

AMBERGRIS CAYE COASTAL ZONE MANAGEMENT GUIDELINES

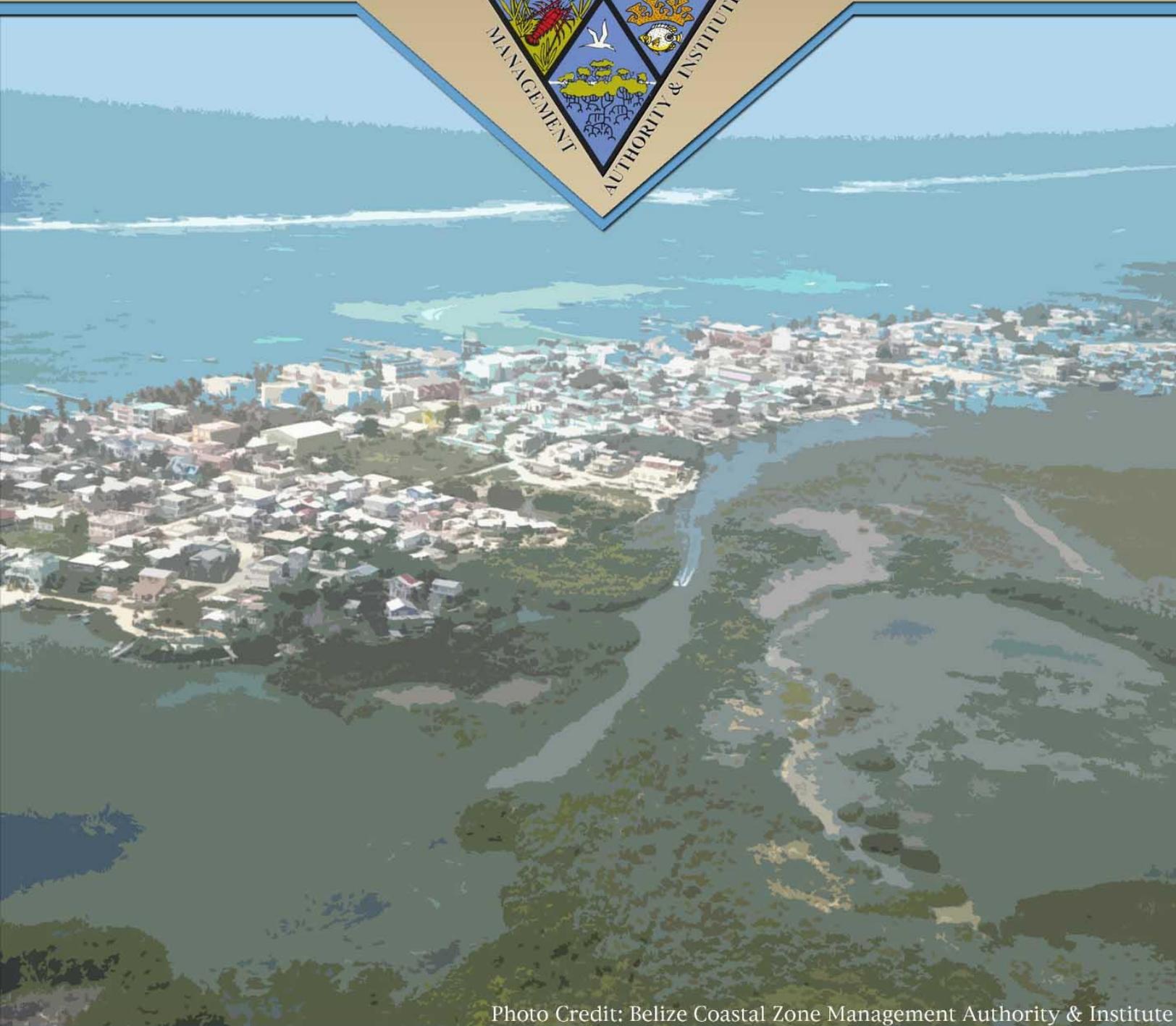
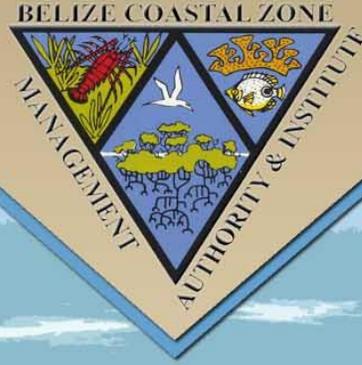


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2016



Cite as:

Coastal Zone Management Authority and Institute (CZMAI). 2016. *Ambergris Caye Coastal Zone Management Guidelines*. Belize Integrated Coastal Zone Management Plan. CZMAI, Belize City.

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ACKNOWLEDGEMENTS

The Belize Coastal Zone Management Authority and Institute (CZMAI) extends its sincere gratitude to all those individuals and organizations who participated in the development of the Ambergris Caye Coastal Zone Management Guidelines. In particular, CZMAI acknowledges all those interested individuals and stakeholder groups of the region for their time commitments in updating the cayes development guidelines that have led to the preparation of the present coastal zone management guidelines for the region. The individuals that participated in the process during 2011-2012 are namely:

Ambergris Caye Consultation Participants (2011-2012)

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The revised draft of the Master Development Plan for Ambergris Caye (2011) also provided valuable information for developing these guidelines. Key stakeholders that helped to shape Ambergris Caye’s master development plan included the San Pedro Town Board, San Pedro Planning Authority, Ambergris Caye Concerned Citizens for Sustainable Development and The Coastal Zone Management Authority and Institute.

CZMAI held a series of consultation meetings that were open to the general public during the mandatory 60-day public review period following the completion of the first comprehensive draft of the Belize Integrated Coastal Zone Management Plan document. The meeting for the Ambergris Caye Region was held in San Pedro Town on Wednesday June 12, 2013, and had participation from the following individuals:

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A final round of consultations was held July 7th 2015-September 7th 2015 as-the re-constituted CZMA Board of 2014 directed a re-opening of the public comment period.

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LIST OF ACRONYMS

ACRCAC	Ambergris Caye Region Coastal Advisory Committee
BEL	Belize Electricity Limited
BECOL	Belize Electricity Company Limited
BTB	Belize Tourism Board
BWSL	Belize Water Services Limited
CAC	Coastal Advisory Committee
CBA	Central Building Authority
CZAC	Coastal Zone Advisory Council
CZM	Coastal Zone Management
CZMAI	Coastal Zone Management Authority and Institute
CWC	Consolidated Water Company
DFC	Development Finance Corporation
DOE	Department of the Environment
EIA	Environmental Impact Assessment
GOB	Government of Belize
HRA	Habitat Risk Assessment
IDB	Inter-American Development Bank
InVEST	Integrated Valuation of Ecosystem Services and Trade-offs
ICZM	Integrated Coastal Zone Management
IUCN	International Union for Conservation of Nature
MBRS	Mesoamerican Barrier Reef System
MMP	Marine Monitoring Programme
NSWMP	National Solid Waste Management Plan
SIB	Statistical Institute of Belize
STP	National Sustainable Tourism Master Plan of Belize
TMP	Terrestrial Monitoring Programme
UNDP	United Nations Development Program

GLOSSARY OF TERMS

Certain technical terms have been used in the text of these guidelines. The following represents an explanation of such terms where they have not provided within the text.

Artisanal/Subsistence Fishing means traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption

Building Height means the recommended maximum building height allowed for each building to be measured from ground level to roof

Building Setback means the recommended minimum distance between buildings or between buildings and site boundaries

Commerce means the storage and retail of consumer goods

Commercial Development means land use involving the construction of a building or buildings that are used solely for commerce and business activities by the owners or others to the exclusion of all other uses within the density requirements of these guidelines

Commercial Fishing means the harvesting of fish, either in whole or in part, for sale, barter or trade

Conservation means the retention of the natural features but with allowance of limited non-disruptive development

Conservation Area means areas including the 66ft reserve and other reserves, canal buffers, water bodies, flood prone lands; areas with ecological significance such as mangrove wetlands

Community Facilities means spaces set aside in large residential or commercial subdivisions for public purposes. They may include facilities such as public parking lots, schools, cemeteries, churches, public sporting areas, youth centers, police stations or health facilities

Coverage means any building, including balconies and verandas, and expressed as a percentage of total lot size

Density means a level of development within a site, as measured by the number of lots per acre, number of dwelling units per acre, or maximum site coverage

Development means any activity which involves mining, engineering, building operations or change of use of land or building in, under, over or on land

Dwelling Unit means a living area consisting of contiguous rooms intended for convenient, long-term occupancy by one family and providing complete, independent facilities for living, eating, cooking, sleeping and sanitation

Fish camp means a building that is permanently or temporarily used for ancillary housing, trap-making and storage, boat repair and docking by full or part time commercial fishermen as licensed by the Fisheries Department

Habitable Room means any room except that used for a kitchen or bathroom

Land means all incorporeal hereditaments of every tenure or description that are either permanently or temporarily above the surface of the sea, whether through natural or man-made activity. The seabed, while not 'physical' land, is defined as National Land

Liquid Waste means grey water from bath, basin and sink and sewage waste that consist mainly from discharge of body waste

Low-Density Development means development of a site that does not exceed 20 dwelling units per acre, 6 lots per acre and a maximum site coverage of 50 percent

Low-Impact Development means an ecologically-friendly approach to site development and storm water management that mitigates development impacts to land, water and air; through conserving natural systems and hydrologic functions of the site. Site development includes residential dwelling units and community facilities and impervious surface cover is a maximum of 30 percent of total cover

Marina means a mooring facility for four or more recreational vessels

Maximum Human Carrying Capacity means the maximum population size of humans in an area that the local environment can sustain indefinitely, given accessibility to the food, habitat, water, and other necessities

Maximum Number of Floors means the recommended maximum number of floors a building will be allowed to have including attics or roof space designed for habitation

Maximum Number of Lots means the recommended maximum number of lots in which an acre of land can be subdivided and alienated

Maximum Habitable Rooms means the recommended maximum number of rooms to be allowed and measured per acre of land

Maximum Building Coverage means the recommended maximum ground coverage of any building including balconies and verandahs and expressed as a percentage of total lot size

Maximum Site Clearance means the recommended maximum amount of land that will be allowed to be cleared expressed as a percentage of the total site area

Medium-Density Development means development of a site that does not exceed 40 dwelling units per acre, 8 lots per acre and a maximum site coverage of 66 percent

Medium-Impact Development means an ecologically-friendly approach to site development and storm water management that mitigates development impacts to land, water and air; through conserving natural systems and hydrologic functions of the site. Site development includes a combination of residential dwelling units, community facilities and commercial activities, and impervious surface cover is a maximum of 50 percent of total cover

Minimum Lot Size means the recommended smallest size a parcel will be allowed to be alienated

National Land means all lands, including cayes and parts thereof not already located or granted, and any lands which have been, or may hereafter become, escheated to, leased by, or otherwise acquired by the Government

Piers per Site means the recommended number of piers that will be allowed to be constructed on any site

Primary Land Use means the recommended preferred use for the site

Residential Development means land use that involves the construction of a building or buildings that are used solely for permanent or temporary domiciles by the owners or others on a non-commercial basis to the exclusion of all other uses within the density requirements of these guidelines

Resort means a building, buildings or site which offers accommodation and general amenities to visitors with other uses such as bars, restaurants, general storage and repair facilities and docking

Secondary Land means the recommended next preferred use to be applied to the site either in conjunction with the primary land use or as an alternative to the primary land use if that is not applicable

Solid Waste means any unwanted material that is useless and thrown away or, discarded

Swamp means an area of very shallow lagoon with mud, savannah or very low vegetation

Utility means the service and infrastructure used for the supply of energy, water, communication and waste disposal

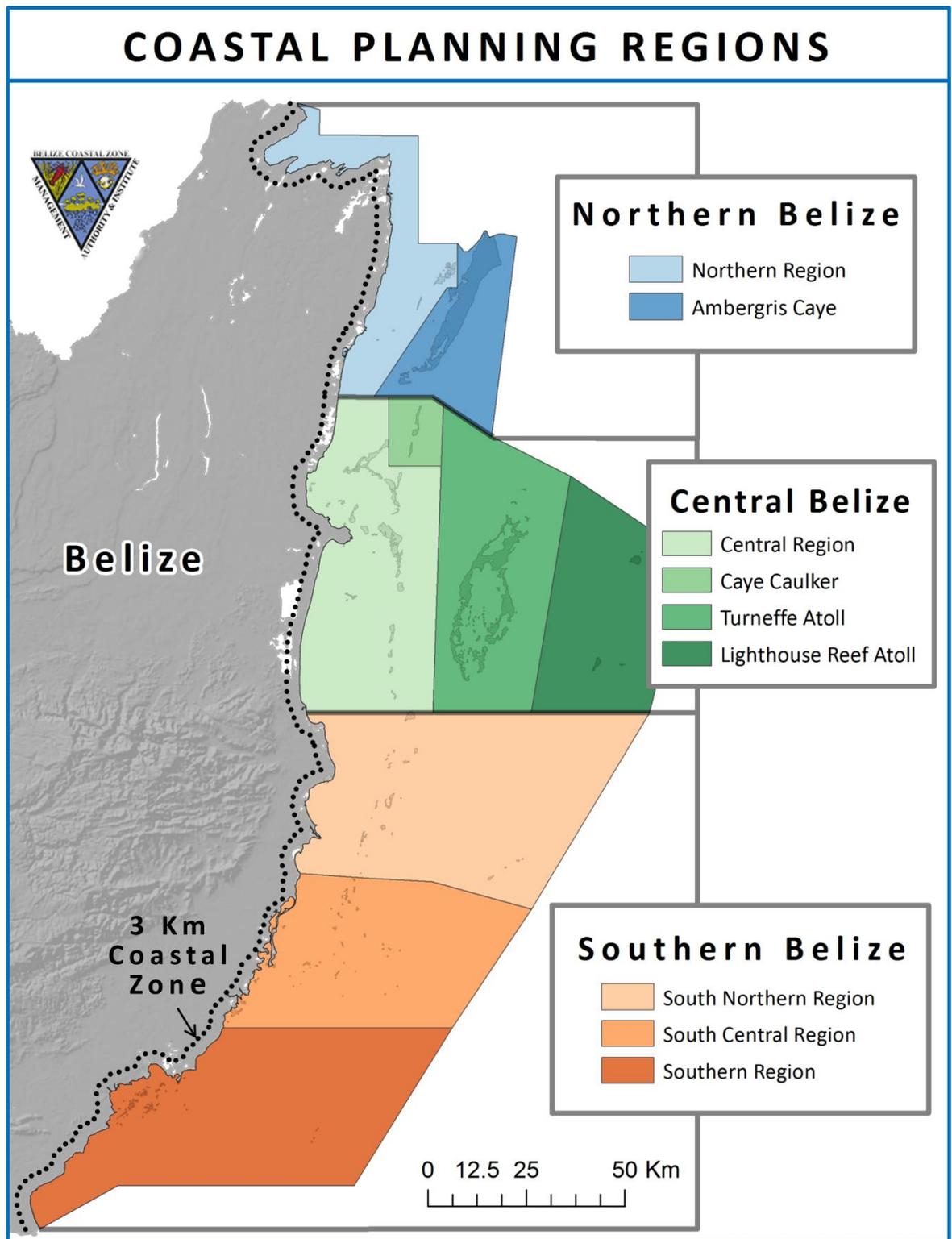
PREAMBLE

The Belize Coastal Zone Management Authority and Institute (CZMAI), a statutory body established by the Coastal Zone Management (CZM) Act of 1998, is tasked with the broad responsibility of assisting with the development of policies, strategies and guidelines for the improved management and sustainable use of the country's coastal resources at a national level. In keeping with its mandate to prepare an integrated coastal zone management plan, CZMAI has developed regional coastal zone management guidelines to provide support for planned development and resource management along the coastline and offshore areas of the entire country. These guidelines have been prepared for nine (9) coastal planning regions (**Map 1**), which were demarcated based on commonalities, geographic definition and regional characteristics. The coastal zone management guidelines will help to integrate management efforts across the land-sea interface.

The Ambergris Caye Coastal Zone Management Guidelines were developed in conjunction with stakeholders of the region, and supporting information from the revised draft Master Development Plan for Ambergris Caye (2011). Ambergris Caye is the northernmost and largest island off the coast of Belize, and is visited by thousands of tourists annually. San Pedro is the only town on Ambergris Caye with an estimated population of almost 12, 000 residents (SIB 2010). Using the expert subjective information from stakeholders in addition to the best available objective data, CZMAI was able to produce this guideline with the following goals:

1. Encourage and promote the sustainable development and use of the coastal and marine environs of Ambergris Caye that will promote economic growth while simultaneously ensuring ecosystem stability and the efficient delivery of ecosystem services.
2. Protect and preserve the traditional way of life of the stakeholders within the Ambergris Caye coastal planning region
3. Ensure sustainability of coastal resources by identifying areas in need of conservation and reducing user conflicts

These goals are informed, and rooted, where possible, on sound science and local knowledge. These guidelines represent the views and recommendations of the stakeholders of the Ambergris Caye Region. They are also a response towards addressing the management gaps identified by stakeholder communities through an extensive consultation process. The coastal zone management guidelines will ensure that human use of the coastal region occurs in consideration of the carrying capacity of the environment in addition to other ecological, cultural, social and economic development priorities of the region. These guidelines will aid policy development for integrated coastal zone management. They will be implemented by all those agencies that have legal mandates and/or permitting powers that impact resource utilization in the coastal zone of Belize, in partnership with this region's stakeholder groups.



Map 1: Coastal Planning Regions of Belize

1.0 INTRODUCTION

Ambergris Caye is the northernmost and largest island off the coast of Belize. Visited by thousands of tourists annually, Ambergris Caye is one of the fastest growing tourist destinations in Belize. Tourism is the primary source of income for the community of San Pedro, the sole town on the island. San Pedro Town is the nucleus of the caye but there are, however, at least six settlements along the periphery of the town core. These include San Juan, Boca del Rio, San Marcos, all of which are located north of the town core. South of the town core are the San Pablo, San Pedrito settlements, and the Escalante subdivision.

San Juan is a predominantly residential community located directly north of the San Pedro Town core; it is the entire stretch from behind the Belize Electricity Limited (BEL) all the way to the river on the lagoon side. This area was the first to be developed after the original town core. *Boca Del Rio* is a settlement in the north of the town core located directly after San Juan and just before the river. *San Marcos* is a residential subdivision on North Ambergris Caye located near the Reef Village. *San Pablo* is the residential area also known as the Development Finance Corporation (DFC) housing project. It is a small community located just over a mile and a half southwest of the center of San Pedro town on the lagoon side of the island. *San Pedrito* is the fifth residential development to be constructed in Ambergris Caye. It was constructed in 1992 with the intention of providing residents of San Pedro with affordable land. Finally, the *Escalante subdivision* was conceived in 1996. Located just north of Victoria House, this subdivision is a full residential area with a few small businesses, several apartments, condominiums and a church located there.

With the increase in tourist arrivals, San Pedro has had to accommodate its visitors as well as its residents and workers in the construction, tourism and fishing industry. This then lead to a boom in construction and a large increase in the island's population density. Increased pressure to construct huge resort and condominium developments, as well as requests for land and homes, strain both the local and national governments' abilities to safeguard the natural resources and cultural heritage of the coastline.

Today, Ambergris Caye is being challenged with the opportunities and advantages brought on by economic development over the decades. Too often, when development takes place in the sole interest of promoting productive tourism activities, the basic objectives and underlying necessity of long-term protection of the natural resources of the coastal zone are not recognized. In the haste to compete, the need to plan is ignored. Hence, the process of development becomes one of crisis management and shortsightedness due to the fact that no consideration was given to the cumulative impacts of development activities on the reef and other sensitive coastal ecosystems.

In an effort to manage its development, the Government of Belize, with the support of the United Nations Development Programme (UNDP), commissioned the preparation of the “Ambergris Caye Master Development and Zoning Plan” in 1988. However, this Master Plan was not legalized and implemented by town administrators, and became outdated. As a result, the San Pedro Planning Authority along with other sponsoring agencies, authorized the financing for the revision and consequent update of the Master Development Plan for Ambergris Caye. The revision was necessary as there was a continued loss of pristine mangrove wetlands and other highly ecologically sensitive areas to residential housing subdivisions in addition to sensing an escalating future demand for residential development. Participants in the process included the San Pedro Town Board, San Pedro Planning Authority, Ambergris Caye Concerned Citizens for Sustainable Development and The Coastal Zone Management Authority and Institute. However, the Master Development Plan was never approved.

The Ambergris Caye Coastal Zone Management guidelines have been prepared with a view to guiding current and future development activities on Ambergris Caye itself and the marine environment that surrounds the caye. The guidelines are based on the provisions set out in the National Integrated Coastal Zone Management Strategy for Belize 2003 for sustainable coastal area use and management. The policy recommendations draw on those presented in the draft Revised Master Development Plan for Ambergris Caye (2011), which represents a consensual vision of San Pedro residents for the future of the Ambergris Caye. The policy recommendations include, but are not limited to, the following: fishing and tourism development, land use planning and development management, conservation of natural resources, mineral extraction, waste disposal, and national strategic considerations.

2.0 REGION BOUNDARIES

Location and Geographic Definition

The Ambergris Caye Region, for which these coastal zone management guidelines have been prepared, is one of nine regions into which the coastal zone has been demarcated (**Map 1**). The entire planning region encompasses 911 square kilometers. Ambergris Caye itself stretches 40 kilometers in length in a north/south direction and 6 kilometers in width in an east/west direction at its widest point (**Map 2**). The island is located 56 kilometers north-north-east of Belize City and 40 kilometers south east of Corozal Bay. The planning region is comprised of all that area enclosed by the lines joining points that have the following UTM 16 coordinates:

Point 1: (2009043 N, 401175 E)

Point 2: (2010674 N, 416342 E)

Point 3: (1960035 N, 409900 E)

Point 4: (1969984 N, 394978 E)

Point 5: (1970065 N, 380055 E)

Point 6: (1997708 N, 398729 E)

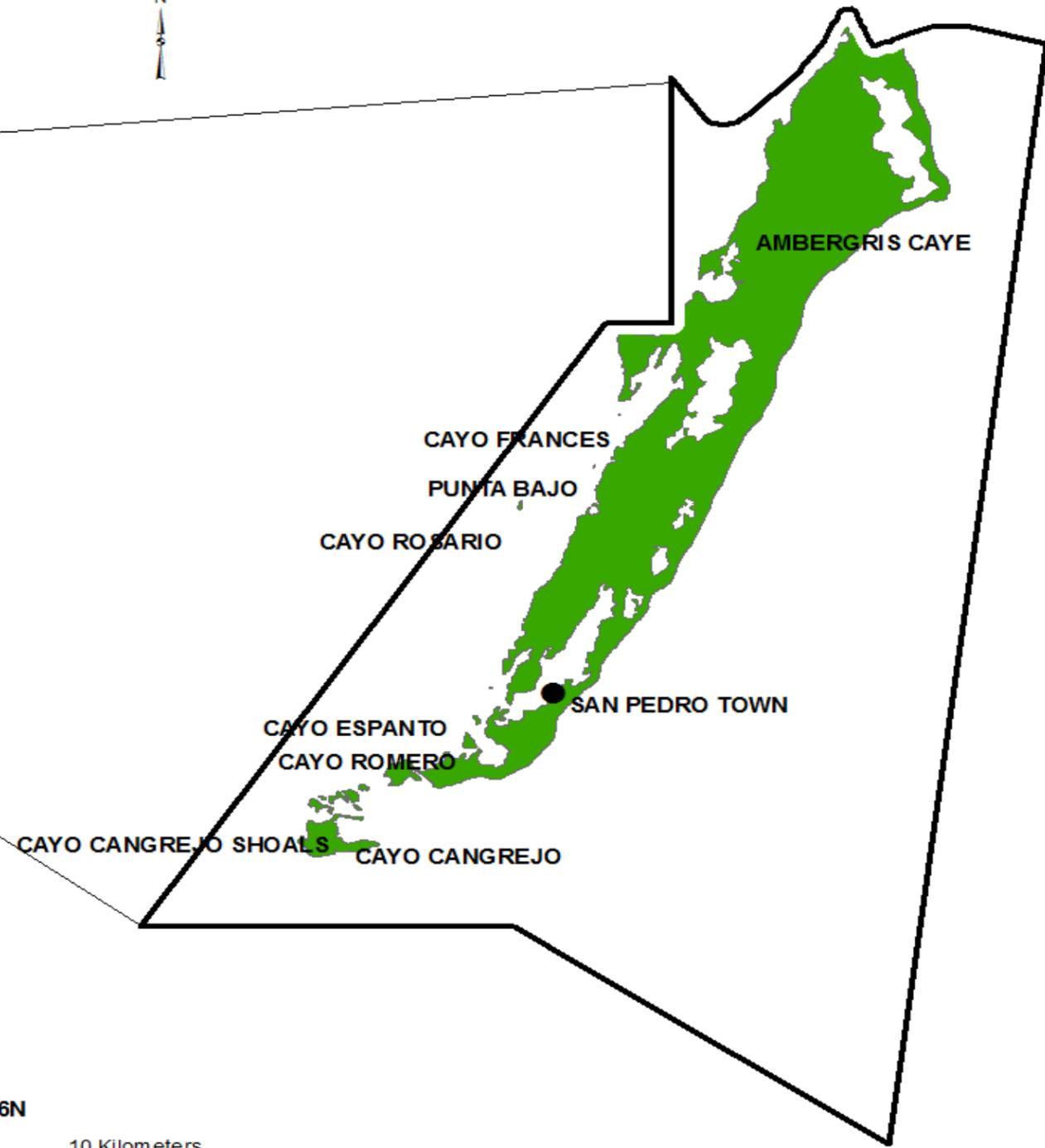
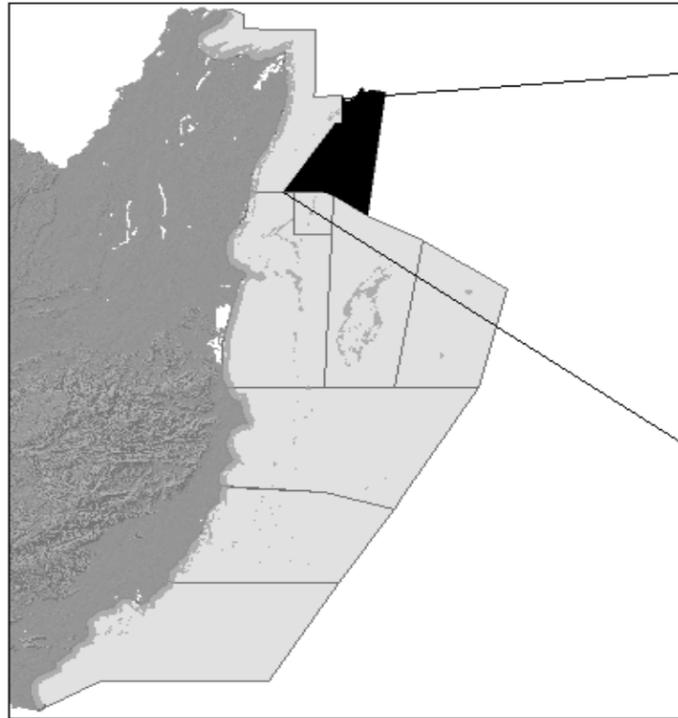
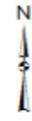
Point 7: (1997872 N, 401257 E)

Regional Context

Ambergris Caye is the largest island in the Belize coastal sea. It has an approximate area of 125 square kilometers. The Island is located just beyond the southern-most point of the Yucatan Peninsula. Ambergris Caye is separated from the Yucatan Peninsula by the 1.6 kilometer long Bacalar Chico Canal, which also marks the most distal northeastern boundary with Mexico. Ambergris Caye lies an average distance of 1.2 kilometers west of the reef crest of the Belize Barrier Reef. The long axis of the Caye lies in a north-south direction congruent with the surf of breaking waves marking the reef crest of the Barrier Reef.

The Caye is made up of mangrove swamps, 12 lagoons, a plateau in the north called Basil Jones, and a series of low sand ridges. The latter are most developed on the eastern side of the island, which is the direction of the prevailing wind. The largest internal lagoon, which is fed by 15 creeks, is the 4 kilometer-long Laguna de San Pedro on the western side of northern Ambergris Caye.

AMBERGRIS CAYE PLANNING REGION



-  Cayes
 -  San Pedro Town
- Scale: 1:225,000
NAD 1927 UTM ZONE 16N



Map 2: Ambergris Caye Coastal Zone Planning Region

3.0 OBJECTIVES

The management of Ambergris Caye's coastal zone must be linked to the goals and aspirations of the people of Belize, particularly the residents of San Pedro Town including the six settlements along the north and south of the town core. Consequently, it must be intrinsically tied to the socio-economic, cultural and other basic needs of the people of San Pedro, and their use and demand for land and marine resources. In order to ensure the continued protection of nationally significant species, biotic communities and physical features and the continued delivery of ecosystem services to the several thriving communities within the region, the objectives of these coastal zone management guidelines include:

1. Protecting the fishing resources and traditional fishing rights, especially for the fisherfolk from the communities of San Pedro Town, Caye Caulker, Belize City, Sarteneja and Copper Bank
2. Promoting orderly and sustainable development, based on suitable land use planning, and with effective development guidelines that will meet the needs of current and future generations
3. Maintaining and protecting ongoing and future conservation, recreational and tourism areas and uses
4. Preventing inappropriate high-impact, unsustainable developments that are incompatible with community needs
5. Protecting and preserving significant national and international natural features and ecological biodiversity of special interest or uniqueness that define the character and scientific importance of the Ambergris Caye coastal zone
6. Preserving the social and cultural values of the people and communities of the region that are connected to the environment
7. Fostering and supporting a continued partnership among stakeholders for managing the coastal resources
8. Establishing a framework for regulating the development and use of resource of the region through the continuation of CZMAI's coastal planning program activities and coastal advisory committee process

4.0 LEGISLATIVE AND INSTITUTIONAL FRAMEWORK FOR INTEGRATED COASTAL ZONE MANAGEMENT IN BELIZE

The Coastal Zone Management Act, hereinafter referred to as “the Act”, was enacted in 1998 and has been described as reflective of the trend in legislation in Belize towards more accountability and transparency for government actions, and more direct participation by the public in decision making, particularly public resources. The intent of the Act is to promote the sustainable development of coastal and ocean areas through coordination of existing legislation affecting coastal resources and through building capacity and expertise to manage coastal resources. The main purpose of the Act is to:

- Provide for the improvement of coastal zone management in Belize through the establishment of a Coastal Zone Management Authority and a Coastal Zone Management Institute;
- Provide for the establishment of a Board of Directors to control and manage the affairs of the Authority;
- Provide for the preparation of a Coastal Zone Management (CZM) Plan;
- Provide for the establishment of mechanisms to improve monitoring of various activities within the coastal zone;
- Provide for the payment of fees and charges related to the use of the coastal zone and
- Provide for matters connected therewith and incidental thereto

The Coastal Zone Management Authority is the policy making and planning institution for coastal zone management. Its functions are primarily in the realm of planning, advising, cooperating, collaborating and monitoring. It is given no jurisdiction to permit or regulate activities which may affect the sustainable development of the coastal zone. The Coastal Zone Management Institute is the research and technical arm of the Authority. As is indicated above, the Coastal Zone Management Authority is mandated to develop a comprehensive Coastal Zone Management (CZM) Plan for Belize. The CZM Plan is to be developed by the Chief Executive Officer (CEO) of the Authority through consultation with all affected government agencies, non-governmental agencies, statutory bodies and the private sector. The Act mandates that the plan address certain areas. These include:

- Guidelines to be used in determining the suitability of particular development activities in the coastal zone;
- Guidelines for the general monitoring of the coastal zone, including its biological species, communities and habitats;
- Proposals, including existing proposals from Government agencies, relating to the coastal zone that deal with the following subjects:
 - Land use
 - Planning for the establishment of marine protected areas and for the conservation of threatened or potentially threatened or endangered species;
 - Preservation and management of the scenic, cultural and other natural resources;
 - Recreation and tourism;
 - Monitoring of the environment and natural resources, mineral extraction, living resources, human settlements, agriculture, aquaculture, and industry
- Proposals for the reservation of land or water in the coastal zone for certain uses, or for the prohibition of certain activities in certain areas of the coastal zone;
- Recommendation for the improvement of public education as well as public participation in the management of coastal resources;
- Recommendations for strengthening governmental policies and powers and the conduct of research for the purposes of coastal resources conservation and management

The process for approval of the CZM Plan is as follows: The Act requires the CEO of the Authority to submit the CZM Plan to the Board of the Authority, who has sixty days to make modifications. Thereafter, the Board is to notify the public of the availability of the CZM Plan by an order published in the Gazette. Any member of the public may submit comments within sixty days. Upon completion of the sixty days, the Board may approve the CZM Plan, subject to modifications, if they deem it fit in regard to the comments submitted, and then submit the same to the Minister for approval. The Minister, after approving the CZM Plan, shall table it in the House of Representatives for approval by the House by affirmative resolution. Subsequent to approval by the House, the CZM Plan must be published in three consecutive issues of the Gazette. The CZM Plan is to come into operation on the date of the last publication or such later date as may be specified therein. The Act requires the CZM Plan to be revised during the four year period after it comes into operation.

It was agreed by the CZMAI that the CZM Plan would be developed in phases, with the first phase being the development of an Integrated Coastal Zone Management Strategy document, which underwent extensive public consultation. It was endorsed by the cabinet in 2003, and is an official policy document of CZMAI. The second phase involved the formulation of cayes development guidelines for eight of the nine coastal planning regions into which the coastal zone has been sub-divided by the CZMAI. This subdivision was based on geographical, biological, administrative and economic similarities. The Ambergris Caye Development Master Plan serves as a guide for regulating the use and development of land in the Ambergris Caye Planning Region. See **Map 1** for the definition of the nine coastal planning regions.

The development guidelines were formulated using the Cayes Development Policy (2001) as a framework. During 2010-2012, the cayes development guidelines were updated to include new information on the cayes, but also to include human use of the coastline and marine waters. As such, the development guidelines have been renamed the coastal zone management guidelines. Thus, the Integrated Coastal Zone Management Strategy (2003), together with the coastal zone management guidelines for the nine coastal planning regions, contributes to the development of the comprehensive Integrated Coastal Zone Management Plan.

5.0 GUIDING PRINCIPLES

It is important that the coastal zone management guidelines for the region be formulated as a part of a sustainable plan geared towards contributing to national, regional and local development policies, goals and aspirations. They must therefore be holistic and pragmatic, yet underpinned by certain fundamental principles. These can be detailed as follows:

Principle 1:- *Recognition that the Ambergris Caye Region needs special protection and management because of its physical, economic, scientific, cultural and aesthetic attributes*

Principle 2:- *Recognition of the need to avoid placing undue strain on the terrestrial and aquatic environment of the region by ensuring that proposed development activities do not exceed the carrying capacity of the region*

Principle 3:- *Recognition of the rights and interests of traditional users and stakeholders while acknowledging the national development policy which promotes tourism and job creation*

Principle 4:- *Recognition that environmental concerns are best handled with the participation of all concerned stakeholders at all levels and from all sectors*

Principle 5:- *Recognition that planning guidelines represent a preventative and precautionary approach to environmental degradation and a tool for pursuing sustainable development of the region*

6.0 SECTORAL ISSUES AND POLICIES

These policies are organized into ten sectors that address current and potential issues within the Ambergris Caye Region coastal zone, and provide recommendations from stakeholders. They include: Fishing, Marine Tourism and Recreation, Land-Use, Marine Dredging, Sensitive Habitats, Utilities, Pollution Control, Social Amenities, Conservation, and Research & Education.

6.1 *Fishing*

The waters surrounding Ambergris Caye offer the potential for both commercial and recreational fishing activities. Commercial fishing has historically been one of the major economic pillars that have built San Pedro. Much of the measurable benefits to be derived from commercial fishing on the Island between the mid 1960's and late 1990's were realized through the Caribeña Fishermen Cooperative Society Limited. Although the Cooperative has receded in functionality and importance over time, commercial fishing still remains an important activity in the seas surrounding the Island.

Much of the effort in commercial fishing is undertaken by fishers from the northern mainland communities of Sarteneja and Copper Bank. The more important areas for commercial fishing are the waters off the north-western and northeastern Ambergris Caye. Species of relevance include spiny lobster and conch, as well as finfish species such as the Mutton snapper, the Grey Snapper the Black Grouper, the Rock Hind and the Cero.

Recreational fishing in Belize, including Ambergris Caye equates, in large measure, to sport fishing. Much of the species relevant to sport fishing are taken by light tackle fishing. The areas relevant to sport fishing activities include the full complement of habitats in and around the Caye such as the deep sea beyond the reef, the inter-reefal lagoon, the leeward lagoonal environment and the various channels or boggles associated with waters off the southwestern and northern ends of the Caye. The variety and abundance of species associated with these areas include the Tarpon, the Bonefish, the Permit, the Barracuda, the Wahoo, and the King Mackerel or 'King Fish'.

Although sharks and rays are not strictly speaking recreational fish species they form the basis of the country's rapidly expanding snorkel and dive tourism industry. Hol Chan Marine Reserve is one of the main areas. Both sharks and rays play a critical role in keeping the coastal, marine and estuarine environments healthy. However, their populations are under increasing pressure from unsustainable and unregulated fishing practices. While Belize has passed shark-friendly legislation to protect the whale shark (2003) and nurse shark (2011), the same needs to be done for rays. Currently, Wildlife Conservation Society's Belize Shark Project is promoting the conservation of sharks and rays throughout the country using research, policy and outreach activities.

The total spiny lobster fishing area within the Ambergris Caye region is approximately 315 km². The results of the InVEST Spiny Lobster model estimate lobster tail catch for the current (2010) zoning scheme to be 45,228 lbs, and generating revenue of approximately BZ \$1.2 million (**Figure 4, Appendix**). The results suggest that an enforced Conservation Zoning

Scheme for this region would increase catch to 93,047 lbs, and generate an annual revenue of BZ \$2.4 million in 2025. A Development Zoning Scheme would decrease catch to 10,596 lbs; and generate an annual revenue in 2025 of only BZ \$0.28 million. However, the results are indicating that in the proposed Informed Management Zoning Scheme (**Map 3**), lobster catch would increase current catch to 80,470 lbs; and generating annual revenue of BZ \$2.1 million by 2025.

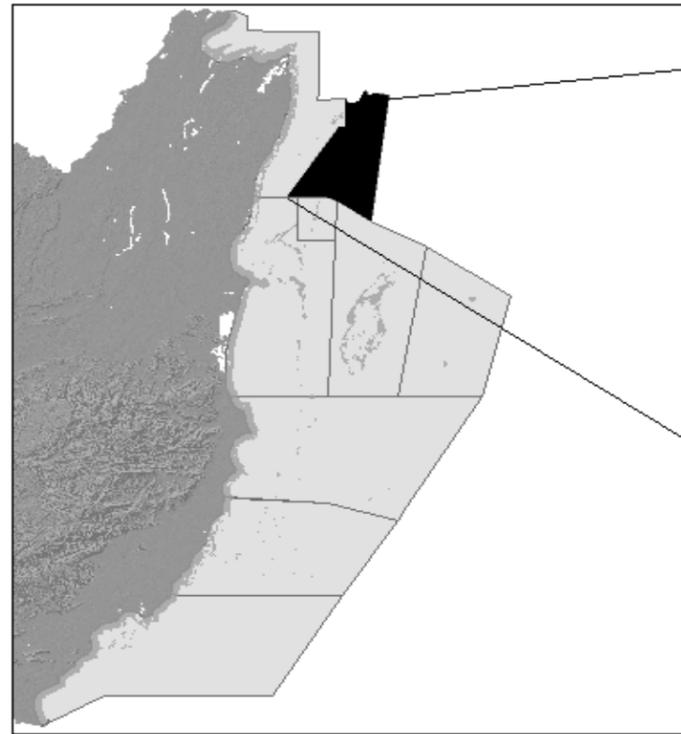
Compared to the Informed Management Zoning Scheme (**Map 3**), the Conservation Zoning Scheme is the better option for maintaining increased lobster catch and revenue through to 2025. This is mainly attributed to the fact that under the Conservation Zoning Scheme, habitats that support the lobster fishery are under relatively less stress from human activity than in the Informed Management scheme. However, while the zoning scheme under a conservation scenario is good for habitats and the provision of important ecosystem services, such as protein from lobster, there are relatively less activities that occur in the scheme. Although there may be some loss to habitat quality and lobster production, the Informed Management zoning scheme represents a balance between managing the resources of the coastal zone and the continued allocation of areas for human use through to 2025.

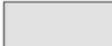
In discussing the results of the InVEST ecosystem models, and in particular the lobster fishery model, there is the need to consider limitations of the model, which are highlighted below:

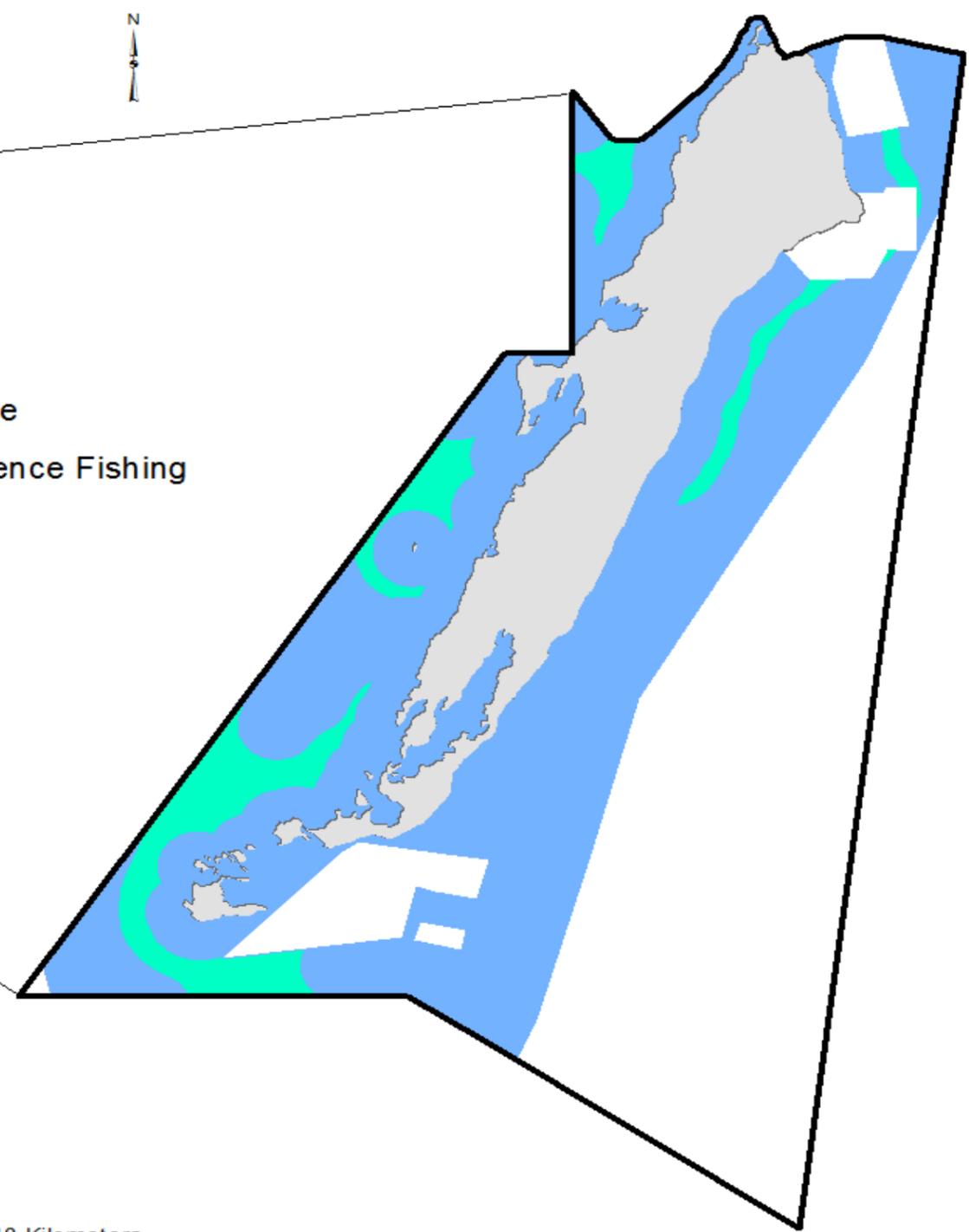
- Population growth parameters are nationwide, not region-specific
- Habitat dependencies are obligatory (e.g., habitat substitutability is not explicit represented).
- The population responds to change in habitat quantity (i.e., areal extent of mangrove, seagrass, and coral reef), not quality of those habitats.
- The fishery is assumed to take place at the start of the year, before natural mortality
- The model assumes near knife-edge selectivity in harvest function
- Harvest selectivity (and catchability) is invariant, such that technological improvements to gear or changes in fishing practices are not modeled.
- Market operations are fixed, such that they do not vary in response to amount of harvest, shifts in market or consumer preference, or technological changes.
- Climate change impacts are not directly accounted for in model

Additional information on how this model works can be found in **Appendix B.4** of the Belize Integrated Coastal Zone Management Plan.

INFORMED MANAGEMENT ZONING SCHEME FOR FISHING: AMBERGRIS CAYE



-  Sportfishing
-  Ambergris Caye Base
-  Commercial/Subsistence Fishing



Map 3: Informed Management Zoning Scheme for Fishing in the Ambergris Caye Region

Illegal fishing is especially relevant in the context of exacerbating the status of fishery resources that are already under stress from over-harvesting. This is pertinent to lobster and conch, as well as sea turtles. The harvesting of ‘undersized’ or sub-adult populations of lobster and conch continues to be a major challenge. The harvesting of these species during the closed season also continues to be a recurrent and macroscopic challenge. This is a direct function of the insufficiency of budgetary resources ascribed to the Fisheries Department.

Sea turtles are also a prime candidate for illegal harvest by fishers. Although it is illegal to fish any sea turtle species in Belize, they are still taken by fishers in the seas around Ambergris Caye. Apart from the taking of turtles, their eggs are a prized possession for a number of fishers. The poaching of turtle nests on the beaches of north-eastern Ambergris Caye continues to be a Fisheries Enforcement challenge.

The Fisheries Act, administered under the Fisheries Department, is the principal governing legislation to regulate the fishing industry (**Table 1**), and is directly concerned with maintaining sustainable fish stocks and protecting the marine and freshwater environments. In order to protect the fisheries resources of Ambergris Caye and the traditional fishing rights of fishing communities of the region, the following action steps are recommended, to complement the existing Fisheries regulations and to enhance regional management of the fisheries resources.

Table 1: Framework for Implementing Informed Fisheries Management at Ambergris Caye

ZONE	CHARACTERISTICS OF ZONE	SCHEDULE OF PERMITTED USES			SCHEDULE OF RESTRICTED USES	SUPPORTING NATIONAL POLICIES	IMPLEMENTING AGENCY
		Dominant	Compatible	Regulated			
Fishing	Marine area defined for the extraction of fish for food and commercial trade, except for sport fishing which only involves the catch and release of fish	1.Sportfishing(bonefish, tarpon, permit); 2.Wild capture of commercial fish species using only permitted fishing gear 3. Subsistence fishing using traditional fishing gear 3. Wild capture of invasive species	Marine recreation and eco-tourism Passage/entry of fishing vessels Research and Education within marine reserves Establishment of fish pots and traps Seaweed culture	Sport fishing Commercial fishing Research and Education	1. Illegal extraction of catch and release species, endangered marine species and organisms under seasonal management regime; 2.Extraction within legally specified “no-take”/replenishment zones 3. Dredging 4. Use of prohibited fishing gear 5. Trawling 6. Shipping and navigation 7. Dumping of solid and liquid wastes 8. Oil exploration and extraction	Fisheries Act Coastal Zone Management Act	Fisheries Department Coastal Zone Management Authority

Recommended Actions:

1. Improve the management of critical habitats and spawning aggregation sites that support species for commercial, subsistence and recreational fishing
2. Provide stronger enforcement of the Belize Fisheries Act and its regulations, including foreign fishing in Belizean waters, illegal fishing during closed seasons, poaching within marine reserves, and size limits. Increased training of enforcement officer could serve an effective enforcement mechanisms
3. Develop and implement education and awareness programs by the Fisheries Department in partnership with established stakeholder groups in the community, such as the local fishermen association and the Ambergris Caye Citizens for Sustainable Development
4. Protect all sharks, rays and sea turtles from unregulated fishing and poaching activities
5. Limit dredging activities from areas within close proximity to important fishing grounds
6. Implement the recommended Informed Management zoning scheme for fishing (**Map 3**)

6.2 *Marine Tourism and Recreation*

Tourism is now the largest source of foreign exchange in Belize and it is the fastest growing economic sector in the country. The continued success of this sector is primarily dependent on the country's natural resources. San Pedro, the only town on Ambergris Caye, was one of the pioneering municipalities in Belize's tourism industry. The Town continues to be the most visited tourism destination in the country. The island has a population of about 11, 600 residents (SIB 2008), and is famous for its laid-back character and lifestyle: Golf Carts are the primary mode of transportation on the Town's sandy streets. In the Town and along the beaches to the north and south, is a diverse collection of restaurants, gift shops, bars, hotels and numerous condominium complexes. Ambergris Caye is the busiest of Belize's tourist destinations however, it still manages to maintain its relaxed atmosphere.

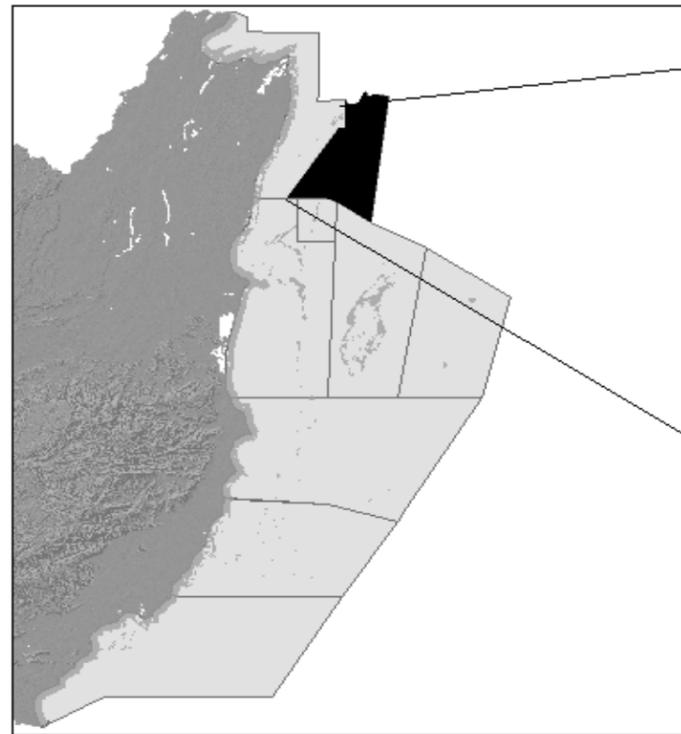
InVEST Recreation and Tourism ecosystem service model results suggest this region may experience a peak in its tourist visitation by 2025 (**Figure 5, Appendix**). In 2012, approximately 272 thousand people visited this region, generating revenue of BZ \$31.8 million annually (**Figure 6, Appendix**). In a Conservation Zoning Scheme, InVEST Recreation model results indicate that there may be an increase in tourist visitation to approximately 293 thousand, generating annual revenue of BZ \$32 million. In a Development Zoning Scheme, there would also be an increase in the current tourist visitation to approximately 315 thousand, and generating annual revenue of BZ \$35 million. In the proposed Informed Management Zoning Scheme (**Map 4**), InVEST Recreation model results indicate that there will also be an increase in tourist visitation to approximately 360 thousand and that tourist expenditure would generate an annual revenue of BZ \$62 million. The supporting framework for implementing the Informed Management Zoning Scheme for marine recreation and tourism is outlined in **Table 2**.

In discussing the results of the InVEST ecosystem models, and in particular the recreation model, there is the need to consider limitations of the model, which are highlighted below:

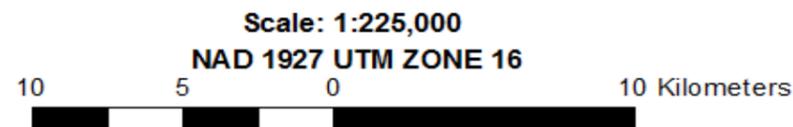
- The model assumes that people will respond similarly in the future to the attributes that serve as predictors in the model. In other words, the assumption is that people in the future will continue to be drawn to or repelled by a given attributes to the same degree as currently.
- Some of the attributes that are used as predictors of visitation are representations of areas managed for particular human use (e.g. transportation). The model assumes that future management of the zones and the type of activities that they represent are similar to current.
- Since there are no fine-scale data on the distribution of visitors to Belize, we use photo-person-days as a proxy for the relative density of actual person-days of recreation across the coastal zone.
- Climate change impacts are not directly accounted for in model

Additional information on how this model works can be found in **Appendix B.3** of the Belize Integrated Coastal Zone Management Plan.

INFORMED MANAGEMENT ZONING SCHEME FOR MARINE RECREATION: AMBERGRIS CAYE



Marine Recreation



Map 4: Informed Management Zoning Scheme for Marine Recreation in the Ambergris Caye Region

Table 2: Framework for Implementing Informed Marine Recreation in the Ambergris Caye Region

ZONE	CHARACTERISTICS OF ZONE	SCHEDULE OF PERMITTED USES			SCHEDULE OF RESTRICTED USES	SUPPORTING NATIONAL POLICIES	IMPLEMENTING AGENCY
		Dominant	Compatible	Regulated			
Marine Recreation	Marine areas especially suited to swimming, snorkeling, diving, kayaking, surfing, jet skiing, kite boarding, and other water sports	1. Swimming 2. Snorkeling 3. Diving 4. Kayaking 5. Surfing, 6. Jet skiing, 7. Kite boarding 8. Other water sports	Passage/entry of water taxis, tour boats, cruise vessels Research and education within marine protected areas Sport fishing	Research and Education Eco-tourism activities within marine protected areas Sport fishing	1. Commercial fishing 2. Establishment of fish pens/cages, mariculture 3. Oil exploration and extraction 4. Dredging 5. Passage of commercial fishing vessels 6. Shipping and navigation 7. Trawling 8. Dumping of solid and liquid wastes from ships and boats	Belize Tourism Board Act Fisheries Act Coastal Zone Management Act Hotel and Tourist Accommodation Act. National Sustainable Tourism Master Plan	Belize Tourism Board Fisheries Department Coastal Zone Management Authority

While the tourism industry generates much needed economic development, on both local and national levels, it has also been identified as one of the leading causes of reef damage. It is also noticeable that it has had the effect of generating speculative, though not always well-informed, development at Ambergris Caye. The National Sustainable Tourism Master Plan (STP) recognizes that Belize’s barrier reef, three atolls, and chain of reef islands are renowned internationally and form the basis of the marine-based, nature tourism product of the country. As such, conservation of the Belize Barrier Reef is a key factor to securing the future of the industry. The long-term objective for sustainable tourism development in area along the reef system, including Ambergris Caye, is to constrain and consolidate development. This includes improving existing tourism infrastructure structures, and the completion of the existing town. The ultimate goal for this region is for San Pedro to be regarded as a “*charming attractive destination with a vibrant town and walkable and attractive waterfront, where beaches are able to be enjoyed and the water scenery is unobstructed*” (BTB 2011). Preservation of the reef system, marine habitats and ecosystem shall be the primary concern when assessing the need to make improvements to the above-mentioned existing facilities.

Recommended Actions:

1. Given the importance of tourism for the country and for the Ambergris Caye residents, it is recommended that low-impact, environmentally-sensitive, nature-based tourism is promoted with care to avoid practices that destroy Ambergris Caye’s sensitive and valuable habitats
2. Avoid high-impact, environmentally-destructive tourism development
3. All tourism facilities should meet BTB’s minimum standards, including disaster preparedness and evacuation plans; and also meet the “*Tourism and Recreation Best Practices Guidelines for Coastal Areas in Belize*” produced by CZMAI
4. BTB and/or DOE should not recommend or approve tourism facilities that do not conform to these coastal zone management guidelines.
5. The recommendations of the National Sustainable Tourism Master Plan for this region are to be supported in order to encourage a long-tem sustainable tourism future
6. Implement the Recreation informed management zoning scheme for this region (**Map 4**)

6.3 *Land-Use*

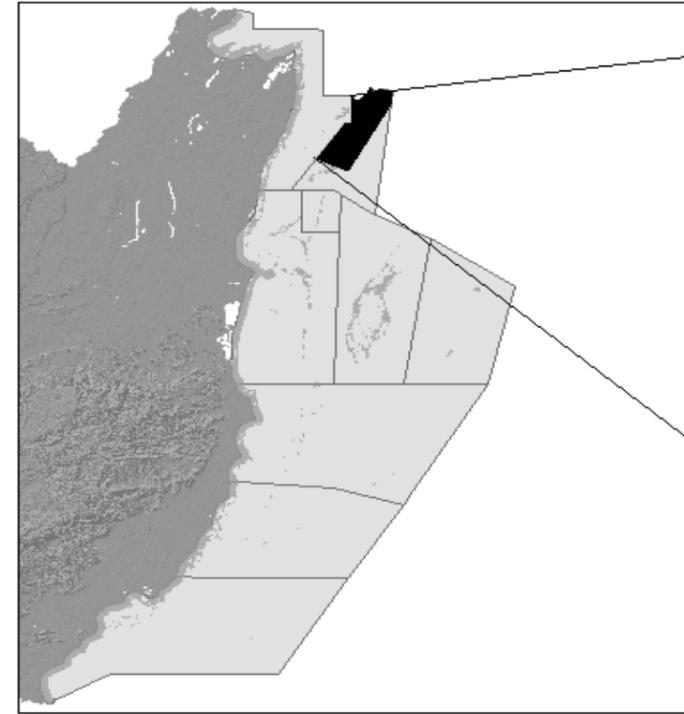
The land use component of these management guidelines for the Ambergris Caye region are based on the carrying capacity of the environment, combined with the existing and projected types of land tenure patterns and use activities. The development suitability, current and future development trends, existing land use and property rights, socio-economic and other relevant data are a critical for determining the land-use classification within the Belize coastal zone. It is also important that these coastal zone management guidelines maintain some flexibility to enable a response to the ever changing socio-economic and physical environment.

The nucleus of San Pedro town now extends in the north from the San Pedro River, through Coconut Drive to the south, with many new housing areas and new beachfront hotels towards and far beyond Victoria House, reaching almost all the way to the Boca Ciega Lagoon at the southern-most end of the island. North of the San Pedro River, is an ever growing collection of condominiums, luxury hotels and high end residencies that extends far north just shy of the Belize – Mexico border. Many of the newer developments fall within the Bacalar Chico National Park and Marine Reserve, but are not technically a part of it as these lands were privately owned prior to the establishment of the park. Although urbanization has occurred from the San Pedro River all the way through to Coconut Drive, the original core of the town still basically remains organized around the north - south streets of Barrier Reef Drive, Pescador Drive and Angel Coral Street.

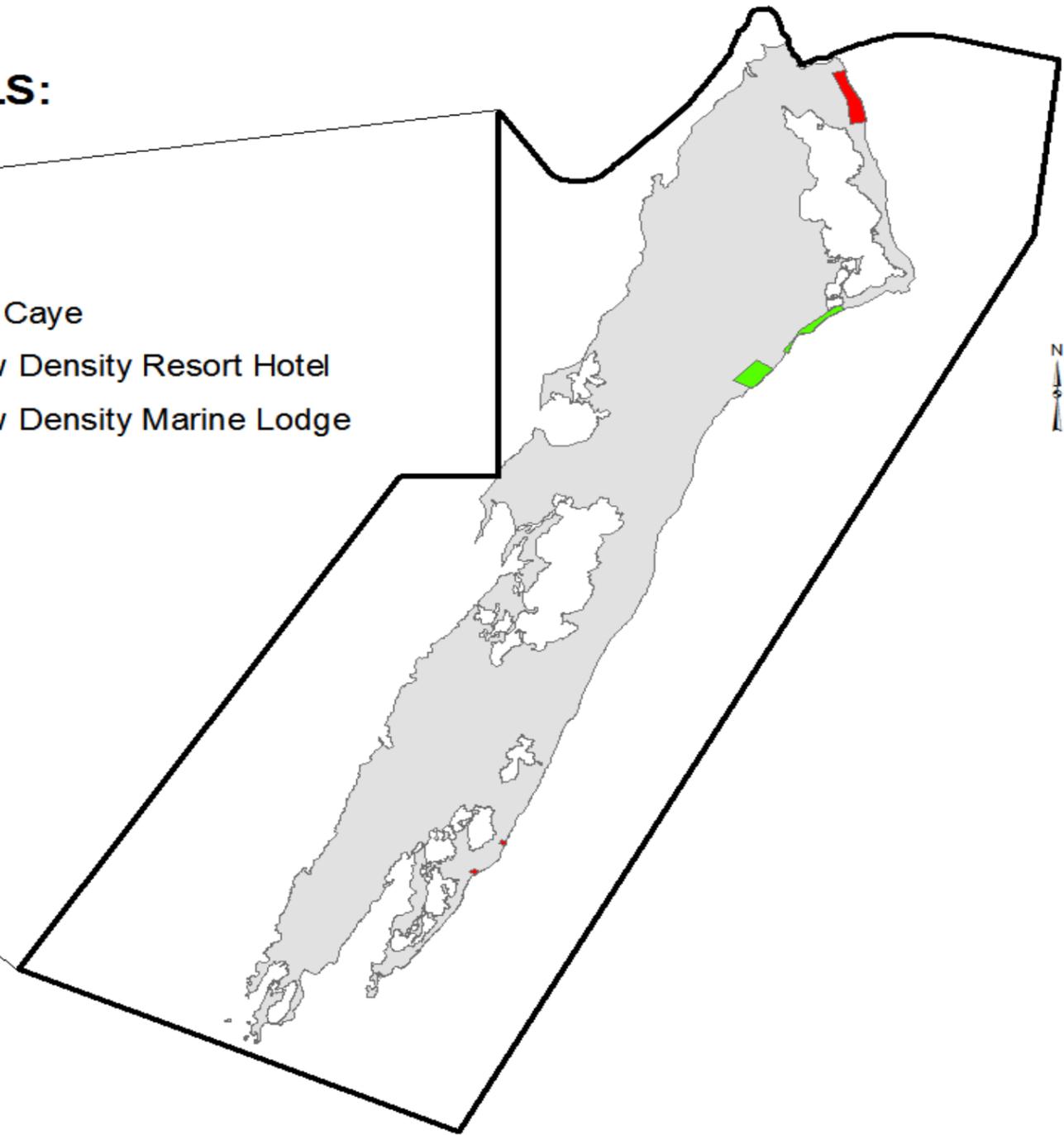
The National Sustainable Tourism Master Plan for Belize (STP) 2030 recognizes that Ambergris Caye is one of those key islands along the Belize Barrier Reef that contain highly sensitive natural ecosystems, whose ecological integrity needs to be maintained. As such, the STP Plan recommends a model of development for the Ambergris Caye region that constrains and consolidates growth, only allowing for necessary improvements and small low-impact, high quality expansion for existing homes, resorts, lodges and other tourism facilities. In order to accommodate potential growth in tourism activities on San Pedro, the creation of an airport in Northern Ambergris Caye can be considered.

The Plan outlines two strategies to accomplish this model of development. First, on the north tip of Ambergris Caye, three low density resort hotels are planned outside of Bacalar Chico National Park. The areas chosen (**Map 5**) have existing development and thus have been previously disturbed. This selection was done in an effort to minimize the environmental impacts of the three proposed resorts. The density proposed for the three designated resort hotels is 20 units/acre – 50 units/hectare. The sole developments that are recommended within the Bacalar Chico Marine Reserve are supporting facilities such as a visitor center, a museum and restaurant facilities (STP 2011). Development standards for these commercial developments are found in **Table 3**, and these correspond to the recommended Informed Management Zoning Scheme for the three proposed resort hotels (**Map 5**).

INFORMED MANAGEMENT ZONING SCHEME FOR FUTURE RESORT HOTELS: NORTHERN AMBERGRIS CAYE



-  Ambergris Caye
-  Future Low Density Resort Hotel
-  Future Low Density Marine Lodge



Scale: 1:150,000
NAD 1927 UTM ZONE 16N
6 3 0 6 Kilometers

Map 5: Informed Management Zoning Scheme for Proposed Resort Hotels at Ambergris Caye

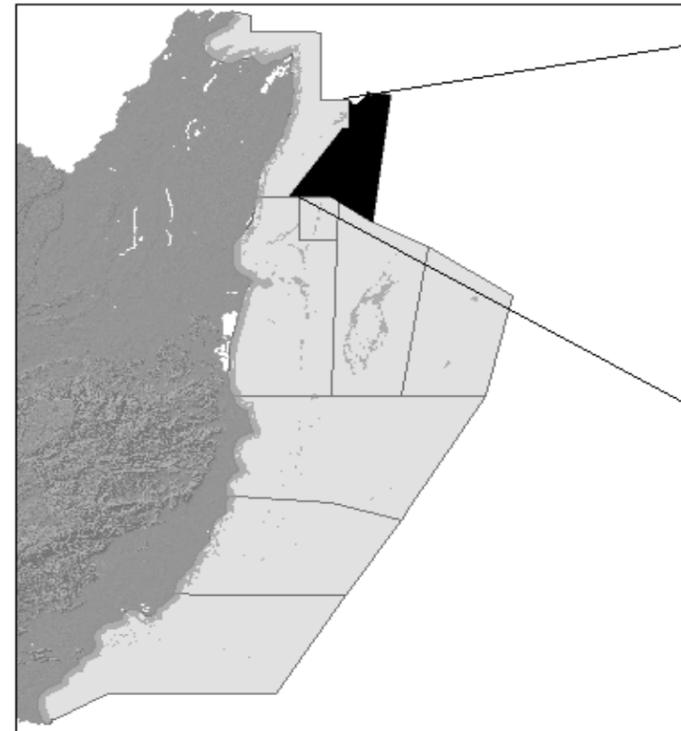
Commercial Development: Land use in which income is generated and commerce is predominant. Includes shops, stores, hotels, office buildings, and warehouses.

Table 3: Commercial Development Standards for Resort Hotels at Ambergris Caye

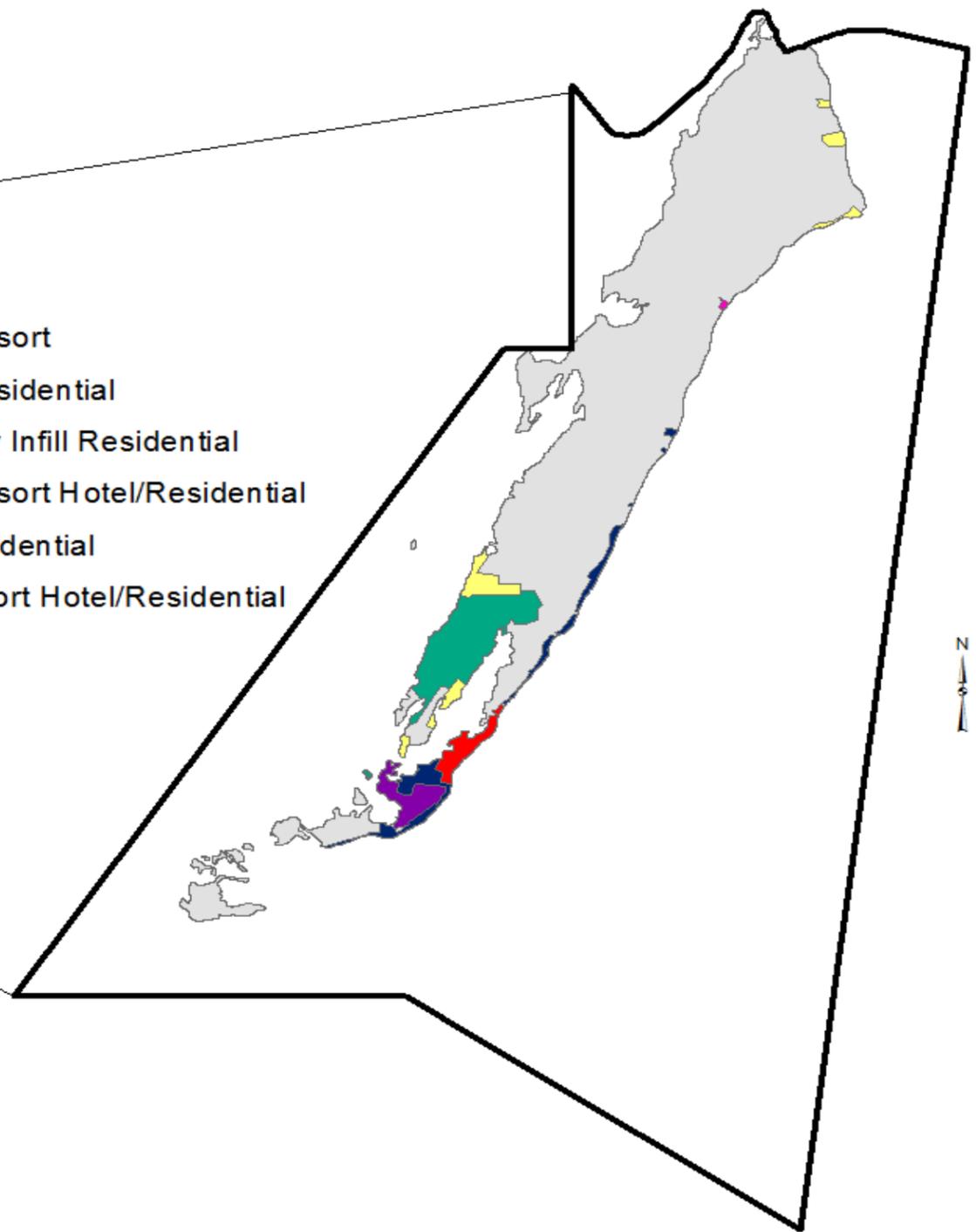
Subdivision Criteria	Commercial Development Standard
Primary Permitted Use	Commercial Low Density (resort hotels);
Secondary Use	None
Maximum Lot Size	0.25 acre
Width/Length Ratio	1:2
Net Density (dwelling units per acre)	20 du/acre
Maximum Site Coverage	33%
Minimum Frontage	65 feet
Minimum Setbacks:	
Front	6ft
Side	6ft
Back	12ft
Maximum Building Height	As per requirements/standards of the Central Building Authority
Maximum # of floors per building	As per requirements/standards of the Central Building Authority
Services	Water, Electricity, Telecommunications, Sewerage Treatment, Waste Disposal

Second, small low density developments are proposed off the main road leading north and after the bridge north from San Pedro (**Map 6**). These developments essentially entail the completion of existing urbanized areas. The density proposed for infilling and completion of the town is 4 units/acre – 10 units/hectare. Residential development standards are found in **Table 4**, and these correspond to the recommended Informed Management Zoning Scheme for the proposed residential developments (**Map 6**). The framework for implementing the zoning scheme for the development of coastal lands is found in **Table 5**

INFORMED MANAGEMENT ZONING SCHEME FOR RESIDENTIAL DEVELOPMENT: AMBERGRIS CAYE



- Existing Low Density Resort
- Existing Low Density Residential
- Existing Medium Density Infill Residential
- Existing Low Density Resort Hotel/Residential
- Future Low Density Residential
- Future Low Density Resort Hotel/Residential



Scale: 1:225,000
NAD 1927 UTM ZONE 16N

A scale bar with markings for 10, 5, 0, and 10 Kilometers.

Map 6: Informed Management Zoning Scheme for Residential Development at Ambergris Caye

Residential Development: Land use in which housing predominates, as opposed to industrial and commercial areas.

Table 4: Development Standards for Completion of Existing Urban Areas at Ambergris Caye

Subdivision Criteria	Residential Development Standard
Primary Permitted Use	Single and Multi-Family Residential
Secondary Use	Commercial Low Density (convenience stores, small service shops,); Community Facilities
Maximum Lot Size	0.25 acre (4 lots/acre)
Width/Length Ratio	1:3
Net Density (dwelling units per acre)	4 du/acre
Maximum Site Coverage	33%
Minimum Frontage	65 feet
Minimum Setbacks:	
Front	8ft
Side	8ft
Back	15ft
Golf Cart Parking	1 per dwelling unit
Maximum Building Height	As per requirements/standards of the Central Building Authority
Maximum # of floors per building	As per requirements/standards of the Central Building Authority
Services	Water, Electricity, Telecommunications, Sewerage Treatment, Waste Disposal

Table 5: Framework for Implementing Informed Coastal Development at Ambergris Caye

ZONE	CHARACTERISTICS OF ZONE	SCHEDULE OF PERMITTED USES			SCHEDULE OF RESTRICTED USES	SUPPORTING NATIONAL POLICIES	IMPLEMENTING AGENCY
		Dominant	Compatible	Regulated			
Coastal Development	Residential settlements, infrastructure, commercial/economic activities on land above water within 3km buffer of the coastline and offshore cayes	1. Expansion of existing communities 2. Small-medium scale residential development 3. Small-medium scale commercial development 4. Community facilities 5. Supporting infrastructure	Small-scale, light industry Tourism facilities, such as small guest houses Subsistence agriculture production, and landscaping with decorative, native, non-invasive crops	Subdivision of land Establishment of small and medium-scale commercial and light-industrial development Establishment of residential expansion Solid and liquid waste management	1. Large-scale coastal agriculture production 2. Coastal aquaculture 3. Dumping of solid, toxic, hazardous waste and untreated liquid wastes, including grey water and sewage 4. Commercial or light-industrial development within residential zone 5. Residential development within commercial or light industrial development zone 6. Squatting/informal settling 7. Unregulated clearing of mangrove forest, including the conversion of mangrove areas into other uses 8. Oil exploration, extraction and establishment of oil refinery 9. Dredging and Mining	Belize Building Act Cayes Development Policy Coastal Zone Management Act Environmental Protection Act Forest Act Hotels and Tourist Accommodation Act Housing and Town Planning Act Land Utilization Act Mines and Minerals Act Solid Waste Management Authority Act Water and Sewerage Act	Central Building Authority Coastal Zone Management Authority Coastal Zone Management Authority Department of the Environment Forest Department Belize Tourism Board Ministry of Housing Land Utilization Authority Mining Unit, Ministry of Natural Resources Solid Waste Management Authority Belize Water Services Limited

Dedicated land clearing in the preparatory phase to construction is the most significant source of deforestation and alteration of terrestrial habitat on Ambergris Caye. Apart from low-lying mangroves the supra-tidal littoral forest landward of the beach berm is the most affected vegetation type on the island. This has major consequences for wildlife, particularly birds. The littoral forests that are under the greatest development pressures on the Island are those associated with the eastern side of northern Ambergris Caye. This is as a consequence of the gradual spread of resort development north of the ‘San Pedro River’, over the last 8 to 10 years

The clearing and in general ‘thinning’ of the littoral forest on the windward or eastern side of northern Ambergris Caye has resulted in the beach erosion. This is a consequence of the interference with the natural ‘sand budget’ of the beach. The removal and thinning of this vegetation to support human settlement has decreased the seasonal sand budget, resulting in a net loss or erosion of the beach. Beach erosion precipitated by the loss of littoral forests would be exacerbated by other sources of erosion such as pier construction, dredging and reclamation.

Recommended Actions:

1. In wetland areas, all development proposals should be required to undertake a full scale Environmental (EIA) and including shoals with no emergent land.
2. Develop and adopt standards and guidelines for the construction, placement and operation of docks and structures incorporated into their design and construction such as dive shops, tour guiding kiosks and other overwater facilities as per the advice of the Department of Environment (DOE). This should include the issue of ‘pier density’ or the number of piers over a unit length of shoreline such as a mile or kilometer, as well as the length and environment-related issues such as beach erosion and placement relative to coral reef and seagrass beds.
3. Maintain the 66 feet reserve, and ensure that minimum setbacks from property lines and beaches, and minimum distances between buildings are enforced
4. Encourage “soft” and permeable coastal defense structures such as the planting of mangrove to avoid related erosion, the acceleration of off-shore currents, and impediments to wildlife. Should “hard” coastal defense structures become necessary, the construction of such structures will follow due process by the relevant permitting agency
5. Discourage heavy and unregulated use of herbicides, pesticides and fertilizers
6. Implement landscape design awareness that would facilitate the preservation of mangroves for shoreline protection
7. Support the institution of a system of restrictive code of covenants between land owners and developers that favor integrated development planning

8. Educate developers, contractors and real estate agents on the existence of all applicable legislation, processes and procedures pertaining to land development
9. Ensure the standards and engineering approval process established by the Central Building Authority for building construction are adhered to
10. Provide for low-density development with the least possible site clearance to maintain the characteristics of the natural environment as much as possible
11. Preserve remaining crown or government-owned lands in the region
12. Require that developers who remove habitats must finance their restoration

6.4 Marine Dredging & Mineral Extraction

Much of the development on Ambergris Caye over the last 3 to 5 years has been accompanied by dredging and reclamation activities. This is especially relevant to the southern portion of the island, which is the traditional reach of San Pedro Town. The general expansion of the town south of the San Pedro Air Strip combined with the development of resorts on the far south and southwest of the Caye makes the lower one-third portion of the Island a prime focus for dredging and reclamation.

The turbidity and sedimentation influences associated with dredging and reclamation has negative implications for biodiversity. Corals and coral reef are among the most vulnerable to the impacts associated with dredging and land reclamation. It has been asserted that the scope and methodology associated with dredging and reclamation around the Island can have major negative consequences on the ecological viability and health status of corals and reef systems.

The mechanical loss and demise of seagrass beds is also another consequence of dredging and land reclamation. The visual loss of mangroves from much of southern Ambergris Caye is arguably the most salient reminder of the connection between development and biodiversity on the island. The loss of mangroves brings with it a decline in productivity as well as the loss of critical habitat. The latter is especially relevant to the prop roots of the Red Mangrove, which form the habitat for a wide range of attached plants and sedentary invertebrates such as sponges, tunicates and tube worms. Dredging is especially deleterious on the windward side of the Caye which is adjacent to the reef crest and reef flat of the barrier reef. It is also the area with the most robust and abundant seagrass meadows. However, it must also be noted that there are instances where some dredging is required in order for activities occur. These instances include the maintenance of port of entry and navigational lane. In this case the relevant authority should lead this process and procure any relevant permits or approval before the activity can take place.

Recommended Actions:

1. Dredging conflicts with the all of the management objectives for Ambergris Caye. Therefore, no dredging, sand mining, or land filling should be allowed at Ambergris Caye without 1) the complete satisfaction of the Environmental Compliance process; 2) compliance with these Guidelines and 3) issuance of a dredging permit from the Mining Unit
2. In consideration of the objectives of these guidelines which include sustainability of commercial fishing sector and support of low-impact, nature-based tourism, development should be confined to areas naturally supportive of such development, and exclusively those development areas that have been identified in these guidelines.

3. Any reclamation of lost property, (after hurricanes) should only be done in consultation with the relevant authorities. Dredging for this purpose should be kept to a minimum while guaranteeing that native habitats are not damaged.
4. Land without feasible access should not be developed and only minimal manual dredging for boat access should be allowed.

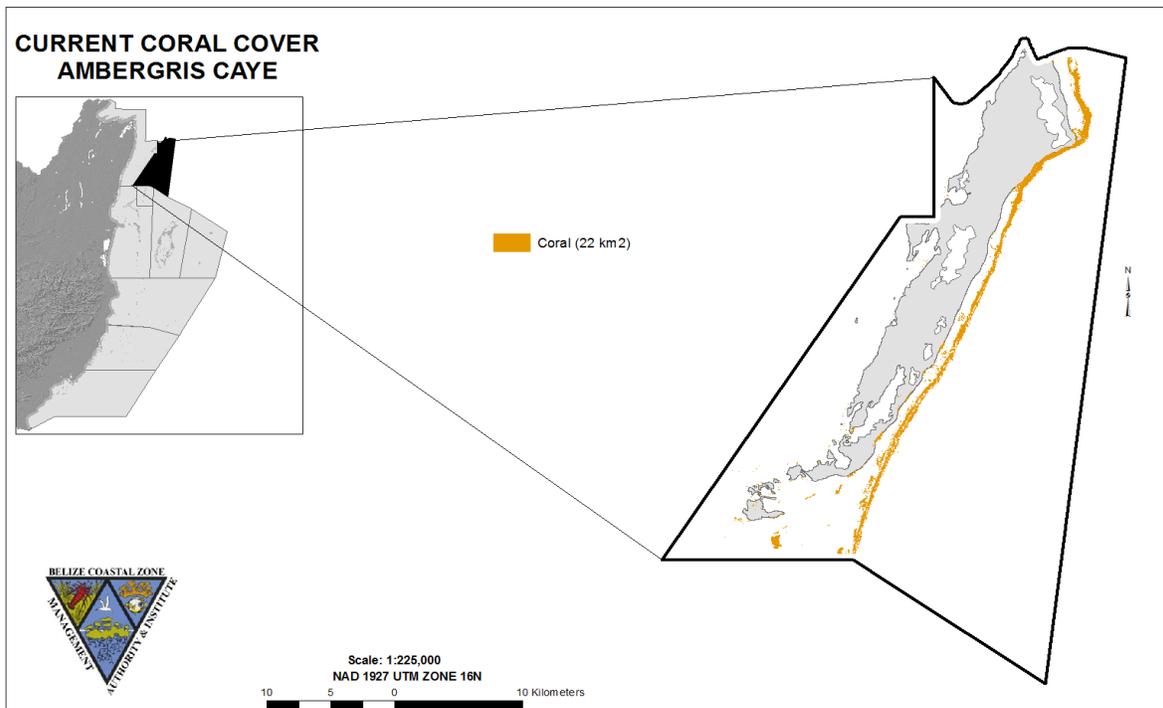
6.5 Sensitive Habitats

6.5.1 Corals

The most visible and relevant subtidal ecosystem off the shores of Ambergris Caye is the Belize Barrier Reef. The reef off Ambergris Caye is characterized by most of the 44 species of reef-building or hard-corals documented in Belize. These include the grooved brain coral (*Diplora labyrinthiformis*), the mountainous star coral (*Monastrea anularis*), the elkhorn coral (*Acropora palmata*), the lettuce coral (*Agaricia agaricites*) and the Stag Horn Coral (*Acropora cervicornis*). Soft corals or non-reef building corals include the Common Sea Fan (*Gorgonia ventalina*), the Corky Sea Fingers (*Briareum asbestinum*), the Common Bushy Soft Coral (*Plexaura homomalla*) and the Sea Rod (*Plexaurella grisea*).

The ecosystems services associated with the reef system are food production, physical protection of the coastline from erosion and damage to building and urban infrastructure associated with storm surge and heavy sea-states, as well as the maintenance of marine biodiversity and the potentials for bio-prospecting associated with the extraction of chemicals and bioactive compounds which may have applications in the pharmaceutical and cosmetic industries. The reef system is also an important ‘carbon sink’ for the planet, thus the geographical extent and quality or health of the reef is needs to a focus of management efforts at both the national and municipal level.

The total coral cover in the Ambergris Caye region is approximately 22 km² (**Map 7**).



Map 7: Coral Cover in the Ambergris Caye Region

Due to current pressures on corals, InVEST Habitat Risk Assessment (HRA) model results suggest that approximately 0.9% of the region’s corals are currently at low risk, 38.9% at medium risk, and 60.6% at high risk (**Fig. 1**).

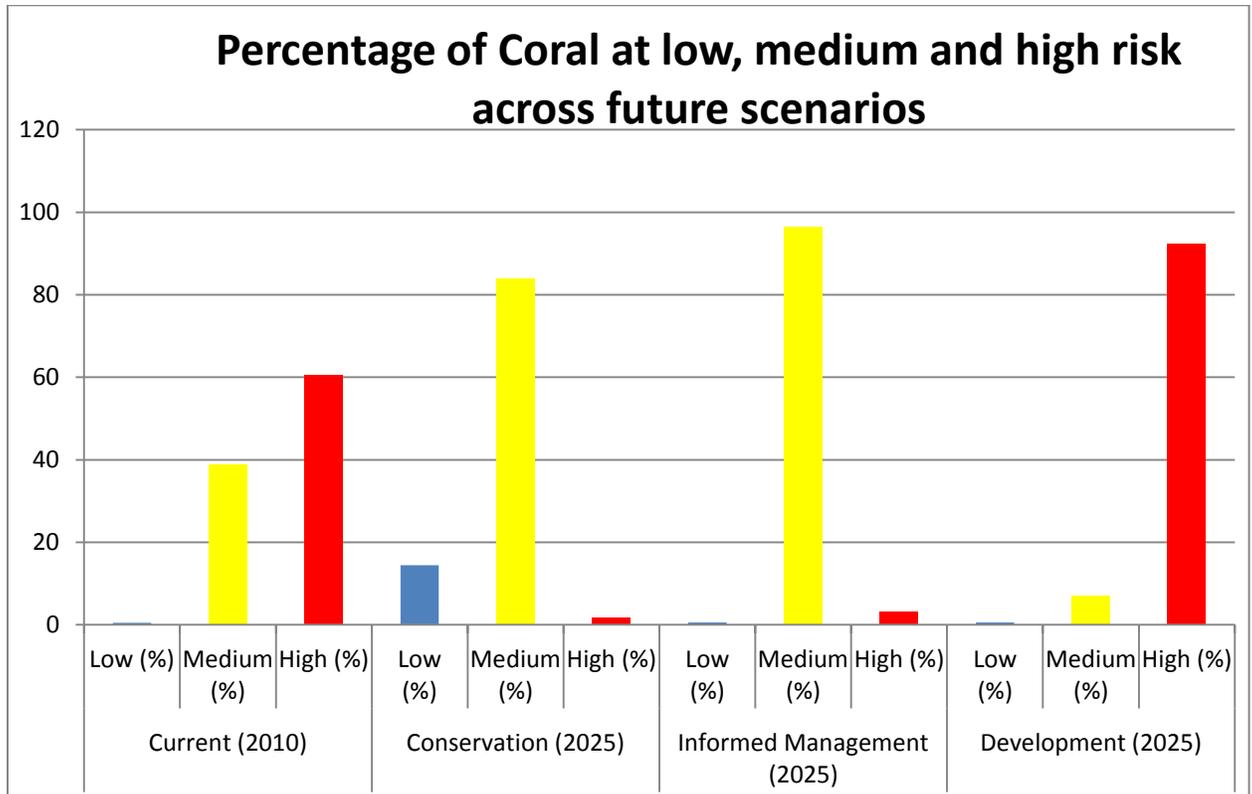


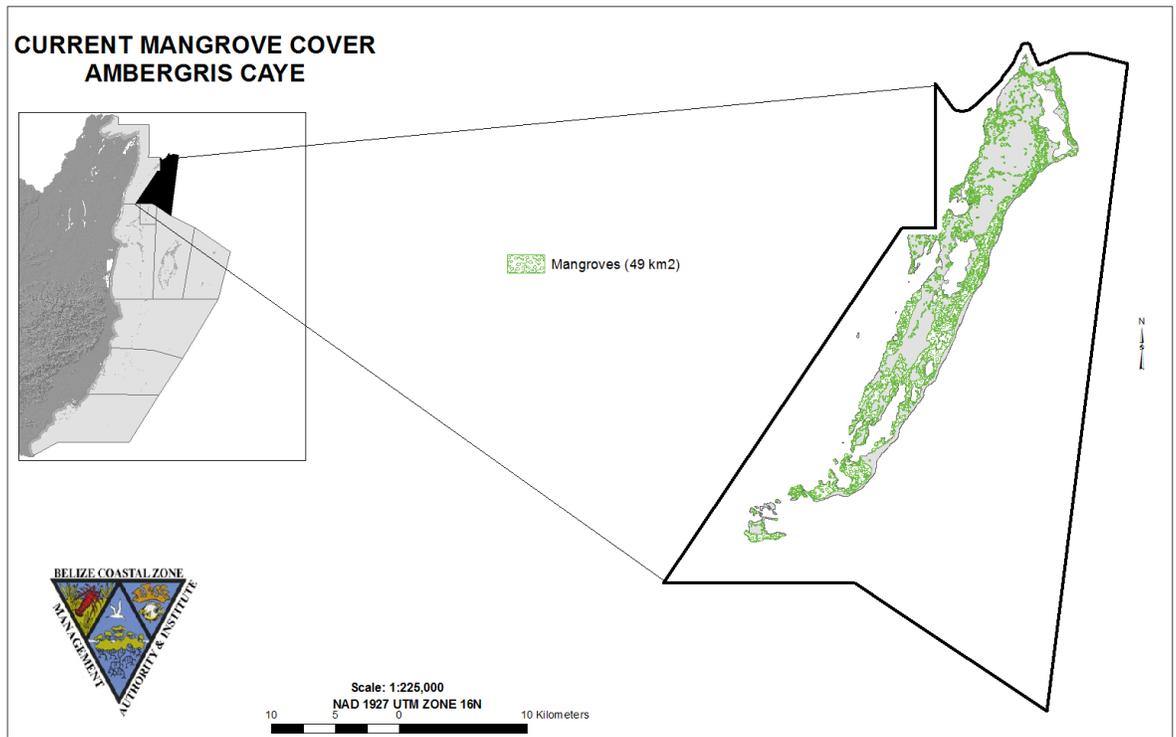
Figure 1: Risks to Corals in the Ambergris Caye Region by Scenario

The results also suggest that in a Conservation Zoning Scheme, 1.8% of corals would be at high risk. There would also be proportionately less corals at medium risk than in the current. According to HRA model results, approximately 45% of corals that were formerly at medium risk in the current scenario would be low risk in a future Conservation Zoning Scheme. Thus, the total percentage at low risk in this scenario is 83.4% and 14.4% at low risk (**Fig 1**). In a Development Zoning Scheme, HRA model results suggest that the threat to corals would become increasingly higher. Only 0.6% of corals would be at low risk whereas 7% and 92.4% of present mangrove would be at medium and high risk, respectively (**Fig. 1**). In the proposed Informed Management Zoning Scheme, HRA results are indicating that 3% of corals would be at high risk, 0.6% of present corals would be at low risk, and 96.4% at medium risk (**Fig. 1**).

6.5.2 Mangroves

Mangroves are salt-tolerant flowering trees that occupy the intertidal zone in tropical and subtropical environments. Three (3) mangrove species exist in Belize, and include the Red Mangrove (*Rhizophora mangle*), the Black Mangrove (*Avicennia germinans*), and the White Mangrove (*Laguncularia racemosa*). All three (3) species of mangroves are found on Ambergris Caye. Mangroves are among the most productive coastal ecosystems in the tropics. In this regard they are a major ‘exporter’ of particulate organic matter and biota. In the case of the latter they form the base of food chain and food web relationships in mangrove ecosystems. In terms of ecology-related ecosystems services, mangroves are a major provider of fish biomass that pay dividends in terms of issues of food security, foreign exchange earnings and income. They perform an important nursery function for a wide range of fin-fishes and invertebrates that inhabit the reef system, seagrass beds and open ocean during the latter stages of their life cycles.

The rapid spread of urbanization and general resort development on the southern portion of Ambergris Caye has resulted in major land-clearing and reclamation activities that have greatly decreased the amount of mangroves in the area. Mangrove clearance on both southern and northern Ambergris Caye continues to be a growing problem. The core of the problem is inadequate monitoring and enforcement. Mangrove clearance on Ambergris Caye, whether legal or illegal, is attributable to a range of causes. The most significant contributor is in relation to real estate development in intertidal or sub-tidal lowland areas: This is engendered by active mangrove cutting or clearance followed by dredging and reclamation. In a number of instances, particularly in areas where dwarf forest dominate, reclamation proceeds without prior land clearance. The total mangrove cover on Ambergris Caye is 50 km² (**Map 8**).



Map 8: Mangrove Cover in the Ambergris Caye Region

Based on results from the InVEST Habitat Risk Assessment model, and as a consequence of current pressures on mangroves, approximately 12% of the region’s mangroves are at low risk, 71% at medium risk and 17% at high risk (**Fig. 2**). The results also suggest that in a Conservation Zoning Scheme, there will be approximately no mangroves at high risk. Instead, 39% of current mangroves would be at low risk, and 61% at medium risk (**Fig. 2**). In a Development Zoning Scheme, HRA model results suggest that the threat to mangroves would become increasingly higher. Only 0.4% of mangroves would be at low risk, whereas 75% and 25% of present mangrove would be at medium and high risk, respectively (**Fig. 2**). In the proposed Informed Management Zoning Scheme, HRA results are indicating that no mangroves would be at high risk, 32% of present mangroves would be at low risk, and 68% of medium risk (**Fig.2**).

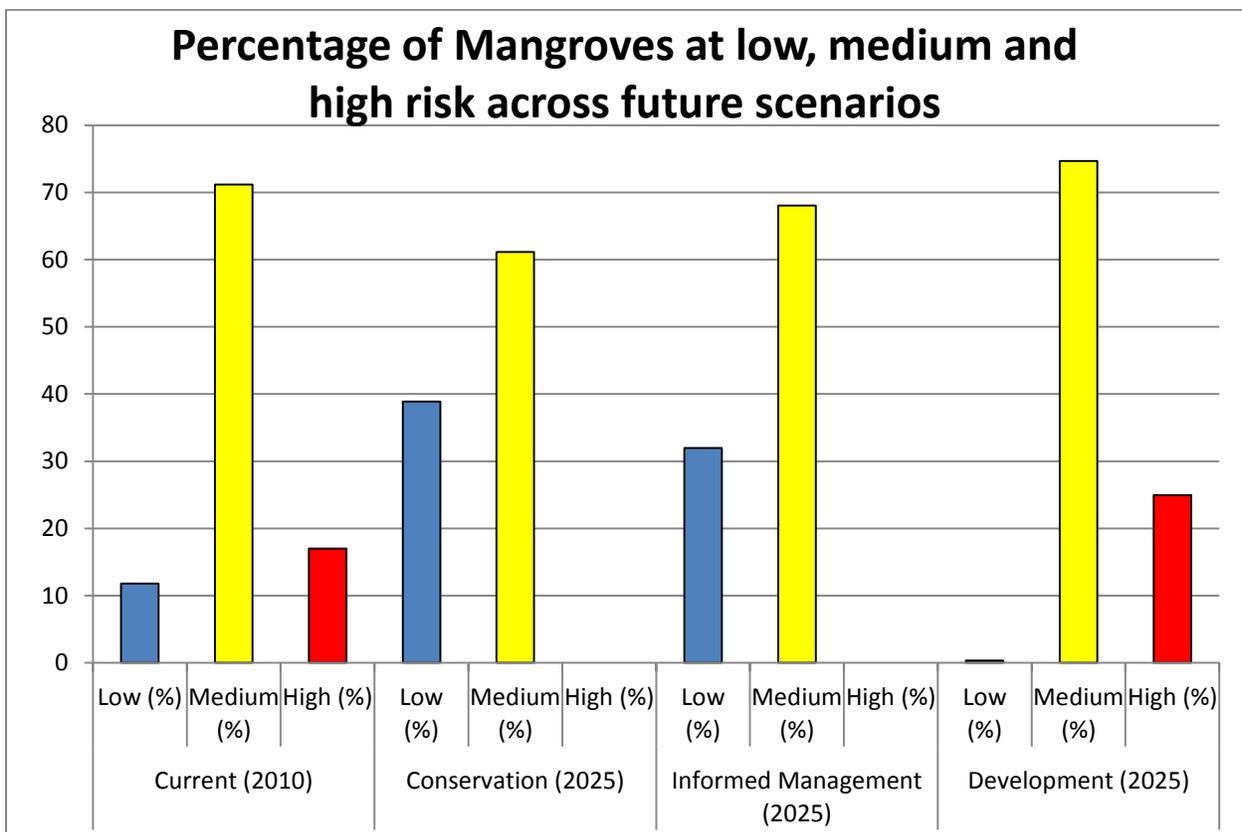
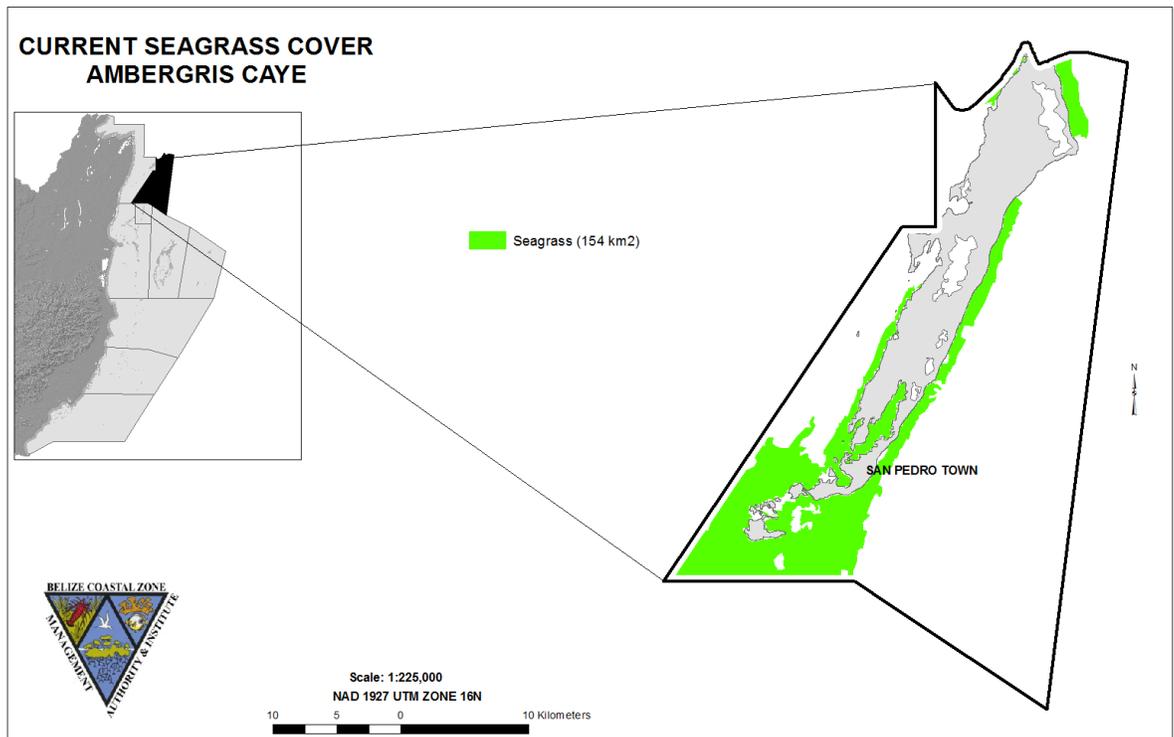


Figure 2: Risks to Mangroves in the Ambergris Caye Region by Scenario

6.5.3 Seagrass

The seagrass beds in the barrier lagoon are dominated by the Turtle Grass (*Thalassia testudinum*). The Manatee Grass (*Syringodium filiforme*) occurs in discernible abundance in a zone just below the low tide line and proceeding for a few feet seaward of this area. The distribution of this seagrass species occurred intermittently adjacent to the shoreline.

The total seagrass cover in Ambergris Caye is approximately 155 km² (**Map 9**).



Map 9: Seagrass Cover in the Ambergris Caye Region

Results of the InVEST Habitat Risk Assessment (HRA) model suggests that currently 0.07% of the region’s seagrass are at low risk, 62.98% at medium risk, and 36.95% at high risk (Fig. 3).

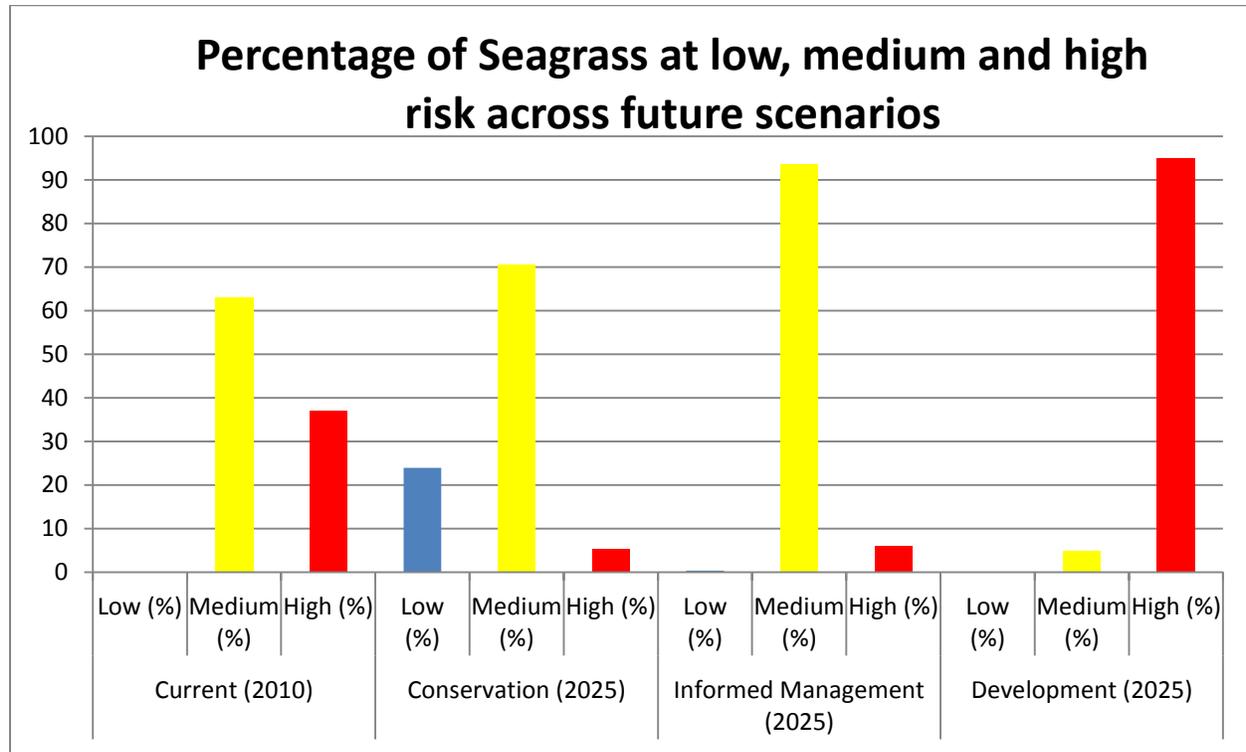


Figure 3: Risk to Seagrass in the Ambergris Caye Region by Scenario

In a Conservation Zoning Scheme, HRA model results suggest a dramatic reversal of the level of risk to current seagrass in this region whereby only 5% of seagrass would be at high risk, 24% of seagrass would be at low risk and 71% at medium risk in 2025 (Fig. 3). In a Development Zoning Scheme, model results suggest that 95% of present seagrass would be at high risk. The results also suggest that in the Development Zoning Scheme, 4.9% of seagrass would be at medium risk and 0.1% at low risk in 2025 (Fig. 3). In the proposed Informed Management Zoning Scheme, the HRA model results suggest an improvement in the amount of seagrass that are currently at risk. Under this zoning scheme, 93.5% of present seagrass would be at medium risk. Additionally, the model results reveal that under this zoning scheme, 0.4% of present seagrass would be at low risk and 6.1% at high risk in 2025 (Fig. 3).

In discussing the results of the InVEST ecosystem models, and in particular the habitat risk assessment model, there is the need to consider limitations of the model, which are highlighted below:

- Results are should be interpreted on a relative scale within a study region and across habitats and stressors, but not to results from separate analyses.
- Results do not reflect the effects of past human activities.
- Results are based on equal weighting of criteria unless the user weights the criteria by importance or data quality.
- Cumulative risk is additive (rather than synergistic or antagonistic)
- Climate change impacts are not directly accounted for in model

Additional information on how this model works can be found in **Appendix B.1** of the Belize Integrated Coastal Zone Management Plan.

Recommended Actions:

1. Analyze current human impacts on habitats in this region in order to prioritize areas requiring immediate management intervention
2. Enhance collaboration among management and permitting agencies to ensure impacts to critical habitats are reduced and controlled
3. Raise awareness and outreach in community stakeholders about the importance of reducing impacts to habitats
4. Implement the Informed Management Zoning Scheme that will support multiple human activities in the region while limiting activities in specific areas in order to reduce impacts to critical and sensitive habitats and to maintaining their integrity

6.6 Utilities

6.6.1 Energy

Belize Electricity Limited (BEL) is the primary distributor of electricity in Belize. BEL meets the country's peak demand of about 70 megawatts from multiple sources of energy. These sources include electricity purchases from Belize Electric Company Ltd. (BECOL), which operates the Chalillo and Mollejón Hydroelectric Facilities in Western Belize; and BEL's gas turbine unit and diesel fired generators. The San Pedro Sub Station, located at the southern end of the island, is connected to the country's national electricity system. Electricity services stretch from as far south as the Boca Ciega lagoon to as far north as the Sueno el Mar development.

6.6.2 Water

Potable water for most residencies and businesses in Ambergris Caye is provided through a reverse osmosis plant operated by The Consolidated Water Company (CWC) and distributed by the Belize Water Services Limited (BWSL). It is the only plant on the Caye providing municipal services although it is believed that several smaller private units exist that supply individual resorts. Potable water is made available to areas from approximately one mile south of the plant to residents / resorts just north of the Boca Del Rio settlement. It is estimated that there are approximately 2,800 connections to the municipal system with an average monthly consumption of 10 million US gallons.

6.6.3 Transportation

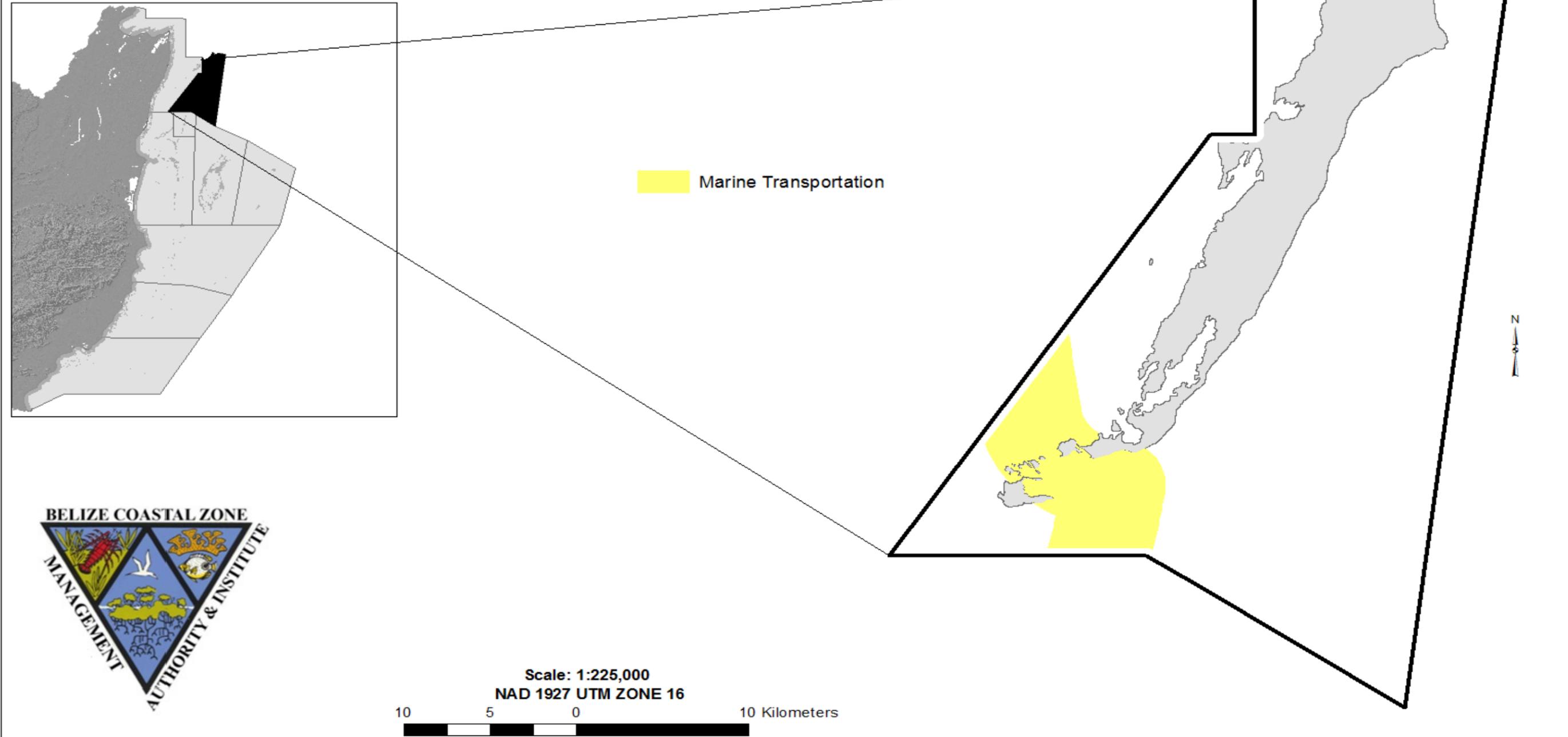
Ambergris Caye is easily accessible by sea through the services of several water taxi associations. By boat, it is a fairly short and very scenic sixty (60) minute ride. However, access to certain areas around the island is also limited by water depth. The maximum depth at which a vessel can enter the barrier reef and anchor off San Pedro beach is about five (5) feet. Only the traditional sailing and fishing boats, twenty-four (24) to thirty (30) feet long and with a depth of three (3) feet, can enter the Laguna de San Pedro either from the west or through the San Pedro River. Larger vessels have to anchor or moor south of the island where the water is deeper, in order to avoid impacts and damage to the reef as tidal range is very small, about one foot but may be significantly affected by wind.

The windward coast of Ambergris Caye is congested with a total of 279 piers and jetties on the eastern coastline. Piers and jetties are used primarily for the docking of private vessels, loading and unloading onto the island materials such as consumer goods, construction materials, and tourism passengers interested in diving and snorkeling. The piers extend into the sea to a suitable depth of water and the area around them is often dredged to increase the available draft.

Because of the excessive pier density and their negative impacts, from both an environmental and social standpoint, a temporary moratorium was placed on all applications seeking approval for the construction of piers on the island. Some of the major concerns related to high pier density include the increased vulnerability to serious beach erosion, navigational safety hazards, fire peril, and visual pollution of the island frontage, and the obstruction of public use of the beach.

There has been an ever present confusion and battle between the San Pedro Town Council and businesses with regard to the public use of piers. All existing piers are open to public use between the hours of 6:00am to 6:00pm, regardless of who built and who maintains them. However, because of the lack of monitoring and enforcement, some piers have barricades on them that impede pedestrians and/or traffic on public beaches. The San Pedro Town Council, in conjunction with the Physical Planning Section, Lands and Surveys Department of the Ministry of Natural Resources and Agriculture, implemented a one-year project entitled “*Strengthening Policy and Legal Framework for Belize Pier and Construction Management Program*” in 2008. The main objective of the project was to sustainably manage piers and other constructions in an effort to prevent, minimize and mitigate negative impacts to the environment, particularly around San Pedro, Ambergris Caye, Caye Caulker, Placencia, and in the vicinity of seven of Belize’s marine protected areas. These guidelines recommend implementation of the Pier and Construction Management Program with the Informed Management spatial zoning scheme for marine transportation in this region (**Map 10**). In addition to the recommended zoning scheme for marine transportation, the framework for implementing the recommended transportation routes for this region is found in **Table 6**.

INFORMED MANAGEMENT ZONING SCHEME FOR MARINE TRANSPORTATION: AMBERGRIS CAYE



Map 10: Informed Management Zoning Scheme for Marine Transportation at Ambergris Caye

Table 6: Framework for Implementing Informed Marine Transportation in the Ambergris Caye Region

ZONE	CHARACTERISTICS OF ZONE	SCHEDULE OF PERMITTED USES			SCHEDULE OF RESTRICTED USES	SUPPORTING NATIONAL POLICIES	IMPLEMENTING AGENCY
		Dominant	Compatible	Regulated			
Marine Transportation	Marine area delineated for the use of watercraft, such as water taxis, cruise ships, etc, to transport people, goods and cargo between multiple destinations	1. Shipping operation activities 2. Port development and operation 3. Vessel traffic use	Dredging for the maintenance of navigational lanes and ports of entry	Passage/entry of vessels Operation and construction of ports	1. Fishing 2. Marine recreational activities 3. Anchoring that leads to disturbance and destruction marine habitats, including but not limited to, coral reef system, seagrass beds, etc 4. Exploration and extraction of petroleum 5. Construction of any illegal structure that would obstruct shipping and navigation 6. Disposal of solid and liquid wastes from boats and ships 7. Transportation of illegal goods, such as drugs and weapons, and human trafficking	Belize Port Authority Act Belize National Coast Guard Service Act Customs Regulation Act Defense Act Environmental Protection Act Harbors and Merchant Shipping Act Immigration Act Maritime Areas Act Marine Dredging Policy (Draft) Mines and Minerals Act	Belize Port Authority Belize National Coast Guard Customs Department Belize Defense Force Department of the Environment Belize Port Authority Immigration Department Ministry of Foreign Affairs Mining Unit, Ministry of Natural Resources Geology and Petroleum Department

Recommended Actions:

1. Identify a new dump site location on north Ambergris Caye to relieve some of the pressure of the existing dump site until the implementation of the National Solid Waste Management Plan.
2. Close collaboration with relevant agencies to ensure that water and energy supply, and sewage and solid waste management in the region are provided through environmentally friendly and cost effective means
3. Formalize and implement the Belize Pier and Construction Management Program
4. Close collaboration with relevant agencies in the placement and maintenance of buoys, lighthouses and protected area boundary markers in the sea
5. Upgrade existing power network to accommodate certain increased energy needs as the area develops and expands
6. Extend and upgrade existing water supplies in order to meet future demand
7. Encourage the use of solar and wind power in the case of resorts and any residential development, as they are unlikely to cause the environmental problems (spillage, fumes, noise) associated with diesel generators
8. Take all precautions to avoidance of pollution and noise generation in accordance with the Pollution Regulations, 1996 of the Department of the Environment

6.7 Pollution Control

Solid Waste Management

Solid waste management continues to be a recurrent and significant challenge on Ambergris Caye, both at the level of the individual household, as well as at the level of the municipal authorities. Solid waste management for Ambergris Caye is the responsibility of the San Pedro Town Council, with its garbage collection department spearheading the daily collection and delivery of both municipal and commercial garbage to the Town's central dump site. The central dump site is situated within a wetland area approximately two miles south of the Business District of San Pedro Town. The dump site is an open area measuring approximately five (5) acres. The garbage is minimally separated and burnt on a daily basis. There is no sorting of garbage for example organic vs. inorganic, or combustible vs. non-combustibles, except for medical waste, which is a minor component of the overall municipal solid waste load. This creates a range of issues with negative consequences for biodiversity.

The disposal of plastics is a huge problem. This ranges from plastic bottles and plastic bags, to wrappers and packing materials for fragile wares and equipment. Translucent plastic bags are known to be inappropriately ingested by sea turtles and other marine life. Sea turtles and other marine life have also been known to be ensnared and entangled by the 'plastic rings' or holster packaging of 'six pack' beers. Discarded containers of plastics, metal, rubber, and Styrofoam are also known to be breeding areas for vectors of diseases such as Malaria and Yellow Fever. These vectors are also nuisance insects to man, his domesticated stocks and wildlife. The discarding of food scraps and other edible wastes are also known to attract feral predators and opportunistic stocks such as crocodiles, raccoons, skunks, foxes and snakes. This would in effect precipitate and sustain the presence of animal groups that would not be at a particular site without the intervention of some form of human settlement.

Although there seems to be some progress in managing the collection and disposal of garbage on the island, some persons still engage in the practice of dumping garbage indiscriminately in mangroves, open lots, road sides and elsewhere. Environment issues resulting from the improper disposal of solid wastes are those normally associated with unplanned development activities along the coast and in the low-lying areas. In some cases waste oil from boats are being dumped into the sea as well as in the wetland areas and inner lagoons. These pollutants generate odors and leachate in the groundwater system, which result in the degradation of coastal resources.

In 1997, an agreement was signed between the Government of Belize (GOB) and the Inter-American Development Bank (IDB) for the preparation of a National Solid Waste Management Plan (NSWMP). The objective of the Plan was to improve solid waste management practices, reduce environmental pollution and enhance its image in the eco-tourism market. As a component of the NSWMP Project infrastructure, work is in progress to close down the existing San Pedro dump site and relocate it to an alternative site measuring 25.01

acres. This is a portion of land that currently belongs to the Belize Port Authority. The closure of the existing dump site will involve the leveling of the terrain, compaction, leachate controls and adequate cover. Waste transfer and recycling facilities will be constructed to carry out source separation of recyclables, household hazardous materials and waste

Liquid Waste Management

The greatest threat from sewage and domestic effluents to the environment and in general biodiversity is from the macronutrients associated there-with. These are the “break-down” products from the various nitrogenous sources and phosphate sources. In the case of the municipal treatment system in San Pedro, the effluent stream from the ‘polishing pond’ does bear macro-nutrient loads. The management of sewage and domestic effluents on Ambergris Caye is a mix primary, secondary and tertiary treatment.

Much of the primary treatment is related to dwellings and businesses in the more populated areas of San Pedro that use septic tanks or are connected to the municipal treatment system. The sewerage system currently serves approximately 3,400 consumers and treats about 160,000 gallons of sewerage per day. The septic tank systems are either completely sealed with a leach field or unsealed with an open bottom that percolates into the soil and ostensibly water table. These systems may or may not be fitted with leach fields. There is no reliable data on the proportion of the septic tanks that are sealed versus those that are not sealed. Those sewage and domestic effluent streams connected to the municipal system are eventually conveyed to oxidation ponds or sewer lagoons to allow for the degradation of the nitrogenous compounds and the denaturing of fecal pathogens.

The developments that have integrated secondary and tertiary treatment into their facilities are a mix of residential premises and resort developments. These are generally located away from the population centers of the Town. Most of these developments are located on the eastern side of northern Ambergris Caye. Treatment technology is a permutation of Package Plants with the capacity to deliver varying quality of effluents that are either secondary or tertiary in characteristic.

The ecosystem that is most vulnerable to eutrophication or nutrient enrichment is the coral reef. This susceptibility is related to the uptake and enhancement in the growth of macroalgae which shades out corals. Over time the reef becomes overgrown by these macroalgae and declines in health and functionality. This is reflected in decreases in live coral cover and increases in bleaching events and pathogenic diseases. The response to increases in nutrient flux by photosynthetic biota in the marine environment is not limited to macroalgae. In instances where seagrasses are found to be growing in close association with corals, they also experience growth spurts and overgrow corals. This is particularly relevant in back-reef areas. The nutrient enrichment in San Pedro and the wider Ambergris Caye region is derived from surface water runoff as well as the leachate of septic tanks. The Sewer Lagoon in San Pedro cannot be

discounted from this process, as under extreme storm events the embankment of the Sewer Lagoon may be breached and/or flooded.

The Central Building Authority (CBA) is the agency mandated by the Belize Building Act 2003 to control building operations in the interest of public safety and health. In 2010, CBA produced detailed specifications for the construction of soak-aways and septic tanks for residential and other low impact buildings. Detailed diagrams can be found in **Figure 9** of the Appendix of this document. A summary of required specifications for septic tanks servicing residential and other low impact buildings can be seen in **Table 7**. The CZMAI recommends that these standards be used for construction of septic tanks and soak-aways on the **coastal mainland**.

Table 7: Specifications for Residential and Low-Impact Septic Tanks and Soakaways

Max # of persons served	Liquid capacity of tank		Internal dimensions							
			Length (l)		Width (w)		Liquid depth (ld)		Total depth (h)	
	Gallons (approx.)	Cubic ft.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
4	500	67	6	0	3	0	4	0	5	2
6	600	81	7	0	3	0	4	0	5	2
8	750	101	7	0	3	6	4	0	5	2
10	900	121	7	6	3	6	4	6	5	8
12	1100	148	8	6	4	0	4	6	5	8
14	1300	174	10	0	4	0	4	6	5	8
16	1500	201	10	0	4	6	4	6	5	8

Recommended Actions:

1. Implement proper sorting and separation of garbage so as to minimize the emission of chemical toxins associated with the incineration of such.
2. Commit to a dedicated focus on the proper disposal and management of plastics given the scope of their contribution to volumes of non-putrescible solid waste and their potential deleterious impacts on marine fauna and wildlife including hatchling and juvenile sea turtles, as well as sharks and birds: This would include recycling and reuse strategies.

3. Mount a public awareness campaign aimed at reducing the volume of food discards going to the public dump site as well as resorts, private businesses and individual households to decrease and ameliorate the impacts to wildlife, as well as public health concerns including waterborne diseases such as malaria, dengue and yellow fever.
4. Improve water quality by addressing transboundary pollution originating from the Chetumal Bay through collaborative (San Pedro Town Council, NGOs, partners in Mexico) water quality monitoring activities and support of transboundary clean-water initiatives.
5. For Northern Ambergris Caye it is recommended that a collaborated effort between the landowners, the San Pedro Town Council and the Belize Water Services Limited be initiated to provide a centralized sewerage system prior to further development of the island.
6. In the event that a central sewerage system in certain areas may prove to be environmentally deleterious and technically or financially infeasible, other technologies should be employed such as Tertiary Level Treatment Package Plant Systems, or compost systems.

6.8 Social Amenities

Present on the island are seven primary schools, two secondary schools, and a medical university. Health services are provided by various institutions on the island. There are ten listed clinics on the island including, dental, gastroenterological, and gynecological/obstetrical, just to name a few. Where serious medical attention is required the Wings of Hope Medical Emergency Air Ambulance is available for immediate transportation to mainland Belize City.

Major public spaces include a town park located on Barrier Reef Drive, two beachside parks, one located next to the Island Academy on Coconut Drive, and the other at the mouth of the San Pedro River; and two playing fields, one between Buccaneer and Black Coral Streets and the other between the primary school and Barrier Reef Drive. There are also a couple other small parks in some of the residential areas.

The Beachside cemetery continues to be of concern as it is too small and needs minor repairs and beautification. The San Pedro Town Council has formulated the San Pedro Cemetery Committee, the goals of which are to find a new site for the cemetery, and to develop ideas on how best to renovate the existing one.

In April of 2001 a new Fire Station was inaugurated. The station houses two modern fire trucks, provides ample office space, a training room and a watchtower. The San Pedro Police Station has also been recently upgraded which includes a new paint job, new furniture, a new small office and new personal lockers.

Recommended Actions:

1. Ongoing communication between the San Pedro Town Council and the San Pedro community to identify current and future needs for social amenities and supporting infrastructure

6.9 Conservation

The threats to biodiversity on Ambergris Caye and the surrounding sea are varied in scope and magnitude. These threats result from anthropogenic developmental issues as well as biological dislocations and global phenomena. The developmental issues range from the general construction of resorts, to pier construction, as well as dredging and land reclamation. The ecological impacts of these activities are relevant to both marine and land-based ecosystems. The impacts associated with the marine environment range from declines in coral cover and diversity, exploitation of sharks and rays, to beach erosion and decreases in the geographic extent and biomass of seagrass. Land-based impacts include the destruction and demise of nesting sites for sea turtles, exploitation and harassment of reptiles such as iguanas and basilisk lizards, declines in the diversity and abundance of woodland bird species, and a loss of mangrove productivity and nursery function.

Conservation issues on Ambergris Caye can be functionally subdivided into protected areas management and individual species protection efforts. The former relates to areas declared under statutory protection efforts by the Government of Belize while the latter relates to the management of threatened and endangered species. There are two (2) types of Protected Areas in and around Ambergris Caye; Hol Chan Marine Reserve and Bacalar Chico National Park. The marine reserve serves as a fisheries management tool that embraces the multi-use concept that allows for both extractive and non-extractive uses. On the other hand, the national park does not allow for extractive uses, and is generally focused on conservation efforts in terrestrial areas. Based on consultations conducted by the Ambergris Caye Wetland Committee with islanders and other interested stakeholders, the Ambergris Caye Marine Reserve Cluster has been proposed which includes three areas: Mexico Rocks, Bajos and the Mata/Cayo Frances lagoons (**Map 11**). The proposals were made on the basis of the sensitivity of ecosystems and species diversity of the region.

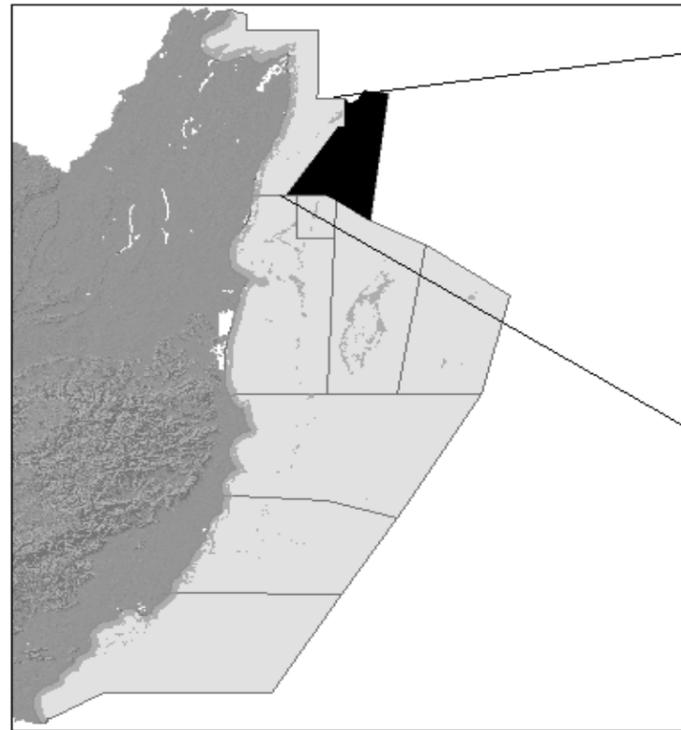
Sandy beaches are one of the visible and outstanding features of Ambergris Caye. The white biogenic coral sand is arguably the greatest natural attraction of Ambergris Caye. This natural asset is of relevance not only to tourism development interests, but also a range of wildlife inhabiting the area. The most noted of these are Sea Turtles which use the beaches for nesting purposes. The beaches from Robles to Rocky Point on the eastern side of northern Ambergris Caye are noted nesting sites for the Loggerhead (*Caretta caretta*) and Green Turtle (*Chelonia mydas*). Although the Hawksbill (*Eretmochelys imbricata*) is not known to nest on Ambergris Caye and seem to prefer areas in the south of Belize for this function, the Caye cannot be ruled out as a possible undiscovered site for the nesting of the species. All three species of the Sea Turtle listed above – the Green Turtle (*Chelonia mydas*), the Hawksbill (*Eretmochelys imbricata*) and loggerhead (*Caretta caretta*) have been listed as endangered by IUCN in its 2000 Red Listing Report.

Even though the main focus of conservation has traditionally been from an ecosystem perspective, the existence of 19 recorded archeological sites on the island calls for the need for efforts to conserve areas that contain these sites of cultural significance for the region and the country of Belize. The largest of these sites is from the Maya Post-Classic period, and is located in the area of the Basil Jones plateau, which features a number of low mounds made from local limestone. There are also areas dotted with well-defined shell heaps and an abundance of obsidian flakings, fragments of pottery and an occasional jade ornament or object carved in bone. The soils in the vicinity of these Maya 'fishing sites' are characterized by a deep black top soil containing fine charcoal.

Development through land use that involves the construction of roads and buildings, mineral extraction, installation of public utilities infrastructure and the removal of trees from the forest, all pose threats to archeological sites. Therefore, the priority of any major development should be to minimize negative impacts on archaeological remains. While the vast majority of archeological sites and monuments are all capable of providing evidence about the past, many are important in the local context of value to the community and therefore require safeguarding through planning processes. In the case where development proposals affect archaeological sites and monuments, alternative sites should be identified for the development. As such, conservation and management of cultural heritage is recommended as the Mayan archaeological sites of Marco Gonzalez and Bacalar Chico are key cultural and economic development features in this region. All developments within this region must therefore reference the National Institute of Culture and History Act where it related to the protection and safeguarding of archaeological, cultural heritage and historical assets.

In an effort to support continued national efforts to conserve biological diversity and reduce the pressures impacting them to ensure their long-term ecological integrity, the CZMAI supports stakeholders' recommendations for the protection of three areas that can benefit from conservation efforts (**Map 11**) on the basis of the sensitivity of habitats and future threats from human activities. The framework for implementing the Informed Management Zoning Scheme for Conservation in the Ambergris Caye Region is found in **Table 8**.

INFORMED MANAGEMENT ZONING SCHEME FOR CONSERVATION: AMBERGRIS CAYE



- Rocky Point Spawning Aggregation Site Reserve
- Existing Coastal & Marine Reserve**
- Hol Chan Marine Reserve *
- Bacalar Chico National Park *
- Bacalar Chico Marine Reserve
- Proposed Conservation**
- Bajo Conservation Zone
- Bajos General Use Zone
- Cayo Rosario Conservation Zone
- Mexico Rocks General Use Zone
- Mexico Rocks Conservation Zone
- Proposed Conservation
- * WORLD HERITAGE SITE



Scale: 1:225,000
NAD 1927 UTM ZONE 16N



Map 11: Informed Management Zoning Scheme for Conservation in the Ambergris Caye Region

Table 8: Framework for Implementing Informed Conservation Management at Ambergris Caye

ZONE	CHARACTERISTICS OF ZONE	SCHEDULE OF PERMITTED USES			SCHEDULE OF RESTRICTED USES	SUPPORTING NATIONAL POLICIES	IMPLEMENTING AGENCY
		Dominant	Compatible	Regulated			
Marine Conservation	Coastal and marine areas delineated for the retention of critical habitats and ecosystems for a diversity of marine life, fish spawning aggregation sites, replenishment zones, biodiversity areas	1. Coastal and marine reserves 2. Breeding, spawning, feeding area for marine life 3. Replenishment zones 4. Seagrass rehabilitation 5. Mangrove planting 6. Foraging area for manatees, dolphins, crocodiles 7. Nesting beaches for sea turtles	1. Research and education 2. Marine Recreation and Tourism 3. Cultural Heritage Conservation Management	Tourism and recreation (snorkeling and diving) Research and education Establishment of new reserves	1. Fishing within “no-take”/replenishment zones, and spawning aggregation sites 2. Development of shoals 3. Anchoring that leads to disturbance and destruction marine habitats, including but not limited to, coral reef system, seagrass beds, mangrove forests, etc 4. Exploration and extraction of petroleum 6. Disposal of solid and liquid wastes from boats and ships 7. Shipping	Belize Port Authority Act Belize National Coast Guard Service Act Customs Regulation Act Defence Act Environmental Protection Act Harbours and Merchant Shipping Act Immigration Act Maritime Areas Act Marine Dredging Policy (Draft) Mines and Minerals Act National Institute of Culture and History Act	Belize Port Authority Belize National Coast Guard Customs Department Belize Defence Force Department of the Environment Belize Port Authority Immigration Department Ministry of Foreign Affairs Mining Unit, Ministry of Natural Resources Geology and Petroleum Department Ministry of Tourism, Culture and Civil Aviation

Recommended Actions:

1. Adopt a set of conservation guidelines that protect the integrity of the natural landscape and direct development to the most appropriate locations on individual sites
2. Minimize negative impacts from developmental activities on archaeological remains. In cases where proposed development activities may potentially affect archaeological sites and monuments, alternative sites should be identified for the development
3. Sharks and rays have a strong tourism impact at Ambergris Caye, and their visual impacts on tourists far outweigh the one-time economic impact of extraction by fisherfolk. Full protection of these species should be enforced.
4. Protect and reduce threats to biodiversity in the region through increased protection of species of conservation significance such as the sea turtles, iguanas and basilisk lizards
5. Explore the implementation of the proposed Ambergris Caye Marine Reserve areas recommended in the Informed Management Zoning Scheme for Conservation(Map 11)

6.10 Scientific Research and Education

Currently, the Bacalar Chico National Park does not have a terrestrial monitoring programme due to financial constraints for a terrestrial biologist. To date, only a Marine Turtle Nest-Monitoring Programme has been established. A complete terrestrial monitoring programme (TMP) should include regular assessment of 9 key terrestrial conservation targets. The TMP should be developed and implemented in collaboration with the Forestry Department and the Belize Audubon Society.

Due to lack of funding, the Bacalar Chico Marine Reserve does not have a complete marine monitoring programme (MMP), which is required to ensure the protection of key marine conservation targets. Regular assessment of the several key marine conservation targets should be included in the MMP and the strategies developed for coral monitoring by the Mesoamerican Barrier Reef System (MBRS) Programme (2003), as well as those of the Hol Chan Marine Reserve should be utilized. At present, monitoring is being conducted on conch, spiny lobster, fin fish of the back reef and fin fish of the fore reef.

Recommended Actions:

1. Implement an integrated research and monitoring programme for the region as a strategy to maintain the long-term ecological integrity of biological diversity and sustainable resource use by dependent communities. Research and monitoring programmes must outline a framework for effective integrated research and monitoring of conservation targets, the development of a data management facility and the incorporation of educational activities and involvement from the Ambergris Caye community

7.0 IMPLEMENTATION STRATEGY

The Ambergris Caye Coastal Zone Management Guidelines form a part of the Belize Integrated Coastal Zone Management Plan being developed by the CZMAI. After approval of the Plan by CZMAI's Board of Directors, it will be offered to the House of Representatives for endorsement. Implementation of these coastal management guidelines will be undertaken through two mechanisms: (a) centralized statutory control through the various Government departments, and (b) localized community and stakeholder participation. Following the mechanism of centralized statutory control, the regulatory and permitting agencies with management mandates for the coastal zone will implement the specific policy actions and informed management spatial zoning scheme that are recommended in the Plan.

While the government agencies have the authority of the law to back up its procedures, it is constrained by limited resources. In several instances, however, local NGOs and community-based stakeholder organizations have greater access to, and knowledge of, local conditions and activities, though they have no statutory powers to either assist or control development beyond those available through the Village Councils and Towns Councils Acts. For this reason, it is recommended that localized community and stakeholder participation complement the management efforts of centralized government and statutory agencies in implementing integrated coastal zone management.

The formation of the Ambergris Caye Region Coastal Advisory Committee (ACRCAC) for this region is recommended subsequent to Cabinet's adoption of the Belize Integrated Coastal Zone Management Plan. The Ambergris Caye Region CAC would be locally based and largely constituted of organizations or associations that have an interest and stake in monitoring the state of the coast and development of the region by making reports and recommendations on issues they identify. This region's CAC will work closely with the Coastal Zone Advisory Council (CZAC) to monitor the implementation of the guidelines. The proposed membership of the reformed Ambergris Caye Region CAC is to be drawn from, but not limited to, the following sources:

- San Pedro Town Board;
- San Pedro Planning Authority;
- Hol Chan Marine Reserve Advisory Committee;
- Bacalar Chico Marine Reserve Advisory Committee;
- Ambergris Caye Planning Committee;
- Ambergris Caye Fishing Guide Association;
- Ambergris Caye Citizens for Sustainable Development;
- Tropical Research Education Center;
- San Pedro Tour Guide Association;
- Ambergris Caye Chapter, Belize Tourism Industry Association;

- San Pedro Business Association;
- San Pedro High School/St. Peter's College;
- National Fishermen Cooperative Association;
- Fisheries Department;
- Lands and Surveys Department;
- Geology and Petroleum Department; and
- Forest Department.

Objectives of the Ambergris Caye Region CAC include, *inter alia*, contributing to the drafting of the coastal zone management guidelines for their coastal region, supporting their initial approval, and monitoring and reporting to the Coastal Zone Advisory Council (CZAC) on the implementation of the guidelines. This means that the Committee will be expected to undertake the following tasks:

1. Develop, assess and approve the draft guidelines;
2. Forward the approved draft guidelines to CZMAI for approval;
3. Monitor the implementation and effectiveness of the guidelines;
4. Identify the appropriate time for a review of all or part of the guidelines;
5. Review and update the guidelines.

Planning is a continual process of recommendation, participation, implementation and review. These guidelines shall be monitored on a continual basis in order to establish its strengths and weaknesses. Through a management planning mechanism, the ACRCAC, along with CZMAI, will regularly update the guidelines, which will hopefully set a good example of representative, cooperative and adaptive management that is environmentally sound, rational and equitable.

Additional studies are needed in liaison with the relevant authorities and region's stakeholders. Such studies should reveal information which may help to further support sustainable development and to address the social, cultural and economic human use of the region and its resources.

8.0 CONCLUSIONS

The coastal zone management guidelines recommended for the Ambergris Caye Region are not intended to be rigid, as changing socio-economic, cultural and environmental conditions may necessitate modifications. Noteworthy, however, these guidelines and Informed Management spatial zoning scheme have identified sites for specific human uses of the coastal zone, and the disqualification of sites for not conducive to sustainable development. It is hopeful that the objectives outlined at the beginning can be realized through the recommended sector policies guidelines and spatially-explicit zoning scheme as they will ensure the sustainable use and development of the Ambergris Caye Region.

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10.0 APPENDICES

10.1 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 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 800,000 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, 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.

For many years, and even today, management of the Belizean coastal zone has been under the regime of sectoral planning. However, 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). Integrated coastal zone management (ICZM) brings together all decision-making agencies to ensure integration among their policies and management plans, to ultimately improve and maintain the quality of coastal and marine ecosystems. A defining feature of Belize's ICZM plan is balancing national economic development needs with conservation priorities within a spatially defined area over a specified timeframe. The development of site-specific coastal zone management guidelines, as a component of the Belize ICZM Plan, serves as a means to guide management decisions and to form the basis on which decisions are made to regulate the development and use of coastal and marine resources within the coastal zone.

10.2 Summary of Enabling Legislation And Implementing Agencies For Enforcement Of The Informed Management Zoning Scheme

The various governmental organizations and agencies with management mandates for the coastal zone that are needed to implement these guidelines, to synchronize the efforts of the CZMAI via the Belize Integrated Coastal Zone Management Plan, and to strengthen inter-agency coordination for integrated coastal zone management include:

Belize Agricultural Health Authority – The Belize Agricultural Health Authority Act requires applications for licenses, permits or certificates to import and export animal products, animal feed, and plant products into and out of Belize following inspection as it affects the region. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on agricultural import and export as it affects the region.

Belize Port Authority – The Belize Port Authority Act requires applications for boat and captain licenses and for the construction and operation of private ports for the region. Also, The Harbors and Merchant Shipping Act requires the Authority to regulate the passage of vessels in and out of Belizean waters as well as the maintenance and delineation of vessel routes, lighthouses and wharfs. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on vessel licencing and shipping as it affects the region

Belize Tourist Board – The Belize Tourist Board Act requires applications for hotel licenses for the region. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on hotel development as it affects the region.

Belize Trade and Investment Development Service (BELTRAIDE) – The Belize Trade and Investment Development Service Act requires that foreign trade and investment be liaised through the BELTRAIDE organization. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on major developments as it affects the region.

Central Building Authority – The Housing and Town Planning Act provides for the regulation of the use and development of land through qualitative measures that is, building densities, land use class assignments etc. However, it does not address the structural integrity of buildings, a component of the development. The Central Building Authority, by way of the Belize Building Act, is legislated specifically to address this, and provides for the appointment of Local Building Authorities to administrate the Act. Thus, the Ambergris Caye Region CAC can be appointed as the Local Building Authority for the Ambergris Caye Region. However, this may require strengthening the Ambergris Caye Region CAC with technical expertise to do this.

Department of Environment – The Environmental Protection Act requires applications for environmental clearance for the region. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on environmental protection as it affects the region.

Fisheries Department – The Fisheries Act requires applications for fishing license for the region. The Ambergris Caye CAC should be included in any discussion on policy formulation on fisheries as it affects the region.

Forest Department – The Forest Act requires applications for the removal of mangroves in coastal areas for the region. The National Parks System Act requires the establishment of National Parks, Nature Reserves, Wildlife Sanctuaries, and Natural Monuments to preserve ecologically important and sensitive areas. The Wildlife Protection Act empowers the Forest Department to determine species to be prohibited from hunting practices as it sees fit. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on mangrove removal and designation of protective status to sensitive areas and species as it affects the region.

Geology & Petroleum Department – The Petroleum Act requires applications for oil exploration and issuing of parcel contracts for the region. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on petroleum activities as it affects the region.

Hydrology Unit, Ministry of Natural Resources - The Water Industry Act requires all entities to apply for a Water Abstraction License where the water source is limited to a natural water body: surface or groundwater. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on water use as it affects the region.

Lands and Surveys Department - The Land Utilization Act requires applications for subdivisions for the region, any demarcation of special development areas, and any allocation of land in the coastal region, this includes any construction on seabed. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on land as it affects the region.

Meat and Livestock Commission – The Meat and Livestock Act requires applications for the rearing, breeding, sale and exportation of meat and livestock for the region. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on the sale of meat and livestock as it affects the region.

Mining Unit, Ministry of Natural Resources– The Mines and Minerals Act requires applications for dredging, oil exploration and sand mining permits for the region. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on dredging and oil exploration as it affects the region.

Ministry of Health – The Public Health Act requires the Director of Health to make arrangements for health inspectors to enforce building and health standards for the region. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on public safety as it affects the region.

Ministry of Housing– The Ministry of Housing formulates policy for housing and human settlements. Its added function is to assist with the alleviation of poverty due to urban growth. The Ministry coordinates planning and development control functions through municipal bodies. The Ministry also provides the services of Planners, Building inspectors and Engineers to provide the required necessary assistance. In accordance with Section 6 of the Act, the Ambergris Caye Region CAC can be delegated the powers and duties of the Central Housing and Planning Authority (CHPA) with regard to approving, with or without conditions, and prohibiting further development in the region as well as powers to serve prohibition notices. This delegation should be supported by the Solicitor General’s Office or an Attorney at Law for the enforcement of the provisions of the Act.

National Emergency Management Organization – The National Emergency Management Act requires that sites be declared as vulnerable areas for the region and policy formulation on disaster management be effectuated. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on issues of national preparedness as it affects the region.

Pesticide Control Board – The Pesticide Control Act requires applications for the importation, manufacturing, sale and storage of restricted pesticides for the region. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on pesticide use as it affects the region.

Solid Waste Management Authority – The Solid Waste Management Act requires the Solid Waste Management Authority to make arrangements for garbage collection or the engagement of contractors for the region. The Ambergris Caye Region CAC should be included in any discussion on policy formulation on garbage collection as it affects the region.

10.3 Checklist for Human Use/Development Of The Coastal Zone

Development Activity/Human Use	Responsible Agencies
1. Coastal Agriculture	
Governing Legislation/Policy:	
Banana Industry Act	<input type="radio"/> Banana Control Board <input type="radio"/> Banana Growers Association <input type="radio"/> Ministry of Agriculture
Belize Agricultural Health Authority Act	<input type="radio"/> Belize Agricultural Health Authority
Citrus (Processing and Production) Act	<input type="radio"/> Citrus Control Board <input type="radio"/> Citrus Growers Association <input type="radio"/> Ministry of Agriculture
Environmental Protection Act	<input type="radio"/> Department of Environment
Land Utilization Act	<input type="radio"/> Land Utilization Authority <input type="radio"/> Ministry of Natural Resources & Agriculture
Meat and Livestock Act	<input type="radio"/> Belize Livestock Producers Association <input type="radio"/> Belize Agricultural Health Authority <input type="radio"/> Ministry of Agriculture
Papaya Growers Association Act	<input type="radio"/> Papaya Growers Association <input type="radio"/> Ministry of Agriculture
Pesticide Control Act	<input type="radio"/> Pesticide Control Board <input type="radio"/> Ministry of Agriculture
Sugar Cane Industry (Control) Act	<input type="radio"/> Belize Sugar Cane Board

1. Coastal Aquaculture**Governing Legislation/Policy:**

Fisheries Act

National Aquaculture Policy (Draft)

Environmental Protection Act

Belize Trade and Investment Promotion Service Act

 Fisheries Department Aquaculture Unit, Ministry of Agriculture Department of the Environment Belize Trade and Investment

DEVELOPMENT ACTIVITY/HUMAN USE

RESPONSIBLE AGENCIES

2. Coastal Development**Governing Legislation/Policy:**

Belize Building Act

Belize City Council Act

Belize Trade and Investment Promotion Service Act

Cayes Development Policy
Coastal Zone Management Act

Disaster Preparedness and Response Act

Electricity Act

Environmental Protection Act

Forest Subsidiary Act

Hotels and Tourist Accommodation Act

Housing and Town Planning Act

Land Utilization Act

Mines and Minerals Act

Private Works Construction Act

Public Health Act

Public Utilities Commission Act

Solid Waste Management Authority Act

Telecommunications Act

 Central Building Authority Belize City Council Belize Trade and Investment Development Services Coastal Zone Management Authority National Emergency Management Organization Belize Electricity Limited Department of the Environment Forest Department Belize Tourism Board Ministry of Housing Land Utilization Authority Mining Unit, Ministry of Natural Resources Ministry of Works and Transport Ministry of Health Public Utilities Commission Solid Waste Management Authority Belize Telemedia Limited

Town Councils Act	<input type="radio"/> Town Councils
Trade Licensing Act	<input type="radio"/> City/Town Councils
Water and Sewerage Act	<input type="radio"/> Belize Water Services Limited
Water Industry Act	<input type="radio"/> Hydrology Unit, Ministry Natural Resources

DEVELOPMENT ACTIVITY/HUMAN USE

RESPONSIBLE AGENCIES

3. Conservation

Governing Legislation/Policy:

Fisheries Act	<input type="radio"/> Fisheries Department
Forest Act	<input type="radio"/> Forest Department
Private Forests (Conservation) Act	<input type="radio"/> Forest Department
National Parks System Act	<input type="radio"/> Ministry of Agriculture, Fisheries, Forestry, the Environment and Sustainable Development
National Protected Areas Policy and System Plan	<input type="radio"/> National Protected Areas Secretariat
Wildlife Protection Act	<input type="radio"/> Forest Department
Coastal Zone Management Act	<input type="radio"/> Coastal Zone Management Authority

DEVELOPMENT ACTIVITY/HUMAN USE

RESPONSIBLE AGENCIES

4. Marine Dredging

Governing Legislation/Policy:

Mines and Minerals Act	<input type="radio"/> Mining Unit, Ministry of Natural Resources
Dredging Policy	<input type="radio"/> Geology and Petroleum Department
Environmental Protection Act	<input type="radio"/> Department of the Environment

DEVELOPMENT ACTIVITY/HUMAN USE

RESPONSIBLE AGENCIES

5. Fishing

Governing Legislation/Policy:

Fisheries Act	<input type="radio"/> Fisheries Department
Coastal Zone Management Act	<input type="radio"/> Coastal Zone Management Authority

DEVELOPMENT ACTIVITY/HUMAN USE

RESPONSIBLE AGENCIES

6. Marine Transportation

Governing Legislation/Policy:

Belize Port Authority Act
Harbours and Merchant Shipping Act

Belize Port Authority

Private Works Construction Act

Ministry of Works and Transport

Customs Regulation Act

Belize Customs Department

Maritime Areas Act

Ministry of Foreign Affairs

Defence Act

Belize Defence Force

Immigration Act

Immigration Department

Dredging Policy

Mining Unit, Ministry of Natural Resources

Environmental Protection Act

Department of the Environment

DEVELOPMENT ACTIVITY/HUMAN USE

RESPONSIBLE AGENCIES

7. Marine Recreation

Governing Legislation/Policy:

Fisheries Act

Fisheries Department

Ancient Monuments and Antiquities Act

Archaeology Department

National Institute of Culture and History Act

National Institute of Culture and History

Belize Tourism Board Act

Belize Tourism Board

Public Health Act

Ministry of Health

DEVELOPMENT ACTIVITY/HUMAN USE

RESPONSIBLE AGENCIES

8. Oil Exploration

Governing Legislation/Policy:

Environmental Protection Act

Department of the Environment

Petroleum Act

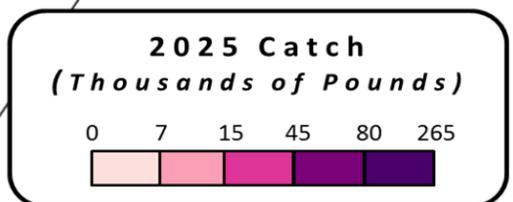
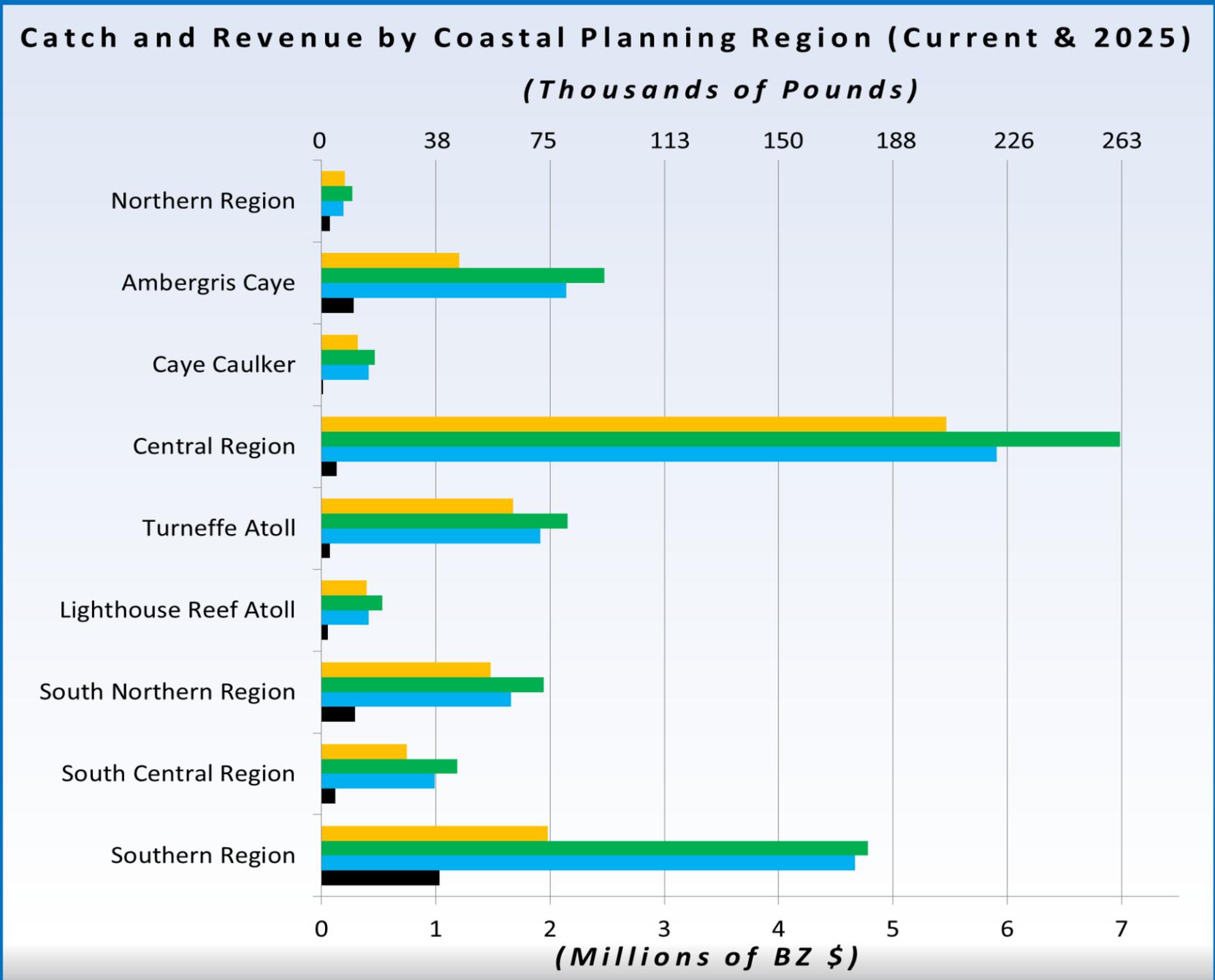
Geology and Petroleum Department

10.4 Figures

LOBSTER FISHERIES

SCENARIOS

- Current (Yellow)
- Informed Management (Light Blue)
- Conservation (Green)
- Development (Black)



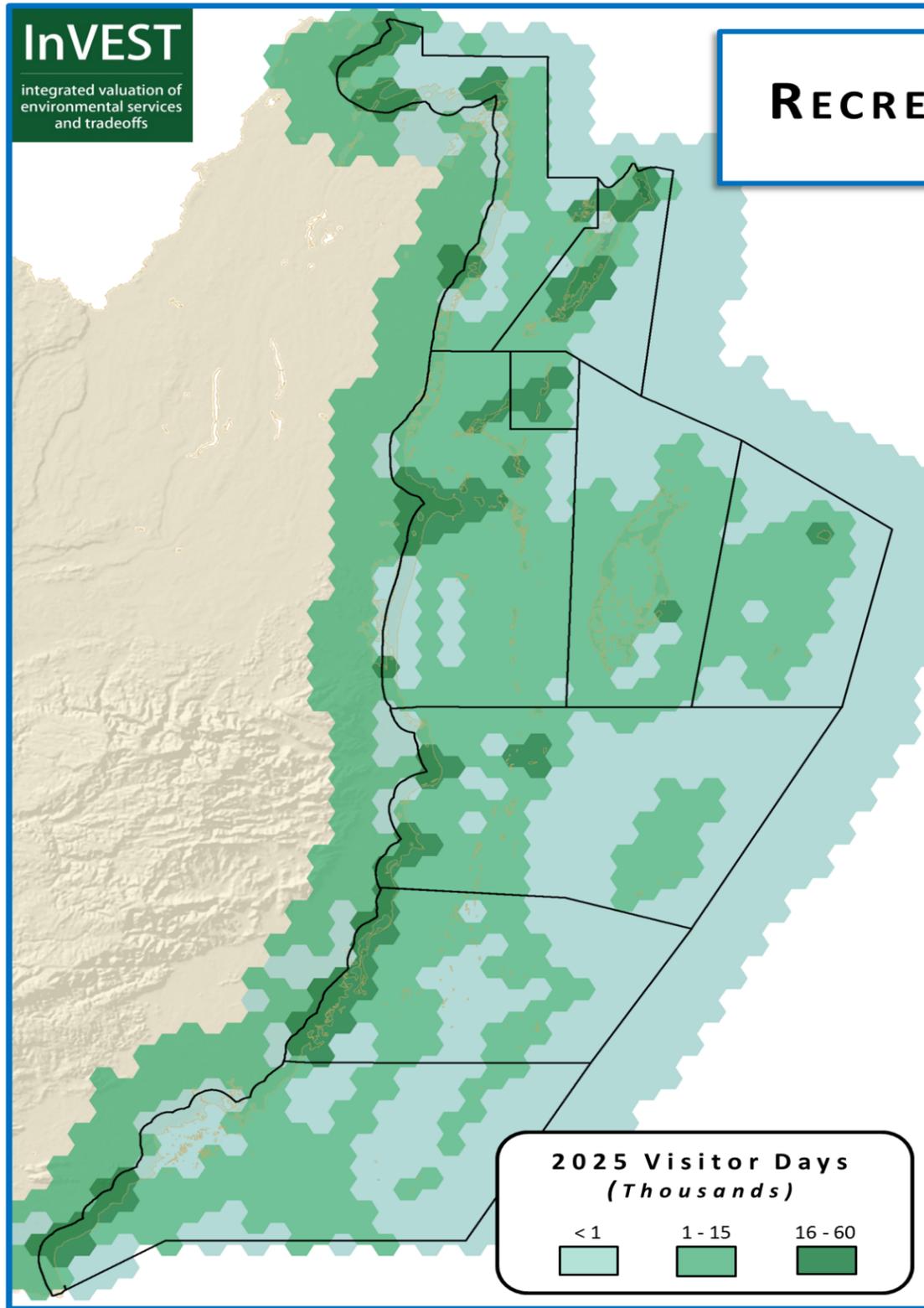
INFORMED MANAGEMENT

Figure 4: Lobster Fisheries Catch and Revenue by Scenario

RECREATION

SCENARIOS

- Current
- Conservation
- Informed Management
- Development



INFORMED MANAGEMENT

Current & 2025 Visitor Days by Coastal Planning Region

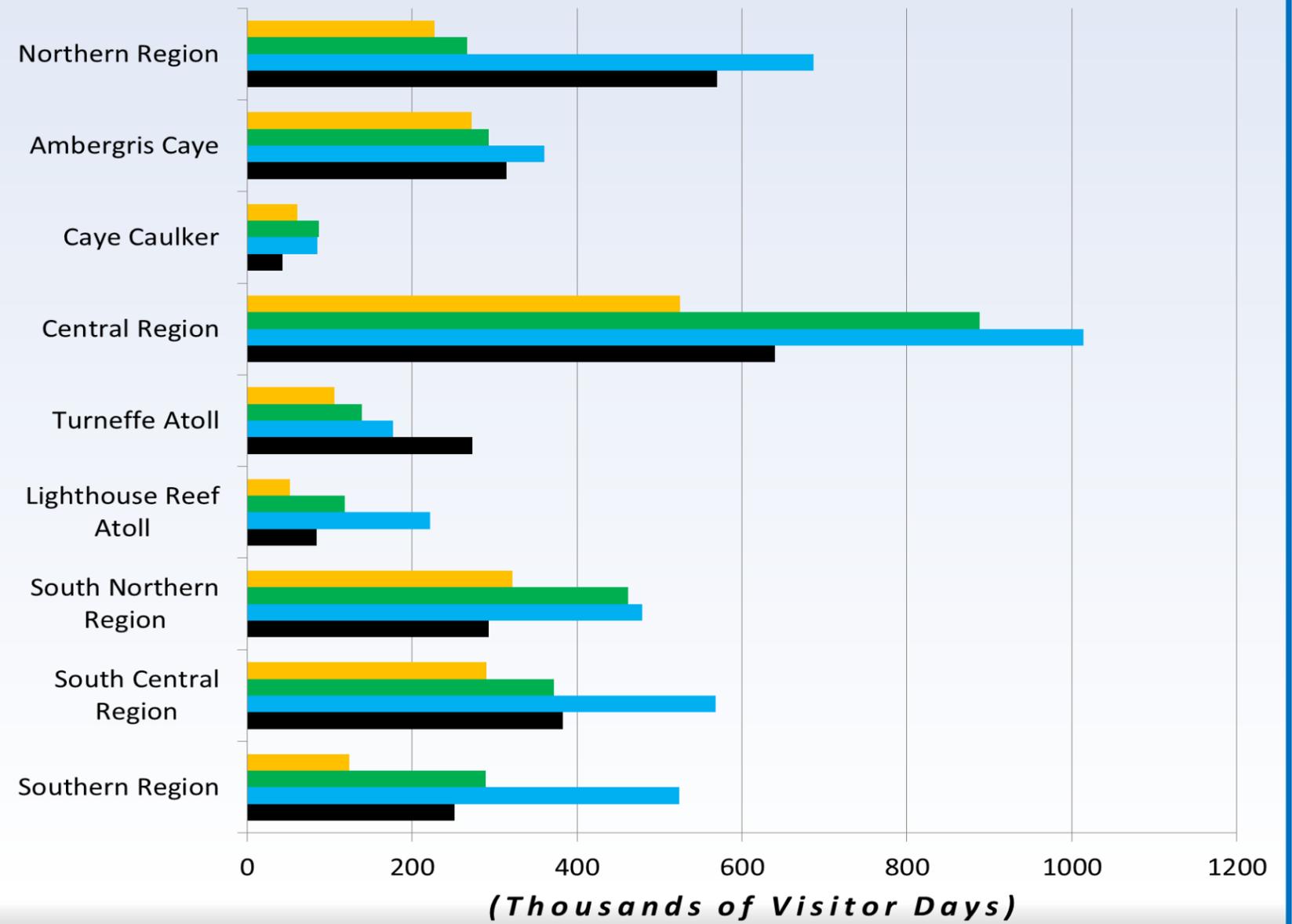
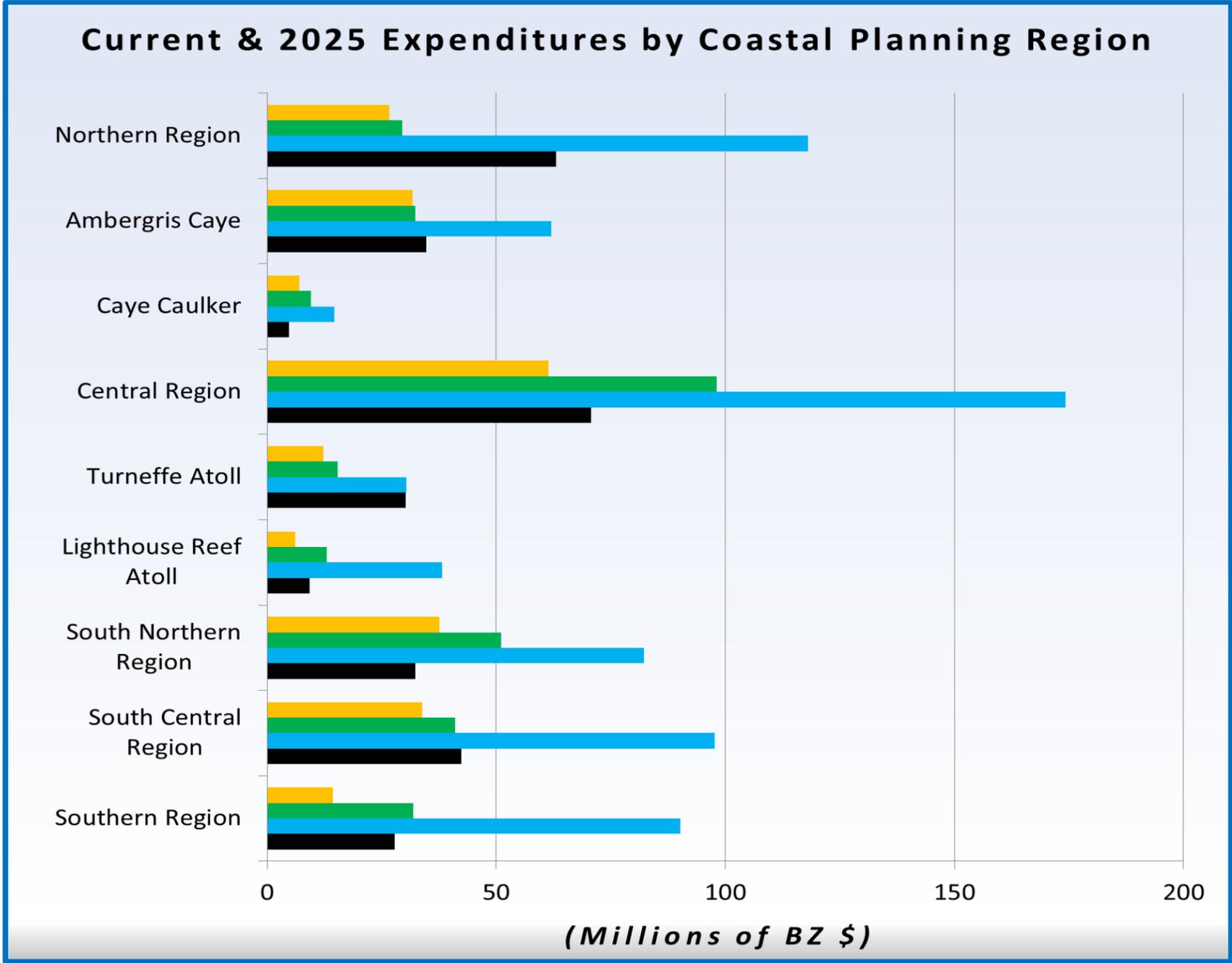
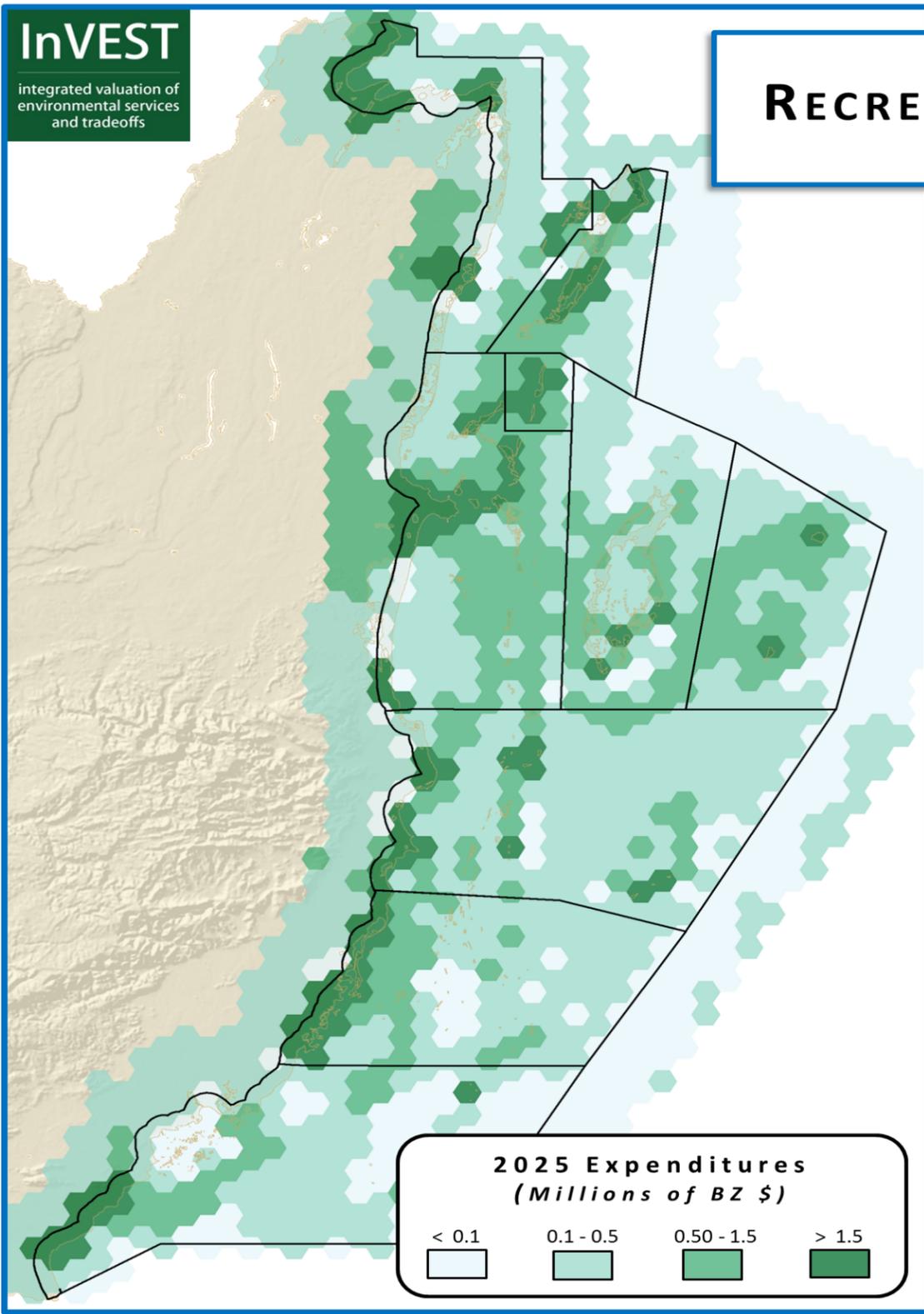


Figure 5: Annual Visitation for Marine Tourism and Recreation by Scenario

RECREATION

SCENARIOS

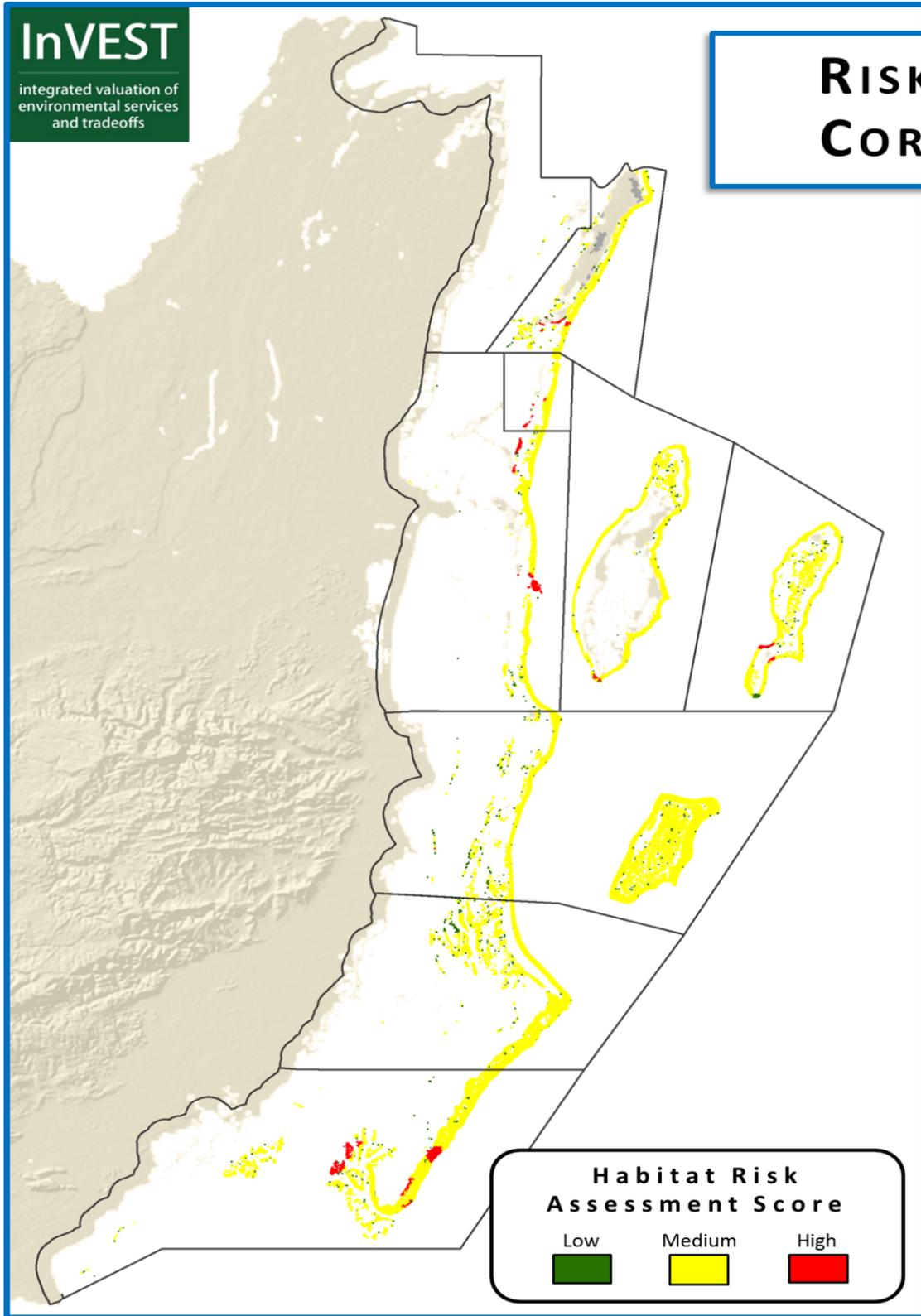
- Current
- Conservation
- Informed Management
- Development



INFORMED MANAGEMENT

Figure 6: Annual Expenditures for Marine Tourism and Recreation by Scenario

**RISK TO
CORALS**



INFORMED MANAGEMENT

**Area of Corals at Risk to
Human Activities by Scenario**

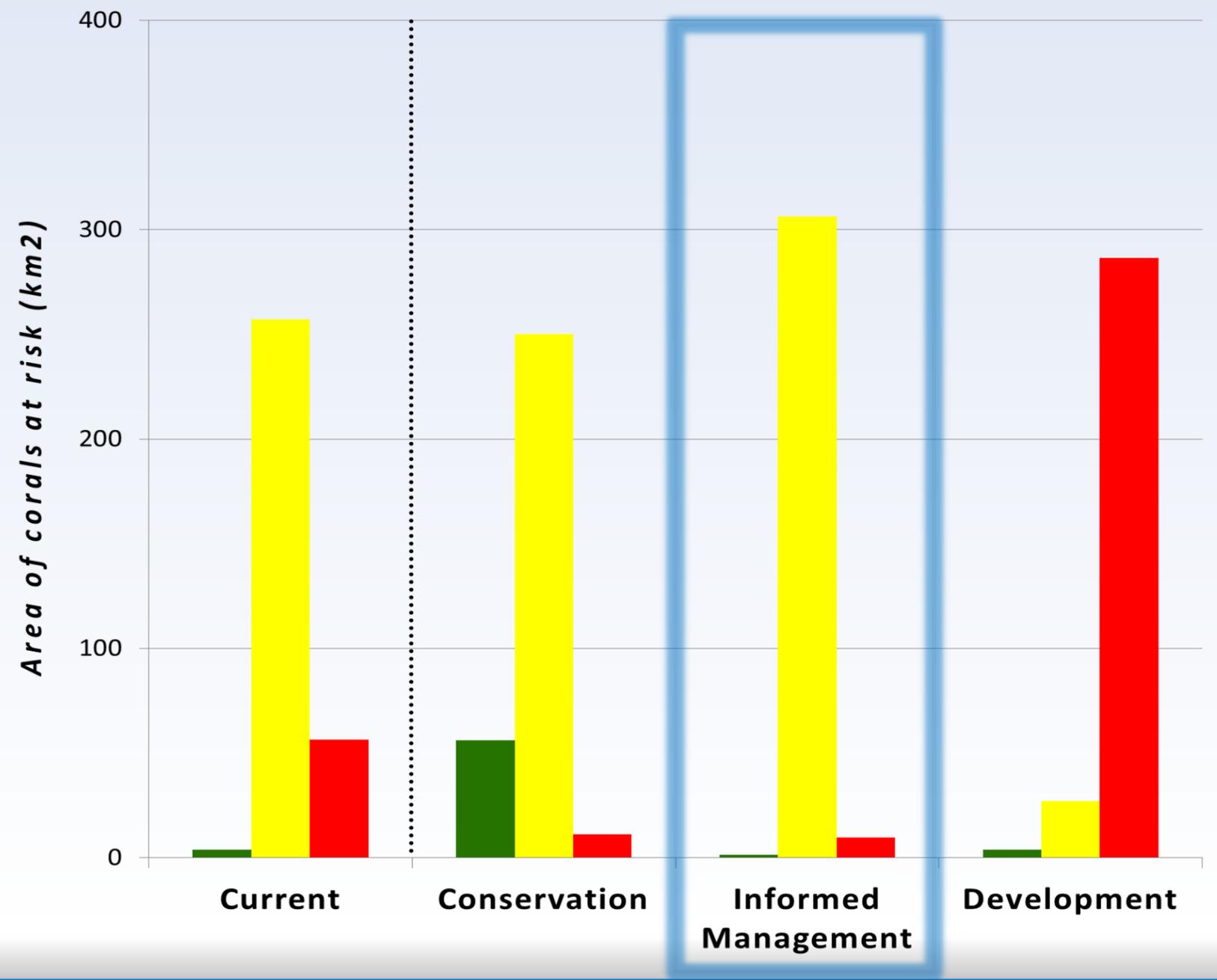
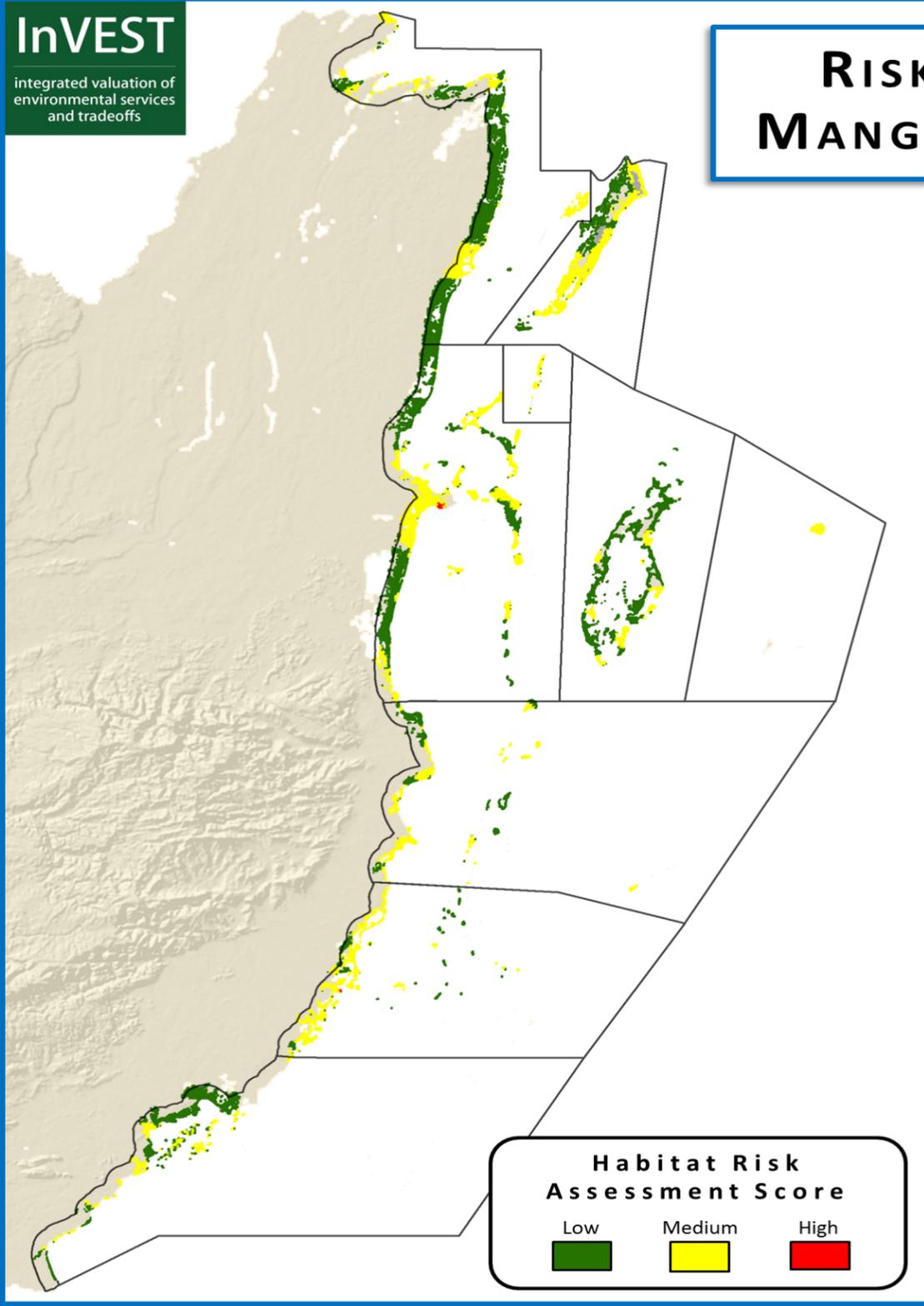


Figure 7: Area of Corals at Risk from Human Activities by Scenario

**RISK TO
MANGROVES**



INFORMED MANAGEMENT

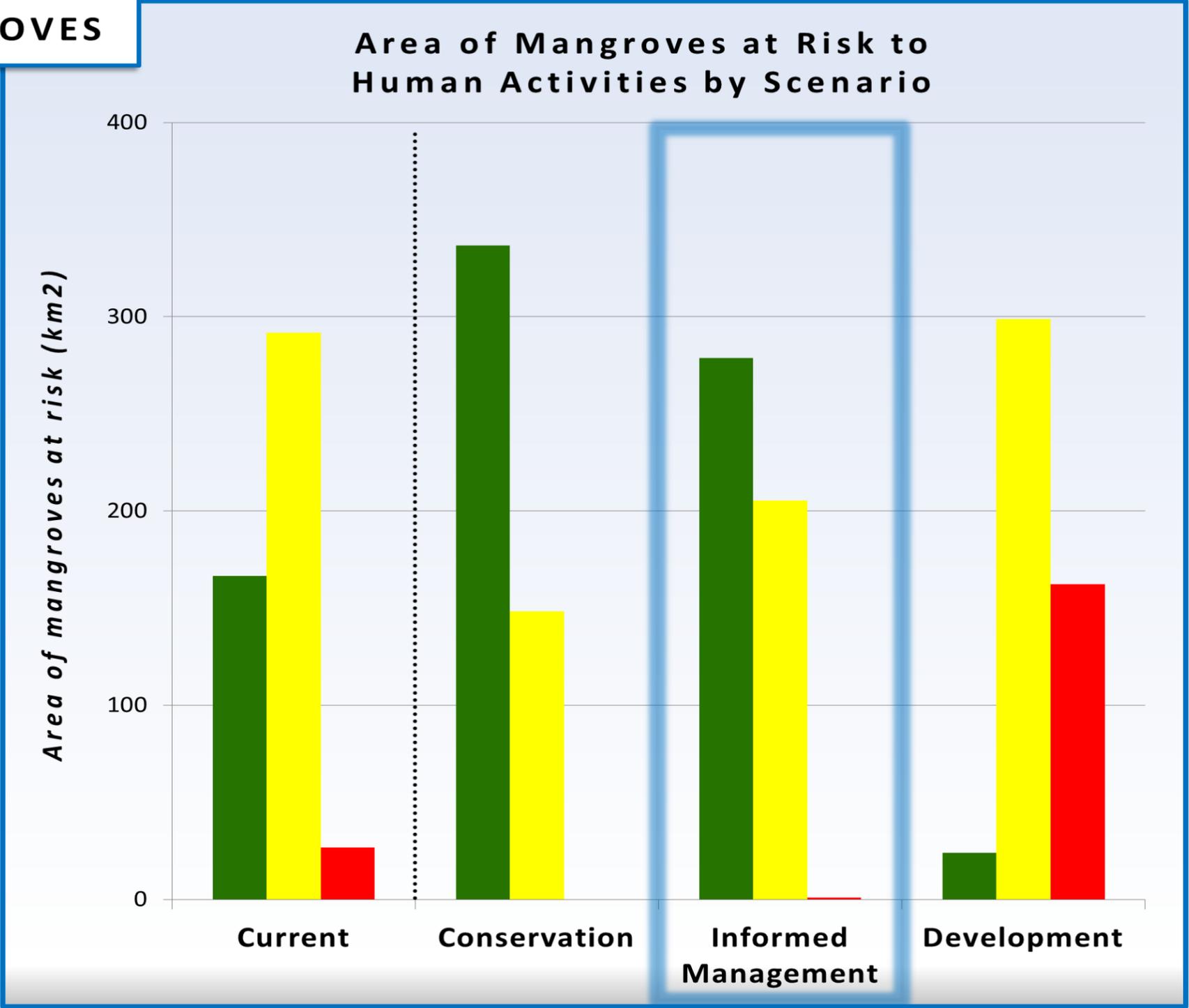
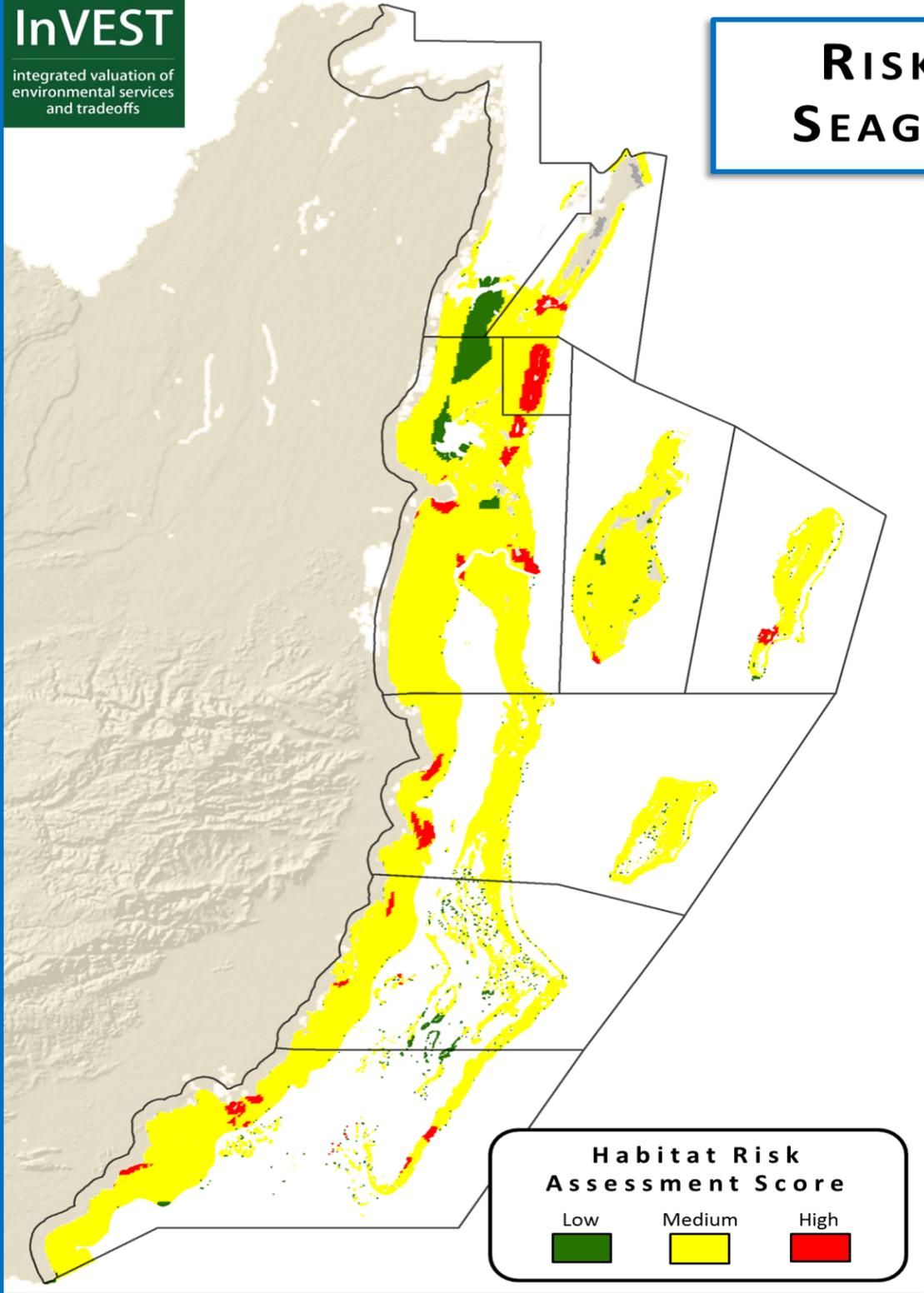


Figure 8: Area of Mangroves at Risk from Human Activities by Scenario

**RISK TO
SEAGRASS**



INFORMED MANAGEMENT

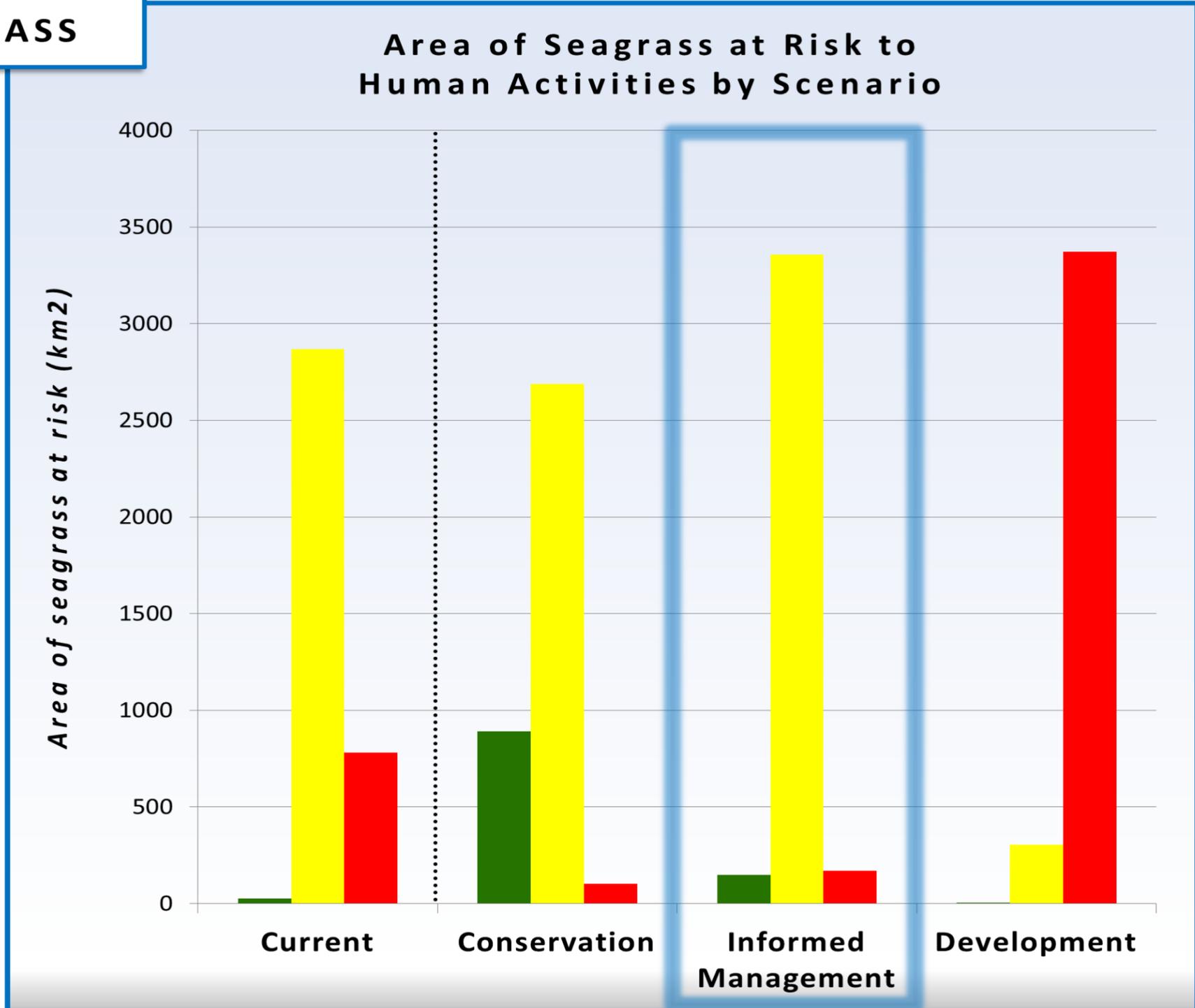
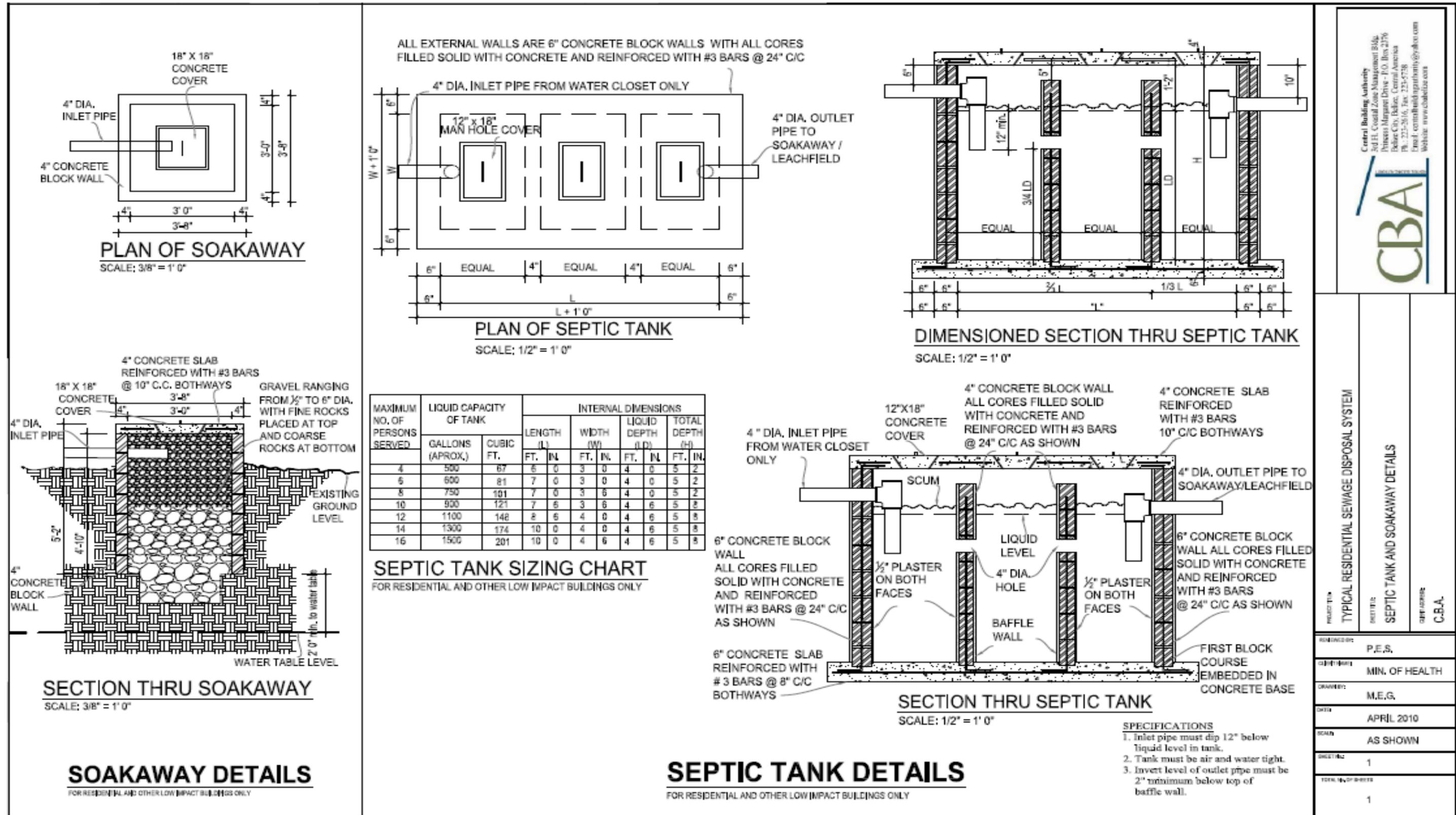


Figure 9: Area of Seagrass at Risk from Human Activities by Scenario



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CBA

PROJECT TITLE	TYPICAL RESIDENTIAL SEWAGE DISPOSAL SYSTEM
DRAWN BY	SEPTIC TANK AND SOAKAWAY DETAILS
CHECKED BY	C.B.A.
APPROVED BY:	P.E.S.
CHECKED BY:	MIN. OF HEALTH
DRAWN BY:	M.E.G.
DATE:	APRIL 2010
SCALE:	AS SHOWN
DRAWING NO.	1
TOTAL NO. OF SHEETS	1

Figure 10: Septic Tank and Soak-a-way Details for Residential and Low-Impact Buildings