



Belize Integrated Coastal Zone Management Plan 2016

“Promoting the Wise, Planned Use of Belize’s
Coastal Resources.”



Coastal Zone Management Authority & Institute
Ministry of Agriculture, Forestry, Fisheries, the Environment & Sustainable Development

EXECUTIVE SUMMARY

Belize is home to the planet's second longest unbroken reef system and its coastal zone contains a rich diversity of habitats and attractions, including three atolls, several coastal lagoons, mangrove forests, and over 300 cayes. Over 40% of the Belizean population live and work in the coastal zone, which supports thriving fisheries, aquaculture and tourism industries. As a result of the multiple uses and increasing demand for coastal lands, the government of Belize passed the Coastal Zone Management (CZM) Act in 1998 to address issues such as rapid development, over-fishing, and population growth. The CZM Act mandates the Coastal Zone Management Authority and Institute (CZMAI) as the entity responsible to design a National Integrated Coastal Zone Management (ICZM) Plan. The goal of the ICZM Plan is to recommend actions that will ensure sustainable coastal resources use by balancing conservation ideals with the economic and social needs of the country.

Although national in scope, the Plan builds upon efforts at the local level to develop sustainable regional guidelines. These efforts are coordinated with Coastal Advisory Committees (CACs) for nine coastal planning regions along the coast and offshore cayes. As an important complement to written guidelines, the Plan includes a zoning scheme, which spatially designates permissible activities and uses. It was created in collaboration with the Natural Capital Project through the use of the Integrated Valuation of Ecosystem Services and Trade-offs (InVEST) modeling tool. The tool was used to examine the effects of human activities on the benefits people receive from coastal and marine ecosystems called 'ecosystems services'.

A flexible work plan was set that made knowledge-building, ecosystem services, and stakeholder engagement central to the process. CZMAI and the Natural Capital Project spent several months gathering existing data about biodiversity, habitats, and marine and coastal uses. This information was comprehensively mapped and shared with the public for review and feedback. CZMAI grouped marine and coastal uses into useful zoning categories and developed three possible zoning schemes at the local and countrywide scales. These three schemes emphasize different priorities of stakeholders: conservation, development and informed management. In order to understand the implications of each zoning scenario, CZMAI used InVEST to model several ecosystem services and to create final zoning schemes.

InVEST results indicate that in a "Development" future, the risk of habitat degradation would increase, and the delivery of ecosystem services would decrease. A "Conservation" future would improve the health of ecosystems but would reduce human use of the coastal zone. An "Informed Management" future embraces a combination of development and conservation priorities, and would minimize impacts on coastal and marine ecosystems. **CZMAI endorses the informed management scenario as it represents the most sustainable future for Belize's coastal zone.** Belizeans will be ensured of a sustainable future where healthy ecosystems support, and is supported by, thriving local communities and a vibrant economy.

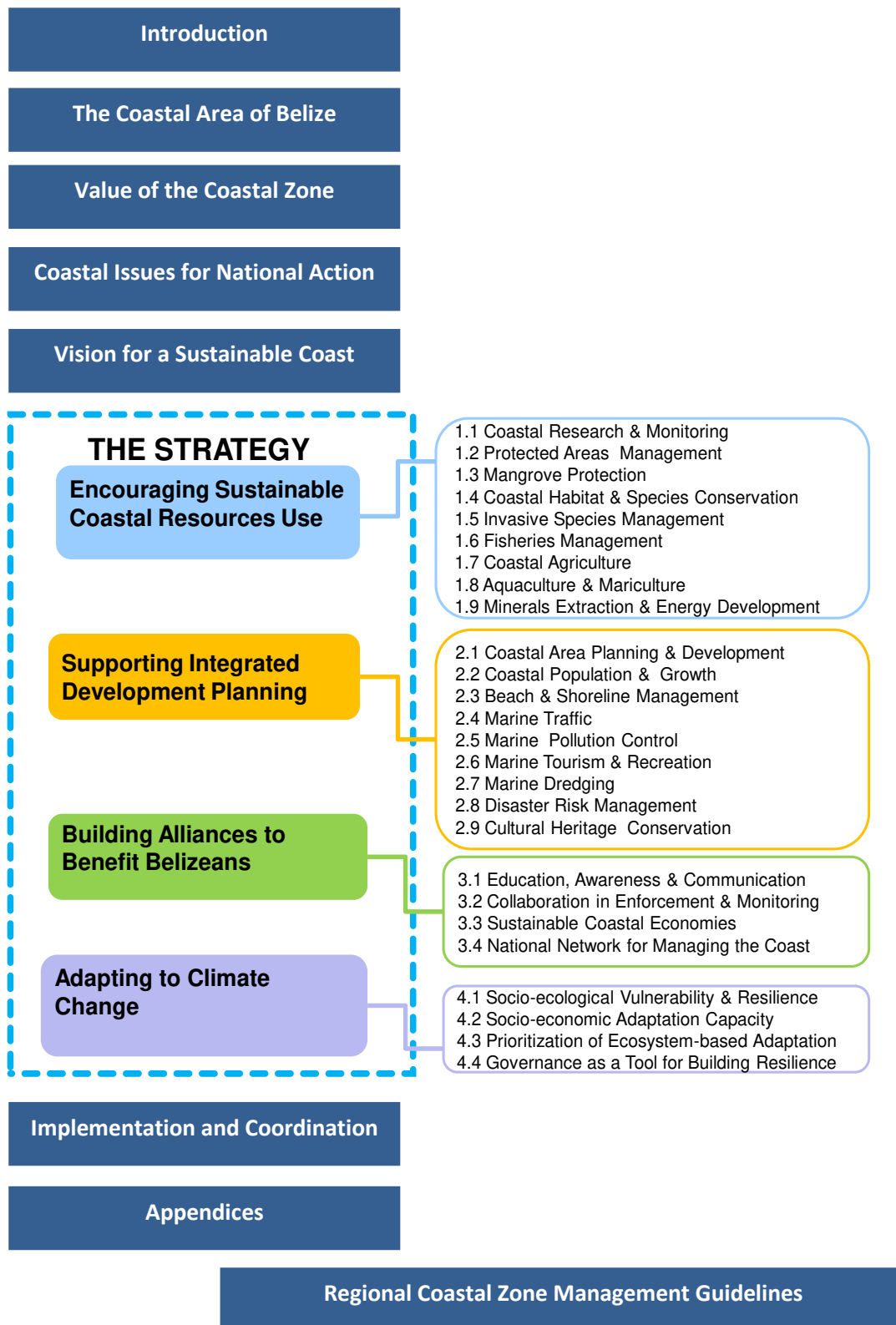
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STRUCTURE OF PLAN



LAYOUT OF PLAN DOCUMENT

This Plan contains a combination of broad, strategic narratives and prescriptive, region-specific guidance that lays out proactive and adaptive strategies to facilitate the improved management of coastal and marine resources within a specified timeframe by all relevant agencies.

Introduction

This section provides historical context on the human use of the coastal and marine resources of Belize. It describes the events that led to the call for an integrated approach to coastal zone management and outlines the goals for integrated coastal zone management (ICZM) in Belize. The vision for a sustainable coast is also articulated that is in line with the country's national development framework. The legal framework, statutory responsibilities and planning processes for the development of Belize's ICZM Plan are also summarized.

Value of the Coastal Zone

This section defines the coastal zone and describes the ecological value of Belize's natural coastal and marine systems. The coastal resources base is highlighted as the central thrust for economic activities and the key to human well-being for the country.

Coastal Issues for National Action

This section specifies the key economic, social, cultural and environmental drivers that affect the current use of coastal resources, and which may affect their future sustainability of coastal and marine resources.

Vision for a Sustainable Coast

This section of the Plan details the strategic action steps required for Belize to attain its vision for a sustainable coast. Specifically, the strategic steps are discussed under four thematic areas: **Encouraging Sustainable Coastal Resources Use; Supporting Integrated Development Planning; Building Alliances to Benefit Belizeans; and Adapting to Climate Change.** For each thematic area, detailed topical issues and activities are addressed and corresponding guiding principles are presented that set the foundation for guiding ICZM.

Implementation and Coordination Plan

The implementation and coordination plan encapsulates the ideal action steps for making ICZM effective, that is, the coordination and integration of existing legislation, policies and management efforts of all organizations managing sectoral areas directly or indirectly related to the coastal and marine environment. The implementation plan identifies an issue, outlines the action that must be taken, identifies the relevant lead agency or agencies and sets a target timeframe for the completion of action items. The action plan also suggests a monitoring and evaluation mechanism by which organizations' performance can be measured. Key components of the implementation strategy are region-specific coastal zone management guideline for nine (9)

ACRONYMS

APAMO	Association of Protected Areas Management Organizations
BELTRAIDE	Belize Trade and Investment Development Service
BNE	Belize Natural Energy
BOD	Board of Directors
BTB	Belize Tourism Board
CAC	Coastal Advisory Committee
CATHALAC	Water Center for the Humid Tropics of Latin America and The Caribbean
COLA	Citizens Organized for Liberty through Action
COMPACT	Community Management of Protected Areas for Conservation
CZMAI	Coastal Zone Management Authority & Institute
DOE	Department of the Environment
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GEF	Global Environment Facility
GOB	Government of Belize
HRA	Habitat Risk Assessment
ICZM	Integrated Coastal Zone Management
InSEAM	InVEST Scenario Modeller
IPCC	Intergovernmental Panel on Climate Change
InVEST	Integrated Valuation of Ecosystem Services and Tradeoffs
IUCN	International Union for the Conservation of Nature
MPA	Marine Protected Area
NCCC	National Climate Change Committee
NCRMN	National Coral Reef Monitoring Network
NEAC	National Environmental Appraisal Committee
NEMO	National Emergency Management Organization
NICH	National Institute of Culture and History
NGO	Non-governmental Organization
NPAPSP	National Protected Areas Policy and System Plan
NTUCB	National Trade Union Congress of Belize
REA	Rapid Ecological Assessment
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SDA	Special Development Area
SIB	Statistical Institute of Belize
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNPEI	United Nations Poverty-Environment Initiative
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UNESCO	United Nations Scientific, Educational, and Cultural Organization
WRI	World Resources Institute
WWF	World Wildlife Fund

GLOSSARY OF TERMS

“Climate Change” refers to a change in the state of the climate that can be identified, using statistical tests, by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer

“Coastal Zone” the area bounded by the shoreline up to the mean high-water mark on its landward side and by the outer limit of the territorial sea on its seaward side, including all coastal waters

“Conservation Scenario” refers to a vision of long-term ecosystem health through sustainable use and investment in conservation

“Development Scenario” refers to a vision that prioritizes immediate development needs over long-term sustainable use and future benefits from nature

“Ecosystem Services” are benefits nature provides to people that support human well being

“Informed Management Scenario” refers to a vision that blends strong conservation goals with current and future needs for coastal development and marine uses

“Integrated Coastal Zone Management” refers to an approach that brings together all decision-making agencies to resolve issues so as to ensure integration among their existing policies and plans to ultimately maintain, restore, and improve the quality of coastal ecosystems and communities they support

“Invasive species” any species (plant, animal or other organism) that is non-native to an ecosystem whose introduction causes or is likely to cause economic, social or environmental harm

“Marine Spatial Planning” refers to a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that are usually specified through a political process

“Protected Area” an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means

“Scenario” refers to a vision or “snapshot” of what the future may look like and allow competing goal to be weighed and compared through narrative, quantitative and/or visual interface

“Sectoral” means pertaining to an economic sector

“Stakeholders” refers to individuals or groups within a region that have a vested interest in coastal and marine resources

“Stressor” refers to any human activity that utilizes coastal/marine resources and affects marine ecosystems

“Vessel” refers to any ship, tug or boat of any kind whatsoever whether it is propelled by steam or otherwise or is towed.

“Zone of Influence” refers to the geographic area, measuring 3 kilometers, where activities affect the properties and functions of the coastal ecosystem and the delivery of services

INTRODUCTION

BACKGROUND

The coastal zone is one of Belize's greatest assets and its magnificent Barrier Reef Reserve System is a renowned World Heritage Site. It is the longest barrier reef in the Western Hemisphere, extending approximately 280 km from the northern to southern borders of the country (Cooper et al. 2009). Belize's coastal zone has complex and dynamic marine ecosystems that support innumerable ecological processes and a vast array of marine life and habitats. In addition to its important ecosystem functions, the coastal zone is vital to the Belizean way of life. The highly productive coastal zone is the resource base for a broad range of economic activities. In fact, approximately thirty-percent of the country's gross domestic product is directly linked to these commercial activities that take place within the coastal zone (Cho 2005). The coastal zone also has important social and cultural values to the Belizean people, especially to the approximately 40% of the population that reside on the coast and in offshore areas (SIB 2010).

Over the past decades, rapid economic development and population growth have taken place in the coastal zone and inland areas of Belize. World-renowned snorkeling and diving draw over 900,000 tourists to the region annually, driving the construction of new development (BTB 2008). These occurrences have led to increasing pressures on coastal and marine resources, with implications to the livelihoods of those that depend upon them. These anthropogenic threats stem from various developmental activities associated with tourism and recreational facilities, population growth and expansion, utility supply, dredging and mineral extraction, land clearance, pollution, waste disposal, fisheries and aquaculture. These threats are compounded by natural hazards, global warming and rising sea levels, and the vulnerability of sensitive ecological systems to climate change. Thus, it is imperative now more than ever to ensure that the coastal zone is utilized in a manner that will continue to support important ecological functions, as well as social, cultural and economic prosperity for current and future generations.

CIRCUMSTANCES AND NEEDS

Many countries, including Belize, have recognized the deficiencies of sectoral planning for coastal zone management and have identified the need for a national cooperative approach for achieving ecologically-sustainable development. The need for an integrated approach to optimally manage Belize's coastal resources was made resoundingly clear at a historic meeting in 1989 when a wide cross-section of stakeholders from various sectors, including scientists, marine managers, private sector, and coastal communities converged in San Pedro, Ambergris

Caye (Gibson 1989). The approach identified was integrated coastal zone management (ICZM) - an approach that brings together all decision-making agencies to resolve issues so as to ensure integration among their existing policies and plans to ultimately maintain, restore and improve the quality of coastal ecosystems and the communities they support (East Riding of Yorkshire Council 2002). The integrated approach also recognizes that many different players (i.e. government agencies, non-governmental organizations, industry, business, private sector, community groups, and indigenous communities) can make a difference in the long-term management of the coastal zone and aims to gain commitment from these key players to a common vision. The lead in promoting the integrated approach to coastal area management has come from the European Union, the outcome of which has informed plans such as the East Riding ICZM Plan (East Riding of Yorkshire Council 2002). The small-island developing state of St. Lucia is among one of few countries in the Wider Caribbean

Integrated Coastal Zone Management (ICZM) is “an approach that brings together all decision-making agencies to resolve issues so as to ensure integration among their existing policies and plans to ultimately maintain, restore and improve the quality of coastal ecosystems and the communities they support”

region that developed and implemented a functional ICZM Plan (UNEP 2012). Costa Rica was the first developing country in Central America to take the lead in ICZM approaches when its program was established in 1977 (Isager 2008). Belize also began the process of preparing an ICZM Plan by way of The National Integrated Coastal Zone Management Strategy for Belize produced by the Coastal Zone Management Authority and Institute (CZMAI 2003). The Strategy was the first step of the ICZM Plan; which provides the framework to guide development and future investment, while ensuring the protection of important natural habitats and existing human uses of coastal resources.

GOALS AND OBJECTIVES

The importance of the coastal zone is recognized by the everyday users of its resources, such as those people that live and work there, and by the multiple agencies tasked with managing different aspects of the coastal zone and its resources. These agencies primarily fall under two key ministries: Ministry of Agriculture, Fisheries, Forestry, the Environment and Sustainable Development, and the Ministry of Natural Resources and Immigration. For many years, and even today, management of the Belizean coastal zone has been under the regime of sectoral planning. While sectoral planning and management are essential, the coastal zone is a highly dynamic area that is connected by ocean currents. Water connects all components of the coastal area, resulting in complex physical, chemical and biological interactions and the interdependency

of ecosystems over large and small spatial scales. Thus, under a sectoral planning and management regime, decisions made for one location can have significant impacts on the condition of the natural environment in that location and elsewhere.

Implementing integrated management is much harder than planning for it; it requires a combination of skills, and commitment from the people involved. Integrated management can only be achieved through a collaborative decision-making process that joins the interests, knowledge and experiences of all stakeholders from civil society, the private and public sectors. This is the core function of integrated coastal area management. The National ICZM Strategy spells out the goal of coastal area management in Belize:

“To support the allocation, sustainable use and planned development of Belize’s coastal resources through increased knowledge and building of alliances, for the benefit of all Belizeans and the global community”

The fundamental goal of ICZM, then, is to facilitate the improved management of coastal and marine ecosystems so as to maintain their integrity while ensuring the delivery of ecosystem service benefits for present and future generations of Belizeans and the global community. A defining feature is that ICZM seeks to balance economic development needs with conservation in a spatially defined area within a specified timeframe. This feature also makes ICZM an ideal approach that can be applied to managing challenges that are national in scale and scope. Furthermore, for ICZM to be effective in Belize, the Plan must possess the following attributes:

- **A proactive and adaptive approach to address national marine and coastal issues that go beyond departmental mandates and jurisdictions;**
- **A specified year timeframe over which certain objectives and targets must be met; and**
- **A thorough and comprehensive means by which to track, monitor and evaluate progress**

INSTITUTIONAL ARRANGEMENTS FOR ICZM IN BELIZE

In 1990, based on recommendations from the historic Ambergris Caye meeting, a small Coastal Zone Management Unit was set up within the Fisheries Department to take a multi-sectoral management approach to coastal resources management. A Technical Committee was formed, and the need for expansion to truly carry out the functions of integrated coastal zone management became clear. Subsequently in 1993, the United Nations Development Programme/Global Environmental Facility (UNDP/GEF) supported the creation of the Coastal Zone Management Project for Belize. The Project focused on data acquisition, management, and coastal planning through several program areas.

Almost a decade after the Ambergris Caye meeting, Belize enacted the Coastal Zone Management Act (hereinafter referred to as the Act), the main function of which is to promote the sustainable development of coastal areas through coordination of existing legislation affecting coastal resources, and through building capacity and increased public participation to manage coastal resources. Through this visionary legislation (Statutory Instrument 52 of 1998), the Coastal Zone Management Authority and Institute (CZMAI) was created as the focal agency with responsibility for coordinating programs and activities for integrated coastal zone management.

Central to the mandate of the CZMAI, under the Act, is the preparation of a comprehensive coastal zone management plan. CZMAI established a coastal planning program as a strategy to ensure the attainment of this mandate. The process for the preparation of the National ICZM Plan is broadly defined in Section 23 (2) of the CZM Act. The process is relatively strict in respect of plan preparation, approval, implementation and monitoring (**Fig. 1**).

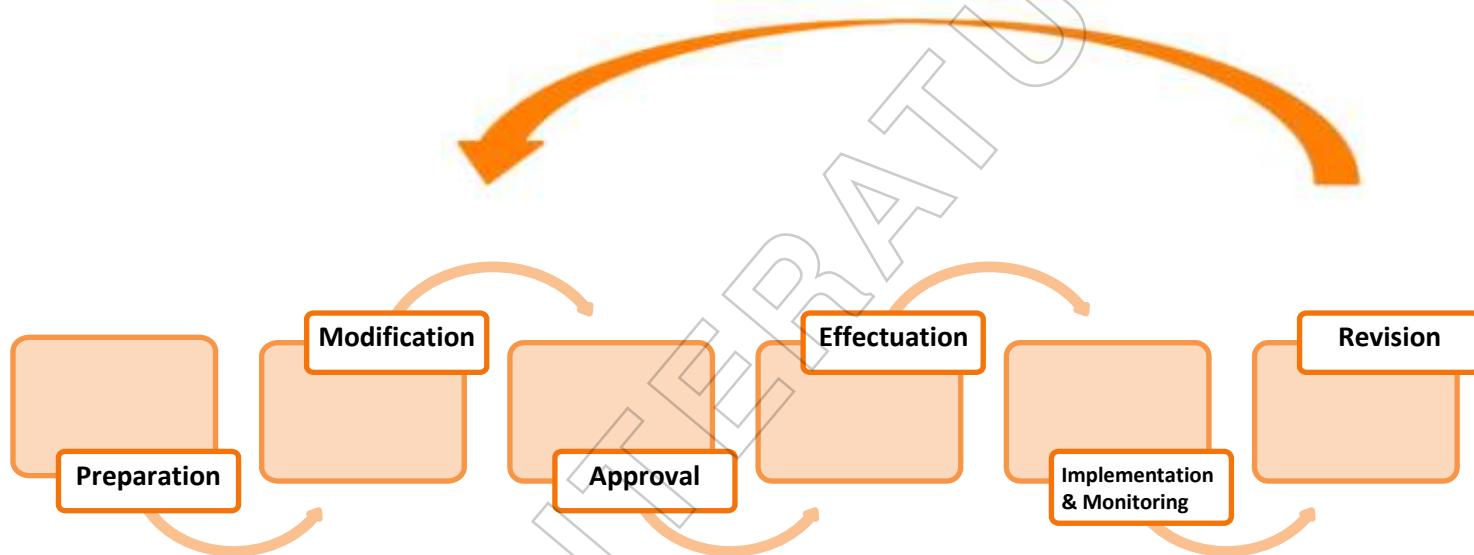


Figure 1: Planning Process for Development of Integrated Coastal Zone Management Plan

The planning process is continuous. The revision, as mandated by the Act, allows for the evaluation of the effectiveness of the proposed measures every four years, and for adjustments and additions to be made as new information comes to light. The process entails 17 clear steps, which are identified and summarized below:

Preparation

Step 1: Coastal Advisory Committees (CACs) for each coastal planning region prepare draft development guidelines, through public consultation.

Step 2: CACs forward guidelines with endorsements to the Chief Executive Officer (CEO) of the CZMAI.

Modification

Step 3: The CEO forwards guidelines to the CZM Advisory Council (CZMAC) for review, assessment, and evaluation within 30 days.

Step 4: While CZMAC is reviewing the guidelines, the CEO/CZMAI forwards the guidelines to other relevant government agencies, statutory bodies, NGOs, and members of the private sector that are not on the council for review and comments within 20 days.

Step 5: The CEO/CZMAI receives comments from relevant government agencies, statutory bodies, NGOs, and private sector and forwards them to the CZMAC.

Step 6: The CZMAC forwards comments on the guidelines to the CEO/CZMAI clearly indicating recommended changes which received full support of the council as well as areas of non-consensus.

Step 7: The CEO/CZMAI submits Plan (which is the compilation of all the guidelines with all comments received) to the Board of Directors (BOD) of the CZMAI for adoption (Section 23 (1)). As an attachment, the CEO will indicate the agency's technical/professional assessment of the guidelines and process for preparation.

Step 8: The BOD reviews the Plan within 60 days, makes modification, if any, and by Order publish in the *Government Gazette* a notice to the public that it is available for public inspection.

Step 9: The public has 60 days to review and submit comments, in writing, to the CZMAI from the date of notice of the availability of the Plan for inspection.

Step 10: At the end of the 60 days, the BOD may approve the Plan subject to such modifications it sees fit.

Step 11: The BOD submits the Plan to the Minister responsible for the CZMAI for approval (with any comments received from the public).

Approval

Step 12: After approving the Plan, the Minister tables it in the House of Representatives for approval of the House by affirmative resolution.

Step 13: Upon approval of the House, the Plan is published in three (3) consecutive issues of the *Government Gazette*.

Effectuation

Step 14: The Plan comes into effect on the last date published or on a later date, which may be specified within the Plan.

Implementation and Monitoring

Step 15: The Plan shall be implemented by government and non-governmental agencies responsible for certain aspects of the Plan.

Step 16: The CZMAI shall, in consultation with the affected GOB & NGO bodies, monitor implementation.

Revision

Step 17: Plan revision must occur within four years, commencing from the date the Plan comes into effect and must include steps 3-7 above.

COASTAL PLANNING INITIATIVES

The National Integrated Coastal Zone Management Strategy (CZMAI 2003) outlined a clear-cut strategy for improving the management of Belize's coastal area. The Strategy, which underwent extensive public consultation, was endorsed by the House of Representatives and adopted as a national policy document in 2003. In addition, using the framework of the Cayes Development Policy (CZMAI 2001), CZMAI prepared development guidelines for the country's more than 300 cayes, including the three atolls by 2004 for eight of nine coastal planning regions (**Fig.2**). Development guidelines for Ambergris Caye were not created as development planning for this region falls under the jurisdiction of the San Pedro Town Council and Ambergris Caye Planning Committee. Instead, a Master Development Plan was created for this region.

The development of both the National ICZM Strategy and site-specific development guidelines for the cayes were the preparatory phases for the development of the ICZM Plan. However, as a result of considerable scaling back of financial resources in 2005, the CZMAI had to limit its activities and the substantial coastal area planning activities embarked upon pre-2005 were effectively abandoned. As a consequence, coastal development projects and activities have been carried out in an ad hoc manner, in spite of the permitting powers several agencies have in respect of directing activities in the coastal zone. With the reinstitution of the CZMAI in 2008, and later the coastal planning program in 2010, the planning activities resumed, the main goal of which is to formulate the ICZM Plan.

It is noteworthy to mention that during the inactive years of CZMAI's coastal planning program, a key planning initiative was endorsed by Cabinet - the National Protected Areas Policy and Systems Plan (NPAPSP). The NPAPSP is a "*coherent approach to protected area establishment and management on a national scale that meets all obligations under international agreements to which Belize is a signatory*" (Meerman & Wilson 2005). Other recent Government-commissioned national planning initiatives with implications for improved resource management include the National Sustainable Tourism Master Plan (BTB 2011), the National Land Use Policy and Integrated Planning Framework (Meerman et al. 2011) and the Horizon 2030 National Development Planning Framework (Barnett et al. 2012).

The relationship between this Plan and the framework for Belize's national development is crucial. The development of the ICZM Plan represents a national planning strategy that is compatible with the consolidated national view for long-term sustainable development in Belize presented in the Horizon 2030 National Development Framework. Horizon 2030 charts a course through which citizens can live in harmony with the natural environment while enjoying a high quality of life. It also recognizes the natural resources base as the central thrust for economic growth as well the intimate connection between environmental quality and the quality of human life in Belize. Thus, embodied in the vision for Belize by the year 2030 is development planning that is based on the principles of environmental sustainability.

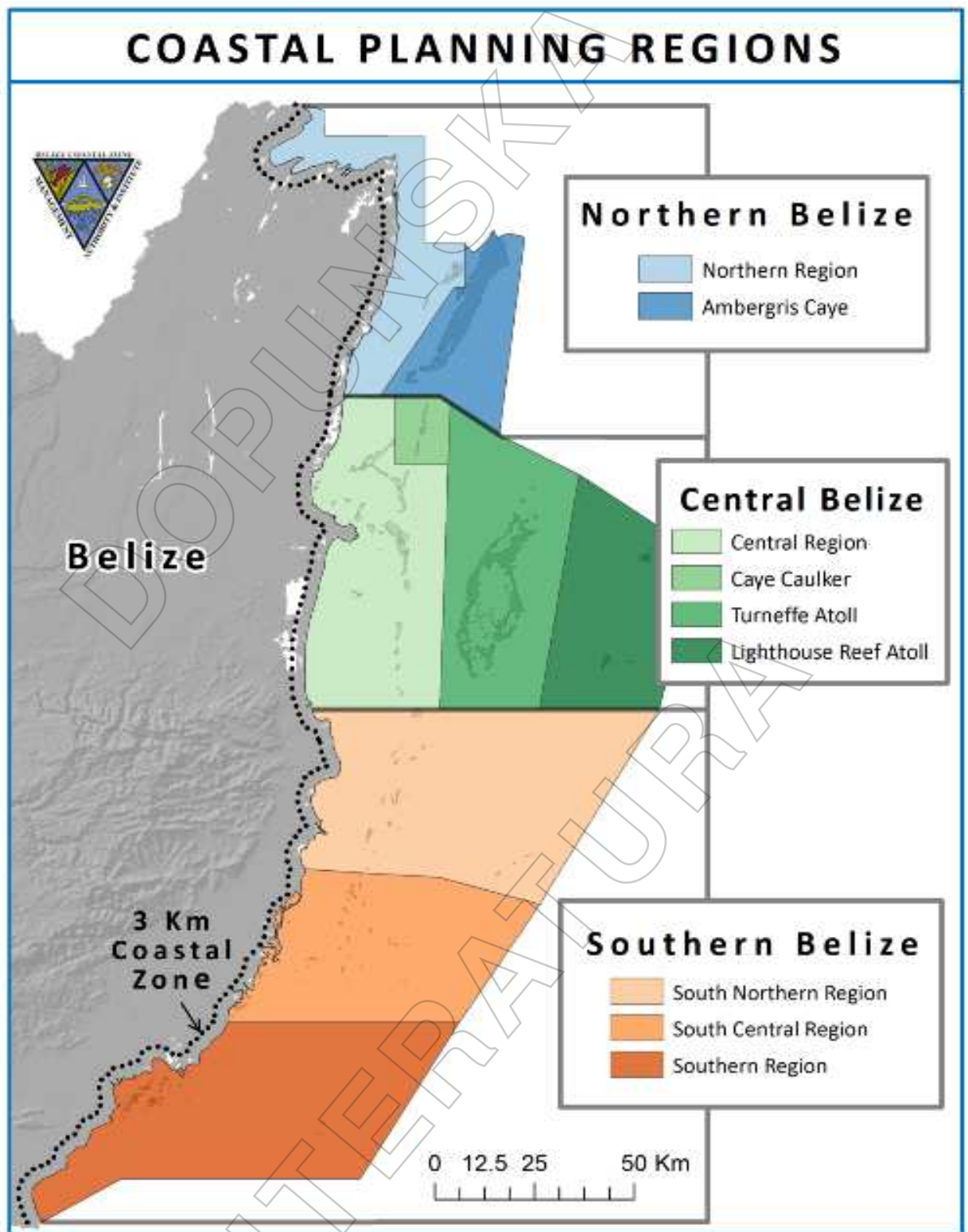


Figure 2: Coastal Planning Regions of Belize

CREATING AN INFORMED ICZM PLAN

The Belize Integrated Coastal Zone Management Plan is a planning framework that calls for national action to facilitate the improved management of coastal and marine resources, and to address the concerns of those people that visit, live in or work within the coastal zone. While the Act prescribes modifications to the Plan every four years, supporting the ideals of adaptive management, this Plan was prepared with a fifteen-year vision of sustainable marine & coastal resources use and management. The specific issues and themes addressed herein, and the proposed action steps, are the outcomes of stakeholder involvement throughout its development. Coastal and marine issues in Belize are wide ranging and cover social, economic, and environmental aspects. This is the heart of ICZM. The task of addressing some of these complex issues is not a light one, and CZMAI recognizes the importance of its partners and key stakeholders in implementing the plan. Thus, this Plan addresses and reflects people's real concerns and views, as much as possible.

CZMAI values the legislations, policies, plans, and strategies currently in place that are relevant to coastal zone management. The intention of CZMAI is to ensure that all existing plans with a relevance to the coast are integrated in this Plan. The ICZM Plan lays out policies for managing all aspects of the coastal zone. The aims of this Plan are twofold: (i) to focus management activities that are already being undertaken, ensuring these are integrated; and (ii) to highlight additional activities and actions that could be undertaken to help meet the challenge of ensuring a sustainable future. The result is a coastal zone where healthy ecosystems support and is supported by thriving local communities and a vibrant economy.

AIMS OF THE ICZM PLAN

Integrate Current Management Activities

Identify Management Gaps

Resolve conflicts over uses of the Coastal Zone

Support Multiple Human Use and Benefits

Ensure a Sustainable Future

APPROACHES

The approach taken by the CZMAI for the development of the Belize ICZM Plan involved four key steps: literature review, data acquisition, stakeholder engagement, ecosystem-based coastal and marine spatial planning:

Literature Review

A comprehensive review of peer-reviewed literature was undertaken for habitats and ecosystems, and existing and relevant planning documents. In particular, Belize planning legislation and initiatives were reviewed in addition to model ICZM plans from several geographic locations with applicability to the Belizean context.

Data Acquisition

Significant research was undertaken to acquire information on the coastal zone and to create a data base to manage data, in addition to data layers for use in a geographic information system (GIS). CZMAI collaborated with several partner agencies, both nationally and internationally, to collect physiographic, oceanographic, climatological, biological, infrastructural, geopolitical, economic, cultural and social data related to the coastal and marine area of Belize. Every effort was made to acquire the best available data and validating them with local experts.

Stakeholder Engagement

In every step of the process, stakeholder participation has been critical, especially for the data acquisition, ecosystem assessments and marine spatial planning processes. The stakeholder engagement process was primarily coordinated with Coastal Advisory Committees (CACs) for the coastal planning regions along the coast and offshore cayes (**Fig. 2**), which convened representatives from multiple sectors and interest – from tourism to fishing to preservation – to make recommendations for development and conservation in their regions. Stakeholder consultations were held countrywide at strategic locations during the planning phase. These consultations included community level group meetings, and



Meeting with members of the Southern Region CAC (CZMAI)

interviews (face to face and telephone) with local experts in coastal zone management and key partners at the United States-based Natural Capital Project.

These consultations were crucial for identifying existing conflicts of interest with respect to resources use, and the vision of stakeholders as it pertains to maintaining a healthy coastal and marine environment that will continue to support livelihoods in the future.

To this end, CZMAI:

- Re-established 5 of 8 CACs
- Established working relationship with advisory committees in other 3 regions
- Hosted over 50 meetings in 9 planning regions with more than 500 stakeholders
- Completed 3 rounds of national stakeholder consultations

Ecosystem-based Coastal and Marine Spatial Planning

Belize's coastal and marine ecosystems provide a number of important benefits to its people. These benefits are sometimes referred to as "ecosystem services" (Daily 1997). For example, mangroves and corals provide protection from storms and critical habitat for lobster, a major source of revenue for Belizean fishing communities. However, they are increasingly at risk from coastal development and marine transportation. In order to address these kinds of conflicts among competing interests in a sound ICZM Plan, the CZMAI established a partnership with the World Wildlife Fund (WWF) and the Natural Capital Project to bring together critical information about the benefits coastal and marine ecosystems provide for people and the impacts human activities have on them. Starting with two major challenges, (i) **the lack of good information about the health of the coastal zone and the many existing uses it supports**; and

(ii) **the competing interests among stakeholders for conflicting resource uses**, the team set up an advisory committee of regional experts to guide the process. Next, the team set out a flexible work plan that made knowledge-building, ecosystem services, and stakeholder engagement central to the process (**Fig. 3**). The team spent several months gathering existing data about biodiversity, habitats, and marine and coastal uses in collaboration with universities, government agencies, industry associations, citizens' groups, and non-governmental organizations.

This information was mapped comprehensively for both the coastal and marine environs for the first time in Belize. Coastal Advisory Committees and other stakeholder groups in the nine planning regions communicated their values and goals for marine and coastal management through meeting minutes, surveys, and interviews. With this information,

CZMAI determined how to group marine and coastal uses into useful zoning categories, which could be used by government agencies and stakeholders to guide implementation of the ICZM



Figure 3: Iterative coastal zone planning process

Plan. Zones included locations set aside for marine protected areas, as well as areas prioritized for fishing, coastal development, marine tourism, aquaculture, and transportation, and other human uses (See **Figs. 7-16**). The team also began to develop three possible zoning scenarios, beginning at the local level and scaling up to countrywide. Each of these three schemes emphasizes different priorities of stakeholders (**Fig. 4**).

In order to understand the implications of each zoning scenario, the team used a decision-support tool for mapping and valuing ecosystem services called InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs), developed by the Natural Capital Project. InVEST maps, measures and values benefits that humans obtain from natural systems. Based on available data and the key services of interest to stakeholders, the team modeled several ecosystem services, including catch and revenue from lobster fisheries, coastal and marine tourism and recreation, and coastal protection from inundations and storms, as well as risks to the habitats that provide these services (**Fig. 5**).

Details on the methodology and InVEST models can be found in Appendices A and B respectively. InVEST results were then used to communicate options to stakeholders for a zoning scheme that would spatially locate permissible activities and human uses (**Figs. 7 - 16**). The results provided the science basis to support the **Informed Management Zoning Scheme**, which optimally minimizes risks to critical habitats and the potential loss of important ecosystem services while also maintaining use of the coastal zone and its resources (**Fig. 6**).



Figure 4: Scenario Zoning Categories

WHY INFORMED MANAGEMENT?

The Informed Management Zoning Scheme, implemented through 2025, was preferentially selected over the Conservation and Development Zoning Schemes because this scenario represents a long-term vision of sustainable development of coastal resources that will ensure future economic benefit for Belizeans, through the minimization of environmental impacts and the maximization of ecosystem service returns. Informed Management especially acknowledges current and future needs for economic development and continued human use of the coastal zone. This zoning scheme was designed to reduce current user-conflicts, which supports the wise use and allocation of coastal and marine resources support. While the Conservation Zoning Scheme could enhance long-term ecological health through environmental preservation, it is largely anti-development and does not align with national economic

development goals for the people and country. It is intended to represent the narrow view of environmentalists who call for full preservation of existing ecosystems. The Development Zoning Scheme, on the other hand, lacks vision and is focused on maximizing economic returns from key coastal resources in the very short term. In other words, the Development Zoning Scheme embraces a vision of fast-paced economic development, based on natural resource utilization and urban expansion. It prioritizes immediate development needs over long-term sustainable use and future benefits from nature. Furthermore, the conflicts and overlapping coastal and marine uses by various industries and interests becomes increasingly greater compared to current conditions.

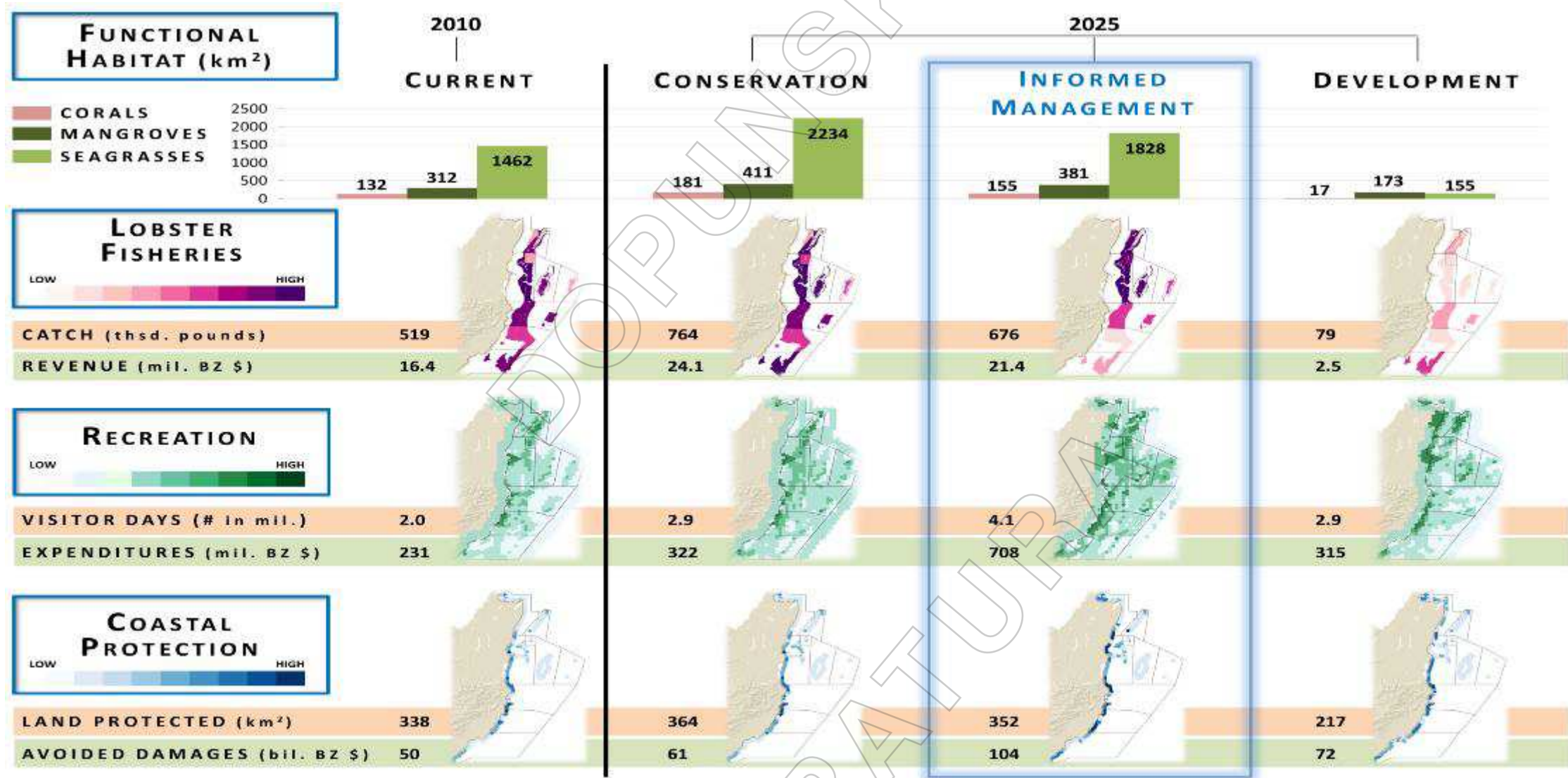


Figure 6: Functional Habitats and the Delivery of Ecosystem Services by Scenarios

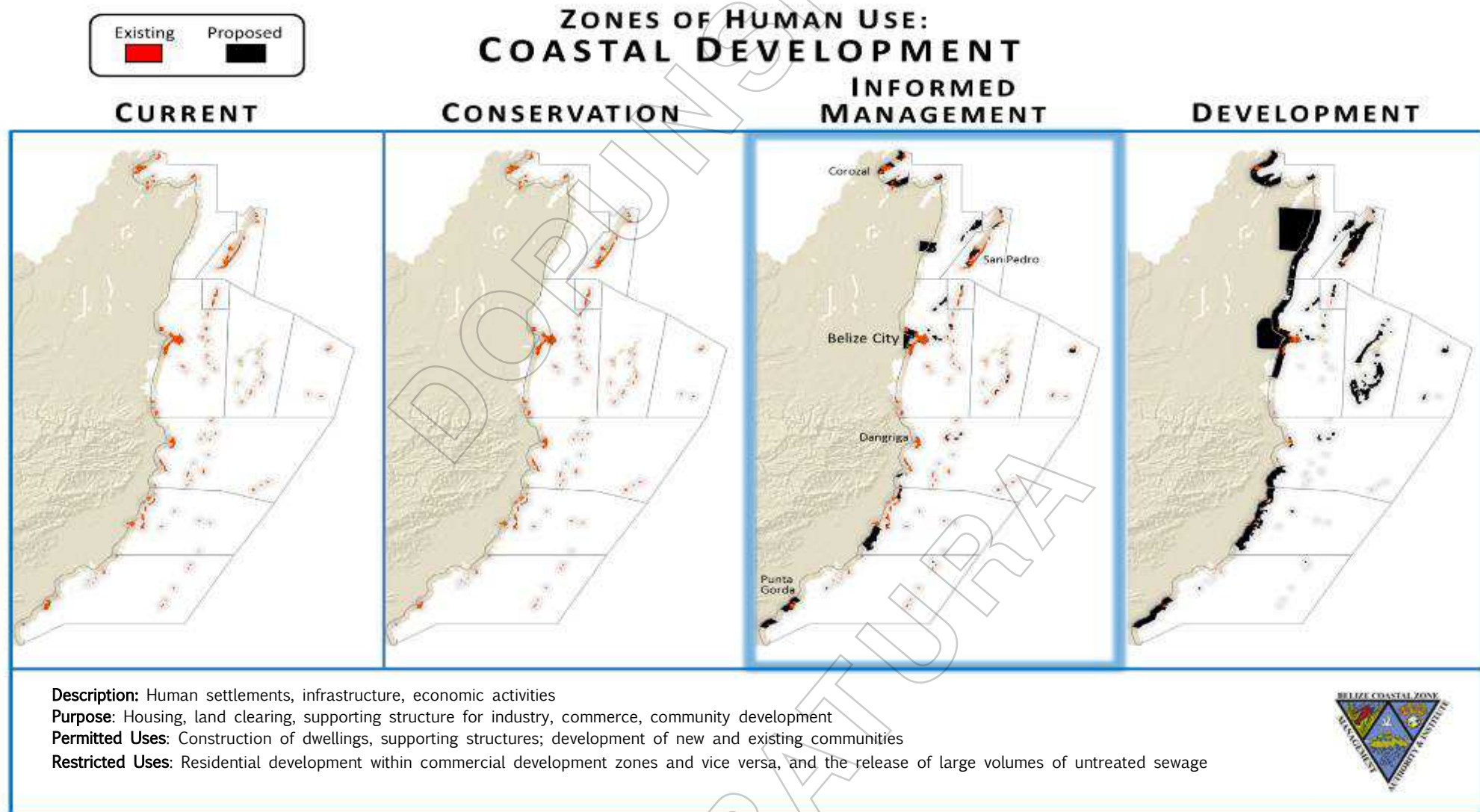


Figure 7: Coastal Development Zoning Scheme for the Current and Three Future Scenarios

ZONES OF HUMAN USE: MARINE TRANSPORTATION

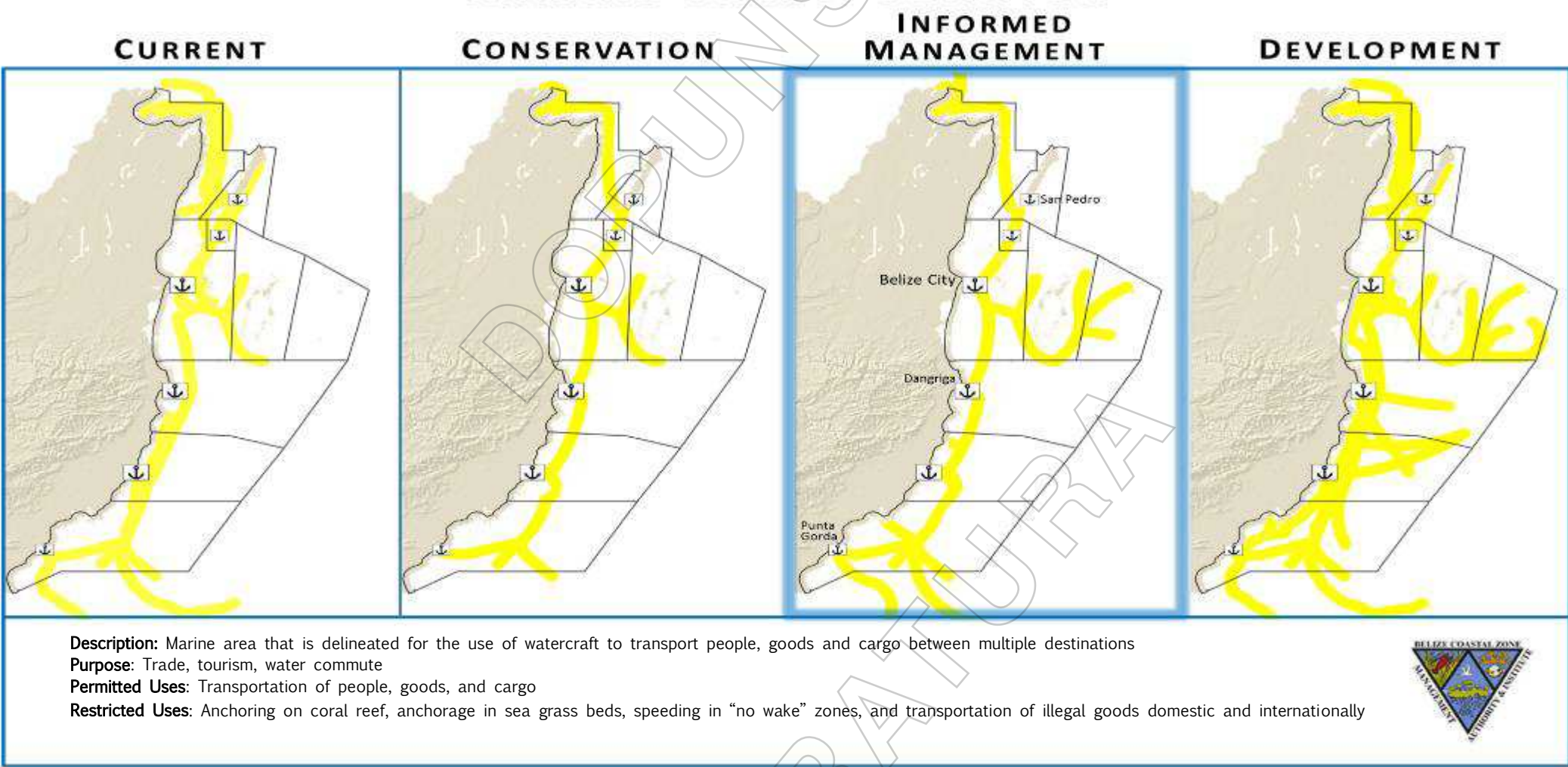


Figure 8: Marine Transportation Zoning Scheme for the Current and Three Future Scenario

ZONES OF HUMAN USE: FISHING

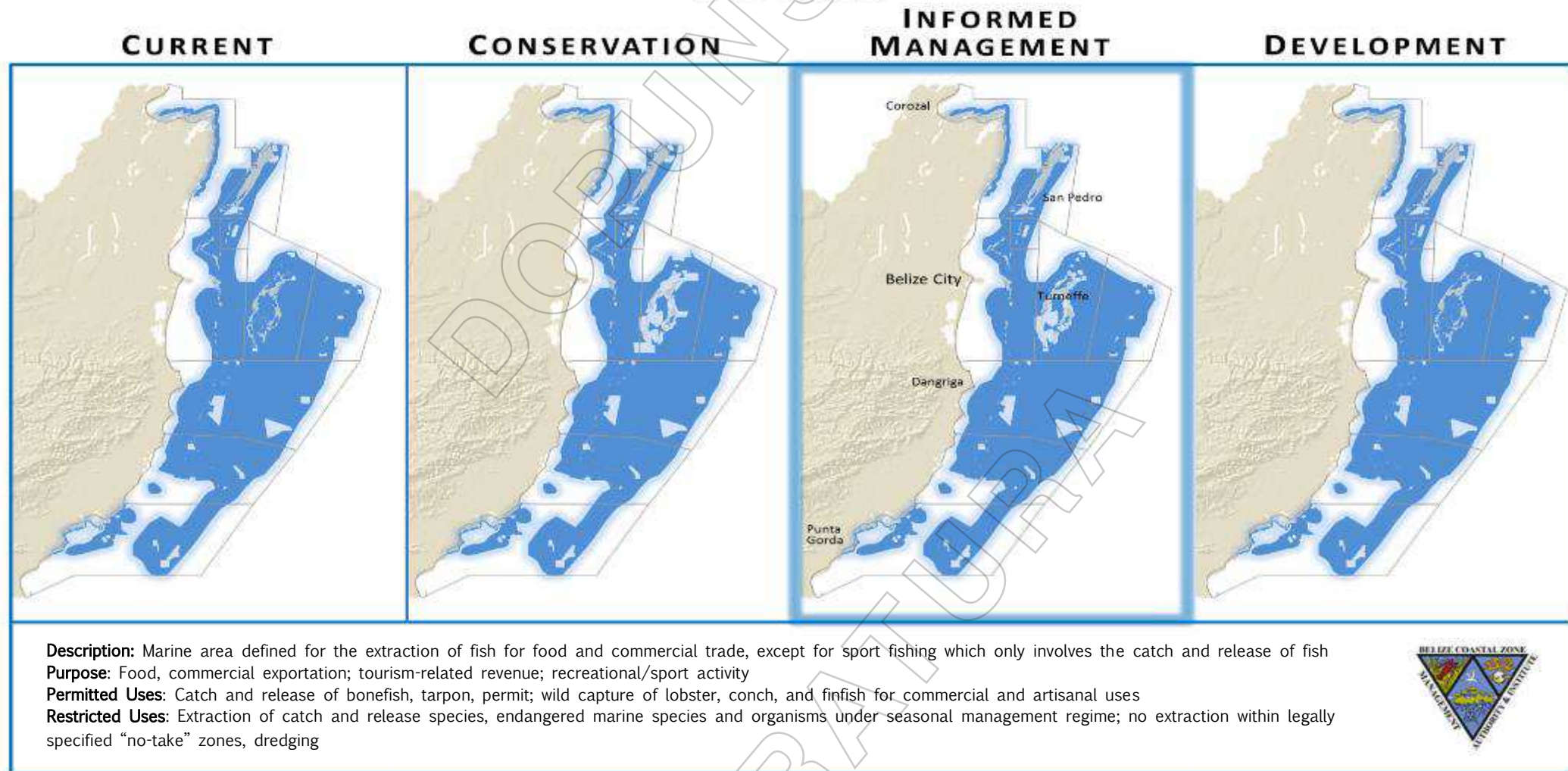


Figure 9: Fishing Zoning Scheme for the Current and Three Future Scenario

ZONES OF HUMAN USE: MARINE RECREATION

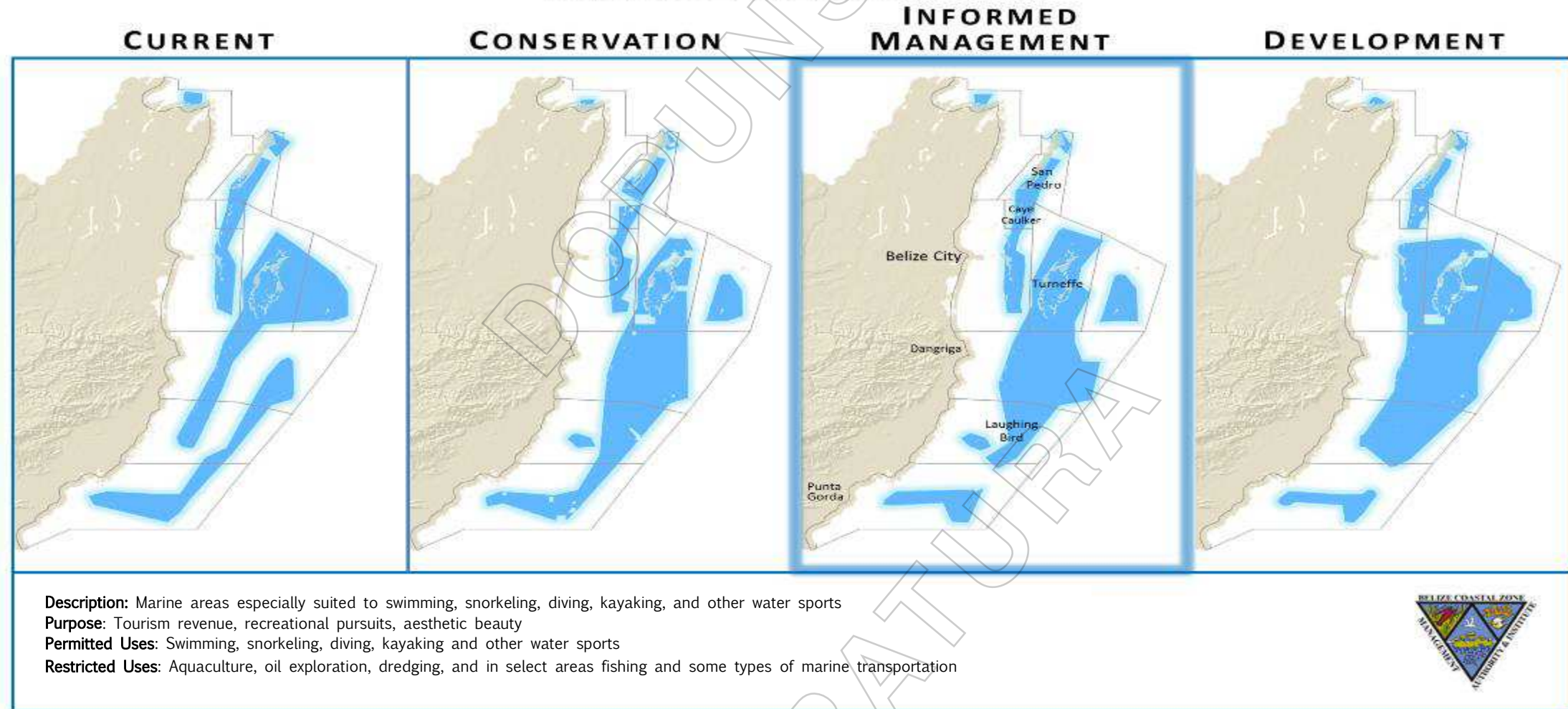


Figure 10: Marine Recreation Zoning Scheme for the Current and Three Future Scenarios

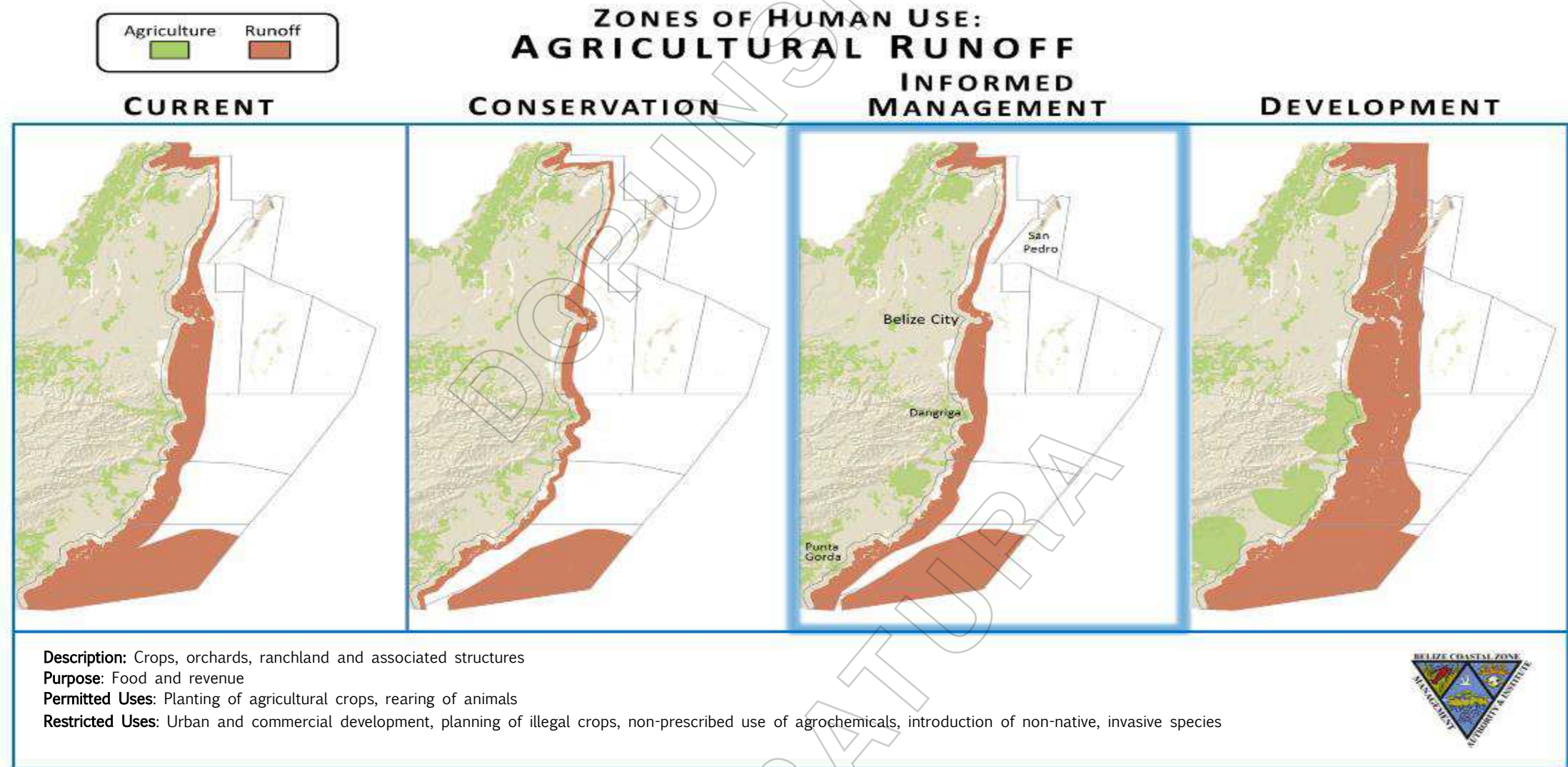


Figure 11: Agricultural Runoff Zoning Scheme for the Current and Three Future Scenarios

**ZONES OF HUMAN USE:
DREDGING**

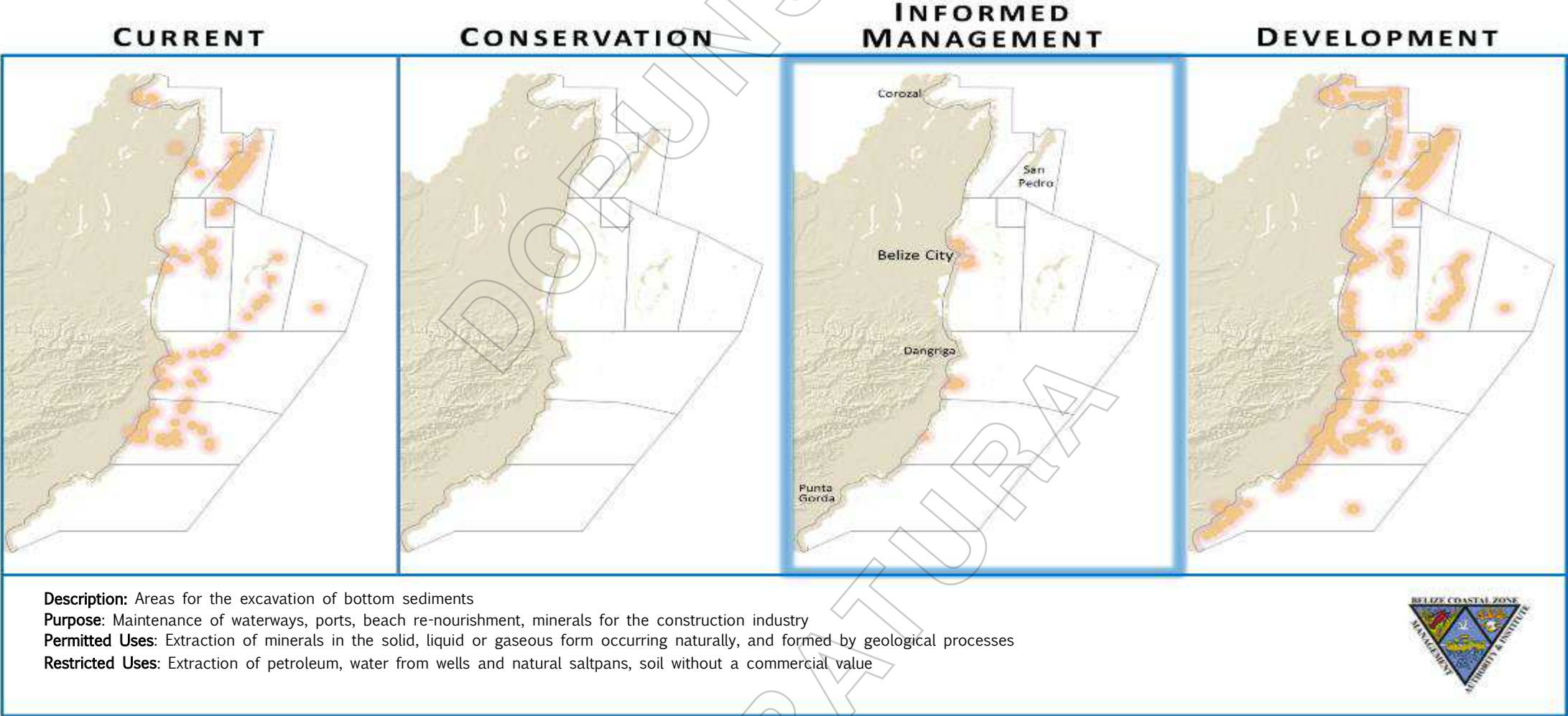


Figure 12: Dredging Zoning Scheme for the Current and Three Future Scenarios

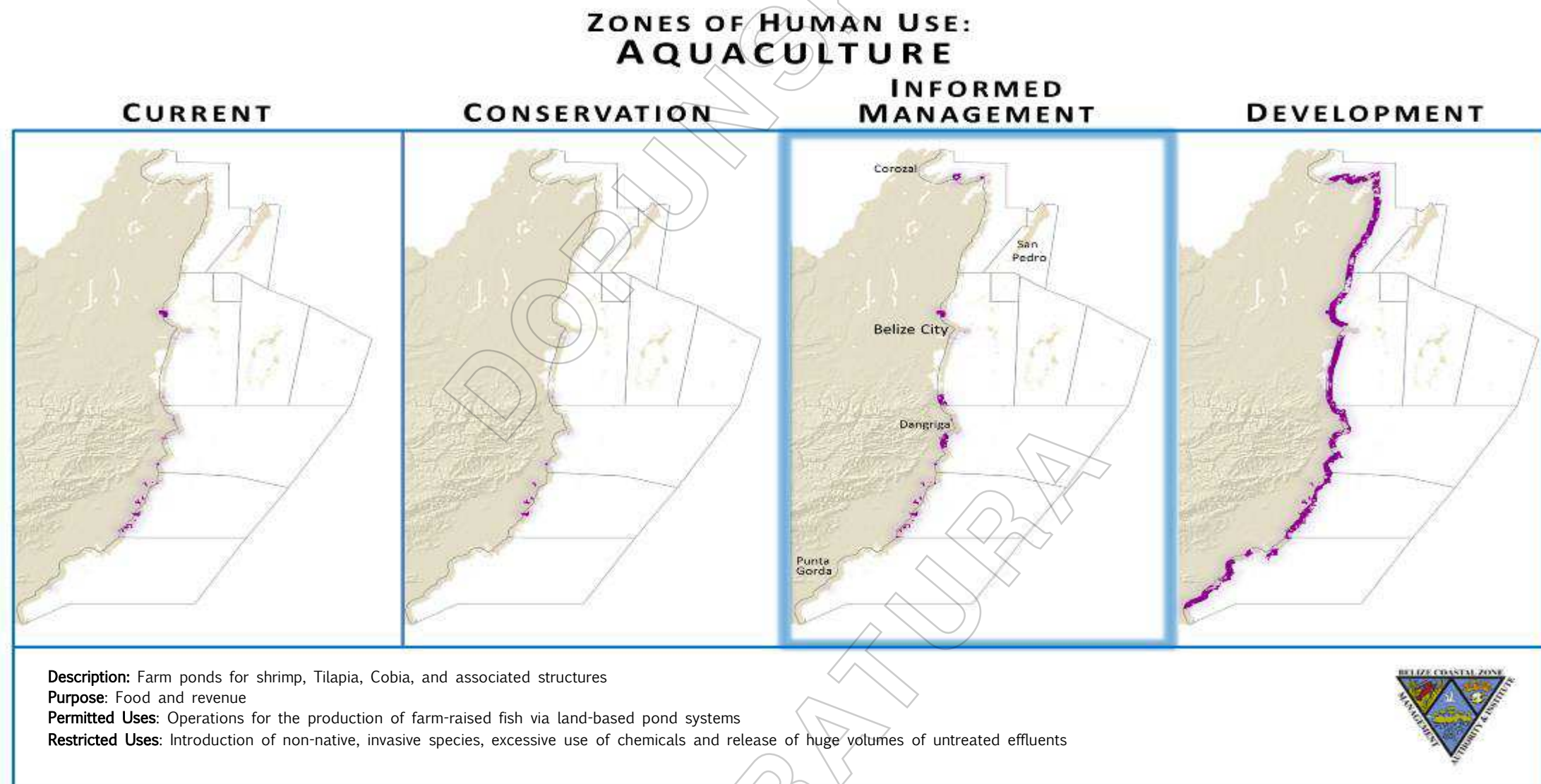


Figure 13: Aquaculture Zoning Scheme for the Current and Three Future Scenarios

ZONES OF HUMAN USE: OIL EXPLORATION AND DRILLING INFORMED MANAGEMENT

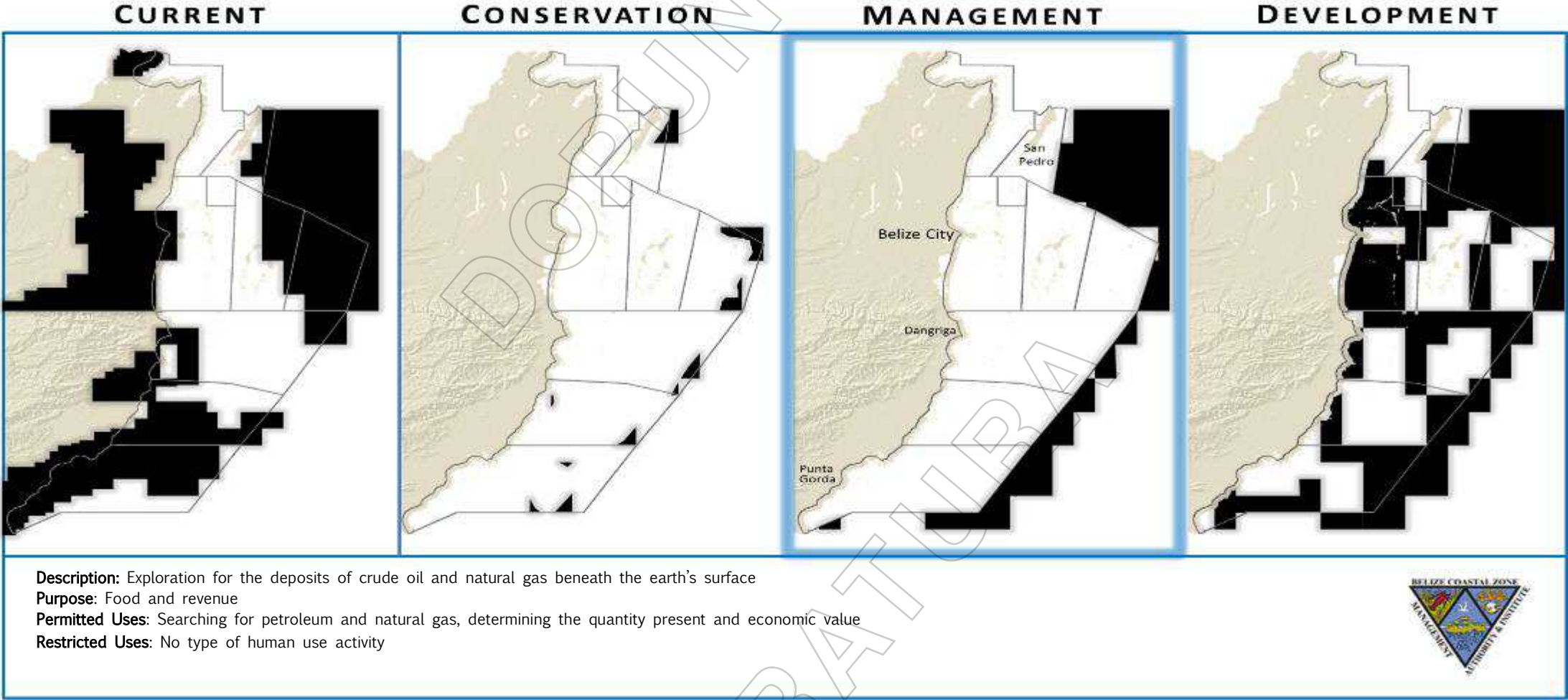


Figure 14: Oil Exploration and Drilling Zoning Scheme for the Current and Three Future Scenarios

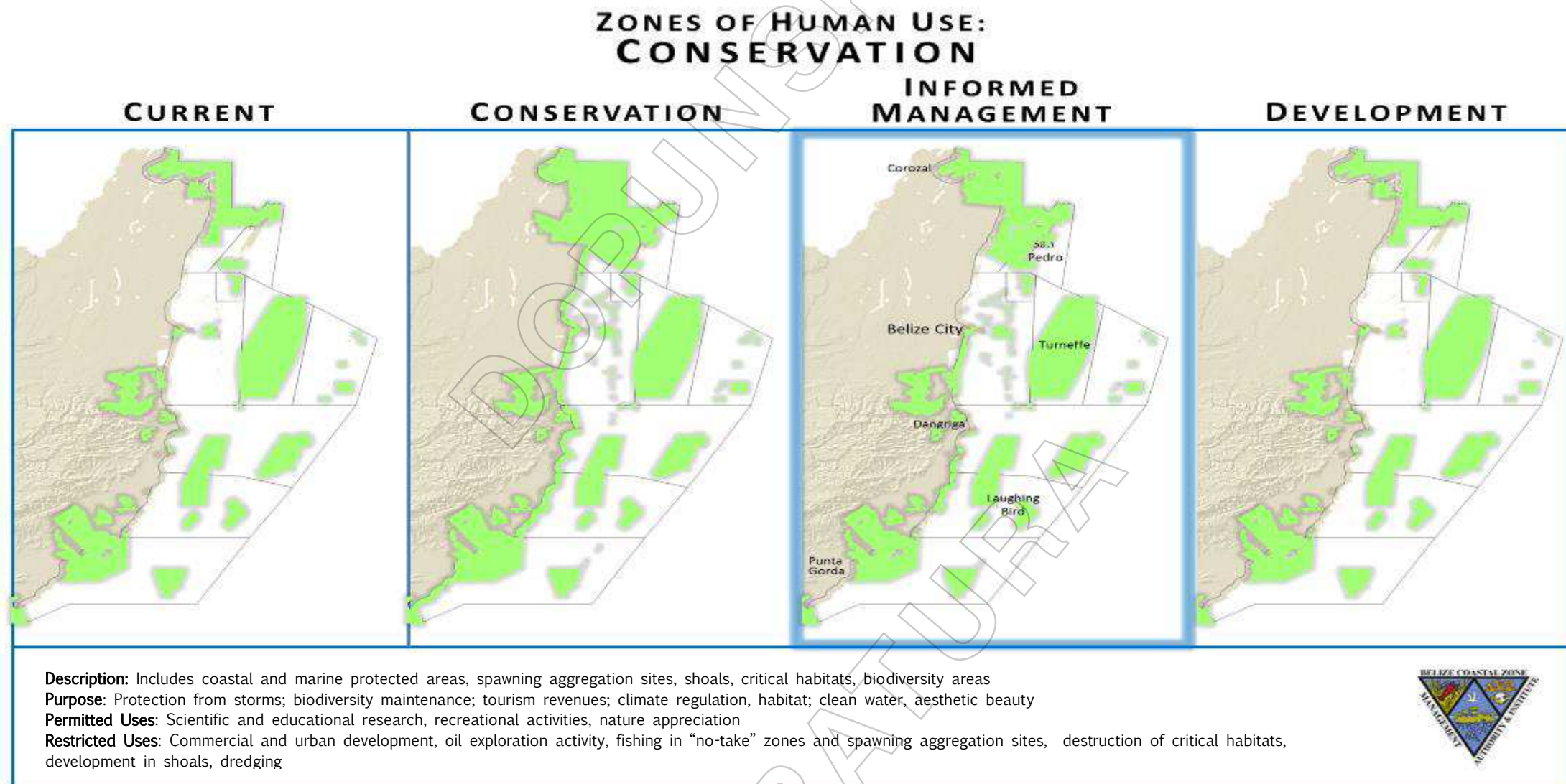


Figure 15: Conservation Zoning Scheme for the Current and Three Future Scenarios

ZONES OF HUMAN USE:

CULTURAL & HISTORIC AREAS



Description: Archaeological sites or cultural monument
Purpose: Preservation of culture and natural heritage, aesthetic beauty, tourism revenue, recreational activities
Permitted Uses: Archaeological research and educational trips, recreational activities
Restricted Uses: Commercial and residential development, major infrastructural modifications

SPECIAL DEVELOPMENT AREAS



Description: Areas with specified development activity as per the Land Utilization Act
Purpose: Agriculture, tourism revenue, reserves, residential development, commercial use, environmental protection, and forestry
Permitted Uses: A combination of uses as per the Land Utilization Act
Restricted Uses: Any human use other than those specified in the Land Utilization Act for each special development area

Figure 16: Cultural and Historic Areas and Special Development Zones

SECTION 1: THE COASTAL AREA OF BELIZE

THE COASTAL AREA OF BELIZE

DEFINITION OF THE COASTAL ZONE

The Belize Coastal Zone Management Act defines the coastal zone as “*the area bounded by the shoreline up to the mean high-water mark on its landward side and by the outer limit of the territorial sea on its seaward side, including all coastal waters*” (Coastal Zone Management Act, Chapter 329, Laws of Belize, Revised Edition 2000). This definition, however, limits the understanding of the coastal area as being comprised solely of the marine environment; it does not consider the influence from the terrestrial environment. Factors, including human activity, natural processes, and their interactions, greatly influence the condition and characteristics of the coast, thereby limiting or promoting ecosystem function (Kremer et al. 2005). The geographic area where activities affect the properties and functions of the coastal ecosystem and the delivery of services is referred to as the *zone of influence* (Merriam-Webster.com 2012). The use of a zone of influence in coastal planning is a common practice internationally (Naish & Warn 2001). Belize, like many other countries, is undergoing a period of growth and expansion in its economic, productive, and social sectors. Hence, there is an exponential change in the magnitude of the impacts associated with these developmental activities. This coupled with the threat of global climatic change increases the stress on the coastal ecosystem (Flood & Cahoon 2011).

MARINE BOUNDARIES

As defined in the Maritime Areas Act (Statutory Instrument 12 of 1992), the territorial sea of Belize (also the outer limits of the coastal zone) is the limit provided by law measured from the mean low water mark to 12 nautical miles outward in most places. In southern Belize from the Sarstoon River to Ranguana Caye, the outer limit is measured 3 nautical miles from the mean low water level to act as a compromise in consideration of Guatemala’s proximity to Belize. Finally in areas where there are fringing reefs, the outer limit is measured using the mean low water level on the fringing reef itself. Therefore the three atolls (Turneffe, Lighthouse Reef and Glovers Reef) are included within the territorial waters of Belize. There are other specialized boundaries defined within territorial waters. These boundaries pertain to issues of conservation in which the specified areas have distinct ecological importance. Within these boundaries, activities can be regulated and extraction of any kind may be restricted.

TERRESTRIAL BOUNDARIES

All features found within three kilometers westward from the mean high water mark are considered in the Plan (**Fig. 2**). This is representative of the zone of influence, which immediately affects the coastal environment. The zone encompasses all coastal communities as well as the distribution of natural features and resources found in marine and coastal ecosystem where water levels (a) are influenced by tidal action, (b) are contiguous with sea-level, (c) have a saline influence, or (d) facilitate migration of fauna between fresh and saline water. This includes extensive riverine, estuary, and wetland systems of the coastal area.

COASTAL AND ESTUARINE WATERS

The coastal waters of Belize are the country's most important natural resource. There are many social and economic benefits attained due to its ecological richness and the many human activities supported. Estuaries, including mangrove estuaries, define the Belize coastal zone. They make up the central portion of the Mesoamerican Barrier Reef System drainage network, running from the karst hills of southern Mexico and eastern Guatemala and the Maya Mountains of southern Belize and discharging into the coastal lagoons and inner channel between the shoreline and the barrier reef (CZMAI 2012). The importance of coastal and estuarine waters to Belize can be summarized as follows:

- As the point of interaction between freshwater runoff and saline water from the Caribbean Sea, coastal waters contain many unique habitats such as estuaries, seagrass meadows, mangroves, and stromatolites. The distribution of these habitats throughout the ecosystem is the result of a variation in the level of tolerance to a salinity and sediment gradient (Mann 2000).
- The coastal waters of Belize supports a plethora of very unique and specialized fish species as well as some threatened and endangered species such as the manatees, sea turtles, and sperm whales (CZMAI 2012).
- It facilitates exchange across national and local boundaries transporting plankton, sediments, and other dissolved and suspended materials that are important to maintain ecosystem functions (Siegel et al. 2002).
- For humans, it provides and facilitates activities such as tourism and recreation, transportation, fisheries, and foreign trade. It also provides habitat for those flora and fauna that are economically important for Belize.

- Finally, coastal land is highly desirable and very valuable, with up to 40% of the population settling along the coast and parcels starting at \$80,000 Belize dollars per parcel in some areas (Belize Real Estate and Auto Rental 2006).

Similar to the processes and components of the coastal ecosystem, the physical structure is equally as dynamic, shaped largely in part by the coastal waters. Through wave action and ocean currents, the seabed and shoreline are continuously being acted upon resulting in changes in position and composition (Natesan & Subramanian 1994). The constant disturbance and upheaval of the shoreline and seabed improves the resilience of the ecosystem and indirectly promotes healthy ecosystem function by unlocking nutrients that have been buried deep within the substrate. As a result, coastal waters are able to support many animals and plants that are essential for day-to-day community existence and cultural identity (Small & Nicholls 2003). Because of this interconnectivity between land, freshwater, brackish water, and marine ecosystems, effective management of watersheds and associated wetlands is essential to effectively manage the coastal and marine natural resources (CZMAI 2012).

BLUE WATER

In Belize, the extent of the sea bed is 280 kilometers long and between 15-40 kilometers wide (Purdy et al. 1975). Located within this underwater shelf extension are the atolls Glovers Reef, Turneffe, and Lighthouse Reef. Atolls are broadly defined as areas with large ring shaped coral reefs that surround a central lagoon. They were first recognized in the scientific community by Charles Darwin who postulated their origin, and linked reef formation and structure to environmental variables (Kohn 1961). Along the edge of the Belize continental shelf is the world's second longest barrier reef. The United Nations Scientific, Educational and Cultural Organization (UNESCO), in recognition of its status and importance at a global level, declared the Belize Barrier Reef Reserve System a World Heritage Site (Gibson 2011) – a serial nomination consisting of seven sites.

THE COASTLINE

Sixteen major watersheds and several coastal stream catchments drain into the continental coast of Belize (CZMAI 2012). Sediments carried by these rivers are redistributed by wave and current action along the shoreline forming numerous depositional features including beach ridges, sand bars, and deltas. These transported sediments and nutrients dictate the distribution of marine habitats such as seagrass bed, mangroves, and coral reefs by either promoting or inhibiting ecosystem functions. Habitat along the coastline act as nesting sites for many bird species and as nurseries for many juvenile marine and aquatic species. The wetlands, rivers, and lagoons are home to manatees, crocodiles, and many species of juvenile and adult

fish. The wetlands are efficient buffers against storm surge, are important in flood control, and can adapt to changing sea levels. They also thrive on nutrients and sediments derived from the land, and in so doing, help to trap them and limit transport to the sediment-sensitive reef systems of our blue water region.

THE SEA FLOOR

The rich seafloor of Belize acts as substrate for seagrass beds, one of the unique marine habitats that exist within our coastal waters. Seagrass beds in turn stabilize the substrate and act as a trap to prevent sediment build up from occurring on the reef. The most common type of sub-aquatic vegetation found in Belize is the turtle grass (*Thalassia testudinum*), which thrives in areas that receive protection from strong currents and high surf. Trapped sediments and other particulate organic matter attract many different species of fish, lobster, conch, turtles, and manatees. These organisms also take advantage of the vastness of the seagrass beds and utilize it for protection.

HABITATS

Corals Reefs

Belize's coral reef is a critical feature of the national economy, food security, and cultural traditions. The reef also provides critical "ecosystem services" that include: providing a habitat for commercially valuable fish, offering opportunities for recreation and tourism, and providing protection from coastal erosion and hurricanes (CZMAI 2012). Prior to 1998, Belize's reefs were thought to be in relatively "good" condition and were considered some of the healthiest in the Caribbean (McField et al. 1996; Kramer, et al. 2000). However, escalating threats, including coral bleaching, disease and a major hurricane in 1998, adversely affected Belize's reefs, which experienced a 48% reduction in the live coral cover along Belize's forereefs (McField 2002). As of 2005 there had been no sign of reef recovery based on the analysis of six reef sites (Bood 2006). The average coral cover and fish abundance was slightly below the Caribbean average (Marks & Lang 2006). In addition, the 2015 Report Card for the Mesoamerican Reef noted that of 94 sites assessed, 47% were in poor condition, 21% critical, 28% fair and 4% were found to be in good health (Healthy Reefs Initiative 2015). These observations were in reef health were attributed mainly due to reduced fish biomass and increased macroalgal cover.

This Plan presents an ecosystem-based assessment of potential threats to coral reef ecosystem in Belize. It draws on 9 environmental stressors (including fishing, marine transportation, coastal development, aquaculture, marine recreation, dredging, agriculture, and oil exploration), information on 9 coastal planning regions, and scientific expertise to model

areas where reef degradation is predicted to occur, given existing human pressures on these areas (**Fig.17**). Results are an indicator of potential threat (risk), not a measure of actual condition. In some places, particularly where good management is practiced, reefs may be at risk but remain relatively healthy. In others, this model may underestimate the degree to which reefs are threatened and degraded.

Results from the InVEST Habitat Risk Assessment (HRA) suggest that 81% of Belize's coral reefs, covering an area of 257 km², are currently at medium risk by human activity (**Fig 17**). One percent of corals are currently at low risk, and almost 18% are currently under high threat from human activities. Coral reefs of the Southern Region, are the most threatened of any region under the current and 3 future scenarios; more than 90 percent are at risk (under medium and high potential threat), and over half are at high risk, primarily from fishing pressures and oil exploration. The South Northern Region, which houses more reef area than any other region, is also the least threatened currently and in the conservation, informed management and development zoning scheme.

InVEST Habitat Risk Assessment results also suggest that nationally, the Informed Management zoning scheme would reduce the area of corals at high risk to about 90% of the area currently at high risk (**Fig 17**). This reduction in high risk in the Informed Management zoning scheme was achieved by reducing the exposure of corals to the cumulative impacts of multiple stressors like fishing and oil exploration. Through this process of zoning areas for certain uses, CZMAI was able to minimize the number and overlap of human activities in sensitive ecosystems. It should be noted, however, that because the Informed Management scenario balances economic development and conservation, large expanses of these ecosystems are nevertheless still at medium risk to stressors. Dramatic increases in the area of the three habitats at low risk only occur in the Conservation scenario (**Fig. 17**). The results indicate that under the Development scenario, the area of corals at high risk is more than five times the area at high risk in the current scenario (**Fig. 17**). Additional information on how the Habitat Risk Assessment model works can be found in **Appendix B.1**.

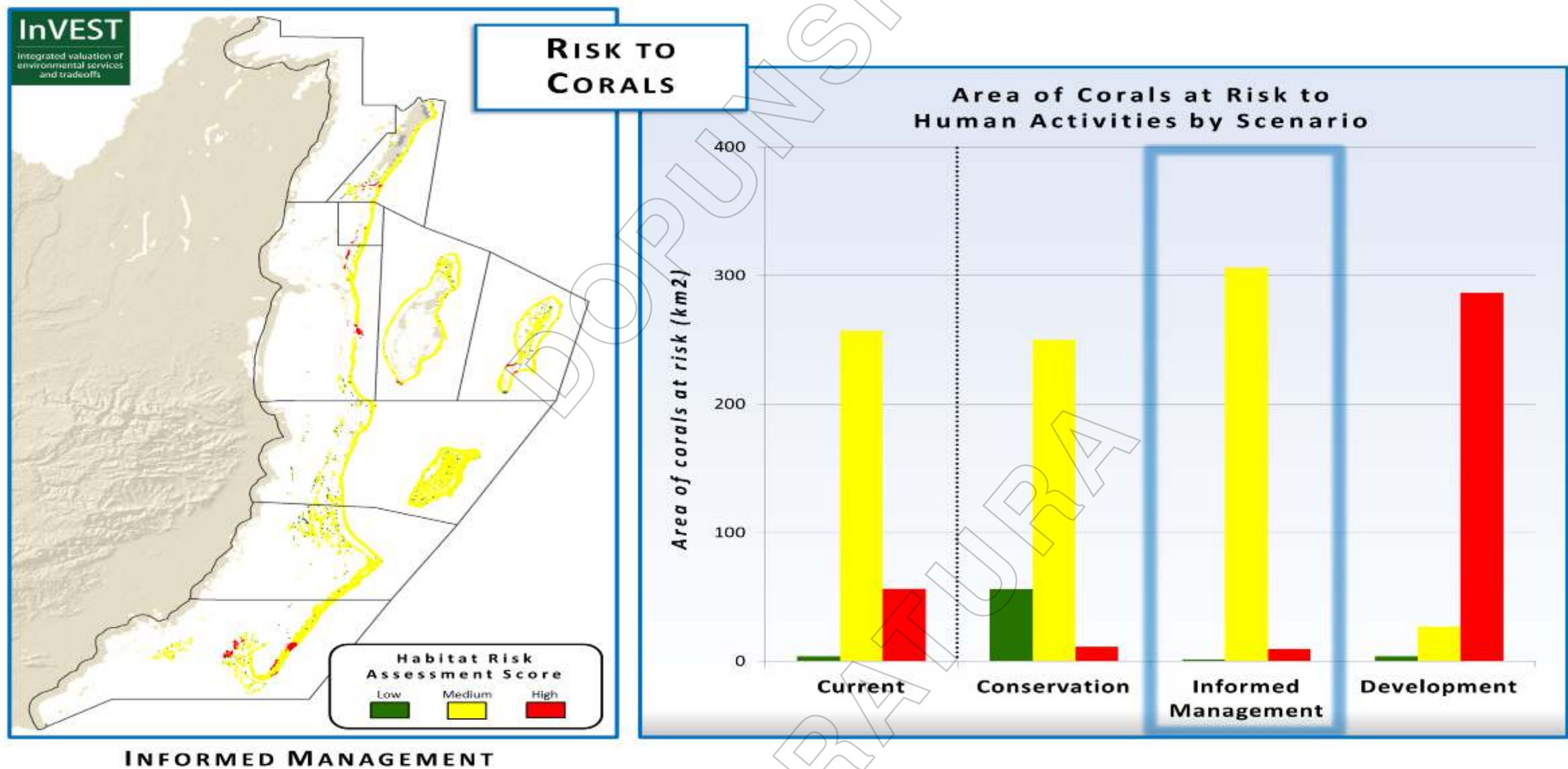


Figure 17: Area of Corals at Risk from Human Activities by Scenario

Seagrass

Seagrass in Belize is widespread and crucial to the health of the country's coastal oceans. Healthy seagrass supports both the fisheries resource (commercial, recreational and artisanal) and the clear marine waters that make Belize a tourist destination. Seagrass is an overall indicator of coastal ecosystem health and monitoring the seagrass status and trends is therefore important. Currently, seagrass are fairly stable and healthy, with only a few sites showing concerning negative trends. The major threats are coastal pollution (primarily nitrogen loading), sediment inputs from upland deforestation and mangrove removal, onshore coastal development, agriculture and aquaculture, and direct dredging and hardening in the coastal zone. Also, in some areas, there are tourist impacts from boating and trampling that may be an issue locally. With monitoring and careful management, along with increased awareness of the value of seagrass habitat to the country's economy, seagrass in Belize can persist and thrive (CZMAI 2012).

Results from the InVEST Habitat Risk Assessment (HRA) suggest that 78% of Belize's seagrass are currently at medium risk from human activity, the equivalent of 2869 km² (**Fig. 18**). One percent of seagrass are at low risk, and 21% are currently under high threat from human activities. Based on the InVEST Habitat Risk Assessment, the greatest area of seagrass currently at high risk of degradation from human activities is in the Central region, followed by Ambergris and Caye Caulker. Further analysis of the HRA results reveal that nationally, the Informed Management zoning scheme would reduce seagrass at high risk to about 75% of the area currently at high risk (**Fig. 18**). This reduction in high risk in the Informed Management zoning scheme was achieved by reducing the exposure of seagrass to the cumulative impacts of multiple stressors. In particular, by limiting the area allotted to dredging, oil exploration and agriculture in the Ambergris Caye, Caye Caulker and the Central regions, we were able to considerably reduce the risk to seagrass in these areas.

Through zoning areas of these areas for certain uses, it is possible to minimize the frequency and extent of overlap of human activities in sensitive ecosystems. Because the Informed Management scenario balances economic development and conservation, however, large expanses of these ecosystems are nevertheless still at medium risk to stressors. Dramatic increases in the area of the three habitats at low risk only occur in the Conservation scenario (**Fig. 18**). Under the Development scenario the area of seagrass at high risk is more than five times the area at high risk in the current scenario (**Fig. 18**). Additional information on how the Habitat Risk Assessment model works can be found in **Appendix B.1**.

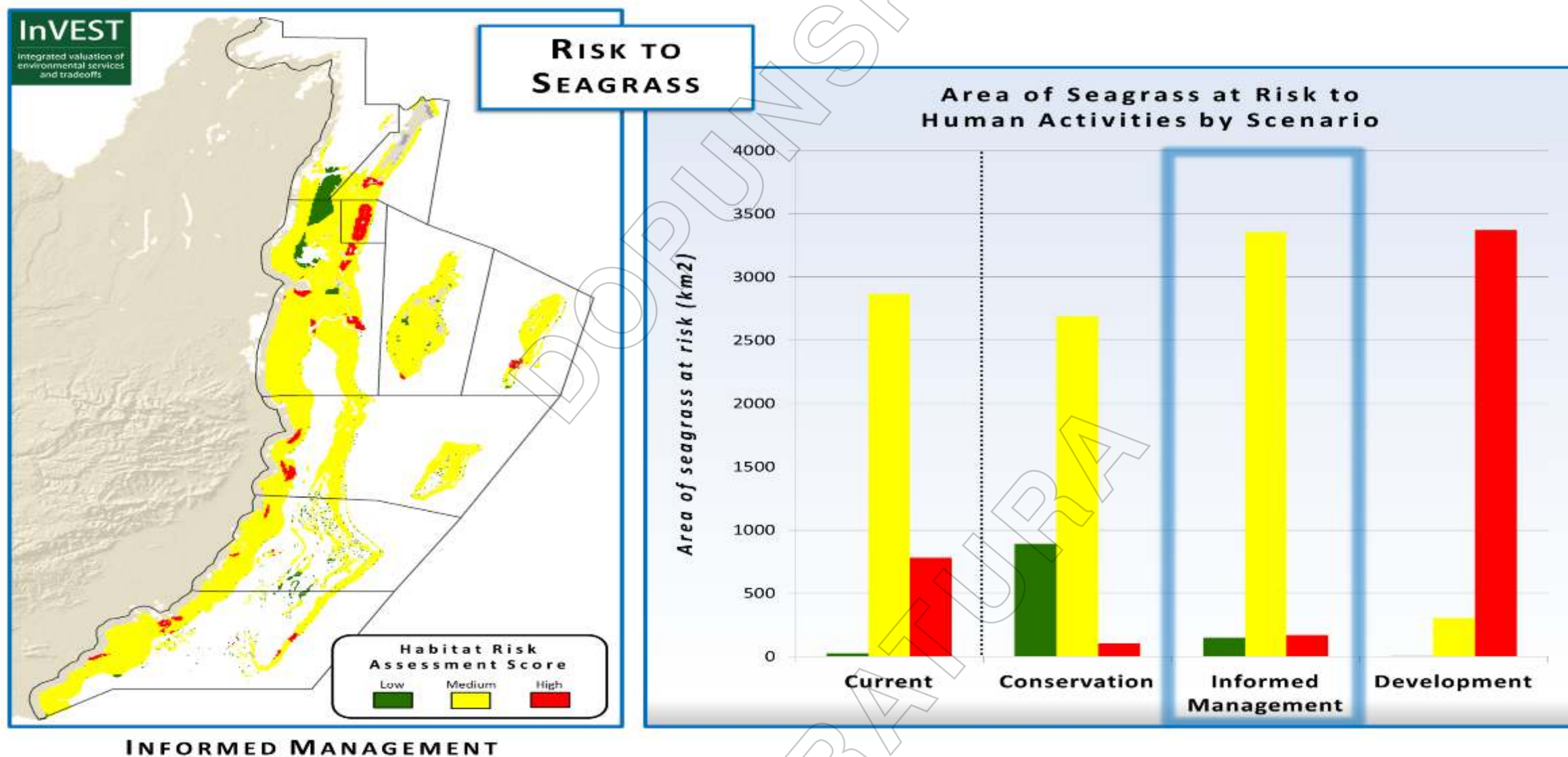


Figure 18: Area of Seagrass at Risk from Human Activities by Scenario

Mangroves

Mangroves play an important role in the cultural and economic livelihoods of coastal communities, and provide risk reduction measures in combating vulnerability to natural threats, for example storms (CZMAI 2012). A national economic valuation study carried out by World Resources Institute (WRI) found that Belize's mangroves annually contribute a value approximately equivalent to 25% of Belize's gross domestic product through the provision of nursery areas for fish and invertebrates, habitat for wildlife, and physical buffers against pollution, cyclonic storms and coastal erosion (Cooper et al. 2009). However, since mangroves grow along the mainland coast and on outer cayes, which are areas considered prime development locales, their domain has been greatly targeted for waterfront properties and other coastal development opportunities (WWF & Brooksmith Consulting 2011; HRI 2008; Boles et al. 2011). The coastal mangroves of Belize are also affected by a variety of other pressures, including logging for charcoal and construction material, pollution from urban, industrial and agricultural activities, direct destruction for urban growth, tourism infrastructure and coastal development, shrimp farms and agriculture as well as storm events (UNEP and CATHALAC 2010).

A key finding of the risk assessment for mangroves is that risks to this ecosystem do not occur uniformly across regions. Mangroves grow along the mainland coast and much of the area of the offshore cayes, which are areas considered prime development locales, have been greatly concentrated in housing and resort developments along the coast (World Wildlife Fund & Brooksmith Consulting 2011; HRI 2008; Boles et al. 2011). Therefore, mangroves being found in these prime areas will eventually be lost if no immediate management interventions are put in place. Results from the InVEST Habitat Risk Assessment (HRA) indicate that, currently, the greatest area of mangroves at high risk of degradation from human activities is occurring in four principal zones in the following order: (1) Ambergris Caye; (2) Central Region; (3) South Northern; and (4) South Central Region. Nationally, 34% of Belize's mangroves are currently at low risk from human activity, 60% are at medium risk, and 6% are under high threat from human activities (**Fig. 19**).

HRA results further suggest that the implementation of an Informed Management zoning scheme could reduce the area of mangroves at high risk nationally to about 95% of the area currently at high risk. This reduction in high risk was achieved by reducing the exposure of mangroves to the cumulative impacts of multiple human activities that overlap mangrove forests, such as coastal development, aquaculture and dredging. Since the Informed Management scenario balances economic development and conservation, large expanses of this ecosystem is still at medium risk to human stressors. Dramatic increases in the area of this habitat at low risk only occur in the Conservation scenario (**Fig. 19**). Under the Development scenario the area of mangroves at high risk nationally would more than triple the area at high risk currently (**Fig. 19**). Additional information on how the Habitat Risk Assessment model works can be found in **Appendix B.1**.

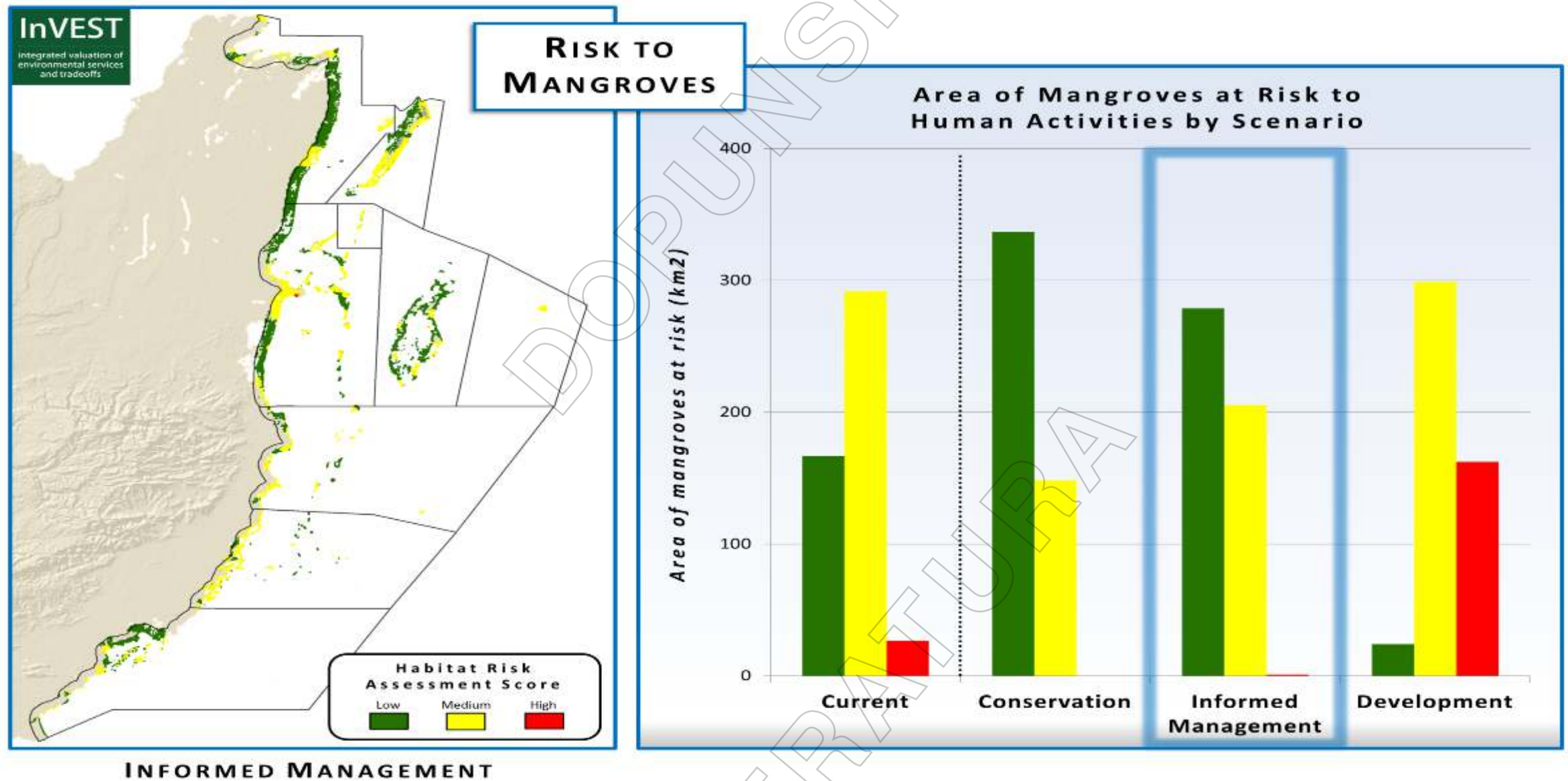


Figure 19: Area of Mangrove at Risk from Human Activities by Scenario

CURRENT CHALLENGES

Much of our daily activities are dependent on resources from the coastal environment. This in turn has its own consequences. We travel on and in the water, use it for recreation, fish in it for livelihoods, conduct oil exploration, and dump liquid and solid wastes within it, causing damage throughout the coastal area. With the expansion of human settlements and an increase in the population, large demands are made on freshwater from rivers, watersheds, and aquifer for public water supply, irrigation, hydropower, and aquaculture. There are documented concerns on impacts from development on this resource. For example:

- Reduced river flow by damming and water extraction is limiting supply of sediment to the coast, causing erosion that is threatening homes from Monkey River Village to as far south as Barranco Village.
- Friends of Placencia Lagoon, a local NGO, is greatly concerned about the quality of coastal water due to effluent disposal from shrimp farms located nearby.
- Citizens of Dangriga have repeatedly had their water supply contaminated by overflow of waste from the citrus industry into the North Stann Creek watershed, contamination that also affects the coastal environment and can impact food security.
- Tour guides in Punta Gorda Town have reported increased usage of the Sennis River for laundry and other related activities as a result of the growing settlement of Bella Vista located in the Toledo District.
- Residents of Sittie River Village have noted the changes in the erosion rate as a result of increased boat traffic in the area, also a local human-wildlife conflict regarding manatees.-
- Construction of a Norwegian Cruise line cruise ship docking facility at Harvest Caye.
- Significant increase in erosion along the southern coast from Monkey River to Hopkins.

By understanding our coastal waters we are able to effectively manage and plan for future usage. However, since this task is enormous, efforts must include input from local experts who utilize coastal resources on a day to day basis.

SECTION 2: VALUE OF THE COASTAL ZONE

VALUE OF THE COASTAL ZONE

The importance of the coastal zone in the productive sector of Belize is increasing rapidly. Most industries in Belize are either directly or indirectly reliant on some component of the coastal environment to function. Industries such as fishing and tourism are dependent on the organisms that inhabit the coastal area to sustain them. Other industries such as agriculture, aquaculture, and petroleum use the coastal waters to transport their products, thereby allowing them to engage in overseas trade. It is estimated that \$350 to \$400 million BZD is generated directly through resource-based economic activity in the coastal zone. Perhaps a further \$450 to \$500 million BZD are transported through the area in exports (sugar, citrus, bananas, timber, and other agricultural products). Approximately \$650 million BZD worth of imports entered the country in 2010, more than half of this through the sea ports (CIA World Fact Book 2012). The following sections provide a brief overview of the contributing sectors.

TOURISM



Visitors at Goff's Caye Special Management Area (CZMAI)

Tourism is the single largest contributor to the country's economic growth. Important attractors include natural features found within the coastal zone such as the barrier reef, atolls, and several hundred cayes. For this reason, Belize has become a major ecotourism destination. According to the Belize Tourism Board's 2008 Statistical Digest, the tourism sector generated \$264.4 million USD and welcomed 842,396 visitors, 597,370 of which were from cruise tourism (BTB 2008). Total

visitation continued to increase annually and in 2014 there were 1.2 million visitors, 321,220 of which were overnight tourists and 968,131 were cruise passengers. Major tourism activities in the coastal zone include diving and snorkeling with the most frequented sites being Hol Chan Marine Reserve, Blue Hole Natural Monument, and Goff's Caye Marine Managed Area (BTB 2008).

FISHING



Harvested conch and lobster (Belize Fisheries Department)

Like most Caribbean countries, the fishing industry is a major part of the Belizean society and plays an important role in building the economy. The industry supports over 2,500 registered fishers and their families, and provides a source of protein for local consumption and exportation to foreign markets. In 2010 the fishing industry generated \$23.2 million BZD with the exportation the three main marine products lobster, conch, and finfish. Table 2 is a summary of total catch and revenue generated from

exportation in 2010 in Belize dollars. Although the lobster industry has been considered to be relatively stable over recent years there has been a decline in the production of lobster. In 2014 there was 484,891 lbs. of lobster caught which generated \$15.2 million in revenue. Some 452,930 lbs. of lobster tail was exported generating \$13.5 million. Other exports included 31,840 lbs. of head meat, 3,102 lbs. of lobster head, and 77,911 whole lobster.

Table 1: Amount of Marine Product Exported and Revenue Generated in 2010

Product	Catch (lbs)	Revenue Generated (BZD)
Lobster (Head and Tail Meat)	492,460	\$13,325,300
Fin Fish	109,190	\$265,878
Conch	726,050	\$7,986,550
TOTAL	1,327,700	\$21,577,729

Source: Belize Capture Fisheries Unit Annual Report 2011

AQUACULTURE

Aquaculture development in Belize dates back to the last thirty years, commencing with the commercial farming of the Pacific white shrimp *Litopenaeus vanammei* (CZMAI 2012). With the successful first commercial trials of shrimp aquaculture, the industry experienced rapid expansion with a total of 16 farms established by the end of 2005 and a total production area of 6,888 acres (CZMAI



Shrimp ponds in southern Belize (Southern Environmental Association)

2012). Although the economic returns from shrimp aquaculture proved promising, significant declines in world market prices and the incidence of disease have resulted in economic losses that have depressed production and resulted in the closure of more than 60% of the production area. In 2013 the number of operational farms reduced to a total of 9 farms with a total production area of 2,673 acres. Currently there are eight active shrimp farms in Belize.

Besides shrimp, the aquaculture species portfolio also includes tilapia and cobia. In 2002 the first commercial tilapia operation, Fresh Catch Belize Limited, was established with the production of the grey tilapia (*Oreochromis niloticus*). Since its inception, the company expanded its tilapia production to 300 acres, and in 2008 produced 1863 million tons (CZMAI 2012). By 2010, however, the industry suffered significant economic losses resulting from Hurricane Richard and also experienced financial problems. The farm ceased operations and was taken into bank receivership. There is development of small scale tilapia productions, which includes 65 producers and an production area of approximately 20 acres (CZMAI 2012).

Cobia (*Rachycentron canadum*) was developed in 2006 by Marine Farms Belize Limited near Robinson Point Cayes. By 2009, the farm produced a total of 500 million tons, representing the highest production of cobia for the county. However, one year later the cage production infrastructure suffered severe damages resulting from Hurricane Richard. The cage site production by Robinson Point ceased in 2010, and the company has since dedicated its efforts in the hatchery production of cobia seedstocks near Dangriga in an effort to diversity the species portflio. Table 2 is a summary of aquaculture production of shimp, tilapia and cobia and revenue generated in 2010 in Belize dollars.

Table 2: Amount of Aquaculture Product Exported and the Revenue Generated in 2010

Product	Production (lbs)	Revenue Generated (BZD)
Farmed Fish (Tilapia & Cobia)	2,504,000	\$1,300,000
Farmed Shrimp	11,264,000	\$38,400,000
TOTAL	13,768,000	\$39,700,000

Source: Belize Capture Fisheries Unit Annual Report 2011

More recently, other species of aquaculture interest have emerged, including hatchery trials of the Florida pompano (*Trachinotus carolinus*) by Marine Farms Belize Limited, the cultivation of seaweed (*Euchuma isoforme* and *Gracelaria* spp.) by fishermen of the Placencia Fishing Cooperative and the experimental grow-out trial of the red drum (*Sciaenops ocellatus*) near Stake Bank Caye. There has also been expressed interest in the cultivation of sea cucumber, common snook, oyster and octopus (CZMAI 2012).

AGRICULTURE



Banana plantation in southern Belize (Belize Trade and Investment Zone)
Belize in 2013 in Belize dollars.

Agricultural practices are common in Belize due to the country's historical past as a logging nation, and agriculturally productive soils. Although not all agricultural practices extend into the coastal zone, the effects of runoff from approximately 57,000 hectares of land being cultivated pose a direct threat to the health of the coastal ecosystem. Table 3 shows the revenue generated from the exportation of major crops in

Table 3: Amount of Produce Exported and the Revenue Generated in 2013

Produce	Amount Exported	Revenue Generated (BZD)
Sugar	105,210 long tons	\$107,360,000
Molasses	9,760,000 Gal.	\$7,810,000
Citrus (Orange & Grapefruit Conc.)	5,100,000 Gal.	\$106,640,000
Banana	217,870,000 tons	\$88,470,000
Papaya	56,510,000 lbs.	\$20,6700,000
TOTAL		\$330,950,000

Source: Central Bank of Belize Annual Report 2014

COASTAL DEVELOPMENT



Development near the famous Caye Caulker "Split" (Samir Rosado)

Of the ten major residential centers in Belize, six are located on the coast. In spite of a stated policy to relocate housing inland due to sea level rise and hurricane vulnerability, all coastal centers are experiencing growth to varying degrees. Development is being undertaken by both the public and private sectors, with the latter involved primarily in sub-divisions in several coastal locations, often targeting foreign markets and retirees.

INDUSTRY AND COMMERCE

Belize still has a relatively small industrial base as compared to more traditional markets. In 2010, non-traditional exports such as orange oil, fresh orange, pepper sauce, red kidney beans, black eye peas, sawn woods, and grapefruit oil generated \$47.2 million BZD (Central Bank of Belize 2010). The re-exportation of goods through the Corozal Free Zone, however, is continuing on its steadily increasing trend, and as sales in 2010 reached \$350.8 million BZD. With the collapse of the Dickies Factory in the Belize District, there was also a collapse of the garment industry with no substantial exportation taking place (Central Bank of Belize 2010).



Marie Sharp's pepper sauce production line (Savour Belize)

INFRASTRUCTURE

All the airstrips with regular, scheduled flights lie within the coastal area: Corozal, San Pedro, Caye Caulker, Belize City, Dangriga, Placencia and Punta Gorda. The Philip S. W. Goldson International Airport is within 5 km of the shoreline of Belize City. The construction of a second international airport is also proposed with the shoreline of the Placencia Peninsula.



Maxi-float arrival at low berth of the Belize City Port (Port of Belize Limited)

Of the three main ports, Belize City acts as a main entry point and is currently upgrading facilities to recover and expand on losses in traffic experienced in recent years. This port received 251 container ships in 2007. The port at Big Creek, located west of Placencia village on the outskirts of Independence/Mango Creek in the Stann Creek District serves as a secondary port with 161 container vessels visiting in 2007. Activity at this port facility is expected to increase significantly due to the expected

increase in visitation this area with the creation of the Norwegian Cruise Line Cruise Ship Docking facility at Harvest Caye. In anticipation of increased activity, port facilities should be expanded to accommodate.

There are several marinas and docking facilities are also found throughout Belize. More specifically they can be found in all major coastal communities including; San Pedro, Caye Caulker, Belize City, Placencia, New Haven, Punta Gorda, Turneffe Atoll, Sittee River and Corozal. Road access across the country has improved tremendously over the last decade and there exists four major two-lane, asphalt-paved highways, including the paving of several important segments important for tourism for example the Placencia and Maskall Roads. All of the major coastal settlements are accessible by paved roads along the network of highways. Additionally, roads leading to smaller coastal communities have also been upgraded and in most cases paved. Municipalities throughout Belize have also began initiatives to cement streets. This was made possible through an investment loan from the Petrocaribe Development Fund and grant monies under the World Bank Climate Resilience Project.

InVEST Coastal Vulnerability model results reveal that of the nine planning regions, five of them contain significant lengths of paved roads that lie within vulnerable coastline. These regions are namely: (1) Central; (2) Northern; (3) South Central; (4) South Northern; and (5) Southern (**Fig. 20**). The Central and Northern regions have the longest lengths of paved roads within vulnerable sections of coastline respectively (**Fig. 20**). While the results do not indicate that these roads will be any less vulnerable in any of the future scenarios (**Fig. 20**), they are helpful for identifying the two regions that may require significant investment in durable materials to avoid costly repairs over time. The results also have implications for community and economic development planning when considering the dependency of road infrastructure for transportation of goods and services and mobility of coastal communities. Additional information on how the InVEST Coastal Vulnerability model works can be found in **Appendix B.2**

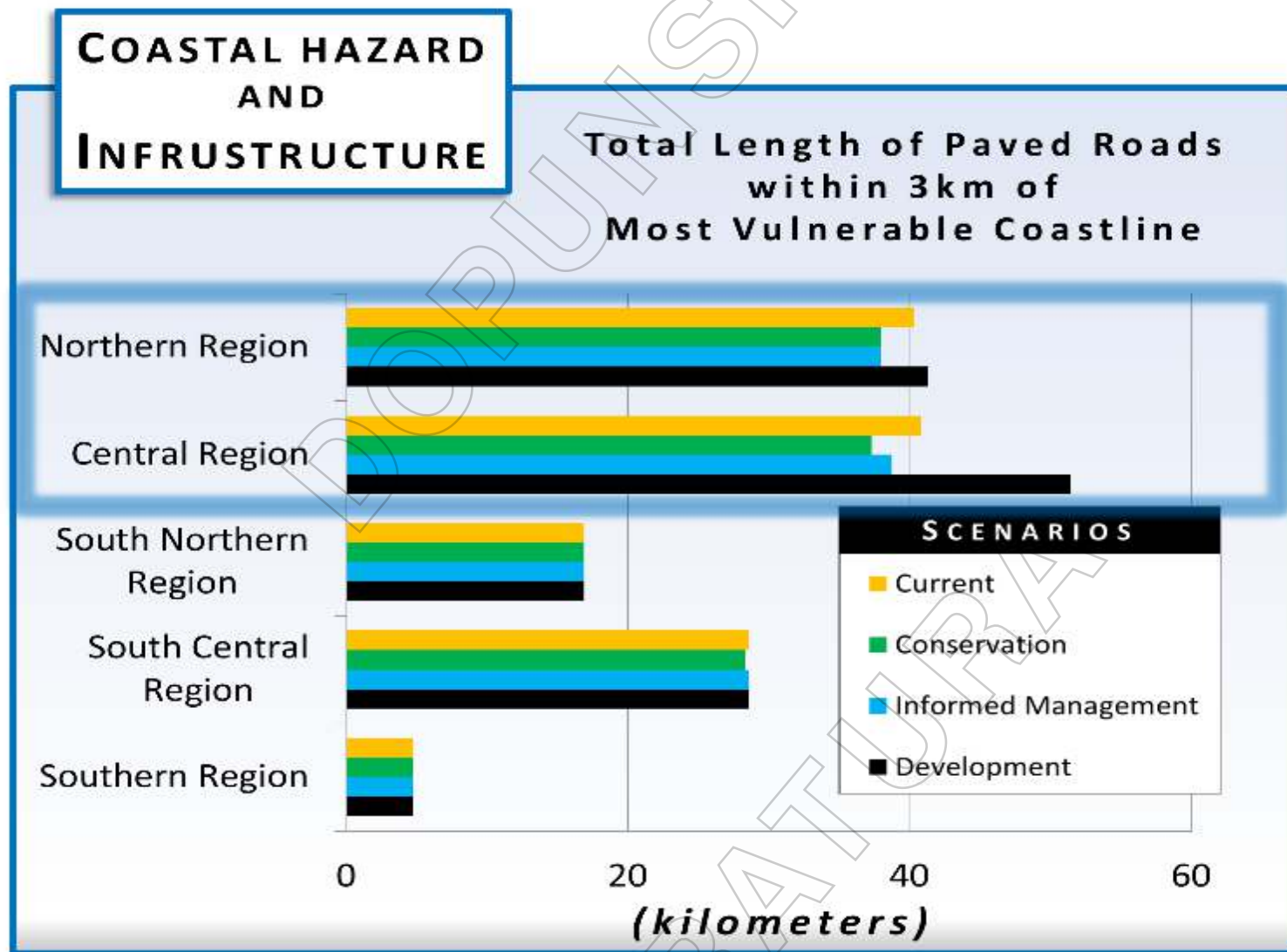


Figure 20: Total Length of Paved Roads within Vulnerable Coastline

OIL AND PETROLEUM

Background Information

The petroleum industry in Belize is governed by the Petroleum Act and Regulations and the terms and conditions of the licenses. The Geology and Petroleum Department administrates the petroleum industry and supervises and monitors all exploration and production operations. Other Government agencies which regulate the petroleum industry are the Income Tax Department and the Department of the Environment.

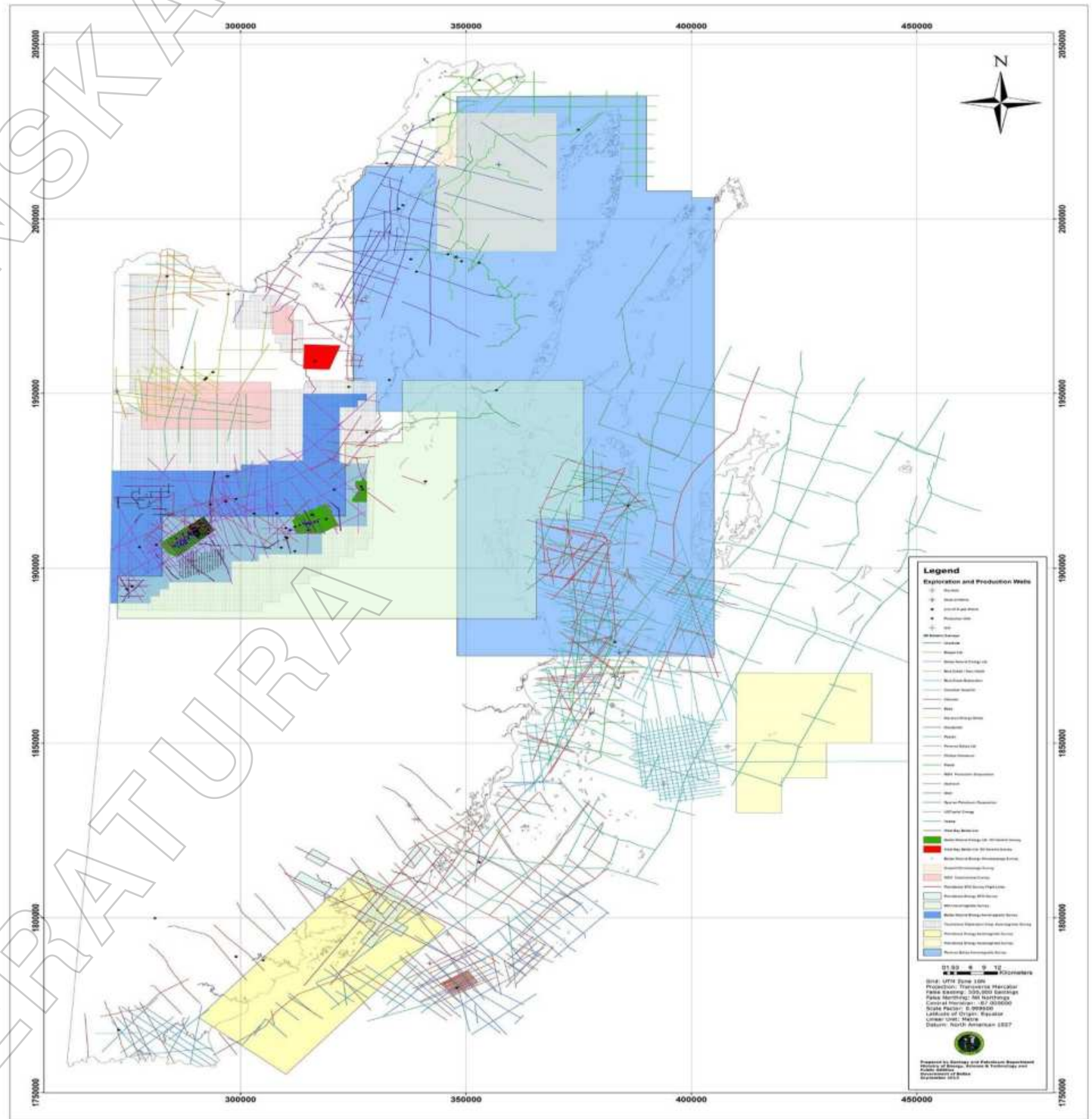


The management of petroleum extraction/exploration activities in Belize is done using a block and sub-block system (**Figure 21a**). Using this system the entire country of Belize, including territorial seas, has been divided into approximately 447 blocks which represents an area of 100 square kilometers. These blocks are further divided into 25 sub-block which are alphabetized A-Y and represents 4 square kilometers. Companies can apply to the Geology and Petroleum Department for licenses to conduct exploration activities in different Blocks and Sub-Blocks. In order to attain a license, prospective companies must undergo a thorough evaluation process which is conducted by the Geology and Petroleum Department. Once the company has received approval from Geology and Petroleum the Minister with responsibility for Petroleum Development will be responsible for issuing the license.

History of the Petroleum exploration in Belize

Petroleum exploration in Belize began in the 1930's. Oil exploration licenses were granted to the large oil companies such as Shell, Esso, Texaco, Gulf Oil, Anschutz and Chevron as well as smaller companies and small independent oil companies to explore for petroleum in both the onshore and offshore areas of Belize. By 2000, a total of 50 exploration wells were drilled, 34 onshore and 16 offshore, the first of which was the Yalbac #1 well located in the Yalbac Hills in the Cayo District drilled by Gulf Oil in 1956. No commercial discovery was made in any of these wells with the closest being the Eagle #1 well drilled in 1984 in Belmopan which recovered approximately 3 barrels of light crude oil. (**Figure 21b**).

Geophysical Surveys and Wells Drilled in Belize



Belize Integrated Coastal Zone Management Plan
Coastal Zone Management Authority & Institute 2016

Discovery and First Production

In 2000 an oil seep was discovered at Calla Creek in the Cayo District sparked new interest of oil extraction in Belize. As a result, the Belize Natural Energy Ltd. (BNE) was granted an exploration license and subsequently made the first commercial discovery of petroleum in the Mike Usher #1 well in Spanish Lookout in July 2005. This discovery was developed by BNE into the Spanish Lookout Oilfield which is currently producing an average of 1,705 barrels of oil per day. BNE later made another commercial discovery in October 2008 in the Never Delay area in the Never Delay #1 well. The Spanish Lookout and Never Delay crude oils are trucked from the oilfields to BNE's export facility in Big Creek and shipped and sold to the US Gulf Coast. BNE is the only producer of crude oil in Belize.

Current Exploration

There are currently eight (8) companies with exploration licenses in Belize that can carry out seismic surveys and drilling of exploration wells. The Belize Petroleum Contracts Map shows these companies and their license areas (**Figure 22**). However, by the end of January 2016 the exploration contracts for four of these companies will expire, thus leaving only four companies in operation which include:

1. BCH/Pacific Rubiales
2. Parenco
3. Maranco Energy
4. Belize Natural Energy Ltd.

In 2014 the Prime Minister of Belize issued a temporary moratorium on the issuing of parcels for offshore oil exploration/drilling activities. Additionally, many of the contracts that are soon to be expired include offshore areas. Therefore, for the near future, oil exploration/extraction activities will be conducted exclusively in onshore areas.

Current Production

The Belize Natural Energy Ltd. is the only company currently extracting oil in commercial quantities for exportation and sale. The Spanish Lookout Oil Field from its inception in 2005 has produced 9,866,232 barrels of oil up to 2014 and the Never Delay Oil Field has produced 151,646.43 barrels from 2008 to 2014. As a result, the total Petroleum revenue earned by the Government of Belize from 2006 to 2014 was \$211,799,521.17 USD. However it is important to note that the price per barrel of oil on the international market has reduced significantly, therefore the revenue from oil production in Belize is decreasing. Also, there is evidence that oil levels are also declining leading to a reduction of barrels being produced.

Belize Petroleum Contracts Map

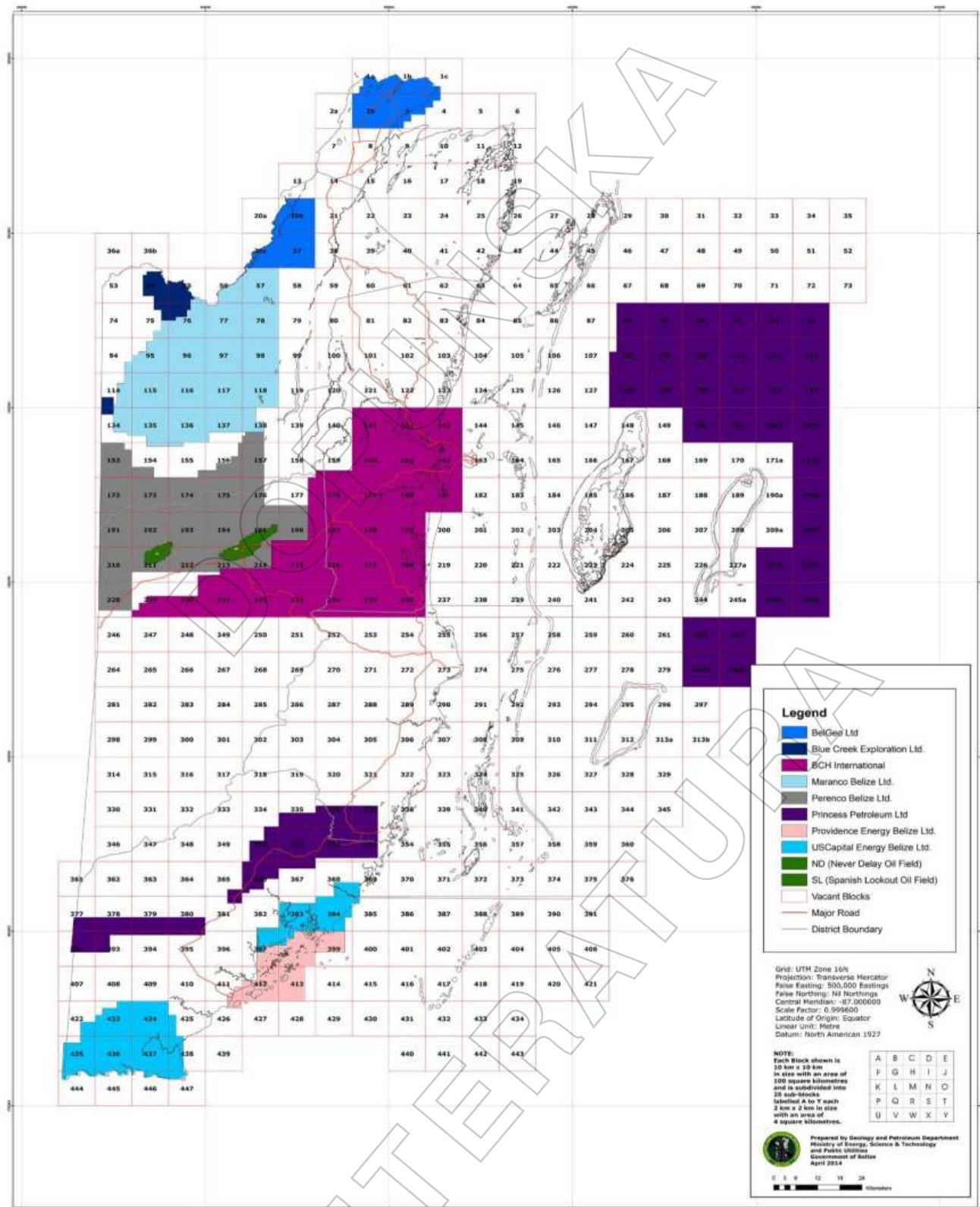


Figure 22: Map showing contract map with parcels up to 2015

THE FUTURE

There is a draft Petroleum Exploration Zones and Guidelines document (September 2013) that was shared by the Department with key stakeholder groups and agencies that identifies four zones for exploration activity based on the level of sensitivity and significance of the zones. Threshold values for the four zones were created being zone 1 – exploration restricted and zones 2 to 4 – exploration allowed with varying degree of restrictions and guidelines. However, this document is yet to be finalized. These guidelines will effectively steer future oil exploration activities in Belize.

SECTION 3: COASTAL ISSUES FOR NATIONAL ACTION

COASTAL ISSUES FOR NATIONAL ACTION

Through consultations with its stakeholders, CZMAI has identified four key drivers, economic, social, cultural and environmental, which currently affect and may affect future sustainable use of coastal and marine resources. These drivers include:

COASTAL RESOURCE BASE PROTECTION

Undeniably, the protection and sustainable use of the coastal resources base is critical to the biological, economic, social and cultural values linked to the coastal zone. The National Development Framework for Belize, *Horizon 2030*, notes the role of the natural environment as both the source and basis of economic and social progress (Barnett et al. 2012). *Horizon 2030* also identifies the incorporation of environmental sustainability in development planning and the strengthening of protected areas management as a key strategy to achieve sustainable development goal while supporting the protection and management of the coastal resource base. Therefore, it is imperative that this resource base be protected and that certain measures are put in place to ensure the sustainable management of the resources that are highly valued by the Belizean populace and the global community. Equal important is the identification of sustainable, long-term alternative livelihood portfolios for resource-dependent communities as a means to reduce current pressures on the resource base. Alternative livelihood initiatives have been implemented across the country. However, these initiatives have been largely project-based and consequently, short-lived and not effective for reducing resource-dependency. This issue requires national action if it is to be effectively addressed as well as the integrated management of resources.



Photo by: Southern Environmental Association

INDUSTRY AND COMMERCE



Sugar factory at Tower Hill, Orange Walk (Belize Trade and Investment Zone)

As noted previously, the coastal zone is a major focus of the country's economic development. Current industry trends for various productive sectors are indicating increased pressure on the coastal zone resources to meet the demands of economic and social progress. Since sustainable development is in the national interest, it is important that development planning takes a holistic, national approach that is rooted in environmental sustainability.

COASTAL POPULATION GROWTH

Since the 1970s, Belize has been experiencing a steadily increasing growth rate. **Table 4** summarizes the historical population trends for the period 1970-2010, and the projected population for 2020 and 2030.

Table 4: Historical and Projected Population Trends

Total Enumerated Population by Census Years					Projected Population	
1970	1980	1991	2000	2010	2020	2030
119,645	145,353	189,392	240,204	312,698	368,693	423,093
Actual Population Inter-censal Change (%)					Projected Population Inter-censal Change (%)	
1970-1980	1980-1991	1991-2000	2000-2010	2010-2020	2020-2030	
21.49	30.30	26.83	30.18	17.91	14.75	

Source: Belize Population and Housing Census (2000, 2010), Statistical Institute of Belize

According to the Belize 2000 Population Census Report, the increase in population over the census period 1970-2000 can be attributed mainly to immigration. This finding is supported by the fact that overall fertility rate, which is the only other potential demographic that could contribute to positive population change, has been declining since the 1980s (Belize 2010 Population and Housing Census). The 2000 census also predicts a doubling in the population by the year 2026, should the trends in immigration and the fertility rate remain constant over time.

Another interesting feature is the urban-rural population dichotomy. Both in the 1970 and 1980, the urban population was relatively higher than the population in rural areas. Specifically, in 1970 the urban to rural population ratio was 54% to 46%. In 1980 the ratio was 51% to 49%. However, during the 1990s the situation reversed. Rather than experiencing urban sprawl, Belize experienced



Coastal development in Belize City ©Gustavo Giron www.astrumhelicopters.com

somewhat of a suburbanization of the rural areas. For instance, in both the 1991 and 2000 censuses, the urban to rural population ratio was 48% to 52%. In 2010, the trend continued with the urban population comprising 44% of the total population while the rural population was 56%. Of this 56%, approximately 73% live along the coast.

By all accounts, the increase in the rural population over the years has also meant an increase in areas settled along the coast. As the 2000 census points out, the shift to rural areas, and by extension the coastal zone, is indicative of the need for national interventions and strategic national development planning to ensure that rural areas have necessary resources to ensure social well-being, supported by vibrant, diverse, and sustainable local economies. Such resources include access to technology and improved infrastructure, such as water supply, waste management and disposal, roads, drainage, and the provision of health, education, security, and emergency management services. There is also the need to factor in the carrying capacity of the various rural areas in future scenarios; this will ensure that the natural resources can support a growing population in perpetuity. The projected population for 2020 and 2030 predicts a growth rate of approximately 18% and 15% over the two respective decades. Thus, it will be necessary to plan for coastal population growth so as to minimize the unsustainable use of coastal resources, while also ensuring that communities in rural areas can enjoy a high quality of life.

CLIMATE CHANGE ADAPTATION

With burgeoning modernization worldwide, there is unforeseen pressure being placed on the environment. The activities of mankind throughout human history are having a rapid and profound effect on global climatic conditions. The result is a continued shift in climatic



Extreme flooding event in Belize City (Belize Meteorology Department)

conditions all over the world. Climate Change is defined as “a change in the state of the climate that can be identified, using statistical tests, by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer” (IPCC 2012). Climate change may be due to natural processes or as a result of persistent anthropogenic changes in the composition of the atmosphere or in land use. Global climate change can fundamentally affect natural, economic and social systems that can result in significant changes to coastal resources availability and the way the coastal

zone is managed or used. According to the Intergovernmental Panel on Climate Change (IPCC), anthropogenic effects are having a significant influence on the earth’s changing climate. Projections have global mean sea surface temperatures rising 1.5 to 6.0 degrees Celsius within the next century and as a consequence, a rise in global mean sea level of 15 to 95 centimeters (NCCC 2008).

The exact changes to Belize and the region are unknown at this stage and this serves as a challenge for how to best develop adaptation strategies. However, the best scientific evidence is indicating that climate change could affect economic and social well-being, including major productive sectors of Belize. Geographically, Belize is located approximately six meters below sea level, thus the threat of rising seas is a major concern especially to the 40% of the population that is settled along the coast and the cayes. A national proactive and adaptive approach is necessary in order to coordinate appropriate responses to climate change across sectors. The Government of Belize, through its national policy on adaptation to global climate change, recognizes the need to adequately plan, as best as possible, appropriate national responses for managing the impacts of global climate change. The policy encourages agencies to “*explore and access the opportunities being developed by the climate change negotiation process*” and it also “*mandates relevant government agencies to prepare adaptation policy options for their sectors*” (NCCC 2008). It therefore calls for a national approach to address adaptation to climate change.

SECTION 4:

VISION FOR A SUSTAINABLE COAST

Encouraging Sustainable Coastal Resources Use

Supporting Integrated Development Planning

Building Alliances to Benefit Belizeans

Adapting to Climate Change

VISION FOR A SUSTAINABLE COAST

The Belize Integrated Coastal Zone Management Plan is a planning framework to focus management activities that are already being undertaken, ensuring these are integrated, and to highlight additional activities and actions that could be undertaken to help meet the challenge of ensuring a sustainable future for the coastal zone where healthy ecosystems support, and is supported by, thriving local communities and a vibrant economy. The framework includes recommendations, supported by a spatially explicit zoning plan. Outlined below are four strategic objectives for achieving this vision for sustainable coast.

1.0 ENCOURAGING SUSTAINABLE COASTAL RESOURCE USE

There is a growing need to advance the economic and resource attributes of the coastal and marine protected areas system, and to improve the management of natural habitats and wildlife. Scientific research and monitoring is central to the process.

1.01 COASTAL RESEARCH AND MONITORING

Coastal research has become an increasingly popular and important activity in Belize. However, this activity is still ill-defined and not well centralized. The purpose of research and monitoring is to provide insight into how events, processes, and activities, over larger spatial and temporal scales, influence the properties and functions of the coastal ecosystem (Nixon 1996). Conducting coastal research at the national level requires an integrated approach, which combines diverse efforts.

Benefits of research and monitoring can be summarized as follows:

- Improving forecasting of future uses of the coastal zone by knowing the effects of events, processes, and activities
- Maintaining ecosystem functions by understanding the relationships between and among its components
- Effectively planning for the future by monitoring the changes in use and interactions by coastal communities
- Providing sound data to incorporate into modelling programmes, thus improving management

Research efforts thus far in Belize have been distributed among government and non-governmental organizations. These organizations focus on components specific to the objectives of the organization, and are either funded locally, by government subvention, or have received

grants from international agencies. The University of Belize launched its Environmental Research Institute in 2010 responsible for the building of national capacity for research and monitoring to better inform natural resource management decisions. One of the major products from the institute is a National Environmental and Natural Resources Management Research Agenda. The purpose of the agenda is to prioritize the country's research needs at five year intervals.

In terms of government organizations, the Department of the Environment, Geology and Petroleum Department, Forest Department and Fisheries Department are the major agencies with mandates that include research or monitoring activities within the coastal areas of Belize. The Coastal Zone Management Authority and Institute (CZMAI) is a quasi-governmental organization mandated to conduct research within the coastal areas of Belize. It is tasked with performing coastal research, community outreach and coordinating data collection for the region. Current research and monitoring programmes being undertaken by the CZMAI include Endangered Species Research (Manatee), Coastal Planning and GIS/Data Analysis.

As a part of the implementation strategy for the Belize Integrated Coastal Zone Management Plan, CZMAI will focus its efforts on establishing a coastal health monitoring program that will include a national water quality monitoring program to be developed in coordination with key agencies. It is envisioned that this program will serve as a means to monitor the effectiveness of the Plan.

Furthermore, in 2008 the Government adopted the "National Integrated Water Resource Management Policy" and in 2011 it enacted the National Integrated Water Resources Act (NIWRA). In addition, the National Integrated Water Resources Management Policy calls for the development of a National Integrated Water Resources Plan and outlines strategic actions necessary to develop the plan.

Actions

- Develop a centralized data repository for Belize on ecosystem health and human use activities within the coastal zone
- Facilitate data accessibility among government agencies and non-governmental organizations for monitoring ecosystem health and human use impacts on the coastal area
- Establish a national water quality monitoring programme for Belize
- Develop a long-term national strategy for the scientific monitoring of the health of critical habitats, including but not limited to reef, seagrass, mangroves, and coastline dynamics
- Prepare annual State of the Coast Report to analyze trends and changes in the coastal zone

1.02 PROTECTED AREAS MANAGEMENT

A “*Protected Area*” is defined by the IUCN as “*An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means*” (Dudley 2008). In Belize, approximately 36% and 20% of the terrestrial and marine areas respectively are protected (Meerman & Wilson 2005). Belize’s network of protected areas is comprised of national parks, nature reserves, wildlife sanctuaries, natural monuments, forest reserves, marine reserves, archaeological sites and archaeological reserves, as well as private reserves, strategic biological corridors and scenic landscapes of geomorphic significance. Although 20% of Belize’s marine area is protected, less than 4% of these are zoned as ‘no take’ as most marine protected areas (MPAs) are zoned for general use (Gordon & Green 2011).

Belize is rich in biodiversity and natural resources. It is home to many threatened species as well as approximately 280 km of the largest barrier reef system in the northern hemisphere. As a result, there are many areas of ecological importance spread across the country that have received protective status. Recognizing its inability to effectively manage, monitor, enforce and maintain all protected areas, the government of Belize entered into co-management agreements with various NGOs to aid in the arduous task of managing these sites (APAMO 2012). The benefits of co-management are summarized as follows:

- NGOs can conduct hands-on management of protected areas, ensuring the sustainability of these areas that are of environmental, social, economic, and cultural importance to all Belizeans.
- NGOs can tap into resource pools not accessible by the government agencies. There are many reputable international organizations that support protected area management by NGOs through grant funding.

Currently, Belize has fourteen (14) marine protected areas in Belize (**Table 5**) with one proposed MPA being considered at Ambergris Caye that would cover three sites: Mexico Rocks, Bajos & Cayo Frances). Twelve of these MPAs are co-managed, leaving two under the complete management of the Fisheries Department.

Table 5: Belize MPAs and agencies with management responsibilities

*World Heritage Site

Marine Protected Area	Management Agency	Co-management Agency
Corozal Bay Wildlife Sanctuary	Forest Department	Sarteneja Alliance for Conservation & Development
*Laughing Bird Caye National Park	Forest Department	Southern Environmental Association
*Blue Hole Natural Monument	Forest Department	Belize Audubon Society
*Half Moon Caye Natural Monument	Forest Department	Belize Audubon Society
*Bacalar Chico Marine Reserve	Fisheries Department	-
Caye Caulker Marine Reserve	Fisheries Department	Forest and Marine Reserve Association of Caye Caulker
Gladden Spit Marine Reserve	Fisheries Department	Southern Environmental Association
*Glover's Reef Marine Reserve	Fisheries Department	World Conservation Society (Informal)
Hol Chan Marine Reserve	Fisheries Department	Hol Chan Trust Fund
Port Honduras Marine Reserve	Fisheries Department	Toledo Institute for Development & Environment
Swallow Caye Wildlife Sanctuary	Forest Department	Friends of Swallow Caye
*Sapodilla Caye Marine Reserve	Fisheries Department	Southern Environmental Association
*South Water Caye Marine Reserve	Fisheries Department	-
Turneffe Atoll Marine Reserve	Fisheries Department	Turneffe Atoll Sustainability Association

Source: Walker & Walker 2011

In 2005, the Task Force on Belize's Protected Areas Policy and Systems Plan was commissioned by the then Deputy Prime Minister and Minister of Natural Resources and the Environment, in collaboration with the then Minister of Agriculture and Fisheries and the Minister of Tourism. The Task Force created the Belize National Protected Areas System Plan. The objective of the plan was to provide guiding principles for managing protected areas in Belize in a way that promotes biodiversity and ensures sustainability for future generations. A summary of the provisions within the document are as follows:

The Protected Areas System:

- Will be established based on ecological and intrinsic value to present and future Belizeans.
- Will adhere to global conventions of conservation. Where needed biological corridors and private protected areas will be established and recognized provided that they are complementary to the national system.

Administration and Management:

- All protected areas will be integrated under the national system.
- Management of these areas must reflect stakeholder knowledge and expertise of the ecology of the environment and must be transparent.
- Thresholds must be established to ensure the social and economic benefit of Belizeans, while not undermining the integrity of ecosystems.
- Management effectiveness and integrity must be ensured through monitoring and evaluation mechanisms.
- Any change in protective status requires stakeholder consultation.

Socio-economic considerations:

- Appreciation of protected areas should be enhanced via public campaigns. The protected areas will in turn facilitate education, research and income for the general public.
- Collaborative management and other socio-economic enhancement mechanisms will be encouraged to maintain the cultural and ecological integrity of the protected areas.
- Equal access opportunities will be granted to all stakeholders.
- Sustainability of protected areas is paramount to the development of Belize and local communities.

At the 20th session of the World Heritage Committee held in Mexico in December 1996, seven of Belize's marine protected areas (**Table 5**), encompassing a total of 96,300 ha, became inscribed as World Heritage Sites. These areas were inscribed under the following natural criteria (Gibson 2011):

- Superlative natural phenomena and natural beauty
- Ongoing biological and ecological processes and biological diversity

In 2008, there was concern about the future integrity of the designated areas, as there was increased mangrove clearing and sale of lands within these areas. Under the conventions set by the World Heritage Committee, countries that host World Heritage Sites should:

- work to promote the prestige of the designated areas
- promote their importance both locally and internationally
- set systems in place that will protect their integrity

- not take any deliberate measures that directly or indirectly damage their heritage
- consider these areas of cultural and natural heritage as being priceless and irreplaceable assets

Consequently, in June 2009 the Belize Barrier Reef System was inscribed on the List of World Heritage Sites in Danger following reports of oil exploration concessions being issued, sale of lands within protected areas, such as South Water Caye Marine Reserve (Gibson 2011). Under the World Heritage Convention, when a property inscribed on the World Heritage List is threatened by serious and specific dangers, the Committee considers placing it on the List of World Heritage in Danger. When the Outstanding Universal Value of the property which justified its inscription on the World Heritage List is destroyed, the Committee considers removing the property from the World Heritage List (UNESCO 2011).

The issue of development within World Heritage Site is one that has caused much debate, and raised more questions yielding few concrete answers. The Coastal Zone Management Authority and Institute (CZMAI) believes that it is very important that development activities within World Heritage Sites are strictly controlled in order to protect their integrity. Through this Plan, recommendations regarding developing World Heritage Sites can only be made within the confines of the law and the World Heritage Convention. There are no clear-cut guidelines for development within World Heritage Sites. Thus any proposed development activity would require extraordinary scrutiny, attention, consultation and monitoring to ensure that the outstanding universal value for which the site was inscribed is kept intact.

The development of an in-country legislation and policy position on development within World Heritage Sites, such as a World Heritage Protection Bill, is recommended to provide guidance for managing proposed development activities. Given the fact that some of the lands within World Heritage Sites are privately-owned, it is inevitable that there will be changes to each site. As an organization that embraces the principles of sustainable use and management, CZMAI recommends that each World Heritage Site should have active, updated management plans that are fully implemented. The management plans should include strategies for promoting or improving community involvement in the management of the sites, and promoting economic development strategies while ensuring environmental sustainability. The management plans should also have a long term vision that is built upon short term action plans and policies. Through these plans, it is envisioned that developmental guidelines for each site will be provided that will allow for better decision-making during the environmental clearance process. To support this process, all development proposals within World Heritage Sites should be placed in Schedule 1 of the EIA regulations. All sites would be treated as “sensitive areas”, and this action would therefore limit developmental activities.

The Belize Integrated Coastal Zone Management Plan recommends several areas in the Informed Management Zoning Scheme for Conservation (**Figure 15**), some of which includes privately-held lands. There are possible legal implications that could arise from recommending land use standards for the conservation and retention of natural features of title hold lands. When lands that provides important ecosystem services to the public, the precedent and common practice in other regions across the world is to incentivize the transfer of development rights and property-ownership. For example, The Nature Conservancy in the United States would privately negotiate to purchase land outright or development rights. The US federal government also acquires land for conservation as a public good using a variety of mechanisms.

One common mechanism for the acquisition of privately-held lands for national conservation purposes is a claim of *eminent domain*. *Eminent domain* is the right of a government or its agent to expropriate private property for public use, with payment or compensation. This mechanism is a viable option for the Government of Belize. Another mechanism that Belize's government can undertake to acquire privately-held lands for conservation is voluntary subsidies. For example, in the United States, the Farm Bill provides farmers within approximately \$4 billion dollars a year if they engage in conservation practices on critical parcels of land. To ensure a good return on investment, the government uses an auction to get farmers to compete against each other to lower the cost of subsidizing this conservation, while simultaneously ranking parcels on their level of environmental quality.

Conservation covenants and financial incentives can undoubtedly facilitate the inclusion of private lands within the corridor routes. Conservation covenants can be an excellent tool to try to bring private lands covering threatened ecosystems or habitat vital for survival of particular threatened species. Belize's draft Conservation Covenant Act provides a mechanism to secure conservation management without a change of ownership. In most cases, however the commitment to implementing the Act if legislated will require some form of financial incentive for landowners. These incentives are more appropriate and economical for the Government than land-purchases in most instances. 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. Another is 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.

Actions

- Increase the technical and management capacity of both management and co-management agencies in order to ensure sound management practices
- Support local and national initiatives to achieve the target of 20% full protection of the marine territory of Belize

1.03 MANGROVE PROTECTION

Next to littoral forests, mangroves are the most affected ecosystem as a result of coastal development (Polidoro et al. 2010). As noted in Section 1, InVEST Habitat Risk Assessment results for mangroves are suggesting that 34% of Belize's mangroves are currently at low risk from human stressors, while 60% are at medium risk and 6% are under high threat. Furthermore, the highest incidence of mangrove degradation is occurring in Ambergris Caye, followed by the Central, South Northern and South Central regions. This seemingly unimportant foliage that lines the riparian zones of rivers and coastlines of Belize are often completely removed to make way for more economic and aesthetically pleasing structures. However, mangroves play a very important role in both ecosystems. The government of Belize recognizes the ecological and social importance of mangroves as summarized in the Forest Act (Statutory Instrument 16 of 1965) as follows:

Mangroves:

- *Stabilize much of the coastline and cayes and form an important component of the natural vegetation;*
- *Have protective functions and mitigate the destructive forces of natural disasters;*
- *Provides habitat for a diverse community of plants and animals, including fish and other species of social, commercial or recreational importance;*
- *Play a crucial role in the ecology of the coastal ecosystem by producing essential organic matter which are used by marine organisms in coastal food webs;*
- *Act as natural filters of nutrients, sediments, agrochemicals, and other contaminants;*
- *Provide critical habitat for migratory and resident birds, wildlife, and aquatic life in Belize;*
- *Are aesthetically attractive and can be incorporated into the landscaping of waterfront residences and communities;*
- *Provide recreation and employment through eco-tourism and sport fishing;*
- *Protect coastal habitats, communities and infrastructure, and mitigate impacts from climate change*

Mangrove regulations (Statutory Instrument 52 of 1989) are provisioned under the Forest Act, and amendments were prepared in 2010 for the Cabinet's consideration and approval. To dates, the recommended amendments have not been approved by Cabinet. These regulations are monitored, administered, and enforced by the Forest Department. Broad provisions of the Act are as follows:

- *There will be no alteration of any mangrove on public or privately owned land unless a special permit is issued by the Forest Department. To obtain such permit a non-refundable fee must be paid which is dependent on the amount of mangrove desired to be*

altered. Also the Department is within its rights to impose restrictions on the percentage of mangrove that may be altered pending a site visit.

- For larger extractions, the Forest Department may warrant a complete environmental assessment of impacts associated with removing mangrove. Pending a review of the results, the Forest Department may issue or deny the permit.*
- Permits will be rarely issued or difficult to obtain in priority areas*
- Removal of mangrove without a permit may result in fines not in excess of ten thousand dollars or imprisonment not exceeding twelve months.*

More recently, mangroves have been identified as an ecosystem that provides important benefits for people. They are a potential deterrent to the effects of climate change because they are carbon sinks for greenhouse gases, and they also provide protective services for Belize's vulnerable coastline against intense cyclonic activity. The results of the InVEST Coastal Protection model suggest that currently, 337 km² of land is protected by coastal habitats, such as mangrove forests, sea grass beds, and coral reefs. Additionally, the results suggest that in the Central region, mangroves and coral reefs currently protect the most land in the event of a Category 1 hurricane in the Central region, followed by the Northern, South Northern, Southern Regions and Turneffe Atoll (**Fig. 21**). These regions are large and encompass an extensive area of coastal habitats. These results suggest that if coastal habitats were destroyed, all coastal planning regions would suffer from erosion, with the most loss occurring in the Central region. The InVEST Coastal Protection model suggest that the Conservation scenario would have the greatest area of land protected, followed closely by the Informed Management Scenario. In many of the regions, the Development scenario may lead to less than half the area of land protected under the current scenario (**Fig. 21**).

Currently, mangroves, coral reefs and seagrass beds provide shoreline protection services with an average annual value of BZ \$50.4 billion per year in potentially avoided damages as per InVEST Coastal Protection model results (**Fig. 22**). In a Conservation scenario, 364 km² of land will be protected by coastal habitats. Mangroves and coral will provide shoreline protection services with an average annual value of BZ \$61.3 billion per year in potentially avoided damages. On the other hand, under a Development scenario, 217 km² of land will be protected by coastal habitats. Mangroves and coral will provide shoreline protection services with an average annual value of BZ \$71.5 billion per year in potentially avoided damages.

InVEST Coastal Protection results also suggest that the Informed Management scenario would result in the highest coastal protection value because it combines both conservation of coral reefs, mangroves and seagrass, which provide protection, and increased development which leads to higher value property that these habitats would be protecting. A total of 352 km² of coastline would be protected by coastal habitats. Mangroves, coral and seagrass would provide shoreline protection services with an average annual value of BZ \$104 billion per year in

potentially avoided damages through reduced erosion and storm damage. Furthermore, InVEST results suggest that the Central Region, South Northern Region and South Central Region are likely to have the highest coastal protection value in the Informed Management scenario. The Informed Management scenario blends strong conservation goals with national economic development needs, and these regions are places where habitats provide significant coastal protection services for high value coastal property. Additional information on how this model works can be found in **Appendix B.5**.

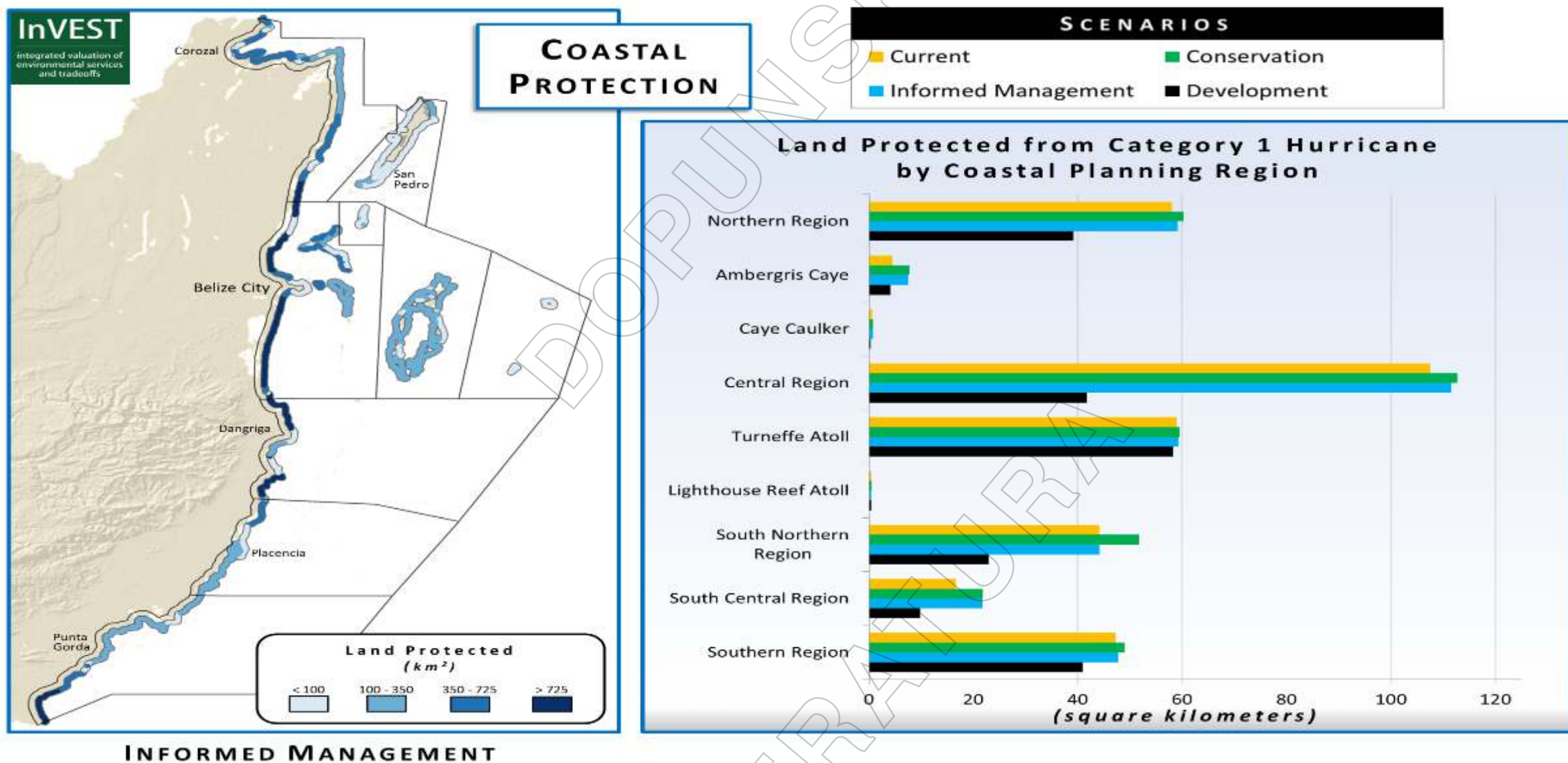


Figure 23: Protection of Coastal Lands from Category 1 Storms by Scenario

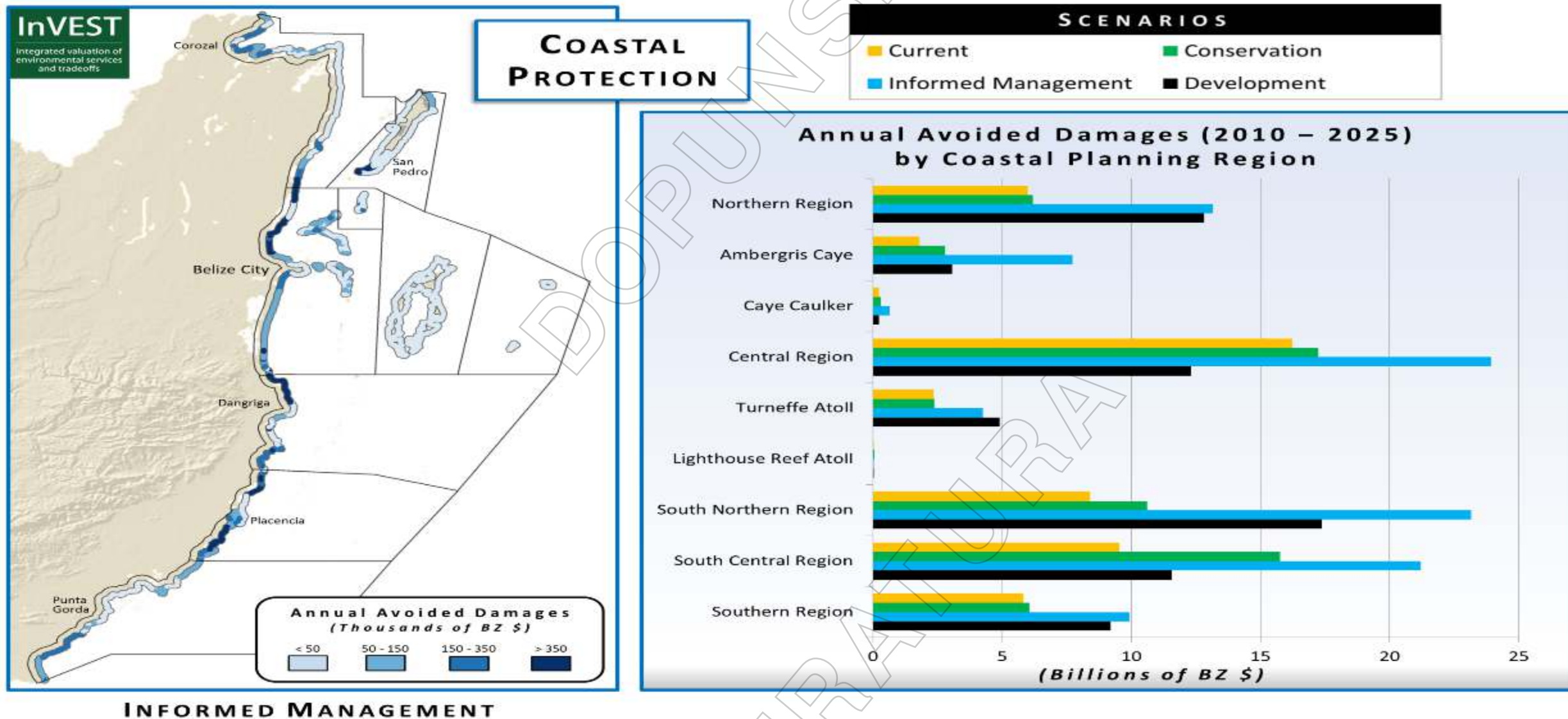


Figure 24: Annual Value of Avoided Damages to Coastal Lands by Scenario

Actions

- Advocate for adoption of revised Mangrove Regulations
- Implement mangrove restoration projects as a means to mitigate the effects of climate change, and to ensure the delivery of coastal protection services especially in areas, such as the Central and Southern region of Belize, which are highly prone to erosion and inundation
- Develop an inventory on Belize's mangrove cover and distribution, which should be updated on a bi-annual basis
- Identify areas for mangrove conservation
- Conduct research to better capture the biomass, coverage, spatial distribution and rates of change for mangroves in Belize, and make this information available to support decisions on the issuing of mangrove alteration permits

1.04 COASTAL HABITAT AND SPECIES CONSERVATION

Increased development activity and extreme weather events due to global climate change have led to increased loss or damage of coastal habitats in Belize. Habitats most at risk include mangroves, sea grass beds, wetlands, shorelines, and coral reefs. These ecosystems are affected directly by development through dredging, effluents, and sedimentation as well as natural events, through inundation, erosion and increased temperature. More recently, Belizeans have become proactive in their efforts to restore habitats at risk. For example, in 2011 the World Wildlife Fund (WWF) Belize Office launched a mangrove restoration project for Belize in which they identified areas in need of restoration. Another component of this project was to determine optimal growth conditions in order to ensure seedling success. Vernon Consultancy and WWF also successfully launched a mangrove restoration project for the Placencia Peninsula in 2011. Protecting habitats at risk is not limited to restoration activities. Often times, sound management principles can help to reduce risks to habitat before they become a cause for concern.

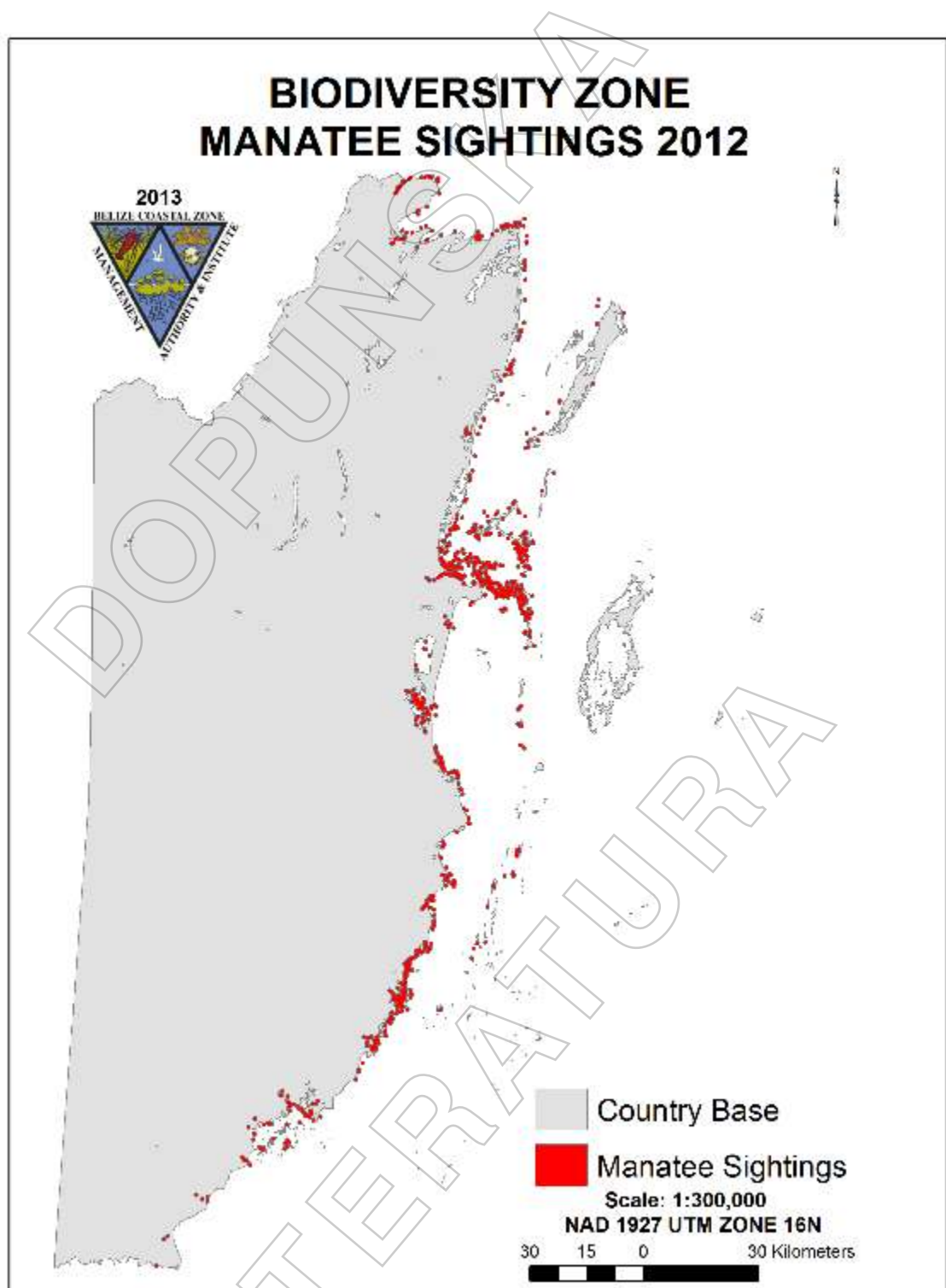
Although there is no way to prevent effects due to weather, the government should work towards identifying and penalizing individuals that contribute to the growing risk to habitats. Whether an offence is committed as a result of non-compliance or mere negligence, the government should impose harsh penalties on violators. Only in this manner will Belize ensure the sustainability of these habitats for future generations of Belizeans.

Reducing the loss of these habitats will ensure the survival of the many threatened and commercially important species present in Belize. Some of these species include manatees, crocodiles, marine turtles, and dolphins (**See distribution Maps 1-4**). These species are protected under the Fisheries Act, Chapter 210, Statutory Instrument 66 (2002), which is enforced by the Fisheries Department.

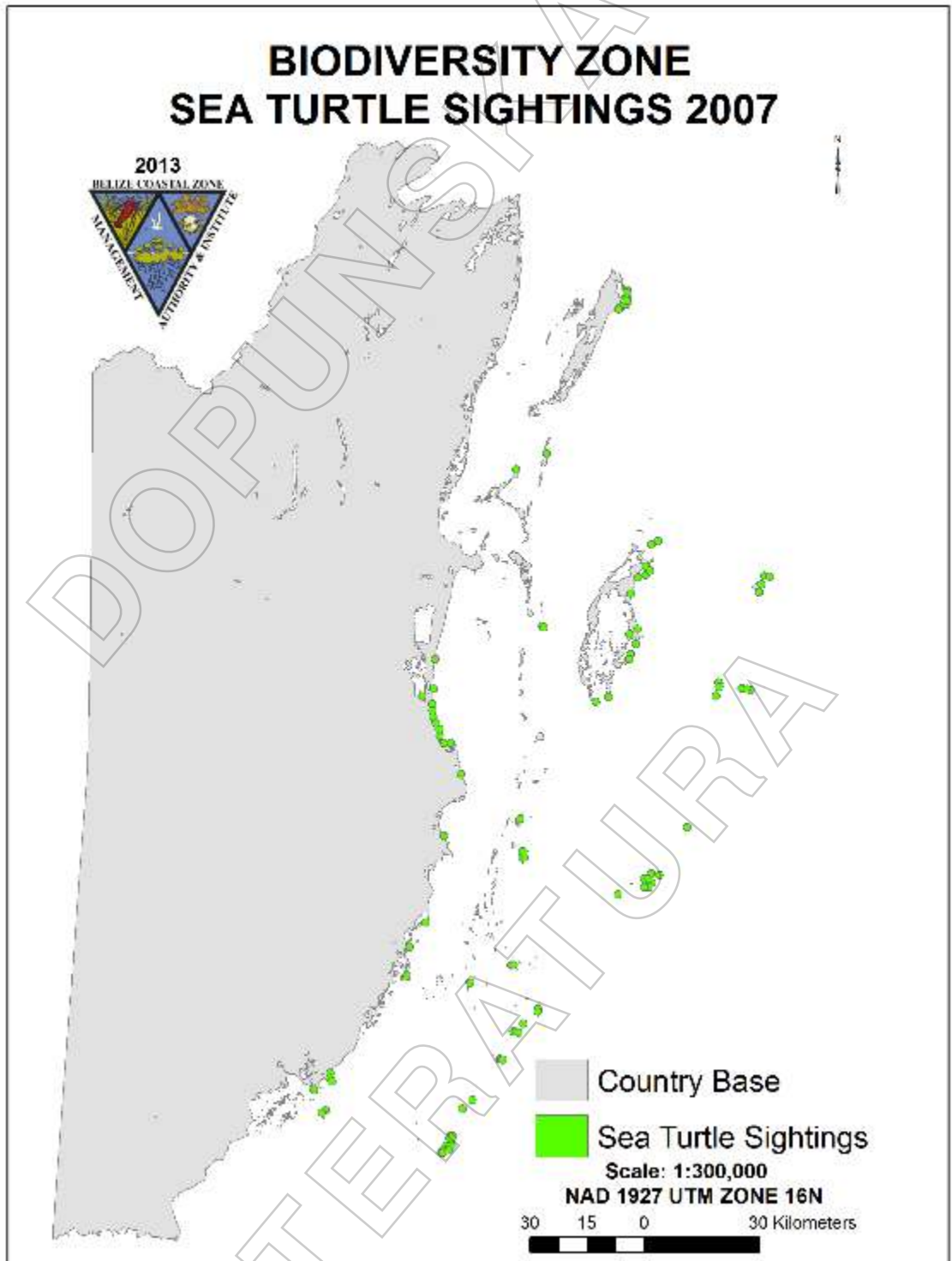
The following is a list of the primary organizations that monitors threatened or commercially important species in Belize:

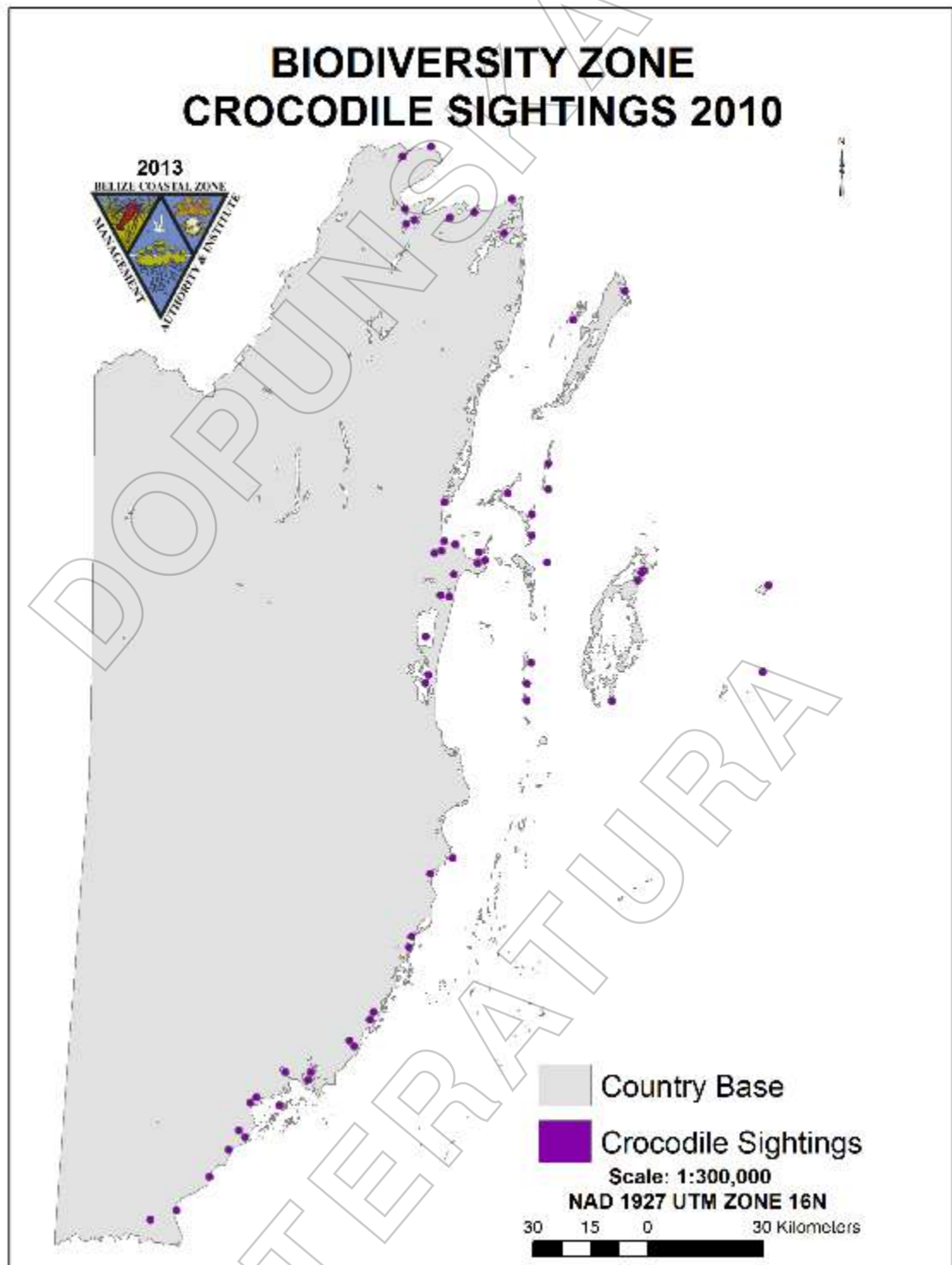
Agency	Species
Belize Fisheries Department	Fisheries resources
Belize Audubon Society	Migratory and Coastal Birds (Booby Bird, Jabiru Stork)
CZMAI/Sea to Shore Alliance	Manatee
Oceanic Society/MAR Alliance	Sharks, Crocodiles, Dolphins
ECOMAR	Marine Turtles
Wildlife Conservation Society	Sharks

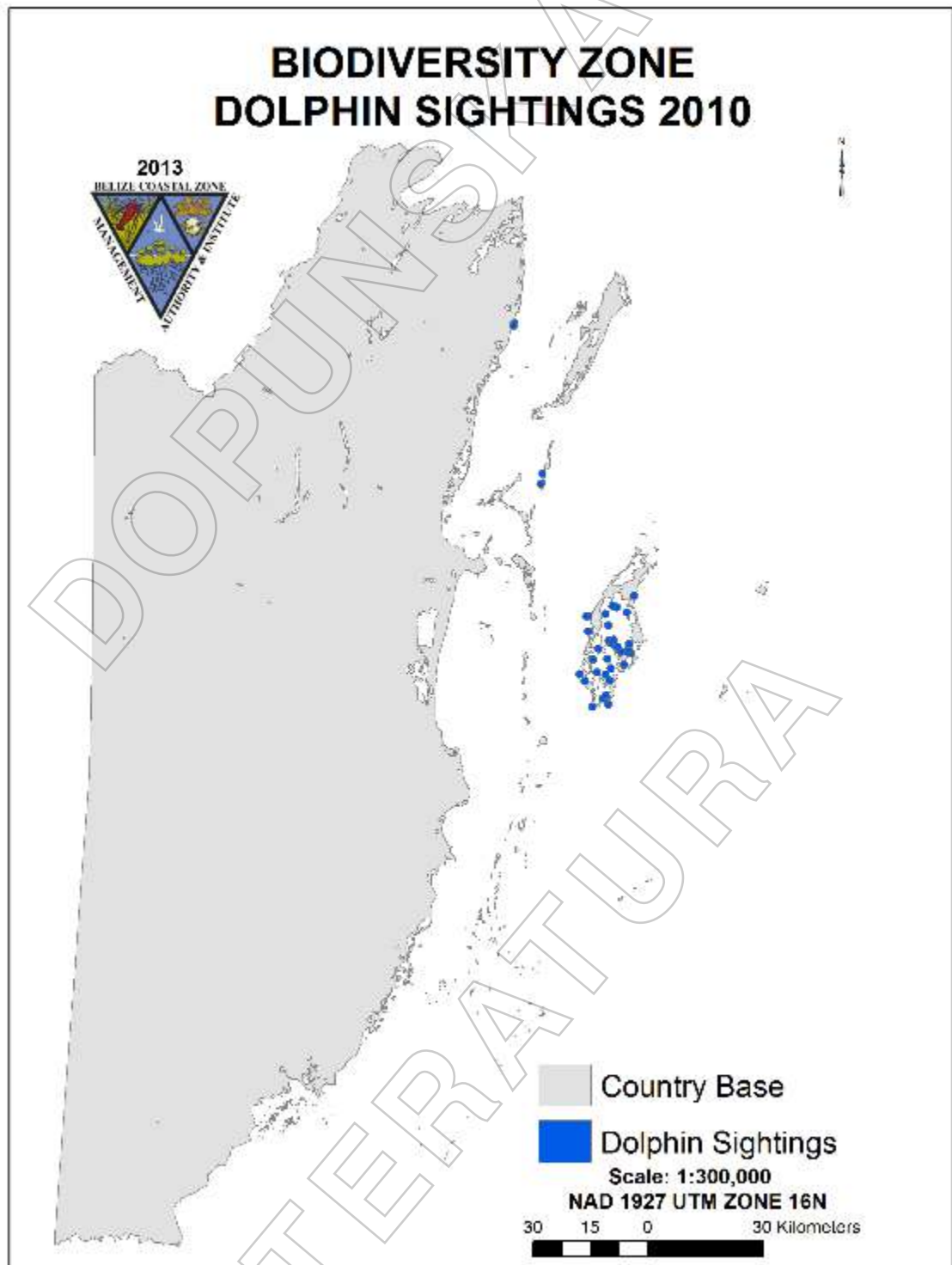
These species all have demonstrated importance to the Belizean society, in terms of social, cultural and economic values. Belizeans take great ownership and pride in being the last stronghold for endangered species such as the West Indian manatee (Auil-Gomez 2012). Also, these species have contributed to Belize's international recognition as an ecotourism destination.



BIODIVERSITY ZONE SEA TURTLE SIGHTINGS 2007







Actions

- Conduct an inventory of potentially resilient critical habitats/areas that could benefit from restoration programs and long-term monitoring
- Preserve critical nesting sites and foraging areas
- Decrease development activities near fragile ecosystems
- Restore mangroves, especially in areas that are most vulnerable to erosion and inundation
- Replant sea grass in areas that have been dredged
- Establish a fund that is dedicated to national restoration projects.
- Increase public awareness about the importance of threatened species to Belize and Belizeans to encourage the promotion of the species within the coastal area of Belize

1.05 INVASIVE SPECIES MANAGEMENT

An invasive species is defined as “any species (plant, animal or other organism) that is non-native to an ecosystem whose introduction causes or is likely to cause economic, social or environmental harm” (USDA 2012). In Belize, several species have been introduced, either accidentally or deliberately, into the environment and have caused notable negative ecological effects. If left unmanaged, these species can also have severe economic and ecological implications.

Since the threats from invasive species are present within the environment, management options have to be low impact. Therefore, very sound decision-making is required, which can only be achieved by building a knowledge base on the species. Although there are many invasive species identified in Belize, only those of increasing concern for the coastal zone are mentioned in this section.

Lionfish

The introduction of lionfish (*Pterois miles* and *Pterois volitans*) to the temperate and tropical Atlantic region is considered as one of the greatest threats to current reef systems, and associated biodiversity. Lionfish were first observed in this region off the coast of Florida in 1985 (Morris & Atkins 2009). By 2012, lionfish have successfully colonized the south-eastern United States, the Caribbean and Gulf of Mexico (USGS 2012) and are expected to expand their spatial range to South America within the next few years (Morris 2012).

Their success in occupying a wide range of habitats is attributed to their:

- Very broad diet, consuming an array of smaller fish species
- Wide habitat preferences including reefs, mangroves (Barbour et al. 2010) and sea grass beds (Smith 2010)

As a result, lionfish have quickly become a top predator on most reef system due to its aggressive behavior and predation on the eggs of other predatory reef species. Impacts associated with the spread of lionfish include:

- Disruption of food web (Albins 2012)
- Reduction in stock-rebuilding efforts by economically important reef fish due to competition for food and space requirements (Morris & Atkins 2009)
- Increasing the mortality rate of species of conservation concern, such as Groupers (Albins 2012)
- Increasing the rate of degradation of reef systems due to additional stress (Côté and Green 2012)

In Belize, lionfish were first sighted and captured in December 2008. As a response to their existence in Belizean waters, a Lionfish Committee was established in early 2009. This

committee was a sub-committee of the Belize National Coral Reef Monitoring Network (NCRMN). Immediately after its formation, the Committee initiated a process to address and manage the problem. One year later, the Belize Lionfish Project was launched, an initiative to promote a nationwide public awareness campaign, and to increase the capacity of the NCRMN to better manage lionfish. The project is being implemented by ECOMAR, in close collaboration with the Belize Fisheries Department, and with grant finding from the UNDP/GEF Community Management of Protected Areas for Conservation (COMPACT) Programme. A lionfish management plan for 2009-2012 was prepared to help guide the management activities of the Belize Lionfish Project. Between 2009 and 2010 alone, a total of 2635 Lionfish were captured throughout the expanse of the elaborate reef system in Belize (Majil 2010). Many juvenile Lionfish have also been captured, which is an indication that they are successfully reproducing. It is believed that the extent of colonization of Belizean waters is much greater than is currently estimated as lionfish have been sighted at depths not originally believed to be occupied by the lionfish (Searle 2010). The lionfish management plan has been updated for the period 2013-2017. Additionally, new markets have been created with the restaurants in Ambergris Caye, Caye Caulker, Placencia and Belize City. Also there is an effort by the National Cooperative to buy Lionfish fillets and sell to the local markets. Finally, there has been a push by Blue Venture, an international NGO, to use the colorful fins and spines to make jewelry. This in effect has created another market using this species and is being targeted towards women in smaller communities.

Actions

- **Update the Belize National Lionfish Management Plan on a regular basis (every 3-4 years), to include any new mechanism/protocol to monitor and suppress Lionfish populations in Belize. Mechanism must also be included to determine success.**
- **Expand the market for Lionfish consumption as a means to manage the lionfish population while providing an alternative**
- **Permanent removal of Coconut Trees near prominent Booby Bird nesting grounds on Half Moon Caye**
- **Conduct feasibility studies and eradicate invasive rat population at Half Moon Caye**

Rats and Coconut Trees

Although considered a common social pest, the introduction of rats (*Rattus rattus spp.*) to Half Moon Caye Natural Monument has had a profound effect on the ecology of this World Heritage Site. Specifically, rats have been reported to consume the eggs of the endangered Red-footed Booby birds (*Sula sula*). Reports of rats at this site began as early as 1959, and the population has grown exponentially since that time (Waight & Lumb 1999). Although their introduction to Half Moon Caye is not definitively known, it is believed that rats were accidentally introduced to the island via cargo vessels during the 1800's. There have been several attempts to rid the island of rats, including a campaign using the poison "Warfarin" in 1969. However, all attempts to rid the island of rats have been unsuccessful.

The success of rats on Half Moon Caye can be attributed to the flora and fauna on the island. Their diet consists of the eggs of the Red-footed Booby birds, the Belize Atoll Gecko (*Phyllodactylus insularis*), and coconut fruits. In addition to providing food, the thick blanket of fallen dry fronds and leaves from coconut trees provide shelter. The increasing population of the non-native coconut trees at Half Moon Caye is also of great concern as they are rapidly replacing littoral forest that provides nesting sites for the Red-footed Booby. Due to their short reproductive periods and readily available food supply, complete eradication of rats is a fruitless management strategy. If not fully eradicated, rats are capable of re-colonizing an area very quickly. This, in addition to encroachment on nesting habitats by coconut trees, is placing the future of Boobies under continuous pressure. Currently, the Belize Audubon Society (Co-managers of Halfmoon Caye and Blue Hole) are conducting feasibility assessments and eradication efforts through a consultant. Their hope is to rid the island of these pests with minimal ecological damage.

1.06 FISHERIES MANAGEMENT

Fisheries resources in Belize are under pressure from unsustainable fishing practices, increased fishing effort and illegal poaching. The Fisheries Department is the regulatory body responsible for all aspects of marine resource utilization in Belize. Their powers extend from the regulation of licenses for fishing and aquaculture operation, to managing marine protected areas. Therefore their regulations encompass all aspects of aquatic and marine flora and fauna. A brief summary of the major constructs of the duties and responsibilities of the Fisheries Department as mandated within the Fisheries Act are as follows:

- *The Department is responsible for enforcing restrictions surrounding all flora and fauna within established marine reserves.*
- *A research permit issued by the Fisheries Administrator is required before any research activities can take place.*
- *Fines and penalties are levied on offenders who breach fisheries regulations pertaining to the size, season, amount, or type of specific, protected commercial fish species.*
- *Bio-research and bio-prospecting require a permit that is issued depending on the impacts of such activities.*

Since its passage in 1948, the latest amendment to the Fisheries Act and its Regulations was in 1989. In late 2010 the Fisheries Department, with support from the Wildlife Conservation Society, initiated the process to review and amend the existing Fisheries Act with the goal of long-term sustainable use and management of fisheries resources. The resulting *Aquatic Living Resources Bill 2012* (draft) now renamed “*Fisheries Resources*” Bill 2015 will incorporate modern conservation and management principles, compliant with international laws and conventions. Provisions within the proposed legislation include:

- Sustainable management of fish and fish stocks
- Promotion of inter-sectoral participation
- Elimination of overfishing and harmful fishing practices
- Data collection and management
- Effective enforcement of compliance with conservation ideals
- Improvement of the welfare of the fishing community

In terms of fisheries resources, the Spiny Lobster (*Panulirus argus*) is the most important fishery commodity fished in Belize (Gongora, 2012). However, there has been a decrease in lobster catch over the past twenty years resulting from overexploitation. Further decline in the production of this fishery commodity and the decrease in price for this product in the international markets could have dire effects on the fishing community and other sectors that depend on this fishery (Gongora 2012). One of the mechanisms through which the Belize

Fisheries Department hopes to increase the numbers of Spiny lobster (among other commercial species) is by increasing the percentage of “no take” zones through the marine protected areas mechanism and by implementing the managed access program in all MPAs. Prior to this the fishing industry worked within an open access fishery, which allows anyone with a commercial fishing license access to fish anywhere in territorial waters except for areas designated as “no take”. With managed access in place, the number of fishermen allowed to fish within the marine reserves is limited to fishermen with their managed access license. The licenses are specific to a certain area and as a part of holding a license fishers are required to report catch data. This mechanism thereby controls the amount of fishers in a given MPA and also collects vital data to needed determine total catch, catch per effort, and diversity which contribute to determining quotas for various commercial species.

The total spiny lobster fishing area for the country is approximately 4,512 km² as calculated using GIS. The InVEST Spiny Lobster Fishery model estimates 0.52 million lbs of lobster tail are caught in the current scenario (2010) and that exports generated revenue of approximately BZ \$16.4 million (**Fig. 23**). These modeled results align well with observed data reported by the Belize Fisheries Department of 0.61 million lbs of tail caught in 2011 and a total revenue of BZ\$16.85 million (Gongora 2012). The results also suggest that the planning regions across the country contribute different amounts to this catch and revenue, with the greatest proportion of lobster currently caught in the Central Region (about 400 lbs annually) followed, by Turneffe Atoll, Ambergris Caye and the Northern Region.

The returns from lobster fishing also differ among future scenarios, with the model forecasting highest catch and revenue in a future similar to the conservation scenario and lowest for the development scenario. In the Conservation scenario, the catch is forecasted to increase to 0.76 million lbs and generate revenue of BZ \$24 million by 2025 (**Fig. 23**). Under the Development scenario, the catch would decrease to 0.079 million lbs and generate an annual revenue of only BZ \$2.5 million by 2025 (**Fig. 23**). However, InVEST results suggest that the Informed Management scheme would increase the catch to 0.68 million lbs, an increase of nearly 25% relative to the current scenario, and generate revenue of BZ\$ 21.3 million by 2025 (**Fig. 23**). The increase in catch and revenue in the conservation and Informed Management scenario results from lower degradation of mangroves, corals and seagrass, which are essential for lobster nursery and adult habitat, through reduction in the area of these habitats at risk from multiple human uses. In particular, InVEST results suggest that through lowering risk to habitat degradation lobster catch and revenue could nearly double in Ambergris Caye under the Informed Management scenario. Additional information on how this model works can be found in **Appendix B.4**.

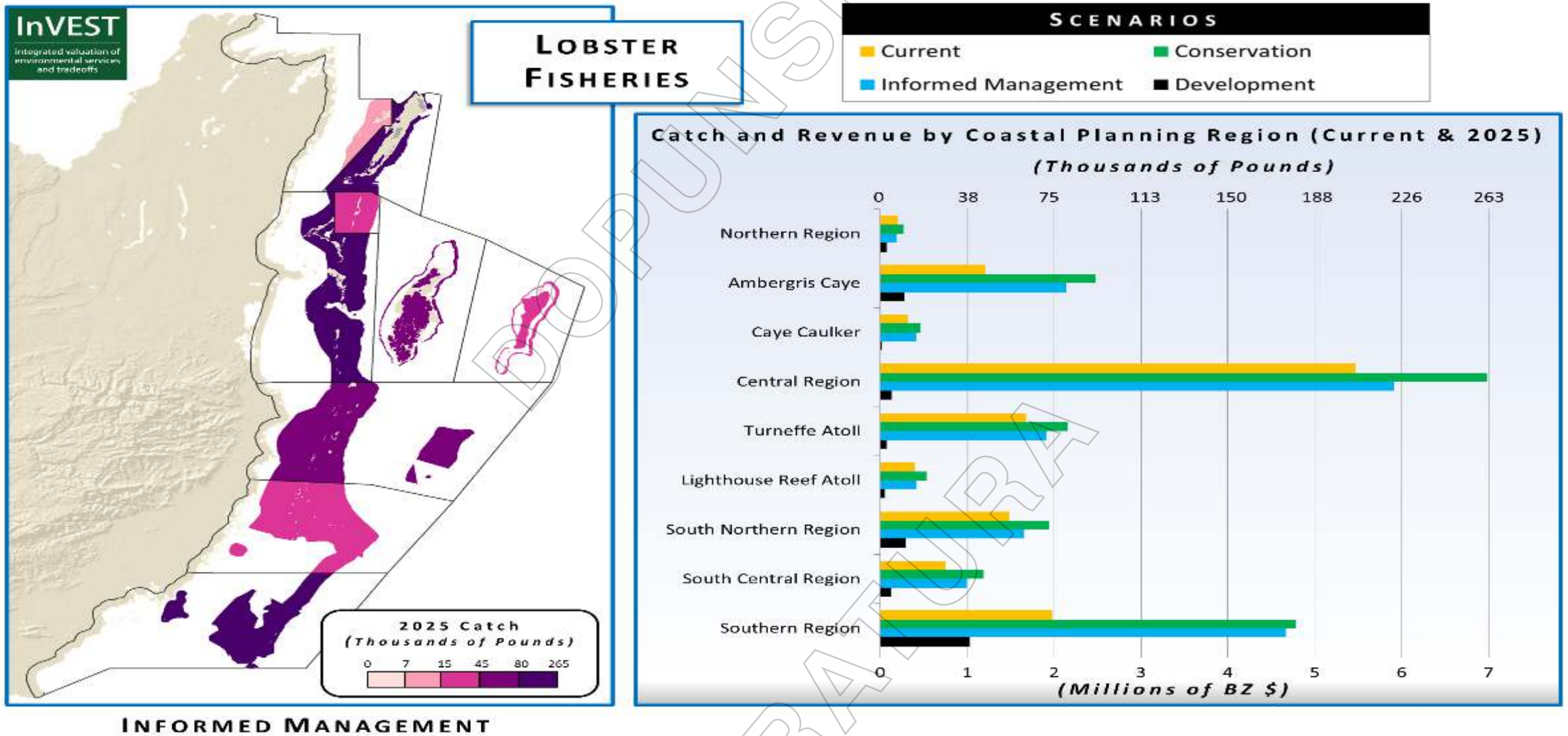


Figure 25: Lobster Fisheries Catch and Revenue by Scenario

Actions

- Strengthen the fisherfolk licensing system through the establishment of standards
- Implement national roll out of Managed Access Program in all Marine Protected Areas.
- Secure resources to permit increased monitoring and data collection at the various landing sites along the coast of Belize to help in the sustainability and conservation of commercially important species
- Monitor quotas to ensure full compliance

1.07 COASTAL AGRICULTURE

Agriculture in Belize accounts for over one third of the labour force in Belize. It is one of the country's leading contributors to the GDP. It is also one of the key terrestrial activities that are influencing coastal zone processes through siltation, eutrophication, and both point and non-point pollution with a growing number of pesticides, hydrocarbons, heavy metals and faecal material from livestock (CZMAI 2012). Cumulative water extraction and diversion to feed large-scale crop production such as banana farms are also affecting coastal sediment transport dynamics. This occurrence is being observed in southern Belize whereby the huge volumes of water being diverted away from the Monkey River have affected sediment transport to the extent that the shoreline from Monkey River Village to Barranco Village is experiencing severe erosion (Galen University 2007).

During the past 15 years, agricultural activities within the coastline have been steadily increasing. Meerman (2012) notes that agricultural expansion, and by extension deforestation, has been most prominent in Northern Belize during 1998 to 2012 specifically in the Rio Hondo River, New River, Shipstern Lagoon and Belize River watersheds. With increased global demand for agricultural commodities, it is projected that agricultural production across Belize will increase incrementally, thereby also increasing nutrient and pollutant load in major watersheds that interact with the coastal zone.

There are several legislations governing agricultural activities in Belize including:

- Banana Industry Act (Statutory Instrument 43 of 1997):
 - *Establishes the Banana Growers Association and Banana Control Board who work toward further enhancement of the Banana Industry in Belize and also ensures pricing and operating procedures.*
 - *Sets regulations and restrictions on the exportation processes of each farm.*
 - *Set penalties for operating without proper permits.*
- Belize Agricultural Health Authority Act (Statutory Instrument 47 of 1999):
 - *Establishes the Belize Agricultural Health Authority as the agency responsible for ensuring food safety, quarantine, plant and animal health to safeguard and facilitate trade.*
- Land Utilization Act (Chapter 188, Laws of Belize, Revised Edition 2000):
 - *Outlines the allowed usages and practices on land slated for agricultural activities.*
- Meat and Livestock Act (Chapter 214, Laws of Belize, Revised Edition 2000):
 - *Appoints a Commission responsible for ensuring quality of livestock and issuing or permits.*
 - *Set regulations for owning and operating a ranch.*

In 2015, the Government of Belize along with the United Nations Food and Agriculture Organization (FAO) in collaboration with the Inter-American Institute for Cooperation on Agriculture and the Task force established by the Ministry Natural Resources and Agriculture drafted the National Agriculture and Food Policy for Belize 2015 – 2030. The document presents the elements of a Policy Incentive Framework and related Good Governance System for the Agriculture and Food Sector of Belize. The objective of which is *“to provide an environment that is conducive to increasing production and productivity, promoting investment, and encouraging private sector involvement in agribusiness enterprises in a manner that ensures competitiveness, quality production, trade and sustainability”*. The framework provides a platform to guide the development of actionable proposals to transform the agriculture and food sector into a modern pillar of economic growth and development in the country, with equity.

Actions

CZMAI recommends:

- Institute best management programs with agriculture and watershed stakeholders for the development and implementation of best management practices for agricultural land use in order to protect and maintain riparian forests
- Incorporate the prescription of minimum flow standard for major watersheds into the National Integrated Water Resources Act
- Monitor water quality for point and non-point pollution sources in the Rio Hondo River, New River, Shipstern Lagoon and Belize River watershed on a regular basis
- Finalize and implement the National Agriculture Food Policy for Belize

1.08 AQUACULTURE AND MARICULTURE DEVELOPMENT

The aquaculture industry made its humble beginnings with a shrimp farm project in southern Belize. Today the aquaculture industry has become one of the country's major foreign exchange earners and production has expanded to include Tilapia and Cobia farms in addition to the long-standing shrimp farms. The Fisheries Department, as provisioned in the Fisheries Subsidiary Act, was responsible for the issuing of licenses to developers wishing to own and operate shrimp farms in Belize. In order to obtain a license, an annual fee of \$1,000 Belize dollars must be paid annually (Gillett & Myvett 2008). However, in 2012 the mandate for the management of aquaculture has been divided between the Department of Agriculture and the Fisheries Department. The Department of Agriculture has the responsibility for land-based aquaculture, with major focus on developing freshwater aquaculture in Belize. The Fisheries Department, on the other hand, has responsibility for mariculture and any other related activities within coastal waters.

In a 2002, CZMAI and the Fisheries Department collaborated to prepare a National Aquaculture Policy and Zoning Plan for Aquaculture in Belize. This document has the following principles regarding a national policy for aquaculture development:

- Management should encompass broad geographic areas and should cross institutional boundaries: including Enhanced Sector Management, Integrated Coastal Zone Management, and Water Shed Management
- Development options should be evaluated on the basis of the costs or consequences, as weighed against the benefits to be derived from undertaking a certain activity or sets of activities: Assessments must include financial, economic, social and environmental evaluations
- Impacts of developments should be within the absorptive or regenerative capacity of nature, and that this issue should be integrated into development decisions: carrying capacity is used interchangeably with environmental capacity;
Best Management Principles should be exercised to assist the effective husbandry of aquatic stocks and conserve the environment.

From January 2014 to December 2015 shrimp farms in Belize worked towards attaining Aquaculture Stewardship Council (ASC) shrimp certification. This process was facilitated by the World Wildlife Fund and included Compete Caribbean and Belize Shrimp Growers Association. With ASC certification shrimp farms in Belize gain a competitive advantage in high-quality international markets since it demonstrates that shrimps were produced with minimal impact to the environment and communities where farms are located. Opportunities available from ASC shrimp certification include:

- Reduction of adverse environmental impacts through wetland and mangrove preservation, improved water and management, responsible use of feed, disease control and addressing biodiversity issues.

- Encourages improvements to coastal zone and fisheries management
- Future food security
- Improved social conditions
- Improved production methods and technology

With this certification, Belizean shrimp farms will set the standards for best practices in shrimp production and processing for this region. Enhancing the sustainability of the industry.

Actions

- **Update draft aquaculture policy and regulations to reflect Aquaculture Stewardship Council guidelines**
- **Formulate an Aquaculture Steering Committee, comprising of government, non-government and private sector stakeholders, to advise and guide planning future aquaculture development in Belize**
- **Implement incentive programs to support small-scale producers to support local economies and reduce pressures on wild fisheries resources**
- **Report on the status and performance of both aquaculture and mariculture developments annually**

1.09 MINERALS EXTRACTION AND ENERGY DEVELOPMENT

The Mineral Sector is governed by the Mines and Minerals Act, Chapter 226 of the Substantive Laws of Belize, Revised Edition 2000-2003, and the associated Regulations: the Mines and Minerals (General) Regulations, and the Mines and Minerals (Safety, Health and Environmental) Regulations. The Mining Unit of the Ministry Natural Resources is the lead agency with responsibility for enforcing the regulations. The scale and nature of the activity determines the type of Mineral Right the will be required. The most common Mineral Rights issued are as follows:

- *Quarry Permits (Renewed yearly)*
- *Mining Licenses (Maximum of 20 years or estimate life of deposit)*
- *Prospecting Licenses (Only granted for 3 years and has a 25 square kilometre limit)*
- *Reconnaissance Licenses (Only granted for 1 year and has a 50 square kilometre limit)*

In 2011, the Geology and Petroleum Department, in collaboration with the UNDP/GEF *Mainstreaming and Capacity Building for Sustainable Land Management in Belize Project* and the Forest Department under the pilot project *Rehabilitation of Scarred Landscapes* prepared the *Mineral Extraction Handbook*. The Handbook highlights procedures in the extraction process, the different methods that can be utilized, and steps to prepare an Extraction Management Plan.

The petroleum industry is relatively new in Belize with the first successful drilling operations commencing in June 2005 by the Belize Natural Energy. Since then, both terrestrial and marine areas have been parceled out to 18 companies under exploratory license agreements with the Government of Belize. These companies include:

BCH International Incorporated	PetroBelize Limited
BelGeo Limited	Princess Petroleum Limited
Belize Natural Energy	Providence Energy Belize Limited
Blue Creek Exploration Limited	RSM Production Corporation
Island Oil Belize Limited	SOL Oil Belize Limited
Miles Tropical Energy Limited	Spartan Petroleum Corporation
Northern Spirit Resources Incorporated	US Capital Energy Belize Limited
Perenco Limited	West Bay Belize Limited
ZMT International Incorporated	OPIC Resource Corporation (abandoned)

Companies are given an eight year exploratory license, and if oil is found during that period, a twenty-five year period for commercial exploitation. However, if no oil is discovered during the exploratory period the contract self-terminates and operations must cease. Importantly, it must also be noted that oil concessions may change with the ruling of the court.

In February 2010, an oil concession map was released by the Geology and Petroleum Department which confirmed that parcels were being issued throughout Belize, including marine reserves and national parks (Oceana 2010). This sparked a nation-wide campaign to ban drilling in these areas led by the Belize Coalition to Save Our Natural Heritage and OCEANA Belize. There was also strong support for the campaign from the tourism and fisheries sectors whose major concerns included:

- Risk from shipping and pipeline accidents
- Increase in marine traffic over sensitive marine ecosystems
- Legal framework is lacking and must be reviewed
- Effects on migratory fish stocks
- Effects on aesthetics of the coastal and marine areas
- Lack of assessments to determine the value of the coastal resources at risk
- The ability of government agencies to respond to oil spills.
- Lack of transparency and accountability in granting oil contracts
- Revenues from the current petroleum operation are being absorbed by the government contrary to government's commitment to its usage to alleviate poverty.
- Additional pressures on the Belize Barrier Reef System

To date, there exists no oil spill response legislation, however a response mechanism has been put in place to deal with a spill event at sea, whether from oil exploration activities or transportation of oil products via bunkers or hydrocarbon cargoes. The Department of the Environment has conducted numerous oil spill drills and have included other government agencies to participate and receive training. . The Petroleum Act governs activities within the country of Belize and its main provisions are as follows:

- *The appointment of an Inspector of Petroleum who is authorized to issue or revoke contracts for the exploration of oil.*
- *Strict penalties for parties that conduct exploration activities without a permit.*
- *Designates the area in which exploration can be undertaken.*

The Geology and Petroleum Department is currently finalizing a National Petroleum Exploration Zoning Framework. This framework will guide exploration activities by establishing various zones based on environmental sensitivity. For each zone the type and extent of exploration activities is outlined. This includes type and scope of testing and requirements for permits. The higher the sensitivity of the area, the more stringent is the requirements. These zones will not include marine protected areas or the reef system as per a decision made by the Cabinet in December 2015.

Actions

- Prepare a sound National Emergency Preparation Plan for Oil Spills and Waste Oil Management
- Conduct cost-benefit analyses of developing a petroleum-based energy sector ,
- Identify viable alternatives to crude oil for energy generation
- Develop the scientific capacity and technical expertise to understand hydrocarbon behavior in the marine environment to assess spill behavior and patterns in order to inform practical spill response.

2.0 SUPPORTING INTEGRATED DEVELOPMENT PLANNING

Integrated resource use and development planning, both on land and in the sea, is a critical issue. This can be achieved by tightening the control on unplanned development through improved planning, co-ordination, legislation and regulations to reduce the impact of both marine and terrestrial development in coastal Belize.

2.01 COASTAL AREA PLANNING AND DEVELOPMENT

The coastal area of Belize has been targeted by local and foreign investors for the development of the public and private sectors. A majority of Belizean livelihoods are linked to coastal resources, which makes the task of managing and allocating its usage much harder. With the introduction of environmental legislation in the 1990's, the government of Belize began making strides toward sustainable use. The major provisions of the laws passed in the 1990's included the following:

- *Enforcement of the Environmental Assessment Process*
- *Establishment of the National Environmental Appraisal Committee, a body which reviews development proposals and determines whether environmental clearance should be granted based on the projected impacts.*

Most areas within the Belizean coastal zone are considered to be sensitive, and as a consequence, all development project proposals should be screened for their impacts on the environment. The Environmental Impact Assessment (EIA) process allows for proper screening of development proposals and project management during the implementation phases. **This process also helps to define specific development standards and limits of acceptable change for proposed developments.** These activities are accomplished through the active participation of the National Environmental Appraisal Committee (NEAC) that examines all possible scenarios of environmental impacts to the environment arising from proposed developments as well as assess the feasibility of the development for the developer. The EIA process also allows for project proposals to be viewed through many angles. For instance, a project may be small in size but its impacts may be great in scale. The overall cumulative impact of an additional structure to an area may have significant implications of that area's capacity to support additional footprints. The Environmental Compliance Plan prepared for projects that have received environmental clearance is legally-binding contact between a developer(s) and the government that lends itself to accountability and mitigation of undesired negative environmental impacts. The informed management zoning scheme for coastal development in this Plan, identifies suitable areas that could be developed by potential interested parties. Investment in these areas should be transparent, giving the investor all the proper information needed to sustainably develop his/her land in an informed manner. The region specific coastal zone management

guidelines contain development standards and are intended to support the NEAC who oversees the EIA process.

Recently, the government has sanctioned several projects geared towards ensuring sustainable development and usage of Belize's land resources. Included in these efforts are coastal lands, cayes, and atolls. The three main planning initiatives include The Belize Land Use Policy Framework, National Sustainable Tourism Master Plan for Belize 2030 and the Belize Integrated Coastal Zone Management Plan. The purpose and anticipated outcomes of the Belize land Use Policy Framework and National Sustainable Tourism Master Plan for Belize 2030 are highlighted below:

Belize Land Use Policy Framework

In November 2011, the cabinet endorsed the Belize Land Use Policy and Integrated Planning Framework during a regular cabinet session. The Land Use Policy Framework is the response by government to the growing demand for access and usage of land throughout the country. The three main components that were approved by Cabinet include:

- *National Land Use Policy – sets out the principles on which land development should be undertaken*
- *Integrated Planning Framework – sets out the process in which the policy will be implemented through interagency cooperation.*
- *Land Suitability Mapping System – a dynamic GIS toolkit containing information that makes resource data layers available that reflect the provisions of the Policy. Intended usage is for national and community level development planning.*

National Sustainable Tourism Master Plan for Belize 2030

The National Sustainable Tourism Master Plan for Belize 2030 is government's actions to ensure the sustainable development of the tourism sector. This Plan consists of several major components, which include a diagnostic of the tourism sector, destination-level planning and associated implementation programs. Destination-specific planning for major tourism destinations in Belize are as follows:

- Belize City – Urban Renovation
- San Ignacio – Promoted Tourism Growth
- Placencia Peninsula – Contain Development and Consolidate
- Stann Creek – New Development
- Ambergris Caye – Contain Development and Consolidate
- Northern Belize – Promote Tourism Growth
- Southern Belize – Promote Tourism Growth
- Belize Reef – Contain Development and Consolidate

Actions

- Implement the spatially-explicit Informed Management integrated planning zoning presented in this Plan. This zoning scheme is in tandem to other existing land-use planning initiatives
- Support the continued partnership and liaison with coastal advisory committees (CACs) and relevant planning agencies as a basis for regional coastal area management planning
- Undertake revisions of regional coastal area management guidelines on a regular basis in consultation with CAC's, Technical advisory Council, and relevant planning agencies.

2.02 COASTAL POPULATION AND GROWTH

Across the globe, coastal regions are quickly becoming home to a large proportion of the world's population. Studies have shown that almost 50% of the world's population resides within 100 km of the coast, and researchers predict an increase of about 35% from 1993 to 2025 (Small & Nichols 2003). Similarly, almost 40% of the population of Belize is concentrated in population centers along the coast or on the cayes. The InVEST Coastal Vulnerability model results indicate that currently, the Corozal and Belize Districts are the coastal areas of highest vulnerability to flooding and erosion from storms, which are also the most concentrated population centers along the coast (**Fig. 23, Fig 24**). InVEST results also suggest that under each of the three future scenarios of Conservation, Development and Informed Management, these vulnerability of communities will remain relatively high (**Fig.23, 24**). Additional information on how the Coastal Vulnerability model works can be found in **Appendix B.2**.

The vulnerability of communities to coastal hazards has severe social and economic implications such as:

- Increased exposure to the effects of sea level rise increases, putting a large proportion of the population at risk
- Higher population densities increases the pressure placed on the marine/coastal environment through sewage and waste disposal
- Urbanization of coastal areas introduces extensive development, which has associated negative effects on marine and coastal ecosystems
- Tourism can lead to unsustainable coastal development such as infrastructure built on the shoreline. In Belize City, cruise ships discharge waste water into the marine and coastal environments, causing eutrophication of sensitive habitats marine ecosystems
- Decrease in fish stocks as a result of over fishing

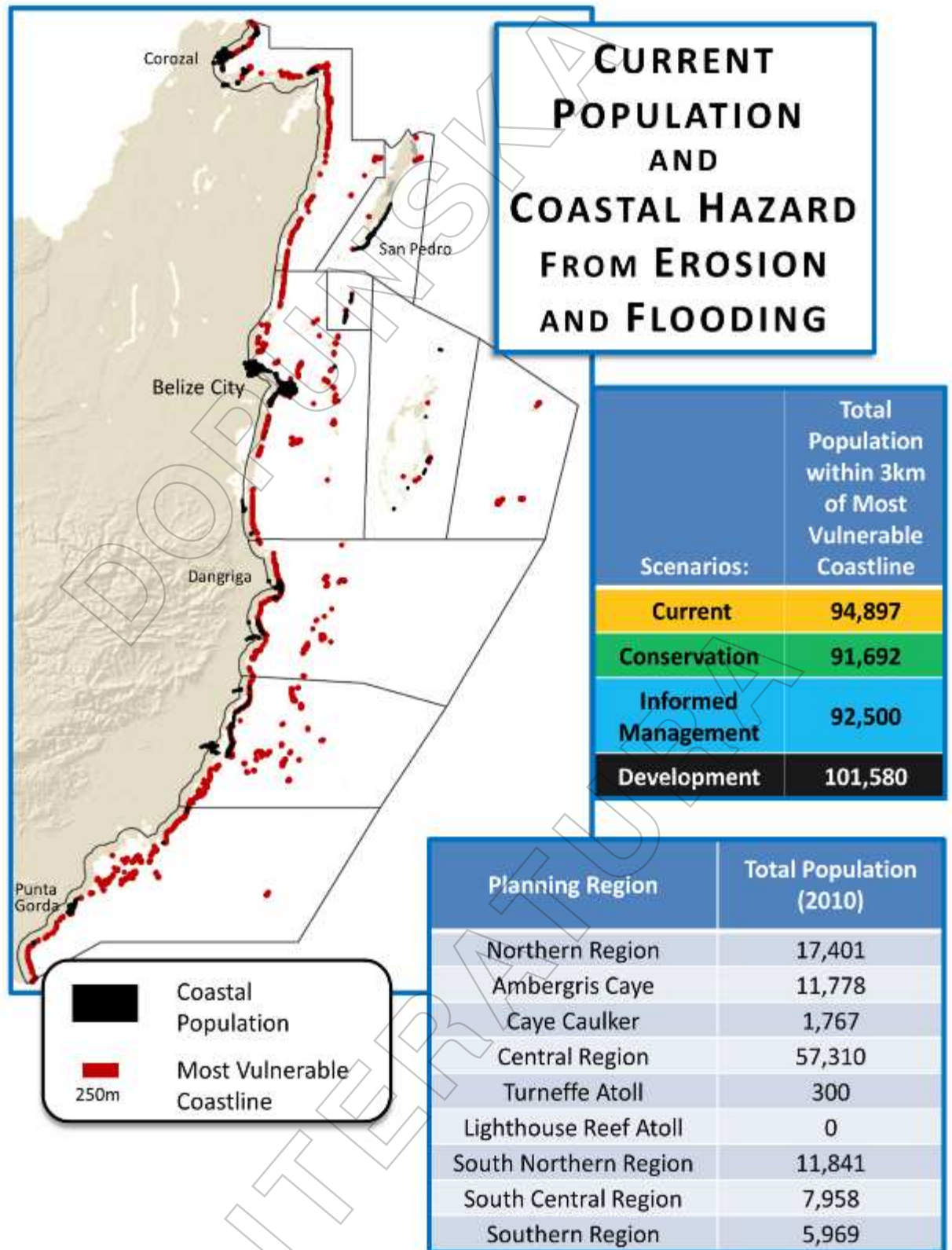


Figure 26: Vulnerability of Communities to Coastal Hazards by Scenario

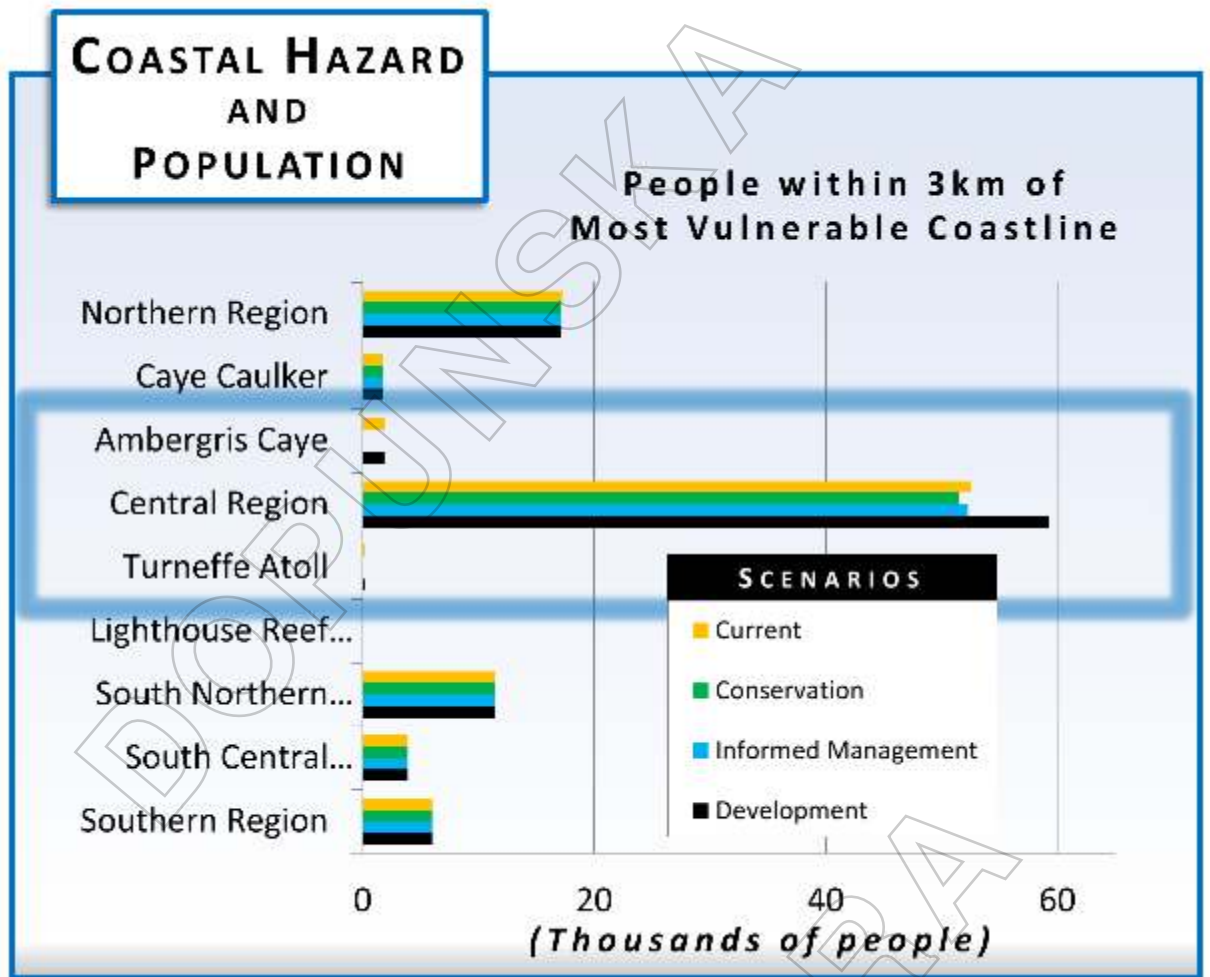


Figure 27: Coastal Regions within Most Vulnerable Coastline by Scenario

The Government of Belize has recognized that the growing threat of climate change to the future of Belize is looming and has taken steps to encourage preparation for anticipated effects. Through the forthcoming amendments to the existing National Climate Change Adaptation Policy (2008), the government will take steps to ensure that all sectors incorporate adaptation planning into their management plans. Also, through the continued strengthening of the protected areas management system, the government is promoting ecosystem-based adaptation, which is the most cost-effective and reliable approach for climate change adaptation since the country possesses resilient ecosystems.

With a population growth rate of 2.011%, Belize can expect that in the near future more than half of the population of Belize will be settled along the coast of Belize. The following are potential steps that CZMAI recommends as worth developing in order to minimize the exposure of coastal communities and the fragile ecosystems that support them to coastal hazards in the future:

Actions

- Undertake initiatives to relocate people who are settled in vulnerable areas, as a precaution against the effects of climate change
- Diversify income generation options to reduce the number of people who rely on the coastal resource base to support their income
- Implement proper building standards set and setback distances
- Limit exponential growth and expansion of communities within 3km of the coastline with high vulnerability to coastal hazards, such as the Central region, which includes Belize City, and the Northern region
- Conduct regular vulnerability assessments of the coastal area in order to understand and to assess the effectiveness of climate adaptation strategies

2.03 BEACH AND SHORELINE MANAGEMENT

Next to the reef and lush tropical forests, the beaches and shoreline of Belize are one of the most iconic features that characterize Belize. They embellish the notion of life in the tropics, and serve as an attraction for tourists around the world. As a result of its multiple uses and prestige, beach and shoreline property have become highly coveted. Consequently, many conflicts and competing interests have resulted between and among stakeholders regarding the use of beaches and shoreline property. Examples of such conflicts include:

- Public access to beaches
- Sale of shoreline and beach properties to foreigners
- Pier construction
- Development in shoals
- Unnatural impacts to beach dynamics and processes, such as dredging and coastal erosion

Setbacks

Setbacks are transitional zones that buffer the effects of human activity from the natural processes of the coastal area. They are important for maintaining the integrity and stability of the shoreline in its natural state. The Government of Belize, through the National Lands Act, has prescribed a vegetative buffer of 66 ft on all national lands that adjoins water bodies outside of a city town or village. However, even though this standard is set, a look at development today suggests that it is not enforced as many structures have been constructed up to the shoreline. Inclusion of setbacks in construction would allow for natural resilience to the effects of global climate change, and also allow public access to the beach.

Pier Construction

In 1999, the Physical Planning Section of the Lands and Survey Department produced a set of guidelines to standardize the construction of piers in coastal areas. The guidelines included provisions for the length, minimum separation between piers, and design as well as emphasized the need for proper illumination and public access. However, the guidelines were not adopted by cabinet therefore there is currently no legal policy to guide pier construction in Belize.

Pier construction requires a permit from the Lands Department. This must be distinguished from the environmental clearance process that must also be conducted by DEO prior to the issuance of the permit. Even if environmental clearance is granted, developers must receive permission from the Lands Department in order to use the sea bed. Additionally, the Belize Port Authority must also be consulted during this process in order to determine whether or not the proposed pier would disrupt the flow of marine traffic and/or obstruct turning bases.

Development within Shoals

Shoals are linear landforms within or extending into a body of water, typically composed of sand, silt or small pebbles. They are characteristically long and narrow, and develop where a stream or ocean current promotes deposition of granular material (Wikipedia.com 2012). In 2010, the Department of the Environment submitted a paper to cabinet recommending that development in shoals be banned. This recommendation was made on the basis that development in shoals poses the following environmental impacts:

- Impact to nursery grounds of commercial species
- Impact to the sport fishing industry
- Waste management concerns associated with development due to the porous nature of the shoal areas.
- Dynamic nature of shoal areas not suitable to support construction
- Increased footprint associated with obtaining materials to fill shoal areas

Subsequently, in 2011, Cabinet endorsed the recommendations by the DOE and has banned development in shoal areas. Specific recommended actions by DOE regarding shoals development are as follows:

- All processing of shoals applications be stopped immediately
- Caution to stop leasing or titling shoals
- A list of all shoals issued either as lease or title be compiled.
- The leases/titles of shoals identified within protected areas should be cancelled
- All sites outside of protected areas are assessed to determine feasibility for development
- For those sites, outside protected areas under processing, a committee be established to review all shoal applications prior to issuance of title or lease
- A rapid ecological assessment (REA) for existing shoals that have been leased or titled will be conducted at GOB's expense
- All new applications sites should be assessed at the investor's expense and MUST go through the committee

While the DOE has developed guidelines for over the water structures, the mandate for permitting the construction of these structures does not only fall under the DOE. The seabed is considered national lands under the National Lands Act. Thus, permission to build on the seabed must come from the Lands Department. Other key agencies such as the Belize Port Authority and the Central Building Authority must also be included to ensure construction is in line with their respective mandates/guidelines.

Shoreline Stabilization

Perhaps the most efficient and cost effective method of shoreline stabilization in Belize is by natural methods, via mangrove protection. It has been shown that mangroves stabilize shorelines with its intricate root system that holds soil together and buffers it against the effects of storm surge and other natural processes. Mangroves are among the ecosystems that are directly affected by development and therefore restoration projects should be encouraged in order to fully utilize their stabilization functions. Other methods of “soft” stabilization includes replanting native plants, creating an artificial slope, constructing armaments using natural features such as logs and digging trenches. The construction of manmade structures such as sea walls can also be used, but are discouraged because they cause isolation of the two environments - there are many negative impacts associated with the construction of such features on the marine environment.

Actions

- Implement restoration projects in Belize with increased investment by developers whose projects will remove vegetation that aid in shoreline stabilization
- Enforce and update national policy to govern the construction of piers, sea walls, jetties, groynes, harbor arms and other hard structures. This policy should encourage the use of soft shoreline stabilization methods
- Strengthen regulatory requirements for the full enforcement for setbacks governing activities related to commercial and/or residential development within the coast that considers the threat of global climate change and coastal hazards

2.04 MARINE TRAFFIC

Due to its location in both Central America and the Caribbean, Belizean waters have become a site for a host of maritime activities, including shipping and cruise tourism. With almost 1000 cayes within territorial waters, leisure boating and travel to and from the cayes is also an integral part of Belizean life. Water taxi routes, shipping and cruise ship lanes traverse almost the entire expanse of the coastal waters of Belize. These marine transportation activities sometimes overlap with other important activities, such as fishing, marine tourism and recreational activities like snorkeling. Increased boat traffic is also contributing to human-wildlife conflicts, especially in the instance of the endangered West Indian manatee (*Trichechus manatus*). Reports of 76 manatee strandings between 2005 and 2010 show the main verifiable cause of death of Belize's manatees was as a result of watercraft collision (Galves 2011). From 2010 – 2014, that number has risen to 114 deaths (Galves 2015) and currently there has been 24 stranding up to the end of April 2015. The regulation of marine transportation routes is done by the Belize Port Authority (BPA). However, there is no policy in place that outlines specific routes for each type of activity or zones the marine area according to activity. To accomplish this Hydrographic surveys/mapping of the seabed are required to inform this process. Additionally, the current nautical charts for Belize are outdated and need to be revised to reduce the growing number of groundings occurring throughout Belize. In the interim clear identification of “sensitive” zones that should not be heavily trafficked has been identified as a temporary solution until more advanced surveys/mapping is possible. Also, setting navigational standards for depth in relation to the vessels draft as well as implementing buffer zones for pleasure vessels can also be used as tools for improving marine traffic in Belizean Waters. For example, setting a buffer zone of approximately 1000 feet around pleasure vessels that frequent the Cayes where there are known sensitive habitats would safeguard these areas and prohibiting vessels from travelling in water less than one foot (0.3m) over the draft of the vessel would prevent groundings and damage to sensitive coral reefs. In order to accomplish this in a cost effective way, joint compliance monitoring of these areas will be necessary to ensure compatible marine traffic.

Marine traffic, particularly oil tankers and cruise ships traveling through our coastal waters, presents the risk of oil pollution from accidents at sea. This poses a threat to the Belize Barrier Reef Reserve System (BBRRS) and biodiversity. Additionally, oil tankers, which transport fuel to inland towns and villages, can threaten water bodies, forest areas and other infrastructure including towns. The cleaning of international vessels in Belizean waters, hull washing, structural maintenance of ships, and the offloading of wastes and garbage is particularly problematic. The “staging areas” for ships are requirements as part of international agreements. The MARPOL Convention, of which Belize is a signatory, provides alternatives to dumping at sea. In regards to the transportation of “dangerous goods” in our water, attention must be given to domestic and international transport of these materials due to the associated risk.

Although the CZMAI is offering a spatially explicit marine transportation zone, this zone and associated routes must be approved by the Ministry of Transport via the BPA. Also, If there is need for revision prior to the four year revision of the National ICZM Plan, as mandated by the CZM Act, the Ministry of Transport/BPA reserves the right to do so as well.

Actions

- Develop a national policy on marine transportation in support of the Informed Management zoning scheme to minimize user-conflicts
- Develop and implement a national policy and supporting standards for the safe transport of hazardous chemicals in the sea.
- Conduct Hydrographic surveys/mapping of the sea bed in order to better inform marine transportation routes.
- Update the navigational charts for Belize to ensure boating safety by vessels.

2.05 MARINE POLLUTION CONTROL

The major cause of marine pollution in coastal areas is the waste products produced from human activities on land. These waste products include municipal, industrial, and agricultural run-off and by-products that enter into the coastal and marine environment through the many waterways that drain into the coast. Once in the coastal zone, it can no longer be controlled and then threatens the survival of highly sensitive and highly productive coastal and estuarine ecosystems.

The following are the major concerns that contribute to marine pollution in Belize:

- Population centers in Belize have very poor sewerage systems, and public awareness about the effects of open latrines is low to non-existent
- Cruise tourism makes up the majority of the tourism sector in Belize (BTB 2008). It facilitates the visitation of a large number of people to coastal areas in short bouts. This leads to increased sewerage production, development activity, and solid waste.
- Belize is a historically agrarian society, with the agriculture industry contributing a large portion to GDP. Land use in this industry is widespread, and cultivating practices includes the increasing use of fertilizer and pesticides to increase crop yield (Fernandez 2002). The use of such agrochemicals consequently leads to nutrient and sediment loading in the coastal environment.

In response to the devastating implications of marine pollution from land-based sources, the Government of Belize joined the global effort to mitigate this threat. In doing so, Belize became a signatory to the Cartagena Convention in 2003, ratifying the Land Based Sources of Pollution Protocol, and designing the Belize National Program for Action for the Control of Land Based Sources of Pollution (NPA LBS) in 2008. The outcome of the NPA LBS development process is a national strategy for the reduction and mitigation of land based sources of marine pollution created and enforced through the Department of Environment (Table 6).

Actions

- **Implement the NPA LBS to effectively manage and mitigate the growing problem of marine pollution in Belize**
- **Design and implement public awareness campaigns to inform the public about the hazards resulting from improper waste disposal**

Table 6: Action for the Control of Land-based Marine Pollution			
Source: Belize National Program for Action for the Control of Land-based Sources of Pollution (2008)			
Issue	Primary Source	Objective	Priority Actions
Sewage	Commercial sewage systems, septic tanks, latrines, service trucks, marine vessels	Improve efficiency of the existing sewage treatment facilities within 5 years to meet existing standards	<ul style="list-style-type: none"> • Assess sewage facilities • Preparation of guidelines for waste management for hotels, including the treatment, re-cycling and disposal of wastewater
		Provide waste water treatment facility for coastal communities within five years	<ul style="list-style-type: none"> • Conduct a feasibility study • Acquire appropriate land for systems • Identify sources of funding • Design and construction of facility
		Increase residential connectivity to existing & future sewage treatment facilities	<ul style="list-style-type: none"> • Educate general public on proper disposal of sewage waste • Subsidize cost for connection • Existing waste treatment facility
		Strengthen building codes for septic tanks and latrines	<ul style="list-style-type: none"> • Develop and implement an educational program for builders, contractors, city, town and village councils • Increase capacity of institutions for monitoring and enforcement • Coordinate the Standardization Guidelines for designs
		Reduce bilge and sewage discharge into the marine environment	<ul style="list-style-type: none"> • Assessment of waste disposal from marine vessels (commercial and recreational) • Develop disposal guidelines and safety standards • Establish a public awareness program for relevant interest groups, including but not limited to, for cruise ship agents hoteliers, and operators • Develop a ship registry

Issue	Primary Source	Objective	Priority Actions
Nutrients	Agriculture / aquaculture (sugar, citrus, banana, livestock, shrimp, tilapia), residential and commercial sewage, and marine vessel effluents (bilge)	<p>Develop one coordinated national water quality monitoring (WQM) network to measure nutrient loads in rivers, lagoons, and coastal areas to reduce nutrient pollution</p> <p>Harmonize water quality monitoring standards and coordinate current and future efforts</p>	<ul style="list-style-type: none"> • Hold two national workshops with government, NGOs, and private sector • Establish one protocol for freshwater and one protocol for marine water monitoring. • Conduct a legislative review of existing WQM issues • Recommend legal responsibilities for continued implementation of the National Water Quality Monitoring Program. • Mechanisms to enforce the Riparian Buffer Zone (66 feet) alongside all water bodies and increase this requirement to 200 feet. • Revisit the 2 WQM Protocols to agree on their joint implementation from a national perspective. • Develop guidelines for the treatment and discharge of point and non-point sources of wastewater
		<p>Identification and Implementation of best management practices (BMPs) from agricultural and aquaculture systems (small to large farms).</p>	<ul style="list-style-type: none"> • Training of farmers in agricultural BMPs • Implement land-use planning and zoning, alongside land distribution policies • Minimize or avoid use of marginal lands for agriculture.

Issue	Primary Source	Objective	Priority Actions
Physical Alteration & Destruction of Habitat	Urbanization & development, deforestation, agriculture & aquaculture.	<p>Development and implementation of a Land Use Plan, zoning scheme for urban areas, zoning scheme for tourism development along the coastal areas.</p> <p>Harmonize land development and existing laws as they relate to coastal areas, e.g., develop a moratorium on mangrove clearance.</p>	<ul style="list-style-type: none"> • Utilize GIS and other technology as part of land use planning • Establishment of baseline data to monitor long term. • Assess ownership of mangrove cays • Revise and promote the use of existing land use plan (SDAs). • Assess agricultural irrigation practices & develop of best practices • Compare and coordinate existing legislation so that they relate to each other. • Implement and enforce existing law (SDA, 66 ft buffer, etc). • Implement a moratorium on sale of mangrove cays. • Enforce and Strengthen legislation in regard to riparian forest and steep slope. • Inventory vegetation along riverbanks. • Revive planning bill initiative.
		Updating and legislating a Coastal Development Policy.	<ul style="list-style-type: none"> • Review and revised both documents • Implement policies • Strengthen the legal coordinating capacity of the CZMA.

Issue	Primary Source	Objective	Priority Actions
Solid Waste Management (SWM)	Household and commercial, agro-industries (citrus, sugar, banana), and meat and seafood processing.	<p>Implement the National Solid Waste Management Plan.</p> <p>Develop norms and specifications for collection, transportation, storage, treatment, and disposal of solidwastes in collaboration with Departments of Environment and Health.</p>	<ul style="list-style-type: none"> • Review status of the Board of Directors to reflect the primary stakeholders in the Authority • Establish the SWM Authority • Establish the secretariat with qualified Staffing • Review and Strengthen Act (Chap 224) • Review and Update Management Plan

2.06 MARINE TOURISM AND RECREATION

The tourism sector in Belize is dependent upon the pristine natural resources, since it is ranked among the top ecotourism destinations in the world (Planet Green.com 2009). Thousands of tourists flock to Belize all year round, with the peak season occurring late November to late April. This causes significant stress to the fragile, interconnected ecosystems of the coastal zone. Consequently, this situation emphasizes the need for sustainable methods of conducting tourism and recreational activities to ensure the viability of the tourism industry. As a step towards this, in 2001 the CZMAI published the *Tourism and Recreation: Best Practices for Coastal Areas in Belize* (CZMAI 2001). It highlights the social and economic benefits to implementing best practices into business plans. The guiding principles for tourism and recreation, as included in the best practice guide are:

- Adequate tourism planning
- Responsible promotion and marketing
- Compliance with legislation, tourism and coastal zone management strategies and related CZM policies
- Reducing tourism impact
- Investigating and investing in appropriate technologies
- Local community involvement
- Working and supporting coastal and marine protected areas

Impacts to the coastal areas originate from external areas and many times result in irreversible damage. Any loss or degradation of habitat that does occur has a direct effect on the amount of tourism dollars that can be generated. Through careful planning and sound operational practices, tourism operators and enthusiasts can ensure the sustainability of the tourism industry in Belize.

The results from the InVEST Recreation and Tourism model suggest that a greater proportion of tourism days are spent in some planning regions than others. By combining these results with the Belize Tourism Board's estimates for total annual number of tourists to Belize, our analysis suggests that tourists spend the greatest total number of days in the Central region followed by the South Northern, South Central and Ambergris regions. The results suggest a similar pattern for expenditures. As per the InVEST Recreation and Tourism model results, currently annual visitation is approximately 1.98 million (**Fig. 26**) generating revenue of approximately BZ \$231 million (**Fig. 27**).

According to the National Sustainable Tourism Master Plan for Belize 2030, and our modeled results, annual visitation will more than double under all future scenarios in all planning regions. However, expenditures are likely to be highest under the Informed Management scenario – more than double expenditures in the Development and Conservation scenarios. In a Conservation zoning scheme, annual visitation is expected to increase to 2.9 million (**Fig. 26**),

and generate revenue of BZ \$322 million by 2025 (**Fig. 27**). A Development zoning scheme is also expected to increase annual visitation to 2.8 million (**Fig. 26**), and generate revenue of BZ \$315 million by 2025 (**Fig. 27**). In the proposed Informed Management zoning scheme for Belize, annual visitation increases significantly to 4.1 million generating revenue of BZ \$708 million by 2025.

Under the Informed Management scenario, the Central region will likely continue to experience the highest tourism days and expenditures. However, results suggest the largest percent increase in expenditures will be experienced in the Lighthouse Reef Atoll and Southern regions. This is largely because people are drawn to areas with both high quality coral reefs and infrastructure to support tourism – a combination that is best enhanced through the informed management scenario. Overall, the results from the InVEST tourism model suggest that the proposed Informed Management zoning scheme for Belize will increase tourism in all regions, with greater number of visitors to regions where new coastal development preserves coral and seagrass habitats. Additional information on how the Recreation model works can be found in **Appendix B.3**.

Actions

- **Implement the National Sustainable Tourism Master Plan (STP) for Belize 2030 in conjunction with the recommended Informed Management zoning scheme for sustainable marine recreation and tourism**
- **Develop and support further sustainable tourism management through products from the STP II Project**

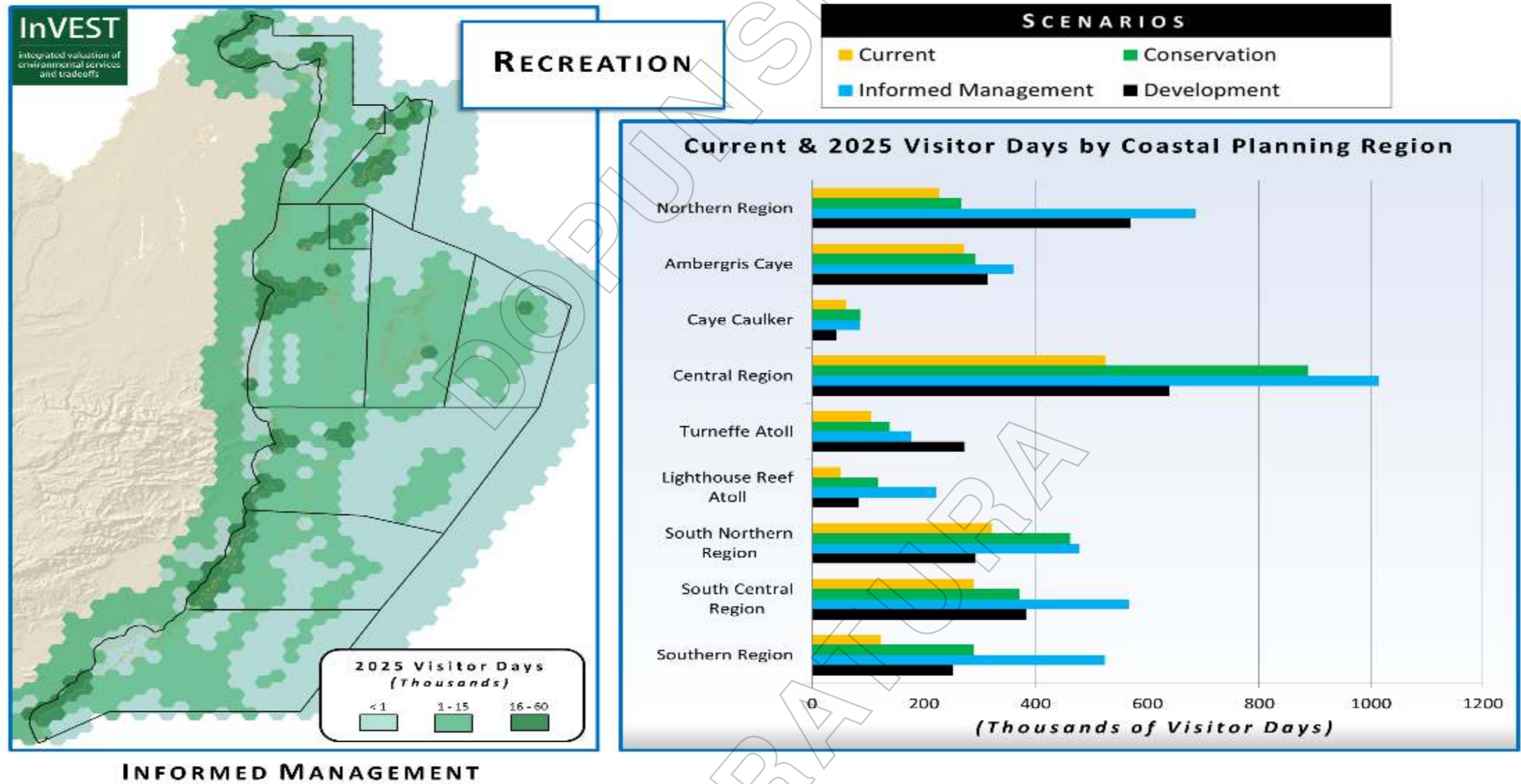


Figure 28: Annual Visitation for Marine Tourism and Recreation by Scenario

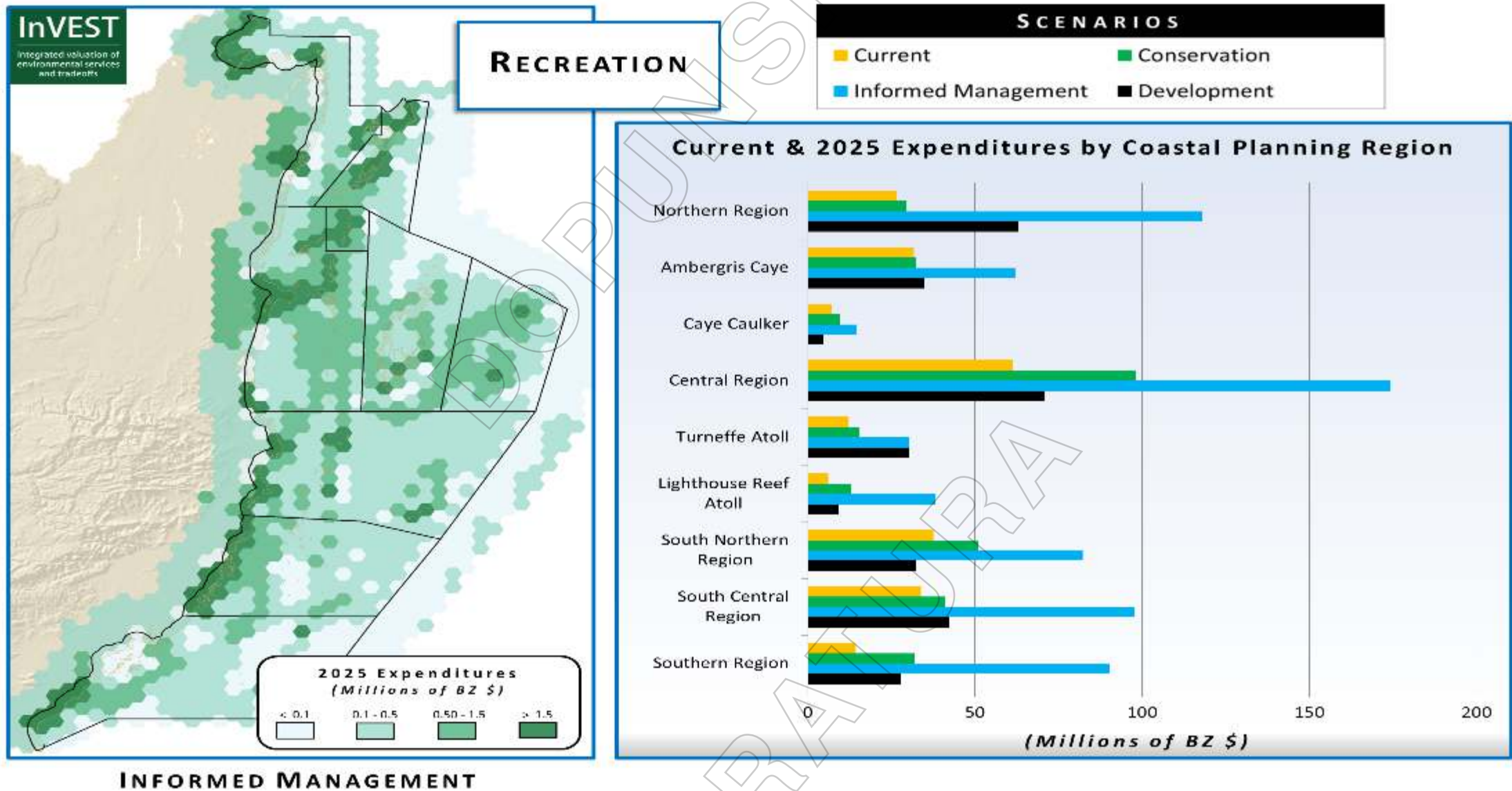


Figure 29: Annual Expenditures for Marine Tourism and Recreation by Scenario