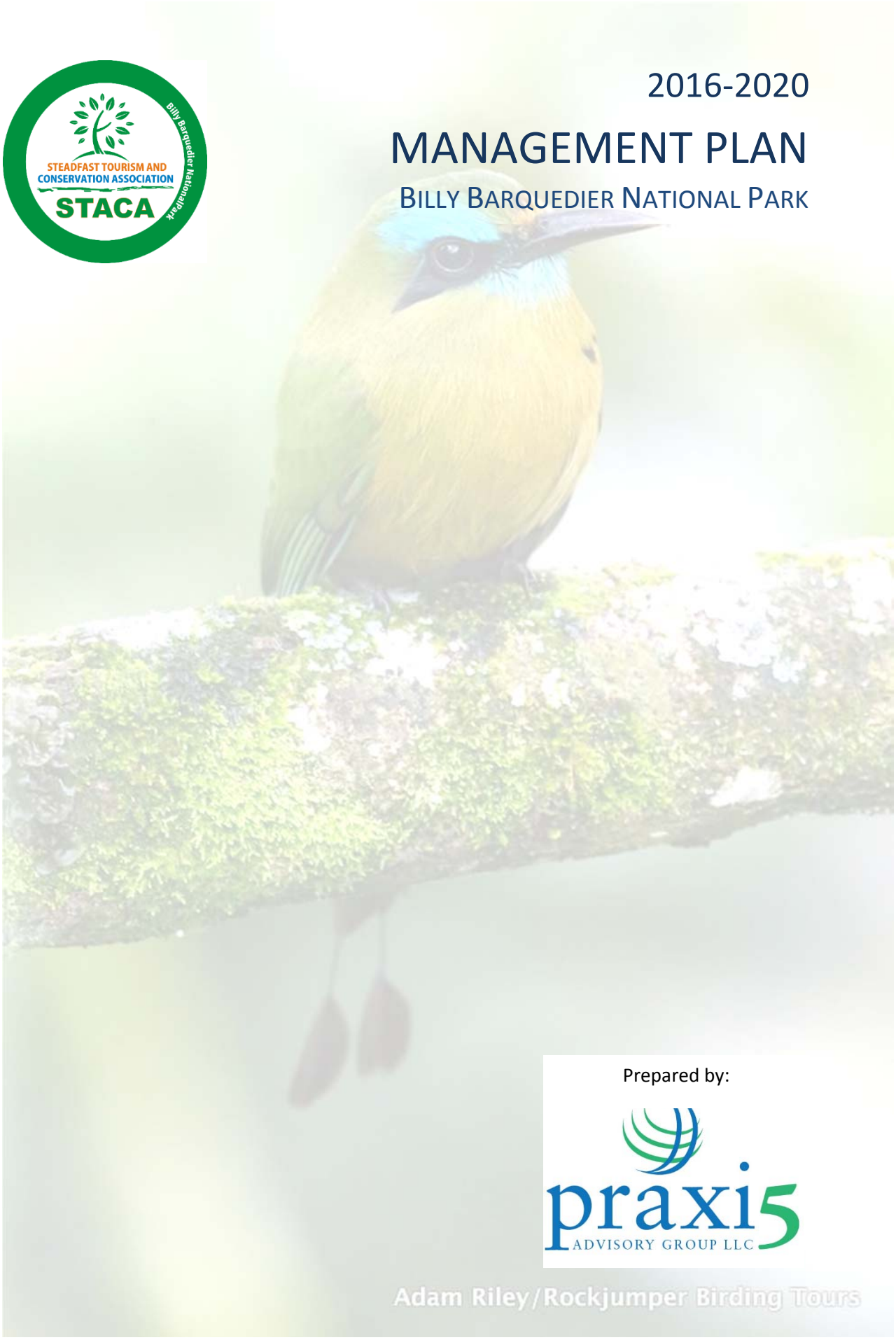
2016-2020

MANAGEMENT PLAN

BILLY BARQUEDIER NATIONAL PARK



Prepared by:

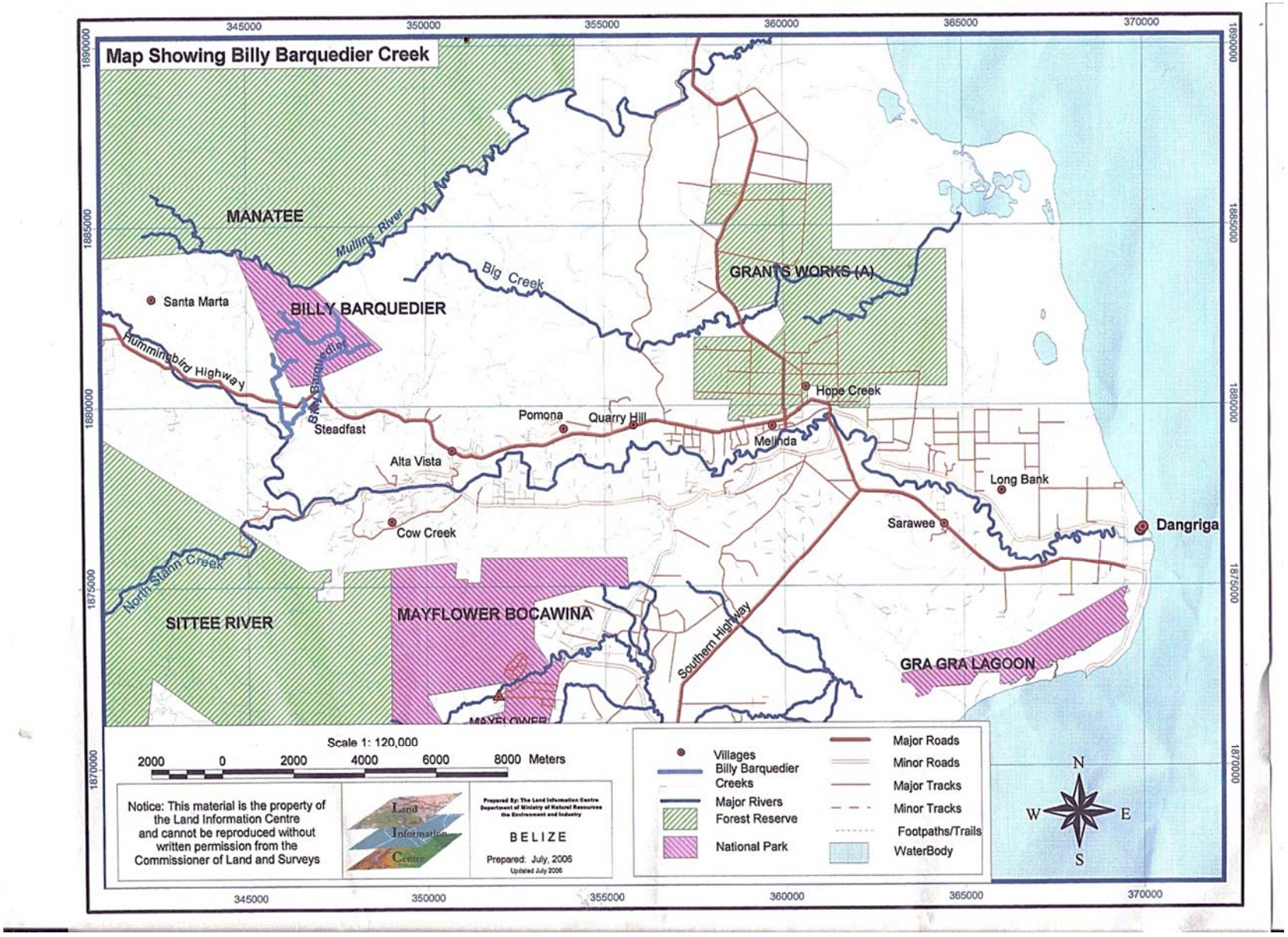
praxis ADVISORY GROUP LLC

BBNP Management Plan (FINAL DRAFT)

Protected Area Data Sheet		
Date	22 October 2015	
Name of Protected Area	Billy Barquedier National Park	
Location of Protected Area	Stann Creek District, Southeastern Belize	
Date of establishment	2001	
Size of Protected Area	Hectares: 663.5	
Land Tenure	Co-Management	
Management Authority	Steadfast Tourism and Conservation Association	
Affiliations / Partnerships with other organizations	Government of Belize (under co-management agreement)	
Number of Staff	Permanent: xxxx	Temporary: xxxx
Annual Budget (Bz$) for management of protected area	BZ$	
Designation (Belize or IUCN category, World Heritage Site, RAMSAR etc.)	National Park – IUCN Category II	
Reasons for Designation	Protection and preservation of natural and scenic values of national significance	
Brief Details of Past Funding	Mix of donor agency funding	
Brief Details of Present Funding	As above	
Brief Details of Future Funding	Donor/charitable support	
List the two primary protected area objectives		
To safeguard the biological heritage of the area, in particular the following three conservation targets: 1) Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest, 2) Freshwater Ecosystem, and 3) Keel-billed Motmot.		
To protect and conserve the water resources of the BBNP and to promote economic development of the adjacent communities.		
List the top two most important threats to the protected area (and indicate why these were chosen)		
Visitor impacts, including unauthorized intrusions into park – affecting the Keel-billed Motmot and Freshwater Ecosystem.		
Logging operations – the single greatest of all threats to the park, affecting all three of the Focal Conservation Targets.		
List the top two critical management activities		
Comprehensive water quality monitoring programme		
Alternative livelihood opportunities for Steadfast, Alta Vista and Valley community		

Name/s of assessors and people consulted: Osmany Salas, Valentino Shal, and Michael F. Somerville in consultation with senior STACA/BBNP administrative and field staff and Board of Directors

Contact details: The Director, STACA, 16½ Miles Stann Creek Valley Road, Stann Creek District


Map Showing Billy Barquedier Creek
345000
350000
355000
360000
365000
370000
1890000
1885000
1880000
1875000
1870000
MANATEE
Mullins River
Big Creek
GRANTS WORKS (A)
Santa Marta
BILLY BARQUEDIER
Hummingbird Highway
Billy Barquedier
Hope Creek
Pomona
Quarry Hill
Steadfast
Melinda
Alta Vista
Long Bank
Sarawee
Dangriga
Cow Creek
North Stann Creek
SITTEE RIVER
MAYFLOWER BOCAWINA
Southern Highway
GRA GRA LAGOON
Scale 1: 120,000
2000 0 2000 4000 6000 8000 Meters
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Land Information Centre
BELIZE
Prepared: July, 2006
Updated July 2006
Villages
Billy Barquedier Creeks
Major Rivers
Forest Reserve
National Park
Major Roads
Minor Roads
Major Tracks
Minor Tracks
Footpaths/Trails
WaterBody
N
W
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Executive Summary

The Billy Barquedier National Park (BBNP) is approximately 663.5 ha in the Stann Creek District, and is bordered in the north by the Manatee Forest Reserve, in the south by private lands, and in the east and west by national lands. The BBNP is managed by the Steadfast Tourism and Conservation Association (STACA), a non-governmental organization (NGO), under the terms of a formal co-management agreement with the Government of Belize. The management regime is based on protection of ecological processes and promotion of education and research, therefore corresponding to an IUCN Category II protected area. The area is also an important component of the Belize National Protected Area System and a biological corridor connecting the North Stann Creek and Mullins River watersheds.

This management plan covers the period 2016–2020 and is the first plan for the BBNP. It was developed in consult with STACA's Board and field staff and provides the basis and direction for the future management of the protected area.

The plan examines the current situation and past experiences, and sets out a systematic approach for management actions over the coming five years, adopting the outline for terrestrial protected areas developed under the National Protected Areas System Plan (NPASP). Two previous planning efforts provided much of the background for this management plan.

The following statement forms the core of the BBNP Management Goal for the next five years:

"To protect and conserve the water resources and biodiversity of the BBNP in order to maintain ecological processes of the protected area and to promote economic development of the adjacent communities."

Following the NPASP outline for terrestrial protected areas, the BBNP management plan is divided into 4 main sections: Section 1 provides the background and context of the protected area, and the purpose and scope of the management plan; and Section 2 gives the BBNP's location, national and regional context, and includes its physical, biological, and cultural aspects. Sections three and four are the heart of the plan, comprising the conservation and management planning aspects, while providing for the other essential activities such as decision making, administration, resourcing, and operation of the BBNP.

At the heart of the plan are the three conservation targets that have been identified for the BBNP, namely, the Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest, the Freshwater Ecosystem, and the Keel-billed Motmot. The BBNP is of high conservation importance and past management has succeeded in keeping its conservation targets in

overall good condition. The overarching objective for this new management planning period is thus to also maintain the conservation targets in this good state.

Based on the conservation target viability assessment, the Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest and the Freshwater Ecosystem are in overall good health, while the Keel-billed Motmot population is currently believed to be in very good health. This species is highly dependent on the overall good condition of the forest ecosystem and access to habitat and resources. The assessment indicates that all three conservation targets are subject to several main threats, some of which are shared with other conservation targets and some that are specific to only one target. The more highly ranked threats appear to affect more than one of the conservation targets and include lack of political will and support (affecting the Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest and the Freshwater Ecosystem) and logging operations and visitation (affecting the Freshwater Ecosystem and Keel-billed Motmot). The lower ranked threats also appear to affect more than one of the conservation targets or a single conservation target and include: fire in wamil areas, chemical fishing, hunting, and palm harvesting.

Threats to BBNP conservation targets will be combatted through four overarching management strategies:

1. Stakeholder Outreach, Education and Advocacy
2. Ecosystems Protection and Management
3. Research and Monitoring
4. Institutional Strengthening and Management

Each of these management strategies has its associated strategic objectives and tactical objectives/actions for guiding the strategies and monitor management implementation.

Acknowledgements

Special appreciation goes to the staff members of STACA and, in particular, the Chairperson, Anthony Hislop, for going beyond the call of duty to support our work throughout the management planning process.

Thank you also to Brenda Chiu (Université de Sherbrooke/ECOSUR) and Araceli Flores (Université de Sherbrooke/ECOSUR). Your reports "*Preliminary Management Plan and Monitoring of Biodiversity in the Billy Barquedier National Park (BBNP), Stann Creek, Belize. Practice Report II*" and "*Integral Management Plan Proposal for the North Stann Creek Watershed and Sub-Watershed Billy Barquedier*", respectively, provided us with useful resource information and maps that were invaluable to the management planning process.

We extend our appreciation to the Board members of STACA and the community stakeholders, as well as to the BBNP field staff who contributed some of their valuable time to share their ideas, views, concerns and aspirations pertaining to the management of the BBNP. Your dynamic participation at the various meetings was invaluable to the planning effort, and resulted in the completion of the BBNP management plan for the next five years and beyond.

And last but certainly not least, we extend our gratitude to the Protected Areas Conservation Trust for its financial support.

Acronyms

ALIDES	Regional Alliance for Sustainable Development
APAMO	Association of Protected Areas Management Organizations
BBNP	Billy Barquedier National Park
BELTRAIDE	Belize Trade and Investment Development Service
BERDS	Biodiversity & Environmental Resource Data System of Belize
BOD	Board of Directors
CAP	Conservation Action Planning
CCAD	Central American Commission for Environment and Development
CGA	Citrus Growers Association
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CPBL	Citrus Products of Belize Ltd
ECOSUR	El Colegio de al Frontera Sur
ERI	Environmental Research Institute
GOB	Government of Belize
GPS	Global positioning system
Ha	Hectares
ITCZ	Inter-Tropical Convergence Zone
IUCN	World Conservation Union
Km	Kilometre
MBCP	Mesoamerican Biological Corridor Programme
NGO	Non-governmental organization
NPASP	National Protected Areas System Plan
NTFP	Non timber forest product
PACT	Protected Areas Conservation Trust
PACT	Protected Areas Conservation Trust
PARCA	Central American Environmental Agenda – Plan Ambiental de la Region Centroamericana
PMIIE	Programa de Manejo Integrado de Ecosistemas en Pueblos Indígenas
SBDC	Small Business Development Center Belize
STACA	Steadfast Tourism and Conservation Association
UB	University of Belize

1. Introduction

1.1. Background and context

The Billy Barquedier National Park (BBNP) was established in 2001 as a protected area to conserve and manage forested land in southeastern Belize threatened with deforestation, hunting, chemical fishing and excessive extraction of natural resources. The park covers approximately 663.5 ha (Boles, 2011) in the Stann Creek district, and is bordered in the north by the Manatee Forest Reserve, in the south by private lands, and in the east and west by national lands.

The BBNP is managed by the Steadfast Tourism and Conservation Association (STACA), a non-governmental organization (NGO), under the terms of a formal co-management agreement with the Government of Belize. The management regime is based on protection of ecological processes and promotion of education and research, therefore corresponding to an IUCN Category II protected area. The area is also an important component of the Belize National Protected Area System and a biological corridor connecting the North Stann Creek and Mullins River watersheds.

1.2. Purpose and scope of plan

The primary purpose of the management plan is to set out the strategic framework for site management over the five year period from 2016-2020. This is the first official plan for the BBNP – the former being a preliminary management plan completed in 2012. Like the preliminary management plan, the methodology used for this planning cycle also follows that adopted for general use in the national protected areas system (Wildtracks, 2005).

The management plan is a guiding document, setting out the main directions for BBNP management over the planning period while retaining operational flexibility in implementation.

It is therefore part of a suite of documents with operations detailed in:

- Sectoral plans for the larger, more complex, programmes
- Annual plans developed by the park managers and tailored to meet terms of individual funding agreements as well as meeting organizational needs

Adaptive management takes place at this level, with the overall management plan assuring continuity of purpose and coherence between strategies. It is based on the founding principles of BBNP management – the protection of ecological processes and promotion of education and research, and to participate in the economic development of the surrounding area.

The management plan also serves two subsidiary but extremely important functions as:

- A reference document summarizing information on the ecological and socio-economic context within which management strategies are developed, and

- An aid to fund-raising, assuring supporters (funding agencies, donors, partners) that their input forms part of a coherent development agenda and facilitating identification of the most strategic areas for assistance.

2. Current Status

2.1. Location

The Billy Barquedier National Park covers approximately 663.5 ha (1639 ac) in the Stann Creek district, in the southeastern part of Belize. The park starts at geographical point (UTM) 1880 550 north and 346 250 east, later spreading to the north-northwest on item 1884 300 north and 344 700 east. Descending to the south the Mullins River, at an approximate distance of 3,500 m is the point 1883 300 north and 346 875 east. The BBNP is extended to the point 1881 600 north and 348 800 east, with a distance of 2,571 m from the previous point. The following coordinate is to the southwest and is located at point 1880 800 north and 347 050 east, and finally, the coordinates of the polygon enclosing the park are located in 1880 650 north and 347 075 east. The park is bordered to the north by the Manatee Forest Reserve (Figure 1) -- the boundary line being the Mullins River; to the south by private lands; and to the east and west by national lands.

The protected area is accessible via main access points (between miles 17 and 18) in Steadfast Village on the Hummingbird Highway. Valley Community and Alta Vista are two communities that are also near to the park.

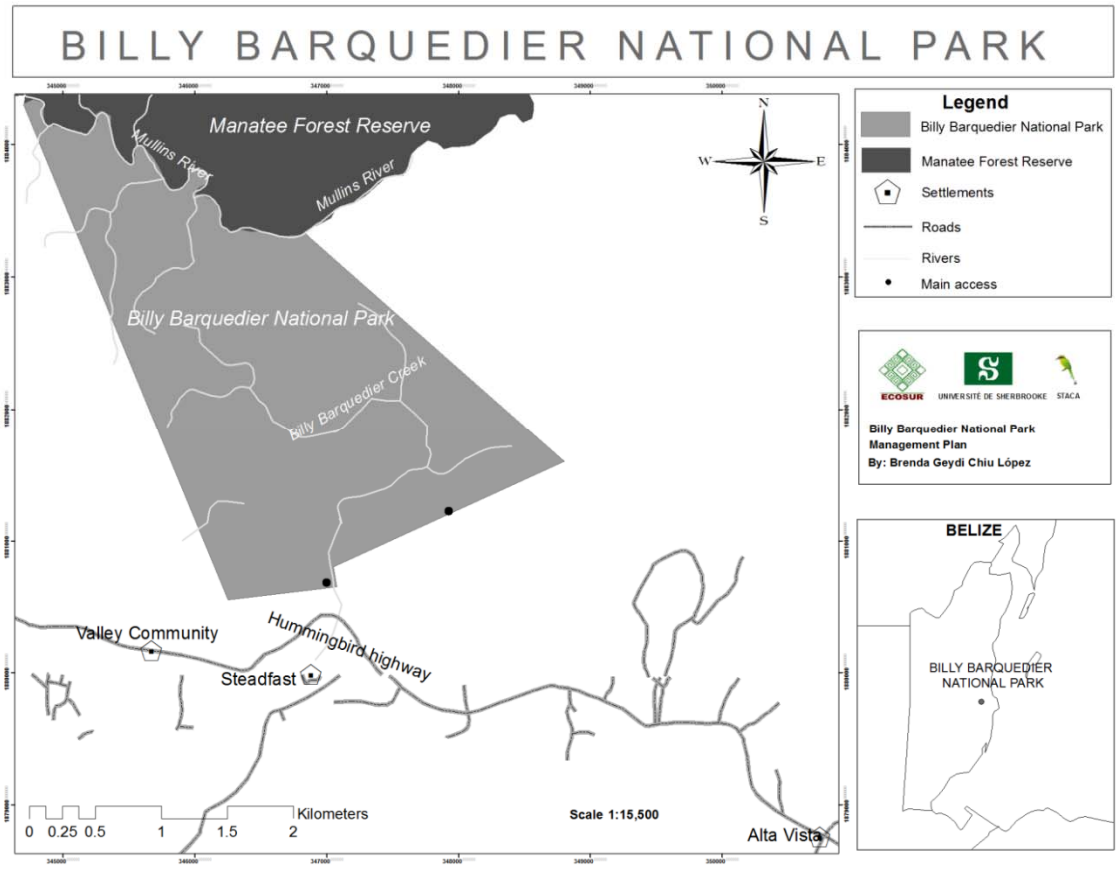


Figure 1: Billy Barquedier National Park location and access points

2.2. Regional Context

The Billy Barquedier National Park lies within Mesoamerica, a region highlighted as a world 'hotspot for species diversity' (Conservation International, 2003), and considered critical for the preservation of the biodiversity of the Western Hemisphere. The combination of North American, South American and Caribbean elements provides for a unique assemblage of plants and animals which has resulted in a particularly rich biodiversity – with 8% of the world's known plant species, and 10% of its vertebrates.

Belize has 3,750 species of plants, 41 species of amphibians, 126 species of reptiles, 574 species of birds and 152 species of mammals (Obando & Herrera, 2010). The number of plant species that BBNP has is not yet known. However, there are records of six species of amphibians, 13 species of reptiles, 152 species of birds, 23 species of mammals and 89 species of insects (See Appendices IV-VII).

The protected area is therefore not only important in itself but also for biodiversity conservation, the provision of environmental goods and services, and in maintaining biological connectivity. It is thus integral to the Mesoamerican Biological Corridor programme. As a key site in the National Protected Area System, the BBNP also plays an

important role in meeting national commitments to the Convention on Biodiversity and other international conventions (Table 1).

The protection of the BBNP fits within the Central American Environmental Agenda – Plan Ambiental de la Region Centroamericana (PARCA) out of which the Central American Commission for Environment and Development (CCAD) was created in 1989. The Government of Belize is a member of this Commission, as well as a signatory of the Convention for the Conservation of Biodiversity and Protection of Priority Wilderness Areas in Central America (formed in 1992), and the Regional Alliance for Sustainable Development (ALIDES) (1994). One of the programmes supported by the Regional Alliance for Sustainable Development is the Mesoamerican Biological Corridor Programme (MBCP). This regional program has been implemented in recent years, establishing corridors of natural vegetation throughout Central America to link protected areas, with the goal of retaining sufficient natural vegetation cover to allow gene flow between protected areas both within and between countries.

Table 1: International Conventions Ratified by Belize

Convention	Ratified
Convention on Biological Diversity	1993
United Nations Framework Convention on Climate Change	1994
Ramsar Convention	1998
Convention on International Trade in Endangered Species of Flora and Fauna	1986
Convention on Biodiversity Conservation and Protection of Wilderness Areas in Central America	1992
Central American Commission for Environment and Development	2000
Regional Alliance for Sustainable Development	1994

2.3. National Context

2.3.1. Legal and Policy Framework

Billy Barquedier was declared a protected area on December 29, 2001, under the status of National Park. The order of reservation is in Chapter 215, Section 3 of the National Parks System in Belize Act, under Statutory Instrument 2001 No. 176. According to the classification criteria of protected areas of Belize, a National Park is established for the purpose of conservation management (Meerman, 2005). The main objective of a National Park is the protection and preservation of natural and scenic values of national significance. The general public must benefit and enjoy these values.

Billy Barquedier National Park complies with the policies established in the National Protected Areas System Plan (NPASP). It is an area of great scenic value and provides several services to Steadfast, Valley Community and Alta Vista villages. Services

provided are potable water, places of great scenic beauty and natural wealth that promote recreation in the area (Walker & Walker, 2011).

Efforts for the protection of BBNP started in 1994. A group of citizens from Steadfast village, who worried about the conservation of Billy Barquedier sub-watershed and its biological richness, started the process to establish the protected area. This group, STACA, aims to promote the economic development of surrounding localities through ecological tourism and the promotion of environmental awareness.

The STACA work has been reinforced by support from the Protected Areas Conservation Trust (PACT) and the Belize Forest Department. Through their actions, these organizations meet the objectives set in the NPASP and the National Development Strategy (Horizons 2030). These objectives include the improvement of the quality of life for Belizeans, the maintenance of the Mesoamerican Biological Corridor, the continuity of natural processes and high resistance against disturbance in the surrounding environment.

2.3.2. Land tenure

The territory occupied by the protected area is for the nation and is in the National Park category, declared under the National Parks System Act.

2.3.3. Evaluation of protected area

The BBNP is important to Belize from an environmental, economic, and socioeconomic standpoint. This pristine protected area provides protection for biodiversity and for a range of essential ecosystem services (game animals, fiber, biomass, soil formation and stabilization, climate regulation, water catchment/storage ability and water protection; and is a gene bank for medicine, agriculture, and forestry). According to Boles (2011), the BBNP includes the Billy Barquedier Creek -- a third-order tributary in the North Stann Creek watershed -- that supplies high quality drinking water, particularly to Steadfast and Alta Vista communities.

BBNP is home to eight vulnerable species identified in the critical species list for Belize. Three of these species are birds (Great Curassow *Crax rubra*, Crested Guan *Penelope purpurascens*, and the Keel-billed Motmot *Electron carinatum*), and five are mammals (Baird's Tapir *Tapirus bairdii*, Yucatan Black Howler Monkey *Alouatta pigra*, Neotropical River Otter *Lontra longicaudis*, Ocelot *Leopardus pardalis*, and the Margay *Leopardus wiedii*). According to the IUCN red list, only the Great Curassow and Keel-billed Motmot are vulnerable, but there are two endangered species, namely the Baird's Tapir and the Yucatan Black Howler Monkey (See Appendix VI). Therefore, the protection and management of this protected area is of great importance for the maintenance and conservation of these species.

The BBNP's great scenic beauty and recreational value also make it an opportunity for the development of local communities through ecological tourism.

2.3.4. Socio-economic context

Economy of the Area

Belize is a small open economy with a narrow export base with economic production and earnings heavily dependent on its natural resource endowment. This is reflected very closely in the Stann Creek District which depends primarily on citrus, bananas, and shrimp production. Tourism also forms part of the region's economy. All these can be considered major exports and provide significant employment to the area. The Stann Creek Valley where the BBNP is located is the historical and traditional heart of the Belizean citrus industry (where grapefruit trees were planted in 1926) with over 75% of farmers (approximately 750 growers) in the area being involved in the cultivation of the crop, the majority of those managing below 10 acres. The industry supports the livelihoods of approximately 1,000 farm families (there are 1,000 registered growers) and approximately 10,000 citrus industry workers. The largest 65 growers (above 100 acres) are responsible for 75% of the production[1].

The population of Stann Creek represents 10.4%[2] of Belize's total population and is ethnically diverse but the rapid changes in ethnic composition over the recent decades reflect population growth dynamics that correspond to the region's economic activities. Census data show a rapid increase in the Mestizo population, attributable mainly to the practice by the main industries of importing minimum wage labourers from Guatemala and Honduras. Indicators from the 2009 Country Poverty Assessment record a sharp three-fold increase in indigence in the Stann Creek District from 5.6% in 2002 to 18.7% in 2009[3].

The citrus and shrimp processing plants provides the greatest employment for residents of the stakeholder communities. Citrus continues to play an important role in the local economy of the communities. Women benefit greatly from employment opportunities at shrimp farms nearby. Aside from these main industries, community members engage in a wide variety of livelihood activities (see Table 2), many pursuing more than one livelihood strategy at a time.

Table 2: Livelihood Activities of Stakeholder Communities

Livelihood Activities of Stakeholder Communities
• Farming -- citrus • Bus driving • Factory workers – citrus industry • BBNP employees • Construction • Shrimp industry workers

[1] www.belizecitrus.org (Belize Citrus Growers' Association)
[2] National Census 2010. Statistical Institute of Belize.
[3] Country Poverty Assessment. 2009. Ministry of Human Development. Government of Belize.

- Banana industry
- Tourism – waiting, bar tending, tour guides
- Public servants - teachers
- Hunting and fishing
- Subsistence farming
- Mechanics
- Shop keepers
- Self-employment – bars, restaurants, caterers
- Jobs with logging companies, minimal

Buffer Communities

The BBNP is located in the Stann Creek Valley is buffered by three main communities namely Steadfast, Valley Community and Alta Vista. According to the 2010 Census, these communities have approximately 1486 inhabitants combined, representing approximately 4.3% of the population of the Stann Creek District and about 0.46% of the national population (see Table 3). Of the total of population, approximately 54.6% is Mestizo/Hispanic ethnic and 15.95% is Creole population, the remaining, 29.45% corresponds to the Garifuna, Mayan, Asian, East Indian and Caucasian ethnic group. In terms of gender, approximately 54.3% of the population is male and 45.7% female, while the age ranges show that 52.4% of the population is between 0 and 19 years of age and 47.6%, from 20 to over 65[4].

[4] Chiu-Lopez, B, G. 2012. Preliminary Management Plan and Monitoring of Biodiversity in the Billy Barquedier National Park (BBNP), Universite de Sherbrooke.

Table 3: Approximate Population Figures by Location

Community	Location	Population	Component Population
Steadfast	16 Q 346878 UTM 1879998 Located at 683.8m from the Billy Barquedier waterfall entrance	485±1	Caucasian/White (1) Creole (111) East Indian (10) Garifuna (17) Maya (37) Mestizo/Hispanic (314) Others (93) Not Reported (1)
Valley Community	16 Q 345679 UTM 1880153 Located at 1478m from the edge of the Billy Barquedier waterfall entrance	629 to 632	Asian (3) Caucasian / White (4) Creole (100) East Indian (20) Garifuna (3) Maya (75) Mestizo / Hispanic (314) Others (110) Not reported (1)
Alta Vista	16 Q 350723 UTM 1878751 It is 4145.6m from the entrance to the Billy Barquedier waterfall	629 to 632	Asian (1) Caucasian / White (1) Creole (26) East Indian (2) Garifuna (1) Maya (13) Mestizo / Hispanic (281) Others (45)

Source: Chiu-Lopez, B, G. 2012

The BBNP provides important benefits to the local communities through ecological goods and services. The main benefit the communities derive from the BBNP is water that is used both within the households as drinking water and in the farms for irrigation. All communities in the area have gravity-fed rudimentary water systems that emanate from the hills within the park. The park provides minimal employment to communities members as rangers and during other project activities. On a broader scale the park provides educational opportunities to both local and foreign students. Students from the University of Belize are involved with STACA in water quality and biodiversity monitoring. The University of Kansas and the University de Sherbrook along with El Colegio de al Frontera Sur (ECOSUR) also bring students to work and study in the park. Lastly, the park also provides aesthetic and recreational values as it has a splendid waterfall within the park itself which is visited by both locals and tourists. Tourism in the areas is not yet well developed and is in its early stages.

Although the BBNP is a protected area, communities continue to exert an impact on it mainly through extractive activities though this is being kept to a minimum (see Table 4). The major concern expressed by community representatives during consultations is the level of deforestation taking place around the park and within the communities themselves. While not directly taking place within the park the ongoing deforestation will eventually affect the entire watershed where both the communities and the park are located. STACA has also shared that they face a challenge with villagers using chemical fishing within the streams inside the park. On the other hand, the park also impacts on the communities but this appears to be mostly positive. Villagers would like more access to extract non-timber forest products and sources of food such as pacaya and game meat. The park also limits the ability of community members to extract medicinal plants. Given the topography of the park, it is not necessarily limiting farming opportunities for community members as the area is generally unsuitable.

Table 4: How the Communities affect BBNP and vice versa

How are communities affecting the BBNP?	How is the BBNP affecting the communities?
• Deforestation (High) • A lot of hillside deforestation is taking place • Hunting (Low) • When logging road opens, this is like a back door into BBNP • Pacaya (chib) harvesting, (Low) • Fishing (Medium) • Local visitors refusal to pay Park entrance fees (High) • Community participation in management of park, (High) • Littering at waterfall (Low)	• Employment (Low) • Food (pacaya, game, fish) though extraction not allowed (High) • Extraction of medicinal plants (though not permitted) • Source of drinking water (High) • Tourism (Medium) • Education/research (Medium) • Recreation (Medium) • Protection of wildlife stock/overspill (High) • Limits access to farmland (Low)

Stakeholders of BBNP

In assessing the ecological services and benefits of and the socio-economic relationships with the RBCMA the following key stakeholders were identified and classified according to organizational interests and characteristics.

- Local Communities

These consist of both communities that area adjacent to the park as well those further away but that also benefits from the watershed protection being carried out by STACA. Steadfast, Alta Vista and Valley Community depend directly on the park for their source

of water. Aside from this obvious benefit, STACA also tries to recruit its staff and workers directly from the adjacent communities.

- Private Sector

Private sector actors especially the citrus industry benefits from environmental services and environmental remediation provided by the park and the greater watershed in the area. Other private actors includes timber and tourism actors who benefit from the conservation work of STACA or negatively impacts on it.

- Local government organizations

Each of the buffer communities have elected Village Councils that look after the development needs of the residents. Each of the three adjacent communities also have independent water boards that look after the water system in each community. The local governance mechanisms plan an important role in the life of the communities as they help to organize and order the lives and livelihoods of the residents. Water boards especially generate revenue from the water supplied to household in the adjacent communities. They are a natural partner for STACA to be involved with to ensure the integrity and sustainability of the water sources within the BBNP. Area Representatives and unelected political party caretakers also form part of the overall government framework for local communities in both formal and informal ways.

- Government Departments

Given that the BBNP, though locally managed, is a government protected area, government agencies play an important role in the institutional and management context. The Forest Department has a primary role given it is the agency responsible for overseeing and regulating all terrestrial protected areas. Other government agencies play important supporting roles such as ensuring compliance with environmental and health regulations. On the other hand, PACT, which is also a government agency provides critical funding for management activities within the park.

- Educational Institutions

Several local and international educational institutions have developed working relationships with STACA and have access to the BBNP. These schools visit the park as well as have their students undertake research within it. Locally the University of Belize has a very strong relationship with STACA and assists with monitoring within the park. Foreign universities also access the park to carry out scientific research as well as to provide field opportunities for their students.

The individual stakeholders are listed in Table 5 along with their corresponding interest/stake in or impact on the BBNP.

Table 5: List of BBNP Stakeholders

Stakeholder	Interest
Steadfast	• Source of drinking water and eco-tourism. Extraction (resource use – illegal) of NTFPs.
Alta Vista	• Source of drinking water and eco-tourism. Extraction (resource use – illegal) of NTFPs.
Valley Community	• Source of drinking water and eco-tourism. Extraction (resource use – illegal) of NTFPs.
Middlesex	• Source of drinking water and eco-tourism. Extraction (resource use – illegal) of NTFPs (indirectly)
Hummingbird Community	• Source of drinking water and eco-tourism. Extraction (resource use – illegal) of NTFPs (indirectly)
CPBL	• Environmental services from the BBNP through provision of freshwater and environmental remediation
Citrus Farmers/CGA	• Environmental remediation
Forest Department	• Regulatory agency/co-managers
Village Council/Water Boards (5)	• Water consumption – (pollution of larger watershed). Generates revenues from water services provided.
Area Representatives/political caretakers	• Provision of water to constituents. Interference in permitting process adjacent to Park.
Loggers (Long term, short term, petty permits)	• Degradation, fragmentation, road building, soil erosion, pollution, timber extraction
Hunters/Fishers	• Extraction of game and NTFPs. Destructive harvesting practices such chemical kills.
Taxi Drivers/Tour Operators	• Eco-tourism and visitation
Sweet Waata Co.	• Water extraction
ECOSUR/Sherbrooke	• Research, education and technical support
UB – Faculty of Science	• Research, education and technical support
University of Arkansas	• Research, education and technical support
Agriculture Department	• Small scale agriculture development, backyard and school gardening
Health Department	• Garbage and sanitary facilities – regulatory
Mullins River Village	• Ecosystem services, affected by chemical runoffs

Fisheries Department	• Regulatory agency – don't play expected role.
Department of Environment	• Regulatory and environmental monitoring. Don't play expected role.
PACT	• Provides funding for management activities for the BBNP.

A participatory analysis of the stakeholders based on their level of Interest and Power/Influence over the management of the BBNP reveals that the main stakeholders of the BBNP are firstly the local communities that depend directly on the ecological goods and service provided by the park especially water, and government departments that have a direct oversight role of the park and its services. The main stakeholder communities are Steadfast, Alta Vista and Valley Community. The main government actors with the highest stakes in the BBNP are the Forest Department and the Department of the Environment. The Protected Areas Conservation Trust, a key funder of STACA who is the co-manager of the BBNP, is also a critical stakeholder.

There are several stakeholders that are in the "middle-ground" that STACA needs to keep on their side. These include~~s~~ mostly the users and beneficiaries of the park and are made of a mixture of private sector players, educational institutions, other government departments. STACA should see these stakeholders as allies and work to keep them informed and supportive of the BBNP and its management. Other stakeholders with low level of interest or low level of influence should be kept informed of the activities taking place through general communication formats. These include communities that are within the larger watershed but not directly connected to the BBNP and loggers who hold short term licenses and petty permits. Their connection to the park is limited and their stake minimal. See Appendix I for Stakeholder Analysis Matrix.

2.4. Physical Environment of Management Area

2.4.1. Climate

Belize is situated on the Caribbean coast of northern Central America with Mexico to the North and Guatemala to the West and the South. It lies between 15°45´ and 18°30´ North Latitude and 87°30´ and 89°15´ West Longitude (BERDS, 2015a). The terrain is low and flat along coastal areas and in some northern regions of the country, while in the central and southern regions low mountains rise gradually to its highest altitude of 3,687 feet (1,124 metres) above sea level (BERDS, 2015b). The climate of Belize is characterized by a marked wet and dry season separated by a cool transitional period (Fuller & Wilson, 2002).

In southern Belize, annual rainfall increases to over 4000 mm (160''). In this part of the country, the rainfall is further enhanced by the intrusion of the Inter-Tropical Convergence Zone (ITCZ) as it journeys northwards (Figure 2). Orographic lifting over steep slopes in the south also enhances rainfall activity. In the southern region the

maximum amount of precipitation occurs in July and is by far the wettest month (Belize National Meteorological Service, 2015). The dry season is typically from November to May and is produced by strong anticyclones in the Atlantic that generate persistent and stable southeasterly airflow across the country. The dry season is divided into a cool transition period that occurs from November through February (as a result of the inclusion of frontal systems), and a warm dry period from March to May (when high pressure systems in the Atlantic produce stable and windy south easterlies) (Belize National Meteorological Service, 2015).

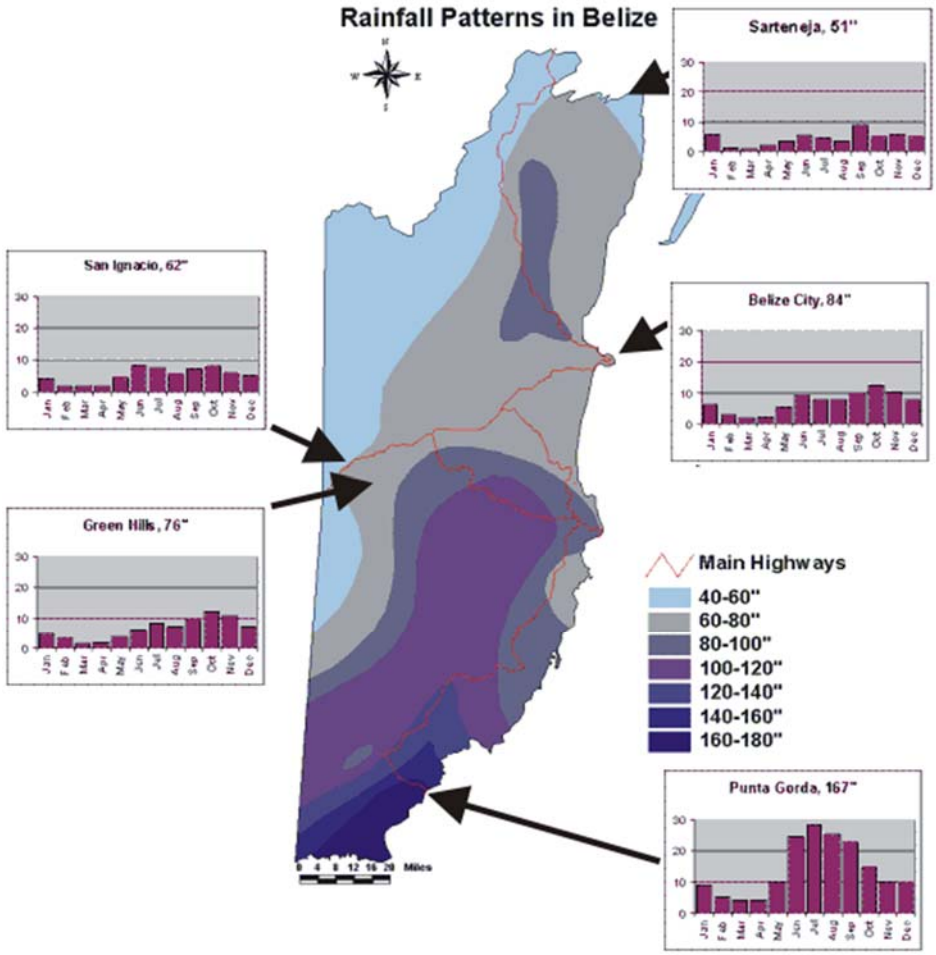


Figure 2: Rainfall Patterns in Belize (adapted from Walker 1973)

The mean temperature in the country varies from 81°F (27°C) along the coast to 69°F (21°C) in the hills. The coldest month is January while the highest temperatures are experienced during the month of May (Belize National Meteorological Service, 2015).

2.4.2. Geology and Soils

Owers (1928) mentions that Belize, formerly called British Honduras, consists of a central peneplain of folded Upper Carboniferous marine beds, with granitic intrusions, surrounded by unfolded limestone of about Oligocene age. Although deposits between

these two periods are unknown, it is known that the main changes are associated with the Permian-Carboniferous and the diastrophism of the Miocene.

According to Owers (1928), the region occupied by BBNP appears to have grown as a block and shows no pliability from the intrusion of granites. Furthermore, Zisman (1994) indicates that, besides being a granitic area, the region occupied by BBNP is included in a complex conglomerate of various metamorphic rocks such as shale, slate, quartzite and granodiorite and, silty portions.

According to Zisman (1994), in the BBNP region it is possible to find soils formed under conditions of continuous acid leaching and skeletal soils (those that do not show a definite development of profiles). The main types correspond to Stopper (subsets Canada and Powder Hill subsets), Melinda (Canquin subset) and Ossory (Curassaw and Pippen subsets) ensembles. The following is a description of each suite in accordance with King, et al. 1989 (Figure 3).

Stopper

Includes all sedentary soils derived from granite rocks and related rocks. One of the main features of this set is that it has a high content of sand and scattered quartz grain (thick or thin) which tends to be equally dispersed in a matrix that is rare in the fine sand. This gives soils bimodal granulometric composition and a very characteristic feel. The textures, usually of medium and crumbly consistency, result in fairly free infiltration and percolation. It is also thought that quartz is the one responsible for the erosion intensity in these soils. Stopper set soils also have a high muscovite (silicate) content.

Melinda

Includes all well or imperfectly drained soils developed on sub-recent alluvial. Most soils in this group have been formed in alluvial mixed siliceous, derived from granite and meta-sedimentary rocks. They also have a high content of silt and mica, especially muscovite, sufficient clay and a high cation exchange capacity to fertilize effectively, making them large potential soils for agriculture.

Ossory

This suite contains sedentary soils and soil-washed hills derived from fine-grained metasediments (quartzite and sandstones) of Santa Rosa Group (Bateson & Hall, 1977) and non-metamorphic shales, sandstones and mudstones of the Margaret Creek formation (Dixon, 1956). This type of soil usually carries a considerable range of forest types. At low altitudes, it is predominantly mixed forest semi-deciduous broadleaf, while at higher altitudes the forest changes in structure and composition to a forest of broadleaf transition.

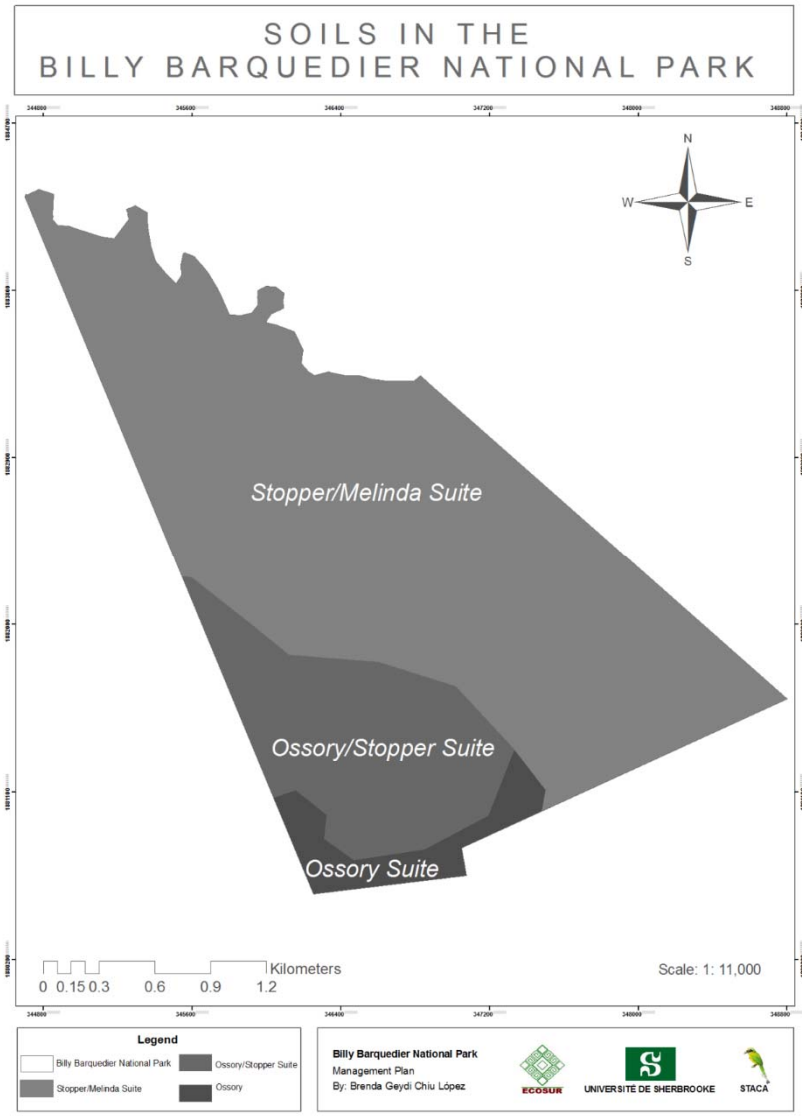


Figure 3: Soil Ensembles found in the BBNP

2.4.3. Hydrology

Boles (2011) notes that watershed are basic units that interconnect landscape biomes by flowing water networks and help define their ecological and land use capability. However, the basins have been damaged many times by various development activities that have been carried out without knowing its importance in the provision of ecosystem services. BBNP is an area where two large basins, the Mullins River Basin and North Stann Creek are located (Figure 4). While there has been no study conducted to date for Mullins River to define physiographic characteristics, there was a rapid ecological assessment done for the North Stann Creek basin.

North Stann Creek is part of a series of basins located southeast of the Sibun River basin with east hillside drainage of the northeastern part of the Maya Mountains. This watershed borders the north by the Mullins River basin and the south by the Sittee River

basin. Its lower section is bordered by streams and coastal wetlands. It is a basin of about 40.74 km (25.32 miles) long at its most developed axis and 14.40 km (8.95 miles) wide at its widest path perpendicular to its longest axis. Its highest point is at the limit of the southwest corner, more than 880 meters above sea level on Mossy Mount.

Billy Barquedier River is a third order sub-basin in North Stann Creek and is located west of Steadfast community. It crosses the North Stann Creek basin at 23.4 km (14, 5 miles) downstream, resulting in the water distribution system of Steadfast and Alta Vista communities.

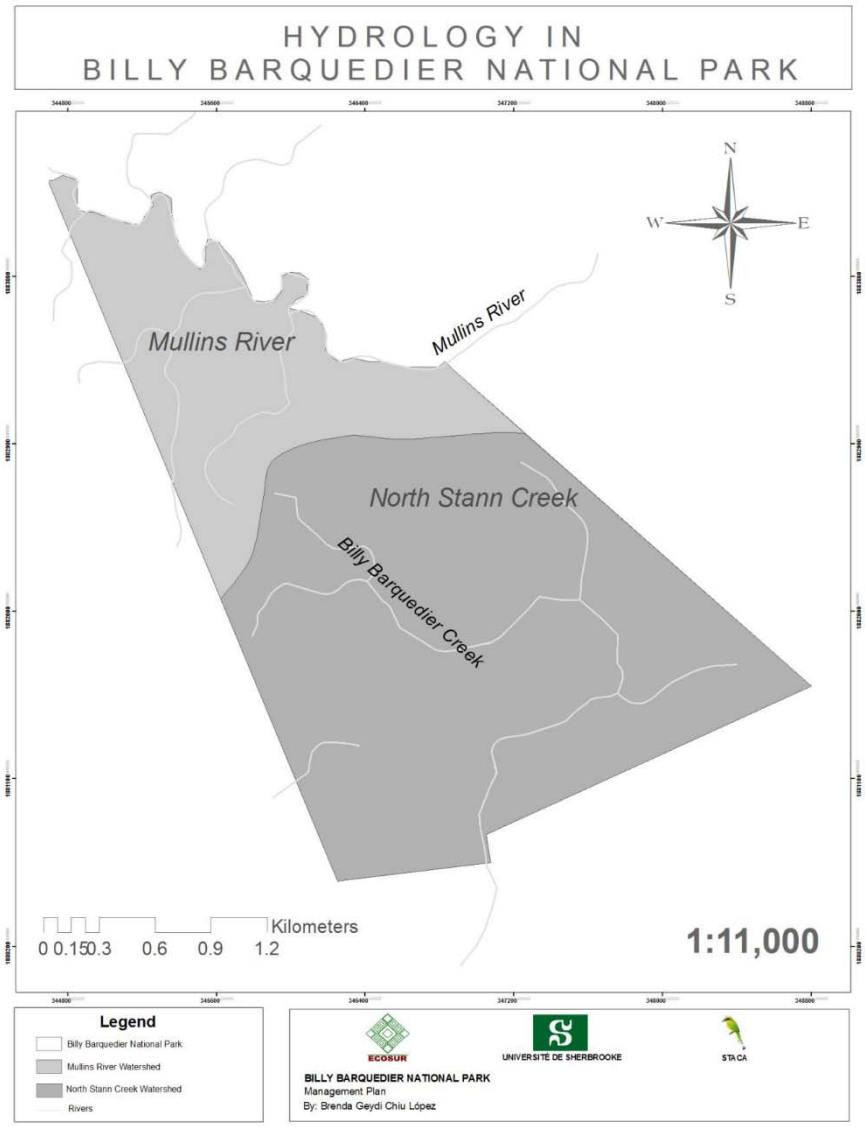


Figure 4: Major Basins and Rivers in the BBNP

2.5. Biodiversity of Management Area

2.5.1. Ecosystems

Belizean ecosystems have been described and mapped in a series of exercises over the past 50 years. The most recent work (Meerman & Sabido, 2001) classifies and maps the vegetation under a scheme applied across Central America. Meerman & Sabido (2001) characterize the BBNP area of Belize as tropical evergreen seasonal broadleaf lowland hill forest. This ecosystem represents a very small area in Belize and most intact forest is within the parameters of BBNP and small areas within the Maya Mountains (Steves, 2008; Figure 5). Moreover, within the eastern part of the area, "wamils" are common. These wamils correspond to secondary vegetation that consists mainly of small trees of Byrsonima crasssifolia, some species of the family Poaceae and palms of Attalea cohune specie (Figure 5).

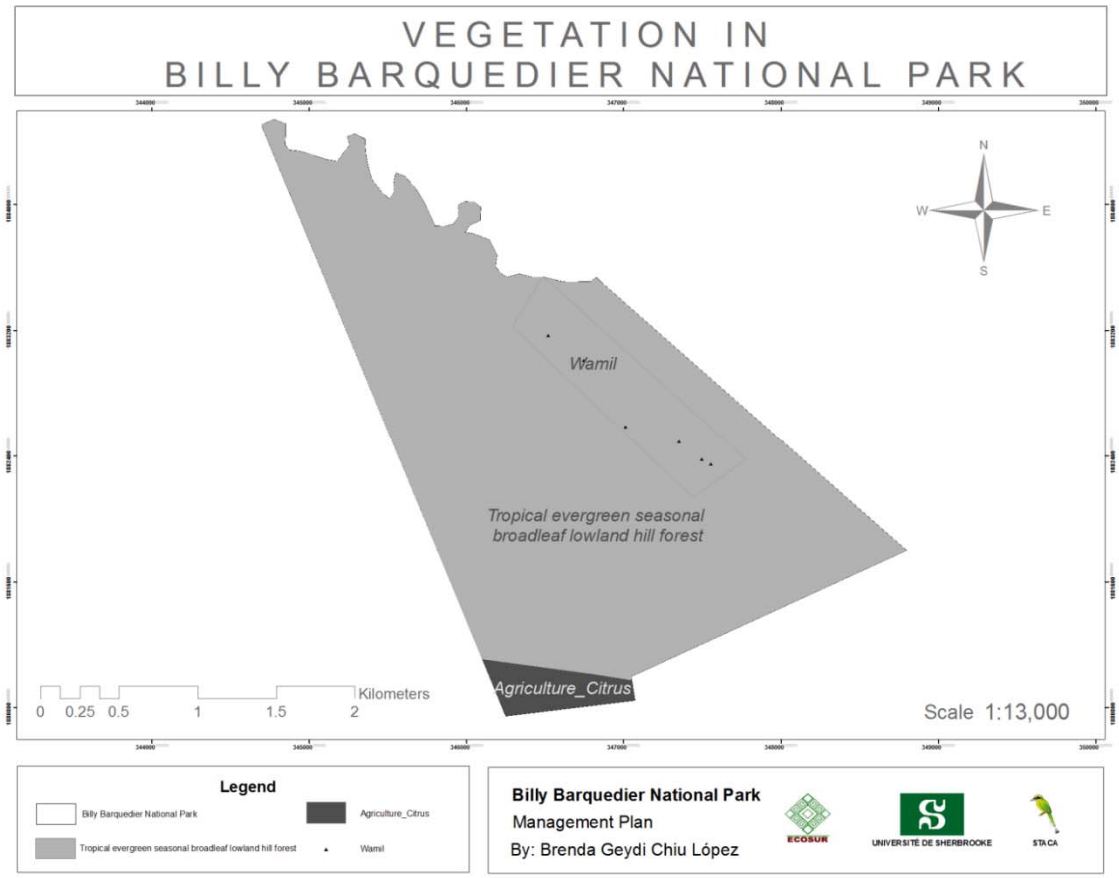


Figure 5: Vegetation Types in the area occupied by the BBNP

2.5.2. Flora

Official studies on flora of the BBNP have not yet been undertaken. However, according to Meerman & Boomsma (1994), secondary growing tree species such as Schizolobium parahyba, Belotia campbelli, Attalea cohune, Cecropia obtusifolia, Inga sp. and Virola sp. May be commonly found.

In addition, according to a study by Rivero (1994) of ferns in the Manatee Forest reserve, there are abundant species of ferns of Polypodiaceae, Pteridaceae, Adiantaceae, Vittariaceae, Hymenophyllaceae, Aspleniaceae, Lomariopsidaceae and Tectariaceae families in the understory.

2.5.3. Fauna

In general terms, faunal diversity in the BBNP is high, including foraging and breeding habitat for a range of species of conservation concern. The most important characteristic is that they occur in fully functioning communities characteristic of the area, most clearly demonstrated by the diversity and relative commonness of top predators (large cats, birds of prey).

Based on studies conducted in the region and from field observations, an estimated 198 species of terrestrial vertebrates is believed to exist in BBNP (eight amphibians, 15 reptiles, 152 birds and 23 mammals). Also, about 89 insect species have been recorded.

Vertebrates

Eight species of amphibians were recorded. Of these, three belong to the family Leptodactylidae, two to the Hylidae family, and the remaining three species to the Craugastoridae, Bufonidae and Ranidae families. Of these species, *Craugastor sabrinus* is an endangered species and *Incillius vaillanti* and *Rana valiceps* are in the category of Least Concern by the IUCN. Other species were not found in any category of IUCN or the list of critical species of Belize (Appendix IV).

Reptiles

This group has a record of 15 species. The family most represented is Colubridae, with four species, followed by families Polychrotidae and Corytophanidae, both represented with two species. There were also recorded species of Elapidae, Eublepharidae, Emydidae, Scincidae, Teiidae and Viperidae families. None of the species found are in any special protection category (See Appendix IV).

Birds

152 species were recorded for this group. The best represented family is Tyrannidae (21 species), followed by Thraupidae (nine species), Columbidae, Icteridae and Trochilidae (the latter with eight species each). Of the total, 137 species are resident and 14 are migratory. In addition, 13 species are highly sensitive to environmental changes, 80 are of medium sensitivity and 13 of low sensitivity. For a species that were identified down to the genus level, the seasonality and sensitivity data were not determined.

As for the risk categories of IUCN, 148 of these bird species are of least concern, one species is near threatened, the Great Tinamou *Tinamus major*, and two are vulnerable (Great Curassow and the Keel-billed Motmot). In relation to the list of critical species of Belize, three species are vulnerable (Great Curassow, Keel-billed Motmot and Crested

Guan). Eight species are found in Appendix II and one species in Appendix I of CITES (See Appendix V).

Mammals

This group has a total record of 23 species (Appendix VI). Of these, the carnivores are the most abundant taxon, with 10 species belonging to the family Felidae, Mustelidae and Procyonidae. Following the order Carnivora are Chiroptera and Rodentia. Under IUCN, two species are near threatened (Jaguar *Panthera onca* and the Margay *Leopardus wiedii*) and two species are endangered (Baird's Tapir and the Yucatan Black Howler Monkey).

According to the list of critical species of Belize, five species of mammals are vulnerable (Ocelot *Leopardus pardalis*, Margay, Neotropical River Otter *Lontra longicaudis*, Baird's Tapir, and the Yucatan Black Howler Monkey), and two are near threatened (Jaguar and the Puma *Puma concolor*). Eight species are found in Appendix I of CITES.

Invertebrates

The total number of invertebrate species recorded is 89. Of these, 29 species are in the order Anisoptera, 52 in Lepidoptera, and 12 in order Zygoptera. The family with the largest number of records is Nymphalidae, followed by Gomphidae and Libellulidae. None of these species are believed to be at risk (See Appendix VII).

2.5.4. Past and Present Research

Studies conducted in the BBNP area have been few. The BBNP has wildlife inventories dating from 1994-1995 but this information needs to be updated for better wildlife management, including conducting new inventories of flora and fauna, and ecological research. Monitoring and studies on the physical aspect of the protected area and social research are also necessary. In addition, it is essential to conduct studies to detect threats and pressures that occur in the buffer zones.

1. *Environmental Issues and Information Needs (from 1994)*: Baseline information collected for The Upper Mullins River Agricultural Development Project. (Simon Zisman).

2. *Avian Surveys (from 1994)*: Upper Mullins River Basin. (Bruce and Caroline Miller).

3. *Upper Mullins River Basin Environmental Review (from 1994)*: (Jan Meerman and T. Boomsma).

4. *Preliminary Survey on Ferns and Epiphytes (from 1994)*: (Raul Rivero).

5. *Search for Archaeological sites in the Mullins River Basin (from 1994)*: (Theresa Batty and Jason Wagner).

6. *Environmental Impact Assessment of Steadfast Tourism and Conservation Association Ecotourism Project (from 1994-1995)*: Mullins River, for Environmental Impact Assessment /Training Program.

7. *Potential of the Billy Barquedier National Park herpetofauna in Steadfast (from 2008)*: (Carrie Elizabeth Steves).

8. *Patrol reports of Billy Barquedier National Park (from 2010-2011)*: (STACA).

9. *Rapid ecological assessment within Billy Barquedier North Stann Creek Watershed (from 2011)*: (Ed Boles).

2.6. Cultural and Socio-Economic Values of Management Area

2.6.1. Community and Stakeholder Use

Most of the area which occupies the park is broadleaf forest of both primary and secondary growth. In the 1990's, land use within BBNP consisted of, in the southeastern part, citrus crops and shifting cultivation, otherwise known as "milpas" (see Table 6). Currently, the areas that were under cultivation are in recovery and due to the declaration and establishment of the park, agricultural activities within the park has ceased. Agriculture development continues in the vicinity and this represents an area of concern for STACA as villagers are clearing land right up to the boundary of the park. Some illicit extractive activities continue to take place but not to a significant level. Most of what is currently taken out are NTFPs including game, fish and materials for local construction. The extractive activity is kept to a minimum given STACA's presence within the site.

Today, STACA and the water boards are the only organizations active in the park. STACA continues to promote biodiversity conservation, environmental education, tourism, and recreation, while the water boards are responsible for maintenance of the water system that supplies water to adjacent communities.

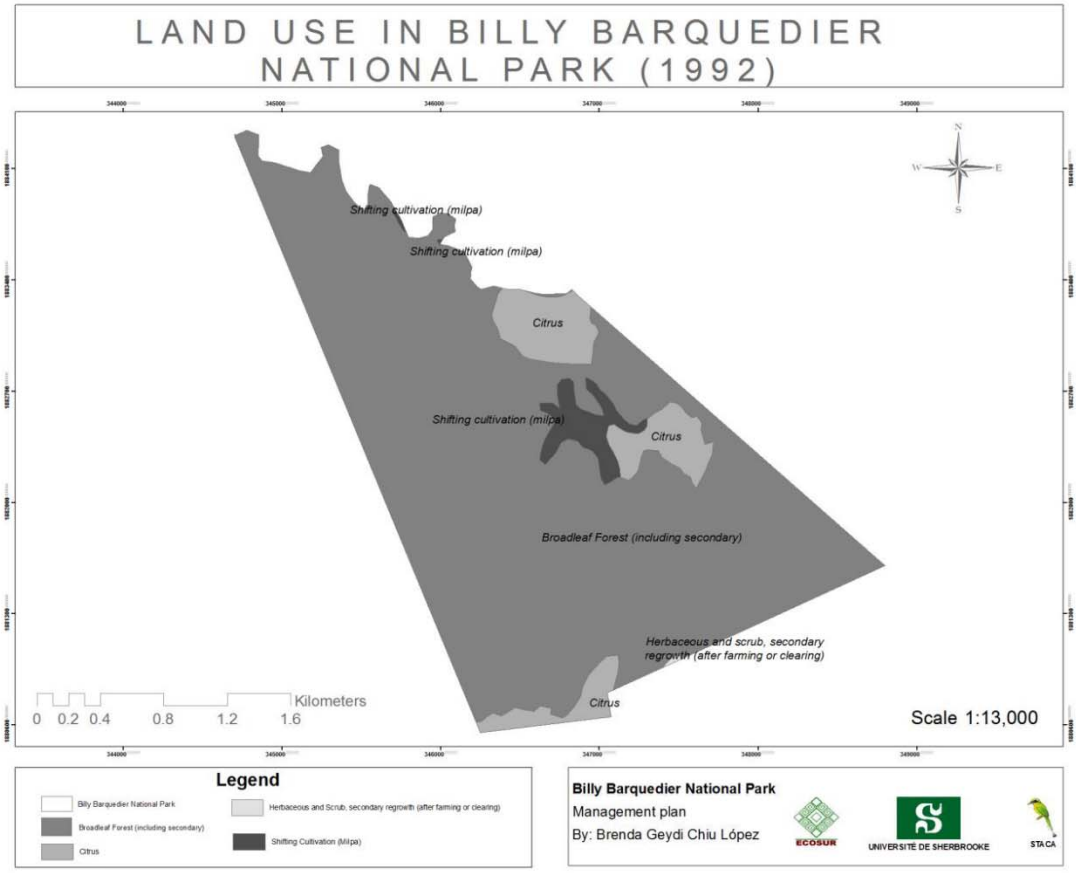


Figure 6: Land Uses in 1992 in the BBNP

2.6.2. Archaeological Sites

According to the study by Batty & Wagner (1994), there are no historic or prehistoric archaeological sites in the Mullins River Basin where the BBNP is located but rather only a relic industry called "Tidewater Industrial Site". This site represents a vestige of equipment used in the days of mahogany logging. This tidewater is located on the western edge of BBNP and is considered by STACA to be a relic of high protection value.

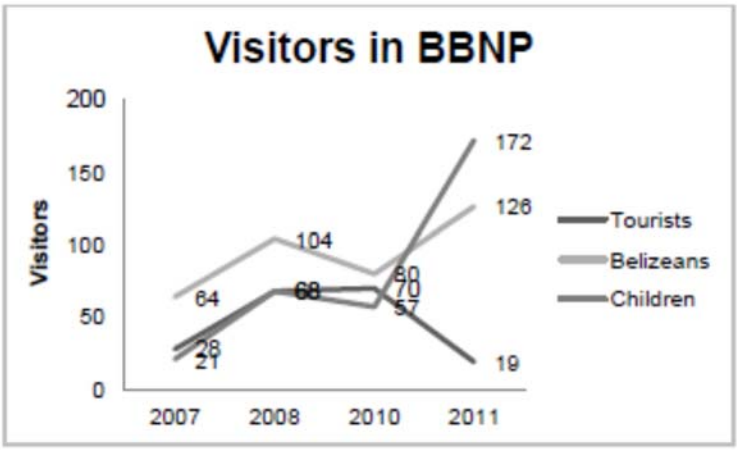
For several years, STACA has been sending letters to the Ministry of Forestry and the Department of Archaeology noting degradation of the site. Unfortunately, it appears that is no official interest in its protection. This tidewater is today the only one known in Belize and is fairly intact hidden in the jungle. Presently, the relic is at a point at which it should be protected. It would take the attention and involvement of relevant agencies such as the Institute of Archaeology for any protection to be possible.

2.6.3. Tourism and Recreation Use

The ecotourism potential of the BBNP is not yet well developed. The park has a waterfall and camping area that are the main attractions. The waterfall is a short 15-20 minutes hike inside the park from the Hummingbird Highway at Mile 17. General park entrance fee including waterfall access is US$4 while jungle camping is US$20 per night. STACA makes guides and tours available for an extra fee. Aside from tourism activities

carried out by STACA, local tour and taxi operators from Dangriga usually bring tourists and guest to visit the waterfall and park. A survey carried out in Alta Vista, Valley Community and Steadfast communities indicate that 74.0% of the people know of the existence of the protected area and of these, 95.7% consider it is important as a recreational and tourist attraction, as well as being a supplier of water and aesthetic value.

A total of 877 visitors from 2007 to 2011, except for 2009, for which there are no figures (see Figure 7). Among them, the highest percentage are nationals (78.9%) and 21.1% are tourists. There has been a gradual increase in visitation to the park.



Source: Chiu-Lopez, B, G. 2012
Figure 7: Visitation to BBNP 2007-2011

The most common activities undertaken by visitors in BBNP are swimming and picnicking, besides observing the natural beauty of the area. There are also activities such as camping and guided tours that contribute to environmental education and visitor recreation. The proceeds from the tours are used for park maintenance carried out by members of STACA.

Some potential tourism and recreation activities for adjacent communities, such as bird watching and hiking with guided interpretation but these need to be developed. For these activities to be undertaken, it is necessary to develop an updated inventory of flora and fauna to serve as a source of information on natural resources and their importance. Also, to avoid negative impacts of visitation, recreational activities must take into account the existing regulations and precautions. The risks, the zoning plan of BBNP and the number of visitors allowed must also be considered. Mainly, a stronger waste management and surveillance programs will need to be put in place the Billy Barquedier waterfall area; the place that receives the highest number of visitors.

2.6.4. Other Economic Use

There are no other economic uses within the protected area.

2.6.5. Education Use

The park sees an active and consistent use for educational purposes. There are regular visits by students and professors of various educational institutions both local and foreign. These include institutions such as the Stann Creek Ecumenical College, University of Belize, University of Kansas, Universite de Sherbrooke, ECOSUR and Arkansas University. The University of Arkansas makes annual visits to the protected area and also to contribute to its maintenance. Meanwhile, STACA has a working relationship with the University of Belize for flora and freshwater monitoring within the park.

3. Analysis of Conservation Targets and Threats

The conservation planning follows the Conservation Action Planning (CAP) process developed by The Nature Conservancy and adopted by the National Protected Areas Policy and System Plan. It is detailed in Appendix III and only summarized here.

3.1. Conservation Targets

3.1.1. Identification of Conservation Targets

Three conservation targets have been identified for the BBNP:

1. Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest
2. Freshwater Ecosystem
3. Keel-billed Motmot

Each of these conservation targets is governed by fundamentally differing ecological processes, experience different types of threat and thus require different strategies. These conservation targets also capture all of the biodiversity and ecological processes within the protected area and conserving these three conservation targets will ultimately ensure the conservation of all the biodiversity and ecological processes within the BBNP.

3.1.2. Assessment of Conservation Target Viability

The viability assessment (Appendix III) indicates that:

- The Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest is in overall good health. Its size is adequate, and its connectivity and basic ecological processes at the landscape level are intact. Structure and species composition are mostly modified by past and present lumber operations, palm harvesting, fire in wamil areas, and hunting, but impacts overall are low, leaving the natural communities in fully functional condition.

- The health of the Freshwater Ecosystem is currently good. The upper catchment area of the Billy Barquedier sub-watershed area is beyond the BBNP boundary, and the presence of contaminants from visitation may compromise hydrological and water chemistry regimes. The population structure and composition of some

fish and other aquatic species may also have been impacted as a result of chemical fishing and siltation of the waterways from logging operations.

- The Keel-billed Motmot population is currently believed to be in very good health. This species is highly dependent on the overall good condition of the forest ecosystem and access to habitat and resources. Nesting success is believed to be highly impacted by logging operations and moderately impacted by human intrusions into their habitat. Management can help to address these impacts to this species of special conservation concern.

3.2. Threats to Biodiversity

The assessment indicates that all three conservation targets are subject to seven main threats, some of which are shared with other conservation targets and some that are specific to only one target.

- The Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest conservation target is affected by the largest number of threats, including lack of political will and support, fire in wamil areas, chemical fishing, hunting, and palm harvesting. All of these threats (with the exception of lack of political will and support threat that was overridden from low to medium) are considered low at the moment.

- The Freshwater Ecosystem is among the most threatened of the conservation targets presently, with logging operations, lack of political will and support, and visitation being the most prominent threats. Chemical fishing is also a threat of particular consideration although the extent of its occurrence is currently low. The logging operations threat for this conservation target had a score of medium in the initial assessment but was overridden to high, resulting in an overall rank of high for this threat across targets. Also, the visitor impacts threat for this conservation target had a score of low in the initial assessment but was overridden to medium, resulting in an overall rank of medium for this threat across targets. The resulting overrides also conferred an overall threat status of high upon this target.

- The Keel-billed Motmot is also among the most threatened of the conservation targets presently, being threatened mainly by logging operations which is considered high, and disturbance from visitation considered moderate. The visitor impacts threat for this conservation target was not scored in the initial assessment but was overridden to medium, resulting in an overall rank of medium for this threat across targets. This resulting override conferred an overall threat status of high upon this target.

The more highly ranked threats appear to affect more than one of the conservation targets and include lack of political will and support (affecting the Tropical Evergreen

Seasonal Broadleaf Lowland Hill Forest and the Freshwater Ecosystem) and logging operations and visitation (affecting the Freshwater Ecosystem and Keel-billed Motmot). The lower ranked threats also appear to affect more than one of the conservation targets or a single conservation target and include: fire in wamil areas, chemical fishing, hunting, and palm harvesting.

The goal of the BBNP is to manage threats to the conservation targets through a range of programmes designed to maintain the conservation targets in a "good" to "very good" state. From the assessment, four of the seven threats are ranked "low", one is ranked "medium", two are ranked "high", and none are ranked "very high". For the purpose of the conservation assessment, the two threats that are ranked "high" are the "critical threats" and should be the priority for management. Threats that rank "medium" and "low" will, fortunately, require less management intervention but nevertheless are conservation issues that should be tackled.

3.3. Strategies to Reduce Threats

Each conservation target is subject to one or more threats and some threats affect more than one conservation target. Furthermore, the proximate source of threat is usually propelled, or at least facilitated, by one or more factors acting indirectly. Strategies must address both, acting on direct sources to gain immediate relief and on indirect sources to alleviate the condition over the long term. The following general strategies are employed to reduce threats to the BBNP conservation targets, and are developed further in management programmes:

- Protection of ecosystems
    - Involving boundary demarcation, surveillance through ground patrols, and legal action when appropriate

- Managed resource use
    - To enhance the relevance of the protected area for the local economy and build it as an important site through delivery of concrete benefits, giving the basis for a constituency of support for the area. This also acts as a form of passive protection by occupying the ground and visibly demonstrating an active presence.

- Outreach, education and advocacy
    - To engage with neighbouring land owners and communities to gain support for BBNP management and protection of the protected area, and to preserve the BBNP resources to maintain biological connectivity in the wider landscape

- Research and monitoring

  - To obtain and disseminate information on the area, reinforcing awareness of its importance, and to monitor the success of management actions

- Institutional strengthening
  - To obtain proper work equipment, resource mobilization, and training of staff to be proactive and reactive to illegal activities

3.4. Monitoring of Success of Conservation Strategies

The conservation strategies in place to reduce the threats to the conservation targets should be monitored continuously throughout the management period. The status of the conservation targets will provide management with a clear indication whether the conservation strategies are working or not. The BBNP research and monitoring programme (Section 4.7.3) provides a list of monitoring actions and activities. These actions and activities can then be tabulated and analyzed based on a "measures of success" scale to determine their success.

3.5. Climate Change Adaptation Planning

Protected areas are essential for safeguarding biodiversity and ecological processes, but they face many human-caused stresses such as pollution, farming, poaching and logging. These existing pressures are now being exacerbated by the effects of climate change. For protected areas to effectively safeguard biodiversity and life-giving ecosystem services into the future, their vulnerability to climate change must be evaluated as a basis for conservation planning.

3.5.1. Vulnerability Factors and Resilience Features

The BBNP, despite only encompassing about 663.5 ha (Boles, 2011), plays a critical role in building ecological resilience to long-term changes, disturbances and the impacts of climate change by regulating climate, reducing vulnerability to floods and droughts, protecting communities from sudden climate events, and supporting species to adapt to changing climate patterns by providing refuge and migration corridors. The BBNP provides other important ecosystem goods and services including non-timber forest products, aesthetic and tourism values, and water catchment/storage ability and water protection.

Some of the most significant threats to the viability of the BBNP and its biodiversity and ecological processes include logging operations that decreases plant diversity, reduce wildlife habitat, decrease connectivity and siltation of waterways; visitor impacts that contaminate soil and decrease water quality; lack of political will and support; chemical fishing that affects aquatic organisms and the drinking water quality for local residents; hunting; fire in wamil areas; and palm harvesting.

Without a doubt, the negative effects of climate change on the BBNP's biodiversity and ecological processes will be compounded by these threats, especially where they are

caused by humans; and the biodiversity, ecological processes, and ecosystem goods and services of the area that may already be vulnerable because of these human threats may be even more quickly or more severely affected by climate change.

A 9 to 22 percent reduction in precipitation and a mean annual air temperature increase of 3.5°C will have profound impacts on water resources in Belize, mainly through reduced surface water availability for direct use by communities, agriculture, and economic processes; decreased groundwater recharge rates, which could substantially affect dry season flows; disappearance or reduced discharge rates of springs, which are an important water supply for communities; possible increased use of irrigation upstream, leading to increased water competition and potential water conflicts among competing users; reduced soil moisture due to higher evaporation levels; and increased water pollution with potential impacts on human health and ecosystems. In addition, these changes will interact with and exacerbate other human-induced pressures affecting water quantity and quality, particularly in communities where population growth rates and urbanization are higher.

3.5.2. Priority Climate Change Adaptation Planning Targets

A series of Focal Targets on which to base climate change adaptation planning are identified to ensure that financial and human resource investments in adaptation strategies are prioritized for maximum effectiveness. Not all focal climate change targets will be equally affected by or be equally resilient to climate change impacts.

- Priority conservation targets
- Key environmental services
- Priority stakeholder communities
- Key socio-economic activities

Priority Conservation Targets

All three of the conservation targets identified during the conservation planning session were selected as priority conservation targets that would be affected by climate change:

- Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest
- Freshwater Ecosystem
- Keel-billed Motmot

Key Environmental Goods and Services

The BBNP helps to maintain the Mesoamerican Biological Corridor and supports species of conservation concern such as the Keel-billed Motmot, Baird's Tapir, and Yucatan Black Howler Monkey. It is also essential for providing protection for key environmental goods and services for buffer communities and the country of Belize on a whole, including food, fiber and freshwater; cultural services such as scenic beauty and tourism values; support services such as biodiversity, biomass, soil formation and stabilization; climate regulation and water catchment/storage ability and water protection; and is a

gene bank for medicine, agriculture, and forestry. In addition, the BBNP's rich ecosystems also play a vital role in buffering communities against storms and hurricanes by reducing potential physical damage to houses and other infrastructure during storm events, and in filtering out sediments and agrochemicals from unsustainable development and agricultural practices.

Through group consensus, two priority environmental services considered to be at greatest risk from climate change were selected:

- Game species
- Water catchment/storage ability and protection

Priority Stakeholder Communities

Priority stakeholder communities were selected from those identified in the BBNP stakeholder analysis. They were chosen based on their significant dependence on the natural resources and ecosystem services of the protected area, and lowest capacity for adaptation.

Three vulnerability factors were examined:

1. Exposure: The extent to which a community comes into contact with climate events or specific climate impacts

2. Sensitivity: The degree to which a community is negatively affected by changes in climate

3. Adaptive Capacity: The potential or capability of a community to adjust to impacts of changing climate, and to minimize, cope with and recover from the consequences of changes

Three priority stakeholder communities were chosen, including Steadfast, Alta Vista, and Valley Community. Of these three communities, Steadfast was thought to be the most vulnerable to climate change -- being the least developed, having a greater number of water channels, and having a lower potential or capability than the other two communities to adjust to and recover from impacts due to its perceived lower economy. Although Alta Vista is located the furthest away from the buffering protection of the BBNP and is prone to mudslides as a result of its adjacency to slopes and barren hillsides, it is seen as having the overall lower vulnerability of the other communities – being the most developed with a stronger governance structure in place, and having a higher adaptive capacity. Valley Community is also vulnerable in its exposure and sensitivity to climate change impacts. Its location makes it prone to flooding, and although it has the larger population of the other communities, it has a good community center and many church buildings that can be used as shelters in times of extreme storm events.

Key Socio-economic Activities

The stakeholder analysis and community consultations revealed that the BBNP communities are dependent on the natural resources of the protected area. Socio-economic activities such as eco-tourism, citrus, shrimp, milpa farming, retail services, cattle and small livestock rearing, fishing, hunting, logging, and extraction of non-timber forest products contribute to the local and national economy.

Citrus farming, milpa farming (vegetables, grains, pig, poultry and sheep), and eco-tourism were selected as the key socio-economic activities based on their dependence on the natural resources of the protected area and that will be most affected by climate change. Changes in temperature, amount of carbon dioxide, and the frequency and intensity of extreme weather could have significant impacts on crop yields. Heat stresses can increase the vulnerability of farm animals to disease, reduce fertility, and reduce milk production. Droughts may reduce the amount of quality forage available to grazing farm animals, and changes in crop production due to drought could also become a problem for animals that rely on feed grain. Climate change may also increase the prevalence of parasites and diseases that affect farm animals, and increases in carbon dioxide may increase the productivity of pastures, but may also decrease their quality and nutritional benefits. Eco-tourism activities could be impacted by an increased risk of visitors getting heatstroke as the temperature increases. An increased intensity of storms could result in decreased visitation to the park, and damage to natural attractions and visitor facilities and infrastructure.

3.5.3. Threat Assessment

Situation Analysis

To achieve conservation, the impacts of climate change must be mitigated. This can be achieved through an understanding of the changes that will come about at the national and site level as a result of these forces, and identifying conditions that may lead to solutions (Table 6).

Table 6: Predicted Climate Change Impacts for Belize

Predicted Climate Change Impacts	Current Status	25 - 50 years	100 years
Sea level rise	▪ Increased global average sea level rise rate of 1.8mm per year from 1961 – 2003 (IPCC, 2007). Current average increase in sea level rise in the Mesoamerican region is estimated at 3.1mm per year (IPCC, 2007).		▪ Predicted increase of between 0.6m and 1.0m over next 100 years, though could be higher (up to 3.3m), dependent on the rate of melt of ice sheets (Simpson et al., 2009)
Sea surface	▪ Water temperature has		▪ Predicted regional

temperature rise	increased by 0.74˚C between 1906 and 2005 ▪ Current levels of increase are estimated at 0.4˚C per decade (Simpson et al., 2009)		increase of temperature by up to 5˚C by 2080, with the greatest warming being experienced in the north-west Caribbean (including Belize) (WWF, 2009).
Increased intensity of storms	▪ Increased storms from 1999 onwards, with annual fluctuations. More storms during La Nina, fewer El Nino. Stronger storms >Cat 4 / 5		
Ocean acidification (corals, lobster / conch)	▪ Atmospheric CO_2 concentration has increased from 280 parts per million (ppm) in 1880 to 385 ppm in 2008 - 35% increase in hydrogen (Simpson et al., 2009). ▪ 48% of all atmospheric CO_2 resulting from burning of fossil fuels has been taken up by the ocean (Hartley, 2010)	▪ Predicted atmospheric CO_2 levels of 450 by 2040 (Simpson et al., 2009) ▪ Predicted 30% decrease in pH ▪ Predicted decrease in calcification rate by 20 - 50% by 2050	▪ Decrease of between 0.3 and 0.5 units by 2100 (Hartley et. al. 2010). ▪ Some experts predict a 35% reduction in coral growth by 2100 (Simpson et al., 2009)
Decreased Precipitation	▪ Mean annual rainfall over Belize has decreased at an average rate of 3.1mm per month per decade since 1960 (NCSP/UNDP)	▪ Predicted ecological shifts up the altitudinal gradient of the Maya Mountains Massif may remove the cloud forest, and the catchment functionality important for maintaining rivers in dry season in the south of Belize, and providing nutrients to the reef environment. ▪ Increased concentration and seasonality of agrochemical delivery	▪ Predicted decrease in precipitation of 9% by 2099 (IPCC, 2007), with significant fluctuations, attributed to El Niño ▪ Some models predict a decrease of as much as 22% (IPCC 2007)
Air Temperature	▪ Mean annual temperature has increased in Belize by 0.45°C since 1960, an average rate of 0.10°C per decade. ▪ Average number of 'hot'		▪ Predicted mean annual temperature increase is 3.5° by 2099 (UNDP, 2009).

	days per year in Belize (days exceeding 10% of current average temperature) has increased by 18.3% between 1960 and 2003 (NCSP/UNDP).		

Using this information about the predicted climate change impacts for Belize, a "Hypothesis of Change" was developed to identify threats to the climate change adaptation targets considered important for BBNP (Table 7).

Table 7: Hypothesis of Change for Climate Change Adaptation Targets

IMPACT	HYPOTHESIS OF CHANGE: TROPICAL EVERGREEN SEASONAL BROADLEAF LOWLAND HILL FOREST
Increased Air Temperature	• Increased frequency and intensity of fires
	• Changes in species composition
	• Increased vulnerability to invasive species
Decreased Precipitation	• Increased frequency and intensity of fires
	• Changes in species composition
Increased Intensity of Storms	• Loss of trees
	• Changes in species composition

IMPACT	HYPOTHESIS OF CHANGE: FRESHWATER ECOSYSTEM
Increased Air Temperature	• Decreased amount of water in system
	• Increased wildlife mortality
Decreased Precipitation	• Decreased amount of water in system
	• Less drinking water available to stakeholder communities
	• Increased mortality of macro inverts and other aquatic species
Increased Intensity of Storms	• Increase forest debris that clog natural drainage system
	• Changes in water quality
	• Increase level of detritus in system, reducing levels of dissolved oxygen

IMPACT	HYPOTHESIS OF CHANGE: KEEL-BILLED MOTMOT
Increased Air Temperature	• Increased vulnerability to predation
Decreased Precipitation	• Decrease vegetation cover may expose nests to higher temperatures, resulting in nesting failures
Increased Intensity of Storms	• Affect nesting success
	• Increased vulnerability to predation

IMPACT	HYPOTHESIS OF CHANGE: KEY ENVIRONMENTAL SERVICES – GAME SPECIES
Increased Air Temperature	• Increased vectors
Decreased Precipitation	• Increased vulnerability to predation

	• Affect wildlife habitat (watering holes), e.g. for Tapirs
Increased Intensity of Storms	• Loss of food source (fruits, berries) for some wildlife
	• Habitat loss
	• Wildlife displacement
	• Increased predation and hunting pressures

IMPACT	HYPOTHESIS OF CHANGE: KEY ENVIRONMENTAL SERVICES -- WATERSHED PROTECTION/CATCHMENT
Increased Air Temperature	• Decreased amount of water in system
	• Reduced availability of fresh water
Decreased Precipitation	• Reduced availability of fresh water
	• Decreased amount of water in system
	• Increased mortality of macro inverts and other aquatic species
Increased Intensity of Storms	• Increase forest debris that clog natural drainage system
	• Increased erosion
	• Increased loading of nutrients into water bodies, affecting water quality

IMPACT	HYPOTHESIS OF CHANGE: PRIORITY STAKEHOLDER COMMUNITIES -- STEADFAST
Increased Air Temperature	• Increased incidents of heatstroke
	• Increased energy consumption
	• Decreased productivity level
Decreased Precipitation	• Decreased availability of drinking water
	• Decreased food production capacity
	• Increased cost of living and poverty rates
Increased Intensity of Storms	• Damage to infrastructure (homes, roads, clogged culverts)
	• Increased unemployment due to loss of citrus industry
	• Increased health problems (water contamination)
	• Increased cost of living (non-food items, health, energy, etc.)

IMPACT	HYPOTHESIS OF CHANGE: PRIORITY STAKEHOLDER COMMUNITIES -- ALTA VISTA
Increased Air Temperature	• Increased incidents of heatstroke
	• Increased energy consumption
	• Decreased productivity level
Decreased Precipitation	• Decreased availability of drinking water
	• Decreased food production capacity
	• Increased cost of living and poverty rates
Increased Intensity of Storms	• Damage to infrastructure (homes, roads, clogged culverts)
	• Increased unemployment due to loss of citrus industry
	• Increased health problems (water contamination)
	• Increased cost of living (non-food items, health, energy, etc.)
	• Increased risk of erosion, mudslides

IMPACT	HYPOTHESIS OF CHANGE: PRIORITY STAKEHOLDER COMMUNITIES – VALLEY COMMUNITY
Increased Air Temperature	• Increased incidents of heatstroke
	• Increased energy consumption
	• Decreased productivity level
Decreased Precipitation	• Decreased availability of drinking water
	• Decreased food production capacity
	• Increased cost of living and poverty rates
Increased Intensity of Storms	• Damage to infrastructure (homes, roads, clogged culverts)
	• Increased unemployment due to loss of citrus industry
	• Increased health problems (water contamination)
	• Increased cost of living (non-food items, health, energy, etc.)
	• Increased risk of erosion, mudslides
	• Increased risk of catastrophic floods

IMPACT	HYPOTHESIS OF CHANGE: KEY SOCIO-ECONOMIC ACTIVITIES -- MILPA FARMING
Increased Air Temperature	• Reduction in crop yields
	• Increased fire damage
	• Reduced soil fertility and structure
Decreased Precipitation	• Reduction in crop yields due to increased droughts
	• Increased risk of fire damage to crops, crop pests and diseases
	• Increased production input costs (irrigation, pesticides, herbicides, etc.)
Increased Intensity of Storms	• Damage to farms due to flooding and wind damage -- increased crop and livestock loss
	• Reduced access to markets due to infrastructure damage

IMPACT	HYPOTHESIS OF CHANGE: KEY SOCIO-ECONOMIC ACTIVITIES -- CITRUS INDUSTRY
Increased Air Temperature	• Reduction in citrus productivity and quality
	• Increased pest infestation
Decreased Precipitation	• Reduction in crop yields due to increased droughts
	• Reduced quality of fruits (less water content)
	• Reduced income
Increased Intensity of Storms	• Damage to farms facilities, equipment and infrastructure
	• Reduced productivity due to citrus crop mortality
	• Increased unemployment

IMPACT	HYPOTHESIS OF CHANGE: KEY SOCIO-ECONOMIC ACTIVITIES -- ECO-TOURISM
Increased Air Temperature	• Increased risk of heatstroke
	• Increased impacts to waterfall due to increased use
Decreased Precipitation	• Increased impacts to park due to increased access to water resources

Increased Intensity of Storms	• Decreased visitation • Increased damage to visitor facilities and park infrastructure

Prioritizing identified threats

The highest priority threats from the "Hypothesis of Change" were selected for addressing with management strategies and actions (Table 8).

Table 8: Priority Threats for Climate Change Focal Targets

Cross Cutting Priority Threats	Climate Change Focal Targets											
	Focal Conservation Targets			Key Environmental Services		Priority Stakeholder Communities			Key Socio-economic Activities			
	Keel-billed Motmot	Freshwater Ecosystem	Tropical Evergreen Forest	Game Species	Watershed Protection/ Catchment	Steadfast	AltaVista	Valley Community	Citrus Industry	Eco-Tourism	Milpa Farming
Changes in water quality		■			■	■	■	■			
Increased frequency and intensity of fires	■	■	■	■		■	■	■	■	■	■
Changes in species composition		■	■								
Increased vulnerability to invasive species, diseases and predation	■	■	■	■							
Increased pest infestation				■					■		
Reduced ability to catch and store water		■			■						
Reduced soil fertility and structure									■		■
Increased incidences of heatstroke						■	■	■		■	
Decreased food production capacity						■	■	■	■		■
Damage to facilities, equipment and infrastructure						■	■	■	■	■	■
Increased impacts to park's attractions and resources										■	
Decreased visitation										■	

Increased production input costs (irrigation, pesticides, etc.)											
Increased unemployment											
Loss of habitat and food sources											
Increased hunting pressures											
Wildlife displacement											
Increased risk of erosion and mudslides											
Increased risk of catastrophic flooding											

3.5.4. Objectives and Strategies towards Climate Change Adaptation

3.5.4.1. Defining objectives

A climate change-related objective was identified based on the high-priority threats identified for each Climate Change Adaptation Target for integration into the BBNP management programmes (Table 9).

Table 9: Objectives for Climate Change Focal Targets

Cross Cutting Objectives	Climate Change Focal Targets											
	Focal Conservation Targets			Key Environmental Services		Priority Stakeholder Communities			Key Socio-economic Activities		
	Keel-billed Motmot	Freshwater Ecosystem	Tropical Evergreen Forest	Game Species	Watershed Protection/ Catchment	Steadfast	AltaVista	Valley Community	Citrus Industry	Eco-Tourism	Milpa Farming
By 2016, have in place a comprehensive water quality monitoring programme											
Develop and fully implement a watershed management plan by 2016											
By 2017, have a											

comprehensive research and monitoring programme in place											
By 2018, have a climate change plan in place for the BBNP											
By 2019, a water conservation programme would have been developed											
Establish alternative livelihood opportunities for Steadfast, Alta Vista and Valley community by 2018											
By 2019, a disaster relief plan will have been instituted for Steadfast, Alta Vista and Valley community											
By 2018, at least 50% of villagers in Steadfast, Alta Vista and Valley community will have access to training and funding opportunities in agricultural best practices											

3.5.4.2. Developing Adaptation Strategies

Key strategies were identified for achieving the objectives identified for integration into the BBNP management programmes (Table 10).

Table 10: Strategies for Climate Change Focal Targets

Target	Objective	Strategy	Priority Threat
Freshwater Ecosystem	By 2016, have in place a comprehensive water quality monitoring programme	Conduct water quality testing and monitoring	Changes in water quality
		Conduct indicator species monitoring	
	Develop and fully implement a watershed management plan by 2016	Institute an education program and communication strategy on watershed management and protection	Decreased amount of water in system
		Engage the regulatory agencies to enforce relevant regulations	
Keel-billed Motmot	By 2017, have a comprehensive Mot Mot research and monitoring programme in place	Conduct protection patrols	Increased vulnerability to predation and invasive species Nesting failure
		Institute control measures to minimize spread of invasive species	
		Conduct wildlife surveys and monitoring, using camera traps	
Tropical Evergreen Forest	By 2017, have a comprehensive forest research and monitoring programme in place	Conduct botanical surveys	Changes in species composition Increased vulnerability to invasive species Increased wildlife mortality
		Conduct protection patrols	
		Monitor changes in species composition	
		Conduct wildlife surveys and monitoring	
Key Environmental Services	By 2018, have a game species research and monitoring programme in place	Conduct wildlife surveys and monitoring, using camera traps	Increased hunting pressures Loss of habitat and food sources Increased vulnerability to vectors and predation
		Increased protection immediately after a natural event -- as part of a disaster preparedness and response plan (e.g., suspend park visitation, outreach strategy)	
		Conduct protection patrols	
		Institute an emergency education outreach and awareness plan	
	By 2019, a water conservation	Engage the regulatory agencies to enforce relevant regulations	Reduced ability to catch and

	programme would have been developed	Institute an education program and communication strategy on watershed management and protection	store water
Priority Stakeholder Communities	Establish alternative livelihood opportunities for Steadfast, Alta Vista and Valley community by 2018	Conduct entrepreneurship and innovation training (SMEs and alternative livelihoods)	Decreased food production capacity Increased energy consumption Increased unemployment and cost of living
		Implement capacity building training programs on best farm practices	
		Establish partnerships with agriculture research institutions to address agriculture and climate change issues	
		Create linkages to micro-financing, agro-processing, and marketing opportunities	
		Develop entrepreneurship through partnership with BELTRAIDE, etc.	
	By 2019, a disaster relief plan will have been instituted for Steadfast, Alta Vista and Valley community	Provide disaster relief assistance	Increased incidences of heatstroke Increased risk of erosion, mudslides and flooding Damage to infrastructure (homes, roads, clogged culvert, etc.)
		Develop and implement climate change adaptation awareness strategy	
		Facilitate the development of community emergency preparedness and response plans	

4. Management Planning

4.1. Management and Organizational Background

The Forest Department is responsible for the management of forest resources in Belize. Its responsibilities are mainly prescribed in Chapter 213 of the Laws of Belize, 2000 (BERDS, 2012). This department has jurisdiction over all of Belize's terrestrial protected areas and biodiversity. Its mission is to ensure the rational use of natural resources, through the coordination of management practices for the conservation, protection and sustainable use. The Forest Department in coordination with Steadfast Tourism and Conservation Association (STACA) is responsible for managing BBNP (BERDS, 2012).

Since 2003, STACA has co-managed BBNP in order to protect the Billy Barquedier sub-basin and to promote economic development of adjacent communities. On September 30, 2005, STACA received from the Ministry of Human Development, the certificate of registration as an NGO in Act No. 26 of 2000. For that year, there were seven members in the organization, which included the Chairperson of the NGO and the Board of Directors.

In 2005, STACA received the first grant to turn the park into a functional protected area. The duration of the project entitled "***From a Paper Park to a Functional Park***" was two years, ranging from 2005 to 2007. The funding source was the Protected Areas Conservation Trust (PACT). For the period 2007-2009, the NGO received a second grant. This second round of funding support was granted by the PACT Foundation in order to improve the management of BBNP.

From 2007 to 2011, STACA was also supported by PMIIE, ***Programa de Manejo Integrado de Ecosistemas en Pueblos Indígenas***. The financial support obtained was used to support the project ***"Community Workshops to Develop and Promote a Management Plan for BBNP"***. The workshops were conducted successfully; however, the management plan was not completed. The reasons have been mentioned in the background (see Section 1.1).

During 2010-2011, STACA benefited from the Global Environment Facility and again from PACT Foundation. This support was used to implement the project ***"Funding for Natural Resources Management, Protection and Monitoring of BBNP"***. For that period, the PACT Foundation approved the continuation of the project. Currently, the park rangers are conducting surveillance and maintenance activities in the BBNP.

4.2. Review of Previous Management

Prior to this management plan, there was no official management plan for the BBNP – only a preliminary one developed by Brenda Chiu in 2012 towards her Master's Degree from the University of Sherbrooke. Although no self-assessment was carried out on the preliminary plan, some specific areas that require strengthening and where management programmes were hindered or constrained include:

- Community Participation
- Infrastructure
- Public Use
- Site Restoration
- Management Planning
- Field Personnel
- Project Financing
- Reallocation of funds to other priority areas

The results of the conservation target viability assessment conducted indicate, however, that the BBNP conservation targets are in overall good health -- implying that management and conservation actions over the past continue to be adequate.

4.3. Management Goal

The management goal of the BBNP is:

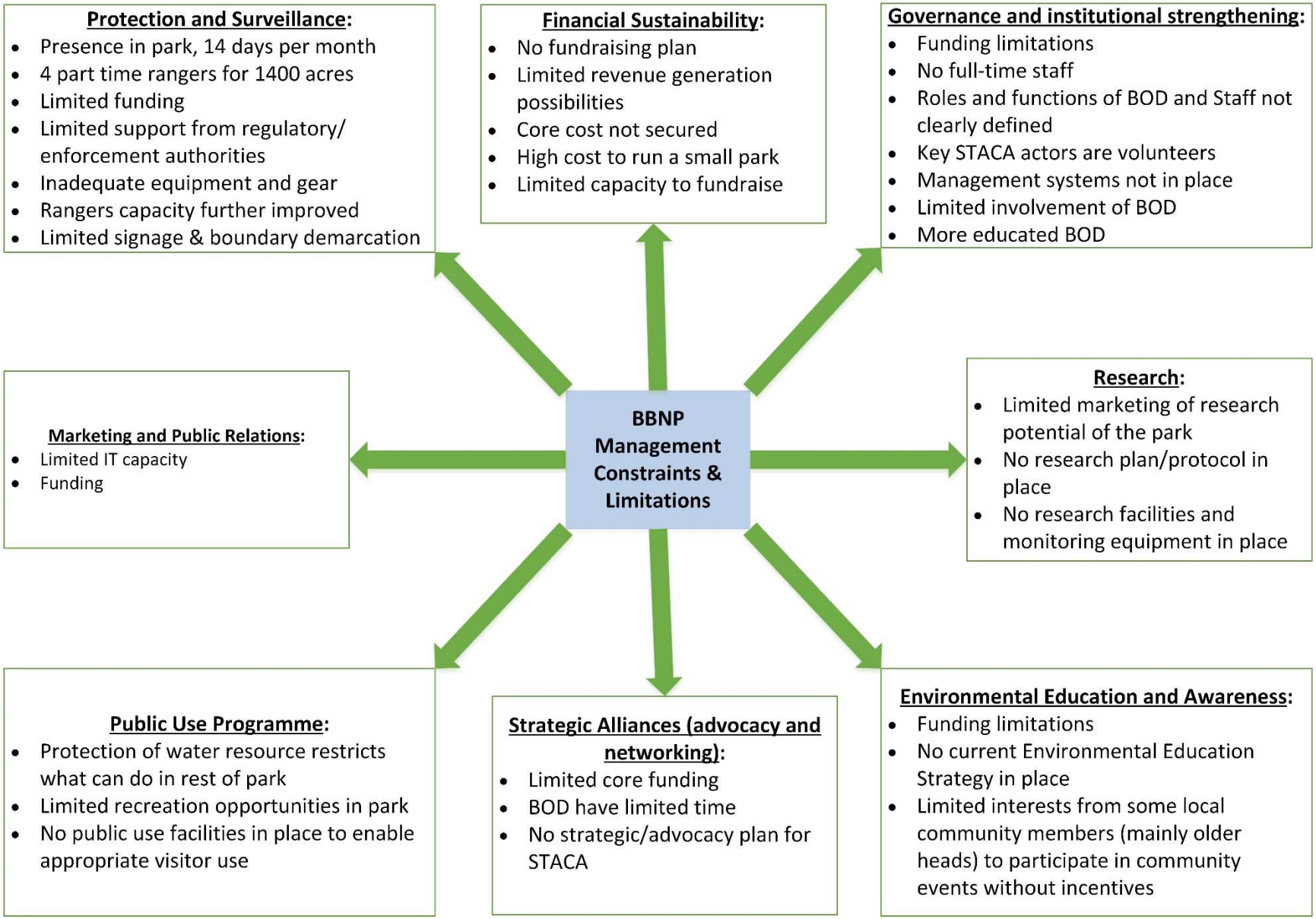
"To protect and conserve the water resources and biodiversity of the BBNP in order to maintain ecological processes of the protected area and to promote economic development of the adjacent communities."

Meeting this goal will also meet the conservation target of maintaining BBNP ecosystems in good condition.

4.4. Management Constraints and Limitations

The limited presence of law enforcement in the region and the lack of economic resources are the main constraints and limitations in the management of the BBNP. Public policies must be consistent when it comes to protecting natural areas in order to promote community economic development. If they are consistent, the protection and conservation of natural resources will be guaranteed. The economic situation of the neighboring communities challenges the implementation of the conservation strategies.

The following management constraints and limitations to BBNP management were identified during the planning sessions (see next page):


Protection and Surveillance:
Presence in park, 14 days per month
4 part time rangers for 1400 acres
Limited funding
Limited support from regulatory/ enforcement authorities
Inadequate equipment and gear
Rangers capacity further improved
Limited signage & boundary demarcation
Financial Sustainability:
No fundraising plan
Limited revenue generation possibilities
Core cost not secured
High cost to run a small park
Limited capacity to fundraise
Governance and institutional strengthening:
Funding limitations
No full-time staff
Roles and functions of BOD and Staff not clearly defined
Key STACA actors are volunteers
Management systems not in place
Limited involvement of BOD
More educated BOD
Marketing and Public Relations:
Limited IT capacity
Funding
BBNP Management Constraints & Limitations
Research:
Limited marketing of research potential of the park
No research plan/protocol in place
No research facilities and monitoring equipment in place
Public Use Programme:
Protection of water resource restricts what can do in rest of park
Limited recreation opportunities in park
No public use facilities in place to enable appropriate visitor use
Strategic Alliances (advocacy and networking):
Limited core funding
BOD have limited time
No strategic/advocacy plan for STACA
Environmental Education and Awareness:
Funding limitations
No current Environmental Education Strategy in place
Limited interests from some local community members (mainly older heads) to participate in community events without incentives

4.5. Management Zones

The Billy Barquedier National Park is managed based on sound scientific research carried out by STACA and its partners. Approximately 50 percent of BBNP is managed as a strict conservation zone, providing the main habitat for the Keel-billed Motmot and the Baird's Tapir, and is essential for the protection of biodiversity and habitats. Only scientific research (under special conditions) and very minimal intrusions by park personnel are permitted in this area. The remainder of the national park is managed for educational, recreational, and ecosystem services (Figure 8).

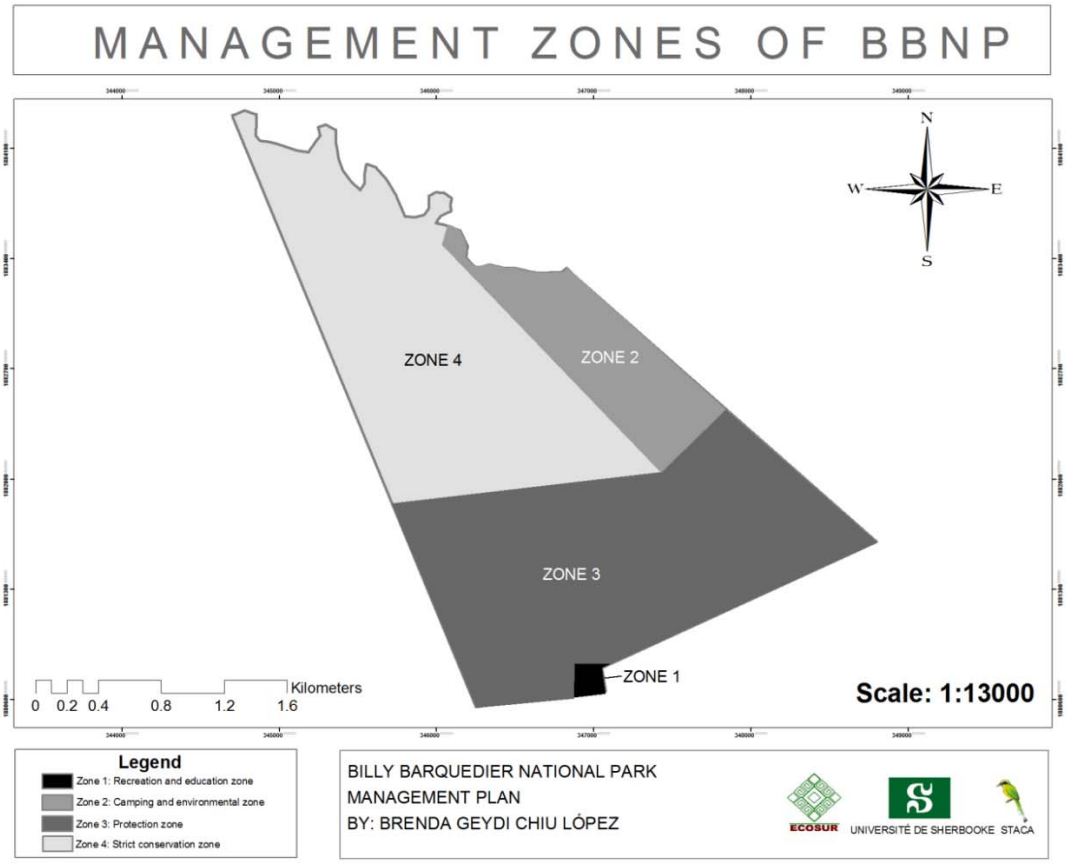


Figure 8: BBNP Management Zones

The major zonation categories include:

- Recreation and education zone
- Camping and environmental zone
- Protection zone, and
- Strict conservation zone

Recreation and Education Zone

Visitor levels are not high in any part of the BBNP but some areas are in regular use. The Recreation and Education Zone is located to the south of the park and includes the Billy Barquedier Waterfall and Billy Barquedier Creek. The area has a trail that connects the Hummingbird Highway to the waterfall, and its main entrance is located at mile 18.

This zone is focused on receiving visitors and delivering environmentally-relevant interpretative tours. In addition, it seeks inclusion of the local communities in the management of the park, and promotes economic development of the local areas thereby improving the quality of life for residents.

Environmental awareness is a key aspect in providing the necessary enforcement for this zone, and can be strengthened through appropriate signage. Permitted activities include:

1. Picnicking, hiking, and swimming (no more than 20 persons allowed at the waterfall at any one time;
2. Scientific research (with prior approval).

This zone is managed to maximize visit quality and educational value. The Billy Barquedier Waterfall site is a special case in that it integrates tourism with education. Similar zones may be created in the future wherever recreational sites are developed for visitation. On the BBNP this could consist of retaining the sites in their forested setting, and using trails, guides and literature for interpretation. Leaving them unspoiled is the most practical way of protecting them for the future.

Camping and Environmental Zone

This zone is located in the eastern part of the national park. From the south, this zone occupies the wamil areas, from the entrance to the middle, while the camping area is located within the tropical broadleaf forest. There is a single point of access to this zone, at mile 16 on the Hummingbird Highway. The camping area consists of a shelter and a large area to pitch tents or hammocks. Wildlife such as the Curassow, Crested Guan, Tinamou, and Otter are common; and the footprints and tracks of the Jaguar and Baird's Tapir are easily found on the trail. The Mullins River that runs alongside the camping site is one of the main areas for recreation.

This zone's primary purpose is to provide greater opportunities for cohabitation between visitors and nature. Permitted activities include:

1. Interpretive nature activities
2. Camping (maximum 10 persons per guide)
3. Recreational non-extractive activities
4. Environmental education activities
5. Scientific research (with prior approval)

Considering that this part of the national park is vulnerable to fires, occasional monitoring and surveillance should be conducted. The infrastructure should be improved, and the creation of interpretive trails adjacent to the camping area will allow visitors to know the elements that constitute the park and their importance in the system.

Protection Zone

This is an extensive area managed on national park precepts and comprising:

- The southern half of the BBNP, excluding the recreation and education zone
- Mostly tropical broadleaf forest and the originating tributaries of the Billy Barquedier sub-watershed
- A mountainous region with steep slopes

This zone is designed to protect biodiversity and ecosystem services, such as water resources. It is an area that can be used to promote tourism in the park, but regulations must be followed. Permitted activities include:

1. Low use of trails
2. Well-organized guided walks (maximum 5 persons per guide)
3. Scientific research (with prior approval)
4. Camping (with a guide, and permit from STACA and the Forest Department)

In reality most of these activities will be localized, leaving much of the area as un-spoilt and where ecological processes can continue undeterred.

Strict Conservation Zone

This zone is located in the northwestern part of the national park. The type of vegetation is tropical broadleaf forest -- the main habitat of the Keel-billed Motmot and the Baird's Tapir. It is the best preserved area in the protected area and includes the Mullins River sub-watershed and one part of Billy Barquedier watershed. It is steep mountainous terrain, and its protection is essential to ensure the viability of populations in the BBNP.

The purpose of this zone is to maintain biodiversity and biological connectivity, and to safeguard ecosystem services and ecological processes in the area. Permitted activities include:

1. Minimal use by management for monitoring and surveillance
2. Scientific research (with strict prior approval)

This zone will require major efforts in surveillance and monitoring. Success in preservation and conservation of the natural resources will depend on the interest and support from stakeholders in all activities

4.6. Limits of Acceptable Change

In order to better protect the BBNP from human activities, the acceptable kinds of resource, social conditions and managerial conditions must be understood. Management actions that can be tracked and traced can then be prescribed to protect or achieve those conditions and allow for stability over time.

Limits of acceptable change, then, are basically the amount of change within the protected area that is considered acceptable as a result of human use. Any amount of human activity will have an impact on the protected area and therefore management should be based on constant monitoring of the site as well as the objectives established for it. It is also possible that within the limits of acceptable change framework, a visitor limit can be established but such limits are only one tool available. The framework is generally outlined in a number of steps and a detailed methodology is set out in the NPAPSP management planning guidelines.

For the BBNP, guidelines serving the same purpose should be set out in future tourism development plans. Essentially, the immediate vicinity of the Billy Barquedier Waterfall and Billy Barquedier Creek can support a trail system that can be used by visitors with a guide. Plans should allow for camping and longer hikes using old forest trails if available. No formal monitoring of impacts has ever been conducted but visitor numbers remain low and no subjective observations of adverse impacts have been noted at the Billy Barquedier Waterfall, the most heavily used area.

In the case of the more mountainous terrain where wildlife such as the Keel-billed Motmot may be more sensitive to disturbance, it is important to continuously monitor potential impacts (see Section 4.7.3) so that practices can be modified if adverse impacts are detected. The general concept can also be applied to other forms of actual and potential resource use.

Limits of acceptable change for the BBNP can be updated as new or more information becomes available, and exceeding or not meeting limits of acceptable change for any component of the site may not necessarily indicate that there has been a change in the protected area's ecosystem components, processes, benefits and services. However, when a limit of acceptable change is not met or has been exceeded, this may require investigation to determine whether there has indeed been a change in the protected area's ecological character.

4.7. Management Strategies and Objectives

Four management strategies have been envisioned for the BBNP 2016-2020 management period:

5. Stakeholder Outreach, Education and Advocacy
6. Ecosystems Protection and Management
7. Research and Monitoring
8. Institutional Strengthening and Management

These four strategies are mutually-supporting, and each has its own set of strategic objectives and tactical objectives/actions that are used to guide the programmes and monitor management implementation. These four management strategies are set out in Section 4.8 and their background and rationale are summarized here.

4.7.1. Stakeholder Outreach, Education and Advocacy

While the BBNP has been in place for 14 years now, and most community members know of its existence, there is need to enhance the public's understanding of the ecological and economic value of the BBNP and its resources. Most of the time the benefits are not readily visible especially complex biological process but which are very important to the livelihoods and wellbeing of nearby communities. STACA also needs to improve its level of engagement with adjacent communities in order to facilitate the public's appreciation of what the park offers. Aside from this, with a growing population and the need to improve household wellbeing, residents are beginning to impact on buffer areas through land clearing and deforestation. This can be addressed by engaging with community residents in order to help them engage in more environmentally sustainable productive activities more while strengthening their resilience to climate change.

The first objective of this strategy therefore is as follows:

- Implement an environmental education and communications strategy that focuses on the ecological importance and economic contributions of the BBNP.

To achieve this, an environmental education program for BBNP buffer communities will be developed. The focus will be on watershed management and protection. The environmental education and community awareness program will engage local schools and take advantage of community events where presentations can be carried out. Other key tactics will be carried as part of the strategy that will be developed. An important aspect of education and awareness is the need to familiarize local communities on the issue of climate change. A specific awareness strategy for this aspect will be developed given its extreme importance.

The second objective of the strategy is to

- Develop and implement a sustainable livelihoods capacity building program.

This will include conducting entrepreneurship and innovation training for the development of small and micro-enterprises and alternative livelihood activities. STACA will partner with existing organizations such as BELTRAIDE to provide such training and support. Training will also be provided on sustainable farming best practices including integrated pest management. Specific focus will be put on developing alternative livelihood opportunities in Steadfast, Alta Vista and Valley Community. In order to build local institutional capacity and community resilience, an emergency preparedness and awareness plan for buffer communities will be developed and implemented.

Lastly, the third objective under this strategy is to:

- Foster strategic alliances with community groups, partner agencies and policy makers to support the management of the BBNP.

This will include STACA maintaining a leadership role within APAMO, and lobbying the Forest Department to strengthen the BBNP co-management agreement so that it has clearly delineated responsibilities for all parties concerned. Collaboration with local water boards of the buffer communities will also be strengthened for the proper and wise use of water resources. Partnerships with agriculture research institutions, including the Agriculture Department, will be sought to address the effects of climate change on agriculture and to assist in providing better crop varieties and improve farming methods. In order to support related sustainable livelihood opportunities, linkages will be sought with relevant institutions in areas of micro-financing, agro-processing and marketing opportunities. Specific attention will be given to community members active in the citrus industry to manage the use of agro-chemicals in the vicinity of the BBNP.

4.7.2. Ecosystems Protection and Management

4.7.2.1. Resource Protection and Enforcement Programme

The ecosystems protection and management strategy will focus on achieving the following objective:

- Institute a strengthened and expanded resource protection and enforcement program at the BBNP.

This will help to deter and eliminate encroachments and illegal incursions into the protected area. More regular ranger patrols are necessary to maintain increased surveillance and monitoring of the BBNP, and so consideration will be made to hire full time park rangers and to increase the number from four to an optimal size. Periodic

joint patrols with enforcement agencies (such as the Forest Department, BDF and Police) will be organized and undertaken, along with regular training of rangers. As part of a disaster preparedness and response plan, protection for the park (in the form of park visitation suspension and community outreach) will be provided immediately after a natural disaster event such as a hurricane or tropical storm. In addition, BBNP illegal activities, trails and boundary demarcation will be described and reinforced through the use of proper signage, and new equipment (such as hiking gear, camping gear, GPS units, etc.) will be acquired and maintained.

Protection of the BBNP is through the team of four part-time rangers, stationed at the STACA headquarters in Steadfast Village. The rangers' primary tasks are to maintain a presence at the park and conduct patrols to detect possible encroachment, deforestation, illegal agriculture, and to monitor fires.

Maintaining a full contingent of rangers with the necessary equipment is expensive, and STACA is often faced with challenges obtaining funding. It is important, therefore, that the most efficient use of the full range of resources already available be made. Resource use programmes would therefore extend into the sensitive areas as passive protection, essentially demonstrating occupancy of the land. Forest inventories and scientific studies could therefore be extended into:

- The camping areas in the eastern part of the park
- The Billy Barquedier Waterfall and Billy Barquedier Creek to the south of the park
- The originating tributaries of the Billy Barquedier sub-watershed in the southern half of the park
- Minimally in areas of the main habitat for the Keel-billed Motmot and Baird's Tapir in the north-western part of the protected area

As these are labor-intensive tasks, the ranger team could collaborate with the forestry team to accomplish them. This will also reinforce security of the areas and allow for the sharing of resources (notably vehicles and radios) between programmes. As protection goes, this activity counts as patrolling.

Another area requiring attention is boundary cleaning and demarcation. To date, few signs have been installed in strategic locations but manpower and other resources have been insufficient to carry out this work and to put lines in place. This activity can be accomplished and maintained in conjunction with the forestry team and in association with the forest inventories and scientific studies.

Throughout, the general aim is to integrate protection and resource management more closely to make better use of available staff and equipment. Annual and monthly planning must therefore be a joint activity.

In addition, the size of the area means that ground presence is thinly spread. At present the 1400 acres are only patrolled by four part-time rangers for only 14 days out of the month. Monitoring of effectiveness therefore becomes extremely important, to ensure available resources are directed most strategically. This in turn implies care in reporting. A standardized monthly reporting system is needed and should include date, time, personnel, route and specific objectives for the patrol. In forested areas, evidence of the following should be recorded:

- Entry (such as vehicle and horse tracks, foot-prints and cut trails)
- Hunting (such as camps, torch batteries, cartridge cases)
- Logging (such as stumps, logs, extraction trails)
- NTFP extraction (such as cut sabal or palmetto, chicle slash-marks)
- Land clearance within the BBNP boundaries

In each case the type of illicit use or other observation must be noted along with an estimate of its age (> 6 months, 6-1 month, < 1 month). Each separate incident must be noted along with its location, by GPS if possible but otherwise as closely approximated as possible. Observations involving hunting will be points but other threats usually affect an area such as a patch of forest or stretch of road – in these cases both the location and the estimated area affected should be estimated. The evidence should be removed where appropriate (e.g. cartridges and camp rubbish, camp shelters knocked down) to avoid 'double-counting' on later patrols.

4.7.2.2. Water Resource Conservation and Management Programme

Another major objective of this management strategy is as follows:

- Develop and institute a Water Resource Conservation and Management Programme to optimize the ability of the BBNP hydrological systems to catch and store water, which have the potential to affect residents of the key buffer communities, particularly Steadfast, Alta Vista and Valley Community.

Strengthening the conservation and management of the water resource within the BBNP is essential also to respond to the increasing threats of pollution and invasive species that could affect the natural populations. Some water resources are outside the boundaries of the BBNP and thus beyond the control of STACA, so their management becomes difficult to adequately address. Meanwhile responsibility for water management issues is diffuse and compartmentalized – different statutory bodies have different responsibilities and coordination is weak. Major management actions include maintaining adequate protection efforts to prevent deforestation within the BBNP sub-watershed; establishing partnerships with local authorities; monitoring forest cover change around the BBNP; working with adjacent land holders for forest connectivity; and instituting control measures to minimize spread of invasive species.

While water is a necessary part of the BBNP landscape, water overuse and contamination pose a threat to its ecological integrity. Hurricanes may also stir up contaminants and significantly increase water contamination. The BBNP Water Resource Conservation and Management Programme aims to improve the current capacity to detect and mitigate water contamination and overuse.

Water conservation and management training needs to be conducted for park rangers and the buffer communities, with the participation of other entities responsible for managing water resources.

4.7.2.3. Public Use Programme

The public use programme aims primarily to:

- Promote visitation and ensure visitor control and monitoring in order to minimize visitor impacts to the BBNP resources.

This programme could be a means of covering costs to maintain camping areas and other visitor facilities and infrastructure, general equipment maintenance and replacement, and field staff as well as support to specific conservation programmes.

Actions under this programme will be detailed in the medium-term financial plan but the principal effort lies in:

- Developing and implementing a visitor control and monitoring strategy;
- Developing and enforcing visitor use rules and regulations;
- Promoting the park attractions to encourage visitation;
- Instituting the park zonation scheme to limit visitor use to areas designated for that purpose.

These actions could also strengthen the demonstration value of the BBNP for eco-tourism as a means of supporting protected area conservation. They can also maintain the STACA headquarters as the base for the other management programmes, and as a center for training.

4.7.3. Research and Monitoring

Past BBNP research activities have been mostly opportunistic and indirect, or occasionally may be built into a particular donor-aided project. STACA recognizes the importance and necessity of research and thus envisions developing an effective research and monitoring programme for the BBNP, and that can also cross-cut the other management programmes. Currently, adequate research facilities do not exist at the BBNP, and STACA's support and field assistance to researchers might be limited due to budgetary constraints.

The aim of the research and monitoring strategy would thus be to:

- Develop and institute a research and monitoring program to integrate science-based decision-making for adaptive management of the BBNP.

This would include development of a research plan that highlights research priorities for the BBNP; conducting botanical surveys with the assistance of partner universities and research institutions (already underway with ECOSUR); monitoring changes in species composition with the assistance of partner universities and research institutions; conducting wildlife surveys and monitoring, using camera traps (focusing on the Keel-billed Motmot and game species); and developing and implementing a comprehensive water quality monitoring program (already underway with UB)

One area should be emphasized:

Initiation of regular monitoring programmes by STACA staff

This effort has been improving and senior management can continue to encourage field staff to carry out regular monitoring and collect general data about the park. Other areas that require re-invigorated and regular data collection include the Gibnut, Red Brocket Deer, Jaguar, Baird's Tapir, Great Curassow, and Keel-billed Motmot. Data could provide valuable information on these species risk categories, hunting impacts, and range.

The following activities appear both to meet identified management issues and capable of integration with the normal duties of the park rangers and other staff:

- Record sightings (by species and by number) of large mammals such as the jaguar and tapir, and other notable species. Records should be made on a standardized data-sheet to allow comparison.

Monitoring of Jaguar and Baird's Tapir

- The method of linear paths of 2.5 km in length should be used, and all evidence and identifiable traces, such as footprints and excreta counted. Sampling should be conducted during the day, typically starting at dusk, and the routes sampled, at least, once per month.

- To avoid overestimating the abundance of species, it is recommended that the directions set out by Bolaños and Naranjo (2001) be used. These consist of counting tracks (series of tracks), and no individual traces, for the Jaguar. For the Baird's tapir, it is recommended that a measure of the width of the claw of the third finger be taken. For all species groups of tracks with a minimum of 100 m apart should be considered as different individuals.

- The same linear paths will serve to register the viewed organisms. In this case, during the sighting of the animals, take the number of individuals observed and the perpendicular distance between the animal and the route (Bolaños & Naranjo, 2001). The sampling effort will be the number of traces/kilometer and the number of individuals/kilometer^2.

Monitoring of Keel-billed Motmot and Great Curassow

- The point counts technique described by Rangel and Pineda (2010) is suggested. This requires the counting of birds in 10 points per transect. Each point count must be separated by a minimum distance of 200 m to avoid double counting of individuals. This sampling consists of carrying out the records of the species in a fixed radius area of 25 m during periods of between 5 and 10 minutes. The sample period spans cover the early hours of the morning (about 15 minutes after sunrise to 11:00 am), when the highest bird activity is observed and that remains constant over all visits (Ralph, et al., 1996). To carry out this sampling in BBNP, prospecting paths are required and potential areas that the species occupies need to be identified. Considering the recommendations of Thomas, et al. (2002), the sampling effort will be measured as counting points/kilometer.

- Location of wildlife concentrations (e.g. bat and bird roosts, feeding areas and breeding sites) near the waterfall and along the creek and river, with regular records of levels of use by time of day and by season. Again, these observations can be combined with visits and are indeed intended to act as a check on visitor impacts.

- Regular checks on traditional breeding sites (e.g. the Keel-billed Motmot) to obtain data on seasonality and breeding success.

4.7.4. Institutional Strengthening and Management

This strategy has to do with enhancing and improving the BBNP's organizational structure and processes, improving executive decision-making, as well as building a strong support structure to enable the work at the protected area to be effectively and efficiently carried out.

The following three key programmes form the main elements of this Institutional Strengthening and Management Strategy for the next five years: 1) Resource Mobilization Strategy, 2) Marketing, and 3) Human Resources. A fourth component focuses on reviewing Management Performance on a periodic basis.

The objectives of this strategy are as follows:

- Implement a resource mobilization strategy for the BBNP and STACA in order to diversify the BBNP's funding base and ensure the continuity and sustainability of the BBNP's management programs;
- Improve the branding and marketing of the BBNP in order to generate greater support for the BBNP and its management programs;
- Manage and enhance the human resources of the BBNP and STACA in order to optimize employee performance in service of the BBNP's conservation objectives and ensure that BBNP and STACA have sufficient staff for effective management and biodiversity conservation; and
- Conduct annual review of management activities in order to ensure compliance with the management plan and make adjustments as necessary (adaptive management).

4.7.4.1. Resource Mobilization Programme

Before STACA can engage in fundraising to support its work at BBNP, it is important to prepare a medium-term financial plan for the protected area. This plan will project income and expenditure for the BBNP over the next five years, based on past work as well as on the activities laid out in this management plan. It is important that the medium-term financial is guided by STACA's strategic plan. Since such a strategic plan is not in place, it is important that this be put in place before the development of the medium-term financial plan.

The financial plan will lay the foundation for the development of a comprehensive fundraising strategy for the BBNP, and will focus on both external funding and self-generated funding. The management of the protected area has been financed in most part from external funding (grants). This situation does not bode well for self-reliance if grant funding and funding sources are not diversified. Examples of self-generated funding initiatives include park entry and user fees, tourism concessions, STACA membership fees and corporate sponsorships, donations and in-kind support, payment for ecological services (e.g., water provision), and other means.

Tourism concessions may present a promising and lucrative opportunity for BBNP. While STACA may not have the capacity to operate tourism concessions such as tour operations (including guided tours) and adventure lodges, it could negotiate with the GOB to enter into agreements with third parties to do so. Revenue to the park would come from concession fees, as well as park entry and user fees. STACA could also operate a well-designed gift shop within the park. The main highlight of such facilities would be a chance to see the elusive and rare Keel-billed Mot Mot. This species is highly sensitive to human activity, which suggests that visitation into the park would need to be well regulated and controlled.

BBNP serves as the primary water source for its three buffer communities – this in effect is an ecological service provided to the communities. The community Water Boards have been charging a fixed water consumption fee to residents. However, STACA has

not been paid for protecting the source of the water – a service that it has been providing ever since the creation of the park. It is recommended that STACA and the Water Boards, with support from the appropriate GOB agencies, negotiate a mutually beneficial agreement where both entities would be paid for the service that each provides: STACA as the manager of the source of the water, and the Water Boards as the water distributor and consumption regulator.

A membership program may not be a viable revenue generation option for STACA given the small population of its buffer communities. However, STACA could engage the Citrus Products of Belize Ltd (CPBL), Belize's premier citrus processor providing concentrated juices and premium not-from-concentrate juices and citrus by-products, with a view to securing long-term support from CPBL through a corporate social-environmental responsibility program. Likewise, the Citrus Growers Association (CGA), which owns on behalf of growers 51% of the shares in CPBL, could be engaged to support the work of STACA at BBNP.

4.7.4.2. Marketing Programme

This strategy aim to:

- Improve the branding and marketing of the BBNP in order to generate greater support for the park and its management programs.

This will be done via a marketing and promotion strategy for BBNP. This strategy will include the implementation of a community relations plan as well as a broader communications plan geared at promoting the work and highlighting the achievements of STACA to a wider audience.

Increased awareness of STACA's work at BBNP – in particular the protection of the water source of the communities and wildlife conservation activities – via a well-designed and sustained public relations program would aim to increase popular support for the park among the communities.

In order to reach out to a wider audience, STACA will implement a comprehensive communications plan that will take advantage of multiple print and electronic media platforms, such as print and e-newsletters, press releases, social media (i.e., a Facebook page), and a website. The website and Facebook page would be linked to those of APAMO and other partner agencies (such as tour companies and hotels). A website should be in place in 2015 with support from APAMO.

The marketing programme is highly connected to the resource mobilization programme. It will be easier for STACA to generate opportunities for financial support from domestic

and international sources if information about its work and achievements are regularly posted and shared and kept in the public domain.

4.7.4.3. Human Resources Programme

The human resources programme of the BBNP aim to:

- Manage and enhance the human resources of the BBNP and STACA in order to optimize employee performance in service of the BBNP's conservation objectives and ensure that BBNP and STACA have sufficient staff for effective management and biodiversity conservation.

The programme will focus on training, improving staff performance, and developing a fair compensation framework for staff. Major actions will be as follows:

- Conduct regular training for STACA Board members focusing on leadership development;
- Conduct a comprehensive training needs assessment of BBNP employees (identification of gaps) for effective management of the BBNP;
- Implement training program for BBNP employees;
- Prepare clear and detailed Terms of Reference (job descriptions) for all staff posts;
- Develop Compensation Framework including compensation philosophy and pay policy;
- Complete the Administrative and Personnel Policy Manual currently being developed with APAMO's support; and
- Develop performance evaluation framework for staff.

Instituting a hiring policy at BBNP that favors residents from neighboring communities would go a long way to generate local support for the BBNP and its management.

4.7.4.4. Review of Management Performance

For management of the BBNP to be effective and on track, there will need to be periodic review of the management plan. This will be carried out as follows:

- Conduct management effectiveness assessments on an annual basis (using the METT tool), for submission to the Forest Department;
- Conduct "Measures of Success" monitoring;
- Preparation and review of annual work plans; and
- Comprehensive review of the management plan after 2.5 years and after 5 years.

4.8. Management Actions and Timeline

Management Actions	Responsibility	Year					
		2015/16	2016/17	2017/18	2018/19	2019/20	→
A. STRATEGY: STAKEHOLDER OUTREACH, EDUCATION AND ADVOCACY							
Objective #1: Implement an environmental education and communication strategy that focuses on the ecological importance and economic contributions of the BBNP							
Rationale: To make local communities and the general public understand the ecological and economic value of the BBNP and its resources							
1. Design and implement an environmental education and awareness program for the BBNP buffer communities (including schools) that focuses on watershed management and protection	STACA Board and Staff members, Volunteers, Interns	✓	✓	✓	✓	✓	✓
2. Develop and implement a climate change adaptation awareness strategy that focuses on the BBNP buffer communities	STACA Board and Staff members; Volunteers, Interns			✓	✓	✓	✓
Objective #2: Implement a sustainable livelihoods capacity building program							
Rationale: To build knowledge, skills, and experience that would foster economic resilience and appreciation for BBNP among the buffer communities							
1. Conduct entrepreneurship and innovation training for SMEs and alternative livelihoods	BELTRAIDE SBDC, Consultant(s)			✓	✓	✓	✓
2. Develop and implement capacity building training programs on best farming practices including Integrated Pest Management (IPM)	Agriculture Department, CGA, Consultant(s)				✓	✓	✓
3. Facilitate the development of community emergency preparedness and response plans	STACA Board and Staff members;		✓	✓	✓	✓	✓

Management Actions	Responsibility	Year					
		2015/16	2016/17	2017/18	2018/19	2019/20	→
with community involvement and participation	Volunteers, Interns						
4. Support community efforts to establish alternative livelihood opportunities for Steadfast, Alta Vista and Valley Community	STACA Board			✓	✓	✓	✓
5. Promote entrepreneurship development through partnerships with BELTRAIDE, etc.	STACA Board			✓	✓	✓	✓
Objective #3: Foster strategic alliances with community groups, partner agencies and policy makers							
Rationale: To support the management of the BBNP, and strengthen economic and climate change resilience							
1. Maintain an active involvement within APAMO to lobby GOB for technical and financial resources to support BBNP's management	STACA Board	✓	✓	✓	✓	✓	✓
2. Through APAMO, lobby the Forest Department and MFFSD for the strengthening of the BBNP co-management agreement with clearly delineated responsibilities for all parties	STACA Board	✓	✓				
3. Expand and formalize collaboration with the Water Boards of the BBNP buffer communities for the proper and wise use of water supply	STACA Board			✓	✓	✓	✓
4. Establish partnerships with the Agriculture Department and agriculture research institutions to promote climate resilient sustainable farming (better crop varieties, increase yields and cost reduction) with appropriate technology within BBNP buffer communities	STACA Board				✓	✓	✓

Management Actions	Responsibility	Year					
		2015/16	2016/17	2017/18	2018/19	2019/20	→
5. Create linkages with relevant institutions for the provision of micro-financing, agro-processing, and marketing opportunities	STACA Board			✓	✓	✓	✓
6. Collaborate with the citrus industry to address the direct effects of climate change on the citrus industry	STACA Board				✓	✓	✓
B. STRATEGY: ECOSYSTEMS PROTECTION AND MANAGEMENT							
Objective #4: Strengthen the resource protection and enforcement program at the BBNP							
Rationale: To deter and eliminate encroachments and illegal incursions into the protected area							
1. Maintain increased surveillance and monitoring within the BBNP via regular ranger patrols	STACA Rangers	✓	✓	✓	✓	✓	✓
2. Strengthen surveillance and monitoring and enforcement of regulations within the BBNP via periodic joint patrols with enforcement agencies (such as the Forest Department)	STACA Rangers, Forest Department, Police Department	✓	✓	✓	✓	✓	✓
3. Procure and maintain field equipment to support protection efforts (e.g., hiking gear, camping gear, GPS units, etc.)	STACA Rangers, PACT		✓	✓	✓	✓	✓
4. Increase protection immediately after a natural event (such as a hurricane) as part of a disaster preparedness and response plan (e.g., suspend park visitation, outreach strategy)	STACA Rangers, Forest Department, Police Department	As Needed					
Objective #5: By 2016, develop and implement a water resource conservation and management program							
Rationale: To optimize the ability of the BBNP hydrological systems to catch and store water.							

Management Actions	Responsibility	Year					
		2015/16	2016/17	2017/18	2018/19	2019/20	→
1. Maintain adequate protection efforts to prevent deforestation within the BBNP sub-watershed	STACA Rangers, Forest Department, Police Department	✓	✓	✓	✓	✓	✓
2. Establish and maintain partnerships with local authorities	STACA Board	✓	✓	✓	✓	✓	✓
3. Monitor forest cover change around the BBNP	STACA Rangers, Volunteers, Interns, Forest Department	✓	✓	✓	✓	✓	✓
4. Work with adjacent land holders for forest connectivity	STACA Board		✓	✓	✓	✓	✓
5. Institute control measures to minimize spread of invasive species	STACA Rangers, Forest Department		✓	✓	✓	✓	✓
Objective #6: By 2018, design and institute a public use program for the BBNP							
Rationale: To promote visitation and ensure visitor control and monitoring in order to minimize visitor impacts to the BBNP resources							
1. Develop and implement a visitor control and monitoring strategy	STACA Board, Forest Department	✓	✓	✓	✓	✓	✓
2. Develop and enforce visitor use rules and regulations	STACA Board, Forest Department	✓	✓	✓	✓	✓	✓
3. Promote the park attractions to encourage visitation	STACA Board		✓	✓	✓	✓	✓
4. Institute the park zonation scheme to limit visitor use to areas designated for that purpose	STACA Board		✓	✓	✓	✓	✓
C. STRATEGY: RESEARCH AND MONITORING							

Management Actions	Responsibility	Year					
		2015/16	2016/17	2017/18	2018/19	2019/20	→
Objective #7: By 2017, develop and institute a research and monitoring program for the BBNP							
Rationale: To integrate science-based decision-making for adaptive management of the BBNP							
1. Develop a research plan that highlights research priorities for the BBNP *(The actions that follow in this section were determined to be research priorities by the planning team.)*	STACA Board and Management		✓				
2. Conduct botanical surveys with the assistance of partner universities and research institutions	STACA Rangers, ECOSUR, UB-ERI		✓	✓	✓	✓	✓
3. Monitor changes in species composition with the assistance of partner universities and research institutions	STACA Rangers, ECOSUR, UB-ERI		✓	✓	✓	✓	✓
4. Conduct wildlife surveys and monitoring, using camera traps (focusing on the Keel-billed Mot Mot and game species)	STACA Rangers, ECOSUR, UB-ERI		✓	✓	✓	✓	✓
5. Develop and implement a comprehensive water quality monitoring program	STACA Rangers, UB			✓	✓	✓	✓
D. STRATEGY: INSTITUTIONAL STRENGTHENING AND MANAGEMENT							
Objective #8: Implement a resource mobilization strategy for the BBNP and STACA							
Rationale: To diversify the BBNP's funding base and ensure the continuity and sustainability of its management programs							
1. Develop a medium-term applied strategic plan for STACA	STACA Board, Consultant(s)	✓					
2. Develop a medium-term financial plan for the BBNP and STACA, which projects income and	STACA Board, Consultant(s)		✓				

Management Actions	Responsibility	Year					
		2015/16	2016/17	2017/18	2018/19	2019/20	→
expenditure over the next five years							
3. Based on this financial plan, develop and implement a comprehensive fundraising strategy for BBNP which focuses on self-generated and external funding	STACA Board, Consultant(s)		✓	✓	✓	✓	✓
Objective #9: Improve the branding and marketing of the BBNP							
Rationale: To generate greater support for the BBNP and its management programs							
1. Design and implement a marketing and promotion strategy for BBNP	STACA Board, Consultant(s)		✓				
2. Institute a public relations program geared at building better relations with buffer communities	STACA Board, Consultant(s)		✓	✓	✓	✓	✓
3. Complete website for STACA and BBNP, linked to the websites of other protected area management and tourism agencies	STACA, APAMO	✓	✓				
Objective #10: Manage and enhance the human resources of the BBNP and STACA							
Rationale: To optimize employee performance in service of the BBNP's conservation objectives and ensure that BBNP and STACA have sufficient staff for effective management and biodiversity conservation							
1. Conduct regular training for STACA Board members focusing on leadership development	Consultant(s)	✓	✓	✓		✓	
2. Conduct a comprehensive training needs assessment of BBNP employees (identification of gaps) for effective management of the BBNP	STACA Board, PACT	✓					
3. Implement training program for BBNP employees	Consultant(s)		✓	✓	✓	✓	✓

Management Actions	Responsibility	Year					
		2015/16	2016/17	2017/18	2018/19	2019/20	→
4. Prepare clear and detailed Terms of Reference (job descriptions) for all staff posts	STACA Board	✓					
5. Develop Compensation Framework including compensation philosophy and pay policy	STACA Board		✓				
6. Complete the Administrative and Personnel Policy Manual	STACA, APAMO	✓					
7. Develop performance evaluation framework for staff	STACA Board		✓				
Objective #11: Conduct annual review of management activities							
Rationale: To ensure compliance with the management plan and make adjustments as necessary (adaptive management)							
1. Conduct management effectiveness assessments on an annual basis (using the METT tool), for submission to the Forest Department	STACA Board and Management	✓	✓	✓	✓	✓	
2. Conduct "Measures of Success" monitoring	STACA Board and Management		✓			✓	
3. Preparation and review of annual work plans	STACA Board and Management	✓	✓	✓	✓	✓	✓
4. Review of management plan after 2.5 years and after 5 years	STACA Board and Management			✓			✓

4.9. Monitoring and Review

Monitoring and review can operate at three levels:

- Managerial efficiency in implementing planned activities – i.e. is what is planned under each programme actually carried out?
- Overall effectiveness of the management regime as organized under the management plan – do these activities add up to a better managed site?
- Success of conservation strategies in containing or reducing levels of threat acting on conservation targets – are the strategies properly targeted, with management improvement leading to improvement in conservation status?

4.9.1. Monitoring managerial effectiveness

The management plan is only a guiding document, setting out a framework for the different actions. Actual implementation is affected by a range of factors that cannot be foreseen up to five years ahead, notably funding availability and the need in practice to modify detailed actions to the terms of financing agreements while maintaining the overall policy thrust.

The principal working documents at this level could be the medium-term financial plan and applied strategic plan (not yet developed) covering the budget for the organization and for individual programmes. These could then be supported by periodic reports, submitted to the Board of Directors and usually also required by the funding agency concerned. The cross-check is the key monitoring mechanism for management efficiency, allowing timely remedial action as and when necessary.

4.9.2. Monitoring management effectiveness

The two primary means of assessing overall management effectiveness (self-assessment of Management Effectiveness and Review of Management Success) could be used for this plan. These exercises should be repeated at the end of the first and third years of the lifetime of the plan, and again in the fifth in preparation for the subsequent plan. The first assessment gives the opportunity for early revision/overhaul of programmes where necessary and the second is essentially a mid-term review, allowing re-orientation as required. The third assessment represents the final assessment of management performance over the planning period.

4.9.3. Monitoring conservation success

The aim here is to check that management effectiveness results in conservation gains and is checked by repeating the conservation planning analysis during the third year as a mid-term review and again in the fifth as a final assessment. The target is to maintain an overall 'good' to "very good" score for the site. Key indicators must be utilized and the assessment must include any new assessments that may have been undertaken on the conservation status of BBNP ecosystems. Indications during the mid-term assessment of slippage in individual scores for viability assessment of conservation targets signal the need for urgent reappraisal of management actions, if necessary extending to strategic review.

The following additional monitoring and review actions are suggested:

1. The STACA Director should collect monthly reports of activities undertaken by employees, members and volunteers
2. BBNP Management Objectives should be consulted frequently to ensure that activities undertaken are reaching those objectives
3. The activities to achieve the objectives should be adjusted to the BBNP management budget
4. Institute formats to record and monitor programme activities
5. Keep stakeholder communities informed of BBNP management goals, objectives and activities

4.10. Financing – Indicative Budget

Management Actions	Indicative Budget (Annual)
A. STRATEGY: STAKEHOLDER OUTREACH, EDUCATION AND ADVOCACY	
Objective #1: Implement an environmental education and communications strategy that focuses on the ecological importance and economic contributions of the BBNP	
Rationale: To make local communities and the general public understand the ecological and economic value of the BBNP and its resources	
1. Implement an environmental education program for the BBNP buffer communities that focuses on watershed management and protection	
2. Implement a community awareness program that focuses on school presentations and community presentations and events	
3. Develop and implement a climate change adaptation awareness strategy that focuses on the BBNP buffer communities	
Objective #2: Implement a sustainable livelihoods capacity building program	
Rationale: To build knowledge, skills, and experience that would foster economic resilience and appreciation for BBNP among the buffer communities	
1. Conduct entrepreneurship and innovation training (SMEs and alternative livelihoods)	
2. Develop and implement capacity building training programs on best farming practices	
3. Facilitate the development of community emergency preparedness and response plans with community involvement and participation	
4. Train farmers in Integrated Pest Management (IPM) including the use of natural pest control measures	
5. Support community efforts to establish alternative livelihood opportunities for Steadfast, Alta Vista and Valley Community	
Objective #3: Foster strategic alliances with community groups and partner agencies and among policy makers	
Rationale: To support the management of the BBNP, and strengthen economic and climate change resilience	
1. Maintain a active involvement within APAMO to lobby GOB for technical and financial resources to support BBNP's management	
2. Through APAMO, lobby the Forest Department and MFFSD for the strengthening of the BBNP co-management agreement with clearly delineated responsibilities for all parties	
3. Expand and formalize collaboration with the Water Boards of the BBNP buffer communities for the proper and wise use of water supply	
4. Establish partnerships with the Agriculture Department and agriculture	

Management Actions	Indicative Budget (Annual)
research institutions to promote climate resilient sustainable farming with appropriate technology within BBNP buffer communities	
5. Partnership with agriculture research institutions to assist in providing better crop varieties, increase yields and reduce cost (farming methods)	
6. Create linkages with relevant institutions for the provision of micro-financing, agro-processing, and marketing opportunities	
7. Collaborate with the citrus industry to address IPM and direct effects on the citrus industry	
8. Promote entrepreneurship development through partnerships with BELTRAIDE, etc.	
B. STRATEGY: ECOSYSTEMS PROTECTION AND MANAGEMENT	
Objective #4: Strengthen the resource protection and enforcement program at the BBNP	
Rationale: To deter and eliminate encroachments and illegal incursions into the protected area	
1. Maintain increased surveillance and monitoring within the BBNP via regular ranger patrols	
2. Strengthen surveillance and monitoring and enforcement of regulations within the BBNP via periodic joint patrols with enforcement agencies (such as the Forest Department)	
3. Procure and maintain field equipment to support protection efforts (e.g., hiking gear, camping gear, GPS units, etc.)	
4. Increase protection immediately after a natural event (such as a hurricane) as part of a disaster preparedness and response plan (e.g., suspend park visitation, outreach strategy)	
Objective #5: By 2016, develop and implement a water resource conservation and management program	
Rationale: To optimize the ability of the BBNP hydrological systems to catch and store water.	
1. Maintain adequate protection efforts to prevent deforestation within the BBNP sub-watershed	
2. Establish partnerships with local authorities	
3. Monitor forest cover change around the BBNP	
4. Work with adjacent land holders for forest connectivity	
5. Institute control measures to minimize spread of invasive species	
Objective #6: By 2018, design and institute a public use program for the BBNP	
Rationale: To promote visitation and ensure visitor control and monitoring in order to minimize visitor impacts to the BBNP resources	
1. Develop and implement a visitor control and monitoring strategy	

Management Actions	Indicative Budget (Annual)
2. Develop and enforce visitor use rules and regulations	
3. Promote the park attractions to encourage visitation	
4. Institute the park zonation scheme to limit visitor use to areas designated for that purpose	
C. STRATEGY: RESEARCH AND MONITORING	
Objective #7: By 2017, develop and institute a research and monitoring program for the BBNP	
Rationale: To integrate science-based decision-making for adaptive management of the BBNP	
1. Develop a research plan that highlights research priorities for the BBNP *(The actions that follow in this section were determined to be research priorities by the planning team.)*	
2. Conduct botanical surveys with the assistance of partner universities and research institutions	
3. Monitor changes in species composition with the assistance of partner universities and research institutions	
4. Conduct wildlife surveys and monitoring, using camera traps (focusing on the Keel-billed Mot Mot and game species)	
5. Develop and implement a comprehensive water quality monitoring program	
D. STRATEGY: INSTITUTIONAL STRENGTHENING AND MANAGEMENT	
Objective #8: Implement a resource mobilization strategy for the BBNP and STACA	
Rationale: To diversify the BBNP's funding base and ensure the continuity and sustainability of its management programs	
1. Develop a medium-term applied strategic plan for STACA	
2. Develop a medium-term financial plan for the BBNP and STACA, which projects income and expenditure over the next five years	
3. Based on this financial plan, develop and implement a comprehensive fundraising strategy for BBNP which focuses on self-generated and external funding	
Objective #9: Improve the branding and marketing of the BBNP	
Rationale: To generate greater support for the BBNP and its management programs	
1. Design and implement a marketing and promotion strategy for BBNP	
2. Institute a public relations program geared at building better relations with buffer communities	
3. Complete website for STACA and BBNP, linked to the websites of other protected area management and tourism agencies	
Objective #10: Manage and enhance the human resources of the BBNP and STACA	

Management Actions	Indicative Budget (Annual)
<u>Rationale</u>: To optimize employee performance in service of the BBNP's conservation objectives and ensure that BBNP and STACA have sufficient staff for effective management and biodiversity conservation	
1. Conduct regular training for STACA Board members focusing on leadership development	
2. Conduct a comprehensive training needs assessment of BBNP employees (identification of gaps) for effective management of the BBNP	
3. Implement training program for BBNP employees	
4. Prepare clear and detailed Terms of Reference (job descriptions) for all staff posts	
5. Develop Compensation Framework including compensation philosophy and pay policy	
6. Complete the Administrative and Personnel Policy Manual	
7. Develop performance evaluation framework for staff	
<u>Objective #11</u>: Conduct annual review of management activities	
<u>Rationale</u>: To ensure compliance with the management plan and make adjustments as necessary (adaptive management)	
1. Conduct management effectiveness assessments on an annual basis (using the METT tool), for submission to the Forest Department	
2. Conduct "Measures of Success" monitoring	
3. Preparation and review of annual work plans	
4. Review of management plan after 2.5 years and after 5 years	

4.11. Indicative Budget (Staff Salaries)

The indicative staff budget is shown below for Years 1 through 5. Annual figures are shown.

Staff Post	Indicative Annual Budget (Gross Salaries)
Coordinator	24,000
Administrative Assistant/Office Manager	12,000
Head Ranger	15,000
Rangers ($12,000 X 3) -- Year 1	36,000
+ Rangers ($13,200 X 4) – from Year 3	*52,800*
+ Rangers ($14,400 X 5) – from Year 5	*72,000*
Field Naturalists (Tour Guides) ($12,000 X 1) – Year 2	12,000
+ Field Naturalists (Tour Guides) ($12,000 X 2) – from Year 3	*24,000*
Field Research Coordinator (Intern) – from Year 2	12,000
GRAND TOTAL (Year 1)	**$87,000**
GRAND TOTAL (Year 2)	**$111,000**
GRAND TOTAL (Year 3)	**$139,800**
GRAND TOTAL (Year 4)	**$139,800**
GRAND TOTAL (Year 5)	**$159,000**

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Appendices

Appendix I. Stakeholder Analysis

POWER/INFLUENCE	**HIGH**	Valley Community Area Representatives Political Caretakers ***WATCH***	Alta Vista UB-ERI ***KEEP SATISFIED***	Steadfast Forest Department Dept. of Environment Protected Areas Conservation Trust ***ACTIVELY MANAGE***
	SOME	Loggers (LTFL) Agriculture Department	Health Department Tour Operators/Taxi Drivers Village Councils/Water Boards Citrus Farmers/CGA Fisheries Department	UB—Faculty of Science & Technology Association of Protected Areas Management Organizations Sweet Waata Co.
			KEEP ON SIDE	
	LITTLE	Mullins River Village Middlesex Hummingbird Community Loggers (Petty & Short term) ***GENERAL COMMUNICATION***	Citrus Products of Belize Ltd.	University of Arkansas ECOSUR/Sherbrooke University Local Hunters and Fishers
			KEEP INFORMED	
		LITTLE	**SOME**	**HIGH**
	INTEREST			

Appendix II. Community Consultations

Introduction

Although the BBNP is a formally established protected area and with clear land tenure there is certain degree of relationship between the communities and the park whether based on their extraction, albeit unauthorized, or the continuity their lands provide to the protected area. Their use of their own lands, mostly for agricultural purposes, affects or has the potential to affect the integrity of the forest and biodiversity of the BBNP.

Community Consultations

The communities adjacent to the BBNP are ethnically but have now become predominantly Mestizo or Hispanic. This ethnic shift is mainly due to the large number of immigrant workers brought in by the banana and citrus industries in the region. The formal and official leadership of the various communities were invited to attend. At least 2 representatives from the village council of each adjacent community were invited. Other informal community leaders were also invited to participate. Based on experience, widespread community participation in public meetings is not the norm in the local communities.

The overall objective of the community consultations was: to get the views and concerns of the communities, advice and input on the development and implementation of the management plan, and to understand the socio-economic context. Each of the sessions were guided by three broad topics that sought to establish the relationship of the respective communities with the BBNP. The broad topics are:

- **Familiarity & Relationship with BBNP** (Awareness, Benefits and Concerns)
- **Socio-Economic Context of Local Communities** (Importance of the Forests and Conservation)
- **Opportunities for Future Collaboration** (Community Understanding and Awareness of the BBNP)

Community consultations meetings were held with the following communities at the following location and dates.

Communities	Venue	Date	Attendance
Consultation 1: Alta Vista, Steadfast, Valley Community.	Community Center, Alta Vista	Saturday, April 18th, 2015	**17**
Consultation 2: Alta Vista, Steadfast, Valley			

Community.			

Attendance

The following persons were in attendance at Consultation #1.

1.	Anthony Hislop (AH)	STACA Chairman
2.	Dwight Montero (DM)	STACA BOD – Steadfast Village
3.	Anthony Romero (AR)	STACA BOD, CPBL
4.	Byron Sanchez (BS)	Secretary, Alta Vista Village Council
5.	Lucinda Choc (LC)	Community Health Worker, Steadfast Village
6.		
7.	Alvin Sanchez (AS)	Treasurer, Alta Vista
8.	Aroldo Augustin (AA)	Alta Vista Village Council
9.	Mancell Lopez (ML)	Visitor, Steadfast Village
10.	Gabby	Visitor, Steadfast Village
11.	Sharon Moreira (SM)	Task Member, Steadfast village
12.	David Cruz (DC)	BOD, Steadfast Village
13.	Soley Evans (SE)	Women of the Rain Forest and Conservation, Steadfast Village
14.	Darrel Audinette (DA)	PACT
15.	Osmany Salas (OS)	Consultant
16.	Valentino Shal (VS)	Consultant
17.	Michael Somerville (MS)	Consultant

The following persons were in attendance at Consultation #2.

Appendix III. Conservation Target Viability Assessment

The assessment follows the Conservation Action Planning (CAP) process developed by The Nature Conservancy and adopted by the National Protected Areas Policy and System Plan.

1. Conservation Targets

Conservation Targets
These are specific species and natural systems that the BBNP will focus on as being representative of its overall biodiversity. These conservation targets will be the basis for setting goals, carrying out conservation actions, and measuring conservation effectiveness. In theory – conservation of these targets will ensure the conservation of all the native biodiversity within the BBNP.

	Conservation Target
1	Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest
2	Freshwater Ecosystem
3	Keel-billed Motmot

2. Viability Assessment:

The conservation targets are carefully looked at to determine how to measure their "health" over time.

Key Ecological Attributes
These are certain characteristics that are critical aspects of the conservation target's biology or ecology that if missing or altered, would lead to the loss of the target over time.

Categories:

- *Size*: A measure of the area or abundance of the conservation target's occurrence.
- *Condition*: A measure of the biological composition, structure and biotic interactions that characterize the occurrence of a conservation target
- *Landscape context*: An integrated measure assessing the degree to which the large-scale processes maintaining the target are operational:
    - Ecological processes: natural disturbance regimes; hydrological and water chemistry regimes; weather regime (seasonality, intensity…); fire regime
    - Connectivity: access to habitats and resources; connectivity among communities and ecosystems; ability to respond to environmental change through dispersal or migration

Indicators
These are specific, measurable characteristics of the key ecological attributes.

Indicator Rating:

- *Very Good*: Ecologically desirable status; requires little intervention for maintenance
- *Good*: Indicator within acceptable range of variation; some intervention required for maintenance
- *Fair:* Outside acceptable range of variation; requires human intervention
- *Poor*: Restoration increasingly difficult; may result in local extinction of target

Acceptable Range of Variation

This is the range of variation for each attribute (or technically its indicators) that would allow the conservation target to persist over time – a range in which the attribute has good or very good status.

Current and Desired Status of each Ecological Attribute

The current status of each target is determined by identifying how the target is doing today, and the desired status of each target is determined by considering what a "healthy state" might look like.

Assessment of Conservation Target Viability

#	Conservation Targets	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating	Source	Desired Rating
1	Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest	Landscape Context	Forest connectivity	Number of acres of degraded forest (wamils)	Over 400 acres	251-400 acres	**101-250 acres**	Less than 100 acres	10% (200 acres) wamil exist	Good	Expert Knowledge	Very Good
		Condition	Wildlife composition and structure	Population of game species	Populations low	Populations slightly less than acceptable	**Populations within acceptable range**	**Populations are at optimum**	Current population of game species appears very good	Very Good	Rough Guess	Very Good
		Size	Extent of forest	Number of acres of forest	500 acres	501-1000 acres	**1001-1499 acres**	Over 1500 acres	85% (1,700 acres) exists	Good	Expert Knowledge	Very Good
2	Freshwater Ecosystem	Landscape Context	Water chemistry	Presence of sediments, organic matter, contaminants (bacterial and chemical)						Good	Rough Guess	Very Good
		Condition	Fish species composition and structure	Populations of gobies	Population structure and composition above acceptable range	Population structure and composition slightly below acceptable range	**Population structure and composition within acceptable range**	Population structure and composition at desired status		Good	Rough Guess	Very Good
		Size	Extent of sub-watershed	Number of acres covered by sub-watershed					8 sq km for Billy Barquedier sub-watershed area. Current 50% in BBNP but desire 55% (other 5% is upper catchme	Very Good	Expert Knowledge	Very Good

#	Conservation Targets	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating	Source	Desired Rating
									nt area of the BBNP)			
3	Keel-billed Motmot	Landscape Context	Access to habitats and resources	Presence of nesting banks within BBNP						Very Good	Rough Guess	Very Good
		Size	Population size and dynamics	Number of individuals sighted and heard	Less than 10	10-14	**15-19**	More than 20	16-20 individuals (in upper Mullins River Basin - 2000 ha)	Good	Expert Knowledge	Very Good

Viability Summary

	Conservation Targets	Landscape Context	Condition	Size	Viability Rank
1	Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest	Good	Very Good	Good	**Good**
2	Freshwater Ecosystem	Good	Good	Very Good	**Good**
3	Keel-billed Motmot	Very Good	-	Good	**Very Good**
	Project Biodiversity Health Rank				**Good**

3. Threats to Conservation Targets

The factors that immediately affect the conservation targets are identified and ranked in order to concentrate conservation actions where they are most needed.

Stresses

These are degraded key ecological attributes (or attributes that are out of their acceptable range of variation) that result directly or indirectly from human sources, and are likely to destroy or seriously reduce the health of the conservation targets.

- *Scope*: The level of damage to the conservation target that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation)
    - *Very High* - The threat is likely to be widespread or pervasive in its scope and affect the conservation target throughout the target's occurrences at the site
    - *High* - The threat is likely to be widespread in its scope and affect the conservation target at many of its locations at the site
    - *Medium* - The threat is likely to be localized in its scope and affect the conservation target at some of the target's locations at the site
    - *Low* - The threat is likely to be very localized in its scope and affect the conservation target at a limited portion of the target's location at the site
- *Severity*: The area of conservation target that can reasonably be expected to be damaged within 10 years under current circumstances (i.e., given the continuation of the existing situation)
    - *Very High* - The threat is likely to destroy or eliminate the conservation target over some portion of the target's occurrence at the site
    - *High* - The threat is likely to seriously degrade the conservation target over some portion of the target's occurrence at the site

- *Medium* - The threat is likely to moderately degrade the conservation target over some portion of the target's occurrence at the site

- *Low:* The threat is likely to only slightly impair the conservation target over some portion of the target's occurrence at the site

Target #1 – Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest

	Stresses	Severity	Scope	Stress Rank	User Override
1	Reduced forest cover	Low	Low	Low	
2	Reduction of game species	Medium	Medium	Medium	
3	Reduced forest connectivity	Low	Low	Low	

Target #2 -- Freshwater Ecosystem

	Stresses	Severity	Scope	Stress Rank	User Override
1	Limited extent of sub-watershed	Very High	Very High	Very High	
2	Reduced water quality	Medium	Medium	Medium	
3	Altered composition of aquatic species	Medium	Low	Low	

Target #3 -- Keel-billed Motmot

	Stresses	Severity	Scope	Stress Rank	User Override
1	Reduced population size	High	High	High	
2	Limited/reduced access to resources	Medium	Medium	Medium	

Sources of Stress (Direct Threats)

The proximate activities or processes that directly have caused, are causing or may cause stresses and thus the destruction, degradation and/or impairment of conservation targets.

- *Contribution*: The expected contribution of the source, acting alone, to the full expression of a stress under current circumstances (i.e., given the continuation of the existing situation)

  - *Very High* - The source is a very large contributor of the particular stress

  - *High* - The source is a large contributor of the particular stress

  - *Medium* - The source is a moderate contributor of the particular stress

  - *Low* - The source is a low contributor of the particular stress

- *Irreversibility*: The degree to which the effects of a source can be restored
    - *Very High* - The source produces a stress that is not reversible (e.g. wetlands converted to a shopping center)
    - *High* - The source produces a stress that is reversible, but not practically affordable (e.g. wetland converted to agriculture)
    - *Medium* - The source produces a stress that is reversible with a reasonable commitment of resources (e.g. ditching and draining of wetland)
    - *Low* - The source produces a stress that is easily reversible at relatively low cost (e.g. off-road vehicles trespassing in wetland)

Critical Threats

Combining the ratings of the stresses and sources of stress (direct threats) produces the critical threats affecting the conservation targets. The direct threats that are highest ranked (often the "very high" and "high" rated threats) are the critical threats.

Target #1 -- Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest

Threats - Sources of Stress		Reduced forest cover	Reduction of game species	Reduced forest connectivity	-	-	-	-	-	Threat to Target Rank
	Stresses #..	1	2	3	4	5	6	7	8	
	Rank..	*Low*	*Medium*	*Low*	-	-	-	-	-	
1	Threat	Palm harvesting								Low
	Contribution	Low								
	Irreversibility	Low								
	Threat Rank (override)									
	Threat Rank	Low	-	-	-	-	-	-	-	
2	Threat	Lack of political will								Low
	Contribution	Low								
	Irreversibility	Low								
	Threat Rank (override)									
	Threat Rank	Low	-	-	-	-	-	-	-	
3	Threat	Chemical fishing								Low
	Contribution	Medium								
	Irreversibility	Medium								
	Threat Rank (override)									
	Threat Rank	Low	-	-	-	-	-	-	-	
4	Threat	Hunting								Low
	Contribution		Medium							
	Irreversibility		Medium							
	Threat Rank (override)									
	Threat Rank	-	Low	-	-	-	-	-	-	
5	Threat	Fire in wamil areas								Low

	Contribution			Medium						
	Irreversibility			High						
	Threat Rank (override)									
	Threat Rank	-	-	Low	-	-	-	-	-	

Target #2 -- Freshwater Ecosystem

Threats - Sources of Stress		Limited extent of sub-watershed	Reduced water quality	Altered composition of aquatic species	-	-	-	-	-	Threat to Target Rank
	Stresses #..	1	2	3	4	5	6	7	8	
	Rank..	*Very High*	*Medium*	*Low*	-	-	-	-	-	
1	Threat	Lack of political will								Very High
	Contribution	Very High								
	Irreversibility	Medium								
	Threat Rank (override)									
	Threat Rank	Very High	-	-	-	-	-	-	-	
2	Threat	Chemical fishing								Low
	Contribution		High	Very High						
	Irreversibility		Medium	Very High						
	Threat Rank (override)									
	Threat Rank	-	Low	Low	-	-	-	-	-	
3	Threat	Visitor impacts								Low
	Contribution		Medium							
	Irreversibility		Medium							
	Threat Rank (override)									
	Threat Rank	-	Low	-	-	-	-	-	-	
4	Threat	Logging operations								Medium
	Contribution		Very High							
	Irreversibility		Very High							
	Threat Rank (override)									
	Threat Rank	-	Medium	-	-	-	-	-	-	

Target #3 -- Keel-billed Motmot

Threats - Sources of Stress		Reduced population size	Limited/reduced access to resources	-	-	-	-	-	-	Threat to Target Rank
Stresses #..		1	2	3	4	5	6	7	8	
Rank..		*High*	*Medium*	-	-	-	-	-	-	
1	Threat	Logging operations								High
	Contribution	Medium	Medium							
	Irreversibility	Very High	High							
	Threat Rank (override)									
	Threat Rank	High	Low	-	-	-	-	-	-	

Summary of Threats

Threats Across Targets		Tropical Evergreen Seasonal Broadleaf Lowland Hill Forest	Freshwater Ecosystem	Keel-billed Motmot	**Overall Threat Rank**
Project-specific threats		1	2	3	
1	Lack of political will and support	Medium	Very High		High
2	Logging operations		High	High	High
3	Chemical fishing	Low	Low		Low
4	Fire in wamil areas	Low			Low
5	Hunting	Low			Low
6	Visitor impacts		Medium	Medium	Medium
7	Palm harvesting	Low			Low
Threat Status for Targets and Project		Low	High	High	High

Appendix IV. List of Reptiles and Amphibians of Billy Barquedier National Park

Class	Family	Scientific name	Common name_English	Common name_Spanish	IUCN	CITES	List of Critical species of Belize
Anura	Bufonidae	*Incilius valliceps*	Gulf coast toad	Sapo costero	LC		
Anura	Craugastoridae	*Craugastor sabrinus*	NA	Rana de riachuelo de piernas largas	EN		
Anura	Hylidae	*Smilisca baudini*	Baudin's frog	Rana arboricola de Baudin			
Anura	Hylidae	*Smilisca sp.*	NA	NA			
Anura	Leptodactylidae	*Craugastor cf. rugulosus*	Long-legged streamfrog	Rana ladrona centroamericana			
Anura	Leptodactylidae	*Eleutherodactylus chac*	Chac's rainfrog	NA	NT		DD
Anura	Leptodactylidae	*Leptodactylus labialis*	American white lipped frog	Ranita de labio blancos			
Anura	Ranidae	*Rana vaillanti*	Vaillant's frog	Rana de Vaillant	LC		
Reptilia	Colubridae	*Clelia clelia*	Common mussarana	Musurrana		II	
Reptilia	Colubridae	*Leptophis ahaetulla*	Green parrot snake	Ranera verde			
Reptilia	Colubridae	*Oxybelis aeneus*	Brown vine snake	Bejuquillo café			
Reptilia	Colubridae	*Pseustes poecilonotus*	Bird-eating treesnake	Pajarera			
Reptilia	Corytophanidae	*Basiliscus vittatus*	Stripped basilisk	Cutete rayada			
Reptilia	Corytophanidae	*Corytophanes cristatus*	Elegant helmeted basilisk	Traicionero elegante			
Reptilia	Elapidae	*Micrurus sp*	Coral snake	Coral			
Reptilia	Emydidae	*Trachemys scripta*	Mesoamerican slider	Jicotea	NT		LC
Reptilia	Eublepharidae	*Coleonyx elegans*	Yucatán banded gecko	Geco manchado			
Reptilia	Kinosternidae	*Kinosternon sp.*	Mud turtle	Chiquiguao			
Reptilia	Polychrotidae	*Norops sp*	Anole	Abaniquillo			
Reptilia	Polychrotidae	*Norops uniformis*	Lesser forest anole	Abaniquillo pequeño de selva			
Reptilia	Scincidae	*Mabuya unimarginata*	Central american mabuya	Sabandija de rayas			
Reptilia	Teiidae	*Ameiva festiva*	Festive ameiva	Ameiva de fiesta			
Reptilia	Viperidae	*Bothrops asper*	Yellow-jaw	Nauyaca real			

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Appendix V. List of Bird Species of Billy Barquedier National Park

Seasonality: R=Resident, MLD=Migratory. Sensitivity: A=High, M=Medium, B=Low. IUCN: LC=Least concern, EN=Endangered, NT=Near threatened, VU=Vulnerable. Population trend: ST= Stable, IC= Increasing, DC=Decreasing, UK= Unknown. Critical Species of Belize: DD= Data deficient, VU=Vulnerable

Family	Scientific name	Common name_English	Common name_Spanish	Seasonality	Sensivity	IUCN	Population trend	CITES	List of critical species of Belize
Accipitridae	*Buteogallus urubitinga*	Great Black-hawk	Aguilila-negra mayor	R	M	LC	ST		
Accipitridae	*Elanoides forficatus*	American Swallow-tailed Kite	Milano tijereta	ML	M	LC	IC		
Accipitridae	*Leucopternis albicollis*	White Hawk	Aguilila blanca	R	A	LC	DC		
Accipitridae	*Spizaetus melanoleucus*	Black-and-white Hawk-eagle	Águila blanquinegra	R	A	LC	DC		
Alcedinidae	*Chloroceryle aenea*	American Pygmy Kingfisher	Martín-pescador enano	R	M	LC	DC		
Alcedinidae	*Chloroceryle americana*	Green Kingfisher	Martín-pescador verde	R	B	LC	IC		
Apodidae	*Panyptila cayennensis*	Lesser Swallow-tailed Swift	Vencejo-tijereta menor	R	M	LC	ST		
Apodidae	*Streptoprocne zonaris*	White-collared Swift	Vencejo cuello blanco	R	M	LC	ST		
Aramidae	*Aramus guarauna*	Limpkin	Carao	R	M	LC	ST		
Ardeidae	*Butorides virescens*	Green Heron	Garceta verde	R	B	LC	UK		
Bucconidae	*Malacoptila panamensis*	White-whiskered Puffbird	Buco barbón	R	M	LC	ST		
Caprimulgidae	*Nyctidromus albicollis*	Common Pauraque	Chotacabras pauraque	R	B	LC	DC		
Cardinalidae	*Caryothraustes poliogaster*	Black-faced Grosbeak	Picogordo cara negra	R	M	LC	UK		
Cardinalidae	*Cyanocompsa cyanoides*	Blue-black Grosbeak	Picogordo negro	R	M	LC	DC		
Cardinalidae	*Passerina cyanea*	Indigo Bunting	Colorín azul	ML	M	LC	DC		
Cardinalidae	*Saltator atriceps*	Black-headed Saltator	Picurero cabeza negra	R	M	LC	UK		
Cardinalidae	*Saltator coerulescens*	Greyish Saltator	Picurero grisáceo	R	B	LC	DC		
Cathartidae	*Cathartes aura*	Turkey Vulture	Zopilote aura	R	B	LC	ST		
Cathartidae	*Coragyps atratus*	Black Vulture	Zopilote común	R	B	LC	IC		
Columbidae	*Claravis pretiosa*	Blue Ground-dove	Tórtola azul	R	B	LC	ST		
Columbidae	*Geotrygon montana*	Ruddy Quail-dove	Paloma-perdiz rojiza	R	M	LC	DC		
Columbidae	*Leptotila cassini*	Grey-chested Dove	Paloma pecho gris	R	M	LC	ST		
Columbidae	*Leptotila plumbeiceps*	Grey-headed Dove	Paloma Cabeza Gris	R	M	LC	ST		
Columbidae	*Leptotila verreauxi*	White-tipped Dove	Paloma arroyera	R	B	LC	IC		
Columbidae	*Patagioenas cayennensis*	Pale-vented Pigeon	Paloma morada	R	M	LC	ST		
Columbidae	*Patagioenas nigrirostris*	Short-billed Pigeon	Paloma triste	R	M	LC	ST		
Columbidae	*Patagioenas speciosa*	Scaled Pigeon	Paloma escamosa	R	M	LC	DC		
Corvidae	*Cyanocorax morio*	Brown Jay	Chara papán	R	B	LC	IC		
Corvidae	*Cyanocorax yncas*	Green Jay	Chara verde	R	M	LC	IC		
Cracidae	*Crax rubra*	Great Curassow	Hocofaisán	R	M	VU	DC		VU
Cracidae	*Ortalis vetula*	Plain Chachalaca	Chachalaca vetula	R	B	LC	ST		
Cracidae	*Penelope purpurascens*	Crested Guan	Pava cojolita	R	M	LC	DC		VU
Cuculidae	*Piaya cayana*	Squirrel Cuckoo	Cuclillo Canela	R	B	LC	ST		
Cuculidae	*Tapera naevia*	Striped Cuckoo	Cuclillo rayado	R	B	LC	IC		
Dendrocolaptida	*Dendrocincla anabatina*	Tawny-winged Woodcreeper	Trepatroncos sepia	R	A	LC	ST		
Dendrocolaptida	*Dendrocincla homochroa*	Ruddy Woodcreeper	Trepatroncos rojizo	R	A	LC	DC		
Dendrocolaptida	*Dendrocolaptes certhia*	Amazonian Barred	Trepatroncos barrado	R	A	LC	DC		
Dendrocolaptida	*Glyphorynchus spirurus*	Wedge-billed Woodcreeper	Trepatroncos pico cuña	R	M	LC	UK		
Dendrocolaptida	*Xiphorhynchus flavigaster*	Ivory-billed Woodcreeper	Trepatroncos bigotudo	R	M	LC	ST		
Emberizidae	*Arremon aurantiirostris*	Orange-billed Sparrow	Rascador pico naranja	R	M	LC	DC		
Emberizidae	*Oryzoborus funereus*	Thick-billed Seed-finch	Semillero pico grueso	R	B	LC	IC		
Emberizidae	*Sporophila torqueola*	White-collared Seedeater	Semillero de collar	R	B	LC	IC		
Falconidae	*Micrastur ruficollis*	Barred Forest-falcon	Halcón-selvático barrado	R	M	LC	DC		
Falconidae	*Micrastur semitorquatus*	Collared Forest-falcon	Halcón-selvático de collar	R	M	LC	DC		
Formicariidae	*Formicarius analis*	Black-faced Antthrush	Hormiguero-cholino cara negra	R	M	LC	DC		
Fringillidae	*Euphonia affinis*	Scrub Euphonia	Eufonia garganta negra	R	B	LC	ST		
Fringillidae	*Euphonia gouldi*	Olive-backed Euphonia	Eufonia olivácea	R	M	LC	DC		
Fringillidae	*Euphonia hirundinacea*	Yellow-throated Euphonia	Eufonia garganta amarilla	R	B	LC	ST		
Furnariidae	*Automolus ochrolaemus*	Buff-throated Foliage-gleaner	Breñero garganta pálida	R	M	LC	DC		
Furnariidae	*Xenops minutus*	Plain Xenops	Picolezna liso	R	M	LC	UK		

Galbulidae	*Galbula ruficauda*	Rufous-tailed Jacamar	Jacamar cola rufa	R	B	LC	DC		
Icteridae	*Amblycercus holosericeus*	Yellow-billed Cacique	Cacique pico claro	R	M	LC	ST		
Icteridae	*Dives Dives*	Melodious Blackbird	Tordo cantor	R	B	LC	IC		
Icteridae	*Icterus chrysater*	Yellow-backed Oriole	Bolsero dorso dorado	R	B	LC	ST		
Icteridae	*Icterus cucullatus*	Hooded Oriole	Bolsero encapuchado	R	B	LC	IC		
Icteridae	*Icterus spurius*	Orchard Oriole	Bolsero castaño	ML	B	LC	ST		
Icteridae	*Molothrus aeneus*	Bronzed Cowbird	Tordo ojo rojo	R	B	LC	ST		
Icteridae	*Psarocolius montezuma*	Montezuma Oropendola	Oropéndola Moctezuma	R	M	LC	ST		
Icteridae	*Psarocolius wagleri*	Chestnut-headed Oropendola	Oropéndola cabeza castaña	R	M	LC	ST		
Mimidae	*Dumetella carolinensis*	Grey Catbird	Maullador gris	ML	M	LC	ST		
Mimidae	*Mimus gilvus*	Tropical Mockingbird	Centzontle tropical	R	B	LC	IC		
Momotidae	*Electron carinatum*	Keel-billed Motmot	Momoto pico quilla	R	A	VU	DC		VU
Momotidae	*Hylomanes momotula*	Tody Motmot	Momoto enano	R	A	LC	ST		
Momotidae	*Momotus momota*	Blue-crowned Motmot	Momoto corona azul	R	M	LC	DC		
Parulidae	*Dendroica magnolia*	Magnolia Warbler	Chipe de magnolia	ML	B	LC	IC		
Parulidae	*Geothlypis poliocephala*	Grey-crowned Yellowthroat	Mascarita pico grueso	R	B	LC	ST		
Parulidae	*Mniotilta varia*	Black-and-white Warbler	Chipe trepador	ML	B	LC	DC		
Parulidae	*Seiurus aurocapillus*	Ovenbird	Chipe suelero	ML	M	LC	ST		
Parulidae	*Setophaga ruticilla*	American Redstart	Chipe flameante	ML	B	LC	DC		
Picidae	*Campephilus guatemalensis*	Pale-billed Woodpecker	Carpintero pico plata	R	M	LC	ST		
Picidae	*Dryocopus lineatus*	Lineated Woodpecker	Carpintero lineado	R	B	LC	IC		
Picidae	*Melanerpes aurifrons*	Golden-fronted Woodpecker	Carpintero cheje	R	B	LC	ST		
Picidae	*Melanerpes pucherani*	Black-cheeked Woodpecker	Carpintero cara negra	R	M	LC	ST		
Picidae	*Veniliornis fumigatus*	Smoky-brown Woodpecker	Carpintero café	R	B	LC	ST		
Pipridae	*Manacus candei*	White-collared Manakin	Manaquin cuello blanco	R	M	LC	ST		
Pipridae	*Pipra mentalis*	Red-capped Manakin	Manaquin cabeza roja	R	M	LC	DC		
Pipridae	*Schiffornis turdina*	Thrush-like Schiffornis	Saltarin café	R	A	LC	DC		
Psittacidae	*Amazona albifrons*	White-fronted Amazon	Loro frente blanca	R	M	LC	IC		
Psittacidae	*Amazona autumnalis*	Red-lored Amazon	Loro cachete amarillo	R	M	LC	DC		
Psittacidae	*Amazona farinosa*	Mealy Amazon	Loro corona azul	R	M	LC	DC		
Psittacidae	*Aratinga nana*	Olive-throated Parakeet	perico pecho sucio	R	B	LC	DC		
Psittacidae	*Pionopsitta haematotis*	Brown-hooded Parrot	Loro cabeza oscura	R	M	LC	ST		
Psittacidae	*Pionus senilis*	White-crowned Parrot	Loro corona blanca	R	M	LC	DC		
Rallidae	*Laterallus ruber*	Ruddy Crake	Polluela rojiza	R	B	LC	UK		
Ramphastidae	*Aulacorhynchus prasinus*	Emerald Toucanet	Tucaneta esmeralda	R	M	LC	DC		
Ramphastidae	*Pteroglossus torquatus*	Collared Aracari	Arasari de collar	R	M	LC	DC		
Ramphastidae	*Ramphastos sulfuratus*	Keel-billed Toucan	Tucán pecho azufrado	R	M	LC	DC	I	
Scolopacidae	*Tringa solitaria*	Solitary Sandpiper	Playero solitario	ML	B	LC	ST		
Strigidae	*Glaucidium brasilianum*	Ferruginous Pygmy-owl	Tecolote bajeño	R	B	LC	DC		
Strigidae	*Lophostrix cristata*	Crested Owl	Búho cuerno blanco	R	A	LC	ST		
Strigidae	*Megascops guatemalae*	Vermiculated Screech-owl	Tecolote vermiculado	R	M	LC	ST		
Strigidae	*Strix nigrolineata*	Black-and-white Owl	Búho blanquinegro	R	M	LC	ST		
Strigidae	*Strix virgata*	Mottled Owl	Búho café	R	M	LC	DC		
Thamnophilidae	*Cercomacra tyrannina*	Dusky Antbird	Hormiguero tirano	R	B	LC	ST		
Thamnophilidae	*Dysithamnus mentalis*	Plain Antvireo	Hormiguero sencillo	R	M	LC	DC		
Thamnophilidae	*Microrhopias quixensis*	Dot-winged Antwren	Hormiguero ala punteada	R	M	LC	DC		
Thamnophilidae	*Thamnophilus doliatus*	Barred Antshrike	Batara barrado	R	B	LC	DC		
Thraupidae	*Chlorophanes spiza*	Green Honeycreeper	Mielero verde	R	M	LC	DC		
Thraupidae	*Cyanerpes cyaneus*	Red-legged Honeycreeper	Mielero pata roja	R	B	LC	ST		
Thraupidae	*Eucometis penicillata*	Grey-headed Tanager	Tángara cabeza gris	R	M	LC	ST		
Thraupidae	*Habia fuscicauda*	Red-throated Ant-tanager	Tángara-hormiguera garganta roja	R	M	LC	ST		
Thraupidae	*Habia rubica*	Red-crowned Ant-tanager	Tángara-hormiguera corona roja	R	A	LC	DC		
Thraupidae	*Piranga rubra*	Summer Tanager	Tángara roja	ML	B	LC	ST		
Thraupidae	*Ramphocelus passerinii*	Scarlet-rumped Tanager	Tángara terciopelo	R	B	LC	ST		
Thraupidae	*Tangara larvata*	Golden-hooded Tanager	Tángara capucha dorada	R	B	LC	ST		
Thraupidae	*Thraupis abbas*	Yellow-winged Tanager	Tángara ala amarilla	R	B	LC	ST		
Tinamidae	*Crypturellus boucardi*	Slaty-breasted Tinamou	Tinamú jamuey	R	M	LC	DC		
Tinamidae	*Crypturellus soui*	Little Tinamou	Tinamú menor	R	B	LC	DC		
Tinamidae	*Tinamus major*	Great Tinamou	Tinamú mayor	R	M	NT	DC		
Trochilidae	*Amazilia tzacatl*	Rufous-tailed Hummingbird	Colibrí cola rojiza	R	B	LC	UK	II	
Trochilidae	*Campylopterus curvipennis*	Wedge-tailed Sabrewing	Fandanguero cola cuña	R	M	LC	UK	II	
Trochilidae	*Campylopterus*	Violet Sabrewing	Fandanguero morado	R	M	LC	UK	II	

Trochilidae	*Chlorostilbon canivetii*	Canivet's Emerald	Esmeralda tijereta	R	B	LC	UK	II	
Trochilidae	*Florisuga mellivora*	White-necked Jacobin	Colibri nuca blanca	R	B	LC	UK	II	
Trochilidae	*Heliothryx barroti*	Purple-crowned Fairy	Hada enmascarada	R	M	LC	ST	II	
Trochilidae	*Phaethornis longuemareus*	Little Hermit	Ermitaño enano	R	M	LC	NF	II	
Trochilidae	*Phaethornis superciliosus*	Long-tailed Hermit	Ermitaño cola larga	R	A	LC	UK	II	
Troglodytidae	*Henicorhina leucosticta*	White-breasted Wood-wren	Chivirin pecho blanco	R	M	LC	DC		
Troglodytidae	*Thryothorus maculipectus*	Spot-breasted Wren	Chivirin moteado	R	M	LC	UK		
Trogonidae	*Trogon collaris*	Collared Trogon	Trogón de collar	R	M	LC	ST		
Trogonidae	*Trogon massena*	Slaty-tailed Trogon	Trogón cola oscura	R	M	LC	ST		
Trogonidae	*Trogon melanocephalus*	Black-headed Trogon	Trogón cabeza negra	R	B	LC	ST		
Trogonidae	*Trogon violaceus*	Guianan Trogon	Trogón violáceo	R	M	LC	IC		
Turdidae	*Catharus ustulatus*	Swainson's Thrush	Zorzal de Swainson	ML	B	LC	DC		
Turdidae	*Hylocichla mustelina*	Wood Thrush	Zorzal maculado	ML	M	LC	DC		
Turdidae	*Turdus assimilis*	White-throated Thrush	Mirlo garganta blanca	R	M	LC	DC		
Turdidae	*Turdus grayi*	Clay-coloured Thrush	Mirlo pardo	R	B	LC	IC		
Tyrannidae	*Attila spadiceus*	Bright-rumped Attila	Atila	R	M	LC	ST		
Tyrannidae	*Contopus cinereus*	Tropical Pewee	Pibí tropical	R	B	LC	ST		
Tyrannidae	*Elaenia flavogaster*	Yellow-bellied Elaenia	Elenia vientre amarillo	R	B	LC	ST		
Tyrannidae	*Empidonax sp*		Mosquero	ND	N	ND	ND		
Tyrannidae	*Leptopogon*	Sepia-capped Flycatcher	Mosquero gorra parda	R	M	LC	ST		
Tyrannidae	*Megarynchus pitangua*	Boat-billed Flycatcher	Luis pico grueso	R	B	LC	ST		
Tyrannidae	*Mionectes oleagineus*	Ochre-bellied Flycatcher	Mosquero ocrillo	R	M	LC	DC		
Tyrannidae	*Myiarchus tyrannulus*	Brown-crested Flycatcher	Papamoscas tirano	R	M	LC	IC		
Tyrannidae	*Myiodynastes luteiventris*	Sulphur-bellied Flycatcher	Papamoscas atigrado	ML	B	LC	ST		
Tyrannidae	*Myiodynastes maculatus*	Streaked Flycatcher	Papamoscas rayado	ML	B	LC	ST		
Tyrannidae	*Myiozetetes similis*	Social Flycatcher	Luis gregario	R	B	LC	ST		
Tyrannidae	*Oncostoma cinereigulare*	Northern Bentbill	Mosquero pico curvo	R	B	LC	ST		
Tyrannidae	*Onychorhynchus coronatus*	Amazonian Royal Flycatcher	Mosquero real	R	A	LC	ST		
Tyrannidae	*Ornithion semiflavum*	Yellow-bellied Tyrannulet	Mosquero ceja blanca	R	M	LC	ST		
Tyrannidae	*Pachyramphus aglaiae*	Rose-throated Becard	Mosquero-cabezón degollado	R	M	LC	ST		
Tyrannidae	*Pitangus sulphuratus*	Great Kiskadee	Luis bienteveo	R	B	LC	IC		
Tyrannidae	*Platyrinchus cancrominus*	Stub-tailed Spadebill	Mosquero pico chato	R	A	LC	ST		
Tyrannidae	*Rhytipterna holerythra*	Rufous Mourner	Plañidera alazán	R	M	LC	DC		
Tyrannidae	*Tityra semifasciata*	Masked Tityra	Titira enmascarada	R	M	LC	DC		
Tyrannidae	*Tolmomyias sulphurescens*	Yellow-olive Flycatcher	Mosquero ojo blanco	R	M	LC	ST		
Tyrannidae	*Tyrannus melancholicus*	Tropical Kingbird	Tirano tropical	R	B	LC	IC		
Tytonidae	*Tyto alba*	Barn Owl	Lechuza de campanario	R	B	LC	ST		
Vireonidae	*Hylophilus decurtatus*	Lesser Greenlet	Verdillo gris	R	M	LC	UK		
Vireonidae	*Hylophilus ochraceiceps*	Tawny-crowned Greenlet	Verdillo ocre	R	M	LC	UK		
Vireonidae	*Vireolanius pulchellus*	Green Shrike-vireo	Vireón esmeralda	R	M	LC	UK		

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Appendix VI. List of Mammal Species of the Billy Barquedier National Park

IUCN: DD: Data deficient, LC=Least concern, EN=Endangered, NT=Near threatened, VU=Vulnerable. Population trend: ST= Stable, IC= Increasing, DC=Decreasing, UK= Unknown. Critical Species of Belize: DD=Data deficient, VU=Vulnerable, LC= Least concern, NT= Near threatened

Order	Family	Scientific name	Common name_English	Common name_Spanish	IUCN	Population trend	CITES	Critical species list of Belize
Artiodactyla	Cervidae	*Mazama americana*	Red Brocket Deer	Temazate	DD	UK		
Artiodactyla	Tayassuidae	*Pecari tajacu*	Collared Peccary	Pacari de collar	LC	ST		
Carnivora	Felidae	*Leopardus pardalis*	Ocelot	Ocelote	LC	DC	I	VU
Carnivora	Felidae	*Leopardus wiedii*	Margay	Tigrillo	NT	DC	I	VU
Carnivora	Felidae	*Panthera onca*	Jaguar	Jaguar	NT	DC	I	NT
Carnivora	Felidae	*Puma concolor*	Puma	Puma	LC	DC	I	NT
Carnivora	Felidae	*Puma yagouaroundi*	Jaguarondi	Yaguarundi	LC	DC	I	LC
Carnivora	Mustelidae	*Eira barbara*	Tayra	Cabeza de viejo, Tayra	LC	DC		
Carnivora	Mustelidae	*Lontra longicaudis*	Neotropical river otter	Nutria de rio	DD	DC	I	VU
Carnivora	Procyonidae	*Nasua narica*	White-nosed Coati	Coati, tejón	LC	DC		
Carnivora	Procyonidae	*Potos flavus*	Kinkajou	Martucha, mico de noche	LC	DC		
Carnivora	Procyonidae	*Procyon lotor*	Northern Raccoon	Mapache	LC	IC		
Chiroptera	Molossidae	*Nyctinomops aurispinosus*	Peale's Free-tailed Bat	Murciélago cola de ratón de Peale	LC	UK		
Chiroptera	Mormoopidae	*Pteronotus parnellii*	Parnell's Mustached Bat	Murciélago bigotudo de Parnell	LC	ST		
Chiroptera	Natalidae	*Natalus mexicanus*	Mexican Greater Funnel-eared Bat	Murciélago con orejas de embudo	LC	UK		
Chiroptera	Phyllostomidae	*Carollia sowelli*	Silky Short-tailed Bat	Murciélago cola-corta sedosa	LC	ST		
Didelphimorphia	Didelphidae	*Chironectes minimus*	Water opossum	Zorro de agua	LC	DC		
Perissodactyla	Tapiridae	*Tapirus bairdii*	Baird's Tapir	Tapir	EN	DC	I	VU
Primates	Cebidae	*Alouatta pigra*	Howler monkey	Aullador negro	EN	DC	I	VU
Rodentia	Agoutidae	*Cuniculus paca*	Paca	Tepezcuintle	LC	ST		
Rodentia	Dasyproctidae	*Dasyprocta punctata*	Central American Agouti	Guaqueque, sereque	LC	ST		
Rodentia	Sciuridae	*Sciurus deppei*	Deppe's squirrel	Ardilla de Deppe	LC	ST		
Xenarthra	Dasypodidae	*Dasypus novemcinctus*	Nine-banded Armadillo	Armadillo	LC	IN		

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Appendix VII. List of Insect Species of the Billy Barquedier National Park

Orden	Familia	Nombre cientifico
Anisoptera	Gomphidae	*Agriogomphus tumens*
Anisoptera	Gomphidae	*Epigomphus maya*
Anisoptera	Gomphidae	*Erpetogomphus spA*
Anisoptera	Gomphidae	*Erpetogomphus spB*
Anisoptera	Gomphidae	*Phyllogomphoides pugnifer*
Anisoptera	Gomphidae	*Phyllogomphoides suasus*
Anisoptera	Gomphidae	*Phyllogophoides sp*
Anisoptera	Gomphidae	*Progomphus clendoni*
Anisoptera	Gomphidae	*Progomphus sp*
Anisoptera	Libellulidae	*Dythemis sterilis*
Anisoptera	Libellulidae	*Elasmothemis cannacrioides*
Anisoptera	Libellulidae	*Erythemis vesiculosa*
Anisoptera	Libellulidae	*Erythrodiplax fervida*
Anisoptera	Libellulidae	*Erythrodiplax fusca*
Anisoptera	Libellulidae	*Erythrodiplax umbrata*
Anisoptera	Libellulidae	*Macrothemis hemichlora*
Anisoptera	Libellulidae	*Macrothemis pseudoimitans*
Anisoptera	Libellulidae	*Micrathyria didyma*
Anisoptera	Libellulidae	*Orthemis ferruginea*
Anisoptera	Libellulidae	*Pantala flavescens*
Anisoptera	Libellulidae	*sp A*
Anisoptera	Libellulidae	*spB*
Anisoptera	Libellulidae	*spC*
Anisoptera	Libellulidae	*Tramea binotata*
Anisoptera	Libellulidae	*Uracis imbuta*
Lepidoptera	Lycaenidae	*Eurybia patrona persona*
Lepidoptera	Lycaenidae	*Juditha caucana*
Lepidoptera	Lycaenidae	*Mesosemia gaudiolum*
Lepidoptera	Nymphalidae	*Adelpha cytherea marcia*
Lepidoptera	Nymphalidae	*Adelpha salmoneus salmonides*
Lepidoptera	Nymphalidae	*Agraulis vanillae incarnata*
Lepidoptera	Nymphalidae	*Anartia fatima*
Lepidoptera	Nymphalidae	*Anartia jatrophae luteipicta*
Lepidoptera	Nymphalidae	*Archaeoprepona sp*
Lepidoptera	Nymphalidae	*Bibis hyperia aganisa*
Lepidoptera	Nymphalidae	*Callicore patelina patelina*
Lepidoptera	Nymphalidae	*Cissia hermes*
Lepidoptera	Nymphalidae	*Cissia labe*
Lepidoptera	Nymphalidae	*Cissia libye*
Lepidoptera	Nymphalidae	*Cissia ocirrhoe*
Lepidoptera	Nymphalidae	*Cissia renata*
Lepidoptera	Nymphalidae	*Dryadula phaetusa*
Lepidoptera	Nymphalidae	*Dryas iulia moderata*
Lepidoptera	Nymphalidae	*Dynamine thalassina*
Lepidoptera	Nymphalidae	*Eueides aliphera gracilis*
Lepidoptera	Nymphalidae	*Greta oto*
Lepidoptera	Nymphalidae	*Hamadryas sp*
Lepidoptera	Nymphalidae	*Heliconius charithonia vazquezae*
Lepidoptera	Nymphalidae	*Heliconius erato petiverana*
Lepidoptera	Nymphalidae	*Hermeuptychia hermes*
Lepidoptera	Nymphalidae	*Historis odius odius*
Lepidoptera	Nymphalidae	*Hypoleria cassotis*
Lepidoptera	Nymphalidae	*Magneuptychia libye*
Lepidoptera	Nymphalidae	*Marpesia chiron marius*
Lepidoptera	Nymphalidae	*Morpho theseus justitiae*
Lepidoptera	Nymphalidae	*Oleria paula*
Lepidoptera	Nymphalidae	*Pareuptychia ocirrhoe*
Lepidoptera	Nymphalidae	*Philaethria dido dilatonica*

Lepidoptera	Nymphalidae	*Pierella luna heracles -*
Lepidoptera	Nymphalidae	*Pteronymia cotytto*
Lepidoptera	Nymphalidae	*Pteronymia fizzela*
Lepidoptera	Nymphalidae	*Siproeta epaphus epaphus*
Lepidoptera	Nymphalidae	*Taygetis andromeda*
Lepidoptera	Nymphalidae	*Taygetis inconspicua*
Lepidoptera	Nymphalidae	*Tegosa guatemalena*
Lepidoptera	Nymphalidae	*Vanessa cardui*
Lepidoptera	Papilionidae	*Battus polydamas polydamas*
Lepidoptera	Papilionidae	*Heraclides thoas autocles*
Lepidoptera	Papilionidae	*Papilio thoas*
Lepidoptera	Pieridae	*Aphrissa boisduvalii*
Lepidoptera	Pieridae	*Appias drusilla drusilla*
Lepidoptera	Pieridae	*Eurema albula*
Lepidoptera	Pieridae	*Eurema nise nelphe*
Lepidoptera	Pieridae	*Phoebis philea philea*
Lepidoptera	Pieridae	*Phoebis sp A*
Lepidoptera	Pieridae	*Phoebis sp B*
Lepidoptera	Pieridae	*Pieriballia viardi laogore - Painted*
Zygoptera	Calopterygidae	*Hetaerina occisa*
Zygoptera	Calopterygidae	*Hetaerina pilula*
Zygoptera	Calopterygidae	*Ypthimoides remissa*
Zygoptera	Coenagrionidae	*Argia elliptica*
Zygoptera	Coenagrionidae	*Argia frequentula*
Zygoptera	Coenagrionidae	*Ennallagma novaehispaniae*
Zygoptera	Coenagrionidae	*Ischnura capreolus*
Zygoptera	Coenagrionidae	*Protoneura cupida*
Zygoptera	Megapodagrionidae	*Hetaerina pilula*
Zygoptera	Protoneuridae	*Heteragrion alienum*
Zygoptera	Protoneuridae	*Neoneura paya*
Zygoptera	Protoneuridae	*Protoneura aurantiaca*

Literatura

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Appendix VIII. List of Plant Species of the Billy Barquedier National Park