Management Plan

Shipstern Nature Reserve

2011 – 2016

PACT
Protected Areas Conservation Trust

Acknowledgements

Thank you to those community members of Sarteneja, Chunox and Fireburn who took time to attend the consultations and provide input, and to those natural resource users who participated in the conservation planning workshop.

Acknowledgments and thanks also go to the following management and staff members of Shipstern Nature Reserve, who participated throughout the management planning process, and provided input into the management programme review process:

Lester Delgado (Ranger, Shipstern Nature Reserve)
Joel Diaz (Ranger, Shipstern Nature Reserve)
Dolores Doran (Ranger, Shipstern Nature Reserve)
Ragiv Castellanos (Ranger, Shipstern Nature Reserve)
Nicolas Tepaz (Ranger, Shipstern Nature Reserve)
Josue Diaz (Ranger, Shipstern Nature Reserve)

Thanks also go to Caspar Bijleveld, and the following researchers, who participated in management evaluation workshops and development of the goals and objectives for the Nature Reserve.

Caspar Bijleveld (Shipstern Nature Reserve)
Christof Schuepp (Researcher, Shipstern Nature Reserve)
Sarah Rittiner (Research Assistant, Shipstern Nature Reserve)
Urs Vurmann (Researcher, Shipstern Nature Reserve)

Acknowledgments also go to Karen Devitt and Kara Berger (Wildtracks) for their assistance in the preparation of the report, and to Adam Lloyd (Wildtracks) for his GIS input.

And finally, and perhaps most importantly, thank you to Heron Moreno, (Manager, Shipstern Nature Reserve), whose vision for the Nature Reserve has helped to give this management plan life, and who will be instrumental in its successful implementation.

Prepared By:

Wildtracks
Conservation, Education and Research

Wildtracks, Belize
office@wildtracksbelize.org

Contents

Introduction

Background and Context

Situated in the north east of Belize, Shipstern Nature Reserve is one of eight private protected areas informally recognized under the National Protected Areas System, and consists of four separate parcels (the original Shipstern Nature Reserve south of the Sarteneja road, the Xo-Pol area, Mahogany Park and the Northern Biological Corridor extension to the south east). Ranging from saline mudflats and mangrove savanna to seasonal and dry forests, the Nature Reserve is recognized as a critical component of the Protected Areas System and Meso-American Biological Corridor. It fills a number of highlighted gaps in ecosystem coverage for Belize, with species assemblages and plants that are unique in Belize, with associations with the Yucatan Peninsula.

The Nature Reserve was first established as Shipstern Wildlife Reserve in 1987, and then changed to Shipstern Nature Reserve in 1989, under new ownership. The current owner, Shipstern Nature Reserve (Belize) Ltd, as the management organization, was registered as a non-profit company in 1989, and as an NGO in 2006. The NGO has a Board of Directors, which supervises operations, while practical management is carried out by the Executive Committee, consisting of the Manager, the Administrator and the Head of Fundraising. At the site level, the Nature Reserve is managed by a staff of nine - the manager, six rangers and two caretakers.

The overarching goal for conservation of Shipstern Nature Reserve is to ensure the long-term viability of all native species, natural communities, and ecological systems, and to sustain the landscape configurations and ecological processes critical to ensuring their long-term survival.

SITE INFORMATION

Size: 24,854 acres (10,058 ha)
Date of Establishment: 22 April, 1989
IUCN Category: II
Management Authority: Private
Management Body: Shipstern Nature Reserve (Belize) Ltd.
Contact: E-mail: shipsternbase@gmail.com

Location:, Shipstern Nature Reserve is situated in the north east of Belize, in Corozal District, approximately 5.1 km west of Sarteneja, the nearest stakeholder community.

Uses: Non-extractive – tourism, education and research
Management Plan: In prep (2010)
Biodiversity Information: Walker & Walker (1988), Meerman (1993), Bijleveld (1998), various student theses.
Facilities (2009): Visitors Centre, Manager's House, Researcher's Accommodation, Lookout Tower, Trails and hides, 2 Ranger posts (Southern Boundary and Iguana Camp)
On-site Staff (2009): 1 Site Manager, 6 rangers, 2 night rangers

Conservation planning within this Management Plan identifies the fauna, flora, and ecosystems that represent the most urgent conservation priorities for the management body, and the strategies that should be put into place to ensure effective management over the 5 year implementation period. These are summarized in the following management objectives:

- *Conservation of wildlife and the unique ecological systems of Shipstern Nature Reserve for present and future generations, contributing to Belize's national conservation goals.*

- *Benefit local communities through environmental services, wildlife protection, education, and opportunities for local economic activity.*

- *Promote increased awareness of protected area and conservation benefits towards greater understanding and support, both locally and nationally*

- *Strengthen collaboration among conservation partners towards integrated conservation efforts in north east Belize.*

- *Improve understanding of environmental processes through applied research and monitoring, to guide effective management.*

- *Implement sound protected area management through strong operational, technical, and administrative processes and effective financial sustainability.*

Purpose and Scope of Plan

This is the first management plan for the protected area, and benefits from the many years of research and data collection that have been carried out since Shipstern's establishment. The Plan includes three sections. The first provides general information on the physical and biological attributes of the reserve, and documents the environmental and human context and current uses. The second section summarizes conservation planning outputs, identifying conservation targets and management challenges. The third further defines the goals and objectives of the protected area, outlines specific management strategies and programmes, and provides a framework for measuring management effectiveness.

This Management Plan has been prepared in line with the National Protected Areas Policy and System Plan, with the input of the various stakeholders of the protected area through meetings with Shipstern Nature Reserve staff, a series of workshops with key stakeholders, and interviews with a wide variety of individuals, including natural resource users (loggers, hunters, and fishermen), the tourism sector and researchers, and seeks to conserve the

resources of the Nature Reserve while allowing economic benefit through tourism. The management programmes are based on the best available data and scientific knowledge, with the integration of conservation planning strategies, and fit within the scope of the regulations that govern the protected area.

This management plan is designed to guide the management of Shipstern Reserve through the next five years, providing a framework for both broad management activities as well as more specific research and monitoring activities. It is recommended that detailed operational plans should be developed on an annual basis by the management and approved by the Board, based on the framework provided by this management plan, with an annual review of implementation success, allowing for adaptive management over the five year period.

1. Current Status

1.1 Location

Shipstern Nature Reserve is located in the north east corner of Belize, approximately 5km to the south-west of the small coastal community of Sarteneja, in Corozal District, with access by road, from Orange Walk and Corozal. It is one of eight private protected areas recognized informally under the National protected Areas System, and consists of four parcels legally defined by their property titles:

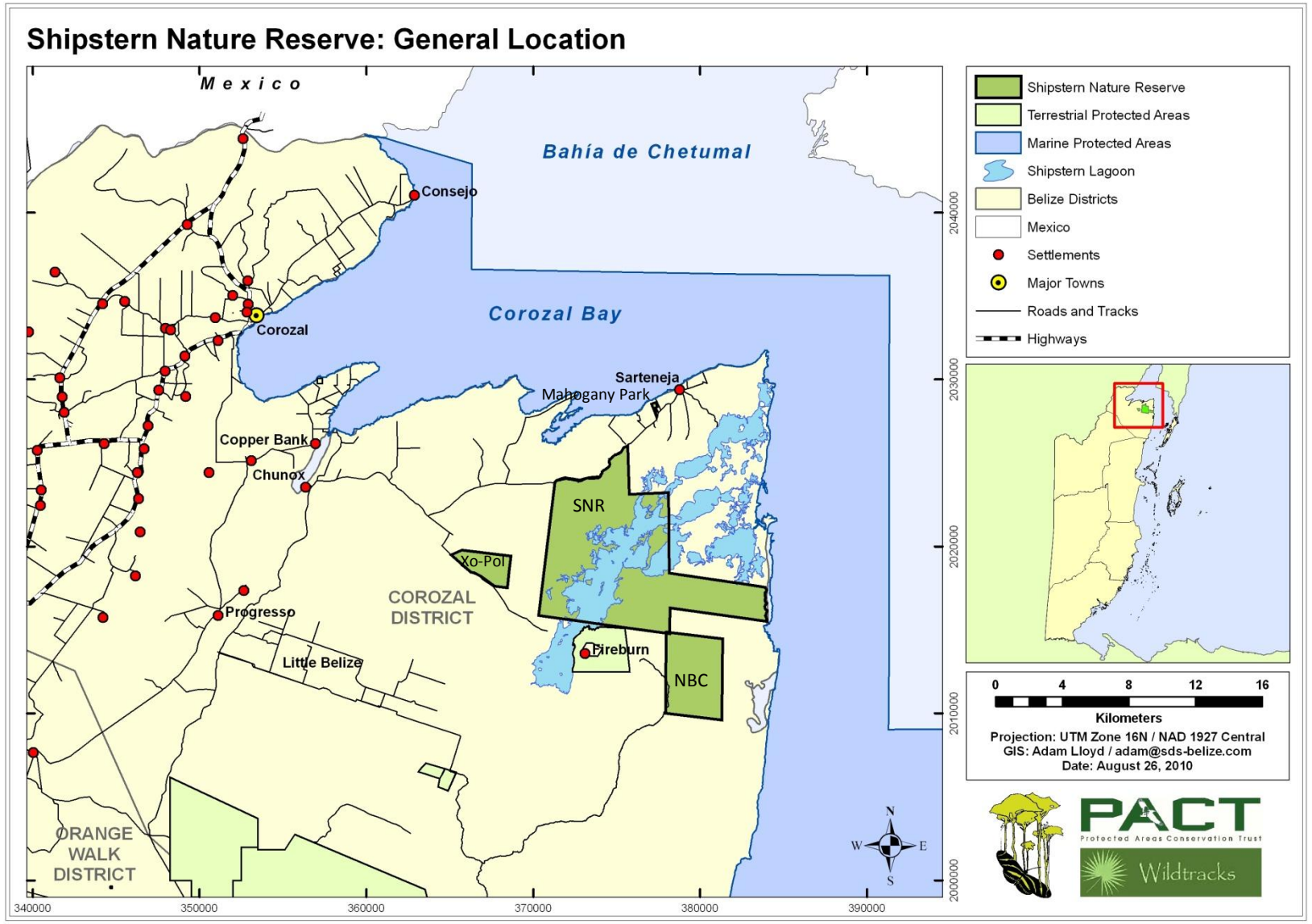
- the original Shipstern parcel (19,286 acres /7,805 ha) stretching to both sides of the Shipstern Lagoon system
- the Xo-Pol area (1531 acres / 620 ha), to the north of the lagoon
- the Northern Biological Corridor extension (NBC – approximately 4,000 acres / 1619 ha), to the south east of the lagoon
- the Mahogany Park (37 acres / 15 ha) lying on the outskirts of Sarteneja

These combine to give approximately 24,854 acres (10,058 ha), ranged to the north and south of Shipstern Lagoon, one of the largest coastal lagoon systems in Belize.

There are no permanent settlements within the protected area, but four communities are located in the immediate landscape – Sarteneja to the east, Chunox and Little Belize to the west and Fireburn to the south.

Facilities include management and visitor infrastructure – the headquarters and visitor centre, staff and visitor accommodation are situated on the main road, 5 km south-west of Sarteneja and 18km east of Chunox, and include an extensive trail system that radiates out, including a botanical trail with labeled plant species, and an 80 foot tall observation tower, providing a view over much of the forest, lagoon, Corozal Bay, and the Sarteneja area.

The Mahogany Museum stands at the entrance to the Mahogany Park on the outskirts of Sarteneja, and two ranger stations are located south of the lagoon, one overlooking the primary wood stork nesting island within the Lagoon, and the other on the southern boundary of the Shipstern block, contiguous with Fireburn Reserve and adjacent to the Kakantulix archaeological site.



Map 1: Location of Shipstern Nature Reserve

1.2 Regional Context

Central America is highlighted as a world 'hotspot for species diversity' (Conservation International, 2003), and considered critical for the preservation of the biodiversity of the Western Hemisphere. Here, the Nearctic bioregions of North America converge with the Neotropical bioregions of South America and, in Belize in particular, also with the Greater Antillean bioregion of the Caribbean. Each of these three bring a unique assemblage of plants and animals, resulting in a particularly rich biodiversity, with 8% of the world's known plant species, and 10% of its vertebrates, and components of all three regions being represented within the Central American land bridge –. The bridge has also enabled movement of species between the North and South American regions since the late Pliocene, and is still of vital importance today to migratory bird species, both as a corridor and as an over-wintering location. This importance will increase with the predicted shifts in ecosystem ranges due to climate change.

The entire Central American region has suffered from an alarming rate of deforestation, with as much as two thirds of the forest having been converted into agricultural land within the last 50 years, much of which has then been degraded by unsustainable agricultural practices and cattle-farming. Belize, with its relatively low population, and large areas of natural vegetation still intact, therefore plays an important role in the survival of many of the threatened species of Central America, as well as being an important waypoint for Nearctic and Neotropical migrants. Up until recently, much of Belize has escaped most of the more destructive land clearance practices, but significant land use change is now taking place, increasing pressure for land - such that the annual rate of deforestation is estimated to be 0.6% across Belize as a whole (Cherrington et. al., 2010).

Several regional agreements have been reached to help balance environmental concerns and development through the Central American Environmental Agenda - Plan Ambiental de la Region Centroamericana (PARCA), starting with the creation of the **Central American Commission for Environment and Development (CCAD)** in 1989. The Government of Belize is a participant in this Commission, as well as in the **Convention for the Conservation of Biodiversity and Protection of Priority Wilderness Areas in Central America** (formed in 1992)**,** and the **Regional Alliance for Sustainable Development (ALIDES)** (1994). The management of the Nature Reserve assists Belize in fulfilling its commitments under these agreements (Table 1).

Belize has commitments under several international agreements concerning issues such as environmental management and sustainable development. The protection and management of Shipstern Nature Reserve also assists Belize in meeting these commitments (Table 2).

Table 1: Regional Conventions and Agreements of Key Relevance to Shipstern Nature Reserve	
Central American Commission for Environment and Development (CCAD) (1989)	**Regional organisation of Heads of State formed under ALIDES, responsible for the environment of Central America. Initiated Mesoamerican Biological Corridors and Mesoamerican Caribbean Coral Reef Programmes.** *The southern block of Shipstern Nature Reserve is an important node of the Belize portion of the Mesoamerican Biological Corridor, and still has viable populations of wide ranging species such as white-lipped peccary*
Convention on the Conservation of Biodiversity and the Protection of Priority Wilderness Areas in Central America (Managua, 1992)	**To conserve biological diversity and the biological resources of the Central American region by means of sustainable development.** *Shipstern Nature Reserve offers opportunities to local communities as a tourism destination, increasing employment opportunities in the area based on sustainable use of the natural resources of the Reserve*

Table 2: International Conventions and Agreements of Key Relevance to Shipstern Nature Reserve	
Convention on Biological Diversity (Rio de Janeiro, 1992) Ratified in 1993	**To conserve biological diversity to promote the sustainable use of its components, and encourage equitable sharing of benefits arising from the utilization of natural resources.** *Shipstern Nature Reserve forms part of the national protected areas system, contributing towards the protection of biodiversity and threatened species. There is a commitment to developing programmes that will promote the sustainable use of the Nature Reserve's resources through tourism, and better integration of community participation and benefit.*
United Nations Framework Convention on Climate Change (New York, 1992)	*Belize was identified by the 1994 National Inventory as a net remover of CO_2, the high percentage of vegetation cover, including SNR, estimated to be absorbing 6 billion tons of CO_2 a year against a total emission estimated at 3 million tons. Shipstern Nature Reserve retains all its natural vegetation cover, contributing towards the conservation of representative ecosystems and the maintenance of vegetation cover in Belize*
Convention on the Protection of Archaeological, Historical and Artistic Heritage of American Nations (Santiago, 1976)	**To protect the archaeological heritage of signatory countries.** *Shipstern Nature Reserve encompasses several Maya archaeological structures*
Other Relevant International Agreements **UNESCO Man and the Biosphere Programme** (1990) **Mundo Maya Agreement** **Convention on International Trade in Endangered Species of Wild Fauna and Flora** (Washington, 1973) **International Plant Protection Convention** (Rome, 1951)	

1.3 National Context

1.3.1 Legal and Policy Framework

At present, Belize has over 2.6 million acres (46%) of its terrestrial area under some form of protection (CSO, 2000) – either as national or recognized private protected areas (including Shipstern Nature Reserve). The national objectives for conservation revolve around the protection, conservation and rational use of Belize's natural resources within the context of sustainable human development. These goals are supported by the National Protected Areas Policy and System Plan (NPAPSP, 2006), which was developed following a full review of the national protected areas system in 2005. It was accepted by Cabinet in January 2006, and centers around the following policy statement:

> *The Government of Belize shall promote the sustainable use of Belize's protected areas by educating and encouraging resource users and the general public to properly conserve the biological diversity contained in these areas in order to maintain and enhance the quality of life for all. This shall be achieved by facilitating the participation of local communities and other stakeholders in decision-making and the equitable distribution of benefits derived from them, through adequate institutional and human capacity building and collaborative research and development.*

The main block of Shipstern Nature Reserve and the Xo-Pol extension to the west are informally recognized under the National Protected Areas Policy and System Plan as part of the National Protected Areas System, but still need formal integration under the protected areas legislation (currently under revision). The other two blocks (Mahogany Park and the Northern Biological Corridor) are not included within the Government recognition (Forest Department, pers. com., 2010). The boundaries of the four separate parcels are defined by land title documents. As a private protected area, the management regime of Shipstern is defined by the management organization – Shipstern Nature Reserve (Belize) Ltd., a registered NGO, and is similar to that of a National Park.

Date	Event
1987	Establishment of Shipstern Wildlife Reserve
1989	Management of Shipstern transferred to ITCF, and name changed to Shipstern Nature Reserve
1994	Northern 2,900 acres excised from the Nature Reserve
1994	Purchase of Shipstern Nature Reserve by ITCF
1994	Shipstern Nature Reserve extended to include 1,500 acre property of Xo-Pol
1994	Shipstern Nature Reserve (Belize) Ltd. established as a non-profit company
2000	Addition of Mahogany Park
2004	Addition of 4,000+ acre North East Corridor
2006	Shipstern Nature Reserve (Belize) registered as an NGO

Table 3: Timeline for Establishment of Shipstern Nature Reserve

History of establishment

Shipstern Nature Reserve was established as Shipstern Wildlife Reserve in 1987, as Belize's first formal private protected area, and extended northwards to encompass approximately 4.5 km of northern shoreline along Corozal Bay. The name was amended to Shipstern Nature Reserve in 1989 following the establishment of a partnership with the International Tropical Conservation Foundation (ITCF) of Switzerland, and with the completion of the change of ownership in 1994, with the excision of the northern area - approximately 2,900 acres. ITCF managed Shipstern Nature Reserve from 1989 and established the Shipstern Nature Reserve (Belize) Ltd., a non-profit company, as owner and manager of the Reserve. This was later registered as a Non-Governmental organization in 2006.

Site Status

As a Private Protected Area, Shipstern falls outside the legislated categories of protected areas designated under the mandate of the Forest Department (Ministry of Natural Resources). Whilst the name includes the words 'Nature Reserve', the management regime is more closely aligned with the National Park category, with use extending to tourism, research and education.

Table 3: Legislated Protected Areas Categories in Belize

Category	Legal Foundation	Purpose	Activities Permitted
Nature Reserve	National Parks System Act, 1981	To protect biological communities or species, and maintain natural processes in an undisturbed state.	Research, education
National Park	**National Parks System Act, 1981**	**To protect and preserve natural and scenic values of national significance for the benefit and enjoyment of the general public.**	**Research, education, tourism**
Natural Monument	National Parks System Act, 1981	To protect and preserve natural features of national significance.	Research, education, tourism
Wildlife Sanctuary	National Parks System Act, 1981	To protect nationally significant species, biotic communities or physical features.	Research, education, tourism
Forest Reserve	Forests Act, 1927	To protect forests for management of timber extraction and/or the conservation of soils, watersheds and wildlife resources.	Research, education, tourism, sustainable extraction
Marine Reserve	Fisheries Act, 1945	To assist in the management, maintenance and sustainable yield of fisheries resources	Sustainable extraction, research, education, tourism

Under the NPAPSP, the equivalent IUCN designation is considered to be ***Category II: A protected area managed primarily for ecosystem protection and recreation.*** This is defined as:

> ***"Natural areas of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation detrimental to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible."***

IUCN Category II Management Objectives

1. To protect natural and scenic areas of national and international significance for spiritual, scientific, educational, recreational or tourist purposes;
2. To perpetuate, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources, and species, to provide ecological stability and diversity;
3. To manage visitor use for inspirational, educational, cultural and recreational purposes at a level which will maintain the area in a natural or near natural state;
4. To eliminate and thereafter prevent exploitation or occupation detrimental to the purposes of designation;
5. To maintain respect for the ecological, geomorphologic, sacred or aesthetic attributes which warranted designation; and
6. To take into account the needs of indigenous people, including subsistence resource use, in so far as these will not adversely affect the other objectives of management.

National Planning Strategies

The national objectives for conservation revolve around the protection, conservation and rational use of Belize's natural resources within the context of sustainable human development. These objectives are supported by the **National Strategy on Biodiversity**, through the National Biodiversity Strategy and Action Plan (Jacobs and Castaneda, 1998) (though this was never ratified at Government level), and more recently, through the **National Protected Areas Policy and System Plan (NPAPSP**) (Figure 1; Meerman and Wilson: 2005), adopted by the Government of Belize in 2006.

National Protected Area Policy Declaration

Recognizing that:

Protected areas in Belize provide irreplaceable public benefits from ecosystem services such as clean water, clean air, carbon sinks, gene pools, baseline data for research and development, all of which contribute to the local, national and regional economies,

And that:

Protected areas are an important resource base for the development and strengthening of economic activities and contribute to poverty elimination by supporting industries such as agriculture, tourism, fisheries, timber and non-timber products, research, bio-prospecting, mining, water and energy services among others:

The Government of Belize shall promote the sustainable use of Belize's protected areas by educating and encouraging resource users and the general public to properly conserve the biological diversity contained in these areas in order to maintain and enhance the quality of life for all. This shall be achieved by facilitating the participation of local communities and other stakeholders in decision making and the equitable distribution of benefits derived from them, through adequate institutional and human capacity building and collaborative research and development.

General Principles:

The Government of Belize shall:

1. Assure, for all Belizeans, safe, healthy, productive, aesthetically and culturally pleasing surroundings by preserving important historic, cultural, aesthetic and natural aspects of Belize's natural heritage;

2. Promote the widest range of beneficial uses of biodiversity without degradation, risk to health or safety, or other undesirable and unintended consequences in order to provide for sustainable economic development;

3. Achieve a balance between population and biodiversity resource use which will permit a higher standard of living and the conservation of natural resources for future generations;

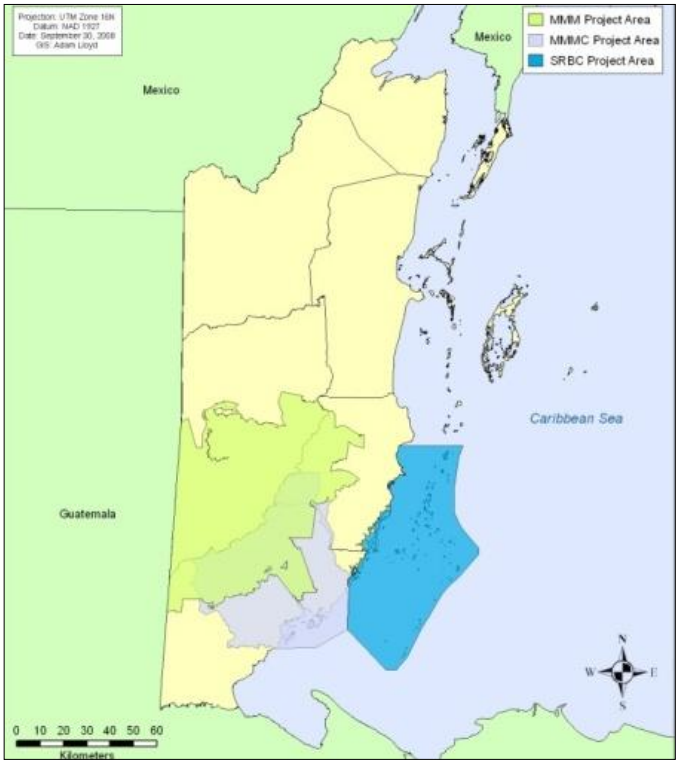
4. Enhance the quality of renewable resources and strive for the optimum use of non-renewable resources.

NPAPSP, 2005

Figure 1

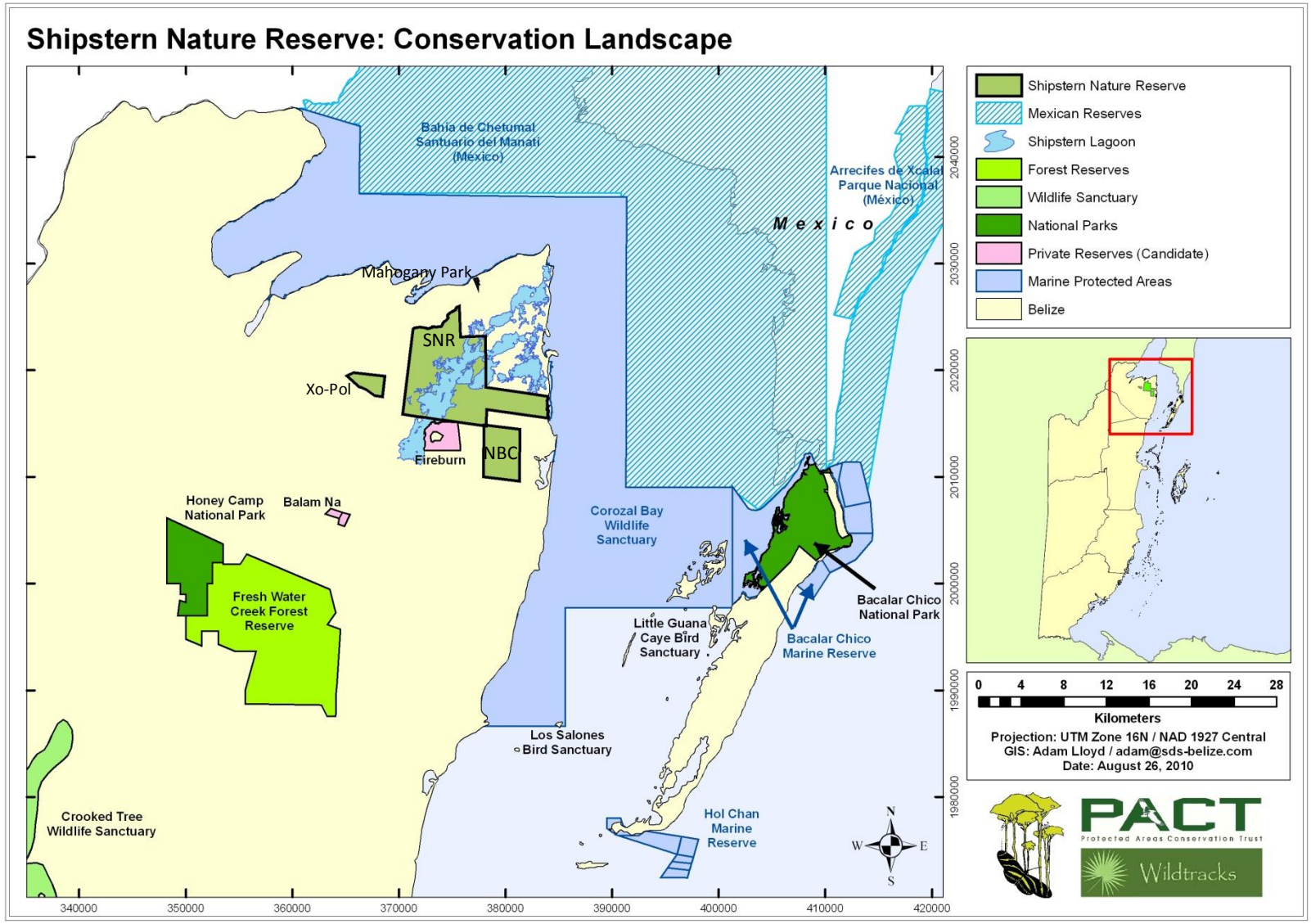
The overall goals of both the National Biodiversity Strategy and the NPAPSP reflect the national objectives - ecological and economic sustainability over the long term, with the development of human and institutional capacity to effectively manage the biodiversity resources within Belize. There is also a policy of decentralisation of the management of these resources, with a strong focus on co-management partnerships, community-based participation, equitable benefit from conservation efforts, and an increasing recognition of the need to form strong partnerships with private protected areas such as Shipstern, critical to the National Protected Areas System.

Under the NPAPSP, government seeks to increase management effectiveness through grouping protected areas into system level management units, and have, to date, implemented system level conservation planning initiatives for three system level management units currently recognized – the Maya Mountains Massif, the Maya Mountains Marine Corridor and the Southern Belize Reef Complex (Map 2). These system level plans recognize that resources exist in a larger landscape beyond the boundaries of the protected areas themselves, and set out discrete goals and objectives at system rather than site-level, increasing management effectiveness through the development of mechanisms for collaboration for surveillance and enforcement, biodiversity monitoring, education and outreach, and management.



Map 2: System Level Management Units	
	Maya Mountains Massif
	Maya Mountains Marine Corridor
	Southern Belize Reef Complex

Shipstern Nature Reserve lies within North East Belize, an area highlighted in the NPAPSP as having the potential for system level planning, to strengthen the matrix of contiguous and near contiguous protected areas (Map 3).



Map 3: Conservation Landscape of Shipstern Nature Reserve

Legal Framework

Shipstern Nature Reserve is private land, with clear title under the land ownership legislation of Belize, and has had a history of private ownership stretching back several decades. There is currently no legally binding agreement between Shipstern Nature Reserve (Belize) Ltd. and the Government of Belize that stipulates that the area should be maintained in its natural state, though the NGO is exploring mechanisms to make this commitment.

The management regime of Shipstern Nature Reserve (Belize) Ltd. is supported by a number of laws designed to protect wildlife and national heritage within the country. The **Wildlife Protection Act** (1982) addresses the need to protect wildlife resources that may live within or pass through the protected area, and the **National Parks System Act** (1982) is responsible for the establishment and management of national protected areas (though private protected areas are not yet recognized or addressed within this legislations). Both these Acts are administered by the Forest Department, under the Ministry of Natural Resources, and are currently being revised. Proposed amendments to the National Parks System Act specifically address the legal recognition of qualifying private protected areas, and establish basic management responsibilities.

The **Forest (Protection of Mangrove) Regulations** (SI 52 of 1989, in revision, 2010) are also under the Ministry of Natural Resources, and provide for the protection of mangroves, with restrictions on mangrove alteration and / or clearance without permission. Before granting a permit for mangrove alteration, Belize law requires the Forest Department consider whether the project will adversely affect the conservation of the area's wildlife, water flow, erosion and values of marine productivity, and to find either (a) that the proposed alteration will not significantly lower or change water quality or (b) that the degradation of water quality is in the "larger and long-term interest of the people of Belize." (Chapter 213, Section 5.5, of Belize's Forest Act). A large percentage of Shipstern Nature Reserve is under some form of mangrove cover, with any alteration of this matrix of ecosystems (eg. to install boardwalks or clear trails on the mangrove savanna) requiring a permit.

With a large expanse of Shipstern Lagoon within the boundaries of the private protected area, regulation of fishing activities is supported by the Fisheries legislation. The **Fisheries Act** (1948), administered by the Fisheries Department (Ministry of Agriculture and Fisheries), is the principal governing legislation to regulate the fishing industry, and is directly concerned with maintaining sustainable fish stocks and protecting the marine and freshwater environments.

The **Mines and Minerals Act** (1989) and the **Petroleum Act** (1991) regulate the exploration and extraction of all non-renewable resources, including petroleum. Shipstern Nature Reserve is included within an oil exploration area, granted to Perenco Belize Ltd. - of significant concern to the management of the protected area, as ownership of the land does not preclude exclusion

from mining and oil prospecting and extraction license areas, with minerals and petroleum below the Earth's surface being considered property of the Government of Belize.

Whilst the above are the legislative Acts directly relevant to Shipstern Nature Reserve, there are others that are also of relevance. The **Environmental Protection Act** (1992) was drawn up under the Department of the Environment (Ministry of Natural Resources), with the aim of ensuring that development initiatives within Belize are planned for minimum environmental impact – this is particularly important when ensuring that the impacts on the protected area from development in adjacent areas are minimized – particularly development adjacent to the lagoon, or any potential oil exploration activities.

Financial sustainability is partially addressed at Government level through the development of a funding mechanism to assist in management and development activities within protected areas – the Protected Areas Conservation Trust (**PACT Act**, 1996), through a 'conservation tax' of Bz$7.50 levied on non-residents as they leave the country. Shipstern Nature Reserve is eligible for funding from the Trust, and received a small project grant in 2010.

The National Protected Areas Policy and System Plan (NPAPSP) recognizes the critical role already played by the recognized private protected areas, including Shipstern Nature Reserve – primarily in conserving ecosystems that are otherwise under-represented within the National Protected Areas System (NPAS), and in providing biological connectivity between protected areas. The Policy and Plan recognizes the vulnerability of the NPAS in having such critical functions provided by private protected areas that do not as yet have legal commitments for conservation management – and recommended that such reserves make appropriate legal commitments for their formal commitment under the NPAS. Mandated by the Forest Department, the Belize Association of Private Protected Areas has developed draft amendments to the National Parks System Act, in line with the NPAPSP recommendations, for the legal recognition of qualifying private protected areas – amendments currently under review by the Government of Belize, and scheduled for adoption by the current administration (Chief Forest Officer, pers. com.). A pro-tem National Protected Areas Technical Committee has recently been established by the Government of Belize, to help guide the implementation of the NPAPSP, including the recommendations relating to private protected areas.

1.3.2 Land and Sea Tenure

The four parcels of Shipstern Nature Reserve are private lands, defined by individual titles under the National Lands Act (1992). All forests resources within the protected area are considered the property of the Forest Department, with any clearance or resource extraction requiring permission. Any mining, including beach sand mining or dredging activities, and oil exploration / drilling activities, require a license from the Geology & Petroleum Department, and all mineral and petroleum rights belonging to the Government of Belize.

Shipstern Nature Reserve encompasses a significant central portion of Shipstern Lagoon, through which the public has legal rights of access. With the support of both the Belize Fisheries Department and the Forest Department, the management of Shipstern Nature Reserve is, however, able to regulate fishing within its boundaries.

1.3.3 Evaluation of Protected Area

Shipstern Nature Reserve as a non-extractive private protected area, encompasses 4 broad ecosystems (Meerman et. al, 2004), and over 266 species of plant, 43 species of mammal, 274 species of bird, 67 species of reptile, 17 of amphibian and 33 species of fish. This high diversity is in part a consequence of the broad range of habitat types found within its boundaries, from a variety of lowland terrestrial habitats to saline wetland and freshwater habitat. The area protects several species of international concern (Table 4). Additionally, it harbours plant species of national significance – including two Yucatan endemic palms largely confined to the Shipstern / Sarteneja area, and an as yet unidentified fig known only from a single specimen at the Reserve Headquarters. It is also the only recognized protected area in Belize protecting the southernmost populations of one amphibian and a number of reptile species that are Yucatan endemics.

Shipstern Nature Reserve Species of International Concern	
Endangered	
Baird's Tapir	*Tapirus bairdii*
Yaxnik	*Vitex gaumeri*
Vulnerable	
Great curassow	*Crax rubra*
Spanish Cedar	*Cedrela odorata*
Mahogany	*Swietenia macrophylla*
West Indian Manatee	*Trichechus manatus*
Lower Risk / Conservation Dependent	
Morelet's Crocodile	*Crocodylus moreletii*
Near Threatened	
Margay	*Leopardus wiedii*
Jaguar	*Panthera onca*
White-lipped peccary	*Tayassu pecari*
Black catbird	*Melanoptila glabrirostris*
Golden-winged Warbler	*Vermivora chrysoptera*
Tabasco mud turtle	*Kinosternon acutum*
Furrowed wood turtle	*Rhinoclemmys areolata*
Mexican giant musk turtle	*Staurotypus triporcatus*
Common Slider Turtle	*Trachemys venusta*

Table 4: Species of International Concern

Ranging from saline mudflats and mangrove savanna to dry forests, Shipstern Nature Reserve is recognized as a critical component of the Regional Protected Areas System and Meso-American Biological Corridor. The protected area fills a number of highlighted gaps in ecosystem coverage for Belize, with species assemblages and plants that are unique in Belize, with associations with the Yucatan Peninsula.

Shipstern Nature Reserve is identified in the national gap assessment as the only protected area in the country supporting seasonal and dry forests typical for the Yucatan Peninsula - the ***Tropical evergreen seasonal lowland forest on calcareous soils, Yucatan variant*** (Meerman, 2005). This is characterized by the presence of Yucatan endemics such as the Kuka palm (*Pseudophoenix sargentii*) and Yucatan Jay (C*yanocorax yucatanicus*). The kuka palm, occurs only in the Shipstern area in mainland Belize, and in Bacalar Chico on Ambergris Caye, and is threatened in its limited Mexican range by rapid tourism development.

Shipstern Nature Reserve falls within one of Belize's six Important Bird Areas (North Eastern Belize - BZ001). The Important Bird Areas programme of Birdlife International aims to identify and protect a network of key sites for birds and biodiversity, through joint efforts of governmental and non-governmental organizations and the public in general (Figure 2). The mangrove cayes of the Lagoon provide structure for two key nesting colonies of wood storks, as well as other regional waterbirds of concern – reddish egrets, roseate spoonbills and white ibis among them. The littoral forests are important for the Near Threatened black catbird, a Yucatan endemic that nests within the protected area. It also provides habitat for migrants such as the endemic Yucatan vireo, a winter visitor. Neotropical migratory birds also use the area as a stopping off point, following the coastline southwards towards their wintering areas (Bayly, 2008). North American waterfowl also migrate through the area, including congregatory species such as blue winged teal and American coot, using Shipstern Lagoon as a sheltered over-wintering stopover.

Criteria for IBA designation

- Globally Threatened Species: based on IUCN Red List criteria
- Range Restricted Species: with distribution of 50,000 km^2 or less
- Biome Restricted Species: found only within a particular biome, and or habitat
- Congregations of significant numbers of birds: Sites with a high concentration of seabirds, shorebirds, aquatic and migratory birds based on global population estimates

Figure 2

Shipstern Lagoon and wetlands to the west of Sarteneja are ranked as moderately important for ducks and waders. Shipstern Lagoon has historically been an important area for nesting wood Storks although for unknown reasons, they don't nest every year – no nesting was reported in 2002 (Laesser, 2007), nor in the 2010 nesting season. The lagoon system also supports nesting cayes for reddish egrets, white ibis, roseate spoonbills and boat billed herons. The extensive mangroves, creeks and lagoons associated with the coast and Shipstern Lagoon have been highlighted within the regional MAR planning as critical for the health and maintenance of the

Meso-American Reef (MAR, 2009), providing important nursery areas for many local commercial fish species.

Shipstern's forested areas provide habitat for all five of Belize's cats, as well as, over 290 species of birds, including keel-billed toucans and the vulnerable great curassow. The swamp pools provide habitat for Morelet's crocodiles and a variety of freshwater turtles.

The southern areas of Shipstern Nature Reserve contribute towards the Shipstern / Fireburn node, one of three forest nodes within Belize that have been identified in conservation planning at national level as important in Belize's contribution to the Mesoamerican Biological Corridor (Meerman, 2000). The Shipstern / Fireburn Node provides a relatively large, intact forest ecosystem that, through connectivity to forests further south (Map 4), supports a number of species requiring large areas for viable populations – among them, the Endangered Baird's tapir, and Near Threatened white lipped peccary and jaguar (IUCN, 2010).

Map 4: Shipstern Nature Reserve: Satellite Imagery of Conservation Landscape (Google)

1.3.4 Socio-Economic Context

Belize has a population currently estimated at approximately 314,522 (CIA, 2010), of which 52% are urban dwellers (Figure 3; CSO, 2004). Population densities are low, with just over 12 persons per sq. km., concentrated primarily within the northern plain, southern coastal plain, Belize Valley and Stann Creek Valley, with much of the remaining country being less suited, such as the steep terrain of the Maya Mountains. It is a country of many ethnic cultures, with Mestizo, Creole, Maya and Garifuna being the major population groups. The Maya occupants of Belize, the descendants of the Central American civilization that was at its height approximately 2,000 years ago, are subdivided into three ethnic groups, and loosely by geography – the Yucatec Maya of the north, the Mopan Maya of the west and south, and the Ketchi of the southern regions.

Belize Demographic Statistics (Average)	
Population (2010 est.)	307,899
Population density (2010)	12.3 /sq. km.
Annual growth rate (2010)	2.2%
Birth rate (2010 est.)	27.3 per 1000
Mortality rate (2010 est.)	5.8 per 1000
Fertility rate (2010)	3.3 children per woman
Life expectancy (2010)	70 (female); 66 (male)
Below Poverty level (2002)	33.5%
Literacy rate (2010)	76.9%
Unemployment rate (2010)	8.1%
GDP (2009)	Bz$2.67 million
GDP (per capita, 2009)	Bz$15,437 per capita
Ref: CIA 2010 Ministry of Health CSO, Mid-term 2004 CSO, Poverty Assessment Report, 2002	

Figure 3: Belize Demographics

There is an ongoing emigration of Belizeans to the United States – generally those from urban areas who have completed secondary school or have professional training. There is also a significant influx of Central American refugees – primarily from Guatemala and Honduras - contributing approximately 13% towards the total population of Belize and resulting in the relatively high population growth rate of 2.3%. This brings different cultural values to community outlooks on natural resources, and increased pressures.

The economy of Belize has, in the past, been based largely on agriculture, with fisheries, banana, sugar and citrus forming some of the traditional exports that contributed significantly towards the GDP. This has recently been exceeded by revenue from oil extraction, and there is an increasing reliance on the developing tourism industry, which is rapidly becoming the major foreign exchange earner. The western section of the Corozal District, with its large number of villages situated along the course of the Northern Highway, and much of the land given over to sugar cane farming, is very different from the north east – in which Shipstern Nature Reserve is located, and is very sparsely populated in comparison with much of the land remaining under natural vegetation cover.

The population of north east Belize is primarily Mestizo, with Spanish being the main language. The main economic activity in the general area is sugar cane farming, though this does not

extend as far east as Shipstern Nature Reserve. A variety of other crops are also grown, especially in the Mennonite communities. There is some tourism, focused on destinations that include Sarteneja, Corozal and the Maya site of Lamanai near Orange Walk. Some revenue is also generated as a result of the area becoming increasingly popular as a location for second homes, primarily for people from the United States and Canada, and a number of retirement settlements in the area are already in existence or are being developed. The villages of Sarteneja, Chunox and Copper Bank rely on fishing as a source of income - as fish stocks decline the fishers of these villages are having to consider alternative sources of income.

Local Socio-Economic Context

Shipstern Nature Reserve has three primary stakeholder communities – Sarteneja, Chunox and Fireburn - each of these affects and is affected by the protected area (Table 5; Maps 5 and 6). Sarteneja and Chunox are predominantly Mestizo, with Yucatec Maya ancestry. Many of the traditional families moved to the area from the Yucatan in the 1850's, as a result of the Caste Wars. There is also a significant and increasing Mennonite presence in the area - Little Belize – with extensive agricultural lands and residential 'camps' that stretch to the southern end of Shipstern Lagoon.

Community	Population	Attitude
Sarteneja	2,300	Negative
Chunox	1,400	Ambivalent
Fireburn	25	Ambivalent
Little Belize	2,059	Ambivalent
Copper Bank and Progresso	Not direct buffer communities, but villagers do access the area for logging, hunting and fishing activities	

Table 5: Stakeholder Communities

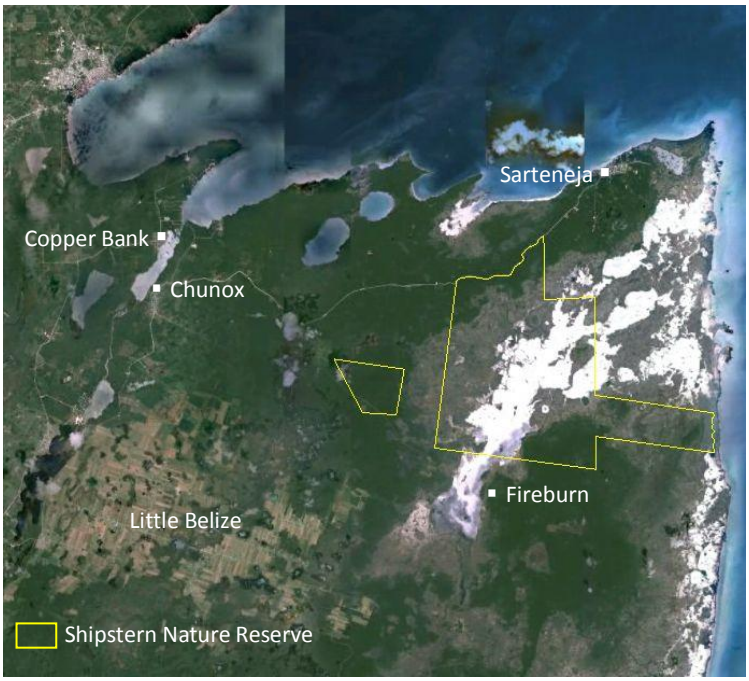
The largest of these (and the closest) is Sarteneja, a Spanish speaking Mestizo community with a resident population estimated at approximately 2,300 (SACD, 2010). Sarteneja lies approximately 5 km to the east of the Shipstern eastern boundary. It is the largest fishing community in Belize, with the greatest footprint on the Belize Barrier Reef, and an almost complete dependence on the marine resources. Eighty percent of households rely on fishing as a major contributor towards annual income (SACD, 2010), and sixty-one percent of households are fully dependent on fishing. (MMAS / Isis Consulting / Catzim, 2009). The fishermen use sail boats, built in the village, that allow them to access the majority of Belize's shallow coastal waters. The traditional 6 to 10-day trips, focused primarily on free diving for lobster and conch, have been lucrative in the past. However, fishermen are now finding that the returns from these trips are diminishing as the marine resources decline and the numbers of fishermen increase – both from traditional fishing communities and more recently from elsewhere in Belize, and from incursions from Guatemala and Honduras. Whilst for much of the year – July 15th to 14th February – the majority of men of the community (an estimated 450 fishermen or more) are out fishing on the reef, a small number of men remain in Sarteneja, and there are some fishing and

hunting activities within the Sarteneja area that, at times, causes conflict with the private protected area.

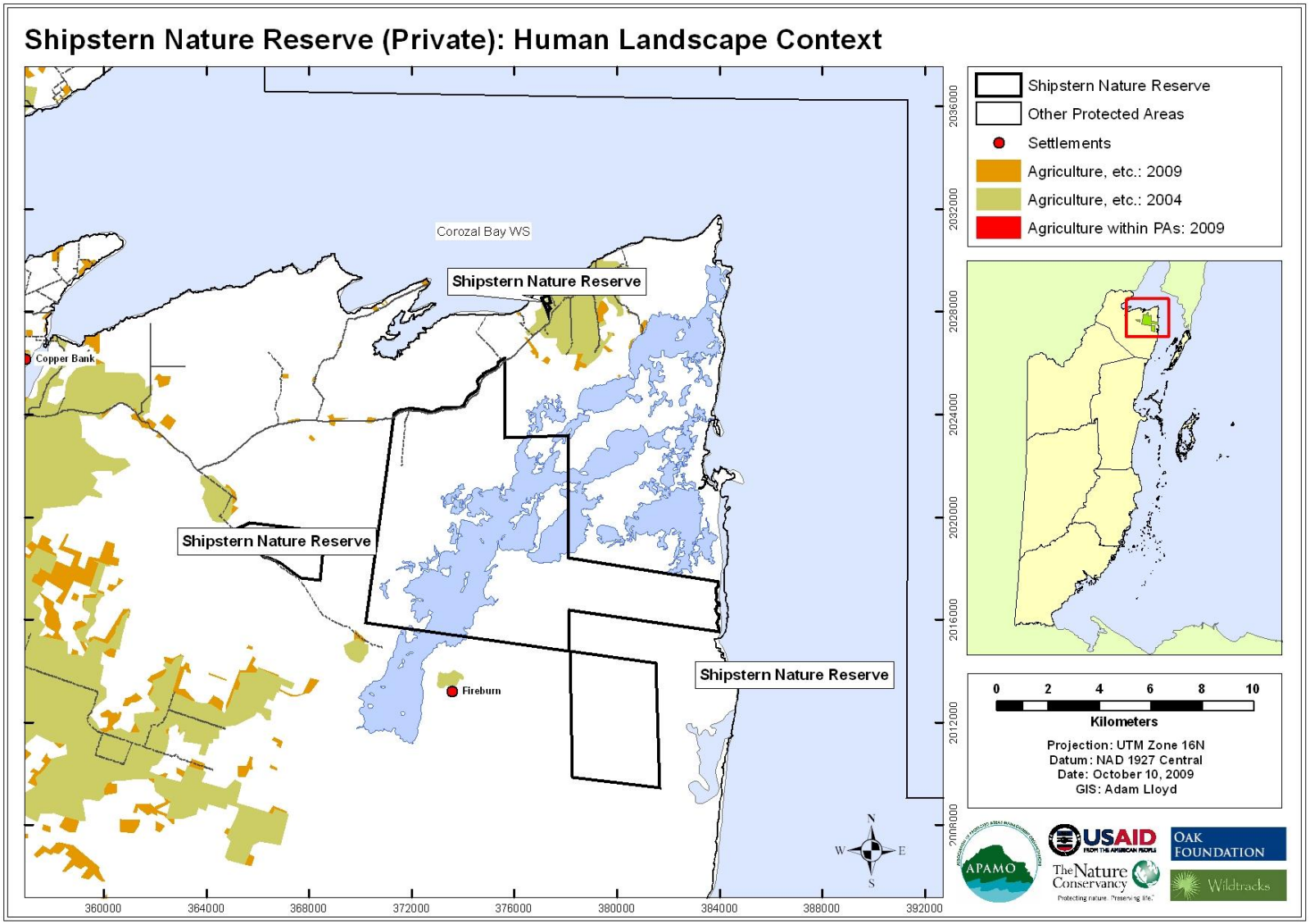
Sarteneja is also the shipping point for natural resources to the tourism-based town of San Pedro – focused primarily on bay leaves ('wano' - *Sabal yapa* and *S. mauritiformis)*). The high price received for these thatch leaves has lead to intense pressure in the forest areas adjacent to Shipstern, and in many places, local extinctions.

Chunox, also predominantly Spanish speaking, is situated to the west of Shipstern Nature Reserve, and has a more diversified income base, including intensive agriculture, sugar cane and logging (not always legal). With the declining returns from sugar cane farming, there has been a recent shift towards fishing, this now being the main source of income for 23.7% of households (MMAS / Isis Consulting / Catzim, 2009).

Fireburn is a remote village to the south of the Shipstern / Fireburn forest node, accessible



Map 5: Primary Stakeholder Communities of Shipstern Nature Reserve



Map 6: Shipstern Nature Reserve: The Human Landscape

only by crossing Shipstern Lagoon by boat. The population of the village is currently 25, although this number changes regularly as people leave and return depending on the availability of work. The community was established in the 1880's as a logging camp, and has maintained many of the traditional Creole ways, though more recently, people of Mestizo background have married into the community. Consequently the languages used are a mix of Creole and Spanish.

Economically, the community has been dependent upon logging (often illegal), resulting in conflict with Shipstern Nature Reserve and the adjacent Fireburn Reserve, with milled timber transported to San Pedro by boat. Farming is also an important economic activity, the main crop being plantain, but other crops are also grown both for personal consumption and for sale. Fishing is carried out for personal consumption in Shipstern Lagoon and the coastal areas adjacent to Shipstern Bar. Despite the small size of the community, there is a primary school in the village, established under the Wildtracks Sustainable Development Programme in 1998, and currently managed by the Ministry of Education, who supply two teachers, enabling the children to stay in the village for their education.

Little Belize, a Mennonite community located 7km to the south-west of Shipstern Nature Reserve, is one of the most traditional Mennonite communities in Belize. Of Dutch/German descent, this Christian Anabaptist religious sect emerged in the early 1500's in Europe, and emigrated to the Americas during the 17th and 18th centuries, in response to enforced military service and taxation (Minority Rights Group International, 2008). The original founders of Little Belize moved there from Canada, establishing the community in the late 1950's. Their primary economic activity is agriculture, the community having extensive farmlands, producing a variety of crops including corn and beans, and farming cattle and poultry. Ongoing and usually illegal logging by Mennonites and their contractors, to supply several sawmills in Little Belize poses a significant challenge to conservation management across the landscape. Extensive use of agrochemicals and the ever-extending agricultural area to the east of the community has the potential to affect water quality in Shipstern Lagoon, and increased fishing pressure on the already depressed fish stocks of Shipstern Lagoon.

Other Local Stakeholders

Shipstern Nature Reserve is also contiguous with the Corozal Bay Wildlife Sanctuary to the east, the largest marine protected area in Belize, with the southern Shipstern parcel connecting with the coastline. Corozal Bay Wildlife Sanctuary is managed under a co-management agreement between the Forest Department and the **Sarteneja Alliance for Conservation and Development (SACD)**, an Alliance of local community and conservation organizations based in Sarteneja, of which Shipstern Nature Reserve is a member.

Other local conservation stakeholders include **Wildtracks**, an NGO that manages the Fireburn Reserve contiguous to the south, forming part of the Shipstern / Fireburn node. Wildtracks has been working with Government towards the establishment of the north east biological corridor, and is active in local and national conservation.

Within the same Shipstern / Fireburn node lies the proposed Kakantulix Archaeological Site**.** This site, which covers an area of 279 acres, is located to the south of the Shipstern parcel, west of the NBC parcel, and adjacent to the Fireburn Reserve. It is considered to be the second largest Maya site in northern Belize, and is in the process of being designated as an Archaeological Reserve by the **Institute of Archaeology**, under a Wildtracks initiative.

A Stakeholder Analysis was completed in mid-2010 for Shipstern Nature Reserve, focusing on how the protected area affects stakeholders, and how the stakeholders impact the protected area (Table 6). This demonstrated an urgent need for stakeholder engagement of local communities, with little support currently existing for the goals of the private protected area. There is recognition of this, and management strategies are currently being developed to address this critical gap.

Table 6: Stakeholder Analysis for Shipstern Nature Reserve				
Stakeholder	**Influence or Impact of SNR on Stakeholder**		**Influence or Impact of stakeholders on SNR**	
Sarteneja, Chunox	Environmental services	+	Provides available pool of labour	+
	Provides a tourism attraction, increasing visitation to Sarteneja and Chunox	+	Potential source of tourists to Nature Reserve	+
			Generally non-supportive (Sarteneja) or ambivalent (Chunox)	-
	Potential income generation by local tour guides using Shipstern Nature Reserve as a tourism destination	+	Occasional illegal commercial logging impacts within Reserve	-
			Impacts from illegal harvesting of non-timber forest products, including kuka palm and bay leaves	-
	Employment opportunities as Nature Reserve staff	+		
	Destination for educational visits by schools – learning opportunities	+	Land use change adjacent to Reserve, with increased potential of fire risk, increased accessibility, and reduced forest connectivity	-
	Community engagement programmes benefiting communities	+		
	Reservoir / source for game species and seed trees	+		
	Shipstern Nature Reserve area is not available to community for logging, hunting, other non-timber forest product extraction or agricultural expansion	-		
Fireburn	Environmental services	+	Generally ambivalent – not an active partner	-
	Potential for tourism visitation	+	Occasional illegal commercial logging impacts within Nature Reserve	-
	Potential support for community projects	+	Impacts from illegal harvesting of timber and non-timber forest products	-
	Reservoir / source for game species and seed trees	+		
	Shipstern Nature Reserve area is not available to community for logging, hunting, other non-timber forest product extraction or agricultural expansion	-	Land use change adjacent to Nature Reserve, with increased potential of fire risk, increased accessibility, and reduced forest connectivity	-
Little Belize	Environmental services	+	Generally ambivalent – not an active partner	-
	Shipstern Nature Reserve area is not available to community for logging, hunting, other non-timber forest product extraction or agricultural expansion	+	Occasional illegal commercial logging impacts within Nature Reserve	-
			Land use change adjacent to Nature Reserve, with increased potential of fire risk, increased accessibility, and reduced forest connectivity	-
			Potential for agro-chemical contamination of Shipstern Lagoon	-

Table 6: Stakeholder Analysis for Shipstern Nature Reserve				
Stakeholder	**Influence or Impact of SNR on Stakeholder**		**Influence or Impact of stakeholders on SNR**	
Researchers	Benefit from infrastructure of Nature Reserve and support from staff	+	Research data increases knowledge of Nature Reserve	+
			Presence of researchers discourages illegal incursions	+
	Access to an area of protected forest	+	Possible detrimental impacts of research activities	-
	Access to knowledge from previous research	+	Requires staff time to provide support to researchers	-
			Requires surveillance effort to regulate and minimize impacts of groups on biodiversity	-
Schools and University of Belize	Benefit from use of Nature Reserve infrastructure for research and education	+	Presence of educational groups in Nature Reserve discourages illegal incursions	+
	Benefit from access to protected area	+	Possible detrimental impacts of educational groups / student activities	-
	Benefit from access to knowledge from previous research	+		
	Increased understanding of conservation	+	Requires staff time to provide support to researchers	-
			Requires surveillance effort to regulate and minimize impacts of groups on biodiversity	-
Government of Belize	Environmental services	+	Financial support through PACT	+
	Contributes towards fulfilling Belize's commitments under international and regional environmental agreements	+	Support for surveillance and enforcement activities	+
			Support for projects and proposals	+
	Contributes significantly towards Belize's efforts to protect mangrove	+	Limited resources in Government Departments, reducing / removing support	-
	Contributes significantly towards Belize's efforts to protect Yucatan forest	+	Lack of political support	-
	Reduces land available for local community use	-		
Belize Public	Environmental services	+	Support for Shipstern Nature Reserve	+
	A venue for education activities for school trips	+	Limited knowledge of Shipstern Nature Reserve, so limited public support	-
	A venue for education activities for national tourism	+		

1.4 Physical Environment of Management Area

1.4.1 Climate

Belize lies within the sub-tropics - the relatively high temperature and rainfall patterns associated with the tropics being one of the factors that promote and sustain the high levels of biodiversity within the region.

Weather Systems: Belize is affected by three very distinct seasonal weather systems:

- ***Trade Winds*** – the predominant winds, blowing from the east and north-east
- ***Northers*** - high-pressure fronts moving down from the north, occurring between October and April
- ***Tropical Storms*** - occurring between June and November, originating in the mid-Atlantic

All three have an influence on the rainfall and temperature patterns and on the water levels in the lagoon system and freshwater pans.

Tropical Storms: Tropical storms affect Belize every year, originating in the Atlantic Ocean over warm, tropical waters. These storms are non-frontal, developing highly organized circulations, and ranging in scale from tropical depressions and tropical storms (with sustained wind speed < 74 mph) to hurricanes (with sustained wind speed > 74 mph). The storms move westward towards the Caribbean, gathering strength until they hit land.

Whilst many hurricanes have very focused paths of destruction, their effects are wide ranging, Shipstern Nature Reserve has been affected on numerous occasions by tropical storms, some of these reaching hurricane strength. All tropical storms, even tropical depressions such as Katrina (1999) can bring increased rainfall, causing extensive flooding of the coastal savannas, and water flow from the rivers, decreasing the salinity of the Shipstern Lagoon system. Some of the stronger storms of most note in the region are Hurricane Janet, Hurricane Keith, and most recently, the Category Five Hurricane Dean.

Figure 4: Hurricane Janet (www.csc.noaa.gov)

Hurricane Janet struck northern Belize on the 27th September 1955, with winds from the northwest, reaching 175 mph. Sarteneja was badly hit, with the majority of the buildings destroyed, and a storm surge estimated at 8 feet, causing widespread forest damage (Figure 4; Friesner, 1993).

Hurricane Carmen also impacted the Shipstern area, making landfall as a Category 4 hurricane on the 2nd September 1974, a little further to the north than Hurricane Janet. On the 21st August, Tropical Storm Chantal passed almost directly over the Shipstern, resulting in numerous tree falls (Figure 5). This was followed in October 2001 by Hurricane Keith, which stalled to the east, over Ambergris Caye, as a Category 3 hurricane, making landfall to the south of Shipstern as a tropical storm on the 3rd October, and causing extensive tree fall, and considerable canopy loss in the Shipstern / Fireburn forest node.

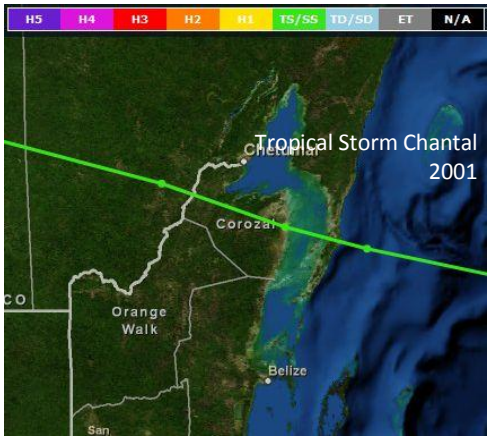


Figure 5: Tropical Storm Chantal www.csc.noaa.gov

The next hurricane to cause major impacts in the area was Hurricane Dean in 2007 (Figure 6). This storm passed a few miles north of Corozal Bay, – a Category Four hurricane with wind speeds of 150mph. The strong winds caused significant damage to forest and mangrove ecosystems in the area, with torrential rain causing extensive run-off of sediments into the Bay. Shipstern Nature Reserve buildings were not significantly affected by the hurricane, but tree and branch fall made most trails impassable, and many sections of survey line needed to be reopened.

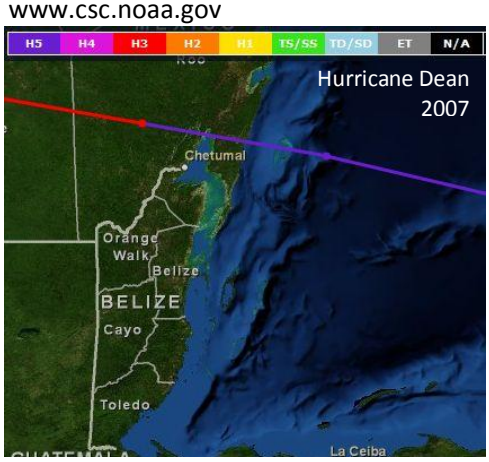
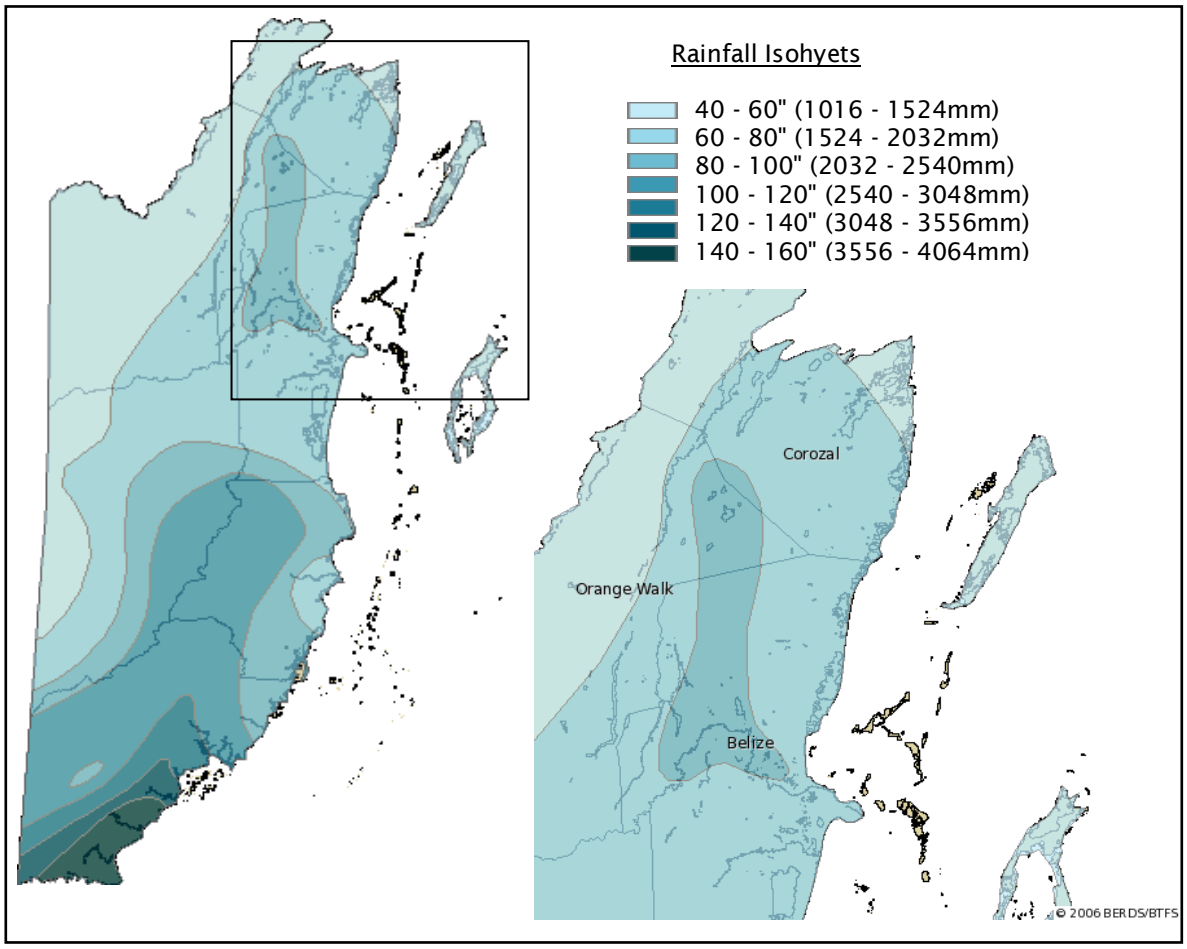


Figure 6: Hurricane Dean www.csc.noaa.gov

The extent of damage in the forest was very unevenly distributed, with the Shipstern / Fireburn node being hit particularly hard. Some areas suffered extensive damage, with trees uprooted, the loss of entire tree canopies, and significant damage to branches, with virtually no forest canopy structure remaining. In other areas, however, the impact was much more minimal, with damage to branches and some leaf loss tree fall, but maintenance of the general forest structure (Walker pers. obs.).

By 2010, the forest was regenerating well. In the most heavily impacted areas, secondary colonizers such as *Cecropia*, wild papaya (*Carica papaya*) and wild chaya (*Cnidoscolus aconitifolius*) are growing fast, as are grasses and many seedlings of canopy tree species. The less heavily impacted areas are also recovering, with branch regrowth restoring the canopy layer (Lloyd, pers. com.).

Rainfall: Shipstern Nature Reserve is situated in north-east Belize, an area defined climatically as sub-tropical, with distinct wet and dry seasons. It lies within the two driest rainfall belts for the country, with annual rainfall averaging approximately 1298 mm a year (Map 7; Table 7).



Map 7: Shipstern Nature Reserve: Rainfall

A pronounced dry season stretches from February through to the end of May. During this period, the minimum monthly rainfall can be as low as 3mm (as recorded in March, the driest month; Figure …). This is followed by a wetter season (June to December / January), punctuated by a mini dry season in the month of August. The majority of rain falls within the hurricane season, associated with passing tropical storms, particularly between September and November. It should be noted, however, that rainfall figures for Shipstern Nature Reserve are out of date, particularly in view of the climate changes over the recent years, and estimates suggest that rainfall is now reduced, with greater seasonality. For this reason, more recent figures from Consejo have also been included (Table 7; Figure 7).

Rainfall in the Shipstern Nature Reserve area			
	Mean Rainfall (mm)		
Month	**Consejo***	**SNR****	**SNR Area (Average)**
January	94.2	121	107.6
February	33.6	29	31.3
March	22.8	29	25.9
April	44.3	7	25.65
May	80.6	97	88.8
June	190.9	112	151.45
July	162.3	112	137.15
August	136.7	88	112.35
September	221.7	224	222.85
October	174.5	112	143.25
November	104.7	171	137.85
December	93.8	135	114.4
Annual Mean	**1360.1**	**1237.0**	**1298.5**
* Source of data: Belize National Meteorological Office, Consejo Shores (1978 - 2000) ** Source of data: Meerman (1989 - 1993)			

Table 7: Mean Rainfall by Month in Consejo and Shipstern Nature Reserve, Belize.
(NB: Recent climate information – rainfall in particular - is considered a significant gap**)**

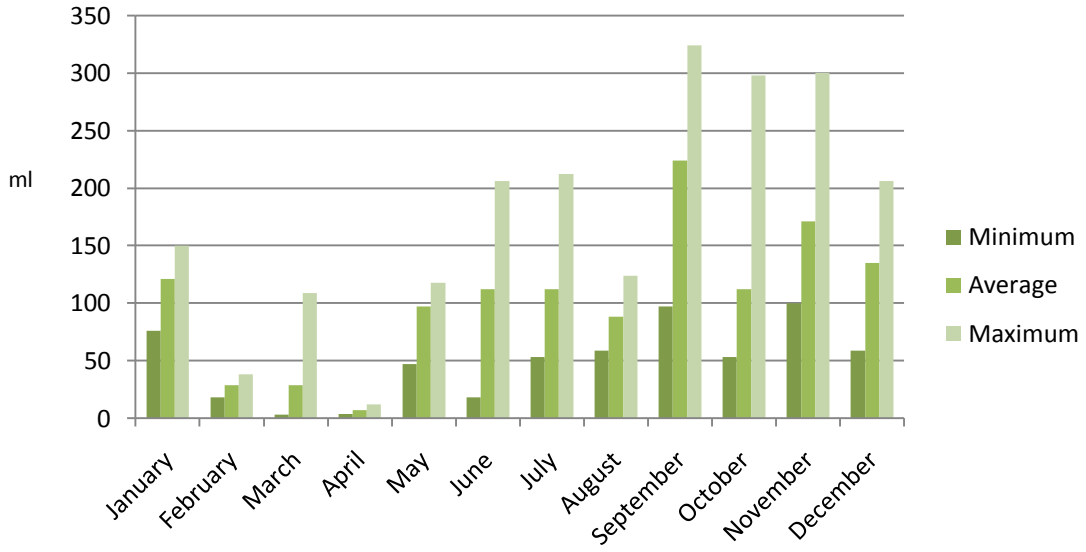


Figure 7: Mean, Average and Maximum Rainfall by, Shipstern Nature Reserve, 1989 – 1993 (Meerman)

Temperature: There are no temperature records for Shipstern Nature Reserve or the immediate area. They are, however, available from Chetumal (Mexico), and Libertad (Corozal District, Belize), and suggest that temperatures can be expected to vary from 18˚C to 34˚C, with minimum temperatures around 18˚C (Libertad) - 21˚C (Chetumal) in March, in the dry season, when the north wind systems

sweep over northern Belize (Table 8; Figure 8). Maximum temperatures were recorded in July in Libertad (33.1˚C) and September in Chetumal (34.8˚C). These regional variations may be attributed to position on the coast and the level of urban development, but provide a broad indication of the temperatures expected for the Shipstern Nature Reserve area.

Temperatures in the Shipstern Nature Reserve area							
	Chetumal*			Libertad, Corozal**			
Month	Mean Temp ºC	Max Temp ºC	Min Temp ºC	Mean Temp ºC	Max Temp ºC	Min Temp ºC	Mean Temp ºC
January	24.7	30.1	18.4	23.0	29.0	16.9	23.8
February	25.1	30.5	18.8	24.5	30.4	18.6	24.8
March	26.5	32.4	21.8	25.0	31.5	18.4	25.7
April	27.8	33.6	22.7	26.7	33.1	20.3	27.3
May	28.8	33.2	24.6	27.8	33.0	22.6	28.3
June	28.9	33.4	25.2	28.2	32.6	23.7	28.5
July	29.1	34.3	24.7	28.1	33.1	23.1	28.6
August	29.4	34.7	24.9	28.0	32.9	23.1	28.7
September	28.8	34.8	23.6	27.7	32.9	22.4	28.2
October	27.8	33.3	22.9	26.5	31.6	21.4	27.2
November	26.7	31.5	20.4	24.4	29.7	19.0	25.5
December	25.5	31.0	19.2	23.7	29.0	18.3	24.6
* Source of data: http://www.tutiempo.net/en/ Chetumal (2004 - 2006) ** Source of data: Belize National Meteorological Office, Libertad, Corozal (1992 - 2002)							

Table 8: Temperatures in the Shipstern Nature Reserve area

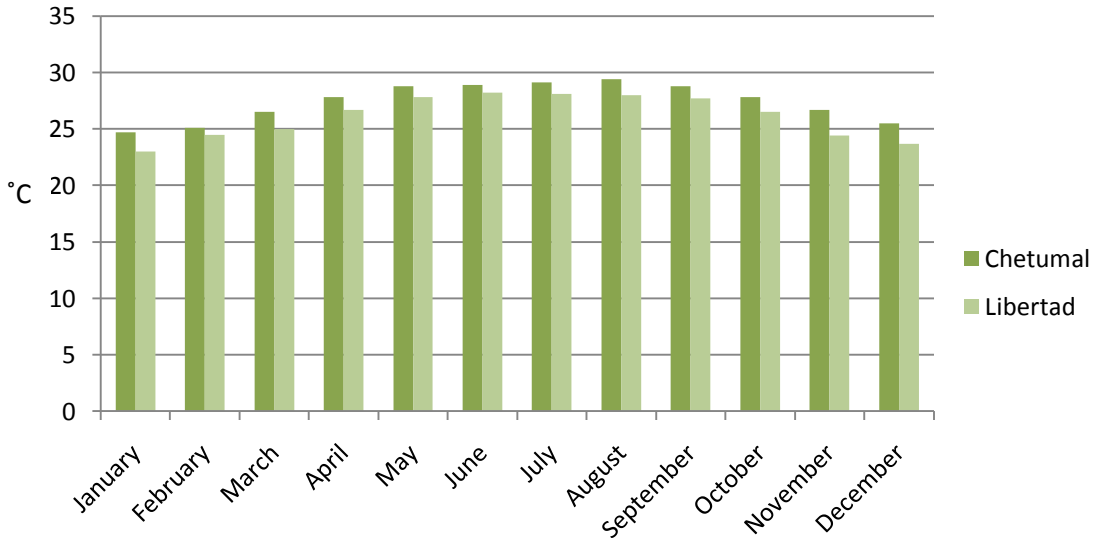


Figure 8: Temperatures in the Shipstern Nature Reserve area

1.4.2 Geology

Shipstern Nature Reserve is situated on the northern coastal plain of Belize, part of the low-lying Yucatan platform, with highest elevations within the immediate area being between 4 and 6m above sea level or lower. The terrain is a gently undulating coastal plain that follows the top surface of the limestone bedrock. These undulations are a dominant feature throughout the forested northern portion of Shipstern, from the coastal area east of Sarteneja to Chunox, and through Little Belize. Throughout, the crests of these weak undulations are easily visible in area of forest clearance – agricultural lands, and along roads and tracks where the top of the limestone is exposed. Throughout the area, soil cover is very thin – generally less than 60cm, leading to droughty conditions, particularly in the more northerly areas in the dry season.

The limestone bedrock, formed in the Pleistocene, is among the youngest in Belize (Flores, 1952; King et al, 1992; MacLeod and Holland, 1998), and provides the parent material for the different soil types of the area. It lies close to the surface, and results in typical limestone scenery, characterized by a lack of surface flowing rivers and streams, and the presence of underlying caves and cenotes. The upper bedrock is a semi-continuous, well cemented, hard limestone layer composed of Tertiary limestones and dolomites which extend offshore into Corozal Bay (Map 8; Cornec, 2002). Below this layer is a sequence of soft, conglomeratic marls (carbonate mudstone with no clay content) containing abundant pebbles and cobbles of hard limestone (Figure 9).

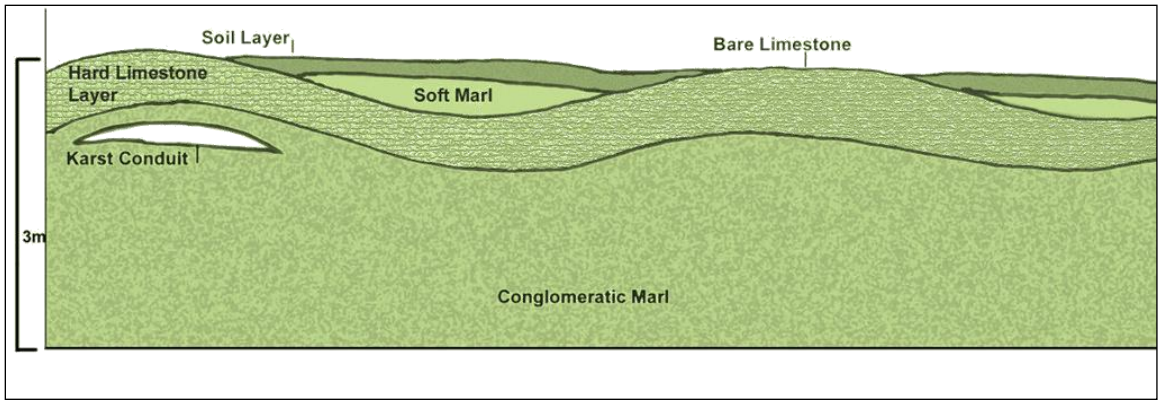
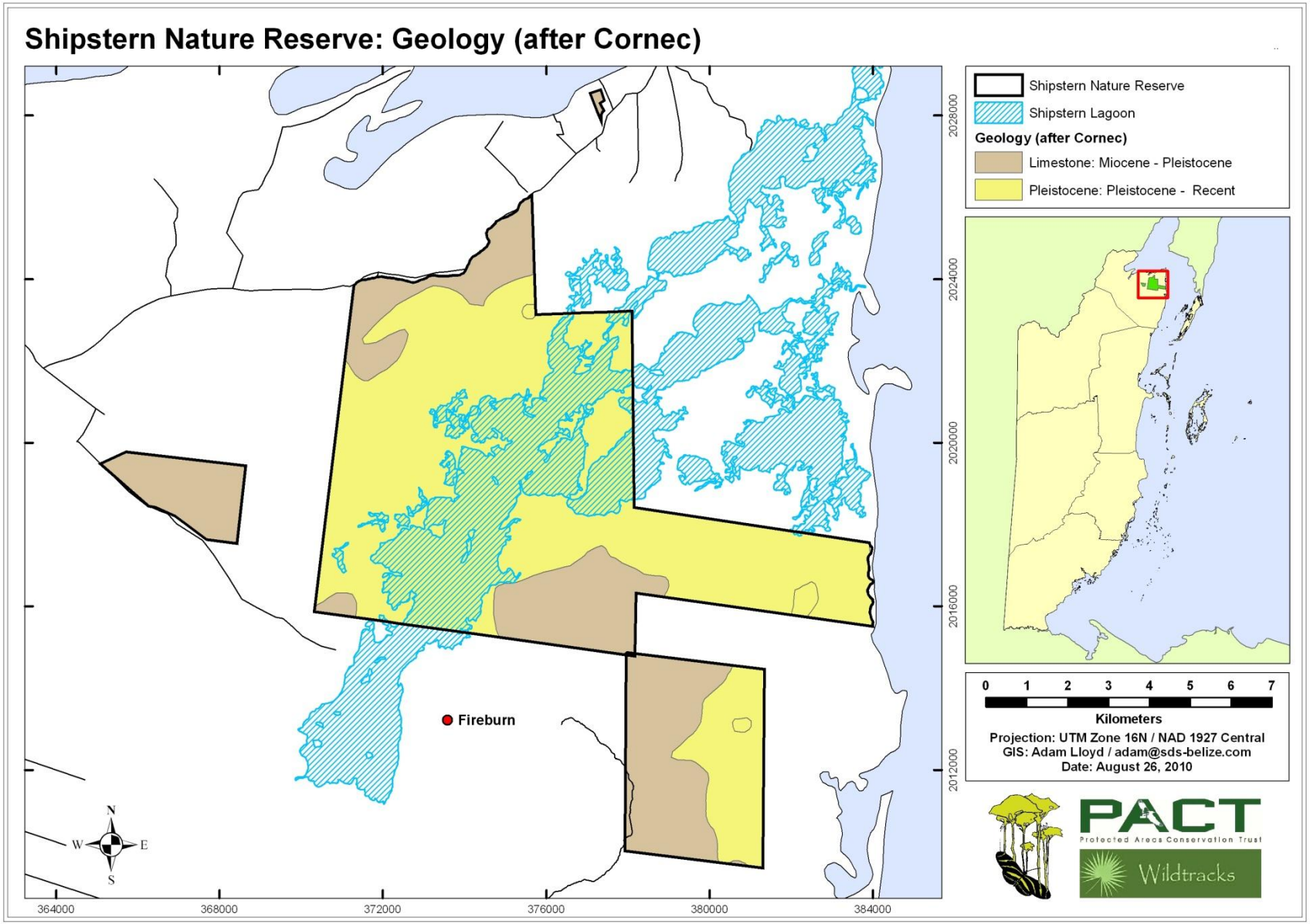


Figure 9: Schematic Geological Cross Section of Bedrock of the area (Information compiled from several quarries and test pits in and around the area; Holland, pers. com.)

A petroleum survey in Sarteneja (Placid Oil Company, 1982) showed that the predominantly limestone and dolomite rock layer extends to a depth of 5,980 feet before reaching a granite layer, which continued to a depth of 6,220 feet (at which point drilling stopped). The survey showed no significant, economically viable hydrocarbon source potential at that time, though there is currently a renewed interest in the area.



Map 8: Shipstern Nature Reserve: Geology (After Cornec)

The coastal savanna, stretching from the forest edge to the lagoon and from the forest to the sea in the south eastern area, has very little altitude, rarely exceeding 0.7 meters above sea level, and is frequently inundated during wet season. The only exceptions are the small, forested, limestone 'islands', or hummocks – low limestone protrusions that occur scattered throughout the area.

The northeast corner of Belize lies on a stable fault block formed as a result of the movement of the Caribbean plate against the North American plate in the Tertiary-Recent era (Lara, 1993). No faults or folding of the limestone strata have been noted, although all of the exposed bedrock show nearly horizontal bedding with slight northeastward dip of the strata (towards Corozal Bay), the New River and other rivers, and Shipstern and Progresso Lagoons, and lagoons further to the west, are believed to be located along SW-NE trending faults down-faulted to the east (Figure 10; King et al, 1992). The coast of Belize remains a tectonically active area (James and Ginsburg, 1979; McCann and Pennington, 1990), and the recent earthquake activity (a 7.3 magnitude earthquake occurring off the coast of Roatan in 2009), has affected the seabed in the adjacent Ambergris Caye area.

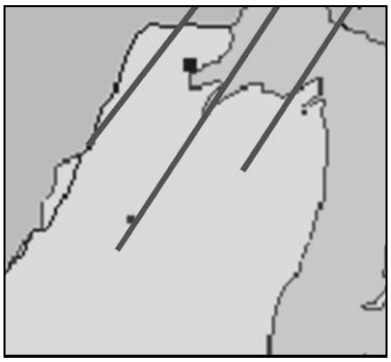
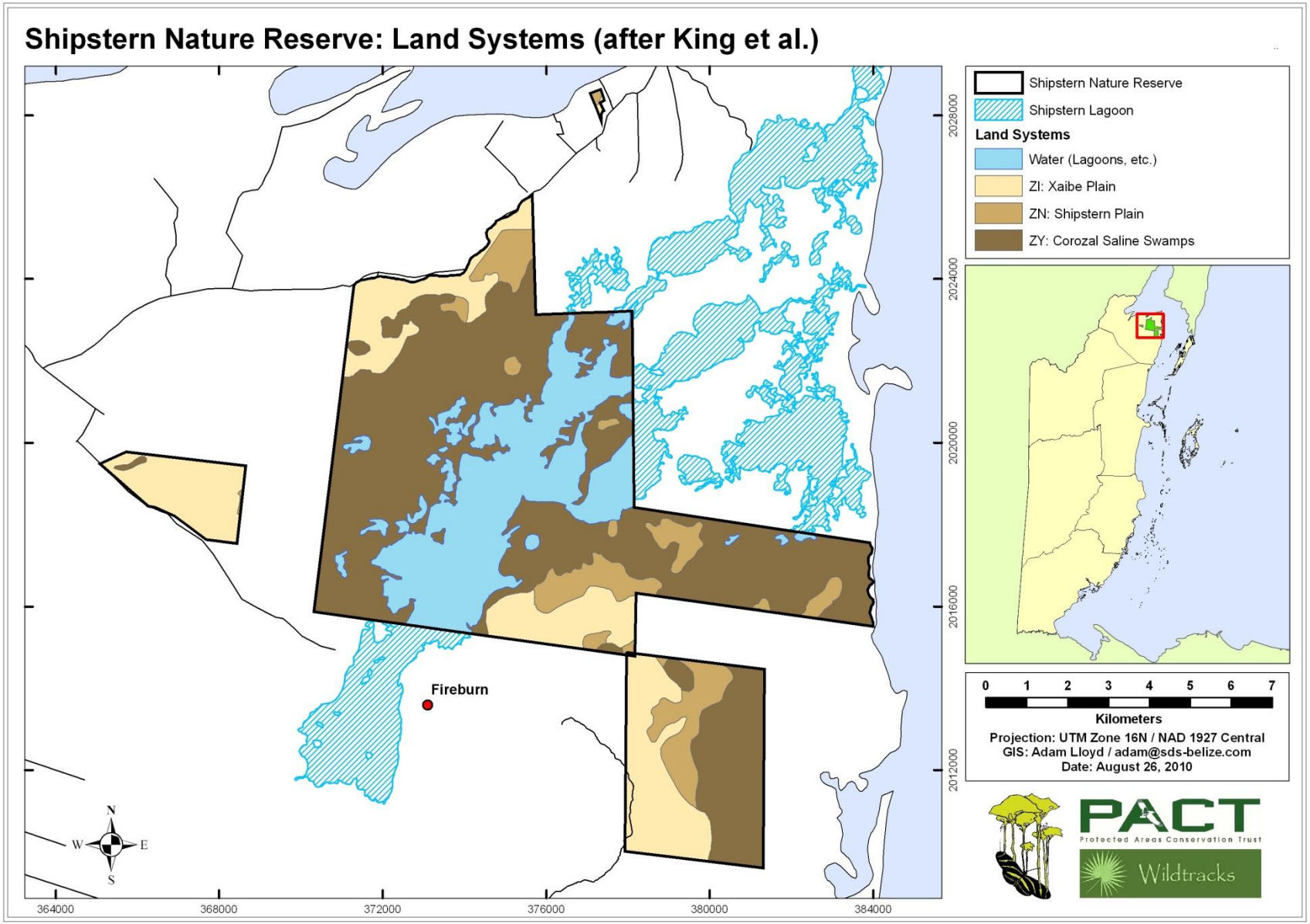


Figure 10: Fault lines of Northern Belize (After James and Ginsburg, 1979)

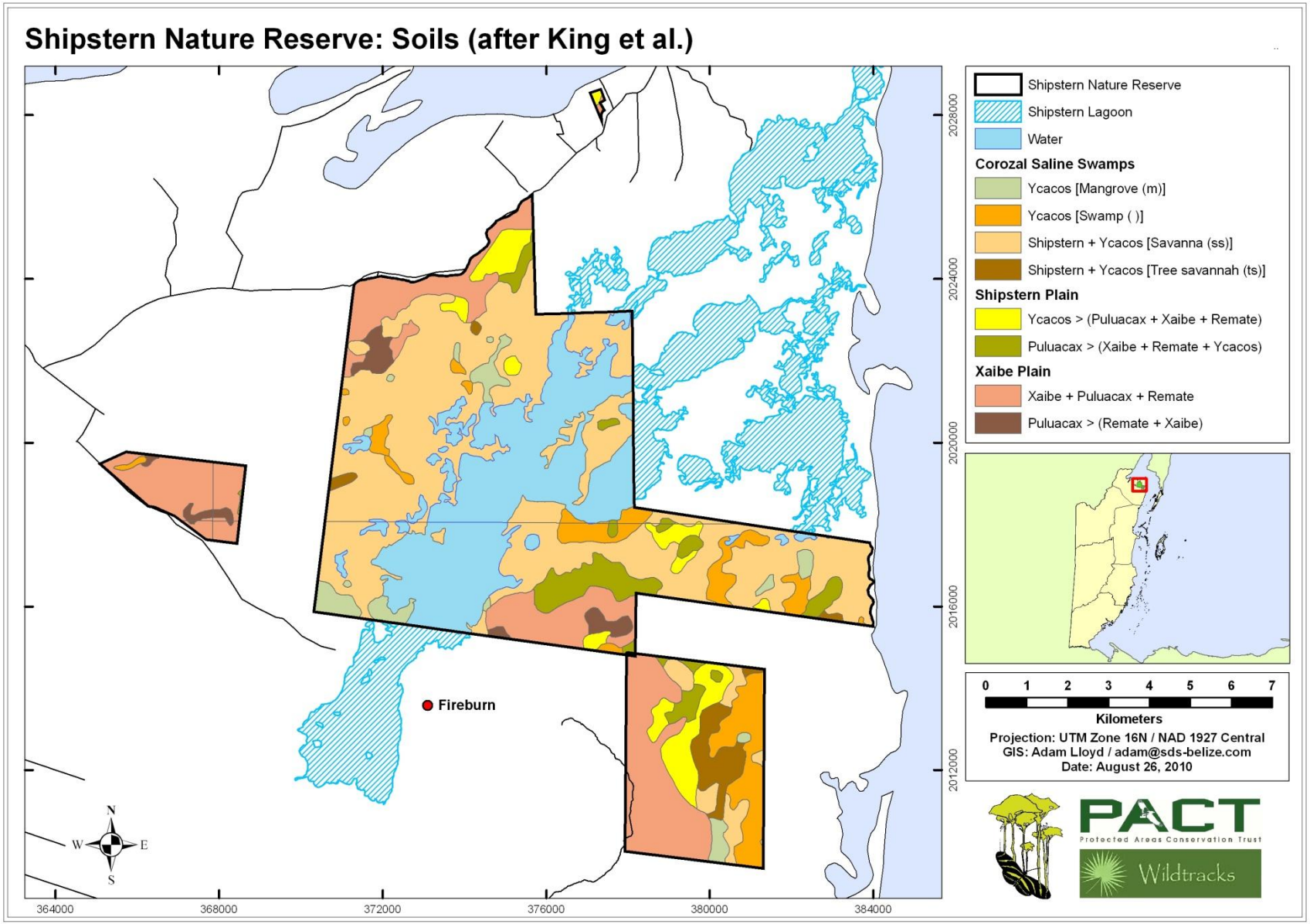
The Land Resources Assessment of northern Belize in 1992 categorizes land types according to their potential productivity levels, and makes recommendations as to the best land use that could be made of specific land system (King et. al., 1992). Very little of the land within Shipstern Nature Reserve is considered suitable for agricultural purposes. Three land system categories are found within Shipstern Nature Reserve (Map 9). Each land system has one or more soil types associated with it, each with its own distinctive sub-suites:

- Corozal Saline Swamp (ZY)
- Shipstern Plain (ZN)
- Xaibe Plain (ZI)

Soil classification is based on this Land System/Suite-Subsuite classification. Suites are defined in terms of parent materials although sometimes soil features such as colour and mineralization are also used (Table 9; Map 10).



Map 9: Shipstern Nature Reserve: Land Systems (After King et. al.)



Map 10: Shipstern Nature Reserve: Soils (After King et. al.)

Land System	Sub-unit	Main Soil Type	Characteristics
Corozal Saline Swamp	Savanna	Shipstern + Ycacos	Corozal Saline Swamp: This land system consists of young soils, geologically recently exposed by decreasing sea levels in Corozal Bay, and occupies the low lying areas seasonally inundated by saline water - the saline floodplain of Shipstern Lagoon and the coastal fringe. Limited by seasonally waterlogged conditions and salinity, conditions are harsh for all but the most adapted plants, and are unsuitable for any form of agriculture. Vegetation is adapted to cope with the high salinity levels, with mangrove associations in areas of highest salinity. Those further inland, surrounded by forest, have a much lower salinity, with vegetation and wildlife more typically found in freshwater areas – for example, with the presence of the reed *Eleocharis geniculata*.
	Swamp	Ycacos	
	Mangrove	Ycacos	
	Tree savanna	Shipstern + Ycacos	
	Saline Plain	Buttonwood	
Xaibe Plain	Flat Plain	Xaibe, Puluacax + Remate	Much of the broadleaf forest both north and south of the lagoon lies on Xaibe soils of the Flat Plain sub-unit, grading to the Lower Slope subunit towards inundation areas. This system is formed on higher bedrock, with deeper soil, and therefore has greater agricultural potential, though is still limited by low nutrient levels and, in places, seasonal water stress. The main soils are the Xaibe, Puluacax and Remate subsuites. These are equal in abundance in the Flat Plain areas, but the imperfectly drained Puluacax subsuite predominates in the lower plain areas.
	Lower Slope	Puluacax > (Remate + Xaibe)	
Shipstern Plain	Glady Forest Plain	Puluacax < (Xaibe, Remate + Ycacos)	Found in some of the wetter open forest savanna areas south of Shipstern Lagoon – particularly in NBC, this forms a transition zone between the inundated coastal / lagoon swamplands and the forested Xaibe Plain. The soil layer of the Shipstern Plain is generally thin, resulting in much of the vegetation showing signs of seasonal water stress during the dry season. Conversely, in wet season, there is a problem of seasonal flooding in parts. These conditions, along with low nutrient levels and, in some locations, high salinity, create a difficult environment for agriculture, and therefore the recommended land use for the area is conservation. (King et. al, 1992)
	Clumped Tree Savanna	Ycacos > (Puluacax + Xaibe + Remate)	
	Mangrove	Ycacos	

Table 9: Land Systems and Soil Classification and Characteristics of Shipstern Nature Reserve

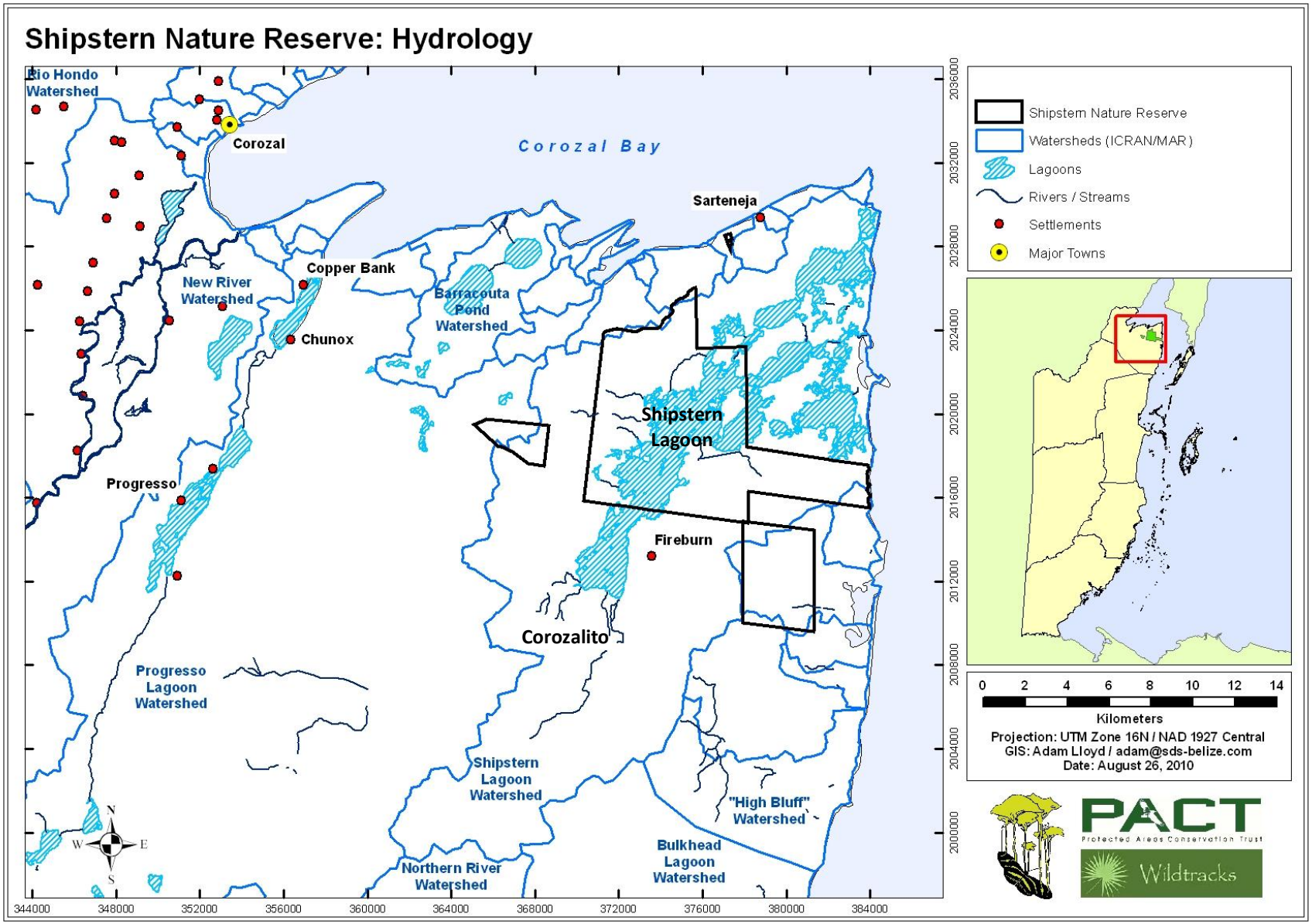
1.4.2 Hydrology

The majority of Shipstern Nature Reserve falls within an area designated as the 'Shipstern Watershed', one of four watersheds in northern Belize (Map 11). Regional mapping suggests Xo-Pol may lie across two watersheds – Shipstern and the Progresso Lagoon Watersheds, though this may need confirmation (the Selva Maya mapping combines these two into a single unit). The hydrology of both these watersheds is influenced by two main agencies: geology and wind patterns.

The primary hydrological feature of the Shipstern Watershed is Shipstern Lagoon, a brackish system of wide, shallow lagoons and narrow, mangrove-lined creeks, connected to the sea through a series of channels to the north and north east of the protected area, and fed by a freshwater area, Corozalito, from the south. The lagoon substrate is loose sediment up to 1m deep with outcroppings of algae-covered limestone below the water surface, and small mangroves where these outcrops project above the water level. The salinity of the lagoon varies according to weather conditions and time of year, but it is always less saline at the southern end. There is a flow of freshwater from Corozalito, in the south, moving northwards to the north east. This maintains the system, reducing the speed of sedimentation. Following heavy rain, freshwater drains into the system from the extensive savannas to either side. There is also, at times, a flow of more saline water from Corozal Bay into the lagoon, flowing through creeks in the east, westwards into the system.

When the 'nortés' – strong winds from the north – blow periodically between November and April, they force the water to flow southwards out of Corozal Bay. This reduces water depth of not only the Bay, but also the coastal lagoons, bajos, and even wells, as the groundwater is drawn out. For the rest of the year, the Trade Winds dominate, with winds from the east pushing water into the Bay and lagoon system. This increases water depth, though there may be a time lag of three to four days before the increased water depth is observed in the southern section of the lagoon.

The shallow depth of the Shipstern Lagoon system (on average between 0.5m and 1.0m), and the often rapidly changing water parameters results in it being a very harsh environment, with fluctuating salinity levels, high water temperatures and low oxygen content. The highest daily salinity recorded within the lagoon has been 24ppt, reported at La Isla in July, 3km north of the protected area boundary. In September, with the heavy rains, the salinity at the same site dropped to 0ppt (Wildtracks data). During January to March, salinity increases as rainfall decreases and north winds result in shallow lagoons (increased evaporation, resulting in increased salinity). The initial heavy rain at the start of wet season (May/June) dilutes lagoon water, reducing the salinity. However, after a time lag, water draining from the highly saline savannas increases salinity to its peak (jumping from 14ppt to 20ppt over 2 to 3 days). After the initial flushing of salts from the savannas, the heavy rainfall of the tropical storm season between August and December reduces the salinity of the lagoon water back down to below 2ppt at the northern end, and 0ppt at the southern end, adjacent to Fireburn waterside. Water entering the lagoon system from Corozal Bay to the east also has a reduced salinity at this time of year, resulting from the increased freshwater flow into Corozal Bay from Rio Hondo and New River.



Map 11: Shipstern Nature Reserve: Watersheds

During the majority of the year, salinity increases from south to north – readings taken in March, 2000 indicate a salinity of 0ppt near Corozalito in the south, with 15ppt at La Isla, in the north (Wildtracks data). This is reflected in the distribution of fish species within the lagoon system, and demonstrated particularly clearly by the Cichlidae family. Plants, too, are affected by the salinity. *Eleocharis,* for example, only grows in the most southern, least saline parts of the lagoon.

Pollution levels in the past have been very low, with no sign of eutrophication, and low nitrate levels (Wildtracks, 2000). However the increasing proximity of the agricultural areas of Little Belize to the Shipstern Lagoon and Corozalito flood plain are of growing concern.

Whilst the limestone characteristics of north east Belize result in a lack of running freshwater streams, a freshwater/low saline lens lies close to the surface in some areas, exposed as freshwater pans, such as that found at Xo-Pol. In the height of wet season, the waters of Xo-Pol rise to inundate the surrounding bajo and swamp forest areas, and link with the larger freshwater pan of Chacan-Chac-Mol in the adjacent property.

1.5. Biodiversity of Management Area

Shipstern Nature Reserve occupies an important biogeographic position both within Belize, and within MesoAmerica, being at the confluence of several major ecological regions – North American, South American and Antillean. This position demonstrates itself in the different elements that contribute to the biodiversity of the area, with species make up the land – Yucatan affinities mix with species more often associated with South America. This, along with the heterogeneity of the habitats and protection from major human impacts, leads to this area being one of the more species-diverse in the region. All three of the key ecosystems prioritized by IUCN for the Meso-American region occur within the Shipstern Nature Reserve Area:

- Freshwater,
- Coastal and Marine
- Broadleaf Forest

A complex matrix of ecosystems, ranging from the dwarf red mangroves and saline savanna to lowland moist forest, stands of cohune, and bajos, containing a diverse range of vegetation types, Shipstern Nature Reserve provides many different habitats for animal and plant species. Initial species lists were created during the establishment of the protected area (Walker and Walker, 1989; Meerman, 1993), and have since been added to over time, with a series of studies on a number of taxa. Also included in this assessment is data from Fireburn Reserve, to the south of Shipstern, south of the lagoon, where wildlife monitoring has been taking place for the past five years. The two areas are contiguous, and those species recorded from Fireburn can be expected to occur in the Shipstern Nature Reserve, and vice versa.

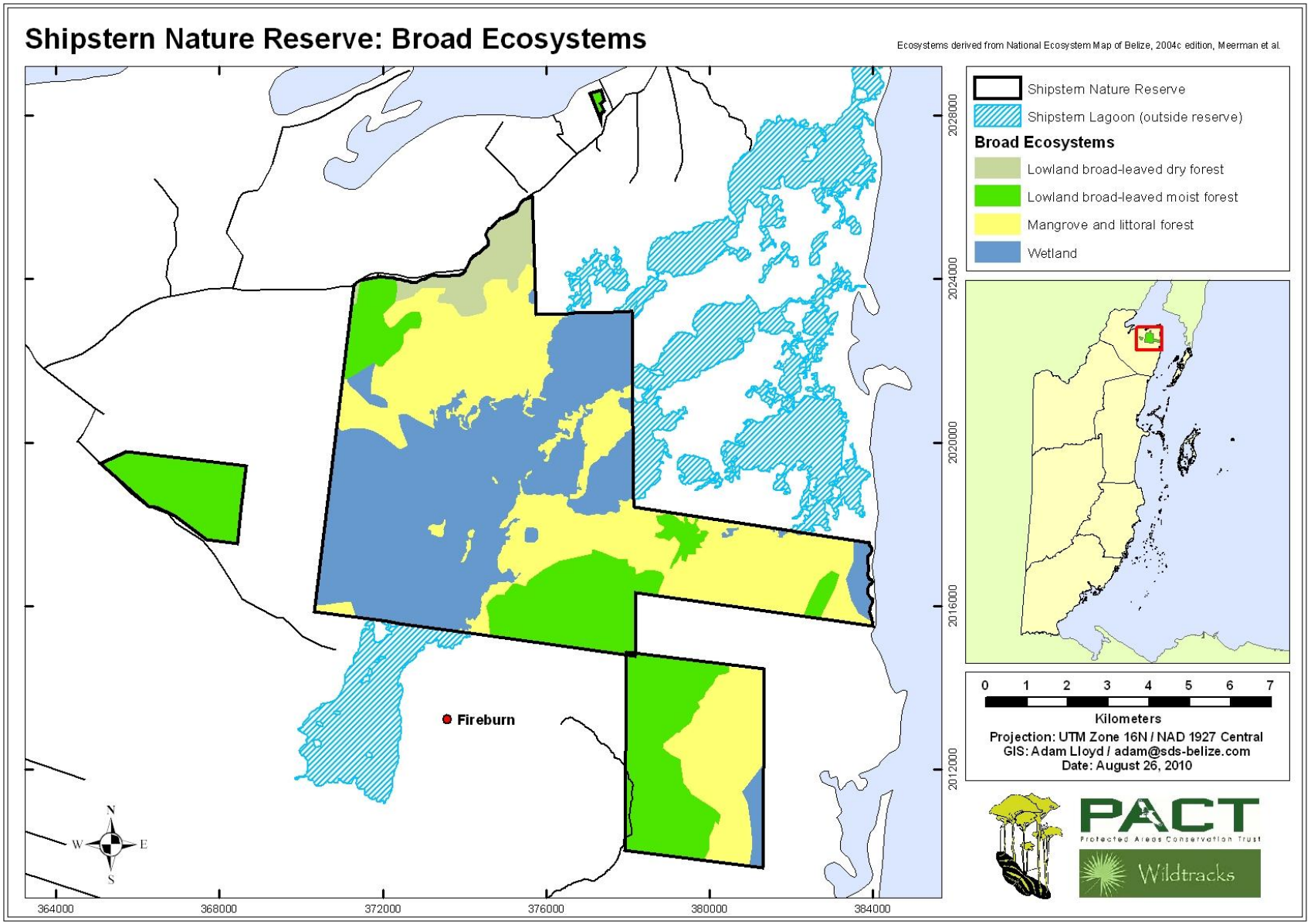
Whilst generally the area can be considered relatively pristine, bearing in mind the natural impacts of Hurricane Janet and Hurricane Dean, a few species have become locally extinct. The Yucatan black howler monkey *(Alouatta pigra*) has been reported as historically present in the Shipstern / Fireburn forest node before the 1950's, when the combined impacts of hurricanes and yellow fever reduced their populations to critical levels. The small toothed sawfish (*Pristis pectinata)* has also disappeared, with fishing pressure removing this once abundant species from Shipstern Lagoon and the coastal waters. Local reports suggest that the general trend in game species populations is of decreasing populations, as the Shipstern area becomes more accessible.

1.5.1 Ecosystems

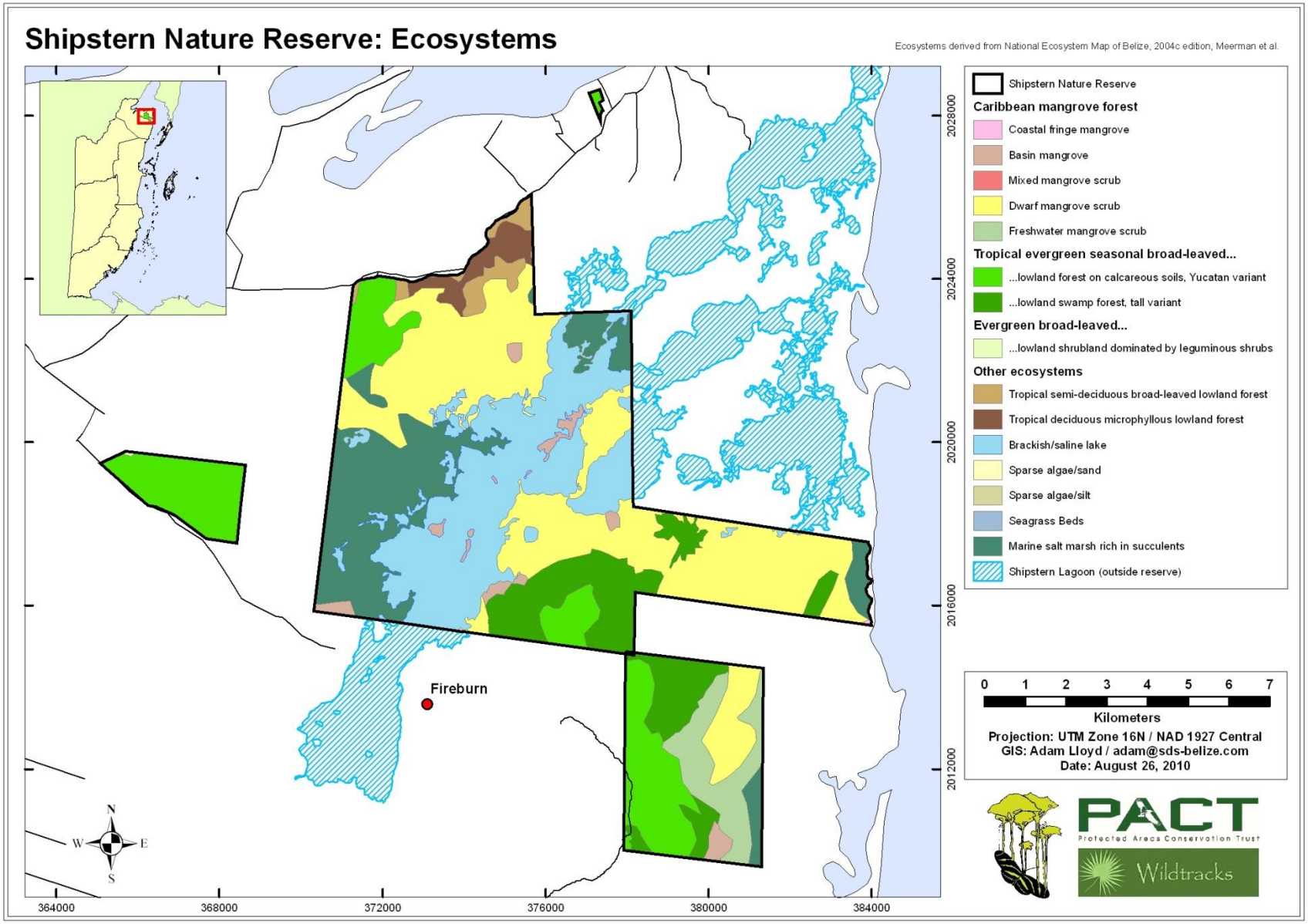
Shipstern Nature Reserve encompasses 10 terrestrial ecosystems as defined under the UNESCO classification system, and a further 4 brackish water ecosystems. These include:

- Caribbean mangrove forest; basin mangrove
- Caribbean mangrove forest; coastal fringe mangrove
- Caribbean mangrove forest; dwarf mangrove scrub
- Caribbean mangrove forest; freshwater mangrove scrub
- Marine salt marsh rich in succulents
- Evergreen broad-leaved lowland shrubland dominated by leguminous shrubs
- Tropical deciduous microphyllous lowland forest
- Tropical evergreen seasonal broad-leaved lowland forest on calcareous soils, Yucatan variant
- Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant
- Tropical semi-deciduous broad-leaved lowland forest
- Brackish/saline lake
- Sparse algae / sand
- Sparse algae / silt
- Seagrass beds

Demonstrating Shipstern's critical contribution to the National Protected Area System is the fact that it encompasses 99.3% of the national protected area coverage of dwarf mangrove scrub, 94.5% of the national coverage of tropical deciduous microphyllous lowland forest, and 58% of the nationally protected marine salt marsh rich in succulents. Approximately 29% (2,772 hectares) of Shipstern is forested, 14% (1,397 hectares) is marine salt marsh, 37% (3,582 hectares) is mangrove forest and 20% (1,951 hectares) is brackish lagoon.



Map 11: Shipstern Nature Reserve: Broad Ecosystems (After Meerman)



Map 12: Shipstern Nature Reserve: Ecosystems (After Meerman)

Caribbean mangrove forest; basin mangrove

A total of approximately 170 hectares of basin mangrove has been mapped in Shipstern, occurring in 5 disjunct tracts: one being a low-lying basin surrounded by dwarf red mangrove mudflat north of Shipstern Lagoon, two being lagoon-edge basins on the southern shoreline of the Lagoon, and two being portions of basins crossing into the southern NBC Shipstern extension. As elsewhere in Belize, these basin mangroves are dominated by *Rhizophora mangle* – growing to a height of over 10m in some areas. Occurring within basins, deep peat deposits have been built up over centuries of leaf and tree-fall, creating soil that retains far more moisture during the dry season than do the fine silts on which the dwarfed *Rhizophora* grows, on the extensive mudflats. These 'oases' of taller vegetation, with a relatively dense canopy, support larger densities of epiphytic *Tillandsia* air plants than do the surrounding areas, and are used as rich foraging grounds by Neotropical migratory birds. The basin mangroves in Shipstern make up approximately 7.5% of the total protected area coverage of this ecosystem in Belize.

Caribbean mangrove forest: Coastal fringe mangrove

Coastal fringe mangrove is found along the majority of the 2km eastern shoreline of Shipstern, bordering onto Corozal Bay Wildlife Sanctuary. It is dominated by *Rhizophora mangle*, rarely exceeding 3-4m in height within the protected area. The characteristic looping stilt roots extend out into the water of Corozal Bay, trapping deep layers of fine sediment, and providing important nursery areas for a wide variety of fish, as well as critical coastal protection against the impacts of tropical storm events. In Shipstern Nature Reserve, *Laguncularia racemosa,* and *Avicennia germinans* are also associated with this vegetation type, growing on the slightly raised sand/mud ridge that has been accumulated by the silt-entrapment of the red mangrove.

Caribbean mangrove forest: Dwarf mangrove scrub

Shipstern Nature Reserve is perhaps best known for its extensive tracts of dwarf mangrove scrub, dominated by stunted *Rhizophora mangle,* mostly growing to no more than 1m - 1.5m in height. These red mangroves occur on extensive mudflats that are seasonally inundated for much of the year, but extremely dry for the duration of the dry season. A black anaerobic band often occurs 5-15cm below the generally grey silt mud. Drainage is primarily via slow lateral sheet drainage, rather than vertical. The

soils are heavily saline which, with the extreme range of hydrological regime, creates an environment to which few plant species are well adapted. In parts, the stunted red mangroves occur as an almost pure monoculture, in others sparse grasses and succulent plants occur among them. Shipstern encompasses virtually all (99.3%) of the dwarf red mangrove ecosystem within the current National Protected Area System of Belize.

Caribbean mangrove forest; Freshwater mangrove scrub

Within Shipstern, this ecosystem occurs only in the southern extension and is dominated by *Rhizophora mangle*. Structurally, and indeed functionally, this system quite closely resembles basin mangrove – occurring on generally peaty soils in low-lying (inland) areas. In Shipstern the depth of seasonal inundation of this system is substantially greater than is the case in the patches of basin mangrove. An area of mangrove on the southern shore of Shipstern Lagoon is mapped within the National Vegetation Map as being freshwater mangrove, but is in fact saline and dwarf red mangrove that is up to 1.5m in height – the greater than average height reflecting the rather lower salinity in this portion of the Lagoon.

Marine salt marsh rich in succulents

The extensive marine salt marshes of Shipstern encompass 58% of the nationally protected coverage of this ecosystem. As with the dwarf red mangrove mudflats, this system occurs on very saline mudflats that become extremely dry during the dry season. The primary determinant factor for the distribution of the marine salt marsh within Shipstern appears to be elevation: it usually occurs in areas that are 2-5cm higher than where the dwarf red mangrove occurs, though soil depth may also be an important factor as well: hard bedrock is often closer to the surface (within 0.5m) for this system. Predominant plants include *Batis maritime, Distichilis spicata, Fimbristylis spadicea, Juncus sp.* and *Salicornia perennis.* With accumulated soils along the small creeks that bisect this system, the bonsai-looking *Bucida spinosa* is quite common, as is *Jacquinia macrocarpa*.

Evergreen broad-leaved lowland shrubland dominated by leguminous shrubs

A small area (less than 2.5 hectares of this ecosystem has been mapped as extending into the northern edge of the Xo-Pol extension of Shipstern. It occurs on a poorly drained soil with some hog-wallow relief; the canopy being 4-5m in height. Characteristic species here include *Acoelorraphe wrightii, Caesalpinia gaumeri, Cameraria latifolia, Metopium brownie* and *Plumeria obtuse*. It is also one of the few areas in NE Belize where *Haematoxylon campechianum* occurs.

Tropical deciduous microphyllous lowland forest

The 187 hectares of this ecosystem mapped within Shipstern constitute almost 95% of its nationally protected coverage, the remainder being with the Bacalar Chico National Park. It is confined to shallow soils overlying hard limestone bedrock, and is therefore seasonally very xeric. The low canopy is generally 6-8m in height, and is often relatively open and is one of the few deciduous forests in Belize. Characteristic species include *Agave angustifolia, Caesalpinia sp., Gymnopodium floribundum, Manilkara zapota* and most of the *Pseudophoenix sargentii* palms occurring in Belize.

Tropical evergreen seasonal broad-leaved lowland forest on calcareous soils, Yucatan variant

In Shipstern this ecosystem is an evergreen broadleaf forest, usually with no more than a 15% leaf loss in dry season, has a taller stature than adjacent forests, reaching 18-24m and occurs in the western and southern areas of the Reserve on deeper soils. It is the most species-rich forest in Shipstern and notably less seasonal than the nearby forests on shallower soils. Prior to the establishment of the Reserve, this forest was favoured for agricultural land – with significant milpa farms having been located in north-western Shipstern, and around the old Shipstern Village area south of the Lagoon. Cohune palm (*Attalea cohune*) is characteristic of these deeper soils, and has been largely cleared north of Shipstern Lagoon in the past but still occurs in Xo-Pol and around the abandoned Shipstern Village. Common trees include *Bursera simaruba, Caesalpinia gaumeri, Pouteria campechiana, Sabal mauritiformis, Sabal yapa, Swietenia macrophylla* and *Vitex gaumeri.*

Tropical evergreen seasonal broad-leaved lowland swamp forest, tall variant

National mapping of this forest type within Shipstern Nature Reserve and the adjacent Fireburn Reserve is inaccurate – much of the forest depicted as swamp forest is not, and is in fact the Yucatan forest variant described above. The extent of tall swamp forest in Shipstern is therefore less than the 1,039 hectares indicated from the national vegetation map, and is almost entirely confined to the southern extension. Common trees include *Bucida buceras, Calophyllum brasiliense, Metopium brownei, Coccoloba spp., Manilkara zapota, Sabal mauritiformis* and *Swietenia macrophylla*. The canopy is generally below 13m in Shipstern, relatively open, and demonstrates significant leaf fall in the dry season.

Tropical semi-deciduous broad-leaved lowland forest

Found in northern Shipstern, the forest habitat bounds the drier deciduous microphyllous forest along its northern and southern edges, and is more extensive than the latter – extending northwards into the adjacent private property. In terms of species composition, forest stature and structure, this forest type is effectively the transition vegetation between the shorter deciduous microphyllous forest and the taller more evergreen Yucatan forest. Its distribution largely reflects soil depth (being intermediate between that of the other two forest types), and possibly also past fire impacts from the extensive fire that burnt through the area in 1956/7 after Hurricane Janet in 1955. Prior to the impacts of Hurricane Dean in 2007, this forest was still slowly increasing in height (post Hurricane Janet), and had developed a canopy of 12-14m. Common tree species include *Bursera simaruba, Caesalpinia gaumeri, Gymnopodium floribundum, Manilkara zapota, Metopium brownei, Piscidia piscipula, Simarouba glauca* and *Vitex gaumeri.* The *Pseudophoenix sargentii* palm is also scattered through this forest on the drier, thinner soils.

Brackish/saline lake

Shipstern Lagoon, one of the largest coastal lagoons in Belize, bisects Shipstern Nature Reserve. An extensive and shallow brackish water lagoon with a freshwater inlet to the southwest, and channels to the sea to the northeast, the Lagoon experiences significant variations in water-flow, depth and salinity throughout the year. Deep layers of fine silt up to a meter in depth are typical, with stunted red mangroves dotted across the area. There is little aquatic vegetation, possibly because of the frequently high turbidity as the fine silts are stirred up in windy weather; small **seagrass beds** and **algal mats** being the only common vegetation. The portion of Shipstern Lagoon lying within Shipstern Nature Reserve encompasses approximately 20% of the Reserve's overall area and 26% of the nationally protected coverage of this ecosystem.

Shipstern Lagoon - south (Photo: Wildtracks)

1.5.2 Flora

A total of 266 plant species have been identified to date in Shipstern, spread across 73 families. Plant diversity owes much to the geographic position of Shipstern, at the juncture between the mesic Yucatan zone and the more humid Peten: Yucatan species such as the *Pseudophoenix sargentii* palm overlap with species such as *Quararibea funebris* occurring at the northern edge of its range. Shipstern Nature Reserve plays a critical role in the conservation of some of Belize's tree species: the *Coccothrinax argentata* palm in Belize is known only from Shipstern, an as yet unidentified species of *Ficus* is known in Belize only from a single specimen in Shipstern. The majority of Belize's specimens of the *Pseudophoenix sargentii* palm occur in Shipstern and the adjacent (unprotected) private lands, along with a number of other Yucatan endemics.

SPECIES OF INTERNATIONAL CONCERN

Endangered	
Yaxnik	*Vitex gaumeri*
Vulnerable	
Spanish Cedar	*Cedrela odorata*
	Pouteria belizensis
Mahogany	*Swietenia macrophylla*

IUCN, 2010

Pseudophoenix sargentii

Vitex gaumeri, listed as Endangered by IUCN is abundant in Shipstern Nature Reserve, and is in fact a predominant tree in the Yucatan forest. Whilst of interest, it should be noted however that the IUCN rating for this species is considered erroneous (Walker, P. pers. obs., Meerman, J., pers. comm.) because of its widespread distribution and abundance. *Cedrela odorata* and *Swietenia macrophylla*, both listed as Vulnerable by IUCN, are present in Shipstern: *Swietenia* is relatively common but *Cedrela* is not. Both have been exposed to significant levels of extraction prior to the establishment of Shipstern as a protected area, and indeed *Swietenia* has since repeatedly been targeted by illegal loggers. The relative scarcity of *Cedrela* in Shipstern may reflect past logging pressure – densities of this species in a contiguous private property (Balam Jungle) to the south are known to be much reduced as a result of long-term unsustainable extraction there.

A number of very dense hardwood species are relatively abundant on the dry shallow soils north of Shipstern Lagoon, species such as *Cordia dodecandra, Lysiloma latisiliquum,* and *Piscidia piscipula* are present in densities seen in few other places. The most comparable forests with significantly overlapping species composition are those of Bacalar Chico National Park on northern Ambergris Caye – where pronounced seasonality and extended dry season appears to be a more significant determinant of species distribution than soil depth.

1.5.3 Fauna

Mammals

A total of forty-seven mammal species have been confirmed within the Shipstern area, including the Endangered Baird's tapir, and the West Indian manatee, listed as Vulnerable (IUCN, 2010). A further three species are considered at Lower Risk or Near Threatened – the margay, jaguar and white-lipped peccary (IUCN, 2010). A further eighteen species are expected to occur within the Nature Reserve, but require confirmation before addition.

SPECIES OF INTERNATIONAL CONCERN

Endangered	
Baird's Tapir	*Tapirus bairdii*
Vulnerable	
West Indian Manatee	*Trichechus manatus*
Lower Risk / Near Threatened	
Margay	*Leopardus wiedii*
Jaguar	*Panthera onca*
White-lipped Peccary	*Tayassu pecari*

IUCN, 2010

The majority of mammal species recorded within the protected area are characteristic of the forest rather than the extensive mangrove savannas and swamps. Many of the larger forest species – particularly jaguar, puma and white lipped peccary – require large home ranges, and are therefore dependent on the maintenance of forest connectivity. The presence of the natural corridor linking the Shipstern/ Fireburn forest node with the more southerly forests of Balam Jungle and Freshwater Creek is thought to be of critical importance to maintaining viability of larger mammals of the area, allowing species to move between the two forest areas, and down into Freshwater Creek Forest Reserve, creating an area with sufficient forested habitat (approximately 75,000 acres) to potentially be able to support viable populations of these species.

The five cat species present in Belize have all been recorded within Shipstern Nature Reserve. Studies show that the forest in the Shipstern / Fireburn node, in particular, appears to be supporting healthy populations of both jaguar and puma, indicating that the region has not only a good prey base but that hunting pressure may be lower here than in other areas. Camera trap surveys conducted in 2006 to examine jaguar populations and connectivity within the Shipstern / Fireburn node demonstrated that 7 identified individuals were using the area, with an estimated jaguar population of between 4.42 and 6.18 individuals per 100km^2, comparable to other densities from similar habitats elsewhere in Belize (Bunyan and Kilshaw, 2007). Of these, only a single female jaguar was identified in the northern forest block (Bunyan and Kilshaw, 2007). The studies also demonstrated that at least two male jaguars utilised the corridor. After Hurricane Dean, the number of identified jaguars remained the same, though the actual individual animals changed, and appeared to be more transitory, with less clearly defined home ranges (Everatt et. al. 2010).

Pumas appear to be doing well in the area, with the estimated capture events/100 trap nights for pumas for the Shipstern / Fireburn node being significantly higher than those calculated for Chiquibul Forest Reserve and National Park (Dillon, 2005).

To the north of the lagoon, both these large Felid species are known to be present, with puma, in particular, being sighted relatively frequently in forested areas adjacent to Shipstern Nature Reserve and Sarteneja. There is some degree of conflict with farmers, with predation of livestock, which has resulted in several jaguars being killed over the past fifteen years

Puma are reported to be doing well in the Shipstern area (Photo: Wildtracks)

White-lipped peccary, perhaps one of the best indicators of forest health, are still present within the area – though probabbly only a single herd estimated at about 30 individuals (Bunyan and Kilshaw, 2007) inhabits the Shipstern / Fireburn forest node, with hunting pressure in adjacent forest blocks reducing the viability of this species, particularly in and adjacent to the protected area north of the lagoon. The herds move seasonally throughout the larger forest area of north east Belize, and will be affected by reduced connectivity. The smaller collared peccary is considered to be more abundant, but still reduced by hunting pressure.

Of the smaller, non-flying mammals, six species of rodent have been recorded from within the Shipstern area, including the Mexican hairy porcupine, Yucatan squirrel and Deppe's squirrel. The Yucatan vesper mouse (a Yucatan endemic) and big-eared climbing rat have both been recorded, along with the spiny pocket mouse - these small rodents form an important prey base for Neotropical carnivores. A number of other small rodents (including *Peromyscus sp.* and *Reithrodontomys sp.*) are known to occur in the area, but have not yet been identified to species level (Kilshaw, pers. com.). The larger rodents – paca and agouti – also important prey species for the larger cats (particularly jaguar), are thought to be present in relatively good numbers south of the lagoon, though there was a significant decrease in noticeable presence following Hurricane Dean (Lloyd, pers. com.), and numbers are still recovering. To the north of the lagoon, hunting pressure in the forested areas adjacent to Shipstern Nature Reserve is thought to have reduced populations below the natural levels (community consultation, 2010).

Of the non-Felidae carnivores, the grey fox (*Urocyon cinereoargenteus*), white-nosed coati (*Nasua narica*), raccoon (*Procyon lotor*) and kinkajou (*Potos flavus*) are all present, the raccoon being one of the few mammal species to frequent the mangrove savanna areas. The Neotropical river otter (*Lutra longicaudis*) has been included on one of the species lists for the Nature Reserve, though its presence should be re-confirmed before being included on the definitive list for the protected area. Of the Mustelidae, two species of skunk (hog-nosed and spotted) and tayra have all been recorded. The long-tailed weasel (*Mustella frenata*) has been reported from farmlands adjacent to Xo-Pol, but not within the Nature Reserve lands themselves (Walker pers. com.) though as this species prefers the open farmland / edge habitats, it may not occur in the protected area itself.

Tracks of Baird's tapir, Belize's national mammal, are found throughout Shipstern Nature Reserve (Photo: Wildtracks)

Other large species recorded within the protected area include the two deer species – white-tailed deer (*Odocoileus virginianus*) and red brocket (*Mazama americana*), and Baird's Tapir. Baird's tapir (*Tapirus bairdii*) is the largest herbivore present in Shipstern Nature Reserve, and is associated primarily with the bajo areas. It is shy, and seen infrequently, though tracks can be commonly found. Listed as Endangered (IUCN, 2010), this species is generally thought to be widespread through Belize, and is seldom hunted for its meat, particularly not in the north of Belize. However, it is threatened by increasing destruction of its habitat, and in most areas, numbers are thought to be decreasing as they get pushed back into marginal habitats.

Bat species have been assessed a number of times over the years (Miller and Miller, pers. com.; Bärtschi, 2000) with twelve species currently confirmed for the area. A further twelve species have been reported but require further confirmation (Bärtschi, 2000; Miller, pers. com.).

West Indian (or Antillean) manatee (*Trichechus manatus manatus*), considered threatened throughout their range, and listed as 'Vulnerable' (IUCN, 2010), have been reported within Shipstern Lagoon at times, near Iguana Camp (I. Ortega; L. Sealy, pers. com.). The Belize coast is home to the largest population of Antillean manatee in the Caribbean (Morales-Vela *et al*, 2000), with a population estimated at between 800 and 1,000 individuals (Auil, pers. com.). Historically the manatee has been hunted for meat by the Sarteneja and San Pedro fishermen (SACD community consultations, 2008), though following the implementation of the Wildlife Protection Act, which levies a fine on anyone killing, or even touching, manatees, this is now not considered a threat. There is, however, still a threat from Mexican incursions with Mexican fishermen taking manatee opportunistically for their meat in the adjacent Corozal Bay Wildlife Sanctuary.

Considered Endangered on a global scale (IUCN, 2010), the Yucatan black howler monkey (*Alouatta pigra*) is only found in Belize and a small portion of northern Guatemala and southern Mexico. This species is reported to have been present in the higher forest of the Shipstern / Fireburn node prior to the 1950's (Community consultations, 2002), but became locally extirpated following the combined impacts of Hurricane Janet and Yellow Fever. The latter affected Black Howler populations throughout Belize, and numbers are only just starting to recover, with the help of reintroductions in some areas (such as Cockscomb). Whilst increasing in numbers in central Belize, there is no longer much of a corridor of natural forest habitat remaining to allow the population to expand into north east Belize once more. The nearest population is thought to be in the Maskall area, though there have been recent reports of vocalizations in the southern Balam Jungle parcel (Walker and Walker, 2004).

Birds

Shipstern Nature Reserve is becoming well known as a birding destination, with a total of 274 species recorded to date within the Shipstern area, and a further fourteen are awaiting confirmation of their presence (Annex One). The forests and coastal mangroves areas are important for a number of Yucatan endemics, including the Near Threatened black catbird (*Melanoptila glabirostris*), and the Yucatan vireo, *Vireo magister* (highlighted by Birdlife International as an Eastern Yucatan Endemic), which prefer the mangrove and semi-deciduous forest areas such as those of Shipstern Nature Reserve.

SPECIES OF INTERNATIONAL CONCERN

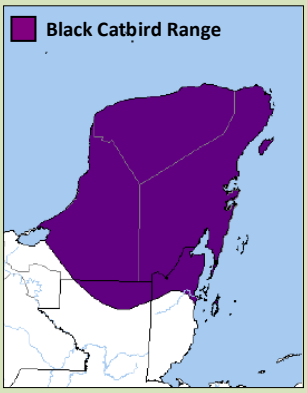
Vulnerable
Great curassow *Crax rubra*

IUCN, 2010

Black Catbird (*Melanoptila glabirostris*)

The black catbird, listed as 'Near Threatened' (IUCN, 2010) is a Yucatan endemic, restricted to the scrubby woodlands and mangrove of the Yucatan and north east Belize. It is threatened by the clearance of coastal areas for tourism development in particular, and has already disappeared from a number of the Belize cayes. This species is particularly abundant in Shipstern Nature Reserve.

It has been recorded further south in Paynes Creek, Toledo, and both the numbers and the range is thought to be increasing (Jones, 2003), despite the rate of land use change for coastal development.



Distribution of the Black Catbird (InfoNatura, 2005)

Other Yucatan endemics with restricted ranges within Belize include the Yucatan jay (*Cyanocorax yucatanicus*), Yucatan flycatcher (*Myiarchus yucatanicus*), Yucatan poorwill (*Nyctiphrynus yucatanicus*), red-vented woodpecker (*Melanerpes pygmaeus*), yellow-lored parrot (*Amazona xantholora*), gray-throated chat (*Granatellus sallaei*) and rose-throated tanager (*Piringa roseogularis*).

The large expanse of dwarf mangrove and mud flats provide feeding areas for many waders, both migrant and resident, and the low mangroves support large numbers of nesting white-winged doves (*Zenaida asiatica*).

The mangroves and forests of Shipstern Nature Reserve also provide an important habitat for migratory bird species, with an estimated 14 to 20 million individuals passing through north-east Belize in the 2007 southward migration (Bayly et. al. 2008), including the Near Threatened olive-sided flycatcher (*Contopus cooperi*), golden-winged warbler (*Vermivora chrysoptera*) and painted bunting (*Passerina ciris*). The shallow waters provide foraging areas for large rafts of migrating American coots (*Fulica americana*), and inlets shelter large flocks of blue-winged teal (*Anas discors*).

The mangrove cayes within the lagoon system offer a number of safe roosting and nesting sites for birds, supporting several colonies of herons and egrets – little blue heron (*Egretta caerulea*), tricolored heron

(*Egretta tricolor*), great egret (*Ardea alba*), reddish egret (*Egretta rufescens*), cattle egrets (*Bubulcus ibis*), double-crested cormorants (*Phalacrocorax auritus*), roseate spoonbill (*Platalea ajaja*), white ibis (*Eudocimus albus*) and boat billed heron (*Cochlearius cochlearius*). A number of species that nest individually also use the cayes – great blue heron, green heron, and bare-throated tiger heron. The fledglings disperse through the lagoon system, feeding in the shallow waters, when they first leave their nests. Black vultures (*Coragyps atratus*) also use the cayes, as do several pairs of osprey (*Pandion haliaetus*). All these species benefit from the protection afforded by the surrounding water, preventing many of the mainland predators from accessing the nesting sites.

The Keel-billed toucan, the national bird of Belize, is common in the forests of Shipstern Nature Reserve (Photo: Wildtracks)

The broadleaf forest of Shipstern Nature Reserve host many bird species characteristic of the northern forests, including the keel billed toucan, black-headed trogon (*Trogon melanocephalus*), greenish elaenia (*Myiopagis viridicata*), northern bentbill (*Oncostoma cinereigulare*), lesser greenlet (*Hylophilus decurtatus*), white-bellied wren (*Uropsila leucogastra*), red-throated ant-tanager (*Habia fuscicauda*), and the rose-throated tanager (*Piranga roseogularis*) (Laesser, 2007). A number of larger birds of prey have also beedn recorded, among them the ornate hawk-eagle, which nests at Cerros, and occasional visitors such as a the balck-and-white-hawk-eagle and king vulture. Reports suggest that the heavily hunted crested guan may be present (though very scarce) in the Shipstern / Fireburn forest node and is a species requiring confirmation.

Wood storks nest on two mangrove cayes in Shipstern Lagoon (Photo: Wildtracks)

Two cayes within Shipstern Nature Reserve have supported large colonies of Wood Stork (*Mycteria americana*), one of the largest wading birds in Belize. This species has been heavily impacted by hunters and fishermen in the past, with heavy harvesting of squabs for the local and Mexican markets. When impacts such as these occurred, the colonies normally moved, reforming on new cayes until these, too were disturbed, resulting in a declining population, with all colonies thought to have disappeared from Belize by 1982. In the late 1991, an over-flight of the Nature Reserve showed that the Shipstern Lagoon and Spanish Point sites had re-established – the first confirmed breeding records for this species for several years (Meerman, 1992). Up to two hundred breeding pairs of these birds have used the cayes continuously between 1991 and 2009, with targeted surveillance and enforcement activities protecting the

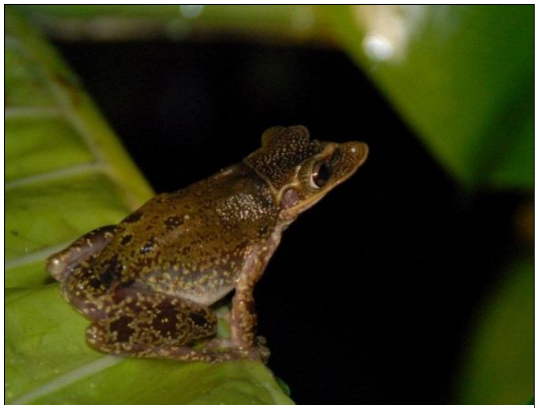
nesting site since 1992. However, no nests were established at either this site or the more southerly Spanish Point site in 2010.

A number of species are known to nest in adjacent areas of similar habitat and may occur within Shipstern as well. Least tern, black necked stilt and Wilson's plover, for example, were all recorded nesting on open savanna within the adjacent Warree Bight property (Walker et. al., 2002).

Reptiles and Amphibians

Shipstern Nature Reserve's rich herpetofauna has been more thoroughly surveyed than has that of most other protected areas in Belize, from the initial surveys in the late 1980's (Walker, 1989), subsequent surveys in the early 1990's (Meerman, 1993), and more recently in 2005 (Nguyen Quang Minh, 2005). After the initial period of rapid species 'acquisition' on the species discovery curve, only 3 additional species have been recorded in or adjacent to Shipstern in the last decade, indicating that the current list of species is close to being comprehensive.

A total of 17 amphibian species occur in Shipstern: 16 having been recorded within the boundaries of the Reserve and the seventeenth (*Bolitoglossa yucatana*) having been recorded 5km east of the Reserve and again 2km south of it – and can confidently be considered as occurring in Shipstern. These two records of the salamander are the southernmost records for this Yucatan endemic, a species that is extremely difficult to encounter: the specimen found in the Fireburn Reserve immediately south of Shipstern was the only one found in the most extensive herpetological survey conducted in any reserve in Belize – over 15,000 man-hours of survey. With the exception of the salamander, Shipstern's amphibian fauna can be considered to be largely typical of Belize's coastal plain – being mostly ubiquitous species that will live in a wide variety of ecosystems. A notable exception is the casque-headed treefrog (*Triprion petasatus*), another Yucatan endemic largely restricted to northern Belize in its national distribution.



The casque-headed treefrog (Photo: Wildtracks)

The pronounced dry season, and annual variation in rainfall pattern is reflected in the breeding behaviour of many of its amphibians. Some species, such as the casque-headed treefrog and the Mexican burrowing toad (*Rhinophrynus doraslis*) appear not to breed at all in drier years, and to then 'reappear' in large numbers to breed in the first subsequent year of really heavy rains. Indeed the casque-headed treefrog was not observed for a 10-year period (1995-2005) and then re-appeared in good numbers at breeding pools in 2006, and each year subsequently. Explosive breeding is the norm for Shipstern's amphibians, genetically programmed to take advantage of the first significant rains that will maintain temporary pools long enough for tadpoles to hatch, develop and metamorphose.

Interestingly, amphibian species in this highly seasonal forest appear better able to 'judge' the right time to breed than do others in forests with less pronounced seasonality – the mass die-offs of tadpoles (due to desiccation) seen in Peruvian Amazonia have never been observed in or around Shipstern (Walker, P., pers. obs.).

Shipstern's reptilian fauna is remarkably diverse, currently including a total of 67 species (including 2 (*Imantodes tenuissimus* and *Thamnophis marcianus*) that are known to occur within 3km of Shipstern in contiguous habitat, but which have not yet been observed in Shipstern itself). The cantil (*Agkistrodon bilineatus*) has been observed twice some 20km west of Shipstern (Walker, P., pers. obs.), but is not included in its species list. The now critically endangered hicatee (*Dermatemys mawii*) occurred in Shipstern Lagoon some decades prior to the establishment of Shipstern Nature Reserve, but had regrettably also been completely extirpated prior to that time too. Recent reports of hicatee in the Xo-Pol extension are considered unreliable and have not been validated, so the hicatee is not included in Shipstern's current herpetofauna.

Shipstern's reptilian fauna includes a number of species at the southernmost edge of their range, including Yucatan endemics like *Laemanctus serratus* and *Imantodes tenuissimus* – which have not been recorded south of Shipstern Nature Reserve. Other Yucatan endemics, such as *Dipsas brevifacies* and *Symphimus mayae*, have been observed in Shipstern but also significantly further south. Other species, such as *Anolis pentaprion*, are generally considered confined to much more humid forests of southern Belize and Guatemala – but have been recorded in both Shipstern Nature Reserve and the contiguous Fireburn Reserve to the south.

The global conservation status has been assessed for only a relatively small portion of reptiles. Of those assessed, Shipstern protects populations of the Lower Risk *Crocodylus moreletii*, *Claudius angustatus*, *Kinosternon acutum, Staurotypus triporcatus* and *Trachemys venusta*, along with the Near Threatened *Rhinoclemmys areolata.* As noted above, recent records of the Critically Endangered *Dermatemys mawii* in Shipstern are considered unreliable and are not considered valid.

Fish

Shipstern Nature Reserve several different types of water bodies with – the brackish Shipstern Lagoon system, permanent and seasonal freshwater pools of the forest bajos, and seasonal, highly saline pools of the mangrove savannas - with a diverse fish fauna. Thirty three species have currently been identified within the Shipstern area.

Shipstern Lagoon, the largest body of water within the Nature Reserve, is open and shallow, with water temperatures increasing to levels as high as 33°C (91°F) or more during the day. The dissolved oxygen concentration deceases as water temperature increases, so these high lagoon temperatures result in reduced oxygen availability for fish. This, combined with the fluctuating salinity, makes the lagoon a

harsh environment for all but the most adaptable species. Three assessments of fish species of Shipstern Lagoon have been conducted (de Rham, 1990; Bjleveld, 1990; Wildtracks, 2000). Whilst these have not all been conducted within the Nature Reserve, it is assumed that, with the changing salinities over the annual cycle, these species will occur within the protected area at some point.

Given the harsh conditions found within the lagoon, the species diversity is limited, and many species, such as the Cichlidae, are found only in the shady areas along the shore line and along the edges of the islands. However, a few species are able to cope with the harsh conditions found away from the edges of the lagoon, such as the chequered pufferfish (*Sphoeroides testudinum*), southern stingray (*Dasyatis americana*), great barracuda (*Sphyraena barracuda*) and redfin needlefish (*Strongylura notata*), which are found in the open water. Several species enter the lagoon system to reproduce – tarpon (*Megalops atlanticus*), common snook (*Centropomus undecimalis*), schoolmaster (*Lutjanus apodus*) and grey snapper (*Lutjanus griseus*), and the shallow waters of the inundated mangroves are important nursery areas for locally important species such as the striped mojarra (*Eugerres plumier*), yellow-fin mojarra (*Gerres cinereus*).

The longnose and Caribbean whiptail stingrays (*Dasyatis gutatta* and *Himantura schmardae* respectively) have been reported within the northern end of the lagoon, and are known to use the Spanish Point lagoon system as a nursery area (Graham, pers. com.) – it is probable that they use Shipstern Lagoon for a similar purpose, though this is still to be confirmed.

The southern part of the lagoon is not as saline as the northern part, and this impacts the distribution of fish within the lagoon system. For example the Central American tetra (*Astyanax aeneus*), yellowbelly cichlid (*Cichlasoma salvini*), the firemouth cichlid (*Thorichthys meeki*) and the bay snook (*Petenia splendida*) are found only in the southern part of the lagoon, while the other cichlid species, the Mayan cichlid (*Cichlasoma urophthalmus*) and the redhead cichlid (*Vieja synspila*), are found throughout the system (though relative numbers of *C. synspilum* decrease as salinity increases). Tilapia (*Tilapia sp.*) were found in the lagoon adjacent to Fireburn Waterside after Hurricane Mitch in 1998, following flooding of *Tilapia* farms on the Rio Hondo, but they have not been recorded in the lagoon in recent years. They may have entered the system in the past year, however, with fishermen reporting large numbers in Corozal Bay following storm-associated flooding in mid-2010. This species has replaced many local cichlid species, being able to compete for both nesting sites and food, and having rapidly maturing young, and its presence in the lagoon system has therefore been a cause for concern.

The Critically Endangered smalltooth sawfish (*Pristis pectinata*), restricted to shallow coastal lagoons such as Shipstern Lagoon, was once present in large numbers, but was extensively fished to the point of becoming locally extinct in Southern Lagoon (community consultations, Sarteneja / Chunox / Fireburn, 2009 - 2010). More recently, however, a series of sightings and three captures were recorded between 2007 and 2009, in the Spanish Point area. This reversed the previous belief that the sawfish was fully extinct in Belize. An extensive survey of the Spanish Point area and adjacent coastal lagoons in 2010 did not locate any individuals, and it is possible that this species has since disappeared from the shallow coastal lagoons in Belize (Wildtracks / SACD data; Graham, pers. com., 2010).

Surveys have also focused on the freshwater pans contiguous with Xo-Pol (de Rham, 1990; Bjleveld, 1990; Walker et. al., 2002), and a number of the freshwater bajos. The Chacan-Chac-Mol area, which links with Xo-Pol during wet season flooding, was surveyed in 2002 (Walker et. al., 2002) - from local reports on fish populations in this freshwater pan, and from a previous visit in the 1980's to the flooded edges of the pan (when a large number of *Astyanax aeneus* were observed), a healthy fish population was expected, with a high diversity of species. However, during the survey, only three species were reported, despite extensive search techniques. These three (*Jordanella pulchra, Gambusia yucatana* and *G. sexradiata*) are all small species capable of withstanding high temperatures in shallow water, and are the first to colonise a waterbody. The absence of the expected fish fauna suggests that in some years, the freshwater pan dries up completely, and the fish fauna replenish the area from permanent forest pools. Xo-Pol, and other similar forest pools, are considered to be permanent water bodies, and may act as one of the replenishment sources for Chacan-Chac-Mol.

The Orchid Pool, located near the Shipstern headquarters, and the Mangrove Pool adjacent to the Main Trail are also typical of the bajo pools that lie on the water table and maintain some water all year round – often through intrusions or caves under the limestone bedrock. These have a resident population of fish that survive the dry season, then re-establish throughout the bajos during the wet season inundation. Species such as the filespine chulin (*Ramdia laticauda*) and Maya cichlid (*Cichlasoma uropthalmus*) are able to withstand the changing conditions of the water – high temperatures, limited oxygen and, in some location, increased salinity – to wait out the dry season. Others such as the *Gambusia* are possibly reintroduced as eggs on the feet of wading birds travelling from pool to pool.

Some species of the mangrove savanna, such as the killifish, aestivate when the pools dry up, re-emerging once the area is inundated once more. These species, including the Yucatan flagfish (*Jordanella pulchra*), are able to withstand extremely hot and saline conditions of the temporary savanna pools, even being found in shallow inundation areas where temperatures can exceed 40˚C.

1.5.4 Past and Present Research

Several studies have taken place in the Nature Reserve since its inception, many of these through the collaboration between ITCF and the Swiss Universities of Neuchâtel, Bern and Fribourg.

- Species lists (Shipstern Wildlife Reserve Newsletters 1 and 2). Walker P. and Z. Walker (1988)
- Freshwater fishes and aquatic ecosystems (Summary Report). P. de Rham (1990)
- Freshwater fishes of Shipstern Nature Reserve. C.F.A. Bijleveld (1990)
- The Status of Crocodiles in the Eastern Corozal District. J. Meerman (1991)
- Biodiversity of the Shipstern Nature Reserve and Checklists. J. Meerman (1993)
- A study of the Chiroptera of Shipstern Nature Reserve and North-Eastern Belize (Central America) together with their ectoparasites (*streblidae, Nycterophiliinae, Acarina)* and endoparasites *(Cestoda, Nematoda, Trematoda, Acanthocephala)*; D. Bärtschi (1998)
- The vegetation of Shipstern Nature Reserve – A structural and floristic approach. C.F.A. Bijleveld (1998)
- Birds of Shipstern Nature Reserve and the Sartenejan region. Census 2002 – 2003. J. Laesser (2007)
- The role of tree size in the leafing phenology of a seasonally dry tropical forest in Belize, Central America. E. Sayer and D. M. Newbery (2003)
- Small mammal inventory in the Shipstern Nature Reserve (Corozal District, Belize, Central America), a preliminary assessment. V. Bersot (2003)
- Big-eared Climbing Rat *Ototylomys phyllotis* ; Margnetti (2002)
- Ecology of the Black Catbird, *Melanoptila glabrirostris*, at Shipstern Nature Reserve (Belize), and distribution in Yucatan. A. Morgenthaler (2003)
- Ecology and census of Odonata ; Pittet (2003)
- Coleopteran biodiversity of Shipstern Nature Reserve in Belize, with a comparison of the fauna of two tropical forest types; G. Roeder (2003)
- Diptera biodiversity ; Rapp (2003)
- Estimates of the herpetofaunal diversity in the Shipstern Nature Reserve. N. Nguyen
- Quang Minh (2005)
- Pedological Study of Shipstern Nature Reserve, Northern Belize, Central America - An Overview of Soil-Vegetation Relationships. Y. Nardini (2010)
- Ecology of Poorwills and Nightjars in SNR (Fürst, in prep.)
- The cycle of potassium in the soils of SNR (Kohler & Singer, in prep.)

Recent studies under Wildtracks on importance of connectivity in adjacent areas, including the contiguous Fireburn Reserve, are also relevant to the maintenance of biodiversity of Shipstern Nature Reserve:

- The Plants of Fireburn Reserve, Corozal District, Belize. – A Species List and Field Guide. Wildtracks / Maskell, L. (1998).

- The Vegetation of Fireburn Reserve, Corozal District, Northeast Belize. Wildtracks / Maskell, L. (2000).
- Plant Species of the Fireburn Area (Provisional species list). Wildtracks / Maskell, L. (2000).
- Developing an integrated assessment of biodiversity of secondary forests in Belize – 2005 to 2009. Walker P., L. Maskall, I. Chan, E. Garcia et. al. Darwin Initiative
- Evaluating a stepping stone for Neotropical migratory birds – the Belizean north- east biological corridor. Bayly, N.J. & Gomez, C. (2008).
- Assessment of population density and structure of mammal assemblages in NE Belize based on camera trapping studies. Bunyan J. and Kilshaw K. (2007).
- Jaguar (*Panthera onca*) abundance and density for the Fireburn Reserve and Balam Na Jungle Estate in northern Belize using photographic capture-recapture sampling. Everatt K., Andresen L. and Kelly M. (2010).

1.6 Cultural and Stakeholder Use of Shipstern Nature Reserve

1.6.1 Community and Stakeholder Use

As a private protected area, community and stakeholder use is strictly regulated by the management body. The management regime does not allow for extraction of natural resources, or for public access unless permitted by Shipstern Nature Reserve staff, for educational purposes. However, people from the local communities of Sarteneja and Chunox do harvest a number of plant species for their own use from adjacent forested areas, including wano *(Sabal yapa)*, elamui (*Malmea depressa*), naranjillo (*Esenbechia pentaphyla*), and negrito (*Simaruba glauca*) for thatch & roof structures; warree wood (*Caesalpina gaumeri*), manchich (*Lonchocarpus castilloi*), habin (*Piscidia piscipula*) and madre cacao (*Gliricidia sepium*) for posts for house-building; tasiste (*Acoelorraphe wrightii)* for house and livestock enclosure walls; and a variety of poles for construction scaffolds.

'Wano' or bay leaf, harvested for roof thatch (Photo: Wildtracks)

Whilst there are perhaps only six serious hunters in Sarteneja, the community being more focused on fishing, Chunox has a larger hunting population. Traditionally, hunters from both communities have hunted white-lipped and collared peccary, white-tailed and red brocket deer, armadillo, paca, agouti, great curassow, freshwater turtles and a variety of cichlid fish and barracuda.

In recent years, with growing prosperity, and the greater emphasis on the more lucrative lobster fishing, traditional harvest of materials has declined significantly around Sarteneja – with the exception of commercial harvest of these materials (particularly wano thatch leaves) for sale to the resorts on the cayes. The population of Sarteneja has in the last few years largely adopted the use of concrete and block in construction. The use of poles for scaffold, and for supporting the molding for the casting of concrete roofs, is still widespread - but it is considered that an adequate supply is still available from within the 17,000 acre Sarteneja lands.

Similarly, hunting for the pot in both communities has become less common in recent years. It appears that this is partly in response to reduced game populations (from past over-hunting with dogs), and partly in response to changing demands and increased availability and convenience of domestic livestock meats. No one in Sarteneja is now dependent upon hunting for their living, and hunting is now as much for sport as it is to provide meat for the table, with people shooting game on a more or less opportunistic basis.

Members of the Fireburn Community have hunted in the Fireburn area in the past, but primarily for the table, and on a very limited basis.

Despite access to the village lands that surround each of the stakeholder communities, there has been continuous pressure on the natural resources of Shipstern Nature Reserve, with illegal extraction throughout the year, particularly of logs, game species and fish. By far the greatest illegal use is logging, with 52% of patrol incidence reports from January to November, 2010, relating to logging. The illegal logging crews come from a variety of communities – both local (Copper Bank, Chunox, Fireburn and Little Belize) and from further afield (Table 10; Figure 11)

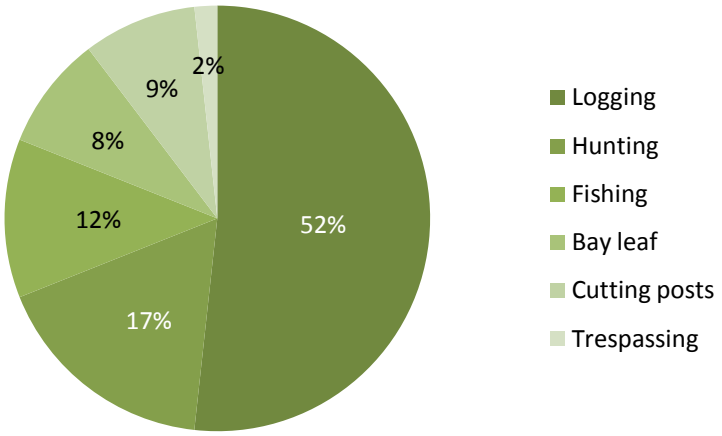


Figure 11: Illegal use of Shipstern Nature Reserve (Patrol reports, 2010)

Illegal Use	Communities Involved
Logging	Chunox, Copper Bank, Fireburn, Progresso, San Estevan, San Lazero, Santa Martha, Caledonia
Hunting	Sarteneja, Chunox, Copper Bank, Progresso, San Estevan, Orange Walk, Maskall, Bomba, Crooked Tree
Fishing	Chunox, Fireburn, Little Belize, Progresso, San Estevan, Orange Walk, Libertad, Consejo, Carmelita, Crooked Tree

Table 10: Illegal Use of Shipstern Nature Reserve (SNR staff consultation, 2010)

Many of these activities are considered to be seasonal, with a marked increase in potential incursions following the closure of the fishing season (April) (Figure 12), mirrored by an increase in enforcement effort. A similar peak was seen in August. With the increasing ease of access, it can be predicted that the threat of these incursions is going to increase over time.

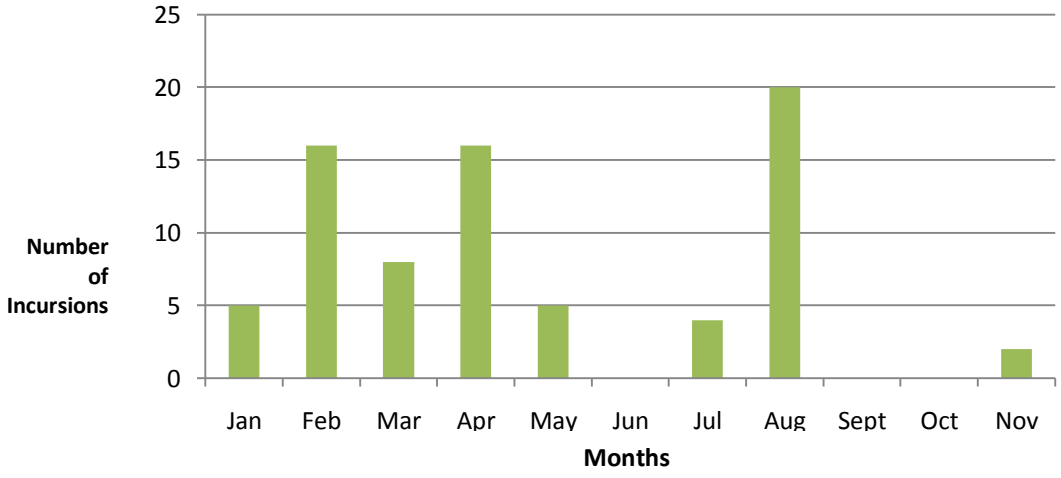


Figure 12: Illegal use of Shipstern Nature Reserve, January to November, 2010 (Patrol reports, 2010)

1.6.2 Recreation and Tourism Use

Since its establishment, Shipstern Nature Reserve has been open to visitation, and in the last three years, has actively promoted tourism and school visits. Total visitation in 2009 was 660, with the majority of visitors from school groups, contributing significantly towards the total number of Belize visitors (Figure 13).

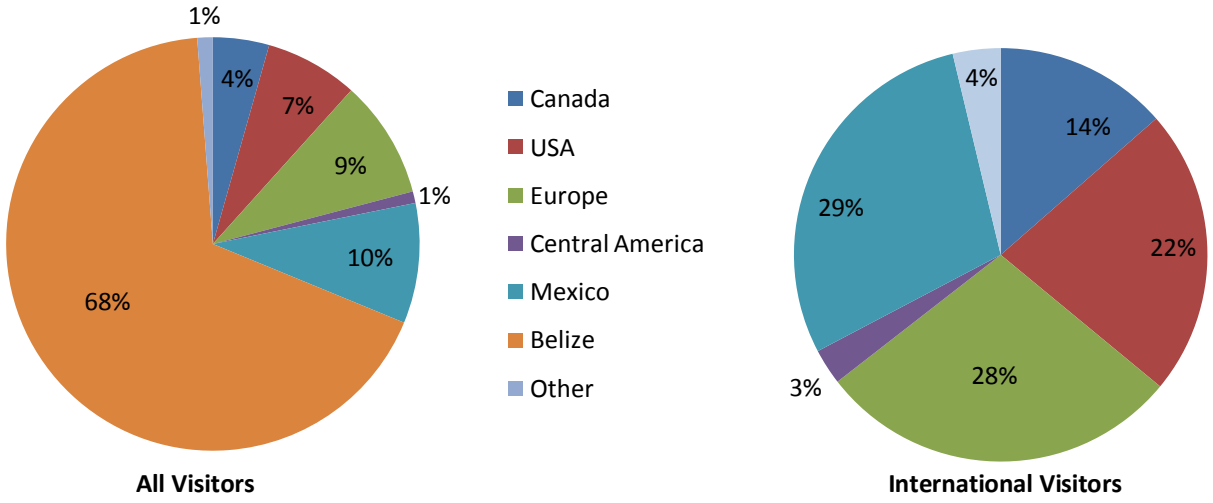


Figure 13: Shipstern Nature Reserve: Visitation, 2009

Mexican, European and North American visitors make up the bulk of international tourism visitation to the protected area, a general trend that is mirrored in the initial 2010 figures. Total visitation over the year is generally higher during the first two quarters (January to June), with much lower numbers from July onwards. Visitation peaks in June, when the majority of school visits occur (Figure 14).

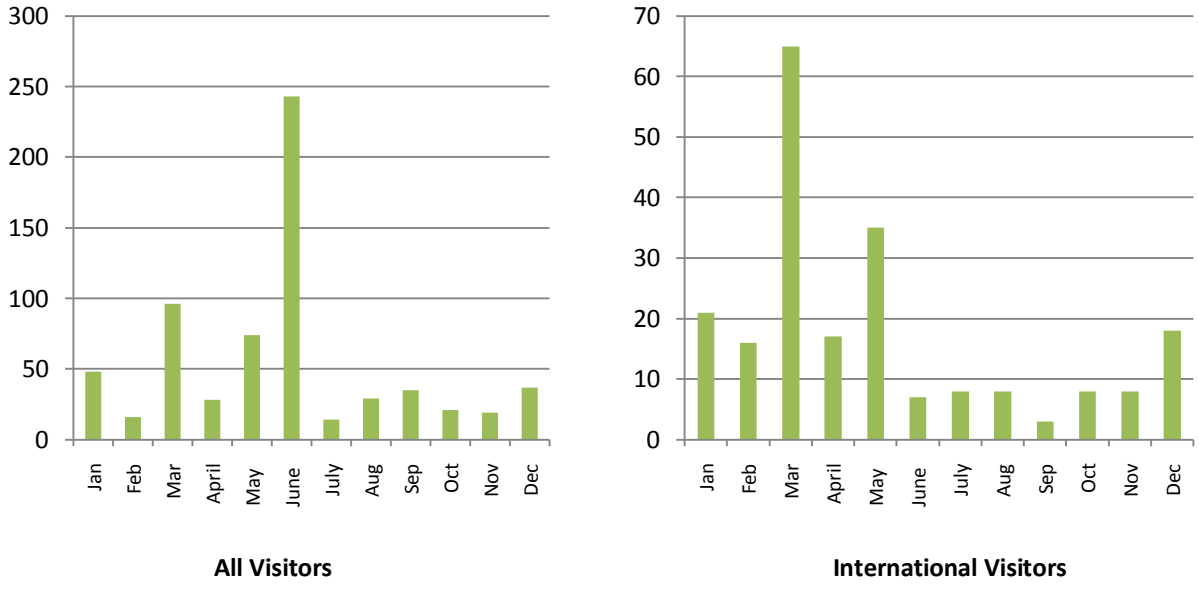


Figure 14: Shipstern Nature Reserve: Visitation by Month, 2009

At a national level, visitation to Belize occurs throughout the year, with higher numbers of international visitors between December and May, (Figures 15, 16 and 17). The developing tourism industry, one of the fastest growing sectors in Belize, has also rapidly become one of the major foreign exchange earners, with over 840,000 tourists arriving in Belize in 2008 (BTB, 2009). Of these, 234,929 (approximately 28%) were overnight visitors, the balance being cruise ship visitation.

Overnight tourism in Belize shows a distinct seasonality, with the majority of visitors arriving in the first quarter of the year. The lowest months are September and October, the main tropical storm season.

State of Tourism in Belize

Tourism is the third ranking productive sector in Belize, contributing 28.2% (BZ$816.3mn) in 2009, with projections suggesting that this will increase to 31.4% (BZ$1,601.2mn) by 2020. The tourism sector provided an estimated 34,000 jobs in 2009, 28.3% of total national employment or 1 in every 3.5 jobs. This is predicted to increase to 53,000 jobs, 31.6% of total employment or 1 in every 3.2 jobs by 2020 (WTTC, 2010).

2008 statistics show that the cruise ship visitors far outnumber overnight visitors, but provide less income for the country – it is estimated that the average cruise passenger inputs $44 per day into the local economy, while the average overnight visitor spends $96 per day - more than twice as much. Per visit, stay-over visitors spend on average 6.8 days in Belize, which translates into an average of $653, or over 14 times more than the average cruise passenger.

From: Belize Tourism Board: 2008 Travel and Tourism Statistics

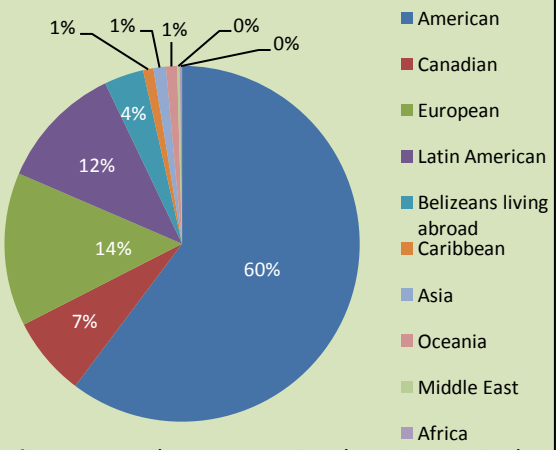


Figure 17: Belize International tourism arrivals by origin (2008) (BTB, 2009)

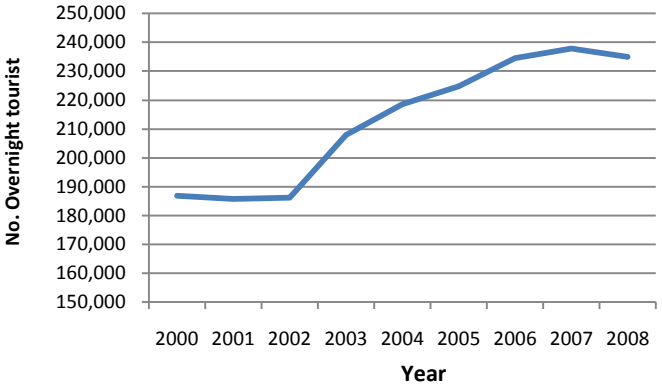


Figure 15: Belize International tourism arrivals per year (2000 - 2008) (BTB, 2009)

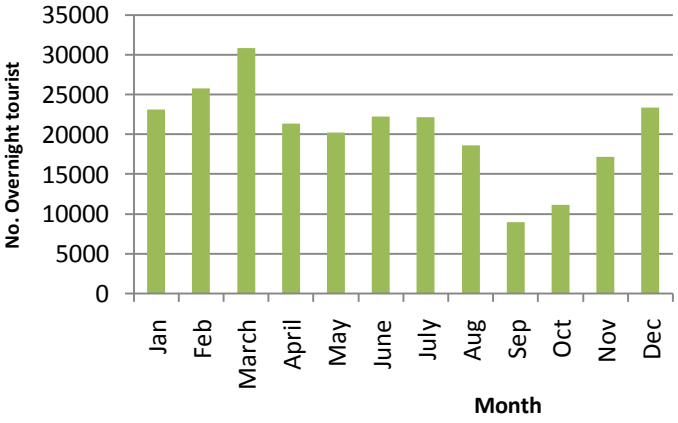


Figure 16: Belize International tourism arrivals per month (2008) (BTB, 2009)

The Sarteneja Tourism Development Plan (SACD / STGA, in prep) highlights Shipstern Nature Reserve as an important tourism resource, attracting visitors to Sarteneja – with the recognition that the shift of the economy base from fishing to tourism is essential for the development of the community. Under the Tourism Development planning, a visitor profile was developed for 2008 (Figure 18).

Sarteneja Visitor Profile - 2008

The majority of tourists visit Sarteneja for its tranquillity, its wildlife and its fly-fishing - visitor surveys conducted during November – December, 2008 highlight a number of activities undertaken by visitors, the majority focused on outdoor pursuits. Over 80% of visitors take part in hiking, wildlife viewing and visiting protected areas, primarily involving tours to Shipstern Nature Reserve. Swimming, cultural sites and reef-based activities are also popular. 92% of visitors surveyed said they would recommend Sarteneja to friends, based on the peaceful, welcoming atmosphere of the community, and the rich culture and wildlife of the area.

Activity	No. respondents (of 150)
Hiking/Trekking	90%
Wildlife viewing	90%
Protected areas	80%
Swimming	50%
Cultural heritage	30%
Snorkeling/diving	20%
Fishing	10%
Biking	5%

The culture and natural environment were also key elements in initially attracting visitors to the area. Surveys found that 90% of visitors stated the quality of natural surroundings to be very important in their decision to visit. Additionally, 70% answered that their desire to learn about other cultures and the opportunity to visit a traditional fishing community, were very important in their decision to come to Sarteneja. The opportunity to be adjacent to a pristine environment and the potential to see wildlife were also major factors in attracting visitors, with 80% indicating that access to a pristine environment was very important in their evaluation of their time in Sarteneja, and 60% highlighting the importance of the opportunities to see wildlife.

Visitors discover the area through a combination of internet and guidebooks - the Backpacker's Paradise, for example, has recently had a positive write-up in the Lonely Planet as a green destination, prompting nearly 50% of visitors surveyed to select Sarteneja as a destination. At present, two websites (Fernando's Guest House and the Backpackers Paradise) attract the majority of visitors to the area. From the visitor feedback, it would appear that greater coverage of Sarteneja on the internet and in guide books would promote increased visitation numbers – if Sarteneja has the capacity to handle this increase without losing those very characteristics that attract visitors in the first place.

At present, the majority of visitors can be categorized as one of two types - the lower-end, backpacker/traveler, attracted by the area's serenity, wildlife and wilderness areas, and older visitor with higher expenditures, either seasonal residents, or looking for potential holiday or retirement properties.

Sarteneja Tourism Development Plan, 2009
Sarteneja Alliance for Conservation and Development

Figure 18

Short-stay Visitors

Short-stay travelers attracted to Sarteneja are primarily from Canada and the USA, and travel most commonly in pairs. With the majority of the community speaking primarily Spanish, the language barrier, not surprisingly, caused an issue for the majority of visitors. Nearly 50% of short-term visitors come to Belize for a 2 – 3 week trip, the Sarteneja component being between 2 to 4 days of their itinerary. All visitors interviewed felt that Sarteneja has a positive, tranquil atmosphere that tourists can happily enjoy for a few days.

The survey showed that the short-stay visitors who, on average, spend less, could be encouraged to spend more if facilities – craft outlets, restaurants, snack shops etc. - were in place. Many visitors indicated that their expenditures would have been higher in Sarteneja if they had not had difficulty in finding food outlets – snack shops or restaurants. A high percentage of visitors also felt that there was inadequate interpretation of the surrounding attractions (i.e. archaeological sites, cultural attractions the surrounding wildlife), and that these could be made more accessible through signs, maps, tour guides, etc. All visitors suggested that these where desirable, and would make an impact on their personal decision to visit an area. Most tourists would have liked to see an information centre, in which interpretive material is displayed – a facility being developed in 2011 under SACD / STGA.

Medium-stay Visitors

Despite the majority of visitors (75%) visiting for leisure, 25% visit Sarteneja with a view to purchasing a house within the community, or land on which to build a second home, a retirement home, or develop their own business ideas. Initially their average expenditure locally is high, and they bring a continued annual input into the community, encouraging others, too, to visit.

There is, however, a common concern expressed by local residents, permanent foreign residents, and the short-term visitor that these foreign investors may initially bring money to the community, but in the long term may cause a detrimental knock-on effect to the economy of the area, driving prices up, out of the range of the local wage, changing cultural outlooks, and leading to a break down in the community structure. An additional concern of local residents is that the number of houses populated by foreign residents for only two to six months of the year is increasing, leading to dysfunctional neighbourhoods with houses standing empty for much of the year, affecting the dynamics of the community, one of those very qualities that many of these buyers are seeking.

Sarteneja Tourism Development Plan, 2009
Sarteneja Alliance for Conservation and Development

Figure 18

The Sarteneja Tourism Development Plan identified lack of accommodation as one of the primary barriers to increasing tourism within the area, and since the development of the plan has launched a homestay programme involving twenty families that now have licensed guest rooms on offer to tourists. This has proven very popular with student and volunteer groups who are seeking both a wildlife and cultural experience.

1.6.3 Educational Use

Shipstern Nature Reserve is well established as an educational venue, with well marked interpretive trails, a visitor's centre and associated butterfly exhibit, and an observation tower that overlooks the Nature Reserve landscape. Staff are trained to be able to greet and guide visitors, whether individuals or school groups, and provide them with an informative tour. The Infrastructure Upgrade Plan includes renovation of the butterfly display and inclusion of a breeding unit. It also includes renovation of the Xo-Pol tree-top hide and refurbishment and the relocation of the Main Trail hide to the Thompson Trail. Facilities for visiting groups are to be expanded with the construction of a dining area, education room and kitchen.

Whilst Shipstern Nature Reserve has acted as a school trip destination since its establishment, 2010 marks the first year where there has been a significant increase in protected area activities targeting the local communities – school visits, school activities and presentations, as well as competitions, aimed at raising awareness of Shipstern Nature Reserve, its goals and objectives, and the importance of conservation.

These activities benefit from the focus of the Community Officer, who also works with the three primary stakeholder communities to increase awareness of the Nature Reserve and its role in the local and national landscape, to increase community support towards effective management.

1.6.4 Research Use

Shipstern Nature Reserve has always placed emphasis on the use of the area for research, with eleven Master's theses having been completed based on fieldwork in the forests and savannas, following the signing of an agreement with a number of Swiss Universities (Infrastructure Upgrade Plan, 2009). It is recognized that Shipstern's ability to host researchers, both students and independent, is currently limited by infrastructure constraints, the site lacking the capacity to host larger university groups, and being restricted by limited laboratory workspace and equipment.

Whilst this is seen as a viable mechanism for generating more income for the Nature Reserve, much of the research has not, to date, been designed to assist with informing management decisions. This has been recognized and priority research needs identified. A mechanism is also needed to make the information more available to Shipstern management and staff, with hard and digital copies of reports in the office, and species lists compiled into a single report for easy access.

2. Conservation Planning

Conservation planning is a structured process that identifies and assesses the species and ecosystems of concern, the threats that impact them, and the strategies that can be used within the management of the area to mitigate these threats.

2.1 Conservation Targets

Conservation targets are species, species assemblages or ecosystems that have been selected as representing the biodiversity of a protected area – such that strategic actions, taken to ensure their continued viability and reduce the pressures impacting them, will adequately address the needs of the system as a whole.

2.1.1 Identification of Conservation Targets

With the areas north and south of Shipstern Lagoon being so ecologically different (with the Yucatan dry forest to the north, and the taller, more moist, semi-deciduous tropical broadleaf forest to the south), an initial list of potential conservation targets was generated for each area. This was then reviewed to provide an overall list of targets that is considered representative of the Nature Reserve as a whole, and encompasses the biodiversity values of the area, to provide a basis for setting goals, developing strategies and actions, and monitoring success.

Potential Conservation Targets	
North of Shipstern Lagoon ▪ Commercial hard wood species ▪ Non timber construction materials – bay leaves, chit, warrie wood, etc ▪ Medicinal plants ▪ Game species – deer, peccary, paca (gibnut), white lipped peccary (warrie), armadillo, great currasow, ▪ Wide ranging species - jaguar, puma, etc) requiring forest connectivity ▪ Mangroves ▪ Bird species – colonies and tourism value ▪ Yucatan Dry Forest (unique ecosystem) ▪ Savannas/wetlands (including Xo-Pol)	**South of Shipstern Lagoon** ▪ Mangroves ▪ Forest (broadleaved, cohune) ▪ Lagoons (inc fish) ▪ Wetlands/savannahs ▪ Wildlife: animals + birds ▪ Archaeological / cultural sites ▪ Nesting birds ▪ Commercial hard wood species ▪ Medicinal plants

These potential targets were then reviewed, combined or nested into a list of nine conservation targets, each representing or capturing the array of ecological systems, communities and species of the Shipstern Nature Reserve, incorporating those highlighted in the preliminary list.

Also considered important, though not addressed as a conservation target, are the archaeological and cultural resources of the area.

Draft Focal Conservation Targets for Shipstern Nature Reserve

Ecosystems

- Yucatan dry forest
- Tropical Forest
- Mangroves
- Brackish Lagoon
- Freshwater wetlands

Species / Species Aggregations

- Timber and Non-timber forest products
- Game species
- Bird Nesting colonies
- Fish

Yucatan Dry Forest	
Justification	**Species / ecosystems nested in this target**
Shipstern Nature Reserve includes the only representative portion of **Tropical deciduous microphyllous lowland forest** within the protected areas system in Belize. This forest type is characterized by the presence of Yucatan endemics such as the Kuka palm (*Pseudophoenix sargentii*), Yucatan Jay (C*yanocorax yucatanicus*). The forest is also important in harbouring a representative fauna and flora, and acting as a reservoir of game species – whilst not as species-rich as the higher sub-tropical forest, the Yucatan dry forest still provides cover for species such as great curassow and collared peccary. It also has a functional role in the maintenance of connectivity within the forests of the north eastern corner of Belize. Several commercial hardwood species and non-timber forest products (including bay leaves and ornamental plants – the kuka palm, orchids and bromeliads) occur within the dry forest, and are harvested outside the protected area to fulfill local demands, particularly from San Pedro. The forest is important for migratory bird species, being one of the first stopover points following the crossing from Florida. It also has its own characteristic species, including the rose throated tanager (*Piringa roseogularis*).	The kuka palm has a limited global range, and only occurs in the Shipstern / Sarteneja area in mainland Belize, and in Bacalar Chico National Park, on northern Ambergris Caye. It is threatened in its limited Mexican range by rapid tourism development, increasing the importance of the fragments present in Belize. The Yucatan Squirrel, Gaumer's Spiny Pocket Mouse (*Heteromys gaumeri*) and Yucatan Vesper Mouse (*Otonyctomys hatti*) are all endemic to the Yucatan Peninsula, and all three occur within the north-east corner of Belize, in the Yucatan dry forests. Other Yucatan endemics with restricted ranges within Belize include several bird species - the Yucatan jay (*Cyanocorax yucatanicus*), Yucatan flycatcher (*Myiarchus yucatanicus*), Yucatan poorwill (*Nyctiphrynus yucatanicus*), red-vented woodpecker (*Melanerpes pygmaeus*), yellow-lored parrot (*Amazona xantholora*), gray-throated chat (*Granatellus sallaei*) and rose-throated tanager (*Piringa roseogularis*).

Tropical Forest	
Justification	**Species / ecosystems nested in this target**
The tropical forest of the Shipstern area is part of the Petén-Veracruz Moist Forest ecoregion, and classified as 'Critical/ Endangered' as the rate of deforestation increases (World Wildlife Fund, 2001). These forests are considered to represent the northern limit of tropical vegetation communities, and are particularly rich in endemic species. They also protect a representative range of tropical forest species, including jaguar, tapir, parrots and toucans. The tropical forest, particularly south of the boundary, forms part of the northern biological corridor node, contributing towards the maintenance of the viability of both forest and wildlife in northern Belize, and forest connectivity with the rest of Belize. Like most forests in the region, the structure of the forest of Shipstern Nature Reserve is hurricane dependent. The forest has been impacted on several occasions by hurricanes, with almost total devastation following Hurricane Janet in 1955, with impacts exacerbated by fire. Hurricane Dean, in 2007, caused similar impacts, particularly south of the lagoon. Regeneration on the thin, poor soils has resulted in a low canopy height, with a predominance of drought resistant species, particularly in the forest north of Shipstern Lagoon. The forest is important for the environmental services it provides, particularly in the maintenance of the water cycle. This will become increasing importance over the coming years, with the predicted impacts of climate change.	The tropical forest of Shipstern Nature Reserve is an important source area for game species and still protects two Endangered (Baird's tapir and Yaxnik) and five Vulnerable species (great curassow, Spanish cedar, *Pouteria sp.* Mahogany, and West Indian manatee) as well as at least one herd of white-lipped peccary, a Near Threatened species that has disappeared from many forests of Belize over the past twenty years. Maintenance of forest connectivity is important for the viability of many forest species – particularly large predators – jaguar and puma. It provides a protected reservoir for traditional medicinal plants such as the gumbolimbo and Chinese yam (kukulmeca), and is also an important resource for local tourism, with relatively abundant wildlife, and scenic forest trails attracting visitors. The matrix of ecosystem and habitat components of the tropical forests of Shipstern include a variety of semi deciduous and evergreen forest types, some seasonally inundated, and the mono-specific cohune ridge. ▪ Tropical evergreen seasonal broadleaf lowland forest over calcareous soils: NE variant. ▪ Tropical evergreen seasonal swamp forests of N Belize (high variant) ▪ Tropical evergreen seasonal swamp forests of N Belize (low variant) ▪ Tropical semi-deciduous broad-leaved lowland forest ▪ Evergreen broad-leaved lowland shrubland dominated by leguminous shrubs

Mangroves	
Justification	**Species / ecosystems nested in this target**
Mangroves play a key role in the maintenance of cayes and coastal integrity through erosion control, and are also critical fisheries nursery areas for commercially valuable species (e.g. yellowfin mojarra, tarpon, etc). The trees themselves serve as nesting habitat for birds, and the leaves provide nutrients for plankton, which serves as the basis of the detrital food chain. Whilst these important roles are widely recognised, there is extensive clearance of mangroves throughout Belize, including the Sarteneja area, with the associated reduction in the essential ecosystem services they provide. Shipstern Nature Reserve protects some of the most extensive stands of mangrove in Belize, with a range of ecosystems nested under this category.	Shipstern Nature Reserve protects several mangrove ecosystems, ranging from the tall Basin Mangrove of lesser saline, higher nutrient areas to the Dwarf Mangrove Scrub of the nutrient-limited, highly saline mudflats. ▪ Coastal fringe mangrove ▪ Basin Mangrove ▪ Mixed Mangrove Scrub ▪ Dwarf Mangrove Scrub ▪ Marine salt marsh rich in succulents Mangroves are important as fish nursery areas and sheltered habitat for species considered of cultural importance, targeted by local fishermen. - striped and yellowfin mojarra, snapper, barracuda, and snook. The mangrove cayes also provide important breeding habitats for many bird species, including the reddish egret (*Egretta rufescens*), roseate spoonbill (*Platalea ajaja*), white ibis (*Eudocimus albus*) and the American wood stork (*Mycteria americana*). The wide expanses of dwarf mangroves provide nesting structure for white-winged doves and the Yucatan endemic, the black catbird (*Melanoptila gabrirostris),* listed as Near Threatened' (IUCN, 2010)

Brackish Lagoon System	
Justification	**Species / ecosystems nested in this target**
Shipstern Nature Reserve includes part of the brackish Shipstern Lagoon system – the largest lagoon system in the north. This complex of shallow lagoons and deeper connecting creeks once provided a valuable fishing area, protecting resources for local communities, but has been heavily impacted by overfishing in the last twenty years, resulting in the decline of fish stocks. However it still provides an important nursery functionality for species such as striped and yellowfin mojarra. Seagrass beds within the more saline areas of the lagoon range from sparse to dense – these are important in nutrient cycling and regeneration, with high productivity rate, and contribute significantly to the total production of inshore waters in the tropics generally, and in the lagoon specifically. McRoy and Helfferich (1977) report values of over 4,000 g C/m/day for *Thalassia* beds in the tropics. The area is important as a stopover for several species of waterfowl, including blue winged teal and American coot, and as a feeding ground for fledging herons and egrets. The scenic appeal of the lagoon, the wide open vistas and lack of human infrastructure is important in the promotion of the area for tourism	*Thallasia testudines* and *Halodule wrightii*and a variety of algae provide the benthic flora for the lagoon, which also supports a thriving complex of mangrove ecosystems – primarily red mangrove (*Rhizophora mangle*). The lagoon supports a number of species considered of cultural and commercial importance, targeted by local fishermen - striped and yellowfin mojarra (*Eugerres plumieri* and *Gerres cinereus*), grey snapper and schoolmaster (*Lutjanus griseus* and *Lutjanus apodus*), barracuda (*Sphyraena barracuda*), and snook (*Centropomus undecimalis*) – acting as a nursery area. Water birds using the area include little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), great egret (*Ardea alba*), reddish egret (*Egretta rufescens*), cattle egrets (*Bubulcus ibis*), double-crested cormorants (*Phalacrocorax auritus*), roseate spoonbill (*Platalea ajaja*), white ibis (*Eudocimus albus*) and boat billed heron (*Cochlearius cochlearius*). Blue winged teal, American coot and lesser scaup use the lagoon as an over-wintering site. The Critically Endangered Small toothed sawfish (Pristis pectinata) were once common within the lagoon system, but were locall extirpated by the use of nets between fifteen and twenty years ago. Local reports suggest that there may still be a remnant population in the northern coastal lagoons south of the Shipstern area. The Endangered Morelet's Crocodile (*Crocdylus moreleti*) is also present in the lagoon system and freshwater pools – this species was almost extirpated when this species was hunted extensively for its skin in the 1970's. It is now starting to recover, but is more common in the freshwater pools such as Xo-Pol.

<table>
<tr><th colspan="3">Freshwater Wetlands</th></tr>
<tr><th>Justification</th><th colspan="2">Species / ecosystems nested in this target</th></tr>
<tr>
<td>With limited freshwater availability in the north eastern corner of Belize, the freshwater ponds of Xo-Pol, the dry and sub-tropical forests, and the Northern Biological Corridor are important for the long term viability of the wildlife within the area.

Baird's tapir frequent these pools, as do white lipped and collared peccary. Freshwater bird species such as the pied billed grebe (Podilymbus podiceps) and muscoy duck (Cairina moschata) also make use of the forest pools.</td>
<td>The freshwater wetlands and pools provide habitats for turtles, water birds, and the Endangered Morelet's crocodile (Crocodylus moreleti). The Snail Kite (Rostrhamus sociabilis) is of conservation concern, being dependent upon a single snail species for its food supply. It is also an important indicator as to the health of the wetland areas.</td>
<td>Freshwater birds of Shipstern Nature Reserve
Pied-billed grebe
Anhinga
Least bittern
Bare throated tiger-heron
Great egret
Little blue heron
Green heron
Black-crowned night-Heron
Roseate spoonbill
Black-bellied whistling duck
Muscovy duck
Blue-winged teal
Snail kite
Ruddy Crake
Grey-necked woodrail
Common moorhen
American coot
Limpkin
Black-necked stilt
Northern jacana
White-rumped sandpiper
American pigmy kingfisher</td>
</tr>
</table>

Timber and Non-Timber Forest Products	
Justification	**Species / ecosystems nested in this target**
Timber populations have been impacted by hurricanes – Janet and Dean have both had significant impacts on the area, as have post-hurricane fires and poorly regulated salvage logging operations. Illegal logging impacts have occurred in the forests both north and south of the lagoon. Some species are more affected than others – Spanish cedar has been removed from the majority of the area, but other species are now reaching critical levels - mahogany followed by zericote and granadillo. To date, Santa Maria is less impacted, but is still a target. There has also been an increase in the extraction of Poison Wood, Machich (Cabbage Bark) and Madre Cacao. Illegal extraction of bay leaves and posts for construction materials and commercial harvesting is a continuing problem, and bay leaves are now considered to rate as POOR.	***Commercial timber species:*** ▪ Mahogany (caoba) ▪ Spanish cedar ▪ Granadillo ▪ Zericote ▪ Warrie wood ▪ Sapodilla ▪ Santa Maria ▪ Poisonwood ▪ Negrito ▪ Cabbage Bark ***Non-timber forest products:*** ▪ Bay leaves ▪ Pimento ▪ Chit ▪ Bayal vine (very minimal) ▪ Madre Cacao ▪ Lemuy (Mickey Mouse herb) ▪ Pata de vaca (used for palapa construction)

Bird Nesting Colonies	
Justification	**Species / ecosystems nested in this target**
Mangrove cayes within Shipstern Lagoon serve as secure colony roosting and nesting sites for herons and egrets, with sequential nesting from November onwards. The large numbers of birds nesting together provide greater protection from potential predators. Shipstern Nature Reserve has two of the few nesting colonies of wood stork in the country, with upward of 200 pairs nesting in 2009 – these large storks are recovering from a population decline in the q970's / '80's, when hundreds of nestlings were taken and sold as a cultural delicacy in Corozal and Chetumal (Meerman, 1991). One of the primary touristic values of the area, the bird colonies of Shipstern Lagoon benefit from the protection of the Shipstern surveillance and enforcement programme. These cayes are, however, particularly vulnerable to disturbance, and visitation needs to be carefully managed.	Colony nesting species using the mangrove cayes include wood stork (*Mycteria* Americana), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), great egret (*Ardea alba*), reddish egret (*Egretta rufescens*), cattle egrets (*Bubulcus ibis*), double-crested cormorants (*Phalacrocorax auritus*), roseate spoonbill (*Ajaia ajaja*), white ibis (*Eudocimus albus*) and boat billed heron (*Cochlearius cochlearius*).

Game Species	
Justification	**Species / ecosystems nested in this target**
The protected area acts as a reservoir for game species, replenishing the populations in the adjacent forest areas. Mammal and bird species considered of cultural importance, targeted by local hunters for the table, and for commercial purposes. All game species are currently believed to be present in decreased numbers, but are sufficient to maintain genetic viability, and to allow populations to recover from natural disturbances, should hunting pressure be alleviated and forest connectivity be maintained. However, hunting levels are currently too high to maintain populations	▪ White-tailed deer () ▪ White lipped peccary ▪ Collared peccary ▪ Armadillo ▪ Paca ▪ Great curassow

2.2 Assessing Biodiversity Viability

The Viability Assessment, as conducted under the Conservation Planning process, provides:

- A means for determining changes in the status of each focal conservation target over time, allowing Shipstern Nature Reserve to measure the success of its conservation strategies, compare the status of a specific focal target with future conditions, and compare regionally with other projects in Belize / Central America that focus on that target.

- A basis for the identification of current and potential threats to a target and identification of past impacts that require mitigating actions.

- A basis for strategy design and the foundation for monitoring.

Each Conservation Target was assessed using the following viability ratings (Table 11):

- **Very Good** – The Indicator is considered to have an ecologically desirable status, requiring little or no intervention for maintenance.

- **Good** – The indicator lies within the acceptable range of variation, though some intervention is required for maintenance.

- **Fair** – The indicator lies outside the acceptable range of variation, and human intervention is required if the viability of the target is to be maintained.

- **Poor** – Restoration of the conservation target is increasingly difficult, and impacts may result in extirpation from the conservation area.

...and the viability ratings and goals summarized (Table 12).

Table 11: Conservation Target Assessment			
Conservation Target	**Current Rating**	**Goal**	**Justification for Rating, Goal and Indicator**
Yucatan Dry Forest	**GOOD**	**VERY GOOD**	***Justification:*** The extent of Yucatan dry forest within Shipstern Nature Reserve is not affected by anthropogenic impacts, though there has been an increase in the harvesting of kuka palms from within SNR and the surrounding area. There is significant threat to this ecosystem in areas adjacent to the protected area, and therefore to long term viability.
			Goal: To maintain the viability and extent of the Yucatan Dry Forest within Shipstern Nature Reserve
			Indicators: Extent of Yucatan dry forest within Shipstern Nature Reserve (acres); Extent of Yucatan dry forest in northern Belize (acres)
Tropical Forest	**GOOD**	**VERY GOOD**	***Justification:*** Extent of tropical forest within the Nature Reserve has not been reduced from its natural extent. Condition has been affected in some places by fire (eg. cohune ridge south of lagoon) Logging has seriously affected the NBC section of SNR. There is also the serious threat of land acquisition in adjacent areas, with the potential for removal of forest connectivity. Serious increase of hunting activity in the tropical forests has already been observed. There is also clearing of land along NBC boundaries by Fireburn community for agriculture
			Goal: To maintain the viability of the tropical forest and its biodiversity
			Indicators: Extent of tropical forest within boundaries of Shipstern Nature Reserve (acres); Extent of forest connectivity (acres of unfragmented forest) in the Shipstern landscape; Presence of white-lipped peccary
Mangrove	**VERY GOOD**	**VERY GOOD**	***Justification:*** The mangroves of Shipstern Nature Reserve are not currently affected by any anthropogenic impacts.
			Goal: Maintain the viability and functionality of the mangrove ecosystems of Shipstern Nature Reserve
			Indicators: Extent of mangrove within the Shipstern Nature Reserve (acres); Extent of mangroves in the larger landscape (acres);

Table 11: Conservation Target Assessment			
Conservation Target	**Current Rating**	**Goal**	**Justification for Rating, Goal and Indicator**
Brackish Lagoon System	**GOOD**	**VERY GOOD**	***Justification:*** There are concerns about the potential for agricultural runoff into the lagoon system from the agricultural lands of Little Belize (this needs to be confirmed with water testing). Overfishing has affected the trophic structure within the lagoon.
			Goal: Maintain the viability and functionality of the lagoon system
			Indicators: Water quality of Shipstern Lagoon (DO, nitrates, phosphates); Density of striped and yellowfin mojarra within the lagoon system;
Freshwater Wetlands	**VERY GOOD**	**VERY GOOD**	***Justification:*** Xo-Pol has few anthropogenic impacts, but there are concerns of agricultural impacts from adjacent Chunox agricultural lands on the northern boundary. No anthropogenic impacts on freshwater areas south of the lagoon
			Goal: To maintain the freshwater wetlands as Very Good
			Indicators: Extent of wetland ecosystems; Number of species, and per species, of waterbirds using Xo-Pol; Number of crocodiles present in Xo-Pol
Timber and Non-timber Forest Products	**GOOD**	**VERY GOOD**	***Justification:*** Shipstern has been impacted by illegal logging activities, with targeting of specific species, with individual trees being taken. Greater impacts south of lagoon with significant logging incursions
			Goal: Increase status to Very Good – but need to focus on one species at a time, starting with the most endangered/affected.
			Indicators: Number of trees removed illegally from the protected area per year; Number of incursions for non-timber forest product harvesting per year;
Nesting Bird Colonies	**GOOD**	**VERY GOOD**	***Justification:*** Woodstorks have nested for the last eighteen years on the two cayes within Shipstern Lagoon. Whilst they didn't nest in Shipstern in 2010, they are still considered effectively protected. Other nesting birds colonies are considered to be in good condition
			Goal: Return of woodstorks, and continued use of the mangrove cayes as nesting sites for other species
			Indicators: Number of wood stork nesting each year; Number of species and number of individuals per species; Number of nesting colonies within protected areaper year;

Table 11: Conservation Target Assessment			
Conservation Target	**Current Rating**	**Goal**	**Justification for Rating, Goal and Indicator**
Game Species	**FAIR**	**GOOD**	***Justification:*** Rated as Fair for north of the lagoon – dependent on the species: Armadillo: GOOD; great curassow, collared peccary, paca, white tailed deer: FAIR; brocket deer: POOR. White lipped peccary are considered seasonal and unpredictable. Game species populations are considered GOOD south of the lagoon (some hunting of paca at Shipstern Landing; hunting incursions in NBC from south.
			Goal: Shipstern Nature Reserve acts as a reservoir, providing source of game species for replenishment of legal hunting activities, with zero hunting incursions within the protected area
			Indicators: Number of hunting incursions recorded per year; Number of reports of great curassow per year from patrols; Number of reports of white-lipped peccary per years from patrols
Fish	**FAIR**	**GOOD**	***Justification:*** Increasing pressure on fish (including from Crooked Tree and Orange Walk) – fishing with seine nets. Fish populations far reduced from levels 20 years ago – particularly barracuda, snook
			Goal: Increased fish stocks within the lagoon;
			Indicators: Density of striped / yellowfin mojarra / snook / barracuda within the lagoon system; Number of fishing incursions per year

Table 12: Conservation Targets – Summary of Current Ratings and Goals		
Conservation Target	**Current Rating**	**Goal**
Mangrove	VERY GOOD	VERY GOOD
Freshwater Wetlands	VERY GOOD	VERY GOOD
Brackish Lagoon	GOOD	VERY GOOD
Yucatan Dry Forest	GOOD	VERY GOOD
Tropical Forest	GOOD	VERY GOOD
Timber and Non-timber Forest Products	GOOD	VERY GOOD
Nesting Bird Colonies	GOOD	VERY GOOD
Game Species	FAIR	GOOD
Fish	FAIR	GOOD

2.3 Threats to Biodiversity

A threat analysis was conducted in 2010 for the biodiversity assessment process, with input from a range of stakeholders – particularly protected area site management staff and local resource users, providing local and technical knowledge of the area.

2.3.1 Identified Threats

Outputs from the threat assessment identified eleven threats (Table 13), of which six were considered key impacts to the protected area as a whole (Table 14). These were then assessed using a series of three criteria to allow prioritization of conservation actions and resources towards mitigating those identified as the most critical threats.

The assessment rated the following criteria:

- The area affected by the threat
- The severity of the threat
- The urgency of actions needed to mitigate the threat

Table 13: Identified Threats to Biodiversity Viability in Shipstern Nature Reserve

- Illegal logging
- Illegal hunting
- Illegal non-timber forest product extraction
- Illegal fishing
- Adjacent land use change
- Reduced forest connectivity
- Fire
- Oil exploration
- Looting
- Tourism impacts
- Agrochemical pollution

Table 14: Key Threats impacting Shipstern Nature Reserve

Combined (North / South)

- Reduced forest connectivity
- Illegal logging
- Illegal hunting
- Illegal non-timber forest product extraction
- Unsustainable fishing
- Oil exploration

North of Shipstern Lagoon

- Illegal logging
- Illegal hunting
- Illegal non-timber forest product extraction
- Oil exploration

South of Shipstern Lagoon

- Reduced forest connectivity
- Illegal logging
- Illegal hunting
- Unsustainable fishing
- Oil Exploration

Rating Critical Threats

The critical threats are assessed by Area, Severity and Urgency, using the following criteria:

Area: The area of the threat (how much of the conservation target area it affects)

Proportion of Area Affected (adapted from WCS)		
Criteria	**Score**	
Area	**4**	Will affect throughout >50% of the area
	3	Widespread impact, affecting 26 – 50% of the area
	2	Localized impact, affecting 11 – 25% of the area
	1	Very localized impact, affecting 1 – 10% of the area

Severity: The severity of the threat – how intense or great the impact is

Severity Ranking (adapted from WCS)		
Criteria	**Score**	
Severity	**3**	Local eradication of target possible
	2	Substantial effect but local eradication unlikely
	1	Measurable effect on density or distribution
	0	None or positive

Urgency: The likelihood of the threat occurring over the next five years

Urgency Ranking (adapted from WCS)		
Criteria	**Score**	
Urgency	**3**	The threat is occurring now and requires action
	2	The threat could or will happen between 1 – 3 years
	1	The threat could happen between 3 – 10 years
	0	Will not happen in > 10 years

<table>
<tr><th colspan="5">Threats to biodiversity of Shipstern Nature Reserve / 1</th></tr>
<tr><td rowspan="8">Illegal Logging / Harvesting of Non-timber Forest Products</td><td colspan="4">Status: Historical | Active | Potential</td></tr>
<tr><td colspan="4">Conservation Target(s): Timber and Non-timber Forest Products</td></tr>
<tr><td colspan="4">Threats (Direct):
▪ Depletion of commercial tree stocks
▪ Associated impacts on game species – hunting by logging crews
▪ Increased accessibility</td></tr>
<tr><td colspan="4">Source (Indirect Threat):
▪ Low income in adjacent communities – traditional occupation
▪ Limited employment opportunities
▪ Increase in demand, including export market
▪ Increased number of adjacent sawmills (Little Belize)
▪ Decreased areas for logging concessions – increased private lands
▪ Local requirement for construction materials</td></tr>
<tr><td>Area</td><td>4</td><td colspan="2">In about 70% of forest area, both north and south of the lagoon. Access from corridor road to NBC section.,</td></tr>
<tr><td>Severity</td><td>2</td><td colspan="2">Increased effectiveness of surveillance and enforcement in last two years. Localised effects north of the lagoon, but larger impact in NBC area</td></tr>
<tr><td>Urgency</td><td>3</td><td colspan="2">Last occurrence was approximately 6 months ago – will happen sometime this year</td></tr>
<tr><td colspan="4">Management Goal: Increase effective management of commercial species through effective surveillance and enforcement

Management Strategies:

Strategy 1: Strengthen surveillance and enforcement, and monitoring of hotspots and stricter application of regulations – size limits, seasons, etc

Strategy 2: Increased communication and collaboration with stakeholder communities

Strategy 3: Continued collaboration with Forest Department regarding issuing of concession and sawmill licences

Strategy 4: Implement/maintain signs: Protected Area, no logging

Strategy 5: Identify and implement effective mechanisms for reducing local community dependence on timber resources, targeting those communities causing the majority of the incursions</td></tr>
</table>

Threats to biodiversity of Shipstern Nature Reserve / 2

Illegal Hunting

Status:	***Historical***	***Active***	***Potential***

Conservation Target(s): Game Species

Threats (*Direct*)*:*

- Reduction in game species population viability
- Fire

Source (Indirect Threat)***:***

- Supplementing food source
- Low income in stakeholder communities
- Recreational hunting
- Commercial hunting
- Cultural demand for game meat

Area	***4***	Hunting is considered to occur in more than 50% the southern area – paca at Shipstern Landing, other game species in NBC. Hunting is more localised in the northern forests and lagoon.
Severity	***2***	The impacts north of the lagoon are relatively high, with markedly reduced game species populations. To the south, the impact is relatively low.
Urgency	***3***	Hunting incursions occur most weeks

Management Goal: Increase game species viability within Shipstern Nature Reserve through reduced hunting pressure

Management Strategies:

Strategy 1: Strengthen surveillance and enforcement, in collaboration with the Forest Department and other stakeholders.

Strategy 2: Increase public awareness of Shipstern Nature Reserve, its goals, and role in maintaining game species stocks for community use. Include Little Belize.

Strategy 3: Collaboration with the Forest Department in the issuing of licenses, etc., with investigation of the potential for recognition of traditional hunters and system for local regulation of hunting activities outside the protected area through a Provisional license system

Strategy 4: Increased collaboration with Fireburn Community towards increasing communication of information on hunting incursions south of the lagoon

Strategy 5: Implement/maintain signs: Protected Area, no hunting, no logging…

Strategy 6: Investigate feasibility of gated access to the area south of the lagoon, in collaboration with Fireburn community

Threats to biodiversity of Shipstern Nature Reserve / 2	
Illegal Hunting	**Strategy 7:** Collaborate with logging license holders/concession holders and Forest Department for no hunting policy in area adjacent to Shipstern Nature Reserve. **Strategy 8:** Identify and implement effective mechanisms for reducing local community dependence on game species, targeting those communities causing the majority of the incursions

Threats to biodiversity of Shipstern Nature Reserve / 3

Unsustainable Fishing

Status:	***Historical***	***Active***	***Potential***

Conservation Target(s): Native Fish Stocks

Threats (*Direct*)*:*

- Reduced viability of fish stock populations
- Damage to mangroves

Source (Indirect Threat)***:***

- Traditional food source
- Commercial demand for native fish species
- Unsustainable fishing methods
- Incursions by fishermen from outside stakeholder footprint (eg. OW)
- Recreational fishing

Area	***1***	Specific areas of the lagoon are targeted – primarily outside the protected area
Severity	***2***	The level of impact is measurable, with numbers far below those of 20 years ago, and loss of species – sawfish – once common in the lagoon system
Urgency	***3***	Fishing is occurring on a regular basis, but more so during the dry season

Management Goal: Maintain and improve native fish stocks within SNR

Management Strategies:

Strategy 1: Engagement of traditional fishermen towards implementation of regulated traditional fishing system, and ban of seine nets within the lagoon system.

Strategy 2: Work with Fisheries Department and the local communities to develop traditional fisheries area with regulated use for traditional users.

Strategy 3: Effective surveillance and enforcement within SNR, with clear boundary demarcation

Strategy 4: Collaborate with the Forest Department and Fisheries Department towards protection of the Corozalito area to maintain fish stocks for maintenance of traditional fishing.

Strategy 5: Increase awareness of the need for more sustainable fishing

Strategy 6: Identify important fish nursery areas within and outside SNR, and work with local fishermen to zone these as no-fishing areas

Strategy 7: Implement/maintain signs: Protected Area, no fishing

Threats to biodiversity of Shipstern Nature Reserve / 4

Adjacent Land Use Change

Status:	***Historical***	***Active***	***Potential***

Conservation Target(s): All Conservation Targets

Threats (*Direct*)*:*

- Isolation of forest and wildlife, with reduced viability
- Reduced forest connectivity
- Increased threat from agricultural runoff

Source (Indirect Threat)***:***

- Government interest in selling north east corridor land to Mennonites
- Increasing Mennonite population – demand for expansion of farmland
- Lack of commitment from Government to conservation of biodiversity priorities (e.g. north east corridor)
- Expansion of agricultural land by Fire burn community along NBC Western Boundary – Land has already been bulldozed

Area	***4***	Reduced connectivity will affect viability of larger forest species, particularly wide ranging species such as white lipped peccary, tapir and jaguar. Agrochemical pollution of water bodies
Severity	***3***	The impacts will be measurable, with the long term loss of species
Urgency	***3***	Government and Mennonites have been discussing corridor purchase and exploring potential for purchase of land within the Shipstern / Fireburn forest node, including corridor connectivity. Fireburn community farmers have already cleared approx. 25 acres of land on the NBC boundary.

Management Goal: Maintain conservation target viability through mitigation of potential land use change impacts in adjacent land

Management Strategies:

Strategy 1: Assemble information on the importance and functionality of the north east biological corridor, to inform strategic decision, lobbying and outreach.

Strategy 2: Lobby Government for maintenance of forest connectivity and protection of watershed values

Strategy 3: Strengthen communication and work in collaboration with other conservation partners and stakeholder communities (including Little Belize) towards establishment of north east biological corridor

Strategy 4: Increase awareness in stakeholder communities and Government of the importance of biological corridors – and the north east corridor in particular – for wildlife (with both tourism value and for meat)

Threats to biodiversity of Shipstern Nature Reserve / 5

Oil Exploration / Extraction

Status:	***Historical***	***Active***	***Potential***

Conservation Target(s): All conservation targets

Threats (*Direct*)*:*

- Decreased biodiversity viability
  - Fragmentation of forest habitat
  - Increased accessibility, with increasing illegal activities (hunting, logging, looting etc.)
  - Potential damage to infrastructure – eg. heavy machinery on roads
  - Noise pollution
  - Disturbance of nesting birds
  - Reduction in tourism potential
  - Potential impacts to aquatic biodiversity – seismic testing, pollution
  - Increased risk of fires on savanna and forest
  - Increased human presence
  - Vegetation clearance
  - Decrease in wildlife populations

Source (Indirect Threat)***:***

- High global demand for oil
- Economic incentives for oil exploration companies and Government

Area	***1***	More extensive impacts during exploration, but drilling would be relatively localized. Potential for broader associated impacts - increased accessibility would increase hunting and other incursions. Potential for exploration exists throughout SNR and adjacent area.
Severity	***1***	The direct impacts may be localized, but would be severe – removal of vegetation, and possible impact on water quality and aquatic species
Urgency	***2***	SNR lies within an oil concession (Perenco Belize Ltd. - an independent Anglo-French oil and gas company), which originally planned to conduct seismic surveys in 2010

Management Goal: Maintain biodiversity and wildlife within area; minimizing impacts of drilling operations on protected area.

Management Strategies:

Strategy 1: Lobby for exclusion of Shipstern Nature Reserve from oil concession area

Strategy 2: Keep informed of oil exploration activity in the vicinity of SNR, and if/when operations would or could take place within the protected area or nearby.

Strategy 3: Collaborate with drilling companies to ensure that planning of operations is as compatible as possible with protected area management goals, and that impacts are minimized as far as possible, with restriction of access.

Strategy 4: Inform oil companies of no hunting, no looting, no fishing, etc regulations of Protected area and Enforcement of Wildlife Protection Act, with patrols keeping track of activities of oil company employees and other people within the PA.

Threats to biodiversity of Shipstern Nature Reserve / 5	
Oil Exploration / Extraction	**Strategy 5:** Establish a mitigation, compensation and restoration program with drilling company in the event drilling is absolutely necessary.

2.3.2 Prioritizing Threats

Once the threat assessment has been completed, the threats are prioritized, to indicate where financial and human resources need to be most focused. This is through a standard prioritization process, with the threat scores being transferred from the threat assessment (Table 15):

Table 15: Prioritization of Identified Threats

Threat	Criteria Ratings			Total AxSxU	Rank
	Area	Severity	Urgency		
Illegal Logging / Harvesting of Non-timber Forest Products	4	2	3	24	**1**
Illegal Hunting	4	2	3	24	**1**
Adjacent Land Use Change	4	3	2	24	**1**
Unsustainable Fishing Practices	1	2	3	6	**2**
Oil Exploration	1	1	2	2	**3**

The threat with the highest total threat score is ranked as the highest threat. This places three of the identified threats as top priorities:

Illegal Logging / Harvesting of Non-timber Forest Products
Illegal Hunting
Adjacent Land Use Change

…as active threats, with the potential to significantly reduce conservation target viability.

Unsustainable Fishing Practices is assessed as a lower risk, as the majority of the impacts are taking place outside the protected area boundaries, though the impacts are considered significant. ***Oil Exploration*** is currently considered the lowest risk, though these may need to be reviewed if the oil company becomes more active in the area.

2.3.3 Strategies to Reduce Threats

The primary cross cutting strategies were identified during the assessment, and leverage of each activity analyzed in terms of the number of targets they impact (Table 16).

Table 16: Key Cross Cutting Strategies									
Key Strategies	**Yucatan Dry Forest**	**Tropical Forest**	**Mangrove and Brackish Lagoon**	**Freshwater Systems**	**Timber and non-Timber Forest Species**	**Game Species**	**Bird Nesting Colonies**	**Fish**	
Effective Surveillance and Enforcement									
Effective Communication and Collaboration									
Demarcation of boundaries									
Effective outreach and awareness of SNR goals									
Maintain updated information on oil exploration activity in area									
Collaborate with oil companies to minimize impacts of exploration / drilling activities									
Engagement and collaboration with communities									
Facilitating opportunities for alternative livelihoods									
Collaboration with Forest and Fisheries Departments									
Mechanisms for reduced dependency on natural resources									
Promote North East Biological Corridor									
Protection of Corozalito area									
Collaborate with FD / logging concession holders for no hunting policy									
Engagement of traditional fishermen									
Develop traditional sustainable fishery for Shipstern Lagoon									

3. Management Planning

3.1 Management Goals

Shipstern Nature Reserve was established to ensure the long-term viability of all native species, natural communities, and ecological systems, and to sustain the landscape configurations and ecological processes critical to ensuring their long-term survival. This is to be achieved through a series of objectives:

- *Conservation of wildlife and the unique ecological systems of Shipstern Nature Reserve for present and future generations, contributing to Belize's national conservation goals.*
- *Benefit local communities through environmental services, wildlife protection, education, and opportunities for local economic activity.*
- *Promote increased awareness of protected area and conservation benefits towards greater understanding and support, both locally and nationally*
- *Strengthen collaboration among conservation partners towards integrated conservation efforts in north east Belize.*
- *Improve understanding of environmental processes through applied research and monitoring, to guide effective management.*
- *Implement sound protected area management through strong operational, technical, and administrative processes and effective financial sustainability.*

3.2 Management and Organizational Background

Shipstern Nature Reserve (Belize) Ltd was registered as an NGO in 2006, and has a Board of Directors of three that supervises operations, while site-level management is carried out by the Executive Committee consisting of the Manager, the Administrator and the Head of Fundraising. At the site level, the Reserve is managed by a staff of nine - the manager, five rangers and two caretakers.

The Board of Directors has ultimate responsibility for governance over all aspects of the organization and the protected area. This includes responsibility for:

- Safeguarding the vision, integrity, objectives and policies of SNR Belize;
- Ensuring high standards of planning, operation, administration, evaluation and reporting in SNR Belize;
- Ensuring that statutory obligations are met;
- Ensuring that adequate resources are available to SNR Belize for all aspects of its work and administration;
- Ensuring that resources provided to SNR Belize are used for their intended purpose and are properly accounted for

SNR Strategic Plan, 2010

Organization Vision:

Shipstern Nature Reserve-Belize is an innovative and effective leader in the protection, conservation and preservation of the ecological integrity of unique highly threatened ecosystems in north-eastern Belize. Its flagship protected area, Shipstern Nature Reserve, is an integral part of the National Protected Area System supporting thriving flora and fauna, providing economic opportunities and benefits to local stakeholders, and serving as a model for successful protected areas management and stewardship in Belize and the region.

Organization Mission:

Shipstern Nature Reserve-Belize is an innovative non-governmental organization dedicated to the protection and conservation of key representative ecosystems of northeastern Belize through effective vigilance, scientific research, environmental education, community outreach and engagement, strategic alliances, and the creation of new sustainable economic models for the benefit of the people of Belize.

Organization structure:

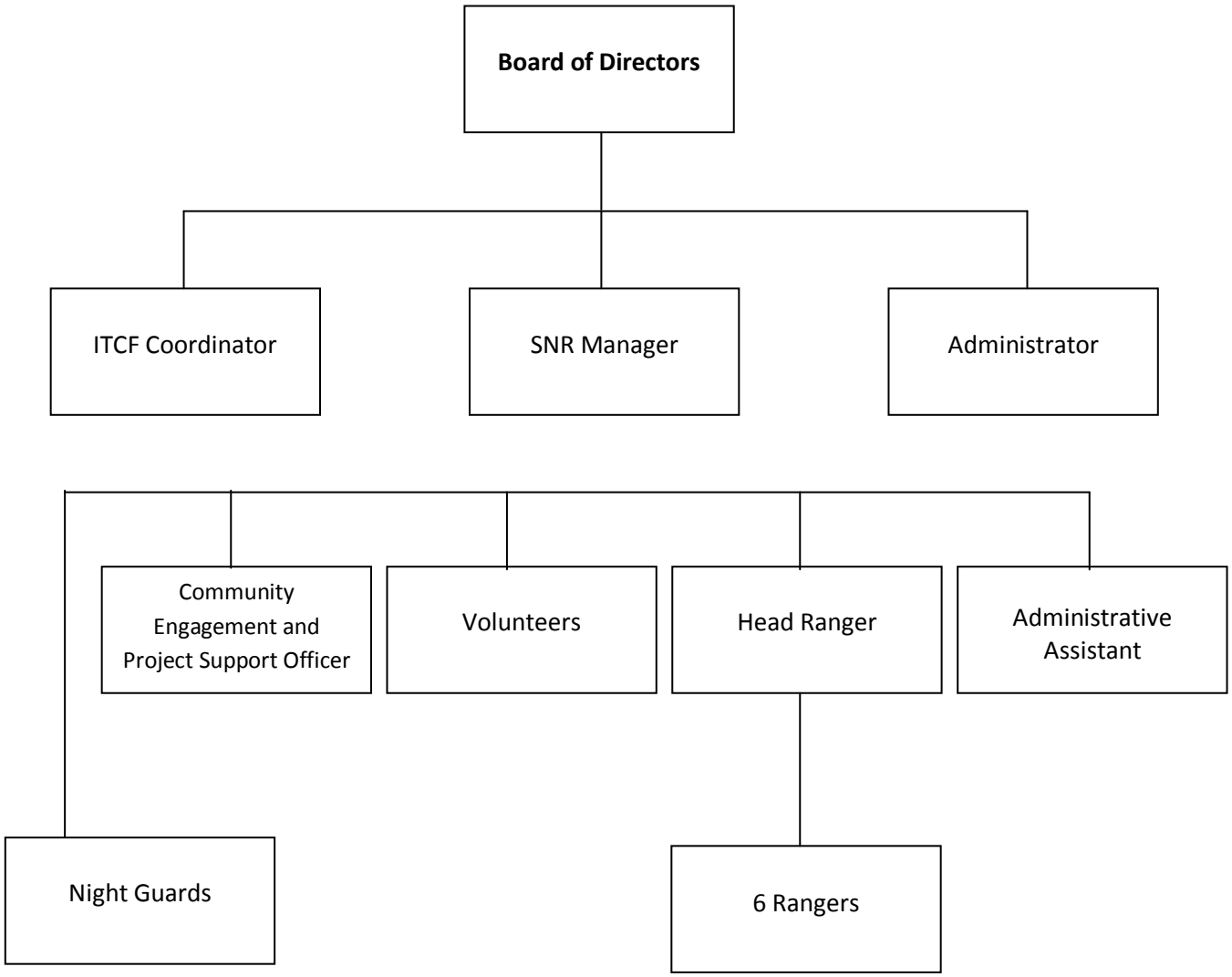


Figure 19: Organizational Structure of Shipstern Nature Reserve (Belize) Ltd.

3.3 Review of Previous Management Effectiveness

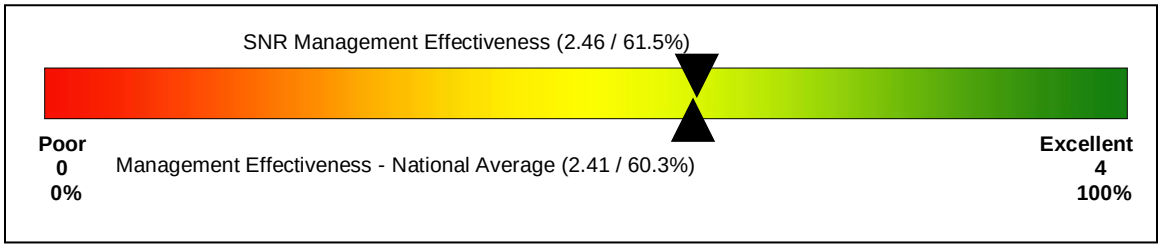
A national assessment of management effectiveness was conducted in 2009 under the Association of Protected Area Management Organizations (APAMO). A site-level self-assessment of Shipstern Nature Reserve was completed as part of the national initiative, by management and staff of the protected area, and is based on the indicators of the **Monitoring Package for Assessing Management Effectiveness of Protected Areas** (Young et. al., 2005), developed under the framework of Belize's National Protected Areas Policy and System Plan (NPAPSP). The data has been used to provide a snapshot of the state of Shipstern Nature Reserve in mid-2009, and contributed towards the national-level assessment, with site-level recommendations for use by protected area managers for adaptive management (Walker and Walker, 2009).

National Indicator Categories

Under the National Protected Areas Policy and System Plan, management effectiveness is evaluated through the **Monitoring Package for Assessing Management Effectiveness of Protected Areas** (Young et. al. 2005), based on 64 indicators, and divided between seven different indicator categories:

1. Resource Information
2. Resource Administration, Management and Protection
3. Participation, Education and Socio-economic Benefits
4. Management Planning
5. Governance
6. Human Resources
7. Financial and Capital Management

The management effectiveness of Shipstern Nature Reserve, as assessed in mid-2009, was rated at the upper end of **MODERATE,** with an overall Management Effectiveness of score of 2.46 out of 4.00 (61.5%).



Overall, Shipstern Nature Reserve is considered to rate as **MODERATE i**n terms of management effectiveness, averaging a score of 2.46 (61.5%) across the national Indicator Categories. The weakest Indicator Categories are identified as **Indicator Category 1: Resource information** and **Indicator Category 4: Management Planning**, both of which score 1.83 (45.8%), rating as **FAIR** (Table 17; Figure 20)**.**

The strongest Indicator Category, scoring above 3.00 out of 4.00 (75.0%), is identified as **Indicator Category 6: Human Resources,** rating as **VERY GOOD,** with a score of 3.13 **(**78.1%)**.** All other Indicator Categories rate as **MODERATE**.

Outputs of Indicator Categories							**Moderate**
Indicator Category					**Average Score 2009**		**%**
1. Resource Information					1.83		45.8
2. Resource Administration, Management and Protection					3.00		75.0
3. Participation, Education and Socio-Economic Benefit					2.07		51.8
4. Management Planning					1.83		45.8
5. Governance					2.80		70.0
6. Human Resources					3.13		78.1
7. Financial and Capital Management					3.00		75.0
Overall					**2.46**		**61.5%**
POOR	≤1,00 (≤25%)	**FAIR**	>1.00- 2.00 (>25 - 50%)	**MODERATE**	>2,00 – 3.00 (>50% - 75%)	**VERY GOOD**	>3.00 (>75%)

***** Indicators and Indicator categories used are from Young et. al. (2005, and scored on a scale of 1 – 4:

Table 17: Results for indicator Categories

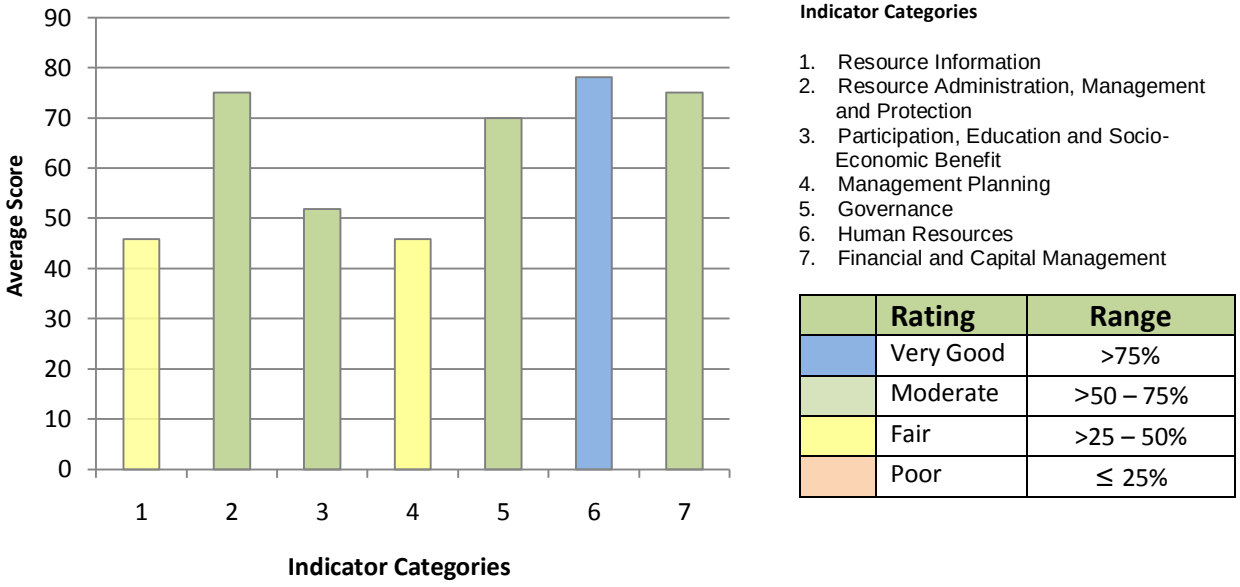


Figure 20: Results per Indicator Category

Of the 64 national indicators, thirteen show particular strength, scoring 4 (**VERY GOOD**), whilst nineteen demonstrate areas that would benefit from significant strengthening, with scores of 1.00 (**POOR**) (Tables 18 and 19). One indicator (Indicator 5.2: Co-management agreement) is not included within the assessment, as it is not considered of relevance to private protected areas.

Table 18: Strengths (Score = 4 out of 4)
2.1 Legal status
2.2 Boundary survey and demarcation
2.3 Permit approval process
2.7 Surveillance Activities
2.8 Enforcement Activities
3.11 Extent of local economic benefits
3.4 Dissemination of knowledge and information
5.3 Administrative autonomy
6.1 Qualified site manager
6.2 Site manager availability
6.3 Administrative staff
6.5 Operational staff
6.8 Staff satisfaction
7.1 Funding adequate for management
7.3 Financial management

Table 19: Weaknesses (Score = 1 out of 4)
1.3 Inventory of cultural and archaeological resources
1.4 Inventory of social, cultural and economic context
1.5 Resource use and occupancy
1.6 Inventory: Tenures and Claims
1.8 Systematic threat assessment
1.9 Traditional knowledge
2.4 Tenure claim conflict and resolution activities
3.1 Communication Activities
3.2 Stakeholder engagement
3.5 Level of stakeholder participation in management
3.6 Local actors leading protected area management
3.8 Strength of social capital
4.1 Management plan
4.3 Regulation and implementation of management zones
5.4 Advisory committee
6.4 Technical, scientific and professional staff
6.6 Human resource assessment
7.7 Signage adequate for management

One indicator (Indicator 5.2: Co-management agreement) is not included within the assessment, as it is not considered of relevance to private protected areas.

Resource Management and **Human Resource Management** are considered particularly strong management areas. Six of the weakest indicators, those scoring 1.00 out of 4.00, reflect the need to increase information availability on the natural resources and threats, on which to base effective management decisions, and the need for a guiding framework through management and operational planning, a gap that is being addressed under the current management planning process (Figure …).

A further six of those indicators rating as **POOR** are associated with Indicator Category Three – **Participation, Education and Socio-economic Benefit,** an area recognized as requiring significant strengthening across the entire national protected areas system (Figures 21 and 22).

Figure 21: Mean score by indicator – sorted by Indicator Section

Indicator Sections
Section One: Resource Information
Section Two: Resource Administration, Management and Protection
Section Three: Participation, Education and Socio-Economic Benefit
Section Four: Management Planning
Section Five: Governance
Section Six: Human Resources
Section Seven: Financial and Capital Management

Non-Biodiversity Indicators (Young et. al. 2005)

1. Resource Information

1.1 Physical Environment
1.2 Biotic Environment
1.3 Cultural and Archaeological Resources
1.4 Social, Cultural, and Economic Context
1.5 Resource Use and Occupancy
1.6 Tenures and Claims
1.7 Conservation Target
1.8 Systematic Threat Assessment
1.9 Traditional Knowledge
1.10 Information Management Systems
1.11 Environmental Monitoring Activities
1.12 Functional Scientific Research Activities

2. Resource Management

2.1 Legal: Legal Status
2.2 Legal: Boundary Survey and Demarcation
2.3 Legal: Permit, and Approval Processes
2.4 Tenure Claim Conflict Resolution
2.5 Guidelines and Best Management Practices
2.6 Natural Resource Management
2.7 Protection: Surveillance Activities
2.8 Protection: Enforcement Activities
2.9 Visitor and Tourism Management Activities
2.10 Visitor and Tourism Monitoring Activities

3. Community Participation and Benefits

3.1 Communication Activities
3.2 Stakeholder Engagement
3.3 Educational Activities
3.4 Dissemination of Knowledge and Information
3.5 Level of Stakeholder Participation in Management Benefits
3.6 Local Actors Leading Management
3.7 Volunteer Activities
3.8 Strength of Social Capital
3.9 Capacity Building Strategies
3.10 Socio-Economic Benefits Strategy
3.11 Extent of Local Economic Benefits
3.12 Sustainable Use for Economic
3.13 Employment in activities related to the protected area
3.14 Local Recognition of Protected Area Benefits

4. Management Planning

4.1 Management Plan Implementation
4.2 Operational Plan Implementation
4.3 Regulation and Zoning Implementation
4.4 Guidelines and Best Management Practices
4.5 Long Term Management Needs Identification
4.6 Program Monitoring and Evaluation

1. Governance

5.1 Protected area objectives
5.2 Co-management agreements
5.3 Administrative autonomy
5.4 Advisory Committee
5.5 Board of Directors
5.6 Inter-organizational mechanisms

6. Human Resources

6.1 Qualified Site Manager
6.2 Site Manager Availability
6.3 Administrative Staff Availability
6.4 Technical, Scientific, and Professional Staff Availability
6.5 Operations Staff Availability
6.6 Human Resource Assessment
6.7 Training and Development
6.8 Staff Satisfaction

7. Financial and Capital Management

7.1 Funding Adequacy
7.2 Revenue Generation
7.3 Financial Management
7.4 Infrastructure Adequacy
7.5 Equipment Adequacy
7.6 Internal Access Adequacy
7.7 Signage Adequacy
7.8 Maintenance Adequacy

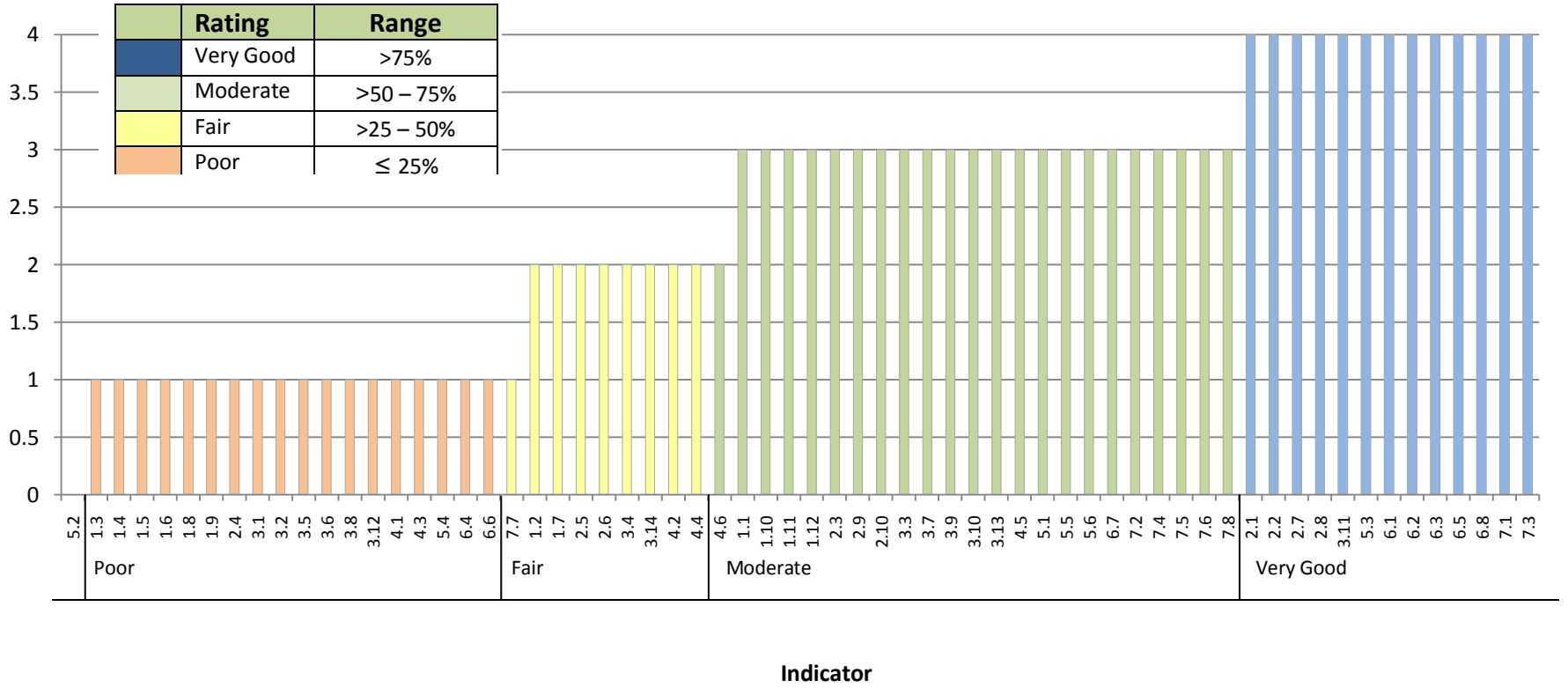


Figure 22: Mean score by indicator – sorted by Score

A number of recommendations were developed per Indicator Category based on the outputs of the assessment:

Indicator Section One: Resource Information

These indicators assess the extent to which:

- Programs are in place to gather, store, analyze, and monitor information important to managing the protected area.
- Information gathered and analyzed is sufficient for effective management.
- Information has been gathered to identify important conservation targets and threats.

Shipstern Nature Reserve rates as **FAIR** for Section One: Resource Information, with a mean score of **1.83 (45.8%)** - lower than the average for the National Protected Areas System, which scores 2.31 (57.7%)**.** The scores per range from 1.00 for the six weakest indicators (rating as **POOR**), to 3.00 for the four strongest indicators, which rate as **MODERATE**, suggesting that there is limited resource information available for management, with a number of key information gaps.

Recommendations:

- Integrate identification and geo-referencing of archaeological structures into patrols and patrol reporting
- Increase the information on the socio-economic context in which Shipstern Nature Reserve is being managed
- Ensure effective documentation of resource use (both legal and illegal) within the Shipstern Nature Reserve, and integrating into management decisions
- Conduct conservation planning to identify priority conservation strategies
- Document traditional knowledge of the Shipstern Nature Reserve area

Indicator Section Two: Resource Administration, Management and Protection

This section identifies strengths and weaknesses in the processes that exist to address and manage legal uses of the protected areas, outside influences, conflicts over rights and uses, and illegal and prohibited activities. These indicators assess the extent to which:

- The protected area is legally established and demarcated.
- Processes exist to address and manage legal uses of the site, outside influences, conflicting rights and uses, and illegal and prohibited activities.

Shipstern Nature Reserve rates at the top end of **MODERATE** for Section Two, with a mean score of **3.00 (75.0%).** Scores range from 1.00 (**POOR**) for one indicator **(Indicator 2.4: Tenure Claim Conflict Resolution)** to 4.00 (**VERY GOOD**) for four indicators, the latter reflecting the strength of the legislation in the designation of private lands, and Shipstern Nature Reserve's strong surveillance and enforcement regime.

Recommendations:

- Ensure the SNR Best Management Guidelines and Practices manual is updated and all staff are fully aware of its contents and incorporating guidelines and practices into their activities
- Provide new staff with an orientation to the SNR Best Management Guidelines and Practices

Indicator Section Three: Participation, Education and Socio-Economic Benefits

Indicators in this section highlight the level of involvement of local communities and stakeholders in the management of the protected area, whether they are benefiting from the presence of the protected area, and whether there is recognition of the goods and services provided by the protected area. These indicators assess the extent to which:

- Local communities and stakeholders are involved in the management of the protected area.
- Local communities, stakeholders, and the public appreciate the environmental and cultural values of the protected area and the national contribution they make.
- Local communities benefit from the presence of the protected area.

Shipstern Nature Reserve rates as **MODERATE** for Indicator Section Three, with a mean score of **2.07 (51.8%)** – slightly lower than the overall average score across the protected areas of 2.13 (53.4%). Of the fourteen indicators, one rates as **VERY GOOD** - **Indicator 3.11: Extent of Local Economic Benefit,** based on the local employment the Nature Reserve provides, both directly (rangers and night watchmen) and indirectly (through tourism). However, six indicators rate as **POOR –** suggesting that Shipstern requires significant strengthening in many areas of stakeholder participation, education and socio-economic benefit if it is to contribute towards the fulfillment of the National Protected Areas Policy and System Plan focus on greater stakeholder benefits. All other indicators score 2.00 or 3.00**.**

Recommendations:

- Strengthen mechanisms for community input into management decisions
- Identify and implement mechanisms for strengthening stakeholder engagement
- Develop a local Advisory Committee, with a well defined Terms of Reference, to integrate community advisory input into management

- Strengthen partnerships with local organizations – particularly the Sarteneja Alliance for Conservation and Development – towards effective collaboration within the conservation landscape of north-east Belize
- Encourage use of Shipstern by tourism stakeholders, with site-level training for local licensed tour guides
- Build understanding and support of the SNR objectives in the stakeholder communities
- Work with other local organizations to build local recognition of protected area benefits

Indicator Section Four: Management Planning

This section highlights strengths and weaknesses in the management planning processes -management plans, operational plans, site design plans, and regulations and zoning – as well as the processes of management, including monitoring. These indicators assess the extent to which:

- Effective planning processes are in place
- Management plans, operational plans, site design plans, regulations and zoning, and guidelines and best management practices are being implemented
- Management resource needs are identified
- Monitoring and evaluation are conducted

Shipstern Nature Reserve rates as **FAIR** for Section Four, with a mean score of **1.83 (45.8%)** - lower than the national average of 2.20 (55.1%) – **MODERATE** – for this section, reflecting the current lack of a management plan or concrete planning framework. Shipstern Nature Reserve rates as **POOR** in two indicators - **Indicator 4.1: Management Plan** and **Indicator 4.3: Regulation and Zoning Implementation,** both areas identified as benefitting from further strengthening, and being addressed through the current management planning process. All other indicators rate between 2.00 (**FAIR**) and 3.00 (**MODERATE**). No indicator rates as 4.00 (**VERY GOOD).**

Recommendations:

- Finalize and implement the 5-year management plan (in progress)
- Identify and implement zones and regulations for effective management, where necessary
- Conduct annual operational planning, based on the management plan
- Conduct an annual review of management and operational plans, and adjust management activities and strategies as necessary

Indicator Section Five: Governance

This section looks at management effectiveness through the establishment of site level authority, responsibility, and accountability, with essential governance structures and supporting processes that

are well designed and implemented. It does not address central governance issues. These indicators assess the extent to which:

- Authority, responsibility and accountability are established for managing the protected area
- Essential governance structures and processes are well designed and implemented
- Relations and communication are effective between all partners

Overall, Shipstern Nature Reserve scores an average of **2.80 (70.0%),** rating as **MODERATE,** marginally higher than the average score of 2.75 (68.8%) for the protected areas system as a whole. Under Indicator Section Five, Shipstern Nature Reserve has one indicator rating as **VERY GOOD (Indicator 5.3: Administrative Autonomy)**, reflecting its status as a private protected area. One indicator rates as **POOR** (1.00) – **Indicator 5.4: Advisory Committee.** It is, however, recognized that an Advisory Committee would greatly strengthen the management of the protected area and provide an effective mechanism for reaching out and involving stakeholders, and a PACT-funded project is currently being implemented to start addressing this.

As a private protected area, **Indicator 5.2: Co-management Agreement** is not considered relevant.

Recommendations:

- Identify and implement effective mechanisms for Advisory Committee input into strengthening management

Indicator Section Six: Human Resources

This section assesses management effectiveness in terms of human resources – the presence of sufficient, adequately educated and trained staff, with good morale to ensure high productivity. These indicators assess the extent to which:

- Necessary staff are recruited and available.
- Necessary staff are adequately educated and trained for their jobs.
- That mechanisms are in place to assess whether there is good staff satisfaction to ensure high productivity
- Volunteers are recruited and managed effectively

Shipstern Nature Reserve scores an average of **3.13 (78.1%)**, rating as **VERY GOOD** – above the national average of 2.49 (62.5%) for the protected area system as a whole. Under Section 6, five indicators score 4.00 (**VERY GOOD**) whilst two indicators scores as **POOR**, (**Indicator 6.4: Technical, scientific and professional staff** and **Indicator 6.6: Human Resource Assessment)**, reflecting the relatively stable funding for staff positions for staff and staff positions.

Recommendations:

- Seek partnerships with local, national and international research partners and volunteers to fill technical and scientific skill gaps
- Build technical capacity of staff in relevant and appropriate areas, following needs assessment

Indicator Section Seven: Financial and Capital Management

For effective management, adequate funds must be available, and necessary protected area infrastructure, equipment, signs and other assets in place and properly managed and maintained. These indicators assess the extent to which:

- Adequate funds are raised and available.
- Infrastructure, equipment, signs, and other assets are adequate for management of the protected area.
- Protected area infrastructure, equipment, signs, and other assets are properly managed and maintained.

Shipstern Nature Reserve scores **3.00 (75.0%)** for Financial and Capital Management, rating at the upper end of **MODERATE** (higher than the protected areas system as a whole, which scores an average of 2.49 (62.4%) – **MODERATE**). Under Section 7, two indicators rate as **VERY GOOD** (**Indicator 7.1: Funding Adequacy** and **Indicator 7.3: Financial Management**) reflecting the relative successful financial sustainability mechanisms and structured financial management in place, with funds being generated from the partner organization, ITCF, in Europe. The weakest indicator is identified as **Indicator 7.7: Signage Adequacy,** which scores as 1.00 (**POOR**).

The recommendations under each Indicator Category have been integrated into the Management Programmes.

3.4 Management Strategies

The management strategies Shipstern Nature Reserve are selected to achieve the goal of:

> "*continuously working towards improving the environmental integrity of the Shipstern Nature Reserve in north-eastern Belize, through effective and collaborative protected areas management".*

At site level, the priority management strategies have been identified as:

- Maintaining and improving current effectiveness of surveillance and enforcement
- Building a local stakeholder support base through community engagement, education and outreach activities and facilitation of economic benefits through sustainable development
- Maintenance of forest connectivity in north-east Belize
- Investigation of mechanisms to engage adjacent landowners in buffer management through sustainable agroforestry

These strategic areas have been integrated into the Management Programmes. A series of broader management strategies were developed to form a framework to support the management of the protected area in the current landscape, during strategic planning for Shipstern Nature Reserve (Belize) Ltd. (Salas, 2010),

- **Conservation**
  - Surveillance and Enforcement
  - Management and Administration
  - Improved Site Management
  - Community Outreach and Engagement
  - Scientific Research and Monitoring
  - Publicity and Marketing
  - Networking (integrating advocacy)

- **Tourism Development**

- **Economics & Sustainable Livelihoods**

3.4.1 Management Constraints and Limitations

This Management Plan has incorporated strategic actions to assist Shipstern Nature Reserve in addressing some of the limitations and constraints identified during management planning. The five highest priorities are detailed below:

2. Current management constraints include the lack of support from the local communities. There is a critical need to increase community engagement and support, and reduce conflict, particularly within Sarteneja. The Nature Reserve staff have initiated a programme to start addressing this through a PACT funded project (2010), but will need to ensure that continuity and consistency is maintained in the level of outreach given to the communities.

3. Another critical management constraint is the heavy dependence on external funding, and funding through a single organization (ITCF). Diversification of the income sources for financial sustainability would be healthy for the future viability of the protected area.

4. The lack of clear boundaries, either on the paper or on the ground, particularly for the NBC parcel are identified as a barrier for effective managemnet. The current survey lines do not match the coordinates used in national mapping – this needs to be resolved from the original survey maps, and the lines corrected on the ground. Without this, effective enforcement will be a problem.

5. Access to the more remote areas, particularly the Shipstern / Fireburn node and NBC, and therefore the effectiveness of surveillance and enforcement in this area, are limited by transportation – small all terrain vehicles and a dedicated surveillance and enforcement vehicles would largely overcome this constraint.

Development of the management plan has also taken into account broad recommendations for effective protected area management (Figure 23; Kelleher, 1999).

Checklist for Effective Protected Area Management

- Be clear about objectives
- Seek local support
- Build partnerships
- Plan for financial sustainability
- Don't prohibit more than necessary
- Build for the unforeseen
- Put in place structures for conflict resolution
- Establish self-enforcement as much as possible

Figure 23: Adapted from Kelleher, 1999

3.4.2 Management Zones

There is no current zoning within Shipstern Nature Reserve. The potential for future public use zones were discussed for increasing effective visitor management, but were not integrated into the management planning, as not enough information currently exists to make informed management decisions.

The Xo-Pol area and the wood stork islands are identified as sites of concern, where information on tourism impacts is currently considered too limited to guide management decisions as to whether to continue to allow visitation

3.4.3 Limits of Acceptable Change

With increasing visitation comes the potential for increasing impacts to the environment, presenting the ever-present dilemma of how a protected area can develop a sustainable financial income from tourism without causing significant damage to the natural resources that attract the visitors. This poses the question that, given increasing tourism use and the inevitable impact this will have on the local environment, what are the biophysical and social conditions that should be considered as acceptable to both the management organization and to visitors.

Planning for the mitigation of visitor impacts is based on the recognition of a number of specific values that are essential for both the conservation management of the area and for future appreciation by visitors.

- The quality of the environment, which forms the basis for environmental benefits and human appreciation and associated with the protected area
- The dependence of tourism appreciation on the maintenance of near-pristine conditions
- The importance of economic and social benefits to both local stakeholders and to the Belize economy as a whole
- The value of the protected area as a tourism, recreational and educational resource

With the relative the limited tourism currently being experienced in the Shipstern Nature Reserve, it is suggested that the development of a full Limits of Acceptable Change programme should not be considered for at least the initial two years of plan implementation. Further attention should be paid, however, to minimizing potential visitation impacts on the nesting birds, and the Xo-Pol area.

3.5 Management Programmes and Objectives

There are six programmes within the overall Management Strategy for Elijio Panti National Park:

A. **Natural Resource Management Programme**
B. **Research and Monitoring Programme**
C. **Community Engagement and Outreach Programme**
D. **Public Use Programme**
E. **Site and Infrastructure Management Programme**
F. **Administration Programme**

When prioritizing activities within these programmes, the results of the Conservation Planning prioritization has also been taken into account (Table 20).

Table 20: Conservation Targets – Current Ratings and Goals

Conservation Target	Current Rating	Primary Threat(s)
Mangrove	**VERY GOOD**	Adjacent Land Use Change
Freshwater Wetlands	**VERY GOOD**	Adjacent Land Use Change, Oil Exploration
Brackish Lagoon	**GOOD**	Adjacent Land Use Change (including agrochemical contamination), Oil Exploration
Yucatan Dry Forest	**GOOD**	Illegal Logging / Harvesting of Non-timber Forest Products
Tropical Forest	**GOOD**	Illegal Logging / Harvesting of Non-timber Forest Products; Adjacent Land Use Change (including forest fragmentation)
Timber and Non-timber Forest Products	**GOOD**	Illegal Logging / Harvesting of Non-timber Forest Products
Nesting Bird Colonies	**GOOD**	Illegal Hunting
Game Species	**FAIR**	Illegal Hunting
Fish	**FAIR**	Unsustainable Fishing Practices

Shipstern Nature Reserve Management Programmes					
Natural Resource Management Programme	**Research and Monitoring Programme**	**Community Engagement and Outreach Programme**	**Public Use Programme**	**Site and Infrastructure Management Programme**	**Administration Programme**
Natural Resource Management	Research Programme	Stakeholder engagement and participation	Visitor education and interpretation	Staff facilities and maintenance	Human Resource Management
Surveillance and enforcement	Monitoring Programme	Environmental education and outreach	Visitor safety and protection	Visitor facilities and maintenance	Accounting
Zoning and boundaries	Training	Public outreach and information		Transportation	Communication and Liaison
Management of Conservation Target	Collaboration and Communication	Sustainable livelihoods and training			Financial Sustainability

3.5.1 Natural Resource Management Programme

Vision

To ensure the continued maintenance of biodiversity and hydrological processes to promote and maintain watershed functionality, viable ecosystems, unique values, and populations of all species within the Shipstern Nature Reserve.

Management Goals:

- To provide the framework for effective natural resource management
- To ensure effective surveillance and enforcement
- To maintain clear boundaries
- To maintain forest functionality and connectivity
- To increase the viability of conservation targets

Natural Resource Management Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
General Natural Resource Management						
Review the name 'Shipstern Nature Reserve' and potential to revise to be more indicative of IUCN category (National Park)	**Responsible:** SNR Board members **NB:** 'Nature Reserve' status in Belize denotes highest state of protection – with no tourism access.					
Lobby for full recognition of all of Shipstern Nature Reserve under the National Protected Areas System	**Responsible:** SNR Board members					
Ensure effective documentation and mapping of resource use (both legal and illegal) within the Shipstern Nature Reserve, and integrate into management decisions	**Responsible:** SNR Manager, Head Ranger					
Develop a patrol reporting protocol and procedure for illegal resource use, with strengthening of report forms	**Responsible:** SNR Manager, Head Ranger					
Develop a fire response plan as part of a disaster management plan for forest and mangrove savanna within and adjacent to SNR	**Responsible:** SNR Manager, Head Ranger					
Develop and implement local fire-awareness programme, targeting adjacent landowners / farmers, to include land clearing best practices information – posters, etc	**Responsible:** SNR Manager, Head Ranger, Community Officer					
Train and equip rangers and local community members in fire management and fire fighting, targeting adjacent landowners / farmers	**Responsible:** SNR Manager, Head Ranger, Community Officer					
Liaise with other organizations for acquiring fire management training (PFB, TIDE, YCT)	**Responsible:** SNR Manager, Head Ranger					

Natural Resource Management Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
General Natural Resource Management						
Raise staff awareness of the environmental benefits of SNR – water security, forest resource source, tourism etc.	**Responsible:** SNR Manager, Head Ranger					
Clearly define the role of SNR in context of local communities to strengthen the working relationship, guided by the organization's purpose, guiding principles, mission and vision	**Responsible:** SNR Manager, Community Officer NB: Integrated into Community Engagement and Participation Plan					
Raise staff awareness of the role of SNR in context of local communities,	**Responsible:** SNR Manager, Community Officer **NB:** Based on SNR Community Engagement and Participation Plan					
Strengthen links with other national and local organisations and Government agencies involved in protected areas management	**Responsible:** SNR Manager					
Revise and disseminate general rules and regulations of Shipstern Nature Reserve	**Responsible:** SNR Manager, Head Ranger					
Identify areas of conflict and potential conflict, and affected stakeholders	**Responsible:** SNR Manager, Head Ranger, Community Officer					
Engage adjacent farmers and landowners – to reduce areas of conflict and increase mutual assistance	**Responsible:** SNR Manager, Head Ranger, Community Officer					
Develop map of present land ownership and land use in adjacent areas for update on an annual basis	**Responsible:** SNR Manager, Community Officer					
Clearly define the role of SNR in context of the national protected areas system	**Responsible:** SNR Board, SNR Manager					

Natural Resource Management Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
General Natural Resource Management						
Strengthen links with other national and local organisations and Government agencies involved in protected areas management	**Responsible:** SNR Manager					
Assess climate change implications, and develop long term strategies/policies plan	**Responsible:** SNR Board, SNR Manager, Consultant					
Promote maintenance of connectivity in forest and aquatic environments within the larger landscape	**Responsible:** SNR Board, SNR Manager					
Promote collaboration with adjacent landowners / conservation organizations towards maintenance of forest connectivity in the north east corridor	**Responsible:** SNR Board, SNR Manager					
Surveillance and enforcement Sub-Programme						
Highlight and map critical areas and times of peak logging, hunting and fishing pressure, fire risk,	**Responsible:** SNR Manager, Head Ranger					
Strengthen and enhance the Surveillance and Enforcement Program through the development of a Surveillance and Enforcement Plan	**Responsible:** SNR Manager, Head Ranger **NB:** With written Surveillance and Enforcement protocols to increase efficiency of patrol effort					
Training of rangers in SE protocols, Forest and Fisheries legislation, collection of evidence etc.	**Responsible:** SNR Manager, Head Ranger					
Increase effectiveness of patrols through ensuring they are fully equipped - improved radio communications and transport for access (including atv)	**Responsible:** SNR Board, SNR Manager					

Natural Resource Management Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Surveillance and enforcement Sub-Programme						
Continue and strengthen liaison and collaboration with police and Forest Department for effective surveillance and enforcement	**Responsible:** SNR Manager, Head Ranger					
Ensure all rangers continue to be trained and certified as special constables	**Responsible:** SNR Manager, Head Ranger					
Ensure, where relevant, that rangers are trained and authorized as Fisheries Officers	**Responsible:** SNR Manager, Head Ranger					
Ensure all SNR regulations are clearly displayed at visitor access areas/visitor centre and HQ offices, and disseminated to relevant stakeholders	**Responsible:** SNR Manager, Head Ranger					
Surveillance of visitors to ensure compliance with regulations	**Responsible:** SNR Manager, Head Ranger **NB:** Includes researchers					
Clarify with communities the role of SNR rangers and relationship with Forest Department and Police Department, as it relates to Wildlife Protection Act, Forest Act and National Protected Areas System Act,	**Responsible:** SNR Manager, Head Ranger, Community Officer **NB:** Community meetings, with review of Green Laws and Fisheries regulations for local leaders and resource users					
Zoning and Boundaries						
Consolidate knowledge of legal boundaries. Ensure on-site confirmation and correction of legal position of land - especially NEC	**Responsible:** SNR Manager, Head Ranger					
Gather information required to identify and implement zones and regulations for effective management in key areas of concern (eg. Xopol, wood stork cayes)	**Responsible:** SNR Manager, Independent researchers					

Natural Resource Management Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Zoning and Boundaries						
If considered necessary, develop a Public Use Plan with integrated zoning for more effective visitor management	**Responsible:** SNR Manager					
Identify and demarcate boundaries at major legal and illegal entry points and areas of conflict	**Responsible:** SNR Manager, Head Ranger					
Construct boundary barriers at legal and illegal entry points and areas of conflict	**Responsible:** SNR Manager, Head Ranger					
Management of Conservation Targets						
Integrate identification, geo-referencing and documentation of archaeological structures into patrols and patrol reporting	**Responsible:** SNR Manager, Head Ranger					
Ensure effective surveillance of Yucatan dry forest areas to prevent extraction of the kuka palm (*P. sargentii*) and all other threatened endemic species and non-timber forest products	**Responsible:** SNR Manager, Head Ranger					
Lobby for establishment of local Wildlife Conflict Response Team in collaboration with Forest Department, Panthera and local conservation organizations to respond to / address wildlife conflicts in stakeholder area	**Responsible:** SNR Manager **NB:** Including jaguars					
Map bird nesting congregations within SNR	**Responsible:** Head Ranger					
Effectively protect wood stork and other bird nesting sites and populations within the pa	**Responsible:** Head Ranger					
Annual overflight to check on proximity of Mennonite farmland to lagoon watershed	**Responsible:** SNR Manager, Head Ranger					

Natural Resource Management Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Management of Conservation Targets						
Increase awareness of Little Belize and other communities of importance of maintaining watershed qualities	**Responsible:** SNR Manager, Community Officer					
Liaise with DoE and Dept of Agriculture and pesticide Control Board in cases where water contamination is detected	**Responsible:** SNR Manager					
Community level information on hunting seasons and legislation through meetings posters and leaflets	**Responsible:** SNR Manager, Head Ranger, Community Officer					
Lobby for Forest Dept / Fisheries Dept presentations in schools on legislation	**Responsible:** SNR Manager, Head Ranger, Community Officer					
Work with farmers to establish hardwood trees – reforestation programme	**Responsible:** SNR Manager, Community Officer					
Establish hardwood tree nursery at Mahogany Park	**Responsible:** SNR Manager					

3.5.2 Research and Monitoring Programme

Vision: To increase management effectiveness and biodiversity conservation through targeted research and monitoring

Management Goals:

- To establish an effective framework for research and monitoring
- To ensure priority baseline information is available on the natural resources for effective management decision-making
- To identify and prioritise functional research required for management decisions
- To ensure effective data management
- To provide an environment for research

A number of priority research and monitoring gaps have been identified by management and staff during management planning:

- Inclusion of key indicator species sightings in all patrol reports
- Mapping of species distributions (in collaboration with Wildtracks)
- Investigation of visitor impacts on wildlife at the Xo-Pol area and the wood stork nesting islands
- Comprehensive records of nesting bird colonies
- Mapping of archaeological structures
- Updated socio-economic assessment of stakeholder communities

Research and Monitoring Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Research and Monitoring						
Develop and Implement a Research and Monitoring Plan with identified research and monitoring priorities	**Responsible:** SNR Manager					
Ensure staff are aware of the value of research and environmental monitoring, and engage them in research and monitoring activities	**Responsible:** SNR Manager, Head Ranger					
Standardise system for in-house approval of research proposals	**Responsible:** Board Members, SNR Manager					
Provision of basic research accommodation facilities	**Responsible:** Board Members, SNR Manager **NB:** In Infrastructure Plan					
Provision of basic lab facilities	**Responsible:** Board Members, SNR Manager **NB:** In Infrastructure Plan					
Develop a research 'package' for researchers and University groups, detailing accommodation, logistical support, etc.	**Responsible:** Board Members, SNR Manager					
Develop / revise guidelines for visiting researchers, with post-research follow through and report submission process	**Responsible:** Board Members, SNR Manager					
Establish/strengthen links with foreign universities and other research organisations	**Responsible:** Board Members					
Facilitate local student research programmes / UB / Galen	**Responsible:** Board Members, SNR Manager					
Standardized system for research permits from FD	**Responsible:** Board Members, SNR Manager					

Research and Monitoring Programme						
Management Activity	Notes	Year				
		1st	2nd	3rd	4th	5th
Data Management						
Employ Research Coordinator	**Responsible:** SNR Board, SNR Manager					
Develop an integrated database for all research, monitoring and socio-economic data, in collaboration with other conservation organizations in the north east Belize area	**Responsible:** SNR Manager					
Strengthen cross linkages with other organisations involved in research and monitoring within northern Belize	**Responsible:** SNR Manager					
Develop data sharing agreement with researchers	**Responsible:** SNR Board, SNR Manager, Research Coordinator					
Ensure that monitoring data is incorporated into SNR management policies and decisions	**Responsible:** SNR Manager, Research Coordinator					
Integrate environmental monitoring information into annual reports and interpretive materials	**Responsible:** SNR Manager, Research Coordinator					
Send biodiversity info to BERDs	**Responsible:** SNR Manager, Research Coordinator					
Ensure biodiversity information is readily available for staff and visiting researchers	**Responsible:** SNR Manager, Research Coordinator					
Ensure researchers submit their raw data to the database, where applicable – before departure	**Responsible:** SNR Manager, Research Coordinator					
Repatriate reports and data from previous research	**Responsible:** SNR Board, SNR Manager, Research Coordinator					

Research and Monitoring Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Conservation Targets						
Assess populations of white lipped and collared peccary	**Responsible:** Research Coordinator					
Assess populations of wood storks	**Responsible:** Research Coordinator					
Monitor migratory bird use	**Responsible:** Research Coordinator					
Monitor hunted turtle species within SNR	**Responsible:** Research Coordinator					
Baseline mapping of archaeological sites and looting activity	**Responsible:** Head Ranger, Research Coordinator					
Baseline and implementation of long term monitoring of water parameters of Shipstern Lagoon	**Responsible:** SNR Manager, Research Coordinator					
Inventory, mapping and monitoring of mahogany within Shipstern Nature Reserve	**Responsible:** SNR Manager, Research Coordinator					
Inventory, mapping and monitoring of kuka palm within Shipstern Nature Reserve	**Responsible:** SNR Manager, Research Coordinator					
Monitor local community use of the protected area (both legal and illegal)	**Responsible:** SNR Manager, Head Ranger, Community Officer					
Monitoring for climate change – water level, O_2 levels etc.	**Responsible:** SNR Manager, Research Coordinator					
Monitor jaguar populations and assess jaguar depredation reports from adjacent communities	**Responsible:** SNR Manager, Research Coordinator, Community Officer					
Other functional research and monitoring						
Active recruitment of researchers to fill prioritised baseline and monitoring gaps highlighted by management plan	**Responsible:** SNR Manager, Research Coordinator					

Research and Monitoring Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Other functional research and monitoring						
Fire risk assessment of ecosystems and critical areas within SNR, with mapping of areas vulnerable to fire	**Responsible:** SNR Manager, Research Coordinator, Head Ranger					
Identify ecologically vulnerable areas within the Nature Reserve and ensure these are integrated into Public Use planning	**Responsible:** SNR Manager, Research Coordinator					
Monitor tourism impact on natural resources – Xo-Pol and Wood Storks and bat caves	**Responsible:** SNR Manager, Research Coordinator					
Installation of a meteorological station and collection of meteorological data and make data available to visiting researchers	**Responsible:** SNR Manager, Research Coordinator					
Develop baseline and monitoring system for climate change	**Responsible:** Research Coordinator					
Develop and implement monitoring of SNR tourism impact on the local economy	**Responsible:** SNR Manager, Research Coordinator, Community Officer					
Assessment of tourism impacts on wood storks and Xo-Pol area	**Responsible:** SNR Manager, Research Coordinator					

3.5.3 Community Engagement and Outreach Programme

Vision: To increase short, medium and long term socio-economic benefits for stakeholder communities, with increased community engagement and support.

Management Goals:

- To increase general awareness of Shipstern Nature Reserve and its role within the local and national landscape
- To build understanding of the importance of biodiversity conservation in local stakeholder communities
- Reduction of pressure on the natural resources of Shipstern Nature Reserve through increased socio-economic opportunities and promotion of sustainable development
- Increased communication with community stakeholders

Community Engagement and Outreach Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
General						
Develop and implement a Community Engagement and Participation Plan	**Responsible:** SNR Manager, Community Officer **Integrate:** ▪ Identify stakeholder awareness gaps ▪ Identify and implement mechanisms for strengthening stakeholder engagement ▪ Socio-economic assessment with focus on SNR with input from past assessments					
Education and Outreach						
Build understanding and support of the SNR objectives in the stakeholder communities	**Responsible:** Community Officer					
Work with other local organizations to build local recognition of protected area benefits	**Responsible:** Community Officer					
Develop and implement more active local community school programme for primary level, complimenting National Curriculum, and extending to secondary level schools within the area	**Responsible:** Community Officer					
Work with St. Viator - develop botanic trail	**Responsible:** Community Officer					
Start hardwood tree nurseries at schools	**Responsible:** Community Officer					
Produce and disperse education materials on general wildlife conservation issues, hunting / fishing regulations, pets, logging	**Responsible:** Community Officer **NB:** In liaison / collaboration with Forest and Fisheries Departments					
Regular update on SNR activities – radio / flyers	**Responsible:** Community Officer					

Community Engagement and Outreach Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Sustainable Development						
Encourage use of Shipstern by tourism stakeholders, with site-level training for local licensed tour guides	**Responsible:** Community Officer					
Provide information on the biodiversity of Shipstern Nature Reserve to local tour guides	**Responsible:** Research Coordinaotr, Community Officer					
Provide support for local sustainable development initiatives within local communities	**Responsible:** Community Officer					
Promote income generation activities for local farmers through forestry initiatives	**Responsible:** Community Officer					
Promote tourism initiatives in stakeholder communities	**Responsible:** Community Officer					
Increase tourism use of stakeholder communities through increased international marketing	**Responsible:** SNR Manager					
Participation						
Strengthen mechanisms for community input into management decisions	**Responsible:** SNR Manager, Community Officer					
Bi-annual information sharing workshop for stakeholder communities, raising awareness of SNR and the economic and environmental values it gives	**Responsible:** SNR Manager, Community Officer					

3.5.4 Public Use Programme

Vision: To provide tourism and educational opportunities, with high visitor satisfaction and increased socio-economic benefits to stakeholder communities

The Public Use Programme covers the following areas:

- To ensure effective management of tourism and educational use
- To ensure minimized visitor impacts through effective visitor rules and regulations
- To provide and educational environment for all visitors
- To promote use of Shipstern Nature Reserve by local tour guides
- To ensure visitor safety and protection

Public Use Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Public Use Program						
Develop protocols and training program for hosting different visitor groups and train staff in 'meet and greet;	**Responsible:** SNR Manager, Community Officer					
Develop and display visitor regulation at visitor access areas	**Responsible:** SNR Manager, Head Ranger, Community Officer					
Ensure enforcement of regulations for tourists regarding noise pollution and garbage	**Responsible:** Head Ranger					
Development of clear tour guide guidelines for local tour guides, including a ban on machetes.	**Responsible:** SNR Manager, Head Ranger, Community Officer					
Ensure that data on visitation and public use is available to assist in management decisions	**Responsible:** SNR Manager, Research Coordinator					
Establish a Public Use database to manage visitor data	**Responsible:** SNR Manager, Research Coordinator					
Monitor visitor satisfaction	**Responsible:** SNR Manager, Research Coordinator					
Develop basic Limits of Acceptable Change and monitor tourism impacts on environment	**Responsible:** SNR Manager, Research Coordinator **NB:** With the assistance of a consultant					
Tour guide workshop – specialised Shipstern Tour	**Responsible:** Community Officer, Research Coordinator					
Re-evaluate use of Xo-Pol and wood stork nesting islands as visitor destinations	**Responsible:** SNR Manager, Research Coordinator **NB:** With assistance of independent research					

Public Use Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Public Use Program						
Develop and Implement Tourism Development and marketing plan	**Responsible:** SNR Manager, Independent consultant					
Visitor Education / Interpretation						
Further develop interpretive trail system for botanical trail, associated interactive trail points and educational literature	**Responsible:** SNR Manager, Research Coordinator, Community Officer					
Construct new, purpose built visitor centre	**Responsible:** SNR Board, SNR Manager					
Construct new educational butterfly exhibit	**Responsible:** SNR Board, SNR Manager					
Develop checklist of mammals and birds of Shipstern	**Responsible:** Research Coordinator					
Develop field guide to wildlife of Shipstern	**Responsible:** Research Coordinator					
Construction of information displays at Iguana Camp and Shipstern landing	**Responsible:** SNR Manager, Research Coordinator					
Visitor Safety and Protection						
Develop and implement safety guidelines and ensure visitor awareness (including researchers)	**Responsible:** SNR Board, SNR Manager					
Ensure that SNR liability issues are reduced through careful planning	**Responsible:** SNR Board, SNR Manager					
Establish a disclaimer form for visitors – can develop entrance tickets with disclaimer statement at back of ticket	**Responsible:** SNR Board, SNR Manager					
Ensure tower and bird houses meet visitor safety requirements	**Responsible:** SNR Board, SNR Manager					

Public Use Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Visitor Safety and Protection						
Clearly display safety regulations on observation tower, including maximum capacity	**Responsible:** SNR Manager					

3.5.5 Infrastructure Management Programme

Vision: To ensure that the necessary infrastructure and equipment is in place for the support of management activities within Shipstern Nature Reserve.

Management Goals:

- To implement the Infrastructure Upgrade Plan
- To ensure maintenance of staff and visitor facilities
- To ensure necessary equipment is in place for effective management of Shipstern Nature Reserve
- To ensure the necessary vehicles / boats are in place for effective management of Shipstern Nature Reserve

Site and Infrastructure Management Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
General Equipment / Infrastructure Issues						
Ensure SNR Infrastructure Upgrade Plan is integrated into annual workplans	**Responsible:** SNR Manager					
Ensure adequate signage for boundaries	**Responsible:** SNR Manager, Head Ranger					
Maintain infrastructure, signs and road monuments	**Responsible:** SNR Manager, Head Ranger					
Construct barriers at entry points – NBC, Xopol, Mahogany Park	**Responsible:** SNR Manager, Head Ranger					
Lobby for upgrade of Xcopen road	**Responsible:** SNR Manager					
Ensure all buildings are maintained on a regular basis	**Responsible:** SNR Manager					
Ensure all buildings are constructed / adapted to withstand hurricane force winds	**Responsible:** SNR Manager					
Ensure staff have adequate equipment for effective management	**Responsible:** SNR Manager					
Ensure all equipment is maintained on a regular basis	**Responsible:** SNR Manager, Head Ranger					
Ensure all staff using equipment are trained in use and maintenance	**Responsible:** SNR Manager, Head Ranger					
Ensure basic first aid equipment is available on site and first aid kits for patrol teams, school visits and tour parties	**Responsible:** SNR Manager, Head Ranger					
Construction – General Infrastructure						
Construct pier at Iguana Camp and Shipstern landing	**Responsible:** SNR Manager, Head Ranger	To Be Determined				
Construct board walk at Southern Boundary / Shipstern landing	**Responsible:** SNR Manager, Head Ranger	To Be Determined				

Site and Infrastructure Management Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Construction - General Infrastructure						
Construct information monuments at Iguana Camp and Shipstern landing	**Responsible:** SNR Manager, Head Ranger	To Be Determined				
Construct new staff house	**Responsible:** SNR Board, SNR Manager	To Be Determined				
Construct and equip new main building (2 floor – office, lab / communal dining area / kitchen, manager's quarters	**Responsible:** SNR Manager	To Be Determined				
Upgrade of Iguana Camp facilities	**Responsible:** SNR Manager, Head Ranger	To Be Determined				
Reconstruction of water tower/water catchment at Iguana Camp, Southern Boundary	**Responsible:** SNR Manager, Head Ranger					
Upgrade of ranger facilities at Southern Boundary	**Responsible:** SNR Manager, Head Ranger					
Construction of Ranger camp site at NBC Link	**Responsible:** SNR Manager, Head Ranger					
Construction - Visitor Facilities						
5 jungle huts to accommodate student groups / researchers	**Responsible:** SNR Manager, Head Ranger	To Be Determined				
Maintain and upgrade current trail system	**Responsible:** Head Ranger					
Upgrade visitor center	**Responsible:** SNR Manager	To Be Determined				
Construct camp sites – HQ, Southern Boundary, Xo-Pol	**Responsible:** SNR Manager, Head Ranger	To Be Determined				
Upgrade/reconstruct visitor bathroom/restrooms	**Responsible:** SNR Manager	To Be Determined				
Construct bathroom/restroom facilities at Xo-Pol, Southern Boundary, Iguana Camp	**Responsible:** SNR Manager, Head Ranger	To Be Determined				
Upgrade/rebuild tree top hides – Xo-Pol	**Responsible:** SNR Manager, Head Ranger	To Be Determined				
Relocation of Main Trail Tree top hide	**Responsible:** SNR Manager, Head Ranger	To Be Determined				

Site and Infrastructure Management Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Construction - Visitor Facilities						
Construction of observation platforms at wood stork colonies	**Responsible:** SNR Manager, Head Ranger **NB:** Dependent on adequate observation distance to ensure minimal disturbance	To Be Determined				
Design and establish a bird and wildlife watching trail system at Southern Boundary and Iguana Camp.	**Responsible:** SNR Manager, Head Ranger	To Be Determined				
Purchase of kayaks for lagoon tours	**Responsible:** SNR Manager	To Be Determined				
Transportation						
Purchase dedicated patrol vehicle / ATVs	**Responsible:** SNR Board, SNR Manager	To Be Determined				
Purchase 2 more 4x4 double cab vehicle	**Responsible:** SNR Board, SNR Manager **NB:** 1 to replace old green Hilux	To Be Determined				
Purchase 2 vans for transportation of tourists/visitors	**Responsible:** SNR Board, SNR Manager	To Be Determined				
Purchase 1 boat for transportation of visitors/tourists on lagoon -	**Responsible:** SNR Board, SNR Manager	To Be Determined				

3.5.6 Administrative Programme

Vision: To ensure that the necessary administration structure is in place for the support of management activities for Shipstern Nature Reserve.

Management Goals:

- To establish and implement an effective planning framework for management of Shipstern Nature Reserve
- To establish and implement effective administration procedures
- To effectively manage human resources, with high staff satisfaction
- To establish and implement health and safety standards and emergency planning
- To effectively communicate with all local, national and international stakeholders
- To ensure effective monitoring and evaluation of management on an annual basis
- To operate with transparency, with effective accounting procedures in place
- To seek mechanisms for greater financial sustainability

Administration Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
General Administration						
Implement 5-year management plan	**Responsible:** SNR Board, SNR Manager					
Conduct annual operational planning / budgets, based on management plan	**Responsible:** SNR Manager					
Conduct an annual review of management and operational plans, and adjust management activities and strategies as necessary	**Responsible:** SNR Board, SNR Manager					
Identify and implement effective mechanisms for advisory input into strengthening management	**Responsible:** SNR Board, SNR Manager					
Strengthen and implement mechanisms for community input into management decisions	**Responsible:** SNR Board, SNR Manager					
Review Strategic Plan on an annual basis	**Responsible:** SNR Board, SNR Manager					
Ensure that all staff are aware of hurricane procedures before start of each hurricane season	**Responsible:** SNR Manager					
Equip and maintain effective office	**Responsible:** SNR Manager					
Human Resources						
Ensure the SNR Best Management Guidelines and Practices manual is updated and all staff are fully aware of its contents and incorporating guidelines and practices into their activities	**Responsible:** SNR Manager					

Administration Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Human Resources						
Provide new staff with an orientation to the SNR Best Management Guidelines and Practices	**Responsible:** SNR Manager					
Build technical capacity of staff in relevant and appropriate areas, following needs assessment	**Responsible:** SNR Manager					
Seek partnerships with local, national and international research partners and volunteers to fill technical and scientific skill gaps	**Responsible:** SNR Board, SNR Manager					
Build technical capacity of staff in relevant and appropriate areas, following needs assessment	**Responsible:** SNR Manager					
Build staff capacity in conflict resolution	**Responsible:** SNR Manager					
Ensure all staff have First Aid training, and a refresher course on an annual basis	**Responsible:** SNR Manager					
Build capacity of staff in hospitality, public relations and visitor interactions	**Responsible:** SNR Manager					
Ensure employment of sufficient staff for effective management of SNR	**Responsible:** SNR Board, SNR Manager					
Develop Disaster Response Plan (fire, hurricanes, medical emergencies)	**Responsible:** SNR Board, SNR Manager, Head Ranger					
Ensure all staff positions are defined by Terms of Reference	**Responsible:** SNR Board, SNR Manager					
Conduct an annual needs assessment	**Responsible:** SNR Manager					

Administration Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Human Resources						
Build capacity of staff through facilitating educational opportunities	**Responsible:** SNR Manager					
Conduct annual Board and staff retreats	**Responsible:** SNR Board, SNR Manager					
Conduct annual team building activities	**Responsible:** SNR Manager					
Ensure staff satisfaction through bonuses, financial renumeration and/or incentives	**Responsible:** SNR Board, SNR Manager					
Strengthen links with other rangers through ranger exchanges – build ranger support network	**Responsible:** SNR Manager, Head Ranger					
Maintain staff insurance	**Responsible:** SNR Board					
Communication						
Develop and implement Communication Plan	**Responsible:** SNR Manager					
Strengthen communication and collaboration with Forest Department, Fisheries Department and Police Dept	**Responsible:** SNR Board, SNR Manager, Head Ranger					
Improve communication with communities and other stakeholders	**Responsible:** SNR Manager, Community Officer					
Develop and disseminate information on Shipstern Nature Reserve posters, 1 page news brief twice a year, annual video update,	**Responsible:** SNR Manager, Community Officer **NB:** Posters, 1 page news brief twice a year, annual video update,					
Upgrade website	**Responsible:** SNR Board, SNR Manager					
Keep and update mailing list / contact details of visitors and partners	**Responsible:** SNR Manager					

Administration Programme						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Communication						
Ensure all patrol and field reports are up to date and submitted to relevant Govt. departments	**Responsible:** SNR Manager, Head Ranger					
Produce and submit Annual Report – to Dept of Human Development	**Responsible:** SNR Board, SNR Manager					
Quarterly reports to Board	**Responsible:** SNR Manager					
Accounting and Financial Sustainability						
Prepare timely financial and management accounts and submit twice monthly	**Responsible:** SNR Board, SNR Manager					
Develop financial sustainability plan for SNR for next five years to set course for economic sustainability	**Responsible:** SNR Board **NB:** With input from consultant					
Identify and assess financial sustainability mechanisms through increased tourism, research group use – cost / benefits, marketing, facilities	**Responsible:** SNR Board **NB:** With input from consultant					
Prepare annual audits	**Responsible:** SNR Board **NB:** With input from auditor					
Develop annual financial donor reports and submit to ITCF, and disseminate to donors	**Responsible:** SNR Board, SNR Manager					
Identify and assess financial sustainability mechanisms	**Responsible:** SNR Board **NB:** With input from consultant					

3.6 Evaluation and Review

Monitoring and evaluation are integral components of any management system and annual evaluations of reserve management are recommended. In the development of this management plan, the action areas are relatively specific, simplifying the process of monitoring success of implementation, and providing a mechanism for continual tracking of management activities, through annual review by the Board members and management staff of Shipstern Nature Reserve.

Management evaluation is also achieved by an assessment of management effectiveness. An initial management effectiveness evaluation was conducted in 2006 (Walker and Walker, 2006), to provide a baseline for assessment, and again in 2009 (Walker and Walker, 2010).

It is suggested that a monitoring and evaluation tracking matrix be developed for the activities under the management programme, following the outline example (Table 21).

Tracking of Management Action Implementation							
Management Actions	**Present Status**	**1st Year**	**2nd Year**	**3rd Year**	**4th Year**	**5th Year**	**Desired Status**
Review the name 'Shipstern Nature Reserve' and potential to revise to be more indicative of IUCN category (National Park)	The term 'Nature Reserve' is used within the NPAS to denote an area under the highest form of protection, which is only accessed for research and education						Shipstern's name is not in conflict with the national objectives for protected area categories under the NPAS
Ensure effective documentation and mapping of resource use (both legal and illegal) within the Shipstern Nature Reserve, and integrate into management decisions	Patrol reports are being kept of all incursions, and visitor data is collected, but a data management system is required to make the information more available for making management decisions						Information on resource use, both legal and illegal, is easily accessible through effective data management and reporting

Table 21: Management Tracking Matrix (Layout Example)

3.7 Timeline

Timelines are incorporated into the management programme tables for all management programmes.

3.8 Financing

Shipstern Nature Reserve, in its current state, is not financially self-sustaining, with the majority of funding being sourced from international donors, through the facilitation of the International Tropical Conservation Foundation. Eighty percent of funding is through individual donations, which support Shipstern Nature Reserve administrative and on-site operational costs. The remaining twenty percent is large grants for specific projects - supporting land purchase and infrastructure development (C. Bijleveld, pers. com.). As a private protected area recognized under the national protected areas system, Shipstern Nature Reserve has also been able to access in-country funds through the Protected Areas Conservation Trust, to assist with strengthening management and community engagement. Collaborating with other management organizations at the system-level may provide greater access to grant funding opportunities such as this in the short and medium term.

In the long term, Shipstern Nature Reserve needs to develop greater financial sustainability, reducing its dependence on grants. Increasing tourism visitation to the protected area may provide funds for some programme activities, but it is also recommended that the viability of engaging in a payment for environmental services or carbon sequestration scheme is explored in detail, either at site level, or at landscape level. This may have the potential to provide financing for all site-level long-term operational costs.

References

Bartschi David (2000). A study of the Chiroptera of Shipstern Nature Reserve and North-Eastern Belize (Central America) together with their ectoparasites (*streblidae, Nycterophiliinae, Acarina)* and endoparasites *(Cestoda, Nematoda, Trematoda, Acanthocephala).* An occasional publication of the International Tropical Conservation Foundation.

Bayly, N.J. & Gomez, C. (2008). Evaluating a stepping stone for Neotropical migratory birds – the Belizean north- east biological corridor. Final Report to Belize Forestry Department, Belmopan, Belize (Nov 2008).

Belize Tourism Board (2008). Travel and Tourism Statistics 2008. Belize Tourism Board.

Bersot V. (2003). Small mammal inventory in the Shipstern Nature Reserve (Corozal District, Belize, Central America), a preliminary assessment.

Bijleveld C.F.A. (1990). Freshwater fishes of Shipstern Nature Reserve. International Tropical Conservation Foundation.

Bijleveld C.F.A. (1998). The vegetation of Shipstern Nature Reserve – A structural and floristic approach. International Tropical Conservation Foundation.

Bunyan J. and Kilshaw K. (2007). Assessment of population density and structure of mammal assemblages in NE Belize based on camera trapping studies.

Cherrington et. al., (2010)

CIA (2010)

Conservation International (2003)

Cornec, 2002

Edgar, P. (2000). The Herpetofauna of the Fireburn Reserve. Wildtracks.

Francisco, D. & Hoare, A. D. (2009) Belize. Pp 85 – 90 in C. Devenish, D. F. Díaz Fernández, R. P. Clay, I. Davidson & I. Yépez. Zabala Eds. *Important Bird Areas Americas - Priority sites for*

biodiversity conservation. Quito, Ecuador: BirdLife International (BirdLife Conservation Series No. 16).

Everatt K., Andresen L. and Kelly M. (2010). Jaguar (*Panthera onca*) abundance and density for the Fireburn Reserve and Balam Na Jungle Estate in northern Belize using photographic capture-recapture sampling.

Flores, G. 1952, Geology of Northern British Honduras. American Association of Petroleum Geologists, Vol. 36, no 2.

Henderson, A. et al. (1995). Field Guide to the Palms of the Americas. Princeton University Press.

Friesner Jon (1993). Hurricanes and the forests of Belize, Forest Department, Government of Belize

Greenfield D. and Thomerson J.E. (1997). Fishes of the Continental Waters of Belize. University Press of Florida.

Government of Belize (1948). Fisheries Act

Government of Belize (1986). PACT Act

Government of Belize (1989). Forest (Protection of Mangrove) Regulations. SI 52 of 1989

Government of Belize (1982). National Parks System Act

Government of Belize (1982). Wildlife Protection Act

Government of Belize (1992). Environmental Protection Act

Government of Belize (1992). National Lands Act

IUCN Red List (Downloaded 2010)

Jacobs, N. and A. Castenada (1998). The Belize National Biodiversity and Action Plan. Ministry of Natural Resources and the Environment, Belize.

Jones H. L. (2003). Birds of Belize. University of Texas Press. ISBN: 0-292-74066-2

Jones H. L., and A.C. Vallely (2001). Annotated Checklist of the Birds of Belize. Lynx Ediciones. ISBN 84-87334-35-0

King, R.B. et al. (1992). Land Resource Assessment of Northern Belize. Natural Resources Institute, Bulletin 43. Vols. I & II.

Laesser J. (2007). Birds of Shipstern Nature Reserve and the Sartenejan region. Census 2002 – 2003.

Lara, M.E. (1993). Divergent wrench faulting in the Belize Southern lagoon: Implications for tertiary Caribbean Plate movements and Quaternary Reef Distribution. American Association of Petroleum Geologists Bulletin, Vol. 77

Lee, J.C. (1996). The Amphibians and Reptiles of the Yucatan Peninsula. Cornell University Press, Ithaca, NY.

MacLeod, N. and Holland, B. (1998). NHM Paleontological investogations in Belizean update. The newsletter for the Las Cuevas Research Station (Belize). No. 2.

Maskell, L. (1998). The Plants of Fireburn Reserve, Corozal District, Belize. – A Species List and Field Guide. Wildtracks.

Maskell, L. (2000). The Vegetation of Fireburn Reserve, Corozal District, Northeast Belize. Wildtracks.

Maskell, L. (2000). Plant Species of the Fireburn Area (Provisional species list). Wildtracks.

Meerman J. (1991). The Status of Crocodiles in the Eastern Corozal District.

Meerman J. (1993). Biodiversity of the Shipstern Nature Reserve. Occasional Papers of the Belize Natural History Society. Volume 2. Nos. 1 – 11.

Meerman, J. (1993). The Woodstork colonies of the northeastern Corozal Distric, Belize. 1991 and 1992 seasons, including a report on other bird colonies in the Chetumal Bay area.

Meerman, J.C. (1993). Provisional Annotated Checklist of the Flora of the Shipstern Nature Reserve. Occ. Papers of The Belize Natural History Society, Vol 2.

Meerman, J.C. (1993). Fish of the Shipstern Nature Reserve. Occ. Papers of The Belize Natural History Society, Vol 2.

Meerman, J.C. (1993). Checklist of the Reptiles and Amphibians of the Shipstern Nature Reserve. Occ. Papers of The Belize Natural History Society, Vol 2.

Meerman, J.C. (1993). Checklist of the Birds of the Shipstern Nature Reserve. Occ. Papers of The Belize Natural History Society, Vol 2.

Meerman, J.C. (2000). Feasibility Study of the Proposed Belize Biological Corridors Project (NBBCP). Programme for Belize.

Meerman, J.C. & Sabido, W. (2001). Central American Ecosystems Map: Belize. Vols. I & II. Programme for Belize.

Meerman, J. C. (2005). Ecosystems Map of Belize – 2004 edition: http://biological-diversity.info

Miller, Bruce (2003). Community Ecology of the Non-phyllostomid bats of Northwestern Belize,with a landscape level assessment of the bats of Belize. Thesis, Durrell Institute of Conservation and Ecology, University of Kent

Miller B. and C. Miller (2007). The Belize Important Bird Areas Project Birdlife International / Belize Audubon Society

Miller, K. et al. (2001). Defining Common Ground for the MesoAmerican Biological Corridor. World Resources Institute.

Morgenthaler A. (2003). Ecology of the Black Catbird, *Melanoptila glabrirostris*, at Shipstern Nature Reserve (Belize), and distribution in Yucatan.

Nardini Y. (2010). Pedological Study of Shipstern Nature Reserve, Northern Belize, Central America - An Overview of Soil-Vegetation Relationships.

NARMAP (1995). National Protected Areas System Plan for Belize

Nguyen Quang Minh N. (2005). Estimates of the herpetofaunal diversity in the Shipstern Nature Reserve.

Placid Oil Company, (1982). Final well report Shipstern 1, Library of the Geology and Petroleum Department, Belmopan

Reid, F.A. (1997). A Field Guide to the Mammals of Central America and Southeast Mexico. Oxford University Press.

de Rham P. (1990). Freshwater fishes and aquatic ecosystems (Summary Report).

Roeder G. (2003). Coleopteran biodiversity of Shipstern Nature Reserve in Belize, with a comparison of the fauna of two tropical forest types.

Salas, O. (2010). Shipstern Nature Reserve Strategic Plan

Sarteneja Alliance for Conservation and Development (2009) Sarteneja Tourism Development Plan.

Sayer E. and D. M. Newbery (2003). The role of tree size in the leafing phenology of a seasonally dry tropical forest in Belize, Central America. *Journal of Tropical Ecology* (2003) 19:539–548

Shipstern Nature Reserve (2009). Infrastructure Upgrade Plan.

Stafford, P.J. & Meyer J.R. (2000). A Guide to the Reptiles of Belize. Academic Press.

Standley, P.C. & Record, S.J. (1936). The Forests and Flora of Briitish Honduras. Field Museum of Natural History, Chicago. Public. 350

Vreugdenhil, Daan, Jan Meerman, Alain Meyrat, Luis Diego Gómez, and Douglas J. Graham. (2002). Map of the Ecosystems of Central America: Final Report. World Bank, Washington, D.C.

Walker, P. (1988). The Herpetofauna of Shipstern Wildlife Reserve. Shipstern Wildlife Reserve Newsletter Vol. 1.

Walker, P. (2001). A Revised and Updated Checklist of the Herpetofauna of Shipstern Nature Reserve. Wildtracks.

Walker, Z. (1988). The Mammals of Shipstern Wildlife Reserve. Shipstern Wildlife Reserve Newsletter Vol. 1.

Walker, Z. (2001). The Fish of the Progresso Lagoon Watershed - A Rapid Environmental Assessment. Wildtracks.

Walker, Z. (2001). The Mammals of the Progresso Lagoon Watershed - A Rapid Environmental Assessment. Wildtracks.

Walker, Z. (2002). The Fish of the Fireburn Reserve - A Rapid Environmental Assessment on the Fireburn Area. Wildtracks.

Walker Z. et. al. (2002). Warree Bight Environmental Impact Assessment.

Walker Z. and P, Walker (2004). Balam Jungle Estate – Biodiversity Report.

Walker Z. and P. Walker (2006). National Report on Management Effectiveness. August 2006. For Forest Department

Walker Z. and P, Walker (2009). Shipstern Nature Reserve – Management Effectiveness Assessment, 2009

Walker Z. and P, Walker (2010). National Report on Management Effectiveness. 2010. For APAMO

Young R., L. Wolfe and V. Macfarlane (2005). Monitoring Management Effectiveness in Belize's Protected Areas. NPAPSP.

Zisman, S. (1997). Mangroves in Belize: Their Characteristics, Use and Conservation. FPMP – Mangrove Specialists Report, Natural Resources Institute, ODA.

Annex One: Species Lists

Plant Species of Shipstern Nature Reserve

Family	Species	
Acanthaceae		*Aphelandra sp.*
		Blechum pyramidatum
	Hulub	*Bravaisia berlandieriana*
		Ruellia sp.
		Ruellia nudiflora
Agavaceae		*Beaucarnea pliabilis*
Amarylidaceae		*Hymenocallis latifolia*
Anacardiaceae	Black Poisonwood, Chechem	*Metopium brownei*
		Spondias purpurea
	Hogplum	*Spondias radlkoferi*
Annonaceae		*Guateria diospyroides*
	Elemui	*Sapranthus campechianus*
	Polewood	*Xylopia frutescens*
Apocynaceae	White poisonwood	*Cameraria latifolia*
		Echites yucatanensis
	Milk Tree	*Lacmellea standleyi*
		Pentalinon andrieuxii
	Wild frangipani, flor de mayo	*Plumeria obtusa*
		Prestonia mexicana
		Rhabdadenia biflora
	Horse balls	*Tabernaemontana alba*
		Thevetia gaumeri
Araceae	Heart vine	*Philodendron hederaceum*
Araliaceae	Mano de lion, White Chaca	*Dendropanax arboreus*
Arecaceae	Tasiste	*Acoelorraphe wrightii*
	Supa palm, coco-yol	*Acrocomia aculeata*
	Cohune	*Attalea cohune*
	Bamboo palm, Xate	*Chamaedorea seifrizii*
		Coccothrinax argentata

Family	Species	
Arecaceae		*Colpothrinax cookii*
	Escoba palm	*Cryosophila stauracantha*
Arecaceae	Bayal, basket tie tie, stay-a-while	*Desmoncus orthacanthos*
		Pseudophoenix sargentii
	Bay-leaf, Botan	*Sabal mauritiiformis*
	Wano, Botan, Bay-leaf	*Sabal yapa*
	Chit	*Thrinax radiata*
Aristolochiaceae	Contribo vine	*Aristolochia maxima*
	Small leaf guaco	*Aristolochia pilosa*
Asclepiadceae	Asclepias	*Asclepias curassavica*
Asteraceae		*Bidens pilosa*
		Bidens squarrosa
		Koanophyllon albicaule
		Mikania cordifolia
		Tuberostylis rhizophorae ??
Bataceae		*Batis maxima*
Bignoniaceae		*Arrabidaea floribunda*
		Arrabidaea pubescens
		Arrabidaea sp.
		Certatophytum tetragonolobum
		Clytostoma sp.
	Calabash	*Crescentia cujete*
		Cydista diversifolia
		Macfadyenaunguis-cati
		Pleonotoma diversifolium
		Tabebuia chrysantha
Bombacaceae		*Ceiba aesculifolia*
		Pseudobombax ellipticum
	Guayabillo, Batidos	*Quararibea funebris*
Boraginaceae	Zericote	*Cordia dodecandra*
	Cordia	*Cordia sebestena*
Bromeliaceae		*Aechmea magdalenae*

	Bromeliad (red-flowering)	*Aechmea sp.*
Family	**Species**	
Burseraceae	Gumbo limbo	*Bursera simaruba*
	Copal	*Protium copal*
Cactaceae		*Selincereus sp.1*
		Selenicereus sp. 2
Cecropiaceae	Trumpet, Warumo	*Cecropia peltata*
Celastracaea		*Crossopetalum gaumeri*
		Elaeodendron xylocarpum
		Wimmeria bartlettii
Chenophodiacaea		*Salicornia perennis*
Chrysobalanaceae	Cocoplum	*Chrysobalanus icaco*
Clusiaceae	Santa maria	*Calophyllum brasiliense*
		Clusia sp.
Combretaceae	Bullet Tree, Pucte	*Bucida buceras*
		Bucida spinosa
	Buttonwood	*Conocarpus erecta*
	White Mangrove	*Laguncularia racemosa*
Commelinaceae		*Callisia repens*
	Rhoeo	*Tradescantia spathacea*
Convolvulaceae		*Ipomoea alba*
		Ipomoea sp.
		Ipomaea violacea
		Merremia cissoides
Cyperaceae	Sawgrass	*Cladium jamaicense*
	Freshwater reed	*Eleocharis geniculata*
		Fimbristylis spadacea
		Rhynchospora floridensis
Dennstaedtiaceae		*Acrostichum aureum*
	Pteridium, Bracken	*Pteridium caudatum*

Family	**Species**	
Dioscoreaceae	Chiny yam	*Dioscorea sp.*
Ebenaceae		*Diospyrus salicifolia*
Erythroxylaceae		*Erythroxylum guatemalense*
		Erythoxylum rotundifolium
Euphorbiaceae		*Chamaesyce prostrata*
	Chaya	*Cnidosculus souzae (?)*
		Croton niveus
		Croton spp.
		Dalechampia scandens
		Euphorbia schlechtendalii
		Gymnanthes lucida
		Jatropha gaumeri
		Jatropha urens
		Pedialanthus deamii
		Phyllanthus mocinianus
		Plukenetia angustifolia
		Poinsettia cyathophora
		Sebastiana adenophora
		Tragia yucatanensis
Fabaceae		
Caesalpinioideae		*Bauhinia divarica*
		Bauhinia glabra
	Wild Bauhinia	*Bauhinia jenningsii*
	Warree wood	*Caesalpinia gaumeri*
	Bukut, Stinking toe	*Cassia grandis*
		Cassia undulata
		Chamaecrista nictitans
		Senna atomaria
		Senna cobanensis
		Senna peralteana
Mimosoideae	Subin	*Acacia collinsii*
	Wild tamarind	*Acacia dolichostachya*
		Acacia gaumeri
Family	**Species**	
Mimosoideae	Guanacaste, Tubroos	*Enterolobium cyclocarpum*

	Salam	*Lysiloma latisiliquum*
	Catzim	*Mimosa bahamensis*
	Sensitive weed	*Mimosa pudica*
	xo-coy, red fowl	*Pithocellobium keyense*
		Sphinga platyloba
		Zygia cognata
Papilionoideae	Billy webb	*Acosmium panamense*
	Bastard cabbage bark, carbon	*Andira inermis*
	Kibix	*Dalbergia glabra*
	Strongback	*Desmodium sp.*
	Suzuk, wild ruda	*Diphysa carthaginensis*
		Erythrina standleyana
	Madre de Cacao	*Gliricidia sepium*
	Cabbage Bark, machich	*Lonchocarpus castilloi*
		Lonchocarpus rugosus
		Lonchocarpus yucatanensis (?)
		Machaerium floribundum
		Mucuna pruriens
	Habin, Dogwood	*Piscidia piscipula*
	Granadillo	*Platymiscium dimorphandrum*
		Sesbania emerus
		Sophora tomentosa
	Catalox, yura-sangre, bastard tambran	*Swartzia cubensis*
Flacourtiaceae		*Casaeria sp.*
		Laetia thamnia
	Water Wood, Tamai, John Crow Wood	*Zuelania guidonia*
Gleicheniaceae		*Eustoma exaltatum*
		Voyria parasitica
Hippocrateaceae		*Hemiangium excelsum*
Lauraceae		*Nectandra coriacea*
		Nectandra salicifolia
		Nectandra sp.
Loganiaceae	Chicoloro	*Strychnos panamensis*
Family	**Species**	
Loranthaceae	Mistletoe	*Psittacanthus pinicola*

Malpighiaceae		*Bunchosia lindeniana*
		Bunchosia swartziana
	Craboo	*Byrsonima bucidifolia*
		Dicella sp.
		Heteropterissp.
		Hiraea reclinata
		Malpighia emarginata
		Malpighia lundellii
		Stigmaphyllon ellipticum
		Tetrapterys schiedeana
Malvaceae		*Gossypium hirsutum*
	Majua	*Hampea trilobata*
		Hibiscus clypeatus
	Turk's cap hibiscus	*Malvaviscus arboreus*
		Sida acuta
Meliaceae	Spanish cedar	*Cedrela odorata*
	Mahogany	*Swietenia macrophylla*
Menispermaceae		*Cissampelos pereira*
		Hyperbaena winzerlingii
Moraceae	Ramon, Breadnut	*Brosimum alicastrum*
		Ficus citrifolia
		Ficus popenoei
		Ficus triogonata
		Ficus sp.
		Maclura tinctora
Myricaceae	Teabark	*Myrica cerifera*
Myrtaceae		*Calyptranthes pallens (?)*
		Eugenia acapulcensis
		Eugenia buxifolia
		Eugenia capuli (?)
		Eugenia rhombea (?)
		Psidium guineense
Family	**Species**	
Myrtaceae		*Psidium sartorianum (?)*

Ochinaceae		*Ouratea lucens*
		Ouratea nitida
Orchidaceae	Lady of the night orchid	*Brassavola nodosa*
	Catasetum	*Catasetum integerrimum*
		Encyclia belizensis
	Butterfly orchid	*Epidendrum nocturnum*
		Habenaria sp.
	Cow-horn orchid	*Myrmecophila tibicinis*
		Oncidium ascendens
		Oncidium sphaelatum
		Polystachya sp.
		Psygmorchis pusilla
		Vanilla planifolia
Passifloraceae	Granadillo	*Passiflora biflora*
	Passionflower	*Passiflora foetida*
		Passiflora rovirosae
	Passionflower	*Passiflora serratifolia*
	Narrow-leaved batwing	*Passiflora xiikzodz*
Piperaceae	Cowfoot, Xmacolan	*Piper auritum*
	Cordoncillo	*Piper hispidum*
Poaceae		*Lasiacis divaricata*
		Olyra sp.
Polygalaceae		*Securidaca diversifolia*
Polygonaceae		*Coccoloba acapulcensis*
		Coccoloba barbadensis
	Bob	*Coccoloba belizensis*
		Coccoloba reflexiflora
		Coccoloba spicata
		Coccoloba sp.
	Canelita	*Gymnopodium floribundum*
		Neomillspaughia emerginata
Family	**Species**	
Rhizophoraceae	Bastard waterwood	*Cassipourea guianensis*

	Red Mangrove	*Rhizophora mangle*
Rubiaceae		*Asemnantha pubescens*
	Glassy wood	*Guettarda combsii*
		Guettarda elliptica
	Polly red head, Ixcanan	*Hamelia patens*
		Hintonia octomera
		Morinda royoc
		Psychotria nervosa
		Randia aculeata
		Randia armata
		Randia truncata
Rutaceae	Naranjillo, Candle wood, Verde lucero	*Esenbeckia pentaphylla*
		Peltostigma ptelioides
		Picramnia sp.
	Prickly yellow	*Zanthoxylum caribaeum*
Sapindaceae		*Cupania dentata*
		Exothea diphylla
		Matayba apetala
		Serjania adiantoides
		Serjania yucatanensis
		Talisia oliviformis
Sapotaceae	Chiceh	*Chrysophyllum mexicanum*
	Sapote	*Manilkara zapota*
	Mammee cerillo	*Pouteria campechiana*
	Mamey apple	*Pouteria sapota*
		Sideroxylon americanum
		Sideroxylon salicifolium
		Sideroxylon persimile
Simaroubaceae	Negrito	*Simarouba glauca*
Smilacaceae		*Smilax spinosa*
		Smilax cumaneusis
	Chinee yam, Chinee root	*Smilax sp*
Family	**Species**	
Solanaceae		*Solanum donianum*

	Solanum	*Solanum sp.*
Sterculiaceae		
	Bay cedar, pixoy	*Guazuma ulmifolia*
	Red-flowering pixoy	*Helicteres guazumifolia*
Theaceae		
		Ternstoemia tepezapote
Theophrastaceae		
	Xcansic, Jacquinia	*Jacquinia macrocarpa*
Tiliaceae		
		Corchorus siliquosa
	copper-leaf Luehea	*Luehea sp.*
Ulmaceae	Bastard bay cedar	*Trema micrantha*
Verbenaceae	Black Mangrove	*Avicennia germinans*
	Lantana, Oregano del monte	*Lantana camara*
	Petrea	*Petrea volubilis*
	Stachytarpheta	*Stachytarpheta jamaicensis*
		Stachytarpheta sp.
	Yaxnik	*Vitex gaumeri*
Violaceae		*Rinorea guatamalensis*
Viscaceae		*Phoradendron robustissimum*
Vitaceae		*Cissus gossypiifolia*
	Water vine	*Vitis tiliifolia*
Vochysiaceae		*Vochysia sp.*
Zamiaceae	Palmita	*Zamia polymorpha*

Mammals of Shipstern Nature Reserve

Family	Species		IUCN Status
Didelphimorpha			
Didelphidae	Virginia Opossum	*Didelphis virginiana*	
	Common Opossum	*Didelphis marsupialis*	
	Grey Four-eyed Opossum	*Philander opossum*	
	Mexican Mouse Opossum	*Marmosa mexicana*	
Chiroptera			
Emballonuridae	Greater White-lined Bat	*Saccopteryx bilineata*	
	Lesser Sac-winged Bat	*Saccopteryx leptura*	
	Common Tent-making Bat	*Uroderma bilobatum*	
	Argentine Brown Bat	*Eptesicus furinalis*	
	Southern Yellow Bat	*Lasiurus ega*	
	Davy's Naked-backed Bat	*Pteronotus davyi*	
	Common Mustached Bat	*Pteronotus parnellii*	
	Vampire Bat	*Desmodus rotundus*	
	Mexican Funnel-eared Bat	*Natalus stramineus*	
	Central American Yellow Bat	*Rhogeesa tumida*	
	Black Mastiff Bat	*Molossus rufus*	
	Pallas' Mastiff Bat	*Molossus molossus*	
Xenarthra	***Myrmecophagidae***		
	Northern Tamandua	*Tamandua mexicana*	
	Dasypodidae		
	Nine-banded Armadillo	*Dasypus novemcinctus*	
Insectivora	***Soricidae***		
	Maya Small-eared Shrew	*Cryptotis mayensis*	
Rodentia	***Sciuridae***		
	Deppe's Squirrel	*Sciurus deppei*	
	Yucatan Squirrel	*Sciurus yucatanenis*	
	Muridae		
	Yucatan Vesper Rat	*Otonyctomys hatti*	
	Big-eared Climbing Rat	*Ototylomys phyllotis*	
	Gaumer's Spiny Pocket Mouse	*Heteromys gaumeri*	

Family	Species		IUCN Status
Rodentia	***Muridae***		
	Yucatan Vesper Mouse	*Otonyctomys hatti*	
	Deer mouse sp.	*Peromyscus sp.*	
	Harvest Mouse sp.	*Reithrodontomys sp.*	
	Erethizontidae		
	Mexican Hairy Porcupine	*Coendou mexicanus*	
	Dasyproctidae		
	Central American Agouti	*Dasyprocta punctata*	
	Agoutidae		
	Paca	*Agouti paca*	
Carnivora	***Canidae***		
	Grey Fox	*Urocyon cinereoargenteus*	
	Felidae		
	Jaguaroundi	*Herpailurus yagouaroundi*	
	Margay	*Leopardus wiedii*	
	Ocelot	*Leopardus pardalis*	
	Puma	*Puma concolor*	
	Jaguar	*Panthera onca*	
	Mustelidae		
	Striped Hog-nosed Skunk	*Conepatus semistriatus*	
	Spotted Skunk	*Spilogale putorius*	
	Tayra	*Eira barbara*	
	Procyonidae		
	Kinkajou	*Potos flavus*	
	Northern Raccoon	*Procyon lotor*	
	White-nosed Coati	*Nasua narica*	
Sirenia	***Trichechidae***		
	West Indian Manatee	*Trichechus manatus*	**VU**
Artiodactyla	***Tayassuidae***		
	Collard Peccary	*Pecari tajacu*	
	White-lipped Peccary	*Tayassu pecari*	
	Cervidae		
	Red brocket Deer	*Mazama americana*	
	White-tailed Deer	*Odocoileus virginianus*	
Perissodactyla	***Tapiridae***		
	Baird's tapir	*Tapirus bairdii*	**EN**

Family	**Species**		**IUCN Status**
Perissodactyla	***Tapiridae***		
	Baird's tapir	*Tapirus bairdii*	**EN**
Watch List	Water Opossum / Yapok		
	Bat sp.	*Micronycteris megalotis*	
		Micronycteris brachyotis	
		Carollia perspicilliata	
		Carollia brevicauda	
		Sturnira lilium	
		Glossophaga soricina	
		Artibeus jamaicensis	
		Artibeus intermedius	
		Artibeus paeotis	
		Trachops cirrhosus	
		Mimon bennettii	
		Diphylla ecaudata	
		Molossus molossus	
	Deer mouse sp.	*Peromyscus sp.*	
	Harvest Mouse sp.	*Reithrodontomys sp.*	
	Southern River Otter	*Lutra longicaudis*	
	Coyote		
	Long tailed Weasel		

Birds of Shipstern Nature Reserve

Family	Species		IUCN Status
Tinamidae	Great Tinamou	*Tinamus major*	
	Thicket Tinamou	*Crypturellus cinnamomeus*	
	Little Tinamou	*Crypturellus soui*	
Podicipedidae	Least Grebe	*Tachybaptus dominicus*	
	Pied-billed Grebe	*Podilymbus podiceps*	
Pelicanidae	American White Pelican	*Pelecanus erythrorhynchos*	
	Brown Pelican	*Pelecanus occidentalis*	
Phalocrocoracidae	Neotropic Cormorant	*Phalacrocorax brasilianus*	
	Double-crested Cormorant	*Phalacrocorax auritus*	
Anhingidae	Anhinga	*Anhinga anhinga*	
Fregatidae	Magnificent Frigatebird	*Fregata magnificens*	
Adeidae	Least Bittern	*Ixobrychus exilis*	
	Bare-throated Tiger Heron	*Tigrisoma mexicanum*	
	Great Blue Heron	*Ardea herodias*	
	Great Egret	*Ardea alba*	
	Snowy Egret	*Egretta thula*	
	Little Blue Heron	*Egretta caerulea*	
	Tricolored Heron	*Egretta tricolor*	
	Reddish Egret	*Egretta rufescens*	NT
	Cattle Egret	*Bubulcus ibis*	
	Green Heron	*Butorides virescens*	
	Black-crowned Night Heron	*Nycticorax nycticorax*	
	Yellow-crowned Night Heron	*Nyctanassa violacea*	
	Boat-billed Heron	*Cochlearius cochlearius*	
Threskiornithidae	White Ibis	*Eudocimus albus*	
	Roseate Spoonbill	*Platalea ajaia*	
Ciconiidae	Wood Stork	*Mycteria americana*	
Cathartidae	Black Vulture	*Coragyps atratus*	
	Turkey Vulture	*Cathartes aura*	

Family	Species		IUCN Status
Cathartidae	Lesser Yellow-headed Vulture	*Cathartes burrovianus*	
	King Vulture	*Sarcoramphus papa*	
Anatidae	Black-bellied Whistling Duck	*Dendrocygna autumnalis*	
	Blue-winged Teal	*Anas discors*	
	Lesser Scaup	*Aythya affinis*	
Accipitridae	Osprey	*Pandion haliaetus*	
	Gray-headed Kite	*Leptodon cayanensis*	
	Swallow-tailed Kite	*Elanoides forficatus*	
	White-tailed Kite	*Elanus leucurus*	
	Snail Kite	*Rostrhamus sociabilis*	
	Double-toothed Kite	*Harpagus bidentatus*	
	Crane Hawk	*Geranospiza caerulescens*	
	Plumbeous Kite	*Ictinia plumbea*	
	Gray Hawk	*Asturina nitida*	
	Common Black-Hawk	*Buteogallus anthracinus*	
	Great Black-Hawk	*Buteogallus urubitinga*	
	Roadside Hawk	*Buteo magnirostris*	
	Broad-winged Hawk	*Buteo platypterus*	
	Short-tailed Hawk	*Buteo brachyurus*	
	White-tailed Hawk	*Buteo albicaudatus*	
	Black and White Hawk-Eagle	*Spizastur melanoleucus*	
	Black Hawk-Eagle	*Spizaetus tyrannus*	
	Ornate Hawk-Eagle	*Spizaetus ornatus*	
Falconidae	Collared Forest-Falcon	*Micrastur semitorquatus*	
	Laughing Falcon	*Herpetotheres cachinnans*	
	Merlin	*Falco columbarius*	
	Bat Falcon	*Falco rufigularis*	
	Peregrine Falcon	*Falco peregrinus*	
Cracidae	Plain Chachalaca	*Ortalis vetula*	
	Great Curassow	*Crax rubra*	VU
Rallidae	Ruddy Crake	*Laterallus ruber*	
	Clapper Rail	*Rallus longirostris*	
	Gray-necked Wood-Rail	*Aramides cajanea*	
	Common Moorhen	*Gallinula chloropus*	
	American Coot	*Fulica americana*	

Family	Species		IUCN Status
Aramidae	Limpkin	*Aramus guarauna*	
Charadriidae	Black-bellied Plover	*Pluvialis squatarola*	
	Wilson's Plover	*Charadrius wilsonia*	
	Semipalmated Plover	*Charadrius semipalmatus*	
	Killdeer	*Charadrius vociferus*	
Recurvisrostridae	Black-necked Stilt	*Himantopus mexicanus*	
Jacanidae	Northern Jacana	*Jacana spinosa*	
Scolopacidae	Greater Yellowlegs	*Tringa melanoleuca*	
	Willet	*Catoptrophorus semipalmatus*	
	Western Sandpiper	*Calidris mauri*	
	Spotted Sandpiper	*Actitis macularia*	
	Semipalmated Sandpiper	*Calidris pusilla*	
	Least Sandpiper	*Calidris minutilla*	
	White-rumped Sandpiper	*Calidris fuscicollis*	
Laridae	Laughing Gull	*Larus atricilla*	
	Caspian Tern	*Sterna caspia*	
	Royal Tern	*Sterna maxima*	
	Sandwich Tern	*Sterna sandvicensis*	
Columbidae	Pale-vented Pigeon	*Columba cayennensis*	
	Scaled Pigeon	*Columba speciosa*	
	White-crowned Pigeon	*Columba leucocephala*	NT
	Red-billed Pigeon	*Columba flavirostris*	
	White-winged Dove	*Zenaida asiatica*	
	Common Ground-Dove	*Columbina passerina*	
	Plain-breasted Ground-Dove	*Columbina minuta*	
	Ruddy Ground-Dove	*Columbina talpacoti*	
	Blue Ground-Dove	*Claravis pretiosa*	
	White-tipped Dove	*Leptotila verreauxi*	
	Gray-fronted Dove	*Leptotila rufaxilla*	
	Caribbean Dove	*Leptotila jamaicensis*	
	Ruddy Quail-Dove	*Geotrygon montana*	

Family	Species		IUCN Status
Psittacidae	Olive-throated Parakeet	*Aratinga nana*	
	White-crowned Parrot	*Pionus senilis*	
	White-fronted Parrot	*Amazona albifrons*	
	Yellow-lored Parrot	*Amazona xantholora*	
Cuculidae	Mangrove Cuckoo	*Coccyzus minor*	
	Squirrel Cuckoo	*Piaya cayana*	
	Groove-billed Ani	*Crotophaga sulcirostris*	
Strigidae	Vermiculated Screech-Owl	*Otus guatemalae*	
	Ferruginous Pygmy-Owl	*Glaucidium brasilianum*	
	Mottled Owl	*Ciccaba virgata*	
Caprimulgidae	Lesser Nighthawk	*Chordeiles acutipennis*	
	Common Nighthawk	*Chordeiles minor*	
	Common Paraque	*Nyctidromus albicollis*	
	Yucatan Poorwill	*Nyctiphynus yucatanicus*	
	Yucatan Nightjar	*Caprimulgus badius*	
Nyctibiidae	Northern Potoo	*Nyctibius jamaicensis*	
Apopidae	Chimney Swift	*Chaetura pelagica*	NT
	Vaux's Swift	*Chaeturi vauxi*	
Trochlidae	Wedge-tailed Sabrewing	*Camplyopteruss curvipennis*	
	Green-breasted Mango	*Anthracothorax prevostii*	
	Canivet's Emerald	*Chlorostilbon canivetii*	
	White-bellied Emerald	*Amazilia candida*	
	Rufous-tailed Hummingbird	*Amazilia tzacatl*	
	Buff-bellied Hummingbird	*Amazilia yucatanensis*	
	Cinnamon Hummingbird	*Amazilia rutila*	
Trogonidae	Black-headed Trogon	*Trogon melanocephalus*	
	Violaceous Trogon	*Trogon violaceus*	
Momotidae	Blue-crowned Motmot	*Momotus momota*	
Alcedinidae	Ringed Kingfisher	*Ceryle torquata*	
	Belted Kingfisher	*Ceryle alcyon*	
	Amazon Kingfisher	*Chloroceryle amazona*	

Family	Species		IUCN Status
Alcedinidae	Green Kingfisher	*Chloroceryle americana*	
	American Pygmy Kingfisher	*Chloroceryle aenea*	
Bucconidae	White-necked Puffbird	*Notharcus macrorhynchos*	
Ramphastidae	Collared Aracari	*Pteroglossus torquatus*	
	Keel-billed Toucan	*Ramphastos sulfuratus*	
Picidae	Red-vented Woodpecker	*Melanerpes pygmaeus*	
	Golden-fronted Woodpecker	*Melanerpes aurifrons*	
	Yellow-bellied Sapsucker	*Sphyapicus varius*	
	Smoky-brown Woodpecker	*Veniliornis fumigatus*	
	Golden-olive Woodpecker	*Piculus rubiginosus*	
	Chestnut-colored Woodpecker	*Celeus castaneus*	
	Linneated Woodpecker	*Dryocopus lineatus*	
	Pale-billed Woodpecker	*Campephilus guatemalensis*	
Furnariidae	Plain Xenops	*Xenops minutus*	
Dendrocolaptidae	Tawny-winged Woodcreeper	*Dendrocincla anabatina*	
	Ruddy Woodcreeper	*Dendrocincla homochroa*	
	Olivaceous Woodcreeper	*Sittasomus griseicapillus*	
	Northern Barred-Woodcreeper	*Dendrocolaptes sanctithomae*	
	Ivory-billed Woodcreeper	*Xiphorhynchus flavigaster*	
	Streak-headed Woodcreeper	*Lepidocolaptes souleyetii*	
Thamnophilidae	Barred Antshrike	*Thamnophilus doliatus*	
Formicariidae	Black-faced Antthrush	*Formicarius analis*	
Tyrannidae	Northern Beardless-Tyrannulet	*Camptostoma imberbe*	
	Greenish Elaenia	*Myiopagis viridicata*	
	Yellow-bellied Elaenia	*Elaenia flavogaster*	
	Ochre-bellied Flycatcher	*Mionectes oleagineus*	
	Northern Bentbill	*Ocostoma cinereigulare*	
	Common Tody-Flycatcher	*Todirostrum cinereum*	
	Eye-ringed Flatbill	*Rhynchocyclus brevirostris*	
	Yellow-olive Flycatcher	*Tolomyias sulphurescens*	
	Stub-tailed Spadebill	*Platyrinchus cancrominus*	
	Royal Flyctacher	*Onychorhynchus coronatus*	
	Olive-sided Flycatcher	*Contopus cooperi*	NT

Family	Species		IUCN Status
Tyrannidae	Eastern Wood-Pewee	*Contopus virens*	
	Least Flycatcher	*Empidonax minimus*	
	Bright-rumped Atilla	*Attila spadiceus*	
	Yucatan Flycatcher	*Myiarchus yucatanensis*	
	Dusky-capped Flycatcher	*Myiarchus tuberculifer*	
	Great-crested Flycatcher	*Myiarchus crinitus*	
	Brown-crested Flycatcher	*Myiarchus tyrannulus*	
	Great Kiskadee	*Pitangus sulphuratus*	
	Boat-billed Flycatcher	*Megarynchus pitangua*	
	Social Flycatcher	*Myiozetetes similis*	
	Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*	
	Piratic Flycatcher	*Legatus leucophaius*	
	Tropical Kingbird	*Tyrannus melancholicus*	
	Couch's Kingbird	*Tyrannus couchii*	
	Eastern Kingbird	*Tyrannus tyrannus*	
Incertae Sedis (species of uncertain affinities)	Thrush-like Schiffornis	*Schiffornis turdinus*	
	Gray-collared Becard	*Pachyramphus major*	
	Rose-throated Becard	*Pachyramphus aglaiae*	
	Masked Tityra	*Tityra semifasciata*	
	Black-crowned Tityra	*Tityra inquisitor*	
Pipridae	Red-capped Manakin	*Pipra mentalis*	
Vireonidae	White-eyed Vireo	*Vireo griseus*	
	Mangrove Vireo	*Vireo pallens*	
	Yellow-throated Vireo	*Vireo flavifrons*	
	Philadelphia Vireo	*Vireo philadelphicus*	
	Red-eyed Vireo	*Vireo olivaceous*	
	Yellow-green Vireo	*Vireo flavoviridis*	
	Yucatan Vireo	*Vireo magister*	
	Tawny-crowned Greenlet	*Hylophilus ochraceiceps*	
	Lesser Greenlet	*Hylophilus decurtatus*	
	Rufous-browed Peppershrike	*Cyclarhis gujanensis*	
Corvidae	Green Jay	*Cyanocorax yncas*	
	Brown Jay	*Cyanocorax morio*	
	Yucatan Jay	*Cyanocorax yucatanicus*	

Family	Species		IUCN Status
Hirundinidae	Purple Martin	*Progne subis*	
	Tree Swallow	*Tachycineta bicolor*	
	Mangrove Swallow	*Tachycineta albilinea*	
	Bank Swallow	*Riparia riparia*	
	Cliff Swallow	*Petrochelidon pyrrhonota*	
	Barn Swallow	*Hirunda rustica*	
Troglodytidae	Spot-breasted Wren	*Thryothorus maculipectus*	
	White-bellied Wren	*Uropsila leucogastra*	
	White-breasted Wood-Wren	*Henichorhina leucosticta*	
Sylviidae	Long-billed Gnatwren	*Ramphocaenus melanurus*	
	Blue-gray Gnatcatcher	*Polioptila caerulea*	
	Tropical Gnatcatcher	*Poliotila plumbea*	
Turdidae	Swainson's Thrush	*Catharus ustulatus*	
	Wood Thrush	*Hylocichla mustelina*	
	Clay-colored Robin	*Turdus grayi*	
Mimidae	Gray Catbird	*Dumetella carolinensis*	
	Black Catbird	*Melanoptila glabirostris*	NT
	Tropical Mockingbird	*Mimus gilvus*	
Bombycillidae	Cedar Waxwing	*Bombycilla cedrorum*	
Parulidae	Blue-winged Warbler	*Vermivora pinus*	
	Golden-winged Warbler	*Vermivora chrysoptera*	NT
	Tennessee Warbler	*Vermivora peregrina*	
	Northern Parula	*Parula americana*	
	Yellow Warbler	*Dendroica petechia*	
	Chestnut-sided Warbler	*Dendroica pensylvanica*	
	Magnolia Warbler	*Dendroica magnolia*	
	Yellow-rumped Warbler	*Dendroica coronata*	
	Black-throated Green-Warbler	*Dendroica virens*	
	Blackburnian Warbler	*Dendroica fusca*	
	Yellow-throated Warbler	*Dendroica dominica*	
	Palm Warbler	*Dendroica palmarum*	
	Bay-breasted Warbler	*Dendroica castanea*	
	Cerulean Warbler	*Dendroica cerulea*	VU
	Black-and-White Warbler	*Mniotilta varia*	

Family	Species		IUCN Status
Parulidae	American Redstart	*Setophaga ruticilla*	
	Prothonotary Warbler	*Protnotaria citrea*	
	Worm-eating Warbler	*Helmintheros vermivorus*	
	Swainson's Warbler	*Limnothlypis swainsonii*	
	Ovenbird	*Seiurus aurocapillus*	
	Northern Waterthrush	*Seiurus noveboracensis*	
	Louisiana Waterthrush	*Seiurus motacilla*	
	Kentucky Warbler	*Oporornis formosus*	
	Common Yellowthroat	*Geothlypis trichas*	
	Gray-crowned Yellowthroat	*Geothlypis poliocephala*	
	Hooded Warbler	*Wilsonia citrina*	
	Wilson's Warbler	*Wilsonia pusilla*	
	Yellow-breasted Chat	*Icteria virens*	
	Gray-throated Chat	*Granatellus sallaei*	
Thraupidae	Gray-headed Tanager	*Eucometis penicillata*	
	Red-throated Ant-Tanager	*Habia fuscicauda*	
	Rose-throated Tanager	*Piranga roseogularis*	
	Summer Tanager	*Piranga rubra*	
	Scarlet Tanager	*Piranga olivacea*	
	Blue-gray Tanager	*Thraupis episcopus*	
	Scrub Euphonia	*Euphonia affinis*	
	Yellow-throated Euphonia	*Euphonia hirundinacea*	
	Red-legged Honeycreeper	*Cyanerpes cyaneus*	
Emberizidae	White-collared Seedeater	*Sporophila torqueola*	
	Olive Sparrow	*Arremonops rufivirgatus*	
	Green-backed Sparrow	*Arremonops chloronotus*	
Cardinalidae	Black-headed Saltator	*Saltator atriceps*	
	Northern Cardinal	*Cardinalis cardinalis*	
	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	
	Blue-black Grosbeak	*Cyanocompsa cyanoides*	
	Blue Bunting	*Cyanocompsa parellina*	
	Blue Grosbeak	*Passerina caerulea*	
	Indigo Bunting	*Passerina cyanea*	
	Painted Bunting	*Passerina ciris*	NT
	Dickcissel	*Spiza americana*	

Family	Species		IUCN Status
Icteridae	Melodious Blackbird	*Dives dives*	
	Great-tailed Grackle	*Quisicales mexicanus*	
	Bronzed Cowbird	*Molothrus aeneus*	
	Black-cowled Oriole	*Icterus prosthemelas*	
	Orchard Oriole	*Icterus spurius*	
	Hooded Oriole	*Icterus cucullatus*	
	Yellow-backed Oriole	*Icterus chrysater*	
	Orange Oriole	*Icterus auratus*	
	Altamira Oriole	*Icterus gularis*	
	Baltimore Oriole	*Icterus galbula*	
	Yellow-billed Cacique	*Amblycercus holosericeus*	
	Montezuma Oropendonla	*Psarocolius montezuma*	
Watch List (to be confirmed)			
	Muscovy Duck	*Cairina moschata*	
	Crested Guan	*Peneleope purpuascens*	
	Least Tern	*Sterna antillarum*	
	Black Tern	*Chlidonias niger*	
	Red-lored Parrot	*Amazona autumnalis*	
Tytonidae	Barn Owl	*Tyto alba*	
	Lesser Swallow-tailed Swift	*Panyptila cayennensis*	
	Golden-olive Woodpecker	*Piculus rubiginosus*	
	Tropical Pewee	*Contopus cinereus*	
	Yellow-bellied Flycatcher	*Empidonax flaviventris*	
	White-collared Manakin	*Manacus candei*	
	Gray-breasted Martin	*Progne chalybea*	
	Blue-gray Tanager	*Thraupis episcopus*	
	Blue Grosbeak	*Guiraca caerulea*	

Amphibians and Reptiles of Shipstern Nature Reserve

Family	Species		IUCN Status
Plethodontidae	Yucatan Salamander	*Bolitoglossa yucatana*	
Rhinophrynidae	Burrowing Toad	*Rhinophrynus dorsalis*	
Leptodactylidae	White-lipped Frog	*Leptodactylus fragilis*	
	Sabinal Frog	*Leptodactylus melanonotus*	
Bufonidae	Cane Toad	*Chaunus marinus*	
	Gulf Coast Toad	*Incilius valliceps*	
Hylidae	Red-eyed Treefrog	*Agalychnis callidryas*	
	Yellow Treefrog	*Dendropsophus microcephala*	
	Stauffer's Treefrog	*Scinax staufferi*	
	Common Mexican Treefrog	*Smilisca baudinii*	
	Mahogany Treefrog	*Tlalohyla loquax*	
	Painted Treefrog	*Tlalohyla picta*	
	Veined Treefrog	*Trachycephalus venulosus*	
	Yucatecan Casque-head Treefrog	*Triprion petasatus*	
Microhylidae	Elegant Narrowmouth Frog	*Gastrophryne elegans*	
	Sheep Frog	*Hypopachus variolosus*	
Ranidae	Rio Grande Leopard Frog	*Lithobates brownorum*	
Crocodylidae	Morelet's Crocodile	*Crocodylus moreletii*	**LR**
Kinosternidae	Narrowbridge Musk Turtle	*Claudius angustatus*	**LR**
	Mexican Giant Musk Turtle	*Staurotypus triporcatus*	**LR**
	Tabasco Mud turtle	*Kinosternon acutum*	**LR**
	White-lipped Mud Turtle	*Kinosternon leucostomum*	
	Scorpion Mud Turtle	*Kinosternon scorpiodes*	
Emydidae	Furrowed Turtle	*Rhinoclemmys areolata*	**NT**
	Slider	*Trachemys venusta*	**LR**
Eublepharidae	Yucatan Banded Gecko	*Coleonyx elegans*	
Gekkonidae	Dwarf Gecko	*Sphaerodactylus glaucus*	
	House Gecko	*Hemidactylus frenatus**	
	Tuberculate Leaf-toed Gecko	*Phyllodactylus tuberculosus*	
	Turnip Tail Gecko	*Thecadactylus rapicauda*	
*Introduced			

Family	Species		IUCN Status
Corytophanidae	Brown Basilisk	*Basiliscsus vittatus*	
	Smoothhead Helmeted Basilisk	*Corytophanes cristatus*	
	Eastern Casquehead Iguana	*Laemanctus longipes*	
	Serrated Casquehead Iguana	*Laemanctus serratus*	
Iguanidae	Black Iguana	*Ctenosaura similis*	
Phrynosomatidae	Yucatan Spiny Lizard	*Sceploporus chrysostictus*	
	Lundell's Spiny Lizard	*Sceloporus lundelli*	
Polychrotidae	Big-headed Anole	*Anolis capito*	
	Ghost Anole	*Anolis lemurinus*	
	Lichen Anole	*Anolis pentaprion*	
	Smooth Anole	*Anolis rodriguezii*	
	Brown Anole	*Anolis sagrei*	
Polychrotidae	Silky Anole	*Anolis sericeus*	
	Schwartze's Skink	*Mesoscincus schwartzei*	
Scincidae	Central American Mabuya	*Mabuya unimarginata*	
	Sumichrast's Skink	*Plestiodon sumichrasti*	
	Brown Forest Skink	*Sphenomorphus cherriei*	
Boidae	Boa Constrictor	*Boa constrictor*	
Colubridae	Two-spotted Snake	*Coniophanes bipunctatus*	
	Black-striped Snake	*Coniophanes imperialis*	
	Schmidt's Black-striped Snake	*Coniophanes schmidti*	
	Snail-eating Thirst Snake	*Dipsas brevifacies*	
	Indigo Snake	*Drymarchon melanurus*	
	Speckled Racer	*Drymobius margaritiferus*	
	Blotched Hook-nosed Snake	*Ficimia publia*	
	Blunthead Tree Snake	*Imantodes cenchoa*	
	Yucatan Blunthead Tree Snake	*Imantodes tenuissimus*	
	Milk Snake	*Lampropeltis triangulum*	
	Rain Forest Cat-eyed Snake	*Leptodeira frenata*	
	Northern Cat-eyed Snake	*Leptodeira septentrionalis*	
	Parrot Snake	*Leptophis ahaetulla*	
	Mexican Parrot Snake	*Leptophis mexicanus*	
	Neotropical Whipsnake	*Masticophis mentovarius*	
	Lizard Eater	*Mastigodryas melanolomus*	
	Redback Coffee Snake	*Ninia sebae*	
	Mexican Vine Snake	*Oxybelis aeneus*	
	Green Vine Snake	*Oxybelis fulgidus*	
	Tropical Rat Snake	*Pseudoelaphe flavirufa*	
	Puffing Snake	*Pseustes poecilonotus*	
	Scaphiodontophis annulatus	Guatemalan Neckband Snake	

Family	Species		IUCN Status
Colubridae	Pygmy Snail Sucker	*Sibon sanniola*	
	Tiger Tree Snake	*Spilotes pullatus*	
	Yucatan White-lipped Snake	*Symphimus mayae*	
		Tantilla cuniculator	
	Red Earth Centipede Snake	*Tantilla schistosa*	
	Yucatan Dwarf Short-tailed Snake	*Tantillita canula*	
	Checkered Garter Snake	*Thamnophis marcianus*	
	Western Ribbon Snake	*Thamnophis proximus*	
	Terrestrial Snail Sucker	*Tropidodipsas sartorii*	
	False Fer-De-Lance	*Xenodon rhabdocephalus*	
Elapidae	Variable Coral Snake	*Micrurus diastema*	
Viperidae	Fer-de-Lance	*Bothrops asper*	
	Neotropical Rattlesnake	*Crotalus tzabcan*	
Species Requiring Confirmation			
Dermatemydidae	Central American River Turtle	*Dermatemys mawii*	**CR**
Viperidae	Cantil	*Agkistrodon bilineatus*	

Fish of Shipstern Nature Reserve

Family	Species		*IUCN Status*
Dasyatidae	Southern Stingray	*Dasyatis americana*	
Megalopidae	Tarpon	*Megalops atlanticus*	
Arridae	Bagre	*Bagre marinus*	
	Sailfin Catfish	*Ariopsis assimilis*	
Pimelodidae	Guatemalan chulin, Buttersea	*Rhamdia guatemalensis*	
	Filespin chulin	*Rhamdia laticauda*	
Batrachoididae	Central American Toadfish	*Batrachoides gilberti*	
Tetraodontidae	Chequered Pufferfish	*Sphoeroides testudinum*	
Lutanidae	Grey Snapper	*Lutjanus griseus*	
	Schoolmaster	*Lutjanus apodus*	
Sphyraenidae	Great Barracuda	*Sphyraena barracuda*	
Centromopidae	Common Snook	*Centropomus undecimalis*	
Belonidae	Redfin needlefish	*Strongylura notata*	
Rivulidae	Ocellated killifish	*Floridichthys polyommus*	
	Rivulus sp.	*Rivulus ocellatus*	
Cyprinodontidae	Yucatan flagfish	*Jordanella pulchra*	
	Pike killifish	*Belonesox belizanus*	
	Yucatan pupfish	*Cyprinodon artifrons*	
Characidae	Central tetra	*Astyanax aeneus*	
Poeciliidae	Teardrop mosquitofish	*Gambusia sexradiata*	
	Southern Yucatan mosquitofish	*Gambusia yucatana*	
	Sleek Mosquitofish	*Gambusia luma*	
	Mangrove molly	*Poecilia orri*	
Sygnathidae	Opossum pipefish	*Oostethus brachyurus*	
Gerridae	Striped Mojarra	*Eugerres plumieri*	
	Yellowfin Mojarra	*Gerres cinereus*	
Cichlidae	Maya cichlid	*Cichlasoma uropthalmus*	
	Redhead cichlid	*Cichlasoma synspilum*	

Family	**Species**		***IUCN Status***
Cichlidae	Firemouth cichlid	*Cichlasoma meeki*	
	Yellowbelly cichlid	*Cichlasoma salvini*	
	Bay snook	*Petenia splendida*	
Beloniidae	Mangrove Blenny	*Lupinoblennius dispar*	
Synbranchidae	Obscure Swamp Eel	*Ophisteron aenigmaticum*	
To be confirmed	Longnose Stingray	*Dasyatis gutatta*	
	Caribbean Whiptail Stingray	*Himantura schmardae*	
	Tilapia*	*Tilapia sp.*	
	Atantic Spadefish	*Chaetodipterus faber*	
**Invasive species*			

P.O.Box 278
Belize City
Belize
E-mail: office@wildtracksbelize.org