercial Extractive Use (timber / non-timber forest products)</td>
</tr>
<tr>
<td>3.2 Value for Non-Renewable Resource Extraction - minerals</td>
</tr>
<tr>
<td>3.3 Value for Non-Renewable Resource Extraction – petroleum</td>
</tr>
<tr>
<td>3.4 Importance for Water Security</td>
</tr>
<tr>
<td>3.5 Value for Hydro-electricity Generation</td>
</tr>
<tr>
<td>3.6 Traditional Resource Use Dependence</td>
</tr>
<tr>
<td>3.7 Tourism / Recreational / Cultural Values</td>
</tr>
<tr>
<td><strong>4.0 Key Resilience Features</strong></td>
</tr>
<tr>
<td>4.1 Forest Connectivity</td>
</tr>
<tr>
<td>4.2 Altitudinal / Lateral Connectivity</td>
</tr>
</tbody>
</table>
Figure 4: Protected Area Prioritization
Protected Area Prioritization

Figure 5: Prioritization / Management Effectiveness
The lowest prioritization protected areas in terms of conservation importance may still be critically components of the National Protected Areas System. Guanacaste National Park, for example, is well situated to play a key role in engagement and education of the general public, with ease of access for schools, with suitable financial investment.

<table>
<thead>
<tr>
<th>Protected Area (&lt;1.5 out of 4.00)</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monkey Caye Forest Reserve</td>
<td>Important ecosystem representation. Provides land-water connectivity. Retain in NPAS, seek active management (currently considered redundant) – possibly under TIDE (adjacent to Port Honduras Marine Reserve)</td>
</tr>
<tr>
<td>Gra Gra Lagoon National Park</td>
<td>Either amend to Category IV for small scale habitat / species protection, or consider realignment to bring under local management as a Community Green Area to allow for greater community ownership and interaction</td>
</tr>
<tr>
<td>Aguas Turbias National Park</td>
<td>Tri-national connectivity – potential to annex to Rio Bravo C&amp;MA, retaining National Park status, or to re-designate as an actively managed Forest Reserve – there is interest in a long term logging license.</td>
</tr>
<tr>
<td>St. Herman’s Blue Hole National Park</td>
<td>Important education / engagement PA. Retain in NPAS</td>
</tr>
<tr>
<td>Grants Works Forest Reserve</td>
<td>De-reserve</td>
</tr>
<tr>
<td>Guanacaste National Park</td>
<td>Important education / engagement PA. Retain in NPAS</td>
</tr>
<tr>
<td>Melinda National Park</td>
<td>Consider re-designation to Community Green Area status</td>
</tr>
</tbody>
</table>

Effective management is important for all protected areas, and particularly for those considered as priorities. A national management effectiveness assessment was conducted in 2009 (Walker et al., 2010), and averaged ratings per protected area analysed in relation to prioritization to identify those priority protected areas most in need of strengthening (Figure 5). It should be borne in mind that the national assessment tool (Young et al., 2005) is heavily focused on assessment of management processes – whether organizations have processes in place - so large organizations and Government departments can have misleadingly high ratings that do not necessarily reflect their conservation outputs. The prioritization scoring is particularly useful in the assessment of where investments in strengthening protected area management are most needed. Of these high priority protected areas, Columbia River Forest Reserve rates as the one in most need of strengthening in terms of having a very high prioritization score but poor management effectiveness.
Key Ecosystem Services

This category serves as a general guide to the relative values per protected area, though it should be recognized that there are four values that are considered more important than others – value for watershed catchment and protection, for example is much more critical for the welfare of communities, agriculture and industry in Belize, than the value for mineral extraction, which impacts a relatively small stakeholder population. This should be borne in mind when making decisions on mining concessions or community use / agroforestry projects. (Annex Eight: Prioritization of Protected Areas – Terrestrial – full output).

6.1.1 Water Catchment

The protected areas of the Maya Mountains are considered particularly important in their role of watershed protection, with the headwaters of the majority of Belize’s river systems originating within the Maya Mountains, supplying the coastal plain communities and agricultural areas of Belize, as well as a significant area in Guatemala.

Watershed catchment and protection is essential for maintaining a clean, continuous water supply for the people in Belize, and relies on intact forest cover. The steep, forested, east-facing slopes of the Maya Mountains and the north facing slopes of the Stann Creek Valley are critical for water catchment through orographic rainfall, forcing clouds moving inland from the coast to rise up the slopes, into cooler temperatures, and release their rain (Map 11). This is the major source of clean and continuous water for communities and agricultural production downstream.

The large tracts of intact forest canopy of lowland Belize also play an important role in rainfall catchment, catalysing rainfall as clouds pass overhead, particularly important for refilling the aquifer of the low lying limestone platform of the north. Clearance of forest cover in tropical forest areas has been reported to reduce rainfall by up to 20% (Pielke et al., 2006). The continued rate of forest clearance will have a negative impact on future water availability in Belize, as will climate change.

Mean monthly rainfall over Belize has decreased at an average rate of 3.1mm per decade since 1960 (UNDP), a trend expected to continue. Forest ecosystems, and more specifically the upper-elevation cloud forest assemblages and associated habitats, are important in increasing net water deposition in catchments, particularly during dry season. Climate change predictions suggest an ecosystem shift up the Main Divide and other high peaks in the Maya Mountains Massif, which may result in a loss of the...
quasi-cloud forest (elfin forest) and other upper elevation forests and their catchment properties critical for water supply to the southern coastal plain during dry season.

Maintenance of the catchment characteristics is therefore critical for not only the ecosystems themselves, but also for water security for the downstream communities, both urban and rural populations, and for the agricultural areas.

With predicted climate change impacts of rising temperatures and increasingly dry weather, there is a valid concern that the Maya Mountains may prove too low to continue functioning as an orographic barrier at all - particularly if the forest cover is removed. If forest cover is removed in the lowlands, increasing the temperature radiating off the land, clouds will be forced higher (and will not receive additional evapo-transpiration moisture from cleared lands), passing over the Maya Mountain divide rather than depositing their water load. Significantly reduced orographic rainfall on these peaks under predicted future climate change regimes could result in several of the southern rivers running dry during the dry season, as is predicted in Jamaica by 2020 (Williams, M. pers. com).

**Rating Information**: Ratings are based on the role of the protected area in water catchment. For cayes where littoral forest is present, the rating is standardised as **High**, recognizing the role the forest cover plays in slowing water run-off and facilitating its entry into the aquifer, replenishing and maintaining the fresh water lens. Cayes with no littoral forest are rated as **Low**.

<table>
<thead>
<tr>
<th><strong>Water Catchment</strong></th>
<th><strong>Rating</strong></th>
<th><strong>Criteria</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Very High</strong></td>
<td>Upper watershed catchment promoting orographic rainfall</td>
<td></td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>Mid watershed / large forest expanse of forest important for water catchment</td>
<td></td>
</tr>
<tr>
<td><strong>Medium</strong></td>
<td>Coastal plain forest of significant size for water catchment / protection</td>
<td></td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>Area too small or not forested – not providing critical watershed catchment role</td>
<td></td>
</tr>
</tbody>
</table>
Protected Area Prioritization

Critical Protected Areas: Water Catchment

<table>
<thead>
<tr>
<th>Protected Areas</th>
<th>Ramifications of Removal of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbia River FR</td>
<td>Reduced water security in communities and agricultural areas of the southern coastal plain, issues of drought, drying rivers in dry season. This is particularly important with the climate change predictions of increased seasonality of rainfall.</td>
</tr>
<tr>
<td>Bladen NR</td>
<td></td>
</tr>
<tr>
<td>Cockscomb Basin WS</td>
<td></td>
</tr>
<tr>
<td>Maya Mountain FR</td>
<td></td>
</tr>
<tr>
<td>Victoria Peak NM</td>
<td></td>
</tr>
<tr>
<td>Sittee River FR</td>
<td></td>
</tr>
<tr>
<td>Sibun FR</td>
<td>Reduced water security in communities and agricultural areas of the Stann Creek valley</td>
</tr>
<tr>
<td>Sittee River FR</td>
<td></td>
</tr>
<tr>
<td>Mountain Pine Ridge FR</td>
<td>Reduced water security in communities and agricultural areas the Belize River valley (including Belize City), and in Guatemala</td>
</tr>
<tr>
<td>Chiquibul FR</td>
<td></td>
</tr>
<tr>
<td>Chiquibul NP</td>
<td></td>
</tr>
<tr>
<td>Rio Bravo C&amp;MA (PPA)</td>
<td>Reduced water security in north-western communities and agricultural areas, with reduced catchment for New River and Rio Hondo systems, and for aquifer replenishment</td>
</tr>
</tbody>
</table>

6.1.2 Wetland Flood Sink Function / Protection

Extensive wetland systems such as that of the Crooked Tree Wildlife Sanctuary provide important storage functions for excess water flowing down the Belize River during storm events, reducing the threat of flooding downstream in the Belize City area. These waters are then released back into the river more slowly once the storm event has passed.

Rating Information: This criterion focuses on the importance of protected areas in holding flood waters, acting as sinks, and providing important flood control services for the safety of communities and agricultural lands downstream.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>Protected area provides critical flood control functions for communities, key agricultural areas and industries</td>
</tr>
<tr>
<td>High</td>
<td>Protected area provides some flood control functions for communities, key agricultural areas and industries</td>
</tr>
<tr>
<td>Medium</td>
<td>Protected area provides flood control functions – but not benefitting communities, key agricultural areas or industries</td>
</tr>
<tr>
<td>Low</td>
<td>Protected area provides no flood control function</td>
</tr>
</tbody>
</table>
## Critical Protected Areas: Wetland Flood Sink Function / Protection

<table>
<thead>
<tr>
<th>Protected Areas</th>
<th>Ramifications of Removal of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burdon Canal NR</td>
<td>Removal of flood sink area for Belize City, increased flooding of Belize City during storm events.</td>
</tr>
<tr>
<td>Hopkins NR</td>
<td>Removal of flood sink area for Hopkins and associated coastal tourism developments, increased flooding of Hopkins and associated coastal tourism developments during storm events.</td>
</tr>
<tr>
<td>Crooked Tree WS</td>
<td>Removal of flood sink area for Belize City, increased flooding of Belize City, Crooked Tree Village and Belize River communities during storm events.</td>
</tr>
<tr>
<td>Aguacaliente WS</td>
<td>Flooding of agricultural areas in communities adjacent to Aguacaliente Wildlife Sanctuary and downstream.</td>
</tr>
<tr>
<td>Gales Point WS</td>
<td>Flooding of Gales Point during storm events.</td>
</tr>
</tbody>
</table>
6.1.3 River Bank / Coastal Protection

Riparian vegetation is important for the stability of river banks, filtering run-off and maintaining water quality. Mangroves play a similar role along the edges of coastal lagoons, cayes and coastlines. As clearance of this vegetation increases, the impacts are seen not only in the declining quality of water in the rivers and along the coast, but also on Belize’s reef system, where sedimentation and agro-chemical run-off reduces reef health. The destruction of the Kendall Bridge by Tropical Storm Arthur clearly demonstrated the impacts of clearing riparian forest.

Rating Information: The river bank protection criterion is specific to those ecosystem values that disappear with vegetation clearance in the riparian belt, increasing erosion and sediment load in rivers, with associated increase in runoff and agrochemical pollution. It also includes coastal and lagoon edge vegetation, which plays a similar function.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Very High</strong></td>
<td>Protects riverine vegetation or coastal / caye fringing mangrove in the lower reaches of rivers or on vulnerable coastline</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>Protects riverine vegetation in mid-watershed areas or fringing mangroves on lagoon / estuarine systems</td>
</tr>
<tr>
<td><strong>Medium</strong></td>
<td>Riverbank / coastline vegetation protection against erosion exists, but river bank / coastal vulnerability is limited</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>Protected area doesn’t include riverine / coastal protection values</td>
</tr>
</tbody>
</table>
## Critical Protected Areas: River Bank / Coastal Protection

<table>
<thead>
<tr>
<th>Protected Areas</th>
<th>Ramifications of Removal of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep River FR</td>
<td>Increased pollution of rivers, increased sedimentation of the south part of the Southern Belize Reef Complex, increased agro-chemical contamination, increased coral mortality, reduced sustainability of seagrass and associated species (including West Indian manatee), reduced sustainability of southern fishing industry, reduced tourism appeal, increased coastal impacts on Sapodilla Cayes Marine Reserve – part of Belize’s World Heritage System. Those protected areas bordering on the coastal areas (Deep River, Payne’s Creek, Sarstoon Temash, Block 127) are also important for their mangrove protection from tropical storm events and increase erosion of cayes, as well as reducing extent of nursery areas for important commercial reef species (fish, lobster...), affecting sustainability of the fishing industry in these areas</td>
</tr>
<tr>
<td>Payne’s Creek NP</td>
<td></td>
</tr>
<tr>
<td>Sarstoon-Temash NP</td>
<td></td>
</tr>
<tr>
<td>Aguacaliente WS</td>
<td></td>
</tr>
<tr>
<td>Block 127 (PPA)</td>
<td></td>
</tr>
<tr>
<td>Golden Stream (PPA)</td>
<td></td>
</tr>
</tbody>
</table>
| Cockscomb Basin WS           | Increased pollution of Belize River and tributaries, decreased viability of fish populations in Crooked Tree lagoon, implications on community dependence on fish resources and water bird populations, increased sedimentation of the central coastal shelf, increased agro-chemical contamination, increased coral mortality, reduced sustainability of central fishing industry, reduced tourism appeal, |}

<table>
<thead>
<tr>
<th>Protected Areas</th>
<th>Ramifications of Removal of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango Creek (1) FR</td>
<td>Increased pollution of Belize River and tributaries, decreased viability of fish populations in Crooked Tree lagoon, implications on community dependence on fish resources and water bird populations, increased sedimentation of the central coastal shelf, increased agro-chemical contamination, increased coral mortality, reduced sustainability of central fishing industry, reduced tourism appeal,</td>
</tr>
<tr>
<td>Crooked Tree WS</td>
<td>Increased pollution of Belize River and tributaries, decreased viability of fish populations in Crooked Tree lagoon, implications on community dependence on fish resources and water bird populations, increased sedimentation of the central coastal shelf, increased agro-chemical contamination, increased coral mortality, reduced sustainability of central fishing industry, reduced tourism appeal,</td>
</tr>
<tr>
<td>Spanish Creek WS</td>
<td>Increased pollution of Belize River and tributaries, decreased viability of fish, increased sedimentation of the central coastal shelf, increased agro-chemical contamination, increased coral mortality, reduced sustainability of central fishing industry, reduced tourism appeal,</td>
</tr>
<tr>
<td>Community Baboon Sanctuary (PPA)</td>
<td>Increased pollution of Belize River and tributaries, decreased viability of fish, increased sedimentation of the central coastal shelf, increased agro-chemical contamination, increased coral mortality, reduced sustainability of central fishing industry, reduced tourism appeal,</td>
</tr>
<tr>
<td>Chiquibul NP</td>
<td>Increased sediment load in river before entry into Guatemala and return to Belize</td>
</tr>
<tr>
<td>Caye Caulker FR</td>
<td>Mangrove clearance will, remove protection from tropical storm events and increase erosion of cayes, as well as reducing extent of nursery areas for important commercial reef species (fish, lobster...), affecting sustainability of the fishing industry in these areas</td>
</tr>
<tr>
<td>Bacalar Chico NP</td>
<td></td>
</tr>
<tr>
<td>Monkey Cay FR</td>
<td></td>
</tr>
</tbody>
</table>
6.1.4 Steep Slope Erosion Protection

Maintaining forest cover on steep slopes plays an important role in reducing the potential for landslides, with tree root systems being critical in improving the stability of steep slope soils. Steep slope protection against erosion has been a contributing factor in the establishment of a number of protected areas in Belize, in terms of best use, and protection of steep slopes is also written into logging concession agreements, and is largely responsible for the lack of catastrophic fatal landslides that occur in neighbouring countries. The fatal floods associated with Tropical Storm Arthur were a stark reminder of the impacts of reduced watershed protection resulting from inappropriate forest clearance, as are the countless and continuing reminders annually within the Central American region of the erosion protection given by forested slopes - with mudslides engulfing communities adjacent to de-forested slopes in Guatemala, Honduras and Mexico after tropical storm events.

Rating information: This criterion reflects the role of the protected area in stabilizing soils through the protection of vegetation cover on steep slopes

<table>
<thead>
<tr>
<th>Rating</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>Protected area includes slopes of over 25° (28%)</td>
</tr>
<tr>
<td>High</td>
<td>Protected area includes slopes of between 15° and 25°</td>
</tr>
<tr>
<td>Medium</td>
<td>Protected area includes isolated karst outcrops</td>
</tr>
<tr>
<td>Low</td>
<td>Protected area is located on the coastal or northern plain – no steep slopes</td>
</tr>
</tbody>
</table>

Critical Protected Areas: Steep Slope Protection

<table>
<thead>
<tr>
<th>Protected Areas</th>
<th>Ramifications of Removal of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbia River FR</td>
<td>Clearance of steep hill slopes in areas of agriculture and/or settlement will increase the risk to property and human life. Climate change predictions suggest an increased intensity of storms, which will destabilise soils on cleared, steep slopes, resulting in the mudslides and landslides seen in Guatemala and Honduras, and the deaths of thousands of people. All these protected areas have steep slopes unsuitable for agriculture or habitation.</td>
</tr>
<tr>
<td>Mountain Pine Ridge FR</td>
<td></td>
</tr>
<tr>
<td>Chiquibul FR</td>
<td></td>
</tr>
<tr>
<td>Deep River FR</td>
<td></td>
</tr>
<tr>
<td>Sibun FR</td>
<td></td>
</tr>
<tr>
<td>Vaca FR</td>
<td></td>
</tr>
<tr>
<td>Manatee FR</td>
<td></td>
</tr>
<tr>
<td>Maya Mountain FR</td>
<td></td>
</tr>
<tr>
<td>Sittee River FR</td>
<td></td>
</tr>
<tr>
<td>Chiquibul NP</td>
<td></td>
</tr>
<tr>
<td>Nojkaаксmeen Elijio Panti NP</td>
<td></td>
</tr>
<tr>
<td>Billy Barquedier NP</td>
<td></td>
</tr>
<tr>
<td>Mayflower Bocawina NP</td>
<td></td>
</tr>
<tr>
<td>Five Blues Lake NP</td>
<td></td>
</tr>
<tr>
<td>St. Herman’s Blue Hole NP</td>
<td></td>
</tr>
</tbody>
</table>
6.2. Protected Area Prioritization - Marine

Fifteen criteria were used to guide prioritization of the marine protected areas system, allocated to four categories. These criteria were selected to evaluate the importance of each protected area within the system, focusing on the long-term sustainability of the capture fishery – the presence of important nursery and reproductive areas for commercial species such as conch, lobster and finfish. They also reflect the biodiversity values, socio-economic and environmental services provided by the protected areas.

Also considered is resilience - the ability of a system to maintain key functions and processes in the face of stresses or pressures by either resisting or adapting to change (Annex 9).

Each of the criteria used was rated out of a total possible score of 4, with scores then totalled and averaged per protected area. Prioritization scores ranged from 3.33 out of 4.00 for Gladden Spit and Silk Cayes Marine Reserve, considered the highest priority overall within the system, to the lowest score - 1.67 out of 4.00 for Blue Hole Natural Monument (Figure 6).

**High (>3.00 out of 4.00)**

- Gladden Spit and Silk Cayes
- Port Honduras
- Hol Chan
- Bacalar Chico
- Grovers Reef

With the high connectivity between protected areas in the marine environment, many of the results are more related to the size of the protected areas rather than the values - as with a number of the terrestrial protected areas, some of the marine protected areas are critically important for single values, rather than scoring high across the board. Blue Hole and Half Moon Caye Natural Monuments, for example, provide two of the most important marine tourism venues in Belize, though their small size and isolation ranks them low in terms of overall ecosystem values.
Others, primarily the Marine Reserves, rate highly for their role in the commercial fishery – either as fishing grounds or source populations.

![Marine Protected Area Prioritization](image)

*Figure 6: Marine Protected Area Prioritization*
The Marine Reserves have been established as a fisheries management tool, and are managed for sustainable use. The protected areas administered under the Forest Department, however, are largely non extractive, with values based on species conservation and tourism.

6.2.1 Fisheries Management

The marine protected areas are well situated for protecting the core values required for a sustainable fishery. Based on commercial fishing, artisanal/subsistence use, presence of spawning aggregation sites and nursery areas, two protected areas rate as 'Very High', based on product delivered:

- Gladden Spit and Silk Cayes Marine Reserve
- Glovers Reef Marine Reserve

Those marine protected areas highlighted for support of artisanal fishing, however, are those within easy reach of communities:

- Port Honduras Marine Reserve
- Corozal Bay Wildlife Sanctuary

Five marine protected areas have conditions suitable for spawning aggregation sites, important for maintenance of finfish species, and with legal protection in place:

- Gladden Spit and Silk Cayes Marine Reserve
- Glovers Reef Marine Reserve
- Bacalar Chico Marine Reserve
- Half Moon Caye Marine Reserve
- Sapodilla Cayes Marine Reserve

Seven marine protected areas are recognized for their particularly high nursery functionality for conch and lobster:

- Gladden Spit and Silk Cayes Marine Reserve
- Glovers Reef Marine Reserve
- Bacalar Chico Marine Reserve
- Half Moon Caye
- Laughing Bird Caye
- South Water Caye Marine Reserve
- Hol Chan Marine Reserve
6.2.2 Connectivity and Ecosystem Health

Also of key importance is resilience to climate change. Connectivity and ecosystem health are both considered critical in providing resilience to climate change impacts, ensuring that reefs can recover following bleaching events, that healthy source populations are protected and that connectivity between protected areas and ecosystems is present (Figure 7; Figure 8).

Figure 7: Marine Protected Areas ranked on Connectivity
Protected Area Prioritization

Overall, Belize has a good marine protected areas network, spread out across the coast, reef and atolls, and covering the primary features required for resilience. In the marine environment, already being heavily impacted by climate change, there is no redundancy in ecosystem protection within the MPAs. There is, however, the need for increased coverage of no take zones in key, high resilience areas, with improved surveillance and enforcement to ensure their functionality.

As with the terrestrial protected areas, there are marine protected areas that, whilst too small to rate as high priorities overall, are key in the financial sustainability of the protected areas system — Blue Hole, for example, is a major tourism destination with significant annual income from entrance fees, and Swallow Caye, a key site for species specific protection of the West Indian manatee.
Figure 9: Prioritization outputs for Marine Protected Areas

Annex Nine: Marine Prioritization criteria
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