

# **SARSTOON TEMASH NATIONAL PARK MANAGEMENT PLAN**



**(Prepared for the Sarstoon Temash Institute for  
Indigenous Management SATIIM)**

**June, 2005**

**PROTECTED AREA  
MANAGEMENT PLAN  
(Sarstoon Temash National Park, Toledo District,  
Belize)**

**Prepared on Behalf of the**

**Sarstoon Temash Institute for Indigenous  
Management (SATIIM)**

**and the**

**Forest Department of Belize**

*Citation: Herrera, Allan, 2004. Sarstoon-Temash National Park  
Management Plan, Punta Gorda, Belize*

*(June 2004)*

## PARK MANAGEMENT PLAN SIGNATURE PAGE

This plan was prepared to provide a framework for the management of the environmental resources and cultural values of the Sarstoon-Temash National Park. The plan was developed in consultation with the members of the buffer zone communities, the SATIIM Board of Directors, the staff of the Sarstoon-Temash National Park, the Forest Department of the Government of Belize, and other concerned and involved stakeholders. It is submitted to SATIIM and the Forest Department as per the Park Co-management Agreement.

### Statement of Approval:

I have reviewed the enclosed Park Management Plan for the Sarstoon-Temash National Park and approve the activities and strategies laid out for the achievement of the park's objectives contained therein. I further agree that the objectives and strategies presented herein offer the best options for achieving the sustainable development of the park, while addressing the social and cultural needs of the buffer zone communities and the country of Belize on a whole. In testimony of this, we inscribe our signatures:

SATIIM Board of Directors

_____	_____	_____
Name	Representing	Date
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Hon. John Briceño

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Minister of Natural Resources  
and the Environment

\_\_\_\_\_  
Date

## **Acknowledgments:**

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## ACRONYMS

asl	Above sea level
CARD	Community Initiated Agriculture and Resource Management/Rural Development Project
CDB	Caribbean Development Bank
COMSTEC	Community Managed Sarstoon-Temash Conservation Project
DFID	Department for International Development
ESTAP	Environmental, Social and Technical assistance Project
FD	Forest Department
FUNDAECO	Fundación para ecodesarrollo y la conservación
GEF	Global Environmental Facility
GoB	Government of Belize
ha.	Hectares
IFAD	International Fund for Agriculture Development
IUCN	International Union for the Conservation of Nature
LIC	Land Information Center
MBCP	Mesoamerican Biological Corridor Program
MNREI	Ministry of Natural Resources, Environment and Industry
NGO	Non-Government Organization
PACT	Protected Areas Conservation Trust
S.I.	Statutory Instrument
SATIIM	Sarstoon-Temash Institute for Indigenous Management
STNP	Sarstoon-Temash National Park
STNPSC	Sarstoon-Temash National Park Steering Committee
TCGA	Toledo Cacao Growers Association
TDC	Toledo Development Corporation
UNDP	United Nations Development Program
WB	World Bank

# Part I

## Introduction and Basis for Management



## SECTION I

### 1 INTRODUCTION

#### 1.1 Background and Regional Context

The Sarstoon-Temash National Park was declared a protected area within the National Protected Areas System in 1994 (SI 42 of 1994). The area was first proposed for protection as part of a larger bio-reserve that would have incorporated the Sapodilla Cayes and Colombia River Forest Reserve, in addition to the Lower Temash Watershed area. At the time of its designation, the park had 16,592 ha. (42,000 acres), making it the second largest national park in the country.

In 2000, 40 acres on the south shore of the Temash River at the mouth was excised from the park under Statutory Instrument 22 of 2000. This land remains as private undeveloped land. Presently, the park is operated under a co-management agreement signed on April 27, 2003, between the Government of Belize, represented by the Forest Department and the Sarstoon-Temash Institute for Indigenous Development (SATIIM), which represents the five indigenous communities of the Sarstoon-Temash.

SATIIM is a registered non-governmental organization incorporated in 1999 under the Companies Act, Chapter 250 of the Laws of Belize, Revised Edition 2003. The organization is made up of the five buffer zone communities of Midway, Conejo, Crique Sarco, Sunday Wood and Barranco. In addition, it has representation from the National Garifuna Council, Q'eqchi' Council of Belize, Toledo Alcalde Association and the Forest Department.

The communities of Santa Ana, Graham Creek and Boom Creek are located on the edge of the buffer zone. These communities, along with the small settlements of Tamagas and Tushville, are all located within the buffer zone area but are not officially represented within the co-management body.

In 1998, the predecessor to SATIIM, the Sarstoon-Temash National Park Steering Committee, received a grant from the International Fund for Agricultural Development (IFAD). This project provided for the establishment of a functional organization to initiate the implementation of park co-management activities, including the creation of a Board of Directors and other institutional strengthening measures. Subsequent to its designation as an NGO, SATIIM became eligible to apply for World Bank, Global Environmental Facility (GEF) funding. In 1999 SATIIM submitted a proposal for funding from this organization. The aim was threefold:

- (1) To reduce land degradation and to conserve globally significant resources in the Sarstoon-Temash National Park and its buffer zone area,
- (2) To implement a park management plan recognizing local resource accessibility rights, and
- (3) To assist in the social, economic, and cultural development of the local indigenous communities.



At the present time, SATIIM is using GEF funding to develop management capabilities for the park, which includes the preparation of this management plan. Several earlier studies funded by this project laid the groundwork and established a context for this plan. Apart from the support and collaboration of the communities in overseeing the park, the organization does not have an established management presence in the area, nor has infrastructure been established to aid in the park management effort. These and other issues are to be addressed during the five-year planning period covered by this plan (see subsection 1.4 below)

Under the co-management agreement, SATIIM is responsible for the day-to-day management of the park and is required to produce a management plan for the area in consultation with the Government of Belize.

## 1.2 The Planning Area

Sarstoon-Temash National Park incorporates a diversity of habitats and ecosystems. Several of these systems have been described as either unique to Belize, poorly represented within the national protected areas system network, or nationally or regionally threatened. In a Rapid Ecological Assessment (REA) of the park, carried out in 2003 (Meerman *et al.*), an additional ecosystem (low shrubland, permanently waterlogged with *Sphagnum spp.*) was identified within the central region of the park, as well as in pockets along the Sarstoon River, this ecosystem type is not known to occur elsewhere in Belize or Central America at low elevation. In addition, the protected area has the largest and best stands of the Comfrey Palm (*Manicaria saccifera*) located along the shores of both the Sarstoon and Temash Rivers. The northern range of the Comfrey Palm extends to just north of Barranco Village in the Toledo District.

Originally the area was credited with having some of the best mangroves stands in Belize. This was initially given as one of the main justifications for its establishment, although this claim has since been proven to be somewhat of an exaggeration (Meerman, 2003). Nevertheless, the area does contain significant mangrove resources. The area also encompasses a vast wetland system that is an important sanctuary to a host of birds, reptiles, amphibians and fishes.

The Sarstoon-Temash region is under heavy pressure for resource extraction by local human settlements on the Belizean and Guatemalan side of the border. Rapidly rising populations set in a backdrop of limited economic opportunities and high levels of rural poverty exacerbate this problem. There are numerous current and abandoned subsistence agricultural fields<sup>1</sup> in the northern region of the protected area. Extraction of products for construction, such as, poles, logs and palm fronds, is an ongoing activity. Unregulated hunting and fishing have seriously depleted certain preferred game species within the park and now threatened the biodiversity of the region. In addition, large areas have been converted to farms along the boundary of the protected area both on the Belizean side and in Guatemala. The pattern that emerges is one of a

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<sup>1</sup> Agricultural fields are classified as milpas (areas used for shifting cultivation) of corn, rice, and beans primarily for domestic consumption.



park being increasingly isolated as a management enclave, cut off from other natural areas with its wildlife population living in remnant relic habitats (**Appendix D, Map #1**). Even if the natural areas in the park can be conserved, this area may not be able to provide all the habitat requirements for certain wildlife species.

### 1.3 Mission Statement and Legislative Authority

#### 1.3.1 Mission Statement and Management Implication

The mission statement of SATIIM is:

*“To safeguard the ecological integrity of the Sarstoon-Temash Region and employ its resources in an environmentally sound manner for the economic, social, cultural and spiritual well being of its indigenous people”.*

This is an organizational statement reflecting the outlook of SATIIM’s members and differs in some respects from the vision statement of the park which projects the long term management ideal of the park aside from the other activities of SATIIM in the region (**Section 7.1**). SATIIM’s mission statement explicitly states that management priority should be focused on meeting the needs of the indigenous Garifuna and Q’eqchi’ Maya population around the reserve and the conservation agenda as a first priority. This suggests that supporting local development while adhering to the national or regional conservation agenda need not be conflicting goals but indeed can be mutually supportive of each other.

More and more protected areas management worldwide is focusing on the needs and participation of the local communities as the only viable option to the successful management of protected areas where communities have a long-established association with the use and management of resources. This approach gives recognition to this relationship while benefiting conservation purposes generally since it offers what is in most cases the only feasible, workable option to the management of these areas.

The mission statement also implies direct community benefits from the management of this protected area in both the economic and social sense. At the present time, the communities are deriving direct economic benefits from the reserve by exploiting its resources without the guidance of management planning and in contravention of the statutory designation of the site as a National Park under the National Park Systems Act of 1981 (Chapter 215, Laws of Belize, Revised Edition, 2000). Because of the sensitivity of the issue and the historical claims of the indigenous population, a compromise has had to be struck between strict conservation which is not practical at this point and the resource demands of the communities, which if allowed to continue unbridled, would seriously and perhaps permanently damage the ecological values that SATIIM is trying to maintain in the park. The main challenge of management is therefore to accommodate this activity under a sustainable use regime while other alternative livelihoods can be explored and developed to sustain the communities.



SATIIM believes that conservation and management of the park and its buffer area should not impede the ability of the local communities to maintain their traditional livelihoods and lifestyles.

### 1.3.2 The Legislative and Management Framework

Under its mandate, the Forest Department (FD) of the Ministry of Natural Resources and the Environment is responsible for administering the Forests Act (Chapter 213, Laws of Belize, Revised Edition, 2000) and the National Parks System Act (Chapter 215, Laws of Belize, Revised Edition, 2000). Since the declaration of the Sarstoon-Temash National Park in 1994, management responsibility has rested with FD, with the major responsibility falling to the Conservation Division of that body. Because of downsizing and the added responsibility of managing an increasing number of protected areas with a budget that does not realistically account for the increased levels of responsibility, it has been FD's policy to enter into collaborative co-management arrangements with reputable organizations or groups.

In 2003 FD entered into a co-management arrangement with SATIIM to manage the STNP. The 19-point agreement lays down a legal framework for the joint management of the park, the duties and obligations of the parties, and the management prerogative of the members in the event that either side should decide to disassociate themselves from the agreement. The co-management agreement with SATIIM is for five years in the first instance, but may be renewed pending the performance of the parties. Among other things, the agreement encumbers the parties to adhere to the following duties and guidelines:

- i) Requires the formulation and implementation of full management plans for the Park,
- ii) Gives SATIIM responsibility for day-to-day management of the park,
- iii) Places responsibility for providing security and enforcement of regulations on FD,
- iv) Allows SATIIM to implement advocacy and education programs on behalf of the park, as well as the establishment of physical structures and facilities,
- v) Gives authority to SATIIM to collect fees for the use of the park by the general public, including business establishments operating within the park on concessionary terms, providing the proceeds are shared according to a set formula of 10% accruing to government, 20% to the Forestry Department and the remaining 70% to remain with SATIIM to assist in the management and development of the park,
- vi) Gives SATIIM a transitional period not exceeding one year if the government wishes to resume management of the park,
- vii) SATIIM may terminate the agreement if it deems necessary after consultation with FD providing it gives a notice period of not less than six months.

In addition to the co-management agreement with government, SATIIM has entered into an inter-institutional agreement with the Fundación para el Ecodesarrollo y la Conservación (FUNDAECO) of Guatemala to develop a joint management strategy for the Belizean and Guatemalan protected areas adjacent to each other

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within the Sarstoon River watershed. The goal of the collaboration is to combine efforts and resources to protect the remaining natural ecosystems and support the zoning and appropriate management of the area for the benefit of the neighboring communities.

#### 1.4 Purpose and Scope of the Plan

This management plan seeks to set out the strategic framework for the management of the Sarstoon-Temash National Park. It sets out the management goals, approaches and actions along with a framework for decision making. It establishes the mutually agreed management objectives for the protected area and sets out a plan of action to achieve the said objectives. The plan is meant to be a dynamic document subject to refinement over the planning period. This approach allows it to cater to unforeseen events which could not have reasonably been taken into account during the planning process. Nevertheless, the guiding principles and objectives laid out in the plan should remain unchanged as the standard to guide any future actions.

The preparation of this management plan is one of a series of steps being taken by SATIIM to upgrade its management capabilities within the park. Other background studies have preceded the preparation of this plan and have helped to identify the critical management issues at the site. These studies were carried out in collaboration with the stakeholder community, especially the local indigenous communities in the buffer zone region. To the extent that those studies feed into the preparation of the management plan and that this plan itself was generated with full community support and was referred to the communities in draft form for their consideration, it can be described as community and stakeholder driven. As such, it stands to reason that a plan designed with the assistance and concurrence of the community has a much better chance of being successfully implemented.

This management plan aspires to be progressive and forward looking. It incorporates the values of the entire stakeholder community and tries to be as inclusive as possible instead of advocating the management of the protected area as an “island”. In that regard it seeks to:

- promote social and economic objectives,
- further scientific and cultural awareness in the area,
- fully encourage the participation of all stakeholders as equal partners,
- encourage the view that the protected area is a community asset for the benefit of local people,
- encourage management by local people that draws on their knowledge, and allows new knowledge of the park to filter out to the people.

The primary management objective of this protected area and the buffer zone region should be the protection of the region’s biodiversity. This must remain as the highest management priority and all actions contemplated now and in the future must be measured against this standard.

## SECTION II

### 2 DESCRIPTION OF THE PROTECTED AREA

#### 2.1 General Information

##### 2.1.1 Location

Sarstoon-Temash National Park is located at the extreme southeastern tip of Belize and borders the Sarstoon River and the Republic of Guatemala to the south and the Caribbean Sea to the east. To the north and west, the park is bordered by several indigenous communities whose agricultural layouts extend to its boundaries. Where this is not the case, the land is occupied by private and public landholdings of which the Dolores Estate comprising 60,000 acres is one of the largest. A network of roads connects the buffer zone communities around the park. From the communities it is possible to enter the parks through a series of trails, abandoned access roads and logging roads. The northern tip of the protected area is about 18 km from Punta Gorda Town while the Guatemalan community of Sarstún is located directly adjacent to the southern boundary across the Sarstoon River, which forms a part of Belize's international boundary with Guatemala.

The legally declared area of the park is 16,992.7 Ha (41,898 acres). The Sarstoon-Temash National Park is located between  $89^{\circ}08'51''$  and  $88^{\circ}52'17''$  west longitude and between  $16^{\circ}04'53''$  and  $15^{\circ}53'33''$  north latitude.

##### 2.1.2 Access

Access to the national park is restricted to a limited number of land and water routes. From the sea one can navigate up the rivers into the park, or alternatively, it is possibly to travel down the river into the park. Road access into the park is along a deviation from the Southern Highway, at mile 8, near the community of Jacintoville (**Figure 2.1**). The road passes through the Q'eqchi' communities of San Felipe and Santa Ana and continues on to Midway and Barranco villages. Three miles west of Midway, the road forks to the southwest and travels through the villages of Conejo Creek, Sunday Wood and Crique Sarco on the Temash River.

In Midway it is possible to travel along an abandoned quarry access road into the park. This road terminates at the foot of some Karst Hills, inside the northernmost boundary of the park. Overland access into the park is possible via forest trails from Barranco. Beyond Crique Sarco, it is possible to reach the settlement of Graham Creek via a trail, but essentially vehicular access into the region ends at Crique Sarco.

The park can be accessed by sea approximately 13 miles from Punta Gorda or 0.75 miles from Barranco, at any point along the Temash River, or at any point along the Sarstoon River.

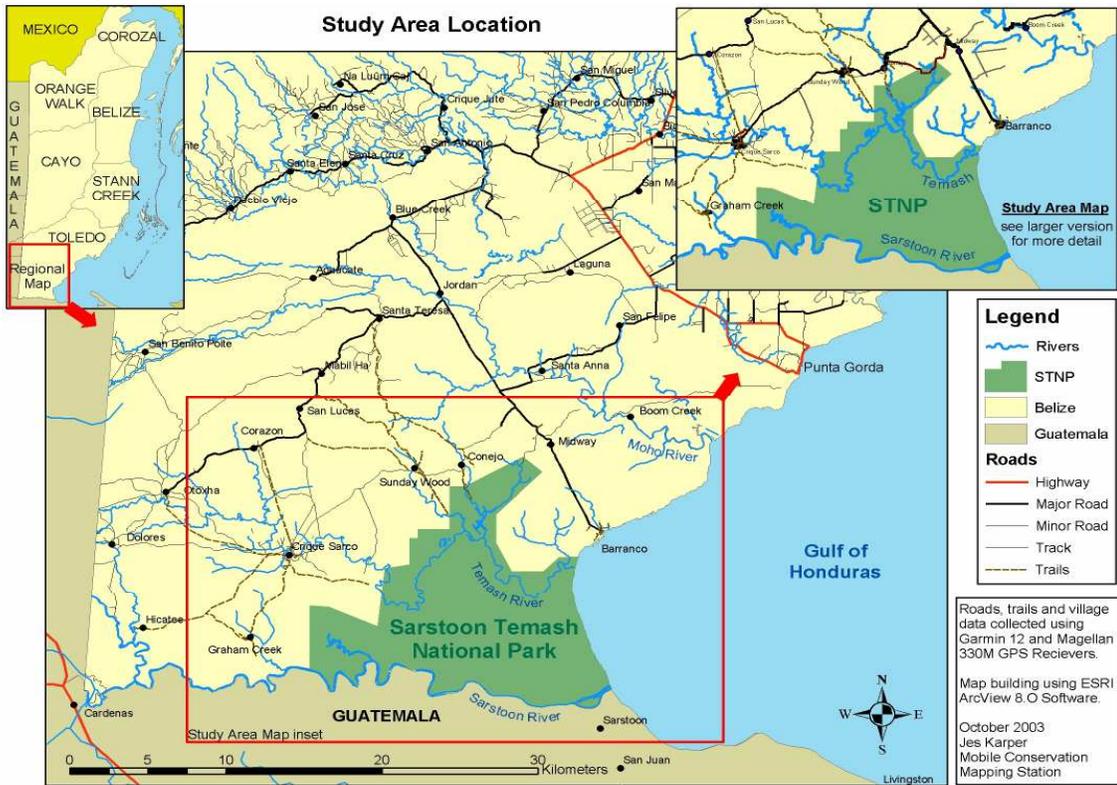


Figure 2.1: STNP location map.

Of these major access roads, only the route via the junction to Barranco and the junction to Crique Sarco can be considered all weather roads, although they can be quite challenging to traverse during the rainy season. Flooding events tend to occur near the Moho River in June and July. Despite this, access to all communities is generally possible throughout the year either by road or water. Besides these roads, the region is crisscrossed with a maze of trails, many of them dating back to previous logging operations before the declaration of the park, while others are of more recent origin and can be attributed to ongoing illegal logging operations.

Apart from the established logging routes there are also clandestine roads established into the park through incursions by illegal loggers mainly to the west and south along the property boundaries. Small scale illegal logging is an identified problem along the frontier with the western communities and neighbouring Guatemala. Doubtless, there are many clandestine trails along the border with Guatemala which have not yet been identified. It is believed that these trails facilitate poaching which is now a major management issue. Once a firm management presence is established on the ground it is the intention of management to identify and map these routes for future reference. Most of the illegal incursions into the park occur through sea and river routes which offer access into over half of the park. Access is from the sea into the Sarstoon and Temash Rivers. It is also possible to enter the park from its tributaries and headwaters. This is the preferred route for residents living within the western buffer areas and offers an attractive alternative to traversing the low and marshy areas of the park on foot. It is

also the preferred method to harvest resources such as Comfrey Palms (*Manicaria saccifera*) which grows in inundated areas.

2.1.3 Climate

Under the Holdridge Life Zone Classification System, the park falls within the tropical wet transitional to subtropical wet life zones. No weather data is available for the park, but the area around nearby Punta Gorda Town is reported to receive on average, about 3800 mm (150 inches) of rainfall per year. There is a three-month dry season running roughly between February to April and a nine months wet season, which peaks in July and August. This rainfall is produced primarily by tropical systems including tropical cyclones. The cool transition period occurs from November through February. Rainfall declines and approximately 12 cold fronts cross the country during these months. The true dry season is from February to April and is produced by strong anticyclones in the Atlantic that generate a persistent stable southeasterly airflow across the country.

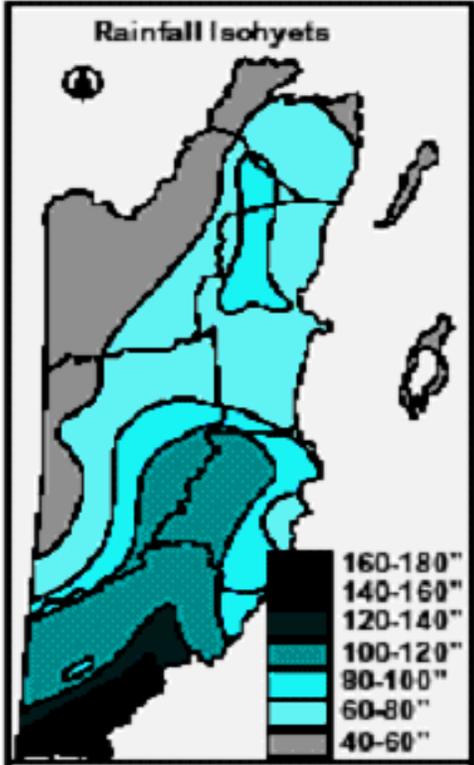


Figure 2.2: Average rainfall for Belize

There is a three-month dry season running roughly between February to April and a nine months wet season, which peaks in July and August. This rainfall is produced primarily by tropical systems including tropical cyclones. The cool transition period occurs from November through February. Rainfall declines and approximately 12 cold fronts cross the country during these months. The true dry season is from February to April and is produced by strong anticyclones in the Atlantic that generate a persistent stable southeasterly airflow across the country.

Temperatures show a slight seasonal variation with normal temperatures varying between 21° C and 32° C. As is typical of lowland tropical areas there is a more noticeable temperature difference between nighttime and daytime temperatures than between seasonal norms. At coastal locations, the warm offshore waters moderate temperature differences. Nevertheless,

seasonal extremes can fall between 13.75° C and 35.75° C. The diurnal temperature range in the interior is greater than that along the coast, where it is moderated by sea breezes. Minimum temperatures in the interior are generally about 5 degrees cooler than those at coastal locations. The mountainous regions are also cooler, exhibiting a fall in temperature of 10 degree Celsius per km (5°F/1000 ft.). Humidity hovers around 80% throughout the year, although it is somewhat lower during the dry season.

Temperature differences are often accompanied by a change in wind direction, with the predominant winds coming from the east and southeast in the warmer months, but sometimes shifting to the north and northeast in the cooler months. **Figure 2.2** compares rainfall levels across the country. **Figure 2.3** shows the average monthly rainfall for Punta Gorda compared with other locations in Belize, while **Figure 2.4**



shows the average high and low temperature for Blue Creek Village located to the north of the park.

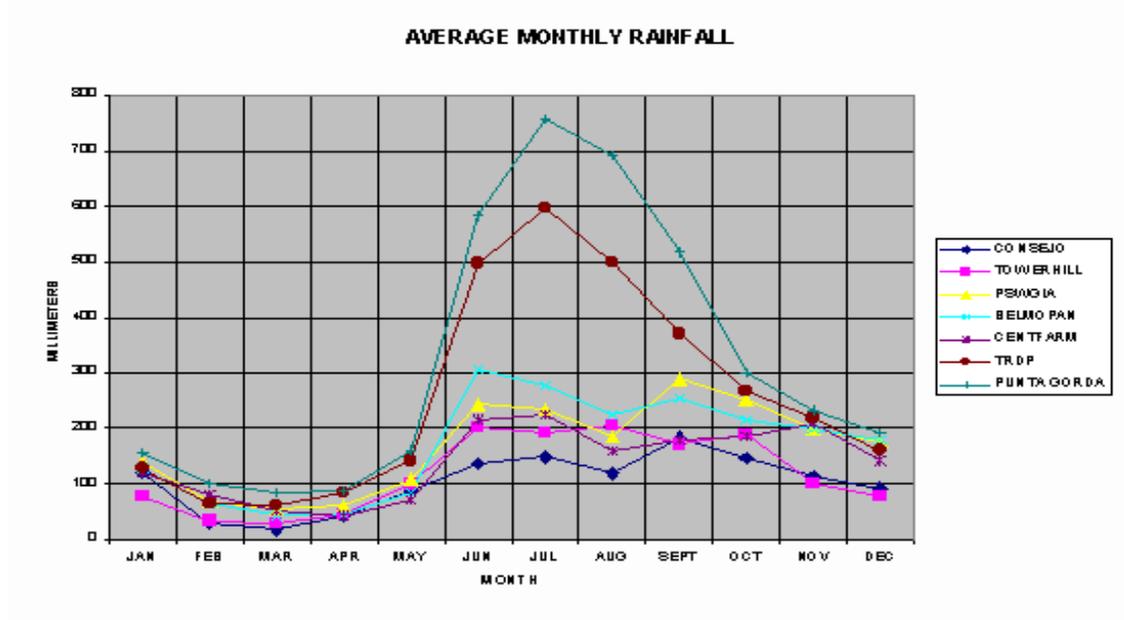


Figure 2.3: Yearly rainfall averages by month for Punta Gorda and other locations in Belize. (N.B.: Reproduced courtesy the Belize Weather Bureau).



Figure 2.4: Average Maximum and Minimum Temperatures for Blue Creek Village, Toledo. (N.B. Reproduced courtesy the Belize Weather Bureau).



Hurricanes are an important part of the natural environmental climatic cycle and indeed the composition of the forest reflect the frequent disturbances caused by the storms. Storms affect the natural composition of the forest creating gaps that are favorable to the growth of fast-growing species that demand light, while other slower-growing species are more likely to be associated with mature forest types. This phenomenon has implications for forest management on the property. During the rainy season, much of the lowland areas inside the park is waterlogged or inundated.

The hurricane season runs from June 1- Nov. 30 of each year. Historically, tropical storms and hurricanes have affected the country about once every three years on average. The southern region gets fewer storms than the northern region of the country, since the general trend of most storms is to move northwestward except when driven back by weather fronts. Hurricane Iris, a category IV storm that struck the area 10 miles north of Punta Gorda Town in 2001, missed the park but caused widespread damage to the forest ecosystems.

Occasional droughts are experienced in this area along with the rest of Belize, especially when the average rainfall is below average in more than one consecutive year, such as occurred in 1994. At such times vegetation is heavily stressed for water and wildfires are known to run into the upland hardwood forest. There is evidence that intense fires frequently run into the Karst Hills along the northern boundary of the property and in the buffer zone area where they do substantial damage to upland vegetation. The lowland marshes also support fires during the dry season when hunters set fires to increase forage for wildlife.

#### 2.1.4 Public Uses and Community Participation

The area presently occupied by the STNP has been used since time immemorial by the indigenous Maya and at least since 1852 by the Garifuna people. Indigenous people have used the area now occupied by the park for hunting, fishing, extraction of building materials, collection of traditional medicines and materials for traditional ceremonies among others. The STNP was declared by the government without community consultation in 1994. In subsequent years, various groups have embarked on programs to bring the communities together to educate them about the park and enlist their support for its management.

One of the earliest and best documented meetings occurred on February 22<sup>nd</sup> 1997 in Barranco, when the community leaders of the buffer zone area met with GoB officials, members of other NGOs, development organizations and funding agencies. At this meeting, the purpose and implications of having a national park were explained to the communities and their questions and concerns entertained. Communities were mostly interested in maintaining their traditional hunting and fishing privileges; however, some of them were also desirous of setting the northern boundary of the park at the Temash River and leaving the area north of the river for community use. These issues are still being debated and the communities continue to extract products from the park.



At the time of its declaration, the National Park included land occupied by the Temash Bar community, whose residents are originally from Guatemala. An area of 40 acres south of the mouth of the river has since been excised from the park (S.I # 22 of 2000), but the settlement is to the north. In addition, this community relies on the park for the establishment of their Matambres.

A large swat in the northern region of the park has been cleared for subsistence agriculture. A portion of this area, especially near to Midway Village is reverting back to natural forest; however, it is believed that further to the southwest farms are still being cleared within park boundaries. Altogether about 3000 acres within the park has been cleared for agriculture. A bone of contention has been over the exact location of the national park boundaries for which exact coordinates have been established but boundary traces are not defined on the ground.

Buffer zone communities are concerned that people from Guatemala are able to go into the park and harvest products while they are being prevented from doing the same. All the main buffer zone communities are represented on SATIIM, which represents the communities and is party to co-management agreement with FD. Consultations are regularly held with the communities as was the case for all the studies done inside the park leading up to the preparation of this management plan. It is the intention of SATIIM to present this plan to the communities for their ratification before it is officially adopted as the management plan for the park.

## **2.2 The Physical Environment**

### **2.2.1 Physical Site Data**

**(i) Geological History** – The Sarstoon-Temash National Park falls into an area composed of sedimentary materials called the Sarstoon Trough which is a part of the larger Belize Basin (Holland, 2003). This trough connects to the Bartlett Trough to the east and continues west into east central Guatemala. Its northern boundary is defined by the southern end of the Maya Mountain Block and the southern boundary by the Polochic Fault which runs along a portion of the Sarstoon River (ibid).

During the early cretaceous period the sinking Sarstoon Trough began filling in with sedimentary materials to a height of about 3000m. From this period to about 65 million years ago, this region formed the southern boundary of the Yucatan Carbonate Platform, which included all of Belize, most of the Peten and southeastern Mexico. The collision of the North American and Caribbean Plate during the late Cretaceous caused a rapid deepening of the Sarstoon Trough creating a marine basin that rapidly filled in with debris derived from sandstone, conglomerates, siltstones and clay. The origin of much of this material was from the Motagua Valley to the south of the park in Guatemala.

By the mid tertiary period, Caribbean Plate movements had resulted in a northwestward compaction of the sedimentary rocks in the Belize Basin including the strata beneath the STNP. This resulted in the formation of a series of NE-SW ridges in southern Belize. Three major lithostratigraphic formations have been identified in the



STNP. They are composed of carbonate rocks and siliciclastic (sand and limestone) materials. Two of the formations have surface exposure within the park.

The oldest lithostratigraphic unit is the **Coban Formation** which is found only in the subsurface of the STNP. The Coban Formation does not occur at the surface in the park or the buffer zone. The **Campur Formation**, of late Cretaceous (Campanian-Maastrichtian) age overlies the Coban Formation. The formation is comprised of dense, white, often thickly bedded and fossiliferous, limestone. In the park and buffer zone, Campur Formation limestone are presently only known from the small group of four hills at Midway Quarry. The hills cover an area of approximately 0.5 square kilometer and form a NE-SW oriented fault block. The Campur Formation limestone at Midway Quarry are intensely karstified and contain numerous fissures and caves.

The early Tertiary **Toledo Formation** (Paleocene-Eocene) is younger than the Campur Formation and comprises mainly thinly bedded siliciclastic sediments—siltstone and sandstone beds interbedded with hemipelagic clays. The Toledo Formation covers nearly the entire STNP and buffer zone, except for the small area of Campur Formation limestone at Midway Quarry. The Toledo Formation is well exposed along the roads connecting the buffer zone communities, especially from Conejo to Crique Sarco.

**(ii) Geological Potential of Area** – The geological formations of the area offer distinct challenges and opportunities for the management of the site. One of the most tantalizing aspects is the potential for petroleum deposits to exist in fields within the park. Investigations including drilling have found traces of oil throughout the Toledo district. In some instances signs of petroleum deposits have even been found at the surface. Within the park and buffer zone areas there are four areas where hydrocarbon (oil) seeps and rock impregnation have been found. These locations are:

1. Oil-stained Toledo Formation limestone outcrops on road to Midway, between junction of the road to Conejo and Midway village.
2. Toledo Formation limestone outcrops which when freshly broken bleed oil, in ditch section on road to Conejo, circa 2 km from Barranco road junction.
3. Abundant oil seeping from fractures in Toledo Formation conglomeratic limestone outcrops, circa 2-3 kilometers east of Crique Sarco Village.
4. Oil staining in Campur Formation limestone in a Ministry of Works quarry southeast of the bridge over the Moho River on the road to Barranco.

While the existence of petroleum deposits in the area would be good news for the country of Belize, it would present significant challenges for the long-term management of the park and for the conservation of biodiversity in the area as a whole. Geological investigations to date have found geological features favorable to the formation of hydrocarbons.

Layers of good quality kaolinic clays have been found within the buffer zone areas of the park and within the park itself. These clays have the potential to be used for ceramic manufacture and the production of bricks, if properly processed. If tests confirm the suitability of the clays, there is the potential for the development of such industries in the area based on the exploitation of this resource.



An area of hydrothermal activity was found within the park. This hydrothermal alteration is of interest to geologists who associate hydrothermal alterations with the occurrence of mineral deposits of economic importance. This area could therefore become the future target of mineral exploration.

**(iii) Soils** – Soils in the park and buffer zone are derived from underlying mineral rich sediments of the Toledo Formation. They contain significant amounts of nutrients; however, they are locked into the nutrient cycle that is broken with deforestation. Once land has been cleared, the recycling of nutrients contained in organic matter is lost. Basic cations and nitrogen are leached out of the soil by large amounts of rainfall as is the case in the STNP.

Analytical investigations carried out in 2003 by Holland et. al. indicate the following:

1. Soils around Barranco, Sunday Wood and Crique Sarco are mostly acidic with very low nutrient levels.
2. Soils near Midway and Conejo are less acidic, but like the other communities, contain little plant nutrients.
3. Nearly all soil samples show high amounts (toxic levels) of exchangeable aluminum. With the low pH values seen in the samples, iron and manganese are also expected to be in the toxic range.
4. High amounts of exchangeable aluminum correlate with low (acid) soil pH.
5. Available nitrogen, phosphorus and potassium are very low for all soils.

Because of the low natural fertility and the high levels of rainfall, nutrients are rapidly leached from the soil. This, compounded by the high acidity, is the principal reason for low agricultural productivity of the soils in the area and shows why the presumption is for the maintenance of forest cover.

Soil erosion is an identified problem in the area wherever land has become deforested. Heavy soil erosion is evident along the roads and the edges of creeks where the vegetation has been removed. Once the topsoil is washed away, the underlying fragile layers soon follow. Once eroded the water is carried into streams where they silt up the rivers while the lighter sediments are taken out to sea where they increase turbidity. Increased sediments in the river may also have a deleterious effect on the local population who use rivers as their principal source of drinking water.

**(iv) Hydrology** – Sarstoon-Temash watershed falls within the region of Belize classified as the coastal plains with elevations of around 20m above sea level (asl). The area consists primarily of marshland and swamps. The Sarstoon River boundary of the park from Graham Creek to the coast is approximately 36 km in length. The Temash River is 23 km from the western region to the Temash Lagoon. It then widens considerably for 22 km until it empties into the "Bahia de Amatique". The watershed for both aquatic system measures approximately 432 km<sup>2</sup>. Land uses include subsistence agriculture, forestry, pasture and inhabited areas (Morgan, 2003).

Rivers and creeks within the watershed show both eutrophic and mesotrophic qualities, although such qualities are highly time sensitive and can depend on flood and drought conditions. Water bodies may exhibit a range of water clarity readings based on flow conditions, intensity of solar radiation and cloud-cover. This is why it is important to continuously monitor the water bodies.



Based on geological mapping, the sedimentary rocks of the Toledo Formation (clays, sandstones, siltstones and limestone conglomerates) appear to form the only shallow aquifers in the STNP and buffer zone. Limestone belonging to the Campur formation is not likely to be available for water extraction using conventional well drilling equipment. Porosity and permeability in the fine grained Toledo Formation sediments are mainly related to fracturing (so called fracture porosity) through tectonic activity (faulting and folding). This formation is relatively “tight”; however, Toledo Formation debris flow conglomerates could form aquifers, especially in the western parts of the buffer zone north of Crique Sarco where they are seen to outcrop as steeply dipping beds. Once saturated with water, the clay-dominated Toledo Formation sediments allow primarily surface flow of water and internal permeability is likely to be very low.

## 2.3 The Biological Environment

### 2.3.1 Vegetation

During the Central American Ecosystems Mapping Project, a total of 87 ecosystems were identified for Belize. Recently this has been augmented by the addition of another ecosystem type, found within the STNP during the 2003 Rapid Ecological Assessment (Meerman et. al., 2003). Originally the STNP was singled out as an area of exceptional mangrove forest formations. This was cited as one of the primary reasons for the designation of the site (Zisman, 1995) and later reechoed in the community consultations that led to the formation of the local management group for the park. Recent investigations in the park commissioned by SATIIM have not found extensive or unique mangrove formations, although the role of these ecosystems along the riverbanks and sea front should not be underestimated.

During the 2003 field investigations, a total of 386 plant species were identified within the park and buffer zone region. This list will almost certainly be augmented over time. The park has species characteristic of Belize on a whole, and others the ranges of which are limited to the southern region where the weather conditions and soil types favor their survival. Indeed, some ecosystems and the species that distinguish them are either completely limited to the park, or the park has their best known representation in the country. Some of the ecosystems found in the park are not adequately represented within the National Protected Areas Systems. For example, the *Tropical evergreen broadleaf lowland swamp forest: Manicaria variant* has its northernmost range a little to the north of the park, however the vast majority of the ecosystem falls within the park. This ecosystem supports the Comfrey Palm (*Manicaria saccifera*) which is used as preferred thatch material by the Garifuna community of Barranco. A large swamp bog near the center of the park has proven to be a new ecosystem for Belize. This previously un-described waterlogged area has been found to contain a very acid soil environment and supports abundant colonies of Sphagnum Moss which have over the years produced a thick layer of peat.

Species composition and diversity depends on the ecosystem type with the mangrove-dominated ecosystems and others such as the *Tropical evergreen lowland peat*



*shrubland with Sphagnum* and the *Tropical evergreen broadleaf lowland swamp forest: Manicaria variant* showing low biodiversity values whereas the high forest near Conejo (*Tropical evergreen broadleaf lowland forest over poor or sandy soils*) has very high biodiversity values.

In all, 13 forest ecosystems were identified within the park; however the area taken up by some ecosystems is very small (see **Table 2.1** and **Figure 2.5**). There are also active and inactive agricultural plots near the northern boundary. These would constitute a 14<sup>th</sup> ecosystem. Although these are the main ecosystem types distinguishable according to the methods and nomenclature given under the UNESCO system it is extremely difficult to predict with any great degree of accuracy forest types

Map prepared by Jan Meerman,  
September 2005

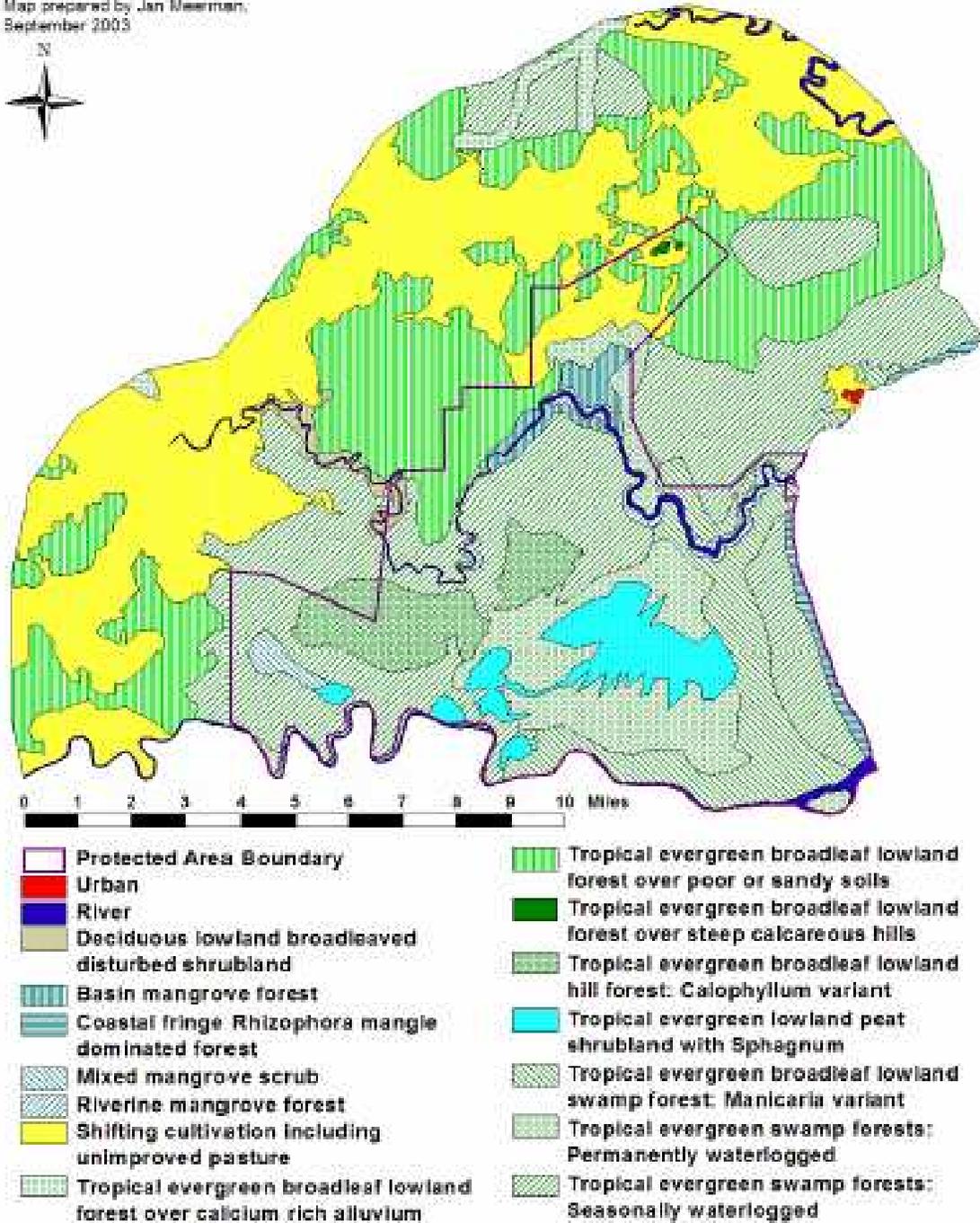
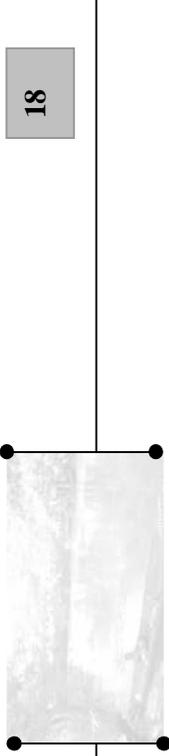


Figure 2.5: Forest Ecosystems Map of the STNP.



**Table 2.1: Main Vegetation Types Found within the STNP and Buffer Zone.**

Vegetation type	Predominant location	Percentage of total area and area coverage (ha.)	Distinguishing features
<i>Basin mangrove forest, Coastal fringe Rhizophora-Mangle dominated forest, Riverine mangrove Forest, Mixed mangrove scrub</i>	Basin mangrove forest grows along the upper reaches of the Temash River in the park, Coastal fringe rhizophora – mangle dominated forest grows in a narrow band along the coast between the Sarstoon and Temash River, Riverine mangrove forest is the dominant vegetation type along a narrow band on both sides of the Temash River, Mixed mangrove scrubs grow in an area near the extreme southwest of the park.	69.4% or 45,885 ha.	Mangrove forest grows predominantly in waterlogged areas or where tidal inundation is frequent. Within these areas salinity and nutrient levels will vary. Rhizophora forest will dominate where tidal flooding is more frequent. Disturbed areas are frequently colonized by ferns and vines. Throughout these areas canopy height varies greatly but can be anywhere in the range of 2 to 30m. Some Riverine mangrove forest can achieve great form.
<i>Deciduous broad-leaved low-land disturbed shrub-land</i>	Occupies a tiny area of the park due east of the village of Crique Sarco. This vegetation type is associated with riverine systems along which it forms a narrow band. It is found along the upper reaches of the Temash River from near the park boundary to an area near to Tamagas Village.	18.86% or 12,473 ha.	Occurs mostly in better drained areas along rivers. Ecosystem is frequently exposed to human induced fires which spread easily due to the presence of grass and other small weedy species.



**Table 2.1: Main Vegetation Types Found within the STNP and Buffer Zone.**

<p><i>Tropical evergreen broad-leaf lowland forest over calcium rich alluvium</i></p>	<p>This ecosystem type is found east of the Manicaria forest and almost completely surrounds the Sphagnum Moss forest.</p>	<p>.36% or 240.4 ha</p>	<p>This ecosystem supports a prolific tall lowland forest typically associated with high rainfall (2500 – 4000mm per annum) such as is found within the STNP. Soil fertility is often replenished by occasional floods which may even alter the architecture of the forest. Fire occurrences are limited to areas supporting agriculture.</p>
<p><i>Tropical evergreen broad-leaf lowland forest over poor or sandy soils</i></p>	<p>This vegetation type is prominent along the western and northern areas of the park and appears to be the area mainly used for agriculture in the buffer zone communities to the north and northwest of the park.</p>	<p>3.21% or 2,124.5 ha.</p>	<p>This forest type is also associated with areas having high rainfall in the order of 2,500 to 4,000 mm per annum. Forest are dense with broken canopies. Soils are acidic and often have retarded drainage. Species diversity is high in fact superseding those of any other forest ecosystem in the park. Soils are fragile and easily eroded after clearing. Erosion can be significant on slopes</p>
<p><i>Tropical evergreen broad-leaf lowland forest over steep calcareous hills</i></p>	<p>This ecosystem occurs in a tiny area to the north of the park, however it is of great importance since it contains the karst hills, caves and significant cultural features.</p>	<p>5.43% or 3,592 ha.</p>	<p>Found in steep terrain over calcareous rocks which are often highly eroded with exposed surfaces. Soils are well drained and have high organic content due to leaching of minerals from rocks and the buildup of organic matter from plant debris. Ecosystem can experience severe water stress in the dry season at which time it becomes susceptible to damaging fires. Fires run up the dry hills and denude them resulting in a bracken type vegetation structure. This ecosystem type is widely used by indigenous communities in the area for medicinal and ceremonial purposes.</p>
<p><i>Tropical evergreen broad-leaf lowland hill forest: Calophyllum variant</i></p>	<p>Located in the western region of the park between the Sarstoon and Temash Rivers.</p>	<p>1.33% or 879 ha.</p>	<p>This ecosystem type typically occurs on well drained soils on higher land that can become quite susceptible to erosion if disturbed. Forest height typically ranges from 20 – 30m.</p>

**Table 2.1: Main Vegetation Types Found within the STNP and Buffer Zone.**

<i>Tropical evergreen broad-leaf lowland swamp forest: Seasonally waterlogged</i>	This is the dominant ecosystem type found inside the park. It also extends into large areas to the west and north of the park.	.05% or 33 ha.	Soils are typically wet and waterlogged with poor drainage. Landscape features a typical hog-wallow micro relief.
<i>Tropical evergreen broad-leaf lowland swamp forest: Permanently waterlogged</i>	This ecosystem is only found in the Toledo District and there confined mostly to the STNP.	.04% or 28 ha.	Soils are poorly drained and waterlogged throughout most of the year. Soil texture is clay to loam and sandy loam. Forest canopy is upwards to 30m.
<i>Tropical evergreen broad-leaf lowland swamp forest: Manicaria variant</i>	This ecosystem type occurs near the east coast and extends between the Temash and Sarstoon Rivers. Along the Sarstoon it extends upriver along the riverbank for about 10 km.	.04% or 28 ha.	This ecosystem type occurs at low altitudes at or a little above sea level. Soils consist of a peaty layer over clays and is waterlogged for most of the year.
<i>Tropical evergreen lowland peat shrubland with sphagnum</i>	Grows on a narrow strip along the eastern boundary of the property	undetermined	This ecosystem typically occupies a transitional zone between the Short Grass Savanna and the tropical evergreen seasonal needle-leaf lowland dense forest at altitudes of < 50m.. Soils are coarse textured and pale in color. They normally overlay brightly red and white mottled layer subsoil. Soils are low in fertility and acidic.
<i>Shifting cultivation including unimproved pasture</i>	Covers large areas to the north and west of the park. Land under this designation straddles the park boundary	1.75% or 1,158 ha.	Consist almost entirely of milpas and abandoned farms. Most of the area falling under this category in the park is no longer being actively farmed however there are still new milpas being cleared inside the park near the western boundary due to difficulty of identifying the boundary. Near Crique Sarco unimproved pastures are common.

over smaller areas and therefore, these are best addressed at the field operational level. Despite this, the major ecosystems are pretty well defined and can be safely used as a broad measure of guidance when working at the landscape level.

As observed earlier, natural phenomena have played and continue to play a significant role in the forest composition in this area. Hurricanes in particular have been known to disrupt ecological systems at intervals. In the intervening recovery period following these disturbances, some species are favored over others. This has caused some species to be well represented in the populations of the immature forest, whereas their numbers in the smaller size classes tend to diminish as the forest becomes more mature and their relative advantages decrease. During the recent rapid ecological assessment, a recommendation was made to realign the park boundaries in the west. The area proposed for inclusion is of the ecosystem type *Tropical evergreen broadleaf lowland swamp forest: Seasonally waterlogged* (see Appendix D). This suggestion bears careful attention since similar areas outside the park are being used intensively for agriculture—a use for which it is patently ill suited. This area is currently under natural vegetation cover and would help to create a more regular boundary line that would be easier to control.

2.3.2 Wildlife

The varied ecosystems within the STNP and buffer zone area would suggest a varied and productive wildlife population among the larger species. This was probably the case before the establishment of permanent communities around the park and the penetration of roads into the area. The high poverty levels and lack of access to gainful employment means that the communities must rely on game meat to supplement their food supply since meat from other sources may be unaffordable. The indigenous communities in the area hunt heavily to supplement their diets and probably to earn extra income through the sale of game meat. There is also a substantial influx of people from bordering Guatemalan communities who come across the Sarstoon River to hunt and fish. During the REA, Meerman et. al. (2003) found low mammal counts at every level and at all sampling points.

High hunting pressure is attributable to the subsistence lifestyle of the population in the buffer zone area and the fact that populations have become sedentary. This means that instead of moving on when soils become depleted and wildlife populations diminish as they used to, the population stays on, since there is no new land available. The result is a burgeoning population and intensive coverage of the available hunting areas which prevents wildlife populations from rebounding.

The land surrounding the park, both in Belize and Guatemala, is becoming increasingly deforested. This has serious implications for the management of wildlife resources in the park. Larger mammals, which need extensive areas for feeding and breeding, will be confined to the STNP; however, in some cases their numbers will not be large enough to maintain a viable breeding population. The Mesoamerican Biological Corridor Program had proposed the maintenance of a corridor link with Guatemala through the STNP. This linkage would then extend into central Belize through the Maya Mountain Massif via the

Golden Stream Corridor Preserve. It now appears that the corridor value of this route is much diminished due to high levels of deforestation for agriculture and settlements. Its value is now very much in doubt and will soon become meaningless unless stakeholder support can be garnered. The most recent environmental assessment of the STNP found the following.

- (i) **Invertebrates** – A comprehensive assessment of the invertebrate population of the park has not yet been made; nevertheless, the area is known to harbor the Red-rump Tarrantula (*Brachypelma vagans*) and a rare stick insect which is abundant within the *Tropical Evergreen lowland peat shrubland with Sphagnum ecosystem*. Besides these, a total of 46 species of Lepidoptera were observed including the *Morpho theseus*, a relative of the popular Blue Morpho which is often raised in Butterfly Farms,
  
- (ii) **Fishes** - Based on the 2003 REA and earlier studies, a total of 42 species of fish were identified within the park and buffer zone areas. More than half of the identified species are associated with marine areas. Noticeable is the relative scarcity of fish in the waterways which suggest heavy and sustained fishing. Observers have also noted the low density of aquatic vegetation within the river systems which would be required to maintain a viable food chain, although riverbank vegetation and their fruits probably make up in part for this.

Notable among the species identified is the Mojarra de Oro (*Cichlasoma bocourti*) a member of the Cichlid family. This specie is only known from a small area in eastern Guatemala and southern Belize with its presence so far only noted in the Temash, Moho and Rio Grande Rivers in that region.

- (iii) **Amphibians and Reptiles** – The amphibian population inside the park is poorly understood and should be the focus of future studies. Since much of the park falls into low marshland and given the heavy rainfall in the area the population of amphibians should be quite healthy and diverse.

Important reptile species noted in the area include the Hickatee (*Dermatemys mawii*) and the Green Iguana (*Iguana iguana*). Hickatees are reported from the area between the Temash Lagoon and the falls. This specie is widely taken by villagers using a variety of methods, such as diving, spearing and fishing. Green Iguanas are reported as being quite common within the park but these too are under heavy pressure from hunters. It is suspected that the Morelet's Crocodile (*Crocodylus moreletti*) inhabit the waterways of the park. Nesting sites have been reported by villagers in the vicinity of Crique Sarco Village. Eggs are often harvested by villagers for local consumption; however, occasionally some are missed and it appears that the survivors of these replenish the local population.

- (iv) **Mammals** – Game mammals are conspicuously absent throughout much of the park and even smaller mammals seem to be in short supply. No more

than 24 species have been reliably reported but it is expected that this number will increase over time as collection efforts intensify under sustained management. The point remains, however, that the habitat appears to be favorable for a more robust mammal population despite the swampy and inhospitable conditions in some areas. Even the larger predators such as the Jaguar (*Panthera onca*) should be able to survive quite well in a park of this size. Black Howler Monkeys (*Alouatta pigra*) are reported from throughout the project area and appear to have healthy populations inside the park. According to Meerman, this is the only animal that is not taken by hunters from the buffer zone communities, although it is not clear if this is also the case with hunters who cross the border.

The paucity of smaller animals suggests a dysfunctional food chain and may help to explain why the larger mammals such as predators, which are higher up the food chain are so scarce. Prized game animals such as Peccaries (*Tayassu pecari*) and Deer (*Odocoileus virginianus*) are absent from many areas of the park. Manatees are reported to travel upriver to feed; however, there is known to be heavy poaching of this animal, mainly from across the border.

- (v) **Birds** – The REA commissioned by SATIIM in 2003 found bird biodiversity comparable to other relatively undisturbed sites in central and southern Belize. The Manicaria Forest had the lowest diversity index, probably because of its lower plant biodiversity; however, other areas with high plant diversity indices scored lower in bird diversity than some sites which were less diverse in flora.

Certain bird species are known to be regularly taken by hunters. Hunters from the buffer zone communities will regularly take Parrots, Toucans, and Chacalacas, although the economics of this can be questioned, given the time and effort required and the cost of inputs such as ammunition. It underscores the importance of hunting in the area and the strong cultural attachment and acceptance of the activity. It also reinforces the view that future management approaches must address this problem at the grassroots level and educate the population about the need for biodiversity conservation.

The REA identified 226 bird species inside the park between April and September 2003. Surveys and point counts were conducted over three day periods that cumulatively amounted to two and a half weeks but covered both the dry and wet seasons. Most of the species identified within the park are well represented throughout Belize; however, certain species such as the White-necked Jacobins were particularly numerous compared to other sites in Belize. Species of conservation concern that were noted in the park include the Wood Stork, Muscovy Duck and the Ornate Hawk-Eagle.

The population of wetland birds was not outstanding, in spite of the fact that most of the habitat is swampland and marsh and, therefore, ideal habitat for

such birds. The scarcity of fish in the wetlands system is at least partly to blame for this phenomenon.

### 2.3.3 Biological Corridors and Trans-boundary Cooperation

Since the advent of the Mesoamerican Biological Corridor Program, the Sarstoon-Temash National Park has always been heralded as the southern connection to other natural areas in Guatemala. Closer examination of recent satellite imagery however shows that massive deforestation has occurred between the STNP and other Belizean protected areas within the Maya Mountain Massif. Between the STNP and the Colombia River Forest Reserve there are essentially three zones of deforestation interspersed with natural areas that are either too inhospitable for settlement and agricultural purposes or are already included in community exploitation zones and agricultural layouts and can expect to be deforested soon (see **Figure 2.6**). The deforested zones are:

- i) From the southern border with Guatemala through Graham Creek and the buffer zone communities of the STNP to Midway Village north of the park,
- ii) From the western border with Guatemala through the community of Dolores, Otoxha, Corazon, San Lucas, Mabil Ha, and Santa Theresa through Jordan and up to the Southern Highway to Laguna,
- iii) From the western border with Guatemala through Pueblo Viejo, Santa Elena, Santa Cruz, San Antonio, San Pedro Colombia and adjacent communities to the boundary of the Yax'che Protected area. This is by far the most serious barrier since it is much wider and has by far the largest population.

The pace of deforestation and the underlying social and population dynamics that drive it does not inspire much confidence that any large portion of this area can be restored or modified for the reestablishment of corridors. Such an initiative would be expensive to undertake, time consuming to implement and the results may well turn out to be below expectations.

The only likely route for a corridor connecting the STNP to other large natural areas and the rest of the national protected areas system is through the Golden Stream Corridor Preserve (private property) and Deep River Forest Reserve. This route passes over the Southern Highway near Punta Gorda Town, which itself is a barrier. Increasingly, the route along the highway is becoming more densely settled with the improvements to the Southern Highway.

On the Guatemalan side of the border facing the STNP, the opportunities for functional biological corridor connectivity are likewise heavily compromised. This area is already mostly deforested and would probably have to be rehabilitated to achieve any useful corridor functions.

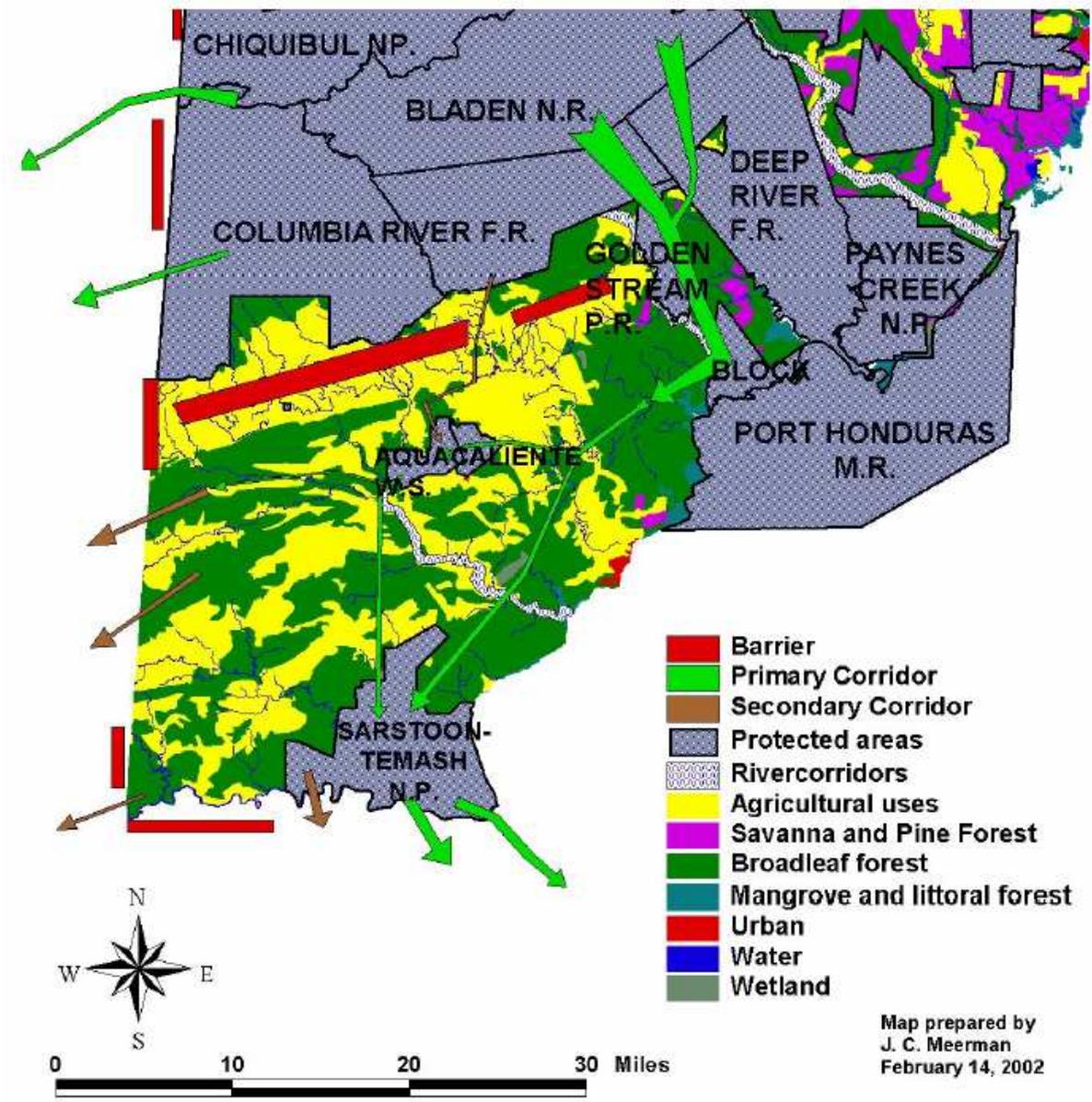


Figure 2.6: Biological Corridors and Barriers in Southern Belize.

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### SECTION III

## 3 DEMOGRAPHIC, CULTURAL AND SOCIOECONOMIC SETTING

### 3.1 Demographic Profile

The origin of some of the communities that border the STNP dates back 100 years or more. Barranco was founded in the 1850s, Conejo in 1907, and Crique Sarco in 1908. Others are more recent, e.g. Midway founded in 1992. Still new communities are taking shape, while others such as Barranco are demographically stagnant or gaining very slowly. All communities within the vicinity of the park are described as “indigenous.” Barranco’s population is predominantly Garifuna, whereas the other communities are predominantly Maya and belong to the Q’eqchi’ community, many of whom have emigrated recently from Guatemala. The Maya population hitherto has been quite transient with noted nomadic tendencies; leaving an area when resources are diminished or in times of communal unrest. This tendency is changing rapidly as communities adopt a more modern lifestyle and are increasingly connected to modern services and conveniences such as roads, water and electricity. Scarcity of land in the face of rapidly increasing population is also causing the Maya groups to adopt a more sedentary lifestyle.

The established communities in the buffer zone areas that are also members of the co-management grouping are Crique Sarco, Sunday Wood, Conejo, Midway, and Barranco. Other smaller communities exist on a quasi-formal basis such as Graham Creek, Temash Bar, Tamagas and Tushville. The character of these communities varies considerably and their tenuous community status has a lot to do with their small populations and recent settlement. There is wide disparity within these communities. Graham Creek has 16 families and is equipped with a school, whereas Temash Bar has only six families and no community services whatsoever.

The total population of all buffer zone communities as reported in the 2000 Housing and Population Census stood at 984 souls, a 140% increase over the 1980 figure (CSO, 2001), although SATIIM believes a population of 1,200 is nearer the true figure. It is likely that the incipient new communities will increase even faster. Almost half of the population in the area is under the age of 14. Only 46% of primary school age children actually manage to attend school. Even among this group there are sharp gender differences with only 26% of the females in this group actually attending school (CSO, 2001). Access to institutions of higher learning is hampered by lack of transportation, financial difficulties and cultural biases. Transportation problems have recently been alleviated by the daily school run into some of the communities. This service is being provided through the GoB.

### Population Profile of Buffer Zone Communities

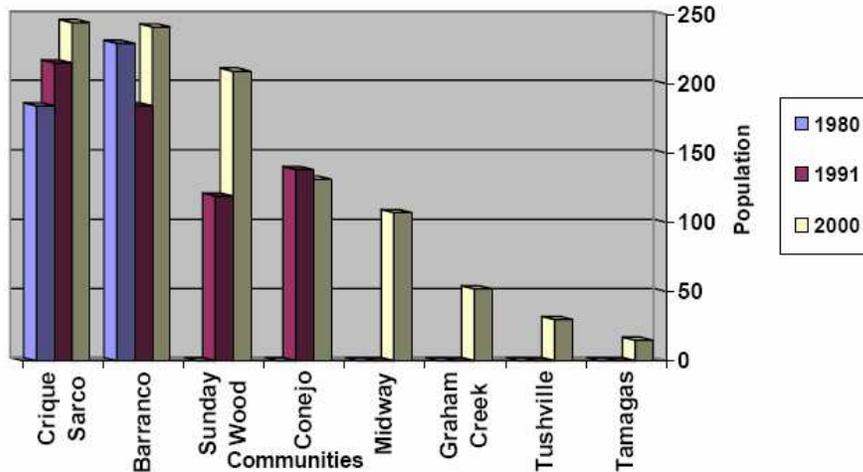


Figure 3.1: Population dynamics in buffer zone communities between 1980 and 2000.

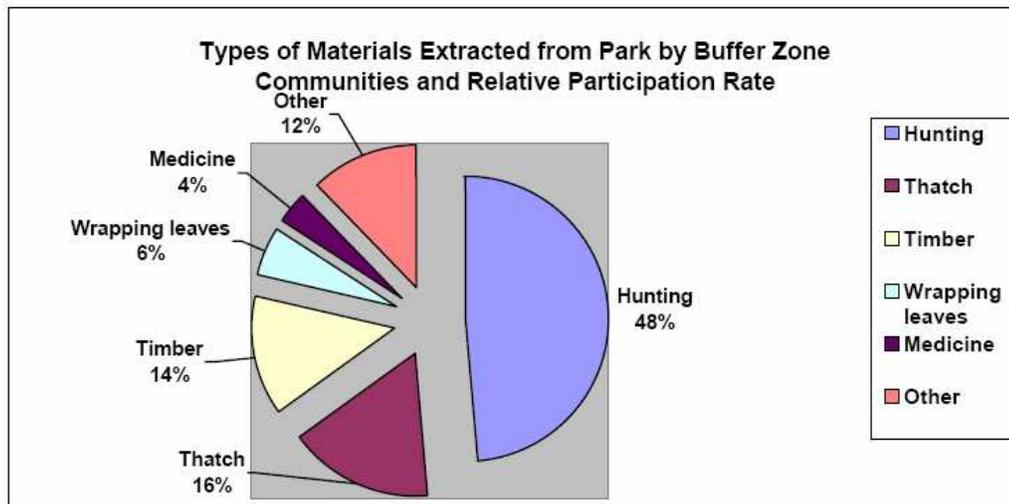


Figure 3.2: Demand for material within the STNP on the part of buffer zone communities.

### 3.2 Employment Opportunities

About 51% of the working age population is unemployed, illustrating the severe shortage of employment opportunities in the area. Of the employed population fully 43% are self employed and of that amount 42% are engaged in subsistence agriculture. Regardless of the occupation, it is clear from the local lifestyles that most people depend on the natural resources of the area for food and shelter. As the number of farmers increase in the Q'eqchi' communities, so does the pressure to acquire additional farmland. This has resulted in farms being established on the boundary of the park and within the park.

Besides the need for land, residents acquire many of their needs by exploiting resources inside the park. Some of this activity such as the collection of bush sticks (for building) and medicinal herbs is probably quite sustainable on the present scale, while others stand to compromise park management severely if they haven't already done so. Uncontrolled hunting is cited as the main reason for the absence of certain animal species within the park. Barranco is trying to diversify its resource base away from land- and water-based resource extraction to one that is based on the provision of services such as providing accommodation for ecotourism, hiking, fly fishing and the sale of locally produced crafts and other small scale cottage industries. These are both private and community-based ventures.

Milpa farming provides the residents of the area with staples such as corn, rice, beans and ground provisions; however, over-reliance on milpa farming when farmland is becoming scarce can become a serious impediment to the further development of the communities. The existing agricultural system barely provides for the subsistence needs of the people and is wasteful of land because it constantly requires that new areas be cleared when old plots lose their fertility. In addition, Holland in his geological assessment of the area in 2003 cites milpa farming as being unsuitable for maintaining the natural fertility of the soil in the areas around the STNP. Milpa farming on the fragile soils of the area can also result in erosion and mass wasting of the topsoil.

Recent projects in the southern region have tried to steer farmers away from milpa farming towards other agricultural pursuits that offer better financial returns per unit of effort, are more sustainable, and do not seriously compromise on biodiversity values. Farmers are diversifying into agro-forestry schemes with cacao being the main cash crop. Cacao is intercropped with other shade tolerant species that provide food for local consumption and are saleable outside the communities. Organic cacao cultivation has been met with limited success as a result of the acidic and poorly drained soils of the Toledo Formation which characterize much of the region. Farmers from Crique Sarco are investing in cattle production; however, it is not known what the long-term repercussions of this practice will be, and whether the soils will be able to support pastures, once the trees are removed and the natural nutrient cycle is broken.

Serious impediments faced by residents when contemplating diversification of their farming practices are lack of credit, no land security (42.9% of residents near to the park occupy lease lands) and low levels of technological inputs. This hampers production, although some progress has been made in alleviating this situation with the CDB / IFAD-funded Community-initiated Agricultural Resource Development project (CARD). The Toledo Development Corporation (TDC) is responsible for implementing the recommendations made by the ESTAP project in regard to supporting sustainable development in this area. Even though land is being surveyed near the park for issuance to villagers from the buffer zone communities, the fundamental problem remains unanswered in that present farming practices are wasteful of land in a situation where there is a very finite supply.



Even with the new parcels, if not given enough time to recover, they will soon lose their productivity and farmers will once again feel pressured to move into other more fertile areas and the STNP is one of the few such areas still around.

### **3.3 Cultural and Traditional use of Resources and Social Participation**

The people of the Sarstoon-Temash region have a close connection to the land and water resources of the area. All of the larger communities predate the park and have traditionally used the resources in the park to sustain their traditional lifestyles. Traditional uses have included hunting and fishing for community consumption, milpa farming, the gathering of building materials such as poles and thatch for traditional houses, the collection of traditional medicines and the use of the rivers as a port of entry and a highway for trade, commerce and industry.

This close relationship to the natural resources of the area continues to the present day. The designation of the Sarstoon-Temash area as a National Park was a unilateral decision on the part of the national government and was carried out without any consultation with the buffer zone communities, although government representatives later described this as an oversight. Initially community members were opposed to the declaration of the area and questioned whether they would still be able to carry on their traditional activities in the area. On the behest of local leaders and the encouragement of environmental and developmental NGOs, community members eventually bought into the concept of the park as an initiative that could bring long-term economic and social benefits; however, they demanded a voice within its overall management structure. From that beginning, the evolution of community participation proceeded along a path of empowerment and participation culminating in the signing of the co-management agreement with the Government of Belize, on April 27, 2003.

In the post co-management era, local communities are insistent that they should benefit directly as was promised to them by park proponents at the Stakeholder’s Workshop held in Barranco Village in February 1997 and at other venues thereafter. Economic betterment was specifically mentioned as one of the advantages of having the park. Although the communities recognize the destructive implications of milpa farming in the park, they would like to continue to have access to traditional hunting and fishing, gathering of medicinal plants and building materials. For the community of Barranco, access to the park is important to collect the fronds of Comfrey Palms to build their traditional buildings of worship, while the Maya communities would like continued access to collect leaves to carry out the religious ceremonies associated with Easter.

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## SECTION IV

### 4 METHODOLOGY

#### 4.1 The Planning Methodological Framework

This is the first management planning document to be prepared for STNP since its declaration in 1994. The production of a management plan within a one-year period is a requirement of the co-management agreement signed between SATIIM and the FD in April 2003. The agreement further stipulates the minimum components that should comprise the document.

The management objectives of the STNP seek to preserve the biological, cultural, social and economic functions of the area covered by the park. Besides protecting watersheds, soils, flora and fauna, this plans seeks to promote the sustainable use of the natural resources of the site without compromising its short- and long-term ecological functions and the integrity of the site as an area conducive to building and maintaining high biodiversity values.

In deciding on an appropriate strategy for preparing a realistic and workable plan, a key consideration has been on how best to accommodate community interest. According to the National Protected Areas Systems Plan (and clearly defined in the National Park Systems Act 1981), a National Park in the Belizean context must uphold the following management principles:

*Protection and preservation of natural and scenic values of national significance. Permissible activities include scientific study, education and maintenance of genetic resources. A management plan is required for the development of visitor facilities. Additionally tourism and recreational activities are also allowed. Fishing is only permissible under special permit.*

This plan is being prepared in the context of complementing the National Protected Areas Systems Plan and conforms to the draft outline for management plans being prepared by the Forest Department. The steps used in the preparation of the plan follows the sequence of steps given in **Figure 4.2**. The plan itself is seen as an evolutionary and cyclical tool that will guide management interventions over the next five years and will help to guide subsequent planning periods as experiences and practices on the ground are refined.

The planning framework is centered on the identification of features of exceptional value that have been selected by the stakeholder community as key to maintaining the significance of the park. Thereafter the main constraints, opportunities and threats were identified to maintain these unique features. These are relevant factors to be considered when planning for the future management of the park and therefore they need to be addressed and, where appropriate, capitalized upon.

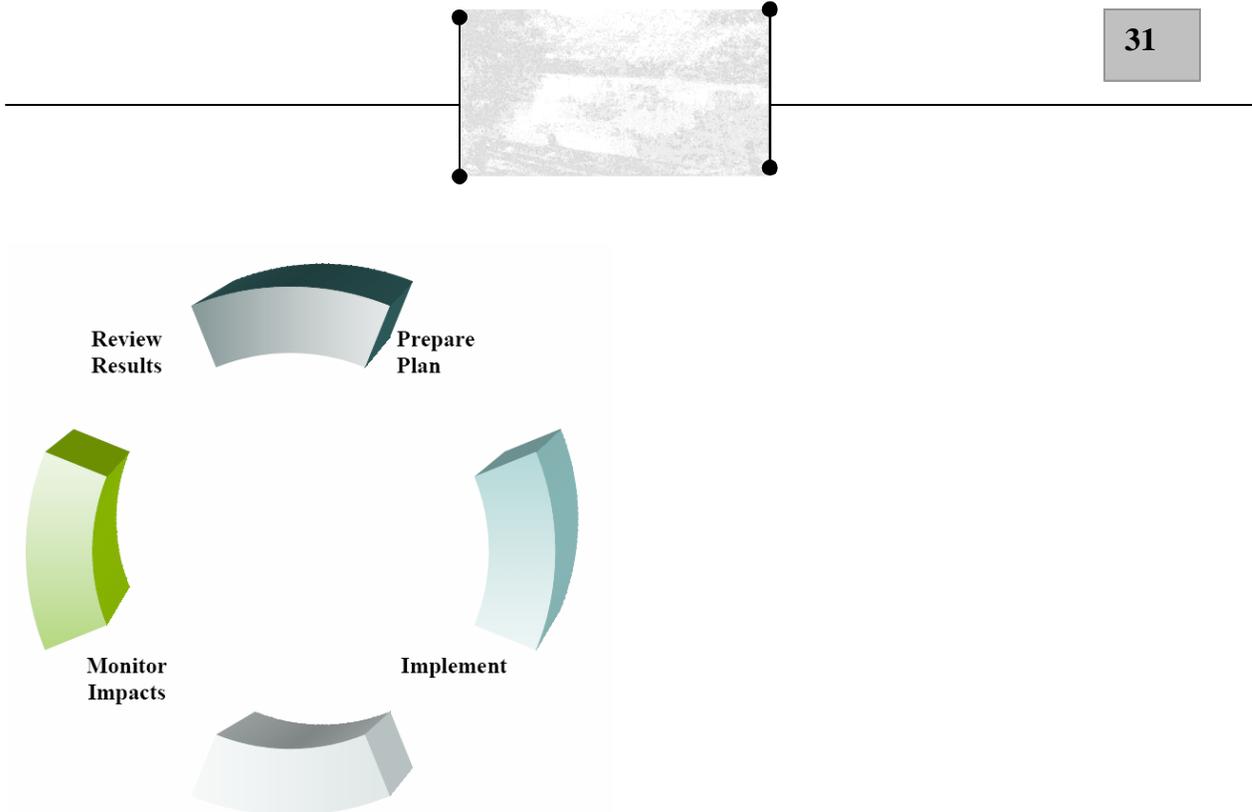


Figure 4.1: The Management Planning Cycle.

Based on the assessments above, a long-term vision of the park is established. This vision is what the stakeholder community agrees to be the ideal outcome based on the policies that they would like to implement. Thereafter, a series of objectives are formulated that the stakeholders believe would offer the best route for achieving the ideal vision for the park. These objectives are then empowered with a plan of action which is the specific strategies that will allow management to achieve the objectives.

A stark reality of protected areas management in Belize is that this ideal, although important in setting management focus and giving a sense of direction is seldom workable in its ideal form. In many cases protected areas are superimposed on an already modified landscape with various, and often conflicting, interests at work. Often protected areas are located near existing settled communities (as is the case of the STNP), where communities have long had a historical claim and cultural attachment to the resources of the area.

This management plan seeks to set a long-term vision that will eventually move the park towards the ideal of national park management. It seeks to establish an approach that takes into account community interest and concern, while setting the groundwork that will move the community from consumptive use of the resources to one that is more sustainable and offers more social and economic benefits and long-term security.

SATIIM has adopted a strategy of community participation in all of the studies that have been carried out in the park and the buffer zone communities. A series of studies have preceded the preparation of this management plan, including geological and hydrological studies, land use, ecological, economic, social and cultural assessments. These baseline assessments have built the foundation for the management plan and feed into it. They heavily emphasize community participation and input. As such they have been invaluable in setting the options and objectives for the management of the park.

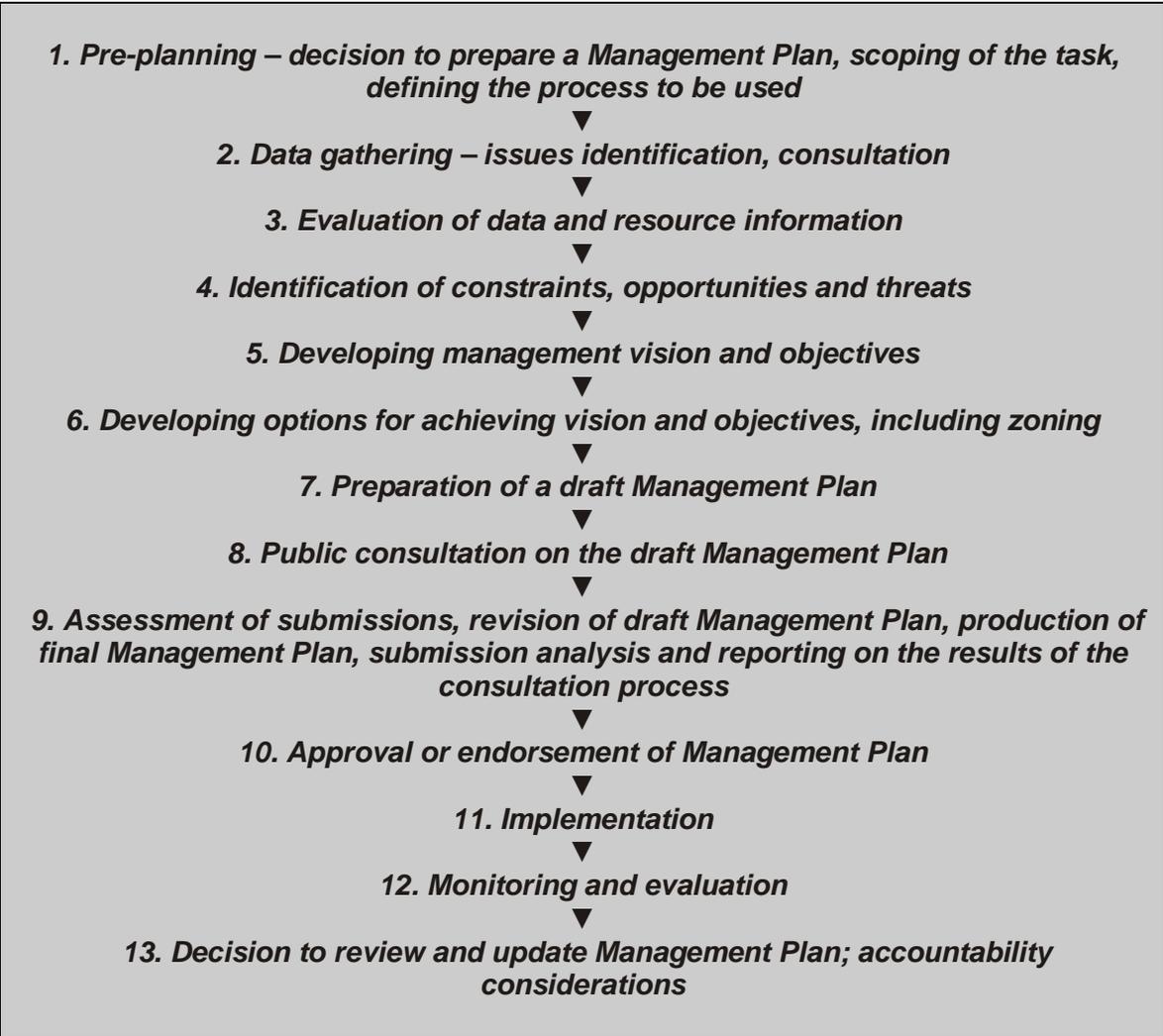


Figure 4.2: The Management Planning Process

**Figures 4.1 and 4.2** document the planning cycle and the planning process. It should be borne in mind that the preparation of the management plan is a process and not an isolated event mechanically carried out every five years. As such the plan must take a holistic view of the management issues, views and opinions. After preparation and approval, the plan should be dynamically implemented and the activities set out for achieving the objectives refined as circumstances should dictate. Lessons learned should be duly recorded, evaluated and fed back into the next phase of the planning cycle.

A particular challenge arises for SATIIM and the FD in that the STNP lies along an international frontier with a protected area lying on the opposite side of the border. This



is both a challenge and an opportunity. This arrangement offers a distinct opportunity for park management to form alliances and joint management initiatives that would maximize the use of available resources, strengthen the case for biodiversity management and promote understanding between the two protected areas. Even if the two areas are governed under different legislation and management designation they should be strongly encouraged to promote ways for trans-boundary co-operation (IUCN, 2001).

During the preparation of this management plan, consultations were held with the community members of all buffer zone communities who are represented on the co-management body. Consultations were also held with members of the SATIIM Board of Directors and representatives of the Forest Department.

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## SECTION V

### 5 EVALUATION OF THE PROTECTED AREA

#### 5.1 Contribution to the National Network of Protected Areas

The first and highest order of priority within the National Protected Areas System is to conserve national biodiversity. The assumption is that action at this level can help to conserve life at the gene, species and ecosystems level. The focus at the national level is on the identification of broad ecosystems, although it is quite possible that some species have extremely narrow habitat requirements and may not be adequately served under any of the existing ecosystem designations. The general assumption is that, while the National Protected Areas Systems Plan can be effective at the landscape level, protection of individual and distinct habitats will occur at site specific levels. The responsibility to identify these sites and design a protection program for their effective management falls mainly on local managers of protected areas.

The International Union for the Conservation of Nature (IUCN) calls for a minimum of 10% of each ecosystems type to fall under protected areas coverage, although this will depend on the total national acreage. Where possible, it is always best to exceed this number to the greatest extent possible. In instances where an ecosystem type exceeds 2000 ha., the IUCN considers adequate coverage at 10% of this area providing it is spread between 2 or more protected areas. In the event that the total area of an ecosystem within a particular country falls below 2000 ha., then the prescription is to designate such areas as restricted and the approach is to aim for a 100% protection of such sites.

One of the most important functions of the STNP is its contribution to ecosystems coverage within the National Protected Areas System. The park contains several ecosystems that are either poorly represented within the existing system or are not represented at all. This will probably be the most enduring contribution of the STNP and gives the park a “high value” status within the overall system. **Table 5.1** gives a description of the national coverage of the ecosystems found inside the park and the contribution to overall coverage by the STNP.

##### 5.1.1 Key Features and Exceptional Values

The following values were identified by the stakeholder community as unique or exceptional and warranting special management consideration. The assumption is that management interventions over the planning period must be chiefly concerned with addressing the protection and management of these values. This should not be done to the exclusion of the other values in the park; however, the STNP management adopts them as the core set of values around which its management program will be based.

Table 5.1: Contribution of STNP to National Ecosystem Coverage.

Ecosystem Type	National Distribution	Contribution of the STNP
<i>Basin mangrove forest</i> UNESCO Code: I.A.5.b.(1).(f).	Found nationwide along coastal lagoons and wetlands. Total national coverage = 97,846 ha.	Found in large area to north of park along northernmost portion of Temash River (407 ha.). Adds to the national coverage but not essential to achieve 10% national coverage.
<i>Mixed mangrove scrub</i> UNESCO Code: I.A.5.b.(1).(c).	Total national coverage = 34,283 ha.	Found in SW region of park to the north of the Sarstoon River (151 ha.). Adds to the national coverage but not essential to achieving 10% national coverage.
<i>Coastal fringe Rhizophora mangle-dominated forest</i> UNESCO Code: I.A.5.b.(1).(d).	Hugs the national coastline along a narrow fringe. Conspicuous along beaches and river mouths. Total national coverage =22,013 ha.	Found along the coast inside the STNP (223 ha.). Essential to achieve 10% national coverage within protected areas.
<i>Riverine mangrove forest</i> UNESCO Code: I.A.5.b.(1).(e).	Grows on rich alluvial deposits along rivers across the country, especially where saline influences exist. Total national coverage = 9,502 ha.	Found in narrow band along the Temash and portions of the Sarstoon River (225 ha.). Essential to achieving 10% national coverage within protected areas.
<i>Deciduous broad-leaved lowland disturbed shrubland</i> UNESCO Code: III.B.1.b.(a).2.	Found in tiny areas in only a few locations in Belize, Stann Creek and Toledo Districts. Total national coverage = 20,211 ha.	Occurs in a tiny area in park (56 ha). Very small acreage under protected areas coverage.
<i>Tropical evergreen broadleaf lowland forest over calcium-rich alluvium</i> UNESCO Code: I.A.1.f.(2).(a).K	Nationally found only in the Toledo District. Some located in Bladen Nature Reserve and small portion in Deep River Forest Reserve.	Occurs in very small area near northern boundary of park. STNP is important to national coverage but not essential to achieve 10% coverage.
<i>Tropical evergreen broadleaf lowland forest over poor or sandy soils</i> UNESCO code: I.A.1.a.(1).(b).P	Nationally found only in Toledo District. Portion falls into Deep River Forest Reserve and Paynes Creek National Park. Total national coverage =79,961 ha.	Occurs in small area to N and NW of park (1,289 ha.). Most of this ecosystem type does not fall into protected areas. STNP not essential to achieve 10% coverage.
<i>Tropical evergreen broadleaf lowland forest over steep calcareous hills</i> UNESCO Code: I.A.1.a.(1).(a).K-s	Identified nationally only in Toledo District and there mainly in the Colombia River Forest Reserve and Bladen National Park. Total national coverage 45,553.5 ha.	Very small section in STNP (18.7 ha.). Park is not essential to achieve 10% national coverage but area has important social and cultural values.
<i>Tropical evergreen broadleaf lowland hill forest: Calophyllum variant.</i> UNESCO Code: I.A.1.a.(1).(a).C	Nationally Occurs only in Toledo District, with major portion falling into Colombia River Forest Reserve. Total national coverage 8,773 ha.	Covers small area in STNP (1,385 ha.). Park is essential to achieve 10% national coverage.
<i>Tropical evergreen broadleaf lowland swamp forest: Seasonally waterlogged.</i> UNESCO Code: I.A.1.g.(1).(a)	Again this forest type is only represented in the Toledo District with a small section falling into Deep River Forest Reserve. Total national coverage 13,870 ha.	The majority of this ecosystem falls into the STNP and its buffer zone area to the NE of the park (5,228 ha.). STNP is essential to achieve 10% national protected areas coverage.
<i>Tropical evergreen broadleaf lowland swamp forest: Permanently waterlogged.</i> UNESCO Code: I.A.1.g.(1).(b)	This ecosystem is confined nationally to two small areas outside the STNP, none of which falls into protected areas. Total national coverage = 17,733 ha.	The STNP contains almost the entire area occupied by this ecosystem type within protected areas and is critical to its protection (2911ha.). STNP is essential to achieve 10% national coverage.
<i>Tropical evergreen broadleaf lowland swamp forest: Manicaria variant</i> UNESCO Code: I.A.1.g.(2).(b).M	Southern Toledo is the limit of the northern range of this ecosystem type. Total national coverage 3,003 ha.	Almost this entire ecosystem falls into the STNP (2,303 ha.). Area comes very close to falling into the IUCN restricted use management category e.i. < 2000ha. Has important cultural and economic significance to communities.
<i>Tropical Evergreen Lowland Peat Shrubland with Sphagnum.</i> UNESCO Code: III.A.1.f.	Is represented nowhere else in the country or Central America.	All of this ecosystem type occurs in the STNP. Nationally and regionally this ecosystem is unique, it therefore qualifies for special management designation.

**Key features or exceptional values of the protected area that are crucial to maintaining the significance of the park.**

- **Red Mangrove forest along the Sarstoon River**—The STNP has been regarded in the past as having some of the best mangrove stands in the whole



country. Although their size and formation is not unique, there are some outstanding mangrove formations along the Sarstoon River. These are found in the forest ecosystem type called *Riverine Mangrove Forest*.

- **Sphagnum Moss area near the middle of the park**—This is a unique ecosystem regionally and nationally since it is found only in the STNP. Within the STNP this ecosystem type is found within the *Tropical Evergreen Lowland Peat Shrubland with Sphagnum* ecosystem.
- **Habitat growing Comfrey Palms**—The Comfrey Palm areas are located to the east of the park between the Sarstoon and Temash Rivers. Found within park in ecosystem type *Tropical evergreen broadleaf lowland swamp forest: Manicaria variant*.
- **Karst Hills**—Karst Hills are near the northern boundary of the park. It is found in ecosystem type *Tropical evergreen broadleaf lowland forest over steep calcareous hills*.
- **River Systems**—The Sarstoon and Temash River are part of the watershed of a vast wetlands system that promotes and supports the development of a unique ecosystem. These water systems also support a broad diversity of aquatic life and other life forms that depend on them including water birds.
- **Trans-boundary Connectivity**—The STNP forms part of Belize’s southern boundary with Guatemala. It adjoins the Guatemalan protected area of Rio Sarstún, which is run by a conservation group called FUNDAECO. As such, it offers a unique opportunity for trans-boundary cooperation and the maintenance of trans-national biological corridors.
- **Wetlands Areas**—The STNP contains important wetland habitats and is an important part of the local watershed system.

**Significance of values (e.g. to human society in terms of environmental social economic)**

- Red mangrove stands within the park are a valuable resource that can be used for scientific research and education. They also play an important function in regulating surface runoff and therefore protect the watershed and fishery resources. This resource is being used illegally to make charcoal.
- Sphagnum Moss is a unique habitat in Belize and Central America and can have important economic values as a source of moss for industry. This is a poorly understood ecosystem in terms of habitat features and qualities. The function of this ecosystem and its interrelationship to the other ecosystems of the area is poorly understood.



- Comfrey palms are used as durable, attractive thatch for buildings by Belizean and Guatemalan communities. They were used by the Garifuna community of Barranco for the building of their ceremonial temple (*Dabuyaba*).
- Karst Hills contain caves, provide communities with medicinal plants, building materials and firewood, and contain at least one archeological site.
- River Systems are used by communities for transportation and the harvesting of fish. Communities are free to fish in the waterways outside the park, but the portion inside the park helps to replenish the wild population and so can offer a sustainable supply of fish to the communities if properly managed.
- Trans-boundary Connectivity—Within the STNP there is widespread poaching of game and fish, and harvesting of forest products by perpetrators originating from Guatemala. Cross-border cooperation can increase the effectiveness of the protected areas management program while helping to create trust and understanding between Belizean and Guatemalan people along that portion of the border. Trans-boundary connectivity is also critical to the establishment and maintenance of biological corridors in an area already plagued by high deforestation and a fragmented landscape.
- Wetlands protect the quality of water in the watersheds in this region and prevent erosion. Heavy erosion washing into surface runoff can affect water quality in the rivers and negatively affect the Belize Barrier Reef System, one of the country's premiere tourism attractions.

## SECTION VI

### 6 ANALYSIS OF IMPORTANT MANAGEMENT ISSUES

#### 6.1 Identified Management Constraints

A number of constraints exist within the institutional and management framework of the STNP which can prevent SATIIM and the Forest Department from achieving their ideals for park management. Some constraints are temporal and will probably be reduced in importance over time while others will persist over the long run and require continual management accommodation within the planning framework and flexibility of approach.

- Statutory designation—limits what SATIIM can do in the STNP in terms of income generation and activities in support of community livelihoods. Reconciling community interest within a sustainable management framework is seen as a necessary step towards realizing effective park management. Under the guidelines given in the Statutory Instrument (S.I.) some types of activities are outright disallowed in national parks (National Parks Act, 1981).

Some activities disallowed under the S.I. occur in the STNP anyway, and management has to decide whether to confront them openly (and risk losing community support) or accommodate them under a structured management program. If the wording of the S.I is followed faithfully, management would not be allowed to design these programs even though they would constitute the pragmatic approach and would help to alleviate the worst impacts of current activities. The fear is that this would be seen as ratifying what would normally be considered illegal practices even though on the ground experience indicates that such programs are necessary.

- Co-management agreement—is a legally binding agreement between SATIIM and the GoB that encumbers the parties to act and behave in a certain way. Although this dual management approach can be beneficial in offering oversight and pooling resources, it can present difficulties where the experience on the ground of one party causes them to adopt a philosophical management approach with which the other party may not agree.
- Altered ecosystems—are large areas to the north of the park that are in farms or are abandoned milpas that need to be restored to their natural state to support a dynamic equilibrium in biodiversity values typical of the natural condition of that area. In the present situation, managing for high biodiversity values under natural conditions cannot be carried out in these areas because the forest and environment has been altered by anthropogenic forces. The introduction of invasive species and selective removal of certain species such as timber trees has created a distorted picture of the true ecological makeup of these areas.
- Management capacity—needs to be strengthened technically, financially and institutionally. SATIIM is a young organization with little protected areas management experience and is still in the process of building capacity. Present financing under the World Bank-GEF grant is allowing significant upgrading in



management capacity; however, the present funding will only continue for another year, so continuity in the building of management capacity cannot be assured. If continuity of the funding is disrupted for any reason, this can become a serious management constraint.

- Potentially conflicting land use demands—Biodiversity conservation and support of community livelihoods are potentially conflicting land use demands on park. Management finds it must deviate from the ideals of park management as laid down under the National Parks Systems Act as a compromise to maintain community support. Without community support it is highly unlikely that management will be able to achieve any of its management objectives. Buffer zone communities are traditional users of resources and have historical claim to use of the area before the establishment of the park. This creates a moral dimension that cannot be easily legislated. The main issue is the delicate balancing act along the gray area of accommodating community interest while still managing for biodiversity.
- National Protected Areas Management Regulations and Policy—Although these may serve the best interest of biodiversity management at the landscape level they might not answer the particular management situation of the STNP even though SATIIM may be required to follow them.

## 6.2 Threats to Park Management

During the stakeholder consultations certain operative activities were identified that could seriously jeopardize park management if not addressed. These are: □□

- Encroachments by Guatemalans—Indications are that Guatemalans readily cross the border to fish, hunt and collect forest materials. With the ongoing attempts to address the Belize-Guatemalan border dispute, this becomes a sensitive issue with international implications. The activity is entirely unsustainable and is now believed to be seriously compromising biodiversity conservation within the park; however, the park management may be constrained from addressing this problem as they would if the problem was originating from within the national borders. National stakeholders have continually voiced their misgivings over this activity.
- Temash Bar Settlement—There was a settlement at the mouth of the Temash River at the time of the first Stakeholder Workshop, which resulted in the request that this area be excised from the park. These families moved from the area soon after that Workshop, but an area of 40 acres south of the mouth of the Temash River was officially excised from the STNP in S.I # 22 of 2000. Six other families of Guatemalan origin now occupy an area north of the mouth of the Temash River in the STNP. They are completely surrounded by the STNP and not able to provide for themselves without recourse to illegally exploiting resources within the park. The inhabitants are alleged to have established Matambres in the park and are likewise known to hunt and fish extensively in the area. It is alleged that members of this community set gill nets and traps in the river, poison smaller

waterways for fish, log and cut mangrove for charcoal. It will be very difficult for SATIIM to control the activities of this group because of their location.

- Establishment of Matambres—Matambres are late summer / autumn farms and are harvested close to the dry season, providing another food source. It is an agricultural practice of the Maya in the region. Matambres have been established inside the park along the creeks and the Temash River both by buffer zone communities and the residents of Temash Bar. Since the activity continues into the present time (albeit at a reduced level), the conclusion can be drawn that there are persistent forces operating in this direction. Matambres result in deforestation and introduction of domestic plant species. It is almost always accompanied by hunting and fishing and the removal of logs and leaves.
- Vulnerability of coastal areas to unsustainable activities—Management of the coastal zone to the east of the park is not the responsibility of SATIIM since this area is not included in the park; however, there is a close relationship between the estuarine areas and the sea. The Rapid Ecological Assessment carried out in 2003 found that fully 59% of the fish species found in the park are marine species. This suggests that an impoverished coastal fishery will negatively impact the ichthyofauna populations within the park and all the other species that depend on them. The community of Barranco is pushing for SATIIM to include the coastal area as one of its management zones. It is also known that the removal of mangroves to make charcoal is depleting the mangrove stands along the river and coast and that this is contributing to erosion in these areas. People are also reported to be discarding garbage into the rivers which eventually is found in coastal areas.
- Loss of biological connectivity—More and more the STNP is standing out as an isolated forested enclave surrounded by large expanses of deforested lands. Although some species may be able to withstand the isolation, others may have a broader habitat requirement or may need to wander over large areas to feed and reproduce. Geographical isolation may also impoverish the gene pool affecting the vigor of future populations. The park loses a lot of its conservation significance in such an isolated landscape.
- Lack of boundary markers—People who infiltrate the park often plead ignorance to its existence or are not aware that they have actually crossed the boundary, assuming it to be somewhere else. The delineation of park boundaries is a critical management issue that must be addressed urgently. The installation of boundary traces also gives SATIIM a firm legal hand when prosecuting perpetrators for more serious offences.
- Heavy hunting and fishing to the point of exhaustion of populations of certain game species—Hunting and fishing are selectively removing certain species from the park. Since there is a close interrelationship between species in the food chain, this can cause other species which depend on the selectively removed species to either migrate or their numbers to collapse.
- Unregulated harvesting of forest products—Logs, poles, leaves for thatch and certain plants used for crafts and medicines are being indiscriminately removed



from the park. Of this group, logging appears to be the most serious because of its scale and the accompanying ecological degradation. Indications are that the forest is being perniciously creamed of a few select species, leaving a forest of diminished economic and ecological value. Loggers create roads, giving access to hunters and farmers who follow in their wake.

- o Resentment of the park on the part of some community members—Although SATIIM has made tremendous strides in enlisting the support of the communities, mistrust and disquiet persist in certain quarters as to the true intent of establishing the protected area. Many villagers still feel that they should have unlimited access into the park to exploit the resources as they see fit and in tune with their traditional practices. There is the potential that disgruntled villagers may actively agitate to prevent the implementation of the objectives of the management plan or lobby the powers that be to change the designation of the site or have certain areas excised from the park altogether.

### 6.3 Opportunities for the Management of this Protected Area

Various factors interplay that if properly managed can be used advantageously by the management of the STNP to further the goal of its protected areas management program. Many of the opportunities identified were also listed as threats or constraints in the previous sections. It therefore stands to reason that management will be challenged to take apparent disadvantages, neutralize the negative factor in the most efficient way, reorient the issues and exploit any positive angle to the fullest extent possible. In its management of the STNP, SATIIM will be closely watched by other like-minded conservation groups in the region who will want to replicate SATIIM's success in their own management programs. The development of suitable strategies assumes a greater regional importance when this is taken into account. The deployment of management strategies from the STNP into other areas with similar situations was quoted as an objective of SATIIM in the proposal it submitted to the funding agency.

- a. Collaboration of communities—Although community violation of park boundaries to carry out illicit activities is often mentioned as a major management problem it should be borne in mind that SATIIM has a large constituency within the communities who support and actively participate in their management programs. During the consultations to prepare reports about the STNP and its buffer zone areas, each community provided trainees to assist with the studies. Including the communities within the management framework earns community respect and loyalty and brings them on board as fully fledged players with a voice.
- b. Cooperation with the FUNDAECO organization in Guatemala for trans-border park management—In 2003 SATIIM signed an agreement with FUNDAECO for collaboration between its management program in the STNP and FUNDAECO's programs in the Rio Sarstún protected area. The agreement calls for both organizations to work together for the advancement of the conservation agenda along the Sarstoon River. The main focus is on the protection of the Sarstoon River and its associated watershed. The agreement goes so far as to establish a co-management arrangement between the two entities for the joint management of the Sarstoon River watershed.

- c. Existence of SATIIM—SATIIM is a community membership organization with its members drawn from the communities and other important stakeholders in the region. As the driving force behind the management of the STNP it brings the most important stakeholders with a vested interest in the proper management of the resources of the STNP into center stage. This arrangement offers the best possible framework for long-term conservation of the area and empowers the communities socially, economically and culturally. Management of the STNP also gives the indigenous communities a platform from which they can voice their opinions and make their contribution to resource management in front of a national audience. Inclusion of the communities makes it easier to disseminate information and to enlist the unique expertise and skill of the communities advantageously in direct park management activities such as ranger patrolling and tour guiding.
- d. Opportunity to protect buffer zones along rivers and for extension to coastal protection—Rivers and watersheds are among the most threatened ecosystems in the southern region. The protection of the STNP and the management agreement with FUNDAECO offers a very good prospect for a meaningful protection of these resources. This has implications for other sectors of the economy such as the fishing and tourism industry. In managing these systems SATIIM is providing an environmental service that benefits other stakeholders in the region, although there is presently not a system in place to pay for this service.
- e. Need to support and conform to MBC objectives and any new protected areas system policy initiative—The STNP is the southernmost protected area in Belize and also has trans-boundary connectivity to protected areas across the border. Although the situation of the corridor in this area is less than ideal, real possibilities for an effective corridor network exist in this area with proper management and joint collaboration across the border. Funding and the support of the communities will be required to reconstruct these corridors and to encourage communities to engage in corridor compatible activities.
- f. Introduction of sustainable livelihoods program—Teaching the communities about sustainable development issues provides them with knowledge and skills to manage their own resources outside the park in the buffer zone areas. If sustainable management of resources occurs outside the park it creates a more conducive environment for biological corridors and offers a functional buffer with good biodiversity values and a healthy food chain.

# Part II

# Management Strategies

## SECTION VII

### 7 MANAGEMENT VISION AND OBJECTIVES

#### 7.1 Vision Statement

The management goal of SATIIM and the FD can be summarized in the following vision statement:

*“To undertake the sustainable management of the natural resources and other environmental attributes of the Sarstoon Temash National Park, so as to ensure their long-term viability and continued contribution to the development of Belize and to a high quality of life for the indigenous people of the Sarstoon-Temash region ”*

The immediate aim of park management is to create suitable management structures within the SATIIM organization, to establish a management presence within the park by the building of appropriate infrastructure, the creation of a security apparatus including the hiring of park rangers and the delineation of park boundaries and the continued building up of a partnership relationship with the communities. Management envisions a building up process whereby capacity will be built up over the five-year period covered by this plan with the ultimate aim of achieving the full suite of management values expected of a national park.

##### 7.1.1 STNP Management Principles and Values

The following five goals were used as the basis for the development of a management strategy for the park. They by no means represent all the important management issues, but they are considered the most important matters to be addressed at this particular juncture in its evolution. Many of the goals have objectives that overlap with those of other goals. Where this is the case, management must capitalize on this and seek convergence in the activities applied in the interest of economizing on the use of time and resources. Despite this, they should be regarded within the overall planning framework as separate and distinct and given equal prominence in their implementation. This means that the application of one should not dilute or reduce the significance of the other.

Buffer zone communities exert considerable influence over what happens inside protected areas whether they are included in the management framework or not. It is not possible to consider the management of the STNP without giving due regard to the activities occurring along its boundaries and the buffer zone region. Because of this, management objectives inside the park must overlap with the need for sustainable management of this zone and to recruit community members into adopting the goals of park management.

**GOAL # 1:**

**To protect the physical resources and biological processes within the STNP.**

**(i) Specific Objectives:**

- To develop a zoning plan for optimal management of the park's resources and the existence of strict conservation areas,
- To ensure that anthropogenic activities within the protected area and the buffer zone region do not impair the geological features of the area,
- To preserve the underlying physical processes that support natural flora and fauna within the STNP.

**(ii) Background information**

The major and potential threats to the conservation of the physical environment of the STNP are:

- Inappropriate fire regimes in Karst Hills which result in erosion along slopes;
- Destruction of mangroves along rivers and the coast which results in accelerated erosion;
- Roads and trails within the STNP which divert water from natural drainage and scarify the landscape;
- Milpas which remove natural vegetation cover resulting in erosion and mass wasting of topsoil;
- Pollution into surface and groundwater resources;
- Deposition of sediments into rivers and streams.

**(iii) Proposed policies, guidelines and actions**

- Develop and implement a fire management strategy that incorporates farmland along the park boundary and the region incorporating the Karst Hills;
- Map areas presently used for charcoal production as areas for special surveillance;
- Zone mangrove areas and buffer strip along rivers and the coastline as conservation and wilderness areas;
- Promote alternative income generation schemes for families presently involved in the production of charcoal;
- Develop a strategy to rehabilitate areas along waterways that have been deprived of mangrove cover;
- Stop all milpa cultivation in park as a matter of urgent priority and allow areas to regenerate naturally;
- Work with communities to create suitable systems for garbage disposal;
- Help communities develop adequate systems for management of human waste; and
- Insist on environmental statements from large developers moving into area in the form of environmental impact assessment and environmental compliance plan.

**GOAL # 2:****To protect the natural flora and fauna of the STNP.****(i) Specific Objectives:**

- To ensure that activities inside the national park do not impair the ecological integrity of the area.
- To maintain healthy park ecosystems
- To ensure that anthropogenic (human) activities within the protected area and the buffer zone region do not impair the ecological integrity of the area,
- To preserve the ecological processes of the STNP support a wide diversity of flora and fauna.
- To develop a mechanism for identifying and protecting species at risk.
- To emphasize the preservation of the unique ecological features of the area,
- To contribute to ecosystems preservation as a direct contribution to the National Protected Areas Systems,
- To promote continued collaboration with conservation organizations in Guatemala to achieve regional conservation goals.
- To regulate hunting and fishing in the park by local residents.

**(ii) Background information**

The major threats and potential threats to the conservation of the natural flora within the STNP are:

- Lack of proper boundary traces and markers;
- Lack of an adequate and properly enforced zoning scheme;
- Unregulated removal of thatch, medicinal plants and building materials;
- Fragmentation of forests across the regional landscape;
- Invasion of pest and exotic plants.
- Uncontrolled hunting on the part of buffer zone communities decimating certain wildlife populations;
- Little knowledge of species composition, distribution and wildlife population dynamics within park;
- Threat to wildlife caused by communities embedded within the park;
- Deforestation, uncontrolled fires and logging;
- Poisoning of waterways and setting of gill nets across waterways to catch fish;
- Isolation of faunal populations across the regional landscape;
- Invasion of feral and domesticated animals.

**(iii) Proposed policies, guidelines and actions**

- Ban extraction of plants within reserve for commercial purposes, except for the production of crafts and for inter-communal sales;
- Encourage research into forest dynamics and regeneration within the STNP;
- Promote a forest connectivity program across the region;
- Ban the harvesting of certain at risk species within the multiple use areas;
- Place a moratorium on all fishing and hunting activities until a management program can be devised based on solid scientific data;

- Increase public awareness and participation in wildlife management activities;
- Work with the Forest Department and the Police to stop sale of wildlife during closed season;
- Identify and monitor all Hickatee Turtle nesting sites to prevent human depredation;
- Initiate a Green Iguana hatching and release program within the park and buffer zone area;
- Design a monitoring program to detect invasive species from the communities that may be invading park.

**GOAL # 3:**

**To foster community cooperation and participation to derive tangible benefits from the management of the park for the local communities.**

**(i) Specific Objectives:**

- To engender the development of community business enterprises and identify new community business opportunities.
- To foster community cooperation and Sarstoon Temash regional cohesion.
- To maintain the special spiritual and cultural values of the park and benefits to the local indigenous communities.
- To identify income generating options available to local communities
- To provide for traditional subsistence use of park resources, and other traditional extractive activities balancing local need with ecological integrity.

**(ii) Background information**

The major threats and potential threats to the development of alternative income generating programs within the buffer zone area are:

- Cultural preferences and traditions;
- Poorly developed internal infrastructure;
- Little exposure to business practices and training;
- Lack of employment opportunities and small internal markets;
- Indiscriminate deforestation regardless of soil suitability resulting in soil degradation;
- Lack of community awareness and education;
- Lack of alternative protein sources other than wildlife;
- Unsustainable and destructive harvesting of roof thatch;
- Lack of understanding of the extent of the resource base and regeneration potential;
- Population growth;
- Alienation of some segments of communities which makes them unreceptive to SATIIM programs.

**(iii) Proposed policies, guidelines and actions**

- Develop an outreach and educational program to sensitize communities in sustainable approaches to resource management;



- Lobby for timber operators in the buffer zone region to adopt a sustainable timber harvesting program
- Encourage community members to rear livestock and game species on a commercial scale for wild game meat substitution;
- Work with local and national authorities for residents of buffer zone communities to get suitable farmland outside park;
- Create special community extraction zones (multiple use and indigenous extraction zones) that are managed under sustainable management regime for limited extraction of plant materials;
- Promote ecotourism, cottage industries based on crafts and agro-forestry programs in buffer zone areas
- Assist each buffer zone community to develop a land use zoning scheme through the concurrence and support of the GoB's Land Management Program;
- Investigate potential for small scale fish farming enterprises in rural communities;
- Conduct research program to determine sustainable harvesting program for bush sticks and thatch within buffer zone areas;
- Identify bush sticks species and thatch used for construction of traditional homes and delineate these areas on a distribution map showing STNP zones and buffer zone areas;
- Enlist community support in conducting research into fish and game species used for local consumption;
- Along with the communities, design a sustainable harvesting program designed around the biological growth and reproductive cycles of the various fish species;
- Along with other regional development programs, promote the adoption of an agro-forestry program based on the use of multiple purpose trees and efficient recycling of nutrients.

**GOAL # 4:**

**To promote the ecological integrity of the regional watershed and offshore waters**

**(i) Specific Objectives:**

- To develop a land use plan that will maintain ecological integrity in the major rivers and headwaters in the regions near the park,
- To conduct ecological studies of aquatic flora and fauna in waterways adjacent to the STNP,
- To carry out water monitoring programs within the park and in neighboring water systems,
- To push for community management rights to the waters offshore the STNP.

**(ii) Background information**

- There is increasing pressure on the waterways and watersheds near the STNP as populations in the area expand. The major threats and potential threats to the protection of the watershed of the STNP are:
- Disposal of garbage into rivers and streams;
- Deforestation along the banks of rivers and within the coastal zone;



- Release of agro-chemicals into waterways;
- Release of human waste into waterways due to absence of sanitary facilities;
- Unsustainable high rates of fishing in marine areas offshore the park, depleting commercial stocks and wrecking the food chain;

**(iii) Proposed policies, guidelines and actions**

- Promote an integrated agro-forestry program emphasizing use of natural biological controls for pest;
- Develop an aquatic based monitoring program in conjunction with the Coastal Zone Management Authority and Institute (CZMA&I), the Fisheries Department and the Toledo Institute for Development and the Environment (TIDE);
- Lobby to incorporate additional wetlands to the west of the park into the protected area (see map in Appendix D);
- Continue to work for the management integration of the Rio Sarstún area and the STNP under a unified watershed management program;
- Lobby for community management rights for the waters offshore the STNP; □
- Initiate a sanitary solid waste management program for communities;
- Work with regional development organizations to promote the installation of adequate toilet facilities for buffer zone communities.

**GOAL # 5:**

**To provide adequate income generation schemes for the management of the STNP**

**(i) Specific Objectives:**

- To encourage the use of the area for paid scientific research
- To promote paid visitation into the STNP;
- To promote feasibility studies for other potential income generation projects,
- To develop and implement a user fee schedule.

**(ii) Background information**

SATIIM is presently funded to develop its management programs under the COMSTEC project; however, funding for this project is only committed until 2005. Long-term management effectiveness will be severely compromised if new funding sources do not come on stream or if existing ones cannot be renewed. The major and potential threats to the conservation of the STNP due to potential funding shortages are:

- Disengagement from the communities resulting in community alienation from the STNP management programs;
- Inability to continue with on-site protection work within the park;
- Inability to engage effectively with other sustainable development collaborators within the region such as the MBCP and FUNDAECO;
- Inability to continue with monitoring programs within the STNP.

**(iii) Proposed policies, guidelines and actions**

- Develop a research program that targets priority areas and market the area to universities and research organizations as an income generation scheme;



- Submit proposals for funding to potential foreign and local donors based on the objectives and plan of action laid down in the Management Plan;
- Recruit suitably qualified foreign and local volunteers and interns to assist with park management programs;
- Conduct a tourism feasibility study for the STNP and the buffer zone area as a potential funding source;

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## SECTION VIII

### 8 THE PARK ZONATION PLAN

#### 8.1 Justification within the National Context

The basic premise of this management plan is that the resources and associated environmental values of the park will be managed to meet the social, economic, spiritual and cultural needs of the people of Belize and contribute to improved environmental quality on the national and global level. There is a growing public awareness that much of the country’s natural resources are not being managed on a sustainable basis and that more and more, undisturbed natural areas will be confined to protected areas.

Of paramount concern in designing a management program for the STNP is to ensure that areas sensitive to disturbances, unique in terms of overall ecosystems coverage or are poorly represented elsewhere within the national protected areas system are given full protection. Within this framework certain regions can be zoned for even stricter protection designation if they have unique qualities or if they meet other IUCN criteria.

The challenge within the STNP is to create a management system that will allow products to be extracted and used to meet the present needs of the indigenous people within the buffer zone communities without compromising the ability of the natural life support systems within the park to support a full range of biodiversity that are natural to and endemic to that area. Such a strategy will ensure that the communities are allowed to meet their basic human resource needs while keeping their support for the management programs until other alternative community livelihoods programs are developed.

#### 8.2 Approach to Ecosystems Management

To meet the many management priorities identified within the park, a range of zones will be established. These are the minimum amounts and categories that management feels is necessary to adequately address the range of ecosystems and the many social and economic pressures that bear down on them. From previous studies, two different zoning schemes have been devised for the park. One scheme was from a purely land use perspective, while the other highlighted ecological considerations. Upon review, neither of these models adequately addressed the complex of issues prevailing within the park. A new zoning scheme has been developed in this plan which seeks to address land use issues, ecosystems management and the social and economic needs of the communities while not being overwhelmingly complex or burdensome to implement.

As a general rule an overly complex zoning system can become burdensome to manage and confusing to community users of the area creating fertile grounds for misunderstanding and resource use conflicts. To address community needs, a multiple use community extraction zone is included. Within this area certain types of extraction activities will be allowed, providing it can be proven to be done sustainable. The critical question at this juncture is what level of harvest is sustainable in the context of the STNP. No historical data exist to support this proposed management strategy. Little

information is available on growth rates, mortality rates and options for silviculture treatments that would best fit the particular situation at STNP. There are no hard numbers on animal populations to warrant extraction with any degree of confidence. Because important questions remain unresolved, it is important that management adopt the precautionary principle in which a safety factor will be built in where there is not sufficient data to build a strong case for a particular action.

Management approaches based on the precautionary principle are expected to be refined over time, as the ecosystem becomes better understood. This implies a period of monitoring and research prior to and congruent with the extraction activity that should eventually build up a sound body of knowledge on which future management interventions should be based. This approach of “adaptive management” should therefore serve as a key principle on which to base all exploitative actions in the park. Essentially the approach should hold to the following standards:

- Extraction activities should not prejudice other important management aims for the park and should not unduly compromise the ability of the ecosystem to function properly.
- The design of the extraction operation should be based on an initial assessment of the extent and condition of the targeted resources.
- Where hard information is not available, the best available information should be used with due regard to the precautionary principle.
- Extraction activities must be pursued in tandem with a research and monitoring program to help in refining approaches and to identify possible impacts so that appropriate mitigation measures can be taken.
- All extraction must be approved by a joint Natural Resource Committee of SATIIM and the Forestry Department and supervised by that body or in lieu of that, by a suitably qualified and appointed proxy.
- Where it cannot be proven that a target resource can be exploited in a sustainable manner, no extraction whatsoever should be undertaken until such information is available.

**8.3 STNP Management Zones**

For management purposes, the STNP can be divided into 4 broad management zones—namely the Multiple Use Zone, the Indigenous Use Zone, the Conservation Zone and the Unique Values Zone. As indicated earlier this should be regarded only as a provisional configuration and should be further refined as the body of knowledge of the property increases and to allow for better management at the site operational level. For example, there is no infrastructural zone because as yet there are no plans to establish accommodations inside the park such as visitor facilities, education centres or research facilities. Ranger stations will need to be established and current management indicates that a base will be established to the north of the park and one along the Sarstoon River, however these will not occupy more than 1.5 acres each. These stations can also double up as research accommodation and visitor facilities if the situation warrants. As the

management programs develop, it will be necessary to include such a zone in subsequent planning periods.

### 8.3.1 Multiple Use Extraction Zone

#### (i) Description of Zone:

This zone is being established for the use of traditional and indigenous users of the resources of the STNP who are also residents of the buffer zone communities. The zone comprises all that area to the north of the Temash River but excludes the small area of Karst hills to the north of the park and a small area of Comfrey Palms near the mouth of the Temash River. This area is in close proximity to the communities and interface with their own Alternative Community Livelihoods Zone. It contains almost all the area previously disturbed by farming and logging and comprises the main area where the communities currently extract products. In addition, it contains significant amounts of the resources required by the community including, building materials, traditional medicines etc and allows easy access.

Within this zone, controlled extraction of certain resources identified with traditional use will be allowed, provided that an annual allowable harvesting level can be established that is scientifically based and does not prejudice the long-term survival of any specie or proper functioning of any ecosystem. The benchmark to be applied is that the practice must be proven to be sustainable. Otherwise the highest guiding principle of the park (biodiversity conservation) will be violated. This would make the purpose of the park and all the other management goals meaningless.

#### (ii) Rationale:

The indigenous communities are an indelible part of the landscape around the park. They have traditionally used the resources within the area now occupied by the park before its declaration and continue to do so up to the present day. At the community meeting in 1997 in Barranco Village, the communities had protested the inclusion of this area into the park and wanted it to be taken out. This approach strikes a balance, in that the communities are allowed to continue using this area in a responsible manner while it stays in the park and continue to increase the biodiversity of the area. Two major issues are apparent here:

- The management of the STNP have a moral obligation to respect the traditional rights of the people of the area and their need to meet their basic human needs.
- Management is confronted with the situation where, without community support, management of the park is simply untenable and would eventually lead to fractious infighting and community indifference to park regulations.

The major issue here is not to compromise the higher objective of the park which is to conserve the biodiversity of the area within fully functional ecosystems. From experience and through consultations with the communities, it has been established that the communities want rights to collect building materials such as thatch and poles, medicinal plants (which they have identified in several areas within the STNP), fish and game

animals. Communities have also traditionally farmed inside the boundaries of the STNP but this can no longer be allowed in any area of the park since it is highly destructive to the ecosystems of the area and totally incompatible with the objectives of a national park except under the proviso given below under regulations.

Other alternative sites where the community can find these resources are limited in the area and getting more so every day, moreover many sites would be too expensive and difficult to access. As a result, this area is being zoned to accommodate the sustainable continuation of the traditional activities mentioned above. Confining these activities to this zone will answer to community concerns, concentrate the impacts in one area and reduce complications with park enforcement personnel. Over time and as soon as other alternative livelihoods program can be developed, all resource extraction in the park should cease except for those with minimal impacts such as the collection of traditional medicines. At such times this zone can be subsumed into other zones with a stricter conservation designation.

**(iii) Regulations:**

- Before any extraction can occur, the Natural Resource Committee of SATIIM and the Forestry Department needs to approve the extraction of the target resource, this can only be done after an initial assessment of the state of the resource and a suitable methodology for harvesting is developed.
- No agriculture or logging will be allowed in this zone, however matambres will be permissible, in areas already used by local communities.
- No fires should be set in this zone.
- No hunting will be permitted.
- Line fishing can be done for subsistence purposes and only by local residents.
- Extraction in this zone will only be allowed for permanent residents of the buffer zone communities who have traditionally used the area.
- Buffer zone communities include those communities represented on SATIIM's Board of management, as well as the other smaller communities not represented, provided they fall into the buffer zone region.
- Extraction of approved products cannot be for sale, profit, or to provide for commercial enterprises or developments outside the buffer zone area, except with special approval from SATIIM and the Forestry Department.
- All resource users must obtain a license or permit from the SATIIM office: the office must organize a system to allow for this.
- Methods used for extraction must be approved by SATIIM, failure to comply can result in forfeiting of extraction privileges.
- Resource extractors must observe all existing SATIIM and national government regulations.

**(iv) Key Enforcement and Monitoring Needs:**

Enforcement of park regulations will be greatly assisted by the establishment of this zone. SATIIM must be attentive to the need to establish an efficient structure to facilitate community request for resources. Park rangers and outreach staff will be invaluable in facilitating communication between the communities and the SATIIM office. They can



also assist in monitoring and supervising the harvesting of products from the area. Since the zone is bounded by the Temash River in the south, it should be very easy to police and the communities should not be confused about the boundaries.

The main management issue will be to monitor and control quantity, species, and seasons when animals are killed, and quantity of plant materials extracted. People may resent having to apply for a license for things that they have traditionally done with little or no encumbrance. A massive educational outreach program is required to bring the communities on board before this zoning scheme can be implemented. If the communities do not understand the physical arrangement of the zones and the underlying ecological processes which makes zoning necessary, the scheme will fail.

SATIIM should conduct monitoring studies to determine the impact of this activity during a one year pilot phase. At the end of the year the concept should be reevaluated and refined based on experiences gathered. It may be necessary to establish annual compartment harvesting coupes so that areas can be harvested incrementally while other areas are allowed sufficient time to recoup. In the case of Bayleaf Palm, a harvesting program has already been established for northern Belize based on selective removal of leaves that does not do long-term damage to the trees and allow them to recoup and flush out quickly. The same studies will have to be conducted for the Cohune Palm to establish sustainable harvesting regime, although considerable indigenous knowledge of their use should not be overlooked. Needless to say, all aspects of the program should be well documented, since this model may well serve as a template for other protected areas managers in Belize.

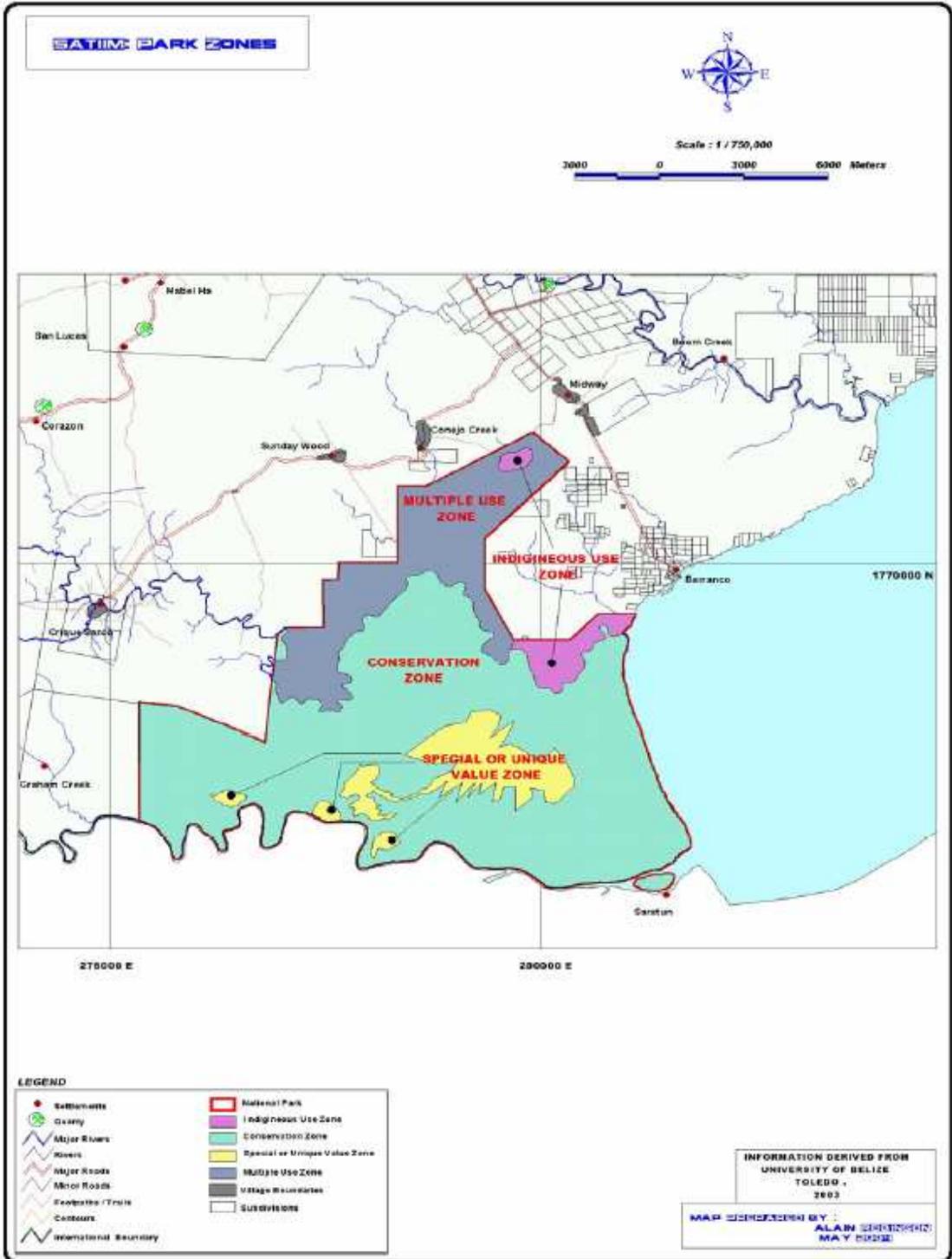


Figure 8.1: Map of the STNP Management Zones.



8.3.2 Traditional (Indigenous) Use Zone

**(i) Description of Zone:**

From consultations conducted with the communities it appears that two areas in the park are important for the indigenous people to collect their traditional medicines and building materials for their ceremonial temple. These areas are the Karst Hills to the north of the park near Midway Village and the stand of Comfrey palms along the north bank of the Temash River. Both areas will be zoned for cultural traditional use only, but unlike the multiple use zones, the type of extraction that occurs will be strictly controlled since these areas also have important additional significance.

**(ii) Rationale:**

The indigenous people of the Sarstoon Temash region are self reliant and rely on nature to provide most of their needs. The Maya people have identified the Karst Hills as an important source of medicinal plants that they would like to have continued access to, while the Garifuna people build their temple from the leaves of the Comfrey Palm and would like to have a guaranteed supply. The total amount of materials collected for both purposes is quite small and should not disrupt the ecosystem functioning of the area if they are properly supervised. Comfrey Palms produce durable leaves that last up to 12 years if properly placed. In the interim period small amounts may be required for occasional repairs to the temple. Other uses of the palm should be countenanced as long as the extraction is sustainable, providing they do not contravene the regulations set out below.

According to the communities, the Karst Hills contain species of plants used for medicine that are not easily obtained elsewhere in the region. This view is supported by Meerman et. al. (2003) who found a high level of plant endemism in this area. The Karst Hills also contain a cave system and, according to the communities, at least one Maya Archaeological site. Because the area is relatively unique in the region but has great cultural importance, this zonation scheme will only allow medicinal extraction and recreational uses.

The Comfrey Palm stands in the STNP are at the northern extremity of their distribution in the Neotropics. Within Belize, the park holds almost this entire ecosystem except for a tiny area further along the coast. It is therefore very important that this ecosystem be preserved. In balancing community interest with the need to conserve this area, only a small portion along the northern boundary of the STNP (north of the Temash River) will be used for traditional extraction, although the communities now harvest over a much wider area. The proposed site is close to the target community (Barranco) with easy access up the Temash River and should be able to provide sufficient quantities for their stated needs on a sustainable basis without the need to move into other areas. All other areas containing Comfrey Palms will be zoned out of bounds to any collecting activity or other

disturbances. The uniqueness of both areas would have warranted their placement in the stricter zoning category of unique or conservation zones if it were not for community dependence.

**(iii) Regulations:**

- Before any extraction can occur the Natural Resource Committee of SATIIM and the Forestry Department needs to approve the extraction of the product in question, this can only be done after an initial assessment of the state of the resource and a suitable methodology for harvesting is developed, this applies especially to the Comfrey Palm stands.
- No extraction of building materials or hunting will be allowed in the Karst Hills area, however line fishing will be allowed.
- Apart from the extraction of Comfrey palm leaves, no other forest products should be extracted from the Comfrey palm traditional use zone.
- No agriculture or logging will be allowed in this zone.
- No fires should be set in this zone.
- Extraction in this zone is allowed only for permanent residents of the buffer zone communities who have traditionally used the area after SATIIM has vetted the claim of such residents.
- Buffer zone communities includes those communities represented on SATIIM, as well as the other smaller communities not represented provided they fall into the buffer zone region.
- Extraction of approved products cannot be for sale, profit, or to provide for commercial enterprises or such types of developments outside the buffer zone region.
- All resource users must obtain a license or permit from the SATIIM office: the office must organize a system to allow for this.
- Methods used for extraction must be approved by SATIIM and the Forestry Department. Failure to comply can result in forfeiting of extraction privileges.
- Resource extractors must observe all existing SATIIM and national government regulations including payment of prescribed fees and royalties.
- No roads or permanent infrastructure such as docks should be established for harvesting products from these zones, although non-permanent trails are allowed.



**(iv) Key Enforcement and Monitoring Needs:**

Because of community respect for the Karst Hills area and their stated need to extract medicinal plants and the ease of identification of this area, it should not be difficult to enforce park regulations here. Nevertheless, this zone should be clearly demarcated on maps for community reference. The Comfrey Palm extraction area should likewise be relatively easy to demarcate, *i.e.*, the Comfrey Palm area on the north side of the Temash River; however, a map will be useful to avoid misinterpretation on the part of the communities.

Congruent to the extraction of products from this zone, a monitoring and evaluation program should be carried out to evaluate impacts. Here again it will be useful to declare the first year a pilot phase and refine the procedures and methods with the benefit of experience. The institutional structures necessary to facilitate this will be the same as for the Multiple Use Extraction Zone.

**8.3.3 Conservation Zone**

**(i) Description of Zone:**

This zone will encompass all lands not falling into the above zoning categories or the unique values zone. This is by far the largest zone in the park comprising all areas between the Sarstoon and Temash Rivers save for the area occupied by the Sphagnum Moss ecosystem. The protection zone will also extend to all areas around major water bodies such as rivers creeks and lagoons irrespective of whether the areas bordering them falls into other zones. For this purpose a 50m buffer strip will be established around such water bodies and managed as a part of the conservation zone.

This area offers the best prospect for being managed as per the guidelines laid down for the management of National Parks under the National Parks Systems Act. This area will be managed without compromise for wilderness protection.

**(ii) Rationale:**

The Conservation Zone comprises several ecosystems, many of which are either underrepresented within the national protected areas system or are not represented at all, such as the *Tropical evergreen broad-leaf lowland swamp forest: Seasonally waterlogged*, *Coastal fringe Rhizophora mangle-dominated forest*, *Riverine mangrove forest*, *Tropical evergreen broadleaf lowland swamp forest: Permanently waterlogged*, and the *Deciduous broad-leaved lowland disturbed shrubland*.

Since the park is being managed to maintain the highest biodiversity values possible, this area must be kept as large as possible to maintain the greatest sizes and number of viable habitats. The conservation zone will be maintained solely for the maintenance of biological



diversity, education, research and other non-extractive purposes such as eco-tourism. Natural processes must be able to dominate completely irrespective of any other considerations. The proviso is also laid down that wherever possible, areas from the existing Multiple Use Zone will be incorporated into the Conservation Zone where they have little extraction value to the communities, or as the communities develop other alternative livelihoods that are less demanding on park resources. The actual extent of this zone will therefore be refined over time but the presumption must always be to increase its area coverage and never to reduce the coverage.

**(iii) Regulations:**

- Access is restricted except for research, education, and management activities.
- Research is allowed under stringent guidelines, based on the research needs of the park.
- No roads, piers or other transport infrastructure will be allowed.
- No extraction of any flora or wildlife whatsoever except for research purposes and then only with necessary permits.
- No agriculture or logging will be allowed in this zone.
- No fires should be set in this zone.
- No habitat disturbance of any kind will be allowed.
- Trails are allowed for recreational purposes, research, education and eco-tourism. All trails must be low impact.
- Camping sites (if the situation warrants) will only be permitted in specially designated areas and their numbers will be strictly controlled.

**(iv) Key Enforcement and Monitoring Needs:**

Incursion by Guatemalans into the area to be covered by this zone has long been a vexing problem plaguing SATIIM. There are several entryways into this zone from Guatemala but river access is the most important. Incursions from across the border occur along a broad front across the Sarstoon River. Illegal activities include logging, poaching/hunting and fishing. Many of these activities are highly destructive to the environment.

The enforcement of park regulations is bound to hit a sticky point when it comes to the interdiction of these cross-border violators. Such cross-border incursions are highly sensitive given the ongoing Belize-Guatemala territorial dispute. Recourse to local law enforcement personnel to enforce the laws in regard to illegal entry will be the preferred approach, although this can at times be cumbersome and time-consuming. SATIIM has a valuable asset in the allegiance of the local communities who can act as informants to help



to curb these activities. A ranger station along the southern boundary of the park would be a valuable deterrent and would help to show management presence in an otherwise intractable area. Joint patrols between staff of the Machaca Forest Station, Police Department and Belize Defense Force, including the Maritime Wing would be beneficial.

Continued collaboration with FUNDAECO is crucial in creating cross-border cooperation in managing the resources along the Sarstoon River. This approach allows SATIIM access to reach the stakeholders on the Guatemalan side of the border and visa versa. In addition the Guatemalan protected area along the Sarstoon acts as a buffer to the park.

Some incursions into this zone occur from the Belizean side of the border. They originate from the buffer zone communities of Graham Creek and Crique Sarco. SATIIM will need to work intensively with these communities to curb this activity and to ensure that their needs are met in the multipurpose zone. Unlike the northern buffer zone communities, these villages have better access to land outside the park; however, they heavily depend on the park for fishing privileges. Delineation of the park boundaries will be an important deterrent to entry from these communities. Much of the area in this zone is swamp land and inhospitable. This is another deterrent to illegal entry

8.3.4 Unique Values Zone

**(i) Description of Zone:**

This zone has a single ecosystem called *Tropical Evergreen Lowland Peat Shrubland with Sphagnum* that is unique both to Belize and the rest of Central America. It is located near the center of the marsh in a vast swamp bog (**Figure 2.5**). As a unique ecological feature, this area is being given the highest priority and stringent standard for protection. The landscape is very remote and impenetrable except for the driest period of the year.

This zone is being set aside for education and research purposes only under strict guidelines. No other use whatsoever will be allowed. Entry will be restricted to researchers and park employees.

**(ii) Rationale:**

The *Tropical Evergreen Lowland Peat Shrubland with Sphagnum* was only identified as a new ecosystem during the REA conducted in 2003. Previously it was misidentified along with another ecosystem due to the fact that no ground trusting accompanied the interpretation of aerial photos and satellite imagery. The area has so far only been briefly described and other assessments will surely be attempted in the future. There are no studies on the ecosystems dynamics within this area and its connectivity to the other regions of the park. The environment is harsh and probably not species rich but it may well contain species unique to the area which have very narrow habitat requirements that are only met in this ecosystem. This is one of the most promising areas for research inside the

park.

**(iii) Regulations:**

- Access is restricted except for research, education, and management activities.
- Research is allowed under stringent guidelines, based on the research needs of the park.
- No roads, piers or other transport infrastructure will be allowed.
- No extraction of any flora or wildlife whatsoever except for research purposes.
- No agriculture or logging will be allowed in this zone.
- No fires should be set in this zone.
- No habitat disturbance of any kind will be allowed.
- Trails are allowed only for research and education. All trails must be low impact.
- Camping and tourism is not permitted in this area.

**(iv) Key Enforcement and Monitoring Needs:**

The present inaccessibility of the area and its lack of resources of high economic value are probably the best deterrent to illegal entry into this zone. Since human impacts over the long term will be kept minimal, there will be little need to monitor for human use impacts. The ranger post along the Sarstoon River will help to enforce park regulations in this area.

**8.4 Proposed Extra-Territorial Zonation Scheme for Areas Beyond Park Boundaries**

SATIIM has long recognized a *de facto* community livelihoods zone covering the buffer zone communities. In this area, the organization conducts outreach work and promotes a sustainable livelihoods program which focuses on relieving pressure on the land by promoting alternative sustainable uses. This zone is being maintained in the new planning period. There is great concern that the coastal resources offshore the park are not being managed in a sustainable manner. The villagers of Barranco in particular are anxious to bring this area under a sustainable management regime since it directly affects their livelihoods and the future growth prospects of the community. SATIIM does not have the legal prerogative to manage this area but has a vested interest in its proper management since many of the ongoing activities can directly affect the management of the natural resources within the park e.g. fish resources. SATIIM should develop a management program for this area over the next five years and lobby for management rights. This would answer both to the needs of the areas stakeholders and SATIIM's vested interest in maintaining high biodiversity values in the area. The proposed area is shown in **Appendix D**.

The Rapid Ecological Assessment carried out in 2003 had recommended that an area bordering the park and east of Crique Sarco and Graham Creek be incorporated into it (see **Appendix D**). At present, this area is under natural forest cover and contains land



poorly suited for agriculture but will eventually be degraded by if left unprotected. Incorporating this land into the park will simplify the park boundaries and make them easier to maintain and to police. If the communities can be brought on board, SATIIM should lobby the national authorities for this area to be incorporated into the park. Additionally, SATIIM should work with the community of Temash Bar to see if the community can be relocated elsewhere outside the park boundaries to a site agreeable to the community members. SATIIM should facilitate the community members to find suitable agricultural land elsewhere. This is a sensitive issue that must be approached delicately and will require both time and diplomacy. The main selling point is that both sides stand to benefit from such a move, not least of which will be Temash Bar which is now hemmed in with no space for community expansion. Any new areas incorporated into the park should be added to the conservation zone, except for the marine areas which will need a multiple use zone designation.

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## SECTION IX

### 9 PARK CONSERVATION MANAGEMENT STRATEGIES

#### 9.1 Identification of Conservation Programs

The main management priorities of the STNP must be addressed within specific conservation programs. The conservation programs are thematic areas in which the management actions are grouped so that they can be efficiently addressed.

The main areas of management priority as defined within the management objectives can be conveniently grouped into the program areas below:

- i. **Site Protection Program**—This program will target resource protection within the STNP, but it may also spill over into the buffer zone communities if the communities voluntarily enlist SATIIM’s help in the sustainable management of the resources within the buffer zone region. The focus of this program is to control all types of unauthorized and unsustainable use of resources which do not conform with the management objectives of SATIIM,
- ii. **Biological Connectivity Program**—The focus of this program will be to:
  - Maintain existing corridor linkages between the STNP and other natural areas,
  - Promote initiatives to encourage corridor compatible uses of land within the region, and
  - Engage in reconstruction of corridors through collaboration with stakeholder groups, national environmental organizations and international conservation organizations.
- iii. **Aquatic Systems Program**—This program will focus on areas in which water is a predominant factor in the ecological makeup of the system. As such it will be concerned with swamps, wetlands, lagoons and rivers. The coastal region will be addressed under a separate management program,
- iv. **Forest Recovery Program**—Large areas within the STNP have been degraded by deforestation for cultivation, logging and fires. It is important that these areas be returned to a state where the natural forest structure and species composition are closer to the natural condition associated with the particular ecosystem. Actions to reconstitute natural forest will fall under this program,
- v. **Alternative Community Livelihoods Program**—The management of the STNP

must invest considerable resources and time in working to alleviate community pressure on the protected area. This program will seek to work with communities to develop economic alternatives to their traditional extraction practices within the STNP, while giving full recognition to their right to live and work in the area around the park,

- vi. **Financial Sustainability Program**—SATIIM's work towards sustainable management of the resources within the STNP can be seriously jeopardized if a suitable funding regime is not developed. This program area will look at developing funding mechanisms by which the organization will help to finance its management intervention work in the park and buffer zone area.

Although the programs are listed above as distinct, separate management categories, they should be viewed as mutually supportive of each other to the extent that action taken in support of achieving the objective of one program may confer benefits on another program. Although synergy within the program is advantageous it must be stressed that the programs identified are critical in addressing the management issues facing the park and all program areas should be pursued with equal vigor.

SATIIM has little experience in executing programs at the field operational level. There is not a body of knowledge or experiences to guide management planning. The actions laid down under the various program areas will need to be refined continuously in a process referred to as adaptive management. The basic operating procedures will be refined over an initial two-year period; however, they will be soundly backed up by resorting to the precautionary principle and constantly yielding to the expediency of adaptive management. This means that generous safeguards must be built in where there is a dearth of information and these should only be relaxed when new information come to light. To that end, management must adopt a dynamic adaptive approach, constantly evolving to embrace new information sources and relying on sound scientific research and monitoring to provide answers where they are lacking.

## 9.2 Stakeholder Analysis

Many stakeholders influence conservation management within the STNP. These stakeholders can be divided into two broad categories: namely, regional stakeholders, who exert direct, often times physical, influence on the protected area, and the national stakeholder community who exert mostly indirect influence in such areas as policy



**Table 9.1:**  
**List of Main Stakeholders and their likely area of Contribution to STNP Program areas.**

Stakeholders	Program Areas						
	Site Protection Program	Biological Connectivity Program	Aquatic Systems Program	Forest Recovery Program	Alternative Community Livelihoods Program	Financial Sustainability Program	
<b><u>Regional Stakeholders</u></b>							
Buffer Zone Communities	✓	✓	✓	✓	✓		
Q'eqchi' Council of Belize (KCB)	✓	✓	✓		✓		
Fundacion para el Ecodesarrollo y la Conservacion (FUNDAECO)	✓	✓	✓			✓	



National Garifuna Council	✓	✓	✓	✓	✓
Large Private Land Owners		✓	✓		
Toledo Development Corporation (TDC)	✓	✓	✓	✓	✓
Toledo Alcaldes Association	✓	✓	✓	✓	✓
Community Initiated Agriculture and Resource Management Project (CARD)		✓			✓
<u>National and international Stakeholders</u>					
Forest Department including Conservation Division	✓	✓	✓	✓	✓
Mesoamerican Biological Corridors Program (MBCP)		✓	✓	✓	✓



National and International Conservation Agencies	✓	✓	✓	✓	✓	✓
The National Security Services	✓					
Department of the Environment (DoE)		✓				
Government of Belize (GoB) (Executive Branch)					✓	

formulation, legislation, financing, etc. Regardless of the category, it is clear that to succeed within the identified program areas, SATIIM will need to work closely with a host of stakeholders. Stakeholders can either be exerting stress or they can be helping to alleviate stress on the protected area. Paradoxically, some stakeholders will play both roles—on one side being the cause of the stress while also being the key to the alleviation of the stress. The buffer zone communities whose practices are depleting wildlife population within the park will also be the key partners in creating corridor networks from the protected area into the larger landscape. The identification of stakeholders in this context refers to those entities that can contribute positively within the program areas in carrying out the various actions identified under those programs.

The most important regional stakeholders are the buffer zone communities who exert a direct daily influence over the site. This group can play an important role in all program areas except in the area of financial sustainability. The key with all stakeholders is to identify areas of common interest and to diligently build upon these. The areas of common interest should deliver a benefit to the stakeholder while also advancing SATIIM's goals for site management. Stakeholders will have different outlooks and priorities. For example, the communities will want direct benefits in terms of goods and services, whereas national funding agencies and the security forces are forwarding the objectives of their organization by participating. Still other organizations like the National Garifuna Council and the Q'eqchi' Council of Belize may feel urged to contribute through a philosophical and moral commitment to serve the best interest of their members who form a large majority of the residents of the area. **Table 9.1** gives a list of the main stakeholders and their likely area of contribution.

Previous work by SATIIM with regional and national stakeholders has prepared the context and laid the groundwork for future collaboration. Several of the studies commissioned under the COMSTEC project have helped to clarify the prevailing socioeconomic and cultural issues in the area. Whereas the *modus operandi* of most protected areas management programs in Belize is to secure the protected area and install the necessary infrastructure and management devices first, and then consult the local communities. At the STNP this will not be the case. Both institutional building and collaboration with the stakeholder community must go hand in hand and one must not be seen to be given greater prominence than the other. This approach is necessitated by the many socioeconomic pressures operating in the region that impact the protected area and the community-driven approach to protected areas management which distinguish this site.

**9.3 Program Areas and Strategies**

### 9.3.1 Site Protection Program

This program will address some of the most urgent management issues facing the STNP. This includes a suite of site violation activities including milpa farming, hunting, fishing, logging, and illegal extraction of non-timber forest products (including Xate, thatch and poles) and uncontrolled fires lit to encourage game or for milpa clearing. Some activities are low intensity and are probably sustainable at current extraction levels, e.g., bush medicine and poles. It may be possible to comfortably accommodate these within the overall site management program, providing that adequate studies are carried out to determine suitable harvesting levels, the extent of the resource and a suitable extraction regime which does not diminish the wild populations.

Other activities are of a more grievous nature and directly threaten the biological integrity of the site. These include activities such as logging (by small scale local operators), fishing, hunting and the establishment of small holder plots. Logging operations in particular, often require large financial outlays which are provided by investors who are then keen to protect their investments. These investors are often well placed with solid connections at the highest levels of national life. Encounters between these interest and site management can therefore be complicated, time consuming, frustrating and outright intimidating for site managers. Oftentimes those who engage in milpa farming, hunting and fishing within protected areas can draw upon a considerable amount of public sympathy. This sympathy comes from a lack of understanding of the role and contribution of protected areas and the general perception that such areas are a part of the commons; are underutilized and that the poor must have some means of survival.

Conservation work can sometimes lead to unpleasant confrontations between perpetrators of offences and site security personnel. In Belize, the norm is for rangers to travel unarmed because national law enforcement agencies are sensitive to the issue of having armed groups proliferating without adequate controls. They insist that arms be provided as a last resort after all other options have been exhausted. The proximity of the protected area to the international border between Belize and Guatemala adds another dimension to the issue; consequently, site protection forces are limited to the role of demonstrating management presence, gathering and collecting intelligence and general deterrence. Where major infractions occur, or where the situation has potential to escalate into violent confrontation, the norm is to refer the matter to the national security forces.

Although satisfactory in most cases, this approach does not answer the unexpected flashpoint situations, where park personnel may need to defend themselves. In the same vein the stretched resources of the national security forces often prevents them from responding in time. This can be a serious impediment to prosecuting perpetrators where successful prosecution depends on linking individuals to the offence. Additionally it is felt

that national legislation does not provide for severe enough penalties to deter repeat offenders and would be perpetrators.

Hitherto, SATIIM has relied on its connections and presence in the community for on-the-ground intelligence. Although proven effective and should be encouraged and maintained, this passive protection system is not sufficient for the intensity of surveillance that is required under a more intensive management regime. The organization has never fielded a ranger force, nor does it currently have a system of logistics and infrastructure to maintain such a force. The institution of these proactive site conservation measures will be a direct result of the COMSTEC project and is justified within this plan as per the actions advocated below:

**9.3.1.1 (Action 1.1): Establishment and Maintenance of a Site Protection Force.**

- i) **The Composition of the Protection Force**—As a first measure in its site protection program, SATIIM must assemble a ranger force capable of undertaking continuous protection and surveillance work on the site. Preferably this force will be recruited from within the region and ideally from the buffer zone communities. Applicants will have law enforcement and or military experience and familiarity with the area. A predisposition to living and working in remote settings and an appreciation for conservation work are also preferred qualities.

The ranger force will consist of at least eight Rangers working under a Head Ranger who is responsible to the Executive Director or an employee designated by that person. The Rangers will be shared equally between two outposts, but can be rotated between them. Assuming a four-week rotation period, this arrangement provides for adequate manpower to allow for time-offs, annual vacations, sick leave etc and allows a continuous gate presence while being able to mount two-man patrols at all times. Where this arrangement does not suffice, temporary help can be brought in where one or more rangers are incapacitated at the same time.

Rangers will be required to patrol the protected area, fight fires, accompany the national security forces on patrol, maintain the property lines, make and install signs along boundary lines, assist researchers and liaise with the communities. Boundary checks will constitute the bulk of patrol duties with special emphasis on known “hot spots”. SATIIM should use its best endeavors to get the members of the ranger team trained and commissioned as special constables. An ongoing record of protection work should be compiled by this body.

- ii) **Ranger Outpost** – Because of the size of the protected area and the difficulty
- SATIIM Park Management Plan



of moving across the site due to the extensive system of bogs and swamps, two ranger outposts will be required. Prevailing on-the-ground considerations indicate the need to set up a post in the northern region of the park near the main entry point in the vicinity of Midway Village. This is a main entry point for foot and vehicular traffic and offers easy access to the other villages via the Barranco and Crique Sarco Roads. It also offers quick and easy access to SATIIM's Punta Gorda office. In addition, the site offers a good vantage point from the nearby Karst Hills allowing rangers to overlook large swathes of the reserve from a single point. These rangers will also be responsible to monitor the activities of the incipient community of Temash Bar.

The second outpost will be established within easy access to the Sarstoon River and should allow for effective patrolling for cross border violators across the river while providing easy access upriver to monitor the activities of buffer zone communities such as Graham Creek and Crique Sarco. It should also be possible for this team to monitor activities along the coastline offshore from the protected area, although as previously mentioned this activity will fall under another management planning program.

Each Ranger Outpost will consist of two wooden buildings secured from weather and the elements. Buildings will have enough space and amenities to comfortably house the rangers and their equipment and to accommodate other park personnel or visiting researchers.

Since the roads leading into the reserve are not public thoroughfares there is no need to establish a gate (barrier) to vet motorists. This policy can be revisited in the future if this situation should change.

- iii) **Equipment**—Adequate equipment for the field staff improves their effectiveness, morale, professionalism and ability to respond to contingencies. Reliable and effective communication equipment is of the utmost importance. Field and base radios and ancillary equipment should be provided for the ranger stations, transport equipment and personal gear. In addition, transport equipment including boats/canoes and vehicles will be required. To reach more difficult areas overland All Terrain Vehicles (ATV) can be invaluable. ATVs are less damaging to roads and more fuel efficient than other vehicles. Rangers should also be provided with field tools, survival kits and field clothes.

**9.3.1.2 (Action 1.2): Establishment and Marking of Boundary Traces and Access Routes**

- i. **Establishment of Boundary Traces**—A constant refrain from perpetrators and

would be perpetrators of offences within the STNP is that they were unaware that they were inside park boundaries. SATIIM has already obtained funding to establish park boundaries which are well defined on area maps but almost impossible to locate on the ground. In creating boundary traces the park is advantaged in that it has two prominent natural boundaries (Sarstoon River and the Caribbean Sea). This greatly reduces the time and cost of boundary clearing. Away from the natural boundaries the park has a very irregular boundary that will require careful mapping on the ground using GPS equipment.

Property lines are normally cleared to the minimum width necessary for a casual observer to easily detect. Only undergrowth and sapling is cleared with larger trees left undisturbed to the extent possible although some may have to be removed to allow for sighting and orientation. Wide, well cleared boundary lines are difficult to maintain, damage the ecosystem and offer an attractive route for vehicles such as illegal logging equipment. Where property lines cross difficult terrain or inhospitable areas such as swamps and bogs it is customary to bypass them and reconnect on the other side, since these are not areas normally traversed by park intruders.

Normally property lines are cleared by local labor under expert supervision using GPS and survey equipment. This helps to provide employment while helping to acquaint the community with the location of the lines. Once cleared the lines should be maintained as necessary using in-house labor. This is normally done by Rangers when on patrol at little or no additional cost to the organization. Alternatively, this can be done on contract to community members if ranger manpower and circumstances indicate their deployment elsewhere.

- ii. **Signs and Management Maps**—After the lines are established on the ground, well designed and placed signs should be installed at prominent locations. Ideally signs should be made of the most durable weather resistant materials; however, these are expensive and can be a recurrent expense when vandalism occurs. Park boundary signage should therefore be regarded as a recurrent expense and will probably remain so until outreach and advocacy work kicks in and begins to create a discernable attitude change throughout the buffer zone region.

During the clearing of the property lines, SATIIM should take the opportunity to map all trails and roads, river landings etc. leading into the protected area. These will be identified as hotspots and will require frequent monitoring. Additionally, areas containing sought-after resources such as merchantable logs can be mapped during this time. Timber resources in close proximity to the

property line are often the most frequently targeted by illegal loggers. In extreme cases, these logs can be sabotaged with metal spikes to prevent chain saw operators from bringing them down.

- iii. **Outreach, Education and Advocacy**—This is an area which often produces multiple benefits including appreciation of the protected area, environmental consciousness and community empowerment, etc. In terms of site protection, a major focus of outreach, education and advocacy should be to sensitize and familiarize people about the protected area and the ongoing site conservation program. This will create goodwill among the residents for the protected area and build strong alliances between SATIIM and the communities. This is a major activity area requiring prolonged and patient effort; however, the dividends can be huge and cost effective over time, requiring less expenditure in active site protection.

Outreach, education and advocacy will require the hiring of one or more individuals who will need to be provided with dedicated transportation, communication, and public presentation equipment. Normally such activities are headquartered within SATIIM’s Punta Gorda office building where equipment can be shared with other program areas.

### 9.3.1.3 (Action 1.3): Co-management of Sarstoon River Watershed

The intent of this activity is to empower an already existing co-management agreement between SATIIM and the Fundacion para el Ecodesarollo y la Conservacion (FUNDAECO) for the management of the Sarstoon River watershed. The agreement calls for the two organizations to enter into the formulation of joint strategies for the sustainable management of the resources of the area. This requires both organizations to combine efforts and resources to increase the effectiveness of their management.

Specific activities identified under this initiative are to:

- i) Disseminate information to the buffer zone communities,
- ii) Organize and train personnel,
- iii) Carry out a diagnostic study of the Sarstoon River basin,
- iv) Strengthen community organizations,
- v) Prepare bi-annual work plans for the STNP and the Rio Sarstun protected areas,
- vi) Strengthen the co-management agreement between the two bodies with relevant national authorities,

Although this agreement has been ratified by both parties, its provisions have not been carried out. Collaboration with FUNDAECO is a worthwhile initiative which gives SATIIM



leverage on the Guatemalan side of the border, allowing it to access the buffer zone communities on that side who have been named among the most important perpetrators of illegal activities within the park. Many of the activities identified for collaboration with FUNDAECO can be subsumed within other SATIIM activity areas such as outreach, advocacy, education, and the park protection program for which a team of rangers will be assembled.

Access into Guatemala and appealing to buffer zone communities on that side will add another dimension to SATIIM programs and will have to be budgeted as a distinct expenditure category. Other actions, such as, carrying out diagnostic studies of the Sarstoon watershed, will require expert technical skills for which the organizations may be able to obtain interns or visiting researchers. If this is the case, costs associated with these activities will be considerably lower.

9.3.2 Biological Connectivity Program

Deforestation around the STNP is increasingly isolating the park from other natural areas. The rate of deforestation is alarming and will threaten biodiversity values within the park if left unchecked. It is therefore in the interest of the management of the STNP to work assiduously to maintain existing corridor linkages, and where possible create others in priority zones. The opportunities for incorporation of more land into the park are limited and even if such options were available, such a move could backfire and result in widespread public opposition.

Changing socioeconomic patterns within the buffer zone areas are resulting in communities becoming permanently established in areas of limited or unsuitable agricultural land. When compounded with rising populations, this means that rotational period for milpa farmers are getting shorter and shorter. Additionally, farmers are planting permanent crops and creating pastures for livestock. This suggests a permanent state of near total deforestation over large areas. Since farmers are farming the land more intensively, the forest does not have time to regenerate or effectively act as biological corridors.

There are recently updated maps to show the state of deforestation within the region near the STNP. However the maps tend to put all deforested areas together and lump them as cultivated land and do not distinguish between areas of secondary forest which succeed milpa plots, tree orchards, actively farmed areas, pastures etc.. These maps do not give a good assessment of corridor functionality or potential; nevertheless, they show areas of human impact and disturbance and, therefore, areas for future concentration of effort.



SATIIM has worked closely with the communities to establish agro-forestry schemes based on organically grown cacao. Several other merchantable crops are intercropped with cacao, which itself is normally grown under shade conditions. This implies that a part of the structure of the natural forest is retained and the mixed cropping system produces an element of plant species diversity which should favor some diversity in the wildlife population. Although agro-forestry schemes such as these are less than ideal and are a poor substitute for the natural forest, they are the best option given the need for communities to generate income from the land. In the future, the long-term objective should focus on diverting pressure from the land by providing alternative income generation options, although agro-forestry should remain a viable land use option. SATIIM will increase its efforts to expand on the total acreage of agro-forestry plots in deforested lands around the park with some of the increase coming from abandoned pastures and degraded milpa systems.

Besides SATIIM, other organizations are working with buffer zone farmers to promote alternative agricultural practices. The Toledo Cacao Growers Association (TCGA), the CARD project and the TDC are promoting agro-forestry development in the area. SATIIM will continue to work closely with these groups in this endeavor. SATIIM should take full advantage of the Fair Trade market offered for organic cacao in southern Belize through collaboration between TCGA and the UK-based chocolate company Green and Black. The relationship between TCGA and Green and Black has recently been strengthened through the provision of a large grant from the Department for International Development (DFID), an agency of the UK government. The single most important factor in determining the outcome of these initiatives is whether farmers will be able to market their products and generate sufficient income to offset or outperform the benefits of milpa farming, bearing in mind that this system of agriculture is engrained in traditional Maya culture.

SATIIM will also need to work closely with FUNDAECO in Guatemala to promote corridor connectivity between the two areas. The areas bordering the Sarstoon are mostly deforested and therefore the potential for cross-border connectivity which should be the basis for the establishment of priority areas does not exist.

**9.3.2.1 (Action 2.1): Small-holder Reforestation Support Strategies.**

Supporting reforestation schemes within the buffer zone area allows SATIIM to support the communities socio-economically, relieves pressure for cultivation within the STNP and helps to create corridor linkages while spreading the sustainable development ethic.. Mayan and Garifuna farmers in the area are well disposed to planting useful trees and living in harmony with the forest, so there are no cultural biases to be overcome. This initiative encourages community members to engage in reforestation by planting multipurpose agro-forestry trees or mixed species of high timber value. The Scheme envisions the following steps.

- i. **Educational Campaign for Reforestation** – This outreach work will inform farmers about the proposed scheme, educate them about reforestation and agro-forestry generally and obtain a list of interested participants. The outreach meetings will also identify timber and agro-forestry trees of interest to farmers. It will be useful to co-ordinate and borrow expertise from other like-minded organizations in the area during these initial contacts and to invite them to workshops.

The aim is to get from 15 to 25% of the farmers evenly spread from all the buffer zone communities involved initially and to augment this percentage over time. Although the program should not turn anyone away, it should aim to identify those with genuine interest and focus on them. Subsequent to the initial contacts, and after a list of prospective participants are identified, a well qualified agro-forestry/forestry specialist will be brought in who will be responsible for the project.

- ii. **Nursery Establishment** – Once a list of potential participants has been identified and their interest in the different species noted, a nursery will be established. The location of nurseries is of paramount importance since it must be close to a well drained place where suitable rooting soils are available. Water for irrigation must also be available all year round. The location of the nursery can be in one of the communities, providing it is centrally located, or at the proposed ranger outpost near Midway Village. Locating the nursery at the ranger outpost has the advantage of keeping SATIIM in control, eliminates security concerns and better utilizes the time of the gate person who would not normally be continuously engaged. On the other hand, this approach alienates the communities and does not transfer knowledge and technology effectively.

Every effort should be made to acquire the best planting materials and provenances of the species selected by the farmers. Nursery management can be an expensive and time consuming operation and therefore any local technologies that can be adopted should be fully investigated e.g., using cohune and comfrey leaves instead of Saran Cloth for shade.

- iii. **Plant Distribution, Planting and Technical Outreach** – Before plants are transferred to the farmers, the SATIIM technical person should have helped the farmers to identify suitable locations and the best growing conditions. Once plants are ready for planting they should be taken out to the communities for distribution. Records must be kept of all transactions and the technician should be available to advise farmers continuously and to carry out monitoring studies to determine plant growth rates, mortality rates, production levels etc.

**9.3.2.2 (Action 2.2): Engagement with other Large Landowners and Protected Areas Managers**

The intent of this activity is to build a network of like minded land management interest across the wider landscape. The co-management agreement with FUNDAECO serves this purpose and has already been mentioned under Action 1.3. There are however, many other land owners and protected areas within the region with whom SATIIM must build alliances and maintain close contact in the interest of working to protect the biological corridors and in reconstituting corridors where these have been broken. Among the main players are the Aquacaliente Wildlife Sanctuary Management Body, which manages the Aquacaliente Wildlife Sanctuary, the Toledo Institute for Development and the Environment (TIDE), which manages the Payne’s Creek National Park, and the Forest Department which manages the Deep River Forest Reserve and the Columbia River Forest Reserve. All the entities mentioned above are committed to the protection of the areas under their charge and share a common interest with SATIIM in maintaining corridor linkages outside their protected areas. The actions tabled here are for communication and coordination at the institutional-technical level with these organizations and FUNDAECO. To that end the following specific activities are proposed:

- i) Conduct biannual meetings with all the major stakeholder groups and with the main private landowners in the region,
- ii) Create a mechanism for creation of a joint plan of action,
- iii) Create suitable institutional structures for follow through on all agreements reached,
- iv) Explore ways for private landowners who are desirous of reforesting their property to leverage funding e.g., through the Clean Development mechanism created under the Kyoto Protocol and subsequent IPPC meetings (See Forest and Climate Change in Central America Project, {Herrera, 2002}),
- v) Prepare bi-annual work plans,
- vi) Strengthen the regional initiative and increase its acceptance by seeking alliances and partners outside the region and internationally.

These activities can be carried out with little additional demands on SATIIM’s human and financial resources. Many of these actions would be addressed through SATIIM outreach and advocacy programs and the actions outlined under the Site Protection Program (Heading 9.3.1) and the Biological Connectivity Programs. (Heading 9.3.1).

**9.3.3 Aquatic Systems Program**

Water figures prominently in many of the ecosystems identified within the STNP (See **Figure 9:1**). Many of the unusual and unique ecosystems identified within the park, such as the *Tropical evergreen broadleaf lowland swamp forest: Manicaria variant* and the



*Tropical evergreen lowland peat shrub land with Sphagnum* are dependent on waterlogged conditions. A large area of the park is either permanently or seasonally inundated. In addition, the area serves as a catchment basin for the Sarstoon and Temash Rivers watershed.

As is the case for the terrestrial systems, the aquatic systems within the park are not properly understood; however, a major effort was made to identify some of their more common species during the rapid ecological assessment conducted in 2003. For example, no definitive information is available on invasive species and, if any, their migratory patterns and reproductive behaviors. Aquatic systems within the park are under assault by an array of disparate forces to an extent even greater than for terrestrial systems. Stress factors are well known but an effective strategy to counter them has proven illusive because of the heavy demand on the resources within these systems.

During the community consultations, several stresses on these systems were identified including heavy fishing using a variety of methods such as gill nets, poisons, traps and diving. It was also reported that garbage was being discarded into waterways and that human waste was also entering these systems. As the areas around the water heads of the main rivers and creeks become more densely settled and developed, there is an increasingly strong likelihood that agricultural runoffs in the form of pesticides and herbicides will enter these systems. The heavy rainfalls associated with the southern

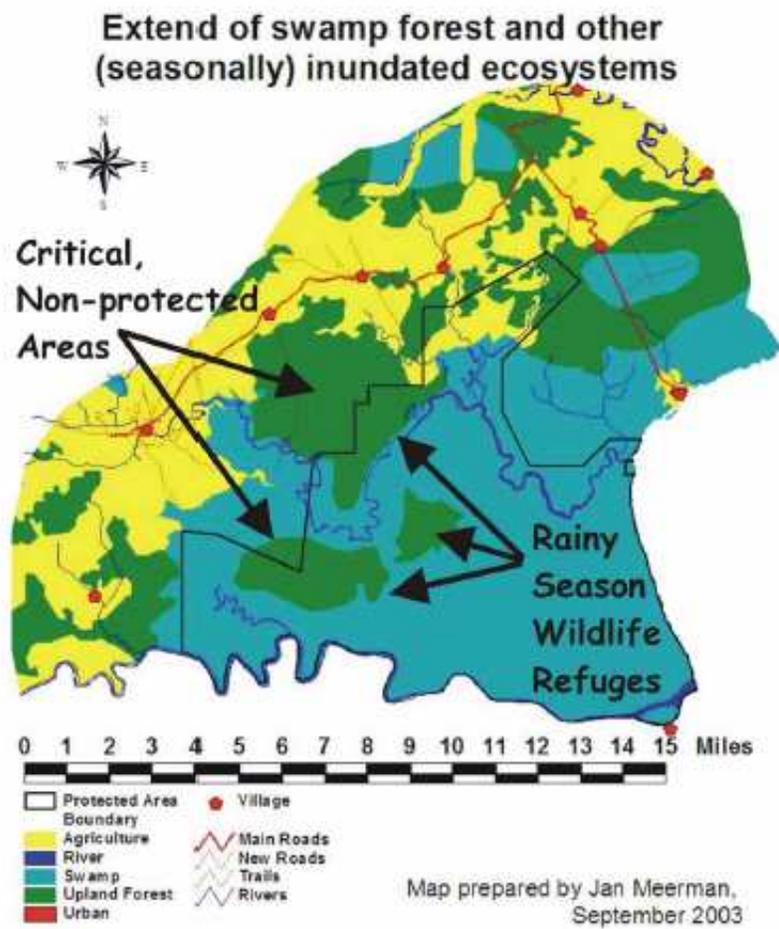


Figure 9.1: Aquatic-based Ecosystems within the STNP.

region will increase the likelihood of leached agrochemicals entering the waterways. Deforestation within the watershed area, especially along the tributaries of the rivers is creating ripe conditions for accelerated erosion. This could upset the nutrient balance of the rivers and unload sediments into the offshore waters resulting in degradation of those ecosystems.

To counter the degradation of the aquatic systems, SATIIM will need to work with a variety of stakeholders, including farmers, ranchers, community leaders, government authorities and community members in Guatemala. This is an area in which collaboration with FUNDAECO can be especially beneficial. Protection of the aquatic systems will require the

committed cooperation of all interest groups not least because the headwaters of the rivers that pass through the park are on private and public lands. There are other issues that also need to be ironed out. For example, does the creation of the national park preclude others from using the waterways that pass through it? Does SATIIM have legal rights to enforce park regulations or its own body of rules on river systems that are held to be public right of ways? The area from the high water mark up to 20m inland is held to be a public right of way. Does SATIIM have enforcement rights in this area?

The Aquatic Systems Program can help to alleviate the worst impacts on the aquatic systems but it is fanciful to imagine that they can be eliminated completely. The following activities, to be implemented during this planning period will be a step in that direction.

**9.3.3.1 (Action 3.1): Assessment of the Aquatic Systems within the STNP and Tributaries outside the Park.**

Within the framework of its agreement with FUNDAECO for the co-management of the Sarstoon River and its watershed, both FUNDAECO and SATIIM are supposed to produce bi-annual work plans and action plans for the protection of this river system. The agreement calls for a diagnosis of the Sarstoon River watershed; however, this does not include the Temash River or any of the other aquatic or wetlands systems within the park. This activity promotes a comprehensive assessment of all aquatic systems within the park with particular emphasis on riverine systems. Fortunately, the area does not have any industrial enterprises and most agricultural practices are traditional and low tech, using very little external inputs. The following components of the aquatic system are identified for closer analysis:

- i. **Assessment of water quality within all source areas and watersheds falling outside the STNP**—The purpose of this activity is first to determine water quality within these areas and secondly to identify point pollution sources. Based on the results obtained, a mitigation program can be developed to tackle the pollution at its source. Monitoring for water quality outside the protected area is the surest way to address water quality issues.

Subsequent to identifying the pollution sources, an educational program should be mounted to inform the communities about the findings and inform them of measures they could take to alleviate the impacts. This program should include public presentations and prepared graphic materials, which should be made available for distribution.

- ii. **Water Quality Monitoring Program**—After the initial assessment of water quality within and outside the STNP has been carried out, SATIIM should initiate a water quality monitoring program with the assistance of outside agencies such as the

CZMA&I. Sites should be identified in strategic locations for the establishment of permanent sampling points. The organization should keep an updated record of the data collected at these points and tailor its efforts at protecting the aquatic systems accordingly.

This effort should be coordinated with FUNDAECO for areas along the Sarstoon River; however, if that organization is not in a position to launch its water quality monitoring program this should not delay SATIIM. To the extent possible, SATIIM should include the communities in this program to increase awareness on this issue and to transfer technical skills and knowledge.

**9.3.3.2 (Action 3.2): Upgrading Community Sanitary Conditions**

The hydrological report commissioned by SATIIM and carried out in 2003 found faecal contamination at several sampling points, particularly publicly used water sources (wells and hand pumps). Community members also noted that waterways were being used for the disposal of garbage. The full extent of this practice is not know; however, both the release of solid and human waste into the aquatic system, whatever the quantity, are serious areas for concern. Such practices affect the health of the aquatic systems and their ability to support life, destroy their aesthetic value, and threaten offshore waters. While some communities are better off than others, they all have serious shortcomings in the area of liquid and solid waste management. This activity seeks to work with the communities to tackle the worst manifestations of these problems. Since the activities below will require substantial financial technical and material inputs over a considerable length of time, SATIIM should embark on a separate project to acquire the necessary financing and resources. It is envisioned that most will be acquired through the relevant government agencies.

- i) **Solid Waste Management** – None of the communities has a centralized system for the management of solid waste. Up to this point, solid waste disposal is left to the discretion of the individual community member who uses a variety of methods including burning, burying and direct discharge into waterways. This activity proposes to establish a more accountable system for garbage disposal which will alleviate impacts to the aquatic systems.
  - A. Embark on an educational program on the benefits to the community and the environment in creating better sanitary conditions. This program should highlight issues on both solid and liquid waste disposal. Community members will be informed of the different methods of waste disposal depending on the waste streams and the benefits of each. Communities will also be taught about how to sort waste into biodegradable and non-biodegradable streams. Inputs from the Public Health Department and the National Solid Waste Management Project will be invaluable in this endeavor.

It is also essential to include the youth and primary school students in an educational effort for a clean and healthy environment. It is the young people of these communities who will provide encouragement to their parents to adopt a healthy and sanitary lifestyle by bringing home ideas learned in school. The basis for a sanitary environment lies with the young generation, as they will adopt these practices at a young age and hopefully apply them in their adult life.

- B. At the end of the educational program, SATIIM will assist the communities in setting up sites for composting. This can initially be done as a pilot project using the most basic technology bearing in mind that in rural communities organic matter is often recycled for animal feed and that other organic waste such as paper are produced in very limited amounts. One compost pile will probably be enough to serve up to 20 families. The community can then use the product of the compost for community beautification and gardening.

Non biodegradable waste should be stored separately. SATIIM will assist the communities through the project to purchase oil drums for this purpose. At regular intervals the drums will be taken away by the villagers to a designated landfill site and emptied. SATIIM will assist each community in locating suitable sites for the landfill.

- ii) **Liquid Waste Management** – As is the case with solid waste the disposal of liquid waste leaves a lot to be desired. Most families do not have latrines and where they do, they are badly placed or performing below acceptable standards. The initiative to assist the communities to safely dispose of their liquid waste should be carried out hand in hand with the scheme for solid waste mentioned above to achieve synergy and to economize on resources and time. The construction of proper latrines in the communities is a major expense category and therefore significant community inputs and the use of local materials is indicated to keep cost down. SATIIM will have to enlist the support and technical and financial input of the Health Department in this endeavor.

1. Assist communities in finding proper location for the placement of latrines.
2. Create a proper design models for latrines that is both sanitary and durable to be used throughout the area.
3. Acquire materials for latrine construction through project funds using as many local materials as possible, providing they meet the criteria above.

4. Work along with the Health Department, local Alcaldes and village council on a continual basis to ensure the success of the program..

**9.3.3.3 (Action 3.3): Work with farmers to avoid deforestation along waterways and pollution runoff into Aquatic Systems**

This activity can be performed in concert with the agro-forestry program (Action 2.1). The intent of this activity is to create in farmers an awareness of land management issues and how their agricultural practices impact the aquatic systems and, by extension, their livelihoods. Hydrological studies commissioned by SATIIM in 2003 found high levels of nitrates and phosphates, which it is believed is originating from agricultural areas (Morgan et. al.,2003). Whether it is or not is a moot point, what is important is that these chemicals in present concentrations stand to disrupt the aquatic environment and therefore their causes will have to be addressed. The cost for carrying out this activity will be minimal since it will involve only outreach work and can be subsumed into other ongoing activities. SATIIM should be able to enlist the assistance of the Forest Department, Agriculture, and the Pesticides Control Board in this effort.

- A. Bring in an agricultural expert to show farmers the safe use of herbicides and pesticides. Emphasis should be placed on the use of biological control wherever possible. Farmers will be made aware of the life cycle of common pests and taught the best practices in the application of chemicals if required.
- B. Using the same venue afforded in above (A), explain to farmers the national legislation in regard to clearing of vegetation along riverbanks and streams. Use graphic symbols to show the detrimental effect of deforestation along this zone including the loss of topsoil and reduced soil fertility.

**9.3.4 Forest Recovery Program**

Past and present agricultural activities within the STNP have degraded large tracks of natural forestland. From an ecological perspective, these areas do not have the biodiversity values that would be typical of such an area in its natural condition. Natural processes, if left to their own devices, will eventually reclaim these areas if they are left undisturbed; however, the process will be protracted and the resultant forest may contain species and structures uncharacteristic of a natural forest given that many exotic species have been introduced through the agency of human hands. Illegal loggers have also left a trail of destruction within the STNP and have modified the natural ecosystems through their practices. Although logging in itself does not seriously jeopardize the ecological integrity of the forest ecosystem, it does leave a forest that is deprived of its typical species



diversity and creates gaps and other disturbances such as roads, clearings for barquediers and skid trails. The activities below seek to rehabilitate cleared areas, previously used for milpas and to create a forest that maintains ecological integrity throughout the STNP.

**9.3.4.1 (Action 4.1): Rehabilitation of Abandoned and Existing Small-holder Plots.**

SATIIM must move rapidly to clear the park’s boundary lines and to ensure that all smallholder agricultural practices cease completely. Once agriculture ceases, the utmost effort should be expended to ensure that new plots are not established. This will be the work of the site protection program; however, recruitment of the disturbed areas to support natural processes typical of a natural mature forest is the work of the Forest Recovery Program. In the way of rehabilitating agriculturally disturbed areas, this program prescribes the following activities.

- i. **Removal of Exotic and Introduced Species** – Traditional agriculturalists intercrop their staple crops with a variety of other plants and trees. In many cases these are fruiting trees or exotic plants. The management of the STNP must work to ensure that these plants are removed and either transplanted elsewhere or destroyed. This may seem a radical and wasteful approach given that many of these trees will be useful to man for food, but leaving them behind gives people an unending excuse to return to the area to harvest them. The problem is that they will almost always engage in some other illegal activities while doing so. These plants give people an attachment to the land and a longstanding claim to it, which can be revived later even if the present creator of these parcels do not currently lay a strong claim to them.

An adequate system for the removal of introduced plants can be time consuming since all old milpas will have to be identified and mapped and their grounds searched for such plants. If the job becomes overwhelming, it is best to destroy those plants nearer to the park boundary first and the ones further back later. Labor for this can be from the local communities, but such work teams should always be assisted by members of the ranger force to ensure integrity of effort. Once cleared, these areas should be left to regenerate naturally. Community members should be alerted of the need to undertake this effort before commencing so that the organization does not seem mean-spirited. Ideally these areas should also be monitored in the long term to ensure that biodiversity values are being reestablished and to undertake further intervention if required.

- ii. **Rehabilitation of logged Areas** – Illegal logging is an ongoing activity within the STNP with a potential to seriously damage the regional ecosystem. Loggers create roads and skid trails and cream the forest of a few species of high value trees



leaving the forest damaged and with diminished economic value. Often this low value forest becomes the target of farmers and agriculturalists who justify their claim by saying the standing forest have no real economic value.

Within the STNP, the suppression of logging activities will fall to the site protection program; however, it will be necessary to do an analysis of the long-term effect of the logging activity after the practice is brought under control. Factors such as the effect of logging on plant and animal biodiversity and its longer term effects on the landscape should be investigated. As a first step, all logging roads should be blocked off, and the access roads sabotaged to prevent further entry by machines. This may be difficult where the terrain allows multiple entry points but should be undertaken where conditions allow.

Previously logged areas should be mapped and allowed to regenerate naturally. Ideally SATIIM should conduct long-term monitoring studies in such areas to determine the long-term effect of such activities bearing in mind the historical intensity and scope of the activity.

9.3.5 Alternative Community Livelihoods Program

A central premise of the co-management agreement between the Government of Belize and the communities is that the presence of the STNP will produce concrete benefits for the communities, especially socio-economically. In agreeing to the partnership, the communities are saying that they will work for the sustainable management of the park as long as it brings them these promised benefits. In the case of the STNP with a long and sustained human presence (which predates the park) there is also an understanding that their traditional use of park resources will be offset by the introduction of other opportunities that will be able to sustain their livelihoods.

SATIIM has an ongoing project to assist the communities to diversify their economic base. The activities below are extensions to existing programs that should continue through the new planning period. Failure to address community development needs will alienate community members as the promised benefits fail to realize. The logical fallout from such an event will be community indifference to SATIIM's programs within the park and a failure on their part to comply with park regulations. The actions forwarded under this program are meant to diversify the income of the communities and to build on the existing cordial relationship.

**9.3.5.1 (Action 5.1): Promotion of Alternative Income Generation Projects**

Although many farmers can be recruited into reforestation schemes, it is not realistic to expect that this can be universally applied throughout the area for the benefit of corridor connectivity. Other initiatives that reorient productive resources away from milpa farming can be likewise beneficial in producing conservation gains. The benefits of such moves can be calculated in terms of deforestation that is avoided as families find alternative means of earning their livelihoods. A great deterrent to improved social and economic improvement in the area stems from people's lack of access to educational opportunities, jobs and exposure to new ways and ideas. Diversification of incomes will tie this region into the national economy and increase the leverage of people in lobbying government for services. This activity seeks to promote increased opportunities for diversification of the local economies.

**i) Establishment of Traditional Crafts Industries**—The buffer zone communities are surrounded by raw materials for the construction of a range of crafts. Communities such as Barranco produce a range of enticing local crafts whose production could easily be expanded with increased investment in product quality, training, business planning, marketing and access to credit. Labor cost in the region is highly competitive with any other region of the country and the people have a tradition of engaging in the production of crafts. The booming cruise ship industry and the large number of establishments catering to overnight visitors offer a logical market outlet. At the present time additional crafts, are being imported into the country to supply demand, especially at the tourism village. This activity proposes movement in the following areas:

- A. Hire a consultant to conduct a market feasibility study of the opportunities and constraints of entering the national handicrafts market. Outcomes of this study should be a comprehensive report detailing local market conditions, market demand for the various products, pricing and potential niche markets, and potential for gainful participation in this sector,.
- B. Conduct series of workshops in the buffer zone communities explaining the purpose of the project and provide training in business planning and management. If this cannot be done with in-house human resources then the appropriate government department or development NGO should be called in to assist.
- C. Prepare and submit proposals for the initial funding of the project until revenue streams allow the activity to become self sustaining. Project funding should cover labor cost to SATIIM, administrative supervision, equipment and transport cost etc. The project should fund any additional training that might be required, cost of purchase of equipment, manufacturing cost, housing for the storage of equipment and crafts etc. Cost of transportation to collect raw materials can be

borne by the communities; however, SATIIM should cover the transportation cost to market through project funding under the transportation line item. The project should also fund outreach work over the initial pilot phase and assist the communities to leverage additional funding from national lending institutions,

- D. Conduct training workshops in handicrafts run by a suitably qualified trainer. Additional expertise should be brought in from other areas of the country for communities who are successfully engaged in this business such as the Maya Center Women’s Group,
- E. SATIIM should allow raw materials for crafts to be obtained from the multipurpose zone of the park. This should be done under a sustainable use regime and be properly monitored. The use of park resources to support this industry will magnify the importance and relevance of the protected area in the eyes of the local inhabitants and produce behavioral changes in terms of their desire to protect the area.

**ii) Creation of Eco-tourism Enterprises**—Currently, the southern region is considered off the main track for tourists visiting the country. With the near completion of the Southern Highway and the provision of utility services throughout the region, this pattern is bound to change. The region contains considerable natural and cultural attractions that are competitive with any other part of the country.

Because of the difficult terrain, the area inside the park offers limited opportunities for ecotourism; however, the communities themselves are imbued in a rich culture surrounded by a lovely landscape. This activity calls for the promotion of ecotourism within one buffer zone community (Barranco) as a pilot project with the potential to expand into other communities over time. This community is being chosen because at the current time it has the highest potential to engage in this activity.

- A. Conduct a series of meetings with Barranco residents to determine their level of interest to become more seriously engaged in this activity,
- B. Based on the outcome of the meeting, hire a consultant to conduct a market feasibility study of the tourism industry in general within Southern Belize including trends and potential for growth. The consultant will carry out an assessment of the existing tourism facilities in Barranco and propose measures for improvement of services. S/He will also prepare a tourism development plan for the community.

- C. SATIIM will prepare and submit a proposal for the funding of the tourism development project in the community. This sustainable livelihood and community empowerment initiative will fund training in hospitality services, business planning and management. Project funding should cover labor cost to SATIIM, administrative supervision, equipment and transport cost etc. This project will fund training for community members, exposure to tourism practices within the national tourism industry and the installation of trails and adequate signage. The project should also fund outreach work over the initial pilot phase and assist the community to leverage additional funding from national lending institutions.
- D. Conduct training workshops in hospitality services and business planning. Take a group to visit other ecotourism sites around the country and talk to the operators of these establishments.
- E. Assist community members in establishing nature trails and in placing signs around the village and along trails.
- F. SATIIM will conduct ongoing outreach work to support the communities and offer technical assistance where needed.

### 9.3.6 Financial Sustainability Program

#### 9.3.6.1 Strategic Financial Outlook

SATIIM must be able to generate necessary revenues if any of the program areas mentioned above will have a chance for success. Revenue generated from management of protected areas rarely covers the cost of the human intervention work required for protection.. It is therefore common practice for additional funding to be sought through national and international funding partners. The problem is that protected areas provide a variety of public goods and services as a result of their management programs; however, these are hardly ever registered in normal market transactions. Hence the protected area does not directly benefit financially from the provision of these goods and services, although there are moves afoot internationally to develop systems to account and pay for these services.

SATIIM will have to depend on foreign and national sources of funding for all its immediate funding needs. Given the lack of revenue-generating infrastructure within the park and the poor development of the services sector generally within the southern region, this is likely to remain the norm for the foreseeable future. Strategically, SATIIM must see this planning

period as an occasion to aggressively build up its management capacities to sustain its management programs in the years to come. This will require a proactive and forward-looking approach to acquire funding. Nonetheless, it is unwise to depend on outside agencies to underwrite all the park's activities indefinitely, given the limited amount of funds available and the intense competition across the board to access these funds.

SATIIM should take tentative steps during this planning period to lay the groundwork for its Financial Sustainability Program. In the first phase of this program, the aim should be to offset some of the management cost of the organization such as its site protection program. As institutional and infrastructural capacity increases, the organization should expect to bear a greater share of the financial burden to fund its programs. The long-term view should be towards eventual financial self-sufficiency; however, this should not be rushed into recklessly at the cost of losing the unique values of the park or compromise its biodiversity.

It should also be borne in mind that pursuing financial self-sufficiency will require that the organization enter into revenue generation activities which will themselves require large financial outlays and a continuing management cost for their upkeep. The end result can be an ever shifting and elusive target as management cost for the new enterprises increases or they fail to generate the projected income. In these cases instead of providing an income, these schemes have to be subsidized from other funding sources. Financial self-sufficiency can therefore be a two edged sword, if to achieve it, management has to cut down on its good housekeeping activities; cut its programs or drastically reduce them. It is therefore imperative that whatever revenue generation ventures the organization engages in should be well thought out and studied and should capitalize on the distinct strengths of the park and SATIIM.

The following activities are identified for close management attention during this planning period to raise funds and to save on management cost:

- A. Maintain adequate fund raising capacity within the SATIIM management structure. The focus should be on proactively identifying potential funding sources, and constructing effective proposals. A highly qualified and experienced person is required for such a position. Once funding is acquired, management must ensure that there is an effective financial management and project execution strategy in place to effectively manage resources bearing in mind that successful management of projects is often a necessary prerequisite to acquiring additional conservation funds. Acquiring and keeping a competent staff for this purpose may be expensive but the costs are easily recouped over the long run.
  
- B. Recruit and use competent volunteers wherever possible. Such personnel can

be obtained from foreign educational and research institutions or are provided as interns from local educational institutions etc. They can be used to help in specific target areas for a set period of time and released when not needed. Such an arrangement gives the organization flexibility where permanent employment is not desirable or funds cannot be obtained to fund a permanent post or where local expertise cannot be obtained.

- C. Pursue the establishment of a strategic conservation fund. This fund would be drawn upon at critical times to fund conservation-related intervention when other sources cannot be tapped into. As a fall back position it should be replenish as soon as the situation allows. Such a fund will enable the smooth continuation of management interventions such as in times of natural disasters or to capitalize on an unexpected opportunity that would enhance the conservation management of the site. If properly invested, interest accruing from the fund can be used to fund contingencies in the onsite management programs.

Acquiring a strategic conservation fund may pose a challenge for SATIIM; however, funding partners can be invaluable in offering insights and to suggest opportunities.

- D. Develop a credible self-generating income capacity. This strategy will require time and the learning curve may be prolonged and bumpy; however, the site and the surrounding region offers distinct opportunities for income generation. It is quite likely that to capitalize on the potential of the area, SATIIM will have to grow with the rest of the district and embrace opportunities as they develop.

The following section elaborates the specific income generation approaches that SATIIM will engage in over this planning period.

**9.3.6.2 (Action 6.1): Development of Education and Research Facilities.**

The Statutory designation of the STNP limits the type of income generation activities that can be contemplated at the site, consequently all extractive pursuits must be ruled out immediately. Many protected areas in Belize are able to realize a substantial revenue stream by attracting foreign educational groups and researchers. Income is derived from research fees and accommodation, although other services such as transportation can also be provided for a fee. Research should focus on priority areas identified by SATIIM. The usefulness of the study to the long-term management of the park should serve as the benchmark for approving any research proposal. In the main, most visiting institutions welcome this as a way of contributing to the management of the protected area.

In the first year, SATIIM will not be able to offer this service for simple lack of facilities, however after the establishment of the ranger outpost such facilities can double up to provide for this purpose. Over time, as marketing efforts bear fruit and demand warrants, the organization can embark upon a building program under well defined guidelines to cater for any increased demand. Catering for schools and educational groups is more of a long term goal which will require substantial investment in infrastructure. During this planning period, the organization should conduct feasibility studies and embark upon a marketing program to determine level of interest for this type of service. Again this program can start modestly and develop additional capacity and standards over time.

SATIIM should produce a brochure and an informational booklet which emphasis the attractions of the site for the target audience. It should also assign responsibility for this initiative to competent personnel within staff or obtain the services of such personnel from elsewhere such as from volunteers or through on loan technical assistance.

**9.3.6.3 (Action 6.2): Ecotourism Development.**

Many studies have identified opportunities for tourism development within the southern region (Finetty et. al., (1999), Cayetano et. al 2003). Attractions identified are numerous but range from canoeing to caving, tubing, nature walks, birding etc. None of these potential visitor activity areas are well developed within the region. Many travelers were noted to travel through the region enroute to Guatemala, with few stopping off because of the dearth of developed attractions.

The studies also noted a number of impediments to the further development of the industry, including such well known factors as poorly developed infrastructure and ancillary services. Ecotourism development within the STNP must be done in tandem with tourism development in the southern region generally and awaits improvement in the provision of infrastructure, utilities and the proper marketing and development of attractions. The park offers formidable challenges to the development of tourism services including lack of transportation and communications infrastructure. The difficult terrain and swampy conditions of the area are also notable challenges. On the plus side, ecotourism is a sustainable business enterprise, promotes the area nationally and internationally and provides substantial employment opportunities. It also supports the growth of offshoot industries such as crafts production, food catering etc. SATIIM should promote ecotourism development on an incremental basis starting with a feasibility study and combine their efforts within a regional initiative. Specific actions to be elicited during the next five years are:

- i. **Conduct an Ecotourism Feasibility Study**—This study can be incorporated within the tourism market feasibility study to be conducted under the Sustainable Livelihoods Program. The study should indicate market demand for attractions that



the park can offer, projected revenue streams, cost and required infrastructure. Based on this study, SATIIM will decide whether to enter this market.

- ii. Depending on the outcome of (i) above, prepare a Tourism Development Plan and a Business Plan for the STNP.
- iii. Acquire funding for business proposal. Ecotourism development can be pursued as a partnership with other tourism developers or as a separate distinct SATIIM business venture.
- iv. Begin the establishment of nature trails and develop attractions for tourism enterprise.
- v. Establish tourism infrastructure.

At the present time no fee structures are being recommended for visitation into the park because the current visitation levels are too low. Instead SATIIM should concentrate on building up the park's infrastructure and market its attraction. A fee at this stage would discourage visitation and produce negligible revenues, while discouraging the very visitors who would be the organization's main marketing ambassadors.



## SECTION X

### 10 PARK MANAGEMENET SUPPORT STRATEGIES

Park management support strategies are activities or conditions that will have to be met in order for the conservation management strategies to be successfully carried out, that which must be in place to empower the conservation strategies. Many have been included under actions given for conservation strategies in Section IX. This is because of the almost total lack of management infrastructure, and support institutions which need to be built as a prerequisite to developing effective field conservation strategies. As a result, field management capacity will have to be built from the bottom up in tandem with the conservation support strategies. Notwithstanding this, there are some structures already in place to support the conservation strategies. The following sections detail the requirements that will be expected of these systems if they are to adequately support the conservation effort.

#### 10.1 Material Resources

##### 10.1.1 INFRASTRUCTURE AND EQUIPMENT

Infrastructural resources in the context of the STNP include roads and buildings while material resources cover such areas as vehicles, field and office equipment.

- i) **Roads**—SATIIM has not built any roads within the STNP, nor is it responsible for the construction or maintenance of roads outside the property. Notwithstanding this, the proper construction and maintenance of access roads into the park is a critical prerequisite to the success of SATIIM’s management programs. The access road from the southern highway is described as an “all-weather” dirt road. Maintenance of the road is sporadic and in between maintenance it quickly deteriorates to create challenging driving conditions. Problems associated with the access road include heavy rutting, dust and mud depending on the season. Apart from posing a driving hazard, such road conditions are hard on vehicles and result in heavy maintenance costs. Many of the bridges along this section flood after heavy rainfall when they become impassable or at least dangerous to cross.

The all-weather dirt roads continue to Barranco to the east and to Crique Sarco in the west from where the road degenerates to a trail to Graham Creek. Vehicular access is not possible from Crique Sarco to Graham Creek. Since Graham Creek is one of the buffer zone communities, it is important that

SATIIM has road access to this community and for Graham Creek to have a road for its own sake. SATIIM should lobby the government on behalf of the communities to facilitate such road access.

Construction and maintenance of roads is not within the remit of SATIIM. In addition, all access roads are public roads and, therefore, the property and responsibility of the Government of Belize. To that end, SATIIM must use its leverage as a regional stakeholder to agitate for improvement to this infrastructure. This can be done in concert with the communities who are the main users of the roads in the area. Such an arrangement offers a golden opportunity for community empowerment with SATIIM playing an organizing and coordinating role. The group should agitate for improvement to the road surface, drainage and improved bridge designs.

Roads within the STNP are limited to illicit logging trails and truck passes. None are surfaced or improved. At the present time SATIIM does not have any need for internal roads within the park. Within the present context, roads into the park would present an unacceptable maintenance burden and a security threat, offering access for illicit activities. This situation may change, if management prerogatives indicate a change in policy or if any of the revenue generation activities require the installation of such infrastructure.

- ii) **Buildings**—SATIIM rents a building for its headquarters office in Punta Gorda Town. Office space is adequate to meet present demands for space. No buildings exist within the park although two ranger outposts are planned. Outside the park, five visitor centers financed by SATIIM have been completed in each of the main buffer zone communities. As management responsibilities increase and the organization develops its management programs it may be necessary to acquire additional office space. SATIIM is not responsible for the maintenance and upkeep of this building; however, the payment of lease fees is a recurrent cost that places a financial burden on the organization.
- iii) **Vehicles and boats**—The organization presently has a fleet of two vehicles. This will be supplemented by additional vehicles for on-site protection work. With additional staff for the marine program and increased responsibilities owing to a more intensive management program it is likely that even with the proposed additions the fleet will be stretched to capacity. Transportation equipment is often the item in shortest supply within protected areas management, given the large number of responsibilities, the extended down time resulting from breakdowns and the short life span of vehicles resulting from the severe driving conditions.

Vehicles are normally purchased with project funding on the understanding that they will be used first and foremost to pursuing the objectives of the project. At the conclusion of the project or after a prescribed period, the vehicles are released for general purpose use, which essentially means that they can be assigned anywhere. In actual fact, the norm is for the better vehicles to be used around the office and for the older vehicles to be sent out to the fields where they are eventually retired.

In the initial period funding for repairs does not distress the organization too much because this is met from project funds for the duration of the project. When the vehicle is finally passed over to the receiving organization funding for vehicle upkeep is no longer available. The result is that the organization with little earning power inherits the equipment just when the maintenance costs are at their highest.

As explained above, poor road conditions are to blame for a good share of the vehicle maintenance problems. Otherwise, failure to adhere to the vehicle maintenance schedule and lack of parts has been identified as culprits. As a general rule, vehicles earmarked for field use will have a shorter useful life than vehicles used under less arduous conditions. It is realistic to set a depreciation period of three years to describe the useful life of field vehicles; however, this will seldom ever be the case given the heavy financial outlays needed to acquire new vehicles. In addition, standardizing the vehicle fleet, assigning vehicles to particular uses, use of designated drivers and adhering to recommended maintenance schedules should help to alleviate some of the problems with vehicular transportation.

SATIIM has recently purchased a boat to assist in the patrolling of the rivers, creeks, and the coastal region of the park. Additionally, SATIIM contracted a boat captain in July 2004, who has experience participating in water patrols. This will allow the effective patrolling of all coastal regions near the park.

- iv) **Field and Office Equipment**—Field equipment will need to be purchased under the Site Protection Program and is listed there as an activity under conservation strategies. Office equipment is lodged within the Punta Gorda office. The office is presently well equipped with modern office furniture and equipment. Since these were purchased recently, they should have a substantial useful life remaining. This includes mainstay electronic office equipment such as computers, printers and copiers. In the future, office equipment replacement and depreciation cost should be included as part of the cost of undertaking projects

## 10.2 Human and Institutional Resources

### 10.2.1 ADMINISTRATION AND STAFFING

The Board of Directors of SATIIM and the Forest Department will have the direct responsibility for implementing the provisions laid down in this management plan as provided in the co-management agreement. The Board is comprised of members drawn from the five main buffer zone communities, the Garifuna and Maya indigenous organizations, and the Forest Department. The day-to-day running of the national park will be the responsibility of the office staff who operate from the organization's office situated on Jose Maria Nunez St., Punta Gorda Town. The office staff is responsible to the Board of Directors of SATIIM and is charged with implementing SATIIM's policies and directives.

Up to the present time, all management activities are based at the Punta Gorda office and office expenditures presently account for the bulk of SATIIM's expenditure. This is a normal state of affairs for a young organization which is in the infancy of building its management programs. In the five-year planning period covered by this management plan, management activities will be concentrated within the STNP and the buffer zone area. At that time the office will function in a supporting role; however, it will remain the center of finance, logistics and communications.

It is expected that in time the bulk of the organizations expenditures will go in support of conservation actions and less than 20% to maintaining the office and to cover overheads there. Many funding organizations require that administrative overheads should not exceed that number and indeed many others stipulate that it falls well below this (IUCN, 2003).

With the added responsibility identified for the new planning period, it will be necessary to review SATIIM human resources *vis a vis* the obligations and responsibilities of the organization. Adequate staffing in financial and technical areas are the most obvious sections that will need to be reviewed. It may be necessary to build up human resources through the hiring of additional staff and/or increase human capacity through training and other incentives. A total of eight new staff members will be hired for the Site Protection Program.

### 10.2.2 HUMAN CAPACITY BUILDING

Apart from the hiring of new staff, SATIIM will have to ensure that new and existing staff members are equipped with the right training to carry out their responsibilities. The Rangers, in particular, will need to be oriented into their new jobs even if they have had



previous protected areas management experience. New rangers will have to become familiar with the park and learn how to get around. This is best done by using local knowledge and expertise and therefore an additional person from the area who is well acquainted with the park may need to be hired temporarily. Even with all of this, learning to move around the area in the most efficient and effective way will require on hands training and a significant amount of trial and error.

Although training for navigating around the park can to a certain extent, be left to trial and error, the same cannot be said for the Rangers' human relations skill and knowledge of pertinent legislation. It will be necessary for SATIIM to send its Rangers for training at an opportune venue if such training is being offered elsewhere, or arrange to have such training carried out on site. Proper training for Rangers will allow them to skillfully and constructively deal with the public, continuously building trust and confidence throughout the area. Such connections can be an invaluable asset, where community informants are needed to provide on-the-ground intelligence. In the same vein proper training and exposure will help the Rangers to detect illegal activities and respond in an appropriate manner. The record of protected areas management in Belize is replete with cases that have been thrown out of court against perpetrators of illegal activities because of badly collected or handled evidence. SATIIM should lobby aggressively to have its Rangers trained as Special Constables at the earliest possible opportunity.

During periods when researchers are conducting research within the STNP, SATIIM should take the opportunity to have the staff, particularly Rangers and the technical staff, shadow them so that field research skills can be passed on. The organization should emphasize to visiting researchers that knowledge should be transferred and SATIIM staff must be given every opportunity to contribute effectively to the research. Many conservation organizations in Belize and abroad mount training sessions for their staff, at which time they invite other organizations to attend. Again SATIIM should capitalize on such activities to build the human capacity of its staff. Apart from such venues, local and international development agencies, GoB and regional bodies offer training that can benefit the staff. In many cases this training is highly subsidized or are offered free of cost.

**10.3 Surveillance and Enforcement**

According to the co-management agreement “SATIIM will be responsible for the day-to-day management of Sarstoon-Temash National Park and the Government shall, along with the Forest Department be responsible for providing security and enforcement of regulations within the National Park ...”. Reading literally this would suggest a GoB/FD presence within the park to enforce matters dealing with park security. In practice this will not be the case, and in fact the presumption is that the GoB/FD will support SATIIM in

security matters if called upon; however, the day-to-day responsibility of enforcing park security will rest squarely on SATIIM's shoulders. It should be emphasized that the relationship does have attractive advantages in that the GoB and the FD can exert enormous leverage and resources should situations develop that are beyond SATIIM's control.

SATIIM's eight-man ranger team will be properly outfitted, trained and equipped for the task for which they have been charged. The recruitment, housing and outfitting of this team is covered as an action under conservation strategies (**Section 9**). SATIIM's enforcement and surveillance activities will be complicated by the zoning plan which allows multiple use and indigenous use zones. Although the zoning plan has been devised to be as simple as possible, catering to and vetting a range of resource users is a complex task that is prone to abuse, conflicts and misunderstandings. It cannot be overemphasized how important it will be for the organization to structure an efficient and effective system for this activity and to bring on board all communities (especially community leadership) and like-minded conservation groups in the region.

In phase 1 of the Site Protection Program, the staff security personnel will preside over a six-month grace period in which park rules are explained to the communities and violators cautioned and educated as to park regulations without any sanctions being brought. After the grace period, park security personnel will begin to enforce the penalty provisions of park regulations more forcefully. This should not suggest a bullying or intimidating approach; rather, the site protection force will continue to build bridges throughout the region with sanctions against perpetrators being limited to repeat non-compliance with park regulations or for serious offenses.

Essentially the enforcement of park regulations will occur at three levels. At the first level are the Rangers and community informants who will monitor for and report illegal activities. The second level will consist of the Rangers who will act to address the violation. Depending on the case, a caution can be given or SATIIM may elect to take legal actions. The third tier will consist of FD and government security personnel who will be required to move in where the gravity of the situation requires diplomatic delicacy or where there is a high potential for violent confrontation.

**10.4 Financial Resources**

A significant amount of financial resources will be required to carry out the activities called for in this management plan. A detailed financial plan cannot be produced within this plan because much of the information required is not presently available; however, SATIIM will produce annual work plans which will provide detailed financial statements about funding requirements. In addition, upon ratification of the management plan, the various program areas will be examined to determine funding needs and efforts made to identify funding sources and acquire funding as a matter of priority.



## SECTION XI

### 11 RESEARCH AND MONITORING

Research and monitoring will be a major activity area within the STNP into the foreseeable future. The park has many areas that are unique, vulnerable or threatened. Although some investigations have previously been conducted into the physical and biological environment, they have mainly served to provide a description of the area. Further investigations are needed to determine the interrelationship of the various ecosystems, complexity of the biotic environment and the effects of past human use impacts.

The future direction of the management programs will be informed by the results of the research and monitoring being conducted within the park. This will help to efficiently target resources into those areas where they stand to do the most good in terms of conserving important park biodiversity values. Research and monitoring is included here as a management support strategy, however owing to the number of management programs and the complexity of the zoning scheme it is being addressed separately in this section.

#### 11.1 Goals for Research and Monitoring in the STNP

The main goal of the research and monitoring program is to provide information necessary for the proper management and sustainable use of the STNP and buffer zone areas. Specific objectives are:

1. To provide sound scientific information on which to base management decisions so that resources can be allocated in the most efficient and transparent manner,
2. To acquire up-to-date information around which to design future research, management programs and interventions,
3. To gather a body of data that will allow for effective communication of park management achievements to interested bodies, supporters and collaborators,
4. To identify potential problem areas so that timely management interventions can be made where necessary,
5. To support management interventions for integrated conservation management within the reserve and adjoining areas.

#### 11.2 Research and Monitoring Strategy

A thorough review will be carried out and a comprehensive threats analysis will be drawn up to identify the key threats to the biodiversity and sustainable use of the park. Past

research efforts in the area will be consulted and gaps warranting further investigation identified. Areas identified as gaps or not properly covered in previous research will be ranked to develop a research priority and monitoring scale to guide future efforts in these areas. Key research and monitoring parameters will be ranked according to the following scale:

- 1 = the highest priority,
- 2 = medium priority
- 3 = low order priority

Once the priority areas have been identified SATIIM will work to ensure that future monitoring and research efforts conform to this ranking and that such efforts give maximum benefit to the park. Research and monitoring efforts will fall under the following broad headings.

- Physical including geological, mapping and climate,
- Chemical including pollution levels,
- Biological including terrestrial and aquatic flora and fauna,
- Socioeconomic.

Specific activities to be carried out within the research and monitoring programs under these broad areas are:

1. Conduct a threats analysis to highlight priority threats to the sustainable function of the park, and direct monitoring efforts to address priority threats,
2. Prepare a research and monitoring program necessary to fill information gaps for management and use of the reserve,
3. Monitor ecosystem health and sustainable functions of critical habitats within and adjacent to the park,
4. Monitor the use of the park, including all environmental, social and economic impacts.
5. Support and participate with national, regional, and global research and monitoring initiatives,
6. Provide comprehensive multi-disciplinary information for managers to continue to manage the park.

Experimental designs and monitoring protocols for the research and monitoring programs will be designed by competent researchers. On-site researchers will be assisted by local staff able to collect data in the absence of researchers after being properly guided and exposed to the research methods. Data analysis and interpretation will remain the purview of the research institution or responsible individual(s). Basic monitoring can be carried out by park technical and research staff when such individuals are available. Monitoring guidelines applicable to the Belizean context are available from a variety of local sources and these should be consulted for the parameter being monitored. It should also be possible for monitoring and research teams to be assisted by local tertiary institutions,

community members and foreign students. SATIIM will be responsible for formalizing and vetting partnerships with academia and other research-oriented institutions who want to participate with research and monitoring at the site.

**11.3 Guidelines for Research**

SATIIM will appoint a Scientific Advisory Committee to advise it on setting its research and monitoring priorities and to guide the process. Members of this committee can be drawn from national and foreign academic institutions, local conservation NGOs, government departments and development organizations. This body should compile a set of rules and guidelines to govern the conduct of researchers working under the authority of SATIIM.

Research and monitoring can only be conducted within the park and buffer zone region after appropriate permits are obtained. Applications should include a proposal for the research or monitoring activity and a copy of the experimental design. The Scientific Advisory Committee will review all proposals for research and advise the Board of Directors of SATIIM. If approved, the application will then be submitted to the Forest Department for a research permit.

The prospective researcher must agree to submit copies of any research results and publications to SATIIM and the Forest Department. Researchers should also be required to present findings publicly and to facilitate access of buffer zone community residents to such presentations.

**11.4 Research and Monitoring Priorities**

Notwithstanding the need to develop a threats analysis it is clear that certain issues within the park will have to be addressed by park management as a matter of urgency. Many areas requiring monitoring and research have been identified under conservation strategies in Chapter 9. The following are identified as important issues to be addressed by the research and monitoring program under the broad headings mentioned above. These are actions that should be taken in support of the conservation strategies.

**1. a) Physical Studies**

The geological features and underlying structures within the park are pretty well understood from previous studies; however, prospecting for minerals and petroleum will likely continue throughout the southern region, including the STNP. Climatic data is badly lacking from the park and any climate data given for the park is purely conjectural. In addition, saline influences on inland rivers and tidal gauges are important features that need to be studied and monitored.



**b) Research and Monitoring Needs**

- Climate: rainfall, temperature, wind speed and direction, relative humidity barometric pressure, tidal gauge, and saline influences
- Flood patterns and effects
- Long-term effect of fires on forest structures and soils

**2. a) Chemical Studies**

Chemical and physical measures of water quality within the main aquatic systems within the park and buffer zone region should be regularly carried out. Monitoring sites should be set up within the buffer zone area and near discharge points into the sea. Monitoring should be carried out to determine the effects of logging, farming and other anthropogenic forces on water quality. Permanent water quality monitoring stations should be set up in these areas preferably with the support and concurrence of the Hydrology Department.

**b) Research and Monitoring Needs**

- Monitor water quality parameters including temperature, salinity, pH, turbidity, and other relevant hydrological parameters of rivers that impact the park.
- Conduct studies to determine nutrient levels.

**3. a) Biological Studies**

The activities prescribed within this plan for the multiple use and indigenous use zones will require that comprehensive research and monitoring is carried out prior to the beginning of any extraction activity and periodically during the activity to determine the levels of impacts. In addition, endangered species or unique features within the park should be identified for special management attention. Monitoring and research will help to tailor an effective management approach for these conservation targets.

**b) Research and Monitoring Needs**

- Conduct studies of the flora and fauna within the multiple use and indigenous use zones.
- Monitor environmental impacts of the extraction activity.
- Conduct detail studies of the ecosystem within the unique values zone.
- Identify endangered or at risk species in the park for monitoring and research.
- Conduct studies on wildlife within aquatic systems and the impact of



anthropogenic activity on aquatic wildlife populations.

**4. a) Socioeconomic Studies**

The new management regime, especially the education and outreach program, as well as the thrust to diversify economic opportunities, will cause social and economic changes within the buffer zone communities. The changes should result in behavioral and attitudinal changes within area residents. The research and monitoring activities should focus on identifying these changes.

**b) Research and Monitoring Needs**

- Monitor land use changes within the park and buffer zone areas.
- Monitor changes in natural resource use within the buffer zone communities.
- Study relationship between land use changes and impacts on aquatic systems.
- Monitor changes in community perception of park and conservation objectives in general.

**11.5 Monitoring of Extraction Activities**

**Background information:** Each Ranger will be responsible for monitoring the resource extraction from his or her village. At present the Conejo and Crique Sarco Rangers will share responsibility for monitoring Sunday Wood extraction permits. Rangers will help residents fill out the permit application and explain to them what it is for and that they will have to wait until the end of the month for approval.

The SATIIM/Forestry Department Natural Resource Committee will meet the last week of every month so that permit applications should be submitted before then to be processed in a timely fashion. Before a permit is approved, the Ranger will assist the Park Manager in making an initial assessment. When a permit is approved, the Ranger will accompany the resident on their first extraction to document the method used. Thereafter the Ranger will periodically monitor the extraction sites near their village as per SATIIM policy.

**Monitoring Protocol:** The Ranger should fill out the form as follows:

<b>Entry form</b>	<b>Description</b>
<b>Application #</b>	The number on the application form
<b>Permit #</b>	The number on the approved permit (if there is one)



**Name** The name of the person extracting  
**Target Resource** What the person will be harvesting

**Status of resource** Record the total number of the target plant available in the area, as well as whether the number of mature plants/trees, and the number of young ones. Record any additional information that will help determine the health of the resource: presence/absence of damage, pests, etc.

**Density of resource** Using the transect square, record the density of plants within the area.

**Other Pertinent Information:**  
Record as with biodiversity monitoring:

**Name of Species** The English / K'ekchi / Garifuna name of the animal. Identify it to the nearest level (E.g. if you see cat tracks, then put "cat" or if you see a hawk that you can't identify, just put "hawk").

**Animal Type:** Is the animal a **M**ammal (has hair), **B**ird (has feathers) or **R**eptile (a snake/ lizard/crocodile)? E.g. jaguar = M, curassow = B, garobo = R, tapir = M, crocodile = R, etc.

**How did you notice it?** Tracks, see it directly, hear, smell, see feathers, see droppings

**No. of individuals** Number of animals seen

**Time** Note am /pm or use 24 hr time!!

**Ecosystem type** The type of habitat the animal was in: e.g. Swamp forest, swamp, scrub, high forest, old milpa, new milpa, river, hill forest, village, mangrove, sea.

**Location** Trail or Transect name

**GPS Coordinates** Both lines of GPS coordinates: Easting and Northing.

**Notes** Any other useful information: e.g. Activity (flying / eating - what? / dying), colour, size, child/adult/ somewhere in the middle

**End of patrol:** The Biodiversity monitoring patrol ends when the Ranger get back to his/her village and then records:

Time and Date finished

Duration (length of time the patrol took), to the nearest 10 minutes



Trail condition (e.g. very muddy).



## SECTION XII

### 12 IMPLEMENTATION PLAN

The activities inscribed in this management plan will be implemented over a five-year period which is the time frame covered by the plan (2005 – 2010). For practical and obvious logistical reasons the activities will not be carried out concurrently but will be implemented under a phased approach. This approach allows SATIIM to build management capacity after which it will begin to apply active management control over the park followed by a period of monitoring and review. The phased approach will allow the organization to gradually build up management capacities, absorbing lessons learned and benefiting from the experiences without overloading management systems.

#### 12.1 Preparatory and Establishment Phase

Upon approval of the management plan, SATIIM should move quickly to carry out its provisions. In this phase which should last over a six-month period staff will be hired oriented, trained and housed. Housing will be constructed at the ranger stations for the site protection force and the boundary lines will be surveyed and cleared. Besides these steps, a very important activity to be carried out will be the preparation of a plan to regulate allowable activities within the park. This effort will be mostly restricted to regulating and controlling allowable extraction activity within the multiple use and indigenous extraction zone. Considerable thought, time and effort should be invested in this activity, given its importance and magnitude.

During this period, the rangers will begin regular patrols and meet with the communities. A six-month grace period will be instituted to allow educational and outreach work in regards to the site protection program to work and bear fruits.

Although some of the activities identified within this plan are ongoing and have committed funding, other activities will need to be conceptually fleshed out, logically ordered and funding sought to carry them out. During this phase, proposals will be submitted to funding organizations to cover expenditures that will be associated with those activities that are proposed but not presently covered. It is important that non-funded items are funded as soon as possible to allow them to be implemented early within the five-year period but definitely before the mid-point so as to allow enough time for implementation.

### 12.2 Operational Phase

During this phase concrete long-term management approaches will be applied on the ground. It will extend over the full five-year planning cycle; however, the bulk of its activities will occur after the first six months and up to the last three months of the cycle. In this phase, the grace period for park offenders will have been brought to an end and normal site protection activities will be in place with the rangers fully equipped, trained and operating within well defined boundary lines. The provisions laid out in the zoning scheme will be fully implemented during this phase and the system devised during phase one to manage activities within the different zones will be applied and refined as necessary.

The outreach and educational programs to enhance community livelihood and to advocate on behalf of the conservation objectives within the park will also be fully instituted. Apart from these activities major projects to be implemented or accelerated with the community are the agroforestry project and the small scale pilot ecotourism development project earmarked for Barranco. The proposed sanitary waste programs for the communities will also be implemented during this phase.

During this phase SATIIM will implement its joint co-management programs with FUNDAECO and other regional stakeholders to maintain, integrate and reconstitute biological corridors where feasible.

### 12.3 Review and Evaluation Phase

Review and evaluation will occur continuously throughout the planning period as activities are carried out and evaluated adjustments will be made as lessons are learned. The final six months should see this activity intensify as experiences are fed into the preparation of the succeeding management planning document. Review and evaluation will be based on the monitoring of the conservation programs discussed in Section XIII.

Throughout the planning period the principle of adaptive management will be applied throughout. Adaptive management assumes that the outcomes of a given activity cannot always be predicted with accuracy. There is thus a learning curve during which time approaches are re-examined where outcomes do not conform to expectations. This approach is entirely acceptable as long as best available knowledge is used at the outset and the refined approaches do not violate the guiding principle of the park.

Adaptive management will be applied in all activity areas which only serve to reiterate the importance of regular review and evaluation.

Table 12.1: Plan Implementation Schedule

Activity	Responsible Party	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Phase I: Preparatory and Establishment</b>						
▪ Approval of STNP Management Plan	SATIIM/GOB	J O J	A J O J	A J O J	A J O J	A J O J
▪ Hire, train and equip rangers,	SATIIM/GOB	-	-	-	-	-
▪ Surveying and clearing of boundary lines,	SATIIM	S D M	J S D M	J S D M	J S D M	J S D M
▪ Stop all milpa cultivation and illegal logging in park	SATIIM/Police/BDF	x	x	x	x	x
▪ Acquire funds for unfunded management plan activities,	SATIIM/FD	x	x	x	x	x
▪ Create plan for managing activities in zoned areas,	SATTIM	x	x	x	x	x
▪ Document and map extraction sites,	SATTIM	x	x	x	x	x
▪ Education and outreach for site protection program,	SATTIM	x	x	x	x	x
▪ Recruit volunteers and staff for management programs.	SATIIM/Conservation Partners	x	x	x	x	x
<b>Phase II: Operational</b>						
▪ Implement community zoning scheme,	SATTIM	x	x	x	x	x
▪ Expand scope of community education programs,	SATTIM	x	x	x	x	x



Activity	Responsible Party	Year 1		Year 2		Year 3		Year 4		Year 5			
		J	O	A	J	A	J	A	J	A	J	O	
<ul style="list-style-type: none"> <li>Develop fire management strategy for park,</li> <li>Implement community income generation schemes,</li> <li>Expand Agro-forestry program,</li> <li>Institute waste management project in buffer zone area,</li> <li>Assist communities to identify farmlands outside park,</li> <li>Promote biological connectivity program,</li> <li>Work with timber operators in region for sustainable logging,</li> <li>Initiate income generation initiative for the STNP,</li> <li>Implement co-management scheme with FUNDAECO,</li> <li>Lobby to incorporate wetland and coastal area into park management.</li> </ul>	SATTIM/FD	x											
	SATTIM	x	x	x	x	x	x	x	x	x	x	x	x
	SATTIM/ Agric. Dept/CARD/TDC			x	x	x	x	x	x	x	x	x	x
	SATTIM/Public Health Dept./BSWMP					x	x	x	x	x	x	x	x
	SATTIM/Lands Dept	x	x	x	x								
	SATTIM/MBCP			x	x	x	x	x	x	x	x	x	x
	SATTIM/FD	x	x	x	x								
	SATTIM/BTB									x	x	x	x
	SATTIM/FUNDAECO	x	x	x	x	x	x	x	x	x	x	x	x
	SATTIM/FD/Fisheries Dept.					x	x	x	x	x	x	x	x
<b>Phase III: Review and Evaluation</b>													
<ul style="list-style-type: none"> <li>Conduct research into flora and fauna in extraction zones before and during extraction,</li> <li>Mount monitoring program for endangered species,</li> <li>Mount monitoring program for aquatic species and plant invasive</li> </ul>	SATTIM/Research institutions	x	x	x	x	x	x	x	x	x	x	x	x
	SATTIM/Research institutions	x	x					x					x
	SATTIM/Research institutions	x	x					x					x



	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Activity</b>	J O J	A J O J	A J O J	A J O J	A J O J
	- - -	- - -	- - -	- - -	- - -
	S D M	J S D	M J S	D M J	S D M
species,					

## SECTION XIII

### 13 MONITORING AND REVIEW

Monitoring and review will provide a feedback loop to the management of the STNP as to the effectiveness of the activities being implemented under the site conservation strategies. This is an important step in the management process and should not be overlooked since it identifies potential problem areas before it becomes too late or costly to correct them. In this regard it saves on scarce park resources such as staff time and financing and provides the maximum benefit to the conservation goal. In the context of the STNP management effectiveness will refer mainly to whether the management systems and processes being applied are appropriate for the park and whether the approach used is delivering on the objectives of this protected area.

The monitoring and review process will assess whether the actions prescribed in the management plan and the field operational plan (which should be produced as a detailed document to guide the implementation of each activity) is in fact achieving its objectives. SATIIM will benefit from this activity in that the organization will be able to use the adaptive management approach to adjust management actions accordingly. Lessons learned in each planning period is fed into subsequent management plans so

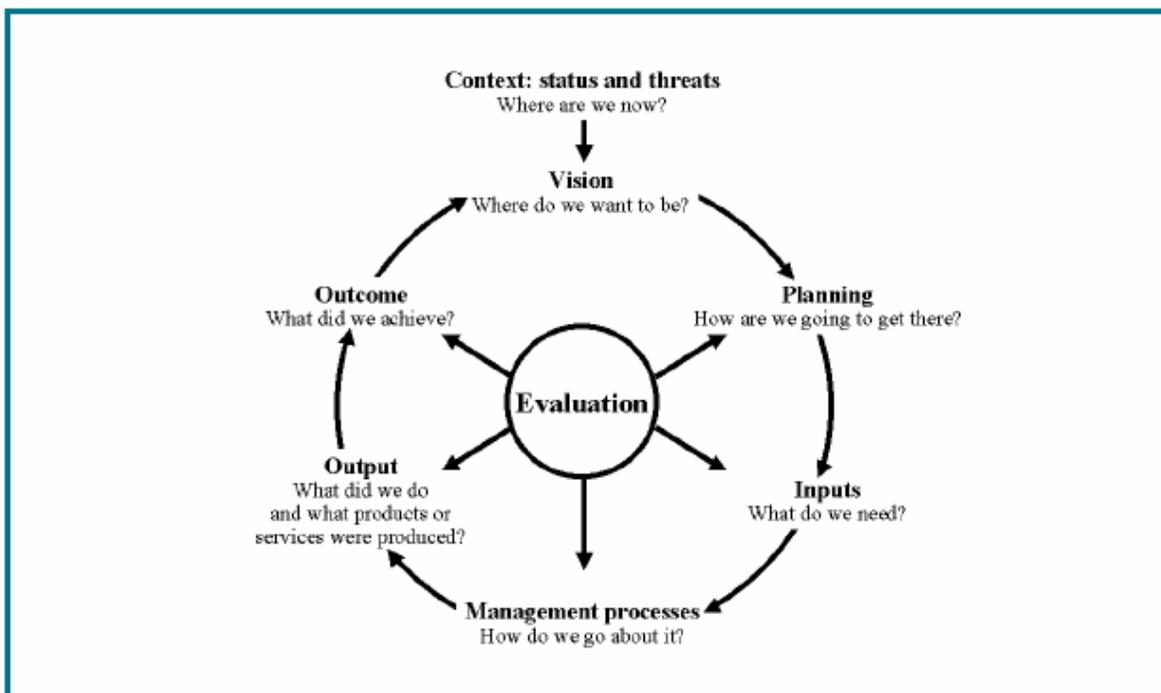


Figure 13.1: Schematic Representation of Management Cycle and Evaluation. Adopted courtesy IUCN, 2000.

that mistakes are not repeated or badly planned and executed projects can be held up for review and the management approach modified.

Monitoring and review will also help the management of the STNP to account for their activities within the park and to determine whether they are managing effectively. Although this process is mainly associated with identifying problem areas it also helps in identifying areas that have met with success and helps the learning process in that the successful elements are fully identified, evaluated and emphasized in subsequent planning.

In carrying out the monitoring and review process, the management of the STNP is directed to adhere to the following guidelines:

- ❖ Assessment of management performance should include all stakeholders including buffer zone communities, funding agencies and the Forest Department,
- ❖ Management performance review reports should be available to all stakeholders mentioned above among others,
- ❖ Monitoring and review of management performance should be based on the objectives included within this management plan,
- ❖ Review and evaluation should focus on the most important management issues defined within the management plan,
- ❖ Factors limiting a full accountability of the management performance should be clearly indicated in the performance and review report,
- ❖ Apart from a detailed assessment of management performance the report should also include a section on recommendations on how management performance can be improved where they are found to be deficient,
- ❖ Assessments should be soundly grounded in science and stoutly supported by a strong methodological framework and verifiable indicators.

The following table provides a suitable framework for assessing the management performance within the STNP for the objectives and important management issues identified in this plan.



**Table 13.1: A Proposed Framework for Assessing Management Performance within the STNP.**

<b>Context</b>	<b>Planning</b>	<b>Input</b>	<b>Process</b>	<b>Output</b>	<b>Outcome</b>
<i>Where are we now?</i>	<i>Where do we want to be?</i>	<i>What do we need?</i>	<i>How do we go about it?</i>	<i>What were the results?</i>	<i>What did we achieve?</i>
<b>Significance</b>	PA Legislation and Policy	Resources of SATIIM	Implementation of management processes	Achievement of planned work program	<b>Impacts – effects of management with regard to objectives</b>
<i>Cultural</i>	- Adequacy of PA legislation	Staff	- Planning	Extent implementation of – management plan	<i>Qualitative or quantitative assessment</i>
<i>Physical</i>	- Adequacy of PA policy	Funds	- Maintenance	- annual work programs'	<i>of achievement of objectives in relation to:</i>
<i>Biological</i>	- Flexibility of legislation and policy to accommodate unique conditions on the ground	Equipment	- Facility development	- Field operational plans	1. management plans or other relevant plans or documents;
<i>Environmental services</i>		Infrastructure	- Patrol and enforcement	- annual budget expenditure	2. specific threats; and
<i>Economic</i>			- Communication		3. generic PA objective of biodiversity conservation
<i>Uniqueness</i>			- Education and advocacy		4. specific objectives
<b>Threats</b>	PA system design	Resources of site	- Training	Services and products	
			- Research		



<ul style="list-style-type: none"> <li>- Inappropriate general resource policy</li> <li>- External threats (e.g. water pollution, deforestation in buffer areas etc.)</li> <li>- Internal impacts (e.g. Logging, milpas, poaching)</li> <li>- Resource extracted (e.g. forest products, wildlife etc.)</li> </ul>	<p>Comprehensive</p> <p>Adequate</p> <p>Representative</p> <p>Connectivity</p> <p>Viability</p>	<p>management</p> <p>Staff</p> <p>Funds</p> <p>Equipment</p> <p>Infrastructure</p>	<ul style="list-style-type: none"> <li>- Monitoring and evaluation</li> <li>- Reporting</li> <li>- Natural resource management</li> <li>- Cultural resource management</li> <li>- Visitor management</li> <li>- Management of resource use by humans (extractive, tourism)</li> <li>- Participation</li> <li>- Conflict resolution</li> <li>- Personnel management</li> <li>- Budget and financial control</li> </ul>	<p>Quantitative measures of services and products arising from management processes</p>	<p>relevant to the management category of the STNP</p>
<p><b>Vulnerability</b></p> <ul style="list-style-type: none"> <li>- Legal status vs pragmatic management approach</li> <li>- Boundary demarcation</li> <li>- Fragility of ecosystems</li> <li>- Susceptibility to environmental impacts (e.g. Hurricanes, fires,</li> </ul>	<p>Reserve design</p> <p>Viability</p> <p>Boundaries</p> <p>Connectivity</p> <p>Tenure</p> <p>Customary use</p> <p>Scale</p>	<p>Partners</p> <p><b>Effectively identifying stakeholders and constructively engaging partners</b></p>			



<i>climate change etc.)</i>	<i>Buffer zone</i>				
<ul style="list-style-type: none"><li>- <i>Current levels of resource extraction,</i></li><li>- <i>Condition of resources</i></li></ul>					
National context	<b>Management planning</b>				
<ul style="list-style-type: none"><li>- <i>Government development priorities</i></li><li>- <i>Strategic approach to protected areas and management policies</i></li></ul>	<ul style="list-style-type: none"><li>- <i>Existence of clear and objectives management plan</i></li><li>- <i>Identification of resource needs</i></li></ul>				

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## APPENDIX A

### WWF and IUCN/WCPA Principles and Guidelines on Indigenous Rights

#### **Principle 1**

*Indigenous and other traditional peoples have long associations with nature and a deep understanding of it. Often they have made significant contributions to the maintenance of many of the earth's most fragile ecosystems, through their traditional sustainable resource use practices and culture-based respect for nature. Therefore, there should be no inherent conflict between the objectives of protected areas and the existence, within and around their borders, of indigenous and other traditional peoples. Moreover, they should be recognised as rightful, equal partners in the development and implementation of conservation strategies that affect their lands, territories, waters, coastal seas, and other resources, and in particular in the establishment and management of protected areas.*

#### **Principle 2**

*Agreements drawn up between conservation institutions, including protected area management agencies, and indigenous and other traditional peoples for the establishment and management of protected areas affecting their lands, territories, waters, coastal seas and other resources should be based on full respect for the rights of indigenous and other traditional peoples to traditional, sustainable use of their lands, territories, waters, coastal seas and other resources. At the same time, such agreements should be based on the recognition by indigenous and other traditional peoples of their responsibility to conserve biodiversity, ecological integrity and natural resources harboured in those protected areas.*

#### **Principle 3**

*The principles of decentralisation, participation, transparency and accountability should be taken into account in all matters pertaining to the mutual interests of protected areas and indigenous and other traditional peoples.*

#### **Principle 4**

*Indigenous and other traditional peoples should be able to share fully and equitably in the benefits associated with protected areas, with due recognition to the rights of other legitimate stakeholders.*

#### **Principle 5**

*The rights of indigenous and other traditional peoples in connection with protected areas are often an international responsibility, since many of the lands, territories, waters, coastal seas and other resources which they own or otherwise occupy or use cross national boundaries, as indeed do many of the ecosystems in need of protection.*



## APPENDIX B

### STNP FOREST TYPES AND ECOSYSTEMS

#### Dominant Vegetation Types and Species found within Protected Area.

Vegetation Type	Plants associated with Vegetation Type
<u>Basin mangrove forest,</u> <u>Coastal fringe Rhizophora-</u> <u>Mangle dominated forest,</u> <u>Riverine mangrove Forest,</u> <u>Mixed mangrove scrub</u>	<p>- Common trees are:            Avicennia germinans, Laguncularia racemosa, Rhizophora mangle, Acoelorrhaphe wrightii, Acrostichum aereum, Conocarpus erectus, Eragrostis prolifera, Myrica cerifera, Rhabdadenia biflora.</p>
<u>Deciduous broad-leaved</u> <u>lowland disturbed shrubland</u>	<p>Common tree species are:            Habitat is distinguished by weedy plants highly susceptible to fires.</p>
<u>Tropical evergreen broadleaf</u> <u>lowland forest over calcium</u> <u>rich alluvium</u>	<p>Frequently encountered species include:  <i>Acosmium panamense</i>, <i>Attalea cohune</i>, <i>Brosimum</i> sp., <i>Calophyllum brasiliense</i>, <i>Carapa guianensis</i>, <i>Castilla elastica</i>, <i>Ceiba pentandra</i>, <i>Celtis schippii</i>, <i>Dendropanax arboreus</i>, <i>Dialium guianense</i>, <i>Ficus guajavoides</i>, <i>Ficus</i> spp., <i>Grias cauliflora</i>, <i>Guarea glabra</i>, <i>Guarea grandifolia</i>, <i>Inga affinis</i>, <i>Licania platypus</i>, <i>Nectandra</i> sp., <i>Ochroma lagopus</i>, <i>Poulsenia armata</i>, <i>Pouteria durlandii</i>, <i>Pouteria mammosa</i>, <i>Protium schippii</i>, <i>Pseudolmedia</i> sp., <i>Pterocarpus rohrii</i>, <i>Quararibea funebris</i>, <i>Rheedia</i> sp., <i>Sabal mauritiiformis</i>, <i>Schizolobium parahybum</i>, <i>Simira salvadorensis</i>, <i>Symphonia globulifera</i>, <i>Vochysia hondurensis</i>.</p>
<u>Tropical evergreen broadleaf</u> <u>lowland forest over poor or</u> <u>sandy soils</u>	<p>Distinctive species include:  <i>Acosmium panamense</i>, <i>Acoelorrhaphe wrightii</i>, <i>Aspidosperma cruenta</i>, <i>Attalea cohune</i>, <i>Bactris</i> sp., <i>Calophyllum brasiliense</i>, <i>Chrysobalanus icaco</i>, <i>Cidemia</i> spp., <i>Coccocypselum herbaceum</i>, <i>Dialium guianense</i>, <i>Dicranopteris</i>, <i>Erblichia odorata</i>, <i>Ficus</i> sp., <i>Guarea</i> sp., <i>Guettarda combsii</i>, <i>Licania hypoleuca</i>, <i>Licania platypus</i>, <i>Miconia</i> spp., <i>Mouriri exilis</i>, <i>Mouriri myrtilloides</i>, <i>Pouteria mammosa</i>, <i>Psychotria poeppigiana</i>, <i>Pterocarpus rohrii</i>, <i>Scleria bracteata</i>, <i>Simarouba glauca</i>, <i>Spondias mombin</i>, <i>Symphonia</i></p>



*globulifera*, *Terminalia amazonia*, *Tetrace volubilis*, *Tococca* sp., *Virola koschnyi*, *Vismia ferruginea*, *Vochysia hondurensis* and *Xylopia frutescens*.

Tropical evergreen broadleaf lowland forest over steep calcareous hills

Distinctive species include:

*Acalypha* sp., *Achimenes erecta*, *Alseis catenensis*, *Aphelandra scabra*, *Astronium graveolens*, *Bauhinia divaricata*, *Bermoullia flammea*, *Brosimum* spp., *Bursera simaruba*, *Ceiba aesculifolia*, *Clusia* sp., *Coccoloba acapulcensis*, *Cryosophila stauracantha*, *Dendropanax arboreus*, *Desmoncus orthacanthos*, *Drypetes brownii*, *Louteridium donnell-smithii*, *Manilkara zapota*, *Malmee depressa*, *Metopium brownei*, *Oreopanax obtusifolius*, *Pimenta dioica*, *Piper psilorrhachis*, *Piper* spp., *Plumeria rubra*, *Pouteria campechiana*, *Pouteria reticulata*, *Protium copal*, *Pseudobombax ellipticum*, *Sapindus saponaria*, *Sebastiania tuerockheimiana*, *Trichilia minutiflora* and *Vitex gaumeri*.

Tropical evergreen broadleaf lowland hill forest: Calophyllum variant

Frequently encountered trees include:

*Acosmium panamense*, *Aspidosperma cruenta*, *Attalea cohune*, *Calophyllum brasiliense*, *Erblichia odorata*, *Guarea glabra*, *Licania platypus*, *Orbignya cohune*, *Pouteria mammosa*, *Pouteria* sp., *Simarouba glauca*, *Terminalia amazonia*, *Virola koschnyi*, *Vismia ferruginea*, *Vochysia hondurensis*, and *Xylopia frutescens*. In places where drainage is impeded *Ficus* sp., *Dialium guianense*, *Pterocarpus officinalis*, *Spondias mombin*, and *Symphonia globulifera* occur.

Tropical evergreen broadleaf lowland swamp forest: Seasonally waterlogged

Frequently encountered plants in these forests are:

*Acosmium panamense*, *Aspidosperma cruenta*, *Astrocaryum mexicanum*, *Attalea cohune*, *Bactris* spp., *Bucida bucera* *Calyptranthes chytraculia*, *Clidemia* sp., *Coccoloba* sp., *Cryosophila stauracantha*, *Dalbergia cubilquitzensis*, *Dalbergia stevensonii*, *Dialium guianense*, *Dracaena americana*, *Guettarda combsii*, *Heliconia vaginalis*, *Hirtella racemosa*, *Inga* sp., *Jacquinia paludicola*, *Miconia* sp., *Mouriri exilis*, *Mouriri myrtilloides*, *Pachira aquatica*, *Psychotria glomerulata*, *Psychotria poeppigiana*, *Scleria bracteata*, *Swietenia macrophylla*, *Symphonia globulifera*, *Terminalia amazonia*, *Virola koschnyi*, *Vismia ferruginea*, *Vitex kuylenii*, *Vochysia hondurensis* and *Xylopia frutescens*. On richer soils *Pterocarpus officinalis* is found; on poorer soils more *Melastomataceae* and *Acoelorrhaphe wrightii*.

Tropical evergreen broadleaf lowland swamp forest: Permanently waterlogged

Frequently encountered species include: *Acacia* sp., *Acosmium panamense*, *Acrostichum aureum*, *Astrocaryum mexicanum*, *Attalea cohune*, *Bactris* spp., *Bucida buceras*, *Calophyllum brasiliense*, *Calyptranthes karlingii*, *Calyptrogyne ghiesbreghtiana*, *Carapa guianensis*, *Cassipourea guianensis*, *Chrysobalanus icaco*, *Coccoloba belizensis*, *Cryosophila stauracantha*, *Dalbergia stevensonii*, *Dendropanax arboreus*, *Desmoncus*



*orthacanthos*, *Erythroxylum guatemalense*, *Euterpe precatória*, *Grias cauliflora*, *Guettarda combsii*, *Hirtella racemosa*, *Inga affinis*, *Lindsaea lancea*, *Lonchocarpus rugosus*, *Manilkara zapota*, *Manicaria saccifera*, *Maytenus schippii*, *Montrichardia arborescens*, *Mouriri exilis*, *Pachira aquatica*, *Pterocarpus officinalis*, *Randia* sp., *Rhabdadenia paludosa*, *Rhizophora mangle*, *Rinorea hummeli*, *Sabal mauritiformis*, *Strychnos panamensis*, *Symphonia globulifera*, *Terminalia amazonia*, *Virola koschnyi*, *Vitex kuylenii*, *Vochysia hondurensis* and *Xylopia frutescens*.

Tropical evergreen broadleaf lowland swamp forest: Manicaria variant

species include: *Astrocaryum mexicanum*, *Bucida buceras*, *Calophyllum brasiliense*, *Ceratozamia robusta*, *Connarus lambertii*, *Euterpe precatória*, *Mouriri exilis*, *Mouriri myrtilloides*, *Pachira aquatica*, *Pterocarpus officinalis* and *Symphonia globulifera*.

Tropical evergreen lowland peat shrubland with sphagnum

The understory of the shrubland consists of lumps of the moss *Sphagnum* (*subsecundum?*), interspersed with sedges (*Hypolytrum longifolium?*). Shrubs and small trees found in the area include *Cyrilla racemiflora*, *Clusia cf. massoniana*, *Connarus lamberti*, *Schizocardia belizensis*, *Symphonia globulifera*, *Ouratea* sp., *Acoelorrhaphe wrightii*, *Blechnum* ferns, *Palicourea cf. crocea*, *Calophyllum brasiliense* and a few as yet unidentified species.

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## APPENDIX C

### GENERAL RULES OF THE PARK

1. All boats and vehicles entering the park, must check with the guards at the entrance gates for permission to do so.
2. All persons with a special permit (this includes all members of buffer zone communities) should abide by the rules within their license agreement.
3. No person shall alter any sign, or notice within the reserve.
4. No person shall have in their possession within the boundary of the reserve any flora or fauna other than in accordance with this plan.
5. No person shall deposit any substance (solid or liquid) within the boundary of the reserve except in cases allowed by the managing authority.
6. Licenses and permits issued are non-transferable.
7. Rules of the park are only non-applicable in life threatening situations.
8. All fisheries, wildlife, and tourism laws apply.
9. All licenses and permits will be issued by the managing body after consultation with the FD.
10. All management personnel reserve the right to stop, board, and search any vessel and confiscate illegal items.
11. All scientific research requires a permit.
12. All educational activities require coordination and approval from the managing body.
13. All educational groups must be escorted by a park guide unless otherwise authorized by management.



## APPENDIX D

### STNP MANAGEMENT MAPS



Map 1: Regional Map



STNP Regional Map

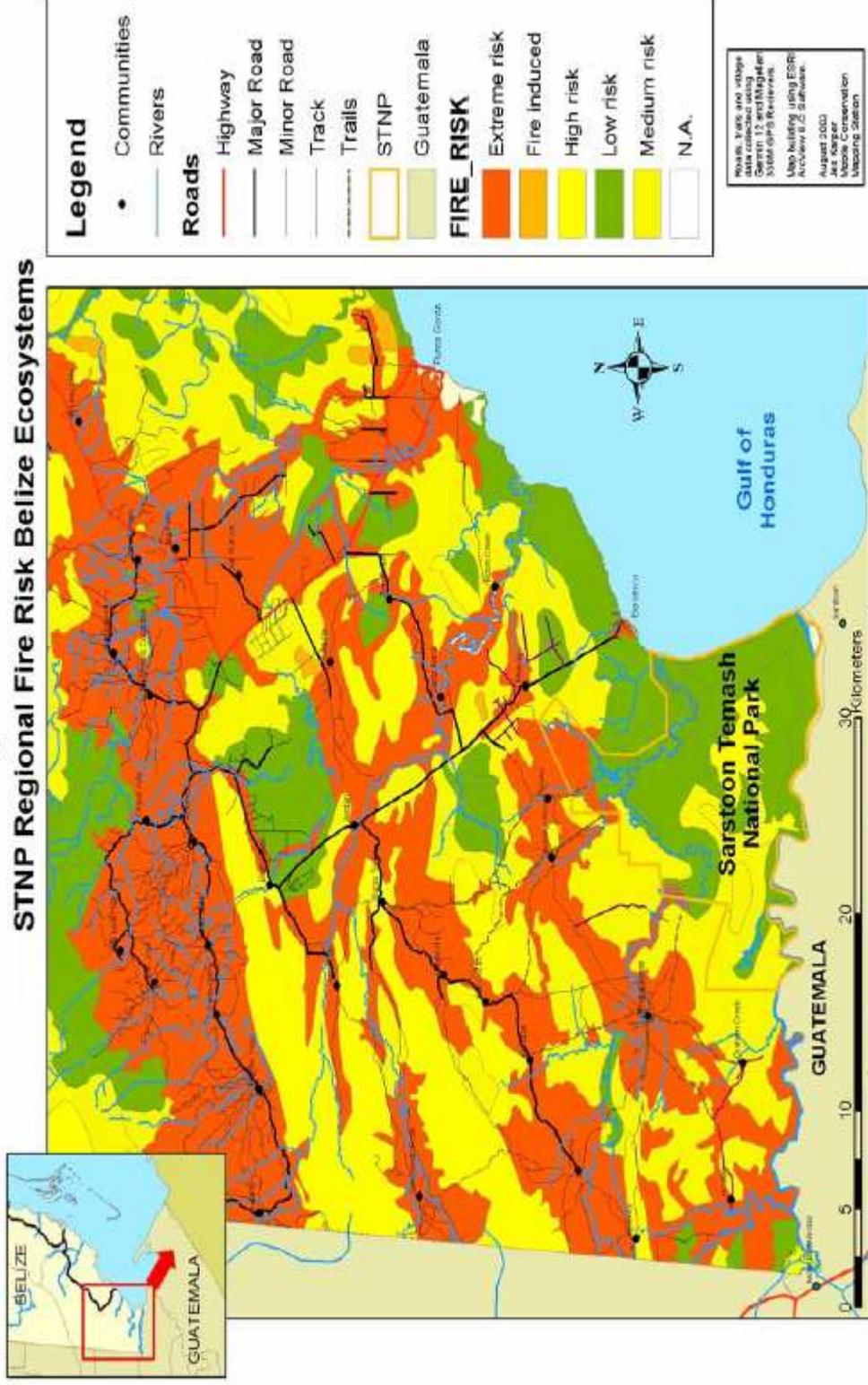


**Legend**

- Rivers
- STNP
- Belize
- Guatemala
- Roads**
  - Highway
  - Major Road
  - Minor Road
  - Track
  - Trails

Roads, trails and village data collected using Garmin 12 and Magellan 330M GPS Receivers.  
 Map building using ESRI ArcView 8.0 Software.  
 October, 2003  
 Jas Karper  
 Mobile Conservation Mapping Station

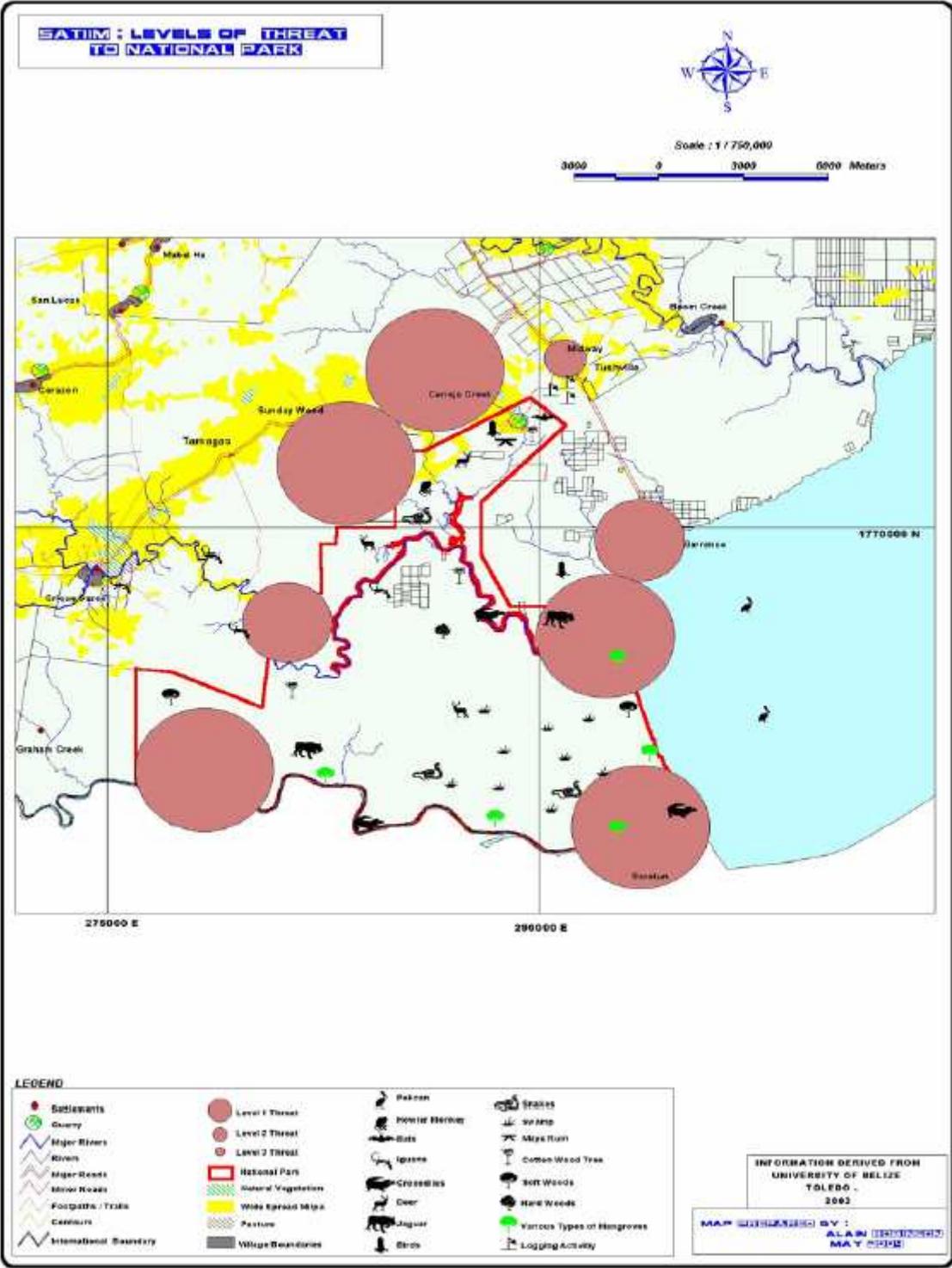
Map 2: Forest Fire Potential within the Southern Region.  
**STNP Regional Fire Risk Belize Ecosystems**







Map 4: Threat Levels and Location around the STNP.



Map 5: Proposed New Management Areas.

