Spanish Creek Wildlife Sanctuary
Management Plan 2016-2021

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Executive Summary

Spanish Creek Wildlife Sanctuary (SCWS) was declared on July 8th, 2002 and covers an area of 6,001 acres (2428.6 ha.) of lowland forest on the boundary between the Belize and Orange Walk Districts. It is a category IV protected area based on the IUCN classification.

The sanctuary was established for the protection of local biodiversity, and to strengthen corridor connectivity between the Rio Bravo Conservation and Management Area, the Community Baboon Sanctuary and Crooked Tree Wildlife Sanctuary. As such it contributes to the continuity of the Central Belize Biological Corridor, a position that is reflected in the Management Goal of the protected area

Management Goal for the Spanish Creek Wildlife Sanctuary

GOAL

The Spanish Creek Wildlife Sanctuary functions as a key link within the Central Belize Biological Corridor and is recognized within the Selva Maya region for its intrinsic natural and cultural values, whilst contributing to local development, and enhancing and maintaining its ecological integrity.

Potential uses within the Wildlife Sanctuary include tourism, education and research. The Protected Area (PA) is considered to be a potential resource for local tourism, with a number of features of touristic value including high bird diversity, and the presence of charismatic species such as the Agami Heron, the Morelet's crocodile and the Black Howler Monkey.

In spite of minimalistic management over the past years, the PA is in relatively good shape. Hurricane damage and wildfires have ravaged large sections of the area, but the overall function as a corridor has remained intact and the level of immediate threats is relatively low, even though deforestation in the immediate surroundings has recently increased.

This Management Plan has been formulated to guide the management and conservation of the Spanish Creek Wildlife Sanctuary over a five year period (2016-2021), starting off in any time in 2016. The Plan can be seen as a framework for adaptive management which lists various management programs, strategies and actions that, when implemented, will address the multiple stresses that impact the management of the SCWS. The Plan will also take advantage of the numerous opportunities that exist to strengthening the management of the protected area, and will set the stage for long-term financial and business planning geared at supporting the implementation of the management strategies and actions.

The Management Plan also recognizes that the SCWS itself forms part of an even larger ecological unit – commonly known as the "Selva Maya" which includes the Rio Bravo Conservation and Management Area, the Aguas Turbias National Park, the protected areas in the Northern Petén of Guatemala and the

Calacmul Area in Campeche, Mexico. The management plan also recognizes that the SCWS is a vital link in the Central Belize Biological Corridor which links wildlife populations from the Selva Maya with those of the Maya Mountains in the southern half of Belize.

The management plan details 10 distinct management programs:

- Institutional Management and Strengthening Program
- Fundraising program
- Strategic Networks and Parnerships Program
- Administrative Program
- Research and Monitoring Program
- Natural Resource Management Program
- Protection and Surveillance Program
- Infrastructure Management Program
- Public Use Program
- Community Development and Environmental Education Program

Each of these management programs has a set of management objectives that, when grouped aim to achieve the SCWS Management Goal.

While all management programs are important and achieving the management goal is of paramount importance, it needs to be stressed that the institutional management and strenghthening program is key to it all. Currently the RDEDG has very little conservation management experience, and needs to be strengthened in order to be able to take on the task of fully carrying out the current management plan.

While the management plan aims to achieve maximum effects, it realizes that funding realities make it unlikely that the full program can attract the required funding. If the total management program could be implemented over the next 5 years, the combined costs would be approximately B$ 320,000.--. Based on the size of the PA, and the relatively low level of imminent threats, in combination with the current management capacity of the co-management agency, it is unlikely that this amount of funding will be realized. Therefore, the management program listing represents a full scale of activities that should be undertaken when sufficient human and financial resources are available. Meanwhile, the most critical components of the management programs and strategies have been highlighted. This should allow for flexible levels of management, including management variants that do not include the traditional wardens. An attempt was also made to identify management actions that are stand-alone making then potential candidates to attract funding under a project bases.

Acknowledgements

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Special appreciation goes to the participants of the multiple planning sessions. These participants represented the gamut of SCWS stakeholders – government agencies, non-government agencies, resource users, researchers and others. Their dynamic participation at these sessions and outside those, was invaluable to the planning effort, and resulted in the definition of SCWS's conservation and management goals and strategies for the next five years.

The Consultants wish to extend special thanks to the board of the Rancho Dolores Environmental and Development Group Ltd., who assisted greatly in the logistical preparations, and provided much of the context related to the planning effort.

And last but certainly not least, on behalf of RDEDG, the Consultants extend sincere appreciation to the Key Biodiversity Secretariat and the Protected Areas Conservation Trust for financial support.

Acronyms

ALIDES	Regional Alliance for Sustainable Development
APAMO	Association of Protected Area Management Organizations
BACONGO	Belize Alliance of Non-Government Organizations
BDF	Belize Defense Force
BERDS	Biodiversity and Environmental Resource Data System for Belize
BTFS	Belize Tropical Forest Studies
CAP	Conservation Action Plan
CBC	Central Belize Corridor
CBS	Community Baboon Sanctuary
CCAD	Central American Commission for Environment and Development
CEPF	Critical Ecosystem Partnership Fund
CI	Conservation International
CSO	Central Statistical Office (Now SIB)
EE	Environmental Education
ERI	Environmental Research Institute of the University of Belize
FD	Forest Department
FFSD	Ministry of Forestry, Fisheries and Sustainable Development
GEF	Global Environmental Fund
GIS	Geographic Information System
GOB	Government of Belize
GPD	Geology and Petroleum Department
GPS	Global Positioning System
ha	Hectare
IoA	Institute of Archaeology
IUCN	World Conservation Union
KBA	Key Biodiversity Area
LCJCWS	Labouring Creek Jaguar Corridor Wildlife Sanctuary
MBCP	Mesoamerican Biological Corridor Programme

NGO	Non-Governmental Organization
NICH	National Institute of Culture and History
NPAC	National Protected Areas Commission
NPAP	National Protected Areas Policy
NPAS	National Protected Areas System
NPASP	National Protected Areas System Plan
NTFP	Non-timber Forest Products
PA	Protected area
PACT	Protected Areas Conservation Trust
PAM	Protected Area Management
PfB	Programme for Belize
RBCMA	Rio Bravo Conservation and Management Area
S.M.A.R.T.	Spatial Monitoring and Reporting Tool
SI	Statutory Instrument
SIB	Statistical Institute of Belize
TNC	The Nature Conservancy
UB	University of Belize
UNDP	United Nations Development Programme
UTM	Universal Transverse Mercator
WB	World Bank
WCPA	World Commission on Protected Areas
WCS	Wildlife Conservation Society

1 Introduction

1.1. Background and context

Spanish Creek Wildlife Sanctuary (SCWS) was declared on July 8th, 2002 and covers an area of 6,001 acres (2428.6 ha.) of lowland forest. It is a category IV protected area based on the IUCN. The area is located on the boundary between the Belize and Orange Walk Districts (fig. 1).

The sanctuary was established for the protection of local biodiversity, and to strengthen corridor connectivity between Rio Bravo Conservation and Management Area, the Community Baboon Sanctuary and Crooked Tree Wildlife Sanctuary. As such it contributes to the continuity of the Northern/Central Belize Biological Corridor (Meerman et al. 2000). Potential uses within the Wildlife Sanctuary include tourism, education and research. The PA is considered to be a potential resource for tourism, with a number of features of touristic value including high bird diversity, and the presence of prominent species such as Morelet's crocodile and the Black Howler Monkey and hickatee.

The Government of Belize, with the assistance of the World Bank is implementing the project entitled "Management and Protection of Key Biodiversity Areas in Belize" with funding from the Global Environment Facility "GEF." The project development objective is to strengthen natural resource management and biodiversity conservation in Key Biodiversity Areas (KBAs) of Belize. Implementation of the KBAs project will be over a five (5) year period. The project has four components:

- Component 1- Supporting Forest Protection and Sustainable Forest Management Activities in Key Biodiversity Areas,
- Component 2- Promoting Effective Management of Key Biodiversity Areas,
- Component 3- Institutional Strengthening & Capacity Building for Enhanced Enforcement of Environmental Regulations,
- Component 4: Project Management, Monitoring and Assessment

Belize counts 94 Protected Areas (including Archaeological Reserves and some recognized Private Reserves), Meerman (2005). In 2007, in a collaborative effort with Government of Belize, Conservation International and the Critical Ecosystem Partnership Fund the Key Biodiversity Areas (KBAs) of Belize were defined. These KBAs are presented in Figure 1.

During an extensive, participatory process[1], six KBAs were selected to become the subject of the Project Management and Protection of Key Biodiversity Areas in Belize. The Spanish Creek Wildlife Sanctuary was one of the six selected KBAs to participate in the current project.

The Project's Development Objective is to strengthen natural resource management and biodiversity conservation through the mitigation of threats to Key Biodiversity Areas (KBAs) in Belize. These threats include:

[1] Documented in: Management and Protection of Key Biodiversity Areas in Belize Project. Social Safeguards, Operational Policy 4.10. July 31st, 2014. 89 pp.

- Illegal logging, hunting, farming, and extraction of non-timber forest products (NTFP);
- Inadequate management structures, institutional arrangements, policy and legislative instruments, and capacities for forest governance, including understanding and application of sustainable forest management , sustainable land management, biodiversity conservation and sustainable human development;
- Poverty amongst the local population
- Limited awareness among resource users and resource managers that the potential benefits from the management and protection of Belize's natural capital could be harnessed for human development, and the advancement of Belize and Belizeans

One of the target project sites is the Spanish Creek Wildlife Sanctuary, located in the northern lowlands in the Orange walk and Belize districts. The main importance of the SCWS was recognized as providing forest connectivity.

This document is part of the process to formulating a new management plan for SCWS. It will identify the current natural resources based livelihood activities in the adjacent communities and within the KBA, This assessment follows the Livelihood Restoration Process Framework (KBA, 2014) which was formulated as part of the KBA program. The villages included in the analysis are Bermudian Landing, Double Head Cabbage, Flowers Bank, Isabella Bank, Lemonal, Rancho Dolores, Scotland Halfmoon, St. Pauls Bank, and Willows Bank.

This analysis is aimed to generate a list of alternative activities that are feasible in the context of the KBA; this list will be subject of discussions to determine which alternatives could be offered by the project.

Figure 1. Belize Key Biodiversity Areas, Meerman 2007

The final decision of selecting of preferred option(s) will be through community consultations within the target population and the project management unit. The implementing agency and the target populations will agree on project activities that will need to be endorsed by the Project Steering Committee. Projects can be submitted to the Project Management Unit once calls-for-proposals are advertised on local media.

Once endorsed, the project(s) identified under the Livelihood Restoration Process could be submitted to PACT for the procurement and financial arrangements to be made.

1.2. Purpose and Scope of the Management Plan

This Management Plan has been formulated to guide the management and conservation of the Spanish Creek Wildlife Sanctuary over a five year period (2016-2021), starting off in any time in 2016. The Plan can be seen as a framework for adaptive management which lists various management programs, strategies and actions that, when implemented, will address the multiple stresses that have an impact on the SCWS. The Plan will also take advantage of the numerous opportunities that exist for strengthening the management of the protected area, and will set the stage for long-term financial and business planning geared at supporting the implementation of the management strategies and actions.

The Management Plan also recognizes that the SCWS itself forms part of an even larger ecological unit – commonly known as the "Selva Maya" which includes the Rio Bravo Conservation and Management Area, the Aguas Turbias National Park, the protected areas in the Northern Petén of Guatemala and the Calacmul Area in Campeche, Mexico. The management plan also recognizes that the SCWS is a vital link in the Northern Belize Biological Corridor which links wildlife populations from the Selva Maya with those of the Maya Mountains in the southern half of Belize.

This Management Plan sets the stage for the integration of the SCWS within the network of Belizean conservation areas. The entire planning process was guided by the National Management Plan Framework developed under the National Protected Areas System Plan project (2005).

Much information on the pressures and challenges facing the SCWS has provided by the RDEDG. This Management Plan is the outcome of a series of meetings and planning sessions held over the second half of 2015 including field visits and planning meetings conducted by the consultants. The series of management planning sessions included the participation of the board of the RDEDG as well as representatives of the core stakeholder agencies including the Forest Department, Programme for Belize, Community Baboon Sanctuary, and Panthera.

2 Current Status

2.1. Location

Figure 2. Location of the SCWS in Belize

Spanish Creek Wildlife Sanctuary (SCWS) was declared on July 8th, 2002 and covers an area of 6,001 acres of lowland forest. The area is located on the boundary between the Belize and Orange Walk Districts (Fig. 2).

The area forms a link between the Rio Bravo Conservation and Management Area, the Community Baboon Sanctuary and the Crooked Tree Wildlife Sanctuary (Fig. 3). As such it contributes to the continuity of the Northern Biological Corridor (Meerman et al. 2000).

2.2. Regional Context

The wider area is commonly known as the Belize River Valley or BelRiv. It is a sparsely inhabited area, with numerous small villages. The area was once occupied by the Mayans, although no large ceremonial centers have been encountered , numerous small mounds dot the area.

The SCWS being strategically located, contributes and enhances the biological connectivity of the Northern Belize Biological Corridor; as it connects the protected areas such as Rio Bravo Conservation and Management Area, Labouring Creek Jaguar Corridor Wildlife Sanctuary with the Crooked Tree Wildlife Sanctuary and the Community Baboon Sanctuary, which in turn connect with other protected areas further to the north of the country (Fig. 3). In this regard SCWS plays an important role in contributing to the ecological functioning of the greater Meso-American Biological Corridor and enhancing the viability and conservation value of one of the two RAMSAR site is Belize being Crooked Tree Wildlife Sanctuary. Overall the proper management of the SCWS helps Belize meet its requirements under the Convention of Biological Diversity.

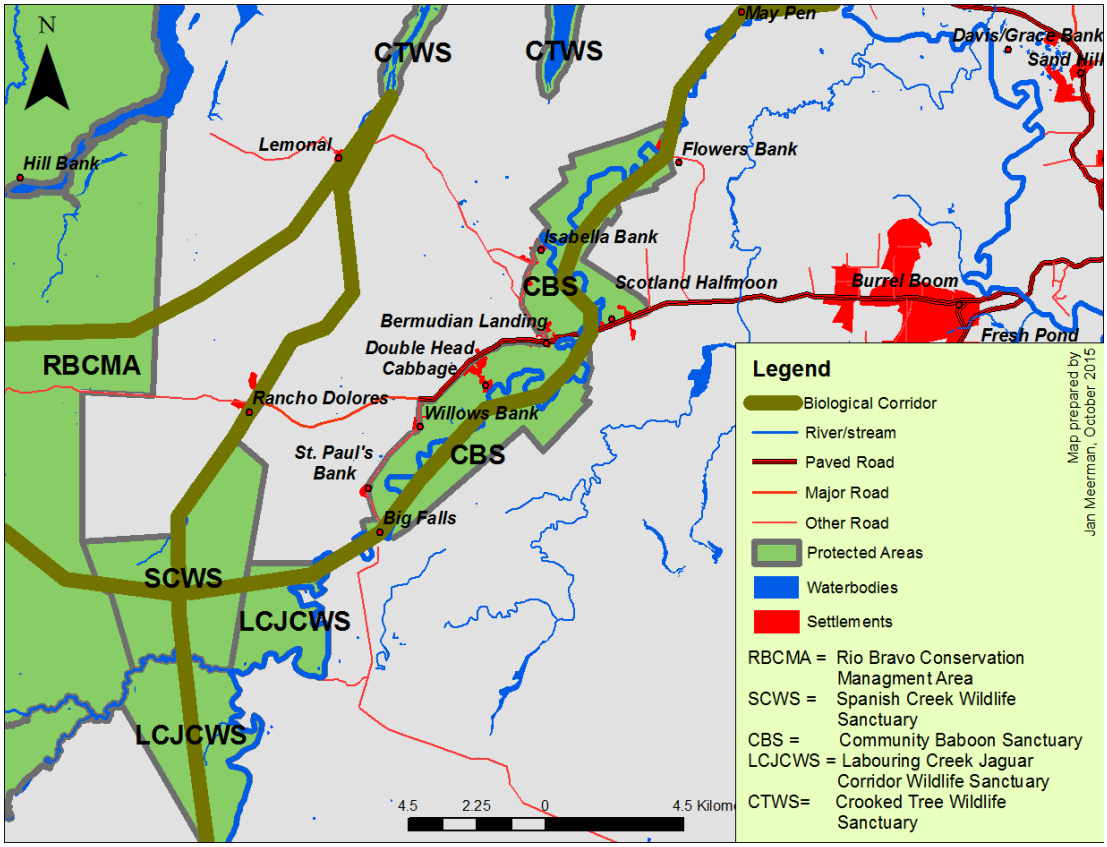


Figure 3. SCWS in relation to other protected areas in the general vicinity, with Central Belize Biological Corridor indicated

2.3. National Context

2.3.1. Protected Areas Prioritization

With limited financial and human resource, it is important to be able to prioritize where investments are focused within the National Protected Areas System. In 2013, a prioritization exercise was conducted (Wildtracks, 2013) with the development of a series of criteria (see inset) considered to be of most importance: environmental and biodiversity values, socio-economic values and climate change resilience values. Each protected area was assessed based on these criteria in orde to provide a baseline for prioritization.

Terrestrial Prioritization Criteria

1.0 Environmental Values
- 1.1 Watershed Catchment and Protection
- 1.2 Wetland Flood Sink Function
- 1.3 Coastal / River Bank Protection
- 1.4 Steep Slope Erosion Control

2.0 Biodiversity Status
- 2.1 Global Recognition for Biodiversity Values
- 2.2 Value for Under Represented Ecosystems or Ecosystems of Limited Extent

3.0 Socio-Economic Value
- 3.1 Value for Commercial Extractive Use (timber / non-timber forest products)
- 3.2 Value for Non-Renewable Resource Extraction - minerals
- 3.3 Value for Non-Renewable Resource Extraction – petroleum
- 3.4 Importance for Water Security
- 3.5 Value for Hydro-electricity Generation
- 3.6 Traditional Resource Use Dependence
- 3.7 Tourism / Recreational / Cultural Values

4.0 Key Resilience Features
- 4.1 Forest Connectivity
- 4.2 Altitudinal / Lateral Connectivity

Fifteen criteria were used to guide prioritization of the terrestrial protected areas system, allocated to four categories. These criteria were developed with input from Forest Department personnel and through feedback from protected area managers who were asked to 'field test' the assessment, to ensure it provided a valid output. Each of these criteria was rated out of a total possible score of 4, with scores then totaled and averaged per protected area.

Spanish Creek came out in the middle category with "*High Prioritization, Low Management Effectiveness*"

The most important justification for the retention of the SCWS in the protected areas system was that de-reservation would likely lead to: "increased pollution of the Belize River and tributaries, decreased viability of fish populations, increased sedimentation of the central coastal shelf, increased agro-chemical contamination, increased coral mortality, reduced sustainability of central fishing industry, reduced tourism appeal". Surprisingly, the report did not specifically list the importance of the SCWS in flood control and strengthening of the Central Belize Biological Corridor.

2.3.2. Legal, Administrative and Policy Framework

The National Protected Areas Policy (NPAP) is the key statement on the role and management of protected areas. This policy aims to guide the establishment, management, and administration of protected areas (terrestrial and marine) in Belize, and to create a National Protected Area System in which all important sites are included in one coherent framework and meet all obligations under international agreements to which Belize is a signatory. The NPAP aims for the PA system to: a) be comprehensive, with representative examples of all ecosystems in the country and including areas providing important environmental services, possessing exceptional scenic values and providing critical habitat for species of conservation concern or economic importance; b) be integrated with regional and national approaches promoting biological connectivity (such as the Mesoamerican Biological Corridors Project) and with other national and regional development plans; c) be economically, socially and ecologically sustainable in order to optimize socio-economic benefits derived from the system as far as these are compatible with maintaining biodiversity values and sustainable resource management and ensure the equitable distribution of these benefits and public awareness of their importance; and d) have transparent management geared towards delivery of measurable benefits and emphasize public participation at all levels. This applies to the establishment, management, modification or de-reservation of all the protected areas included in the national network.[2]

Table 1. IUCN Protected Area Categories

CATEGORY	Primary Objective:
IV: Protects particular species or habitats and management reflects this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.	To maintain, conserve and restore species and habitats.
VI: Conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.	To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

[2] NPASP 2005

The current status of the SCWS is a Wildlife Sanctuary which classification matches IUCN category IV (See Table 1). The Rationalization Exercise of the Belize National Protected Areas System (Wildtracks, 2013) recommends realignment to a category VI classification (Table 1) based on the traditional use of natural resources found within the SCWS (fish) by neighboring communities.

The Revised National Protected Areas System Act was gazette and published in the Government Gazette on October 21, 2015 (SI 17 of 2015), it is the overarching legislation regulating the management of the SCWS.

One important component of the National Protected Areas Act is that the category "Wildlife Sanctuary" was split into two categories. The most appropriate category for the SCWS will be "Wildlife Sanctuary II", which will be in line with the proposal by Wildtracks (2013) to reclassify SCWS on the basis of traditional community fishing within the boundaries of the sanctuary.

Other important changes in the new legislation are the recognition of Private Protected Areas and the option for the declaration of Biological Corridors.

Since its inception the SCWS is under a co-management agreement between the Government of Belize through the Forest Department and the NGO Rancho Dolores Environmental and Development Group Ltd. (RDEDG).

2.3.3. Socio-economic Context

Population

The rural population of the Belize District has relatively increased more than the national rural population over the period 1980-2010. Compared to the national and district increase, the Belize River Valley population growth rates are remarkable low. The populations of four villages even declined over this 30 year period, the only villages that show a growth that kept pace with national development are Scotland Halfmoon and Isabella Bank (Table 2).

Table 2. Population of the Belize River Valley Communities, based on the outcome of the Cenci (Source: SIB)

	1980	1991	2000	2010	Population growth 1980-2010	
Bermudian Landing	220	146	204	183	-37	-16.8 %
Double Head Cabbage	294	306	348	406	112	38.1 %
Flowers Bank	142	78	98	121	-21	-14.8 %
Isabella Bank	58	88	124	143	85	146.6 %
Lemonal	191	117	N.A.	167	-24	-12.6 %
Rancho Dolores	282	162	171	217	-65	-23.0 %
Scotland Halfmoon	117	146	72	259	142	121.4 %
St. Pauls Bank	120	101	276	153	33	27.5 %
Willows Bank	120	107	156	185	65	54.2 %
	1980	1991	2000	2010	Population growth 1980-2010	
Total population stakeholder villages	1,544	1,251	1,449	1,834	290	18.8 %
Belize District rural	9,905	11,094	14,648	26,358	16,453	166.1 %
Country rural	69,076	99,387	125,663	176,358	107,282	155.3 %

Due to the small size of the villages it is hard for them to remain viable and keep up availability of many services such as shops, restaurants and similar.

The paving of the road from Burrell Boom to beyond Bermudian Landing was completed in 2004 and the completion of the water supply system by BWSL in 2015, may turn out to be positive factors that could halt the decline of the population in the villages.

Most household dwellings are owned (Table 3), showing that the project area has been populated for a long time. The low number of rental dwellings could also indicate that few people from outside come to live in the area.

Table 3. Tenure status of dwellings (Source: SIB, Census 2010)

Village	Dwelling (Q1.2 Census 2010)					
	Total households	Total ## households that own a house with or without mortgage	% of the households that own a house with or without mortgage	Total ## households that rent, free of rent or lease	Total ## households that squat	Total other and not stated
	Count	Count	%	Count	Count	Count
Rural Belize district	7,342	5,110	70%	2,171	32	30
Bermudian Landing	43	37	86%	5	0	1
Double Head Cabbage	102	84	82%	9	3	6
Flowers Bank	31	31	100%	0	0	0
Isabella Bank	37	28	76%	9	0	0
Lemonal	41	38	92%	3	0	0
Rancho Dolores	48	43	88%	5	1	0
Scotland Halfmoon	70	57	81%	10	2	1
St. Pauls Bank	37	34	92%	3	0	0
Willows Bank	46	38	82%	8	0	0

The project area has a low level of economic activity apart from cattle ranching. Many people commute on a daily base to urban areas for daily employment, this pattern is the same for other villages in the area such as Ladyville, Lord's Bank, Western Paradise, and Hattieville.

Reasons why people want to live outside Belize City are multiple: having access to reasonable priced house lots, trying to escape from the violence in Belize City, lower local taxes for instance. People that have steady jobs are in a position to afford the daily commute, either by public transportation or by private vehicle.

Main Income Generating Activities

The main livelihood activities of the CBS villages include: small-scale agriculture (milpa or plantation farming); small-scale cattle rearing; employment in nature-based tourism (primarily in the village of Bermudian Landing); small-scale coconut oil and cohune nut oil (*Attalea cohune*) production; cashew and cashew product sales; and outside wage employment (primarily in or around Belize City).

Wyman (2008) in a broad survey of 135 households in the CBS reported the following key results:

- 63% of households had at least one family member who works outside of the CBS.
- 33% of the households received remittances from family members who have left Belize and live and work in the U.S.. Remittances totalled $95,850 BZE (approx US $ 47,925) over the course of one year, accounting for 28.5% of their total income. Of the 33% of households receiving remittances (45 households total), 11 households reported remittances as the only source of monetary income

The question arises: is the livelihood of the people of the 9 stakeholder villages dependent on the natural resources of the Spanish Creek Wildlife Sanctuary?

Most of the extracted resources, as listed elsewhere in this document are (more) widely available outside the SCWS. Additionally, some of the resources available in the SCWS (particular Hickatee, logwood) have already been severely depleted. People may still enter the Sanctuary to extract plants or animals more because there is no presence of wardens that will stop them, or that the SCWS is easier accessible than other areas, but no one is deprived of an income due to the existence of the SCWS.

Wildlife Sanctuaries are a category of protected areas that do not allow extraction of natural resources and the upcoming management plan will emphasize this, and the plan will come up with strategies to implement this principle. As result, informal/illegal extraction should be prevented.

Nonetheless, the noted depletion of natural resources, particularly fish and wildlife in the general area of the stakeholder communities is a matter of severe concern, not only because of the conservation implications, but also because of the cultural implications. This issue needs urgent attention and will be the focus of the safeguard/mitigation analysis with this KBA project.

2.4. Physical environment of SCWS

2.4.1. Climate

Belize is a tropical country, but because of its location in the outer tropical geographical belt, there exists a noticeable variation in average monthly temperatures. Also, there exists considerable variation in the monthly amount of rainfall with a dry season from February through May and a wet season from June through January. In addition there exists considerable variation in the average annual amount of rainfall in Belize, with the North-east receiving as little as 1200 mm/year (48") and the South-east as much as 4,000 mm/year (160"). The SCWS lies in the 100-120" (2,000 - 2,500 mm) zone.

2.4.2. Hydrology

The main source of Spanish Creek is formed by a number of small springs (Fig. 4) situated in the southern half of the SCWS and in the Rio Bravo Conservation and Management Area.

Figure 4. Springs feeding the eastern branch of the Spanish Creek.

In addition, the Spanish Creek is augmented by springs that occur along a NE-SW trending fault line. The actual source of the water flowing out of these creeks is unclear but given the outcrops of heavily karstified limestone in upstream Spanish Creek it is likely that the source is from an underground cave system. This water may or may not originate in the actual Spanish Creek Watershed.

The Spanish Creek/Rancho Dolores area is clearly part of the Belize River watershed. Within this watershed, the Spanish Creek has its own "sub"-watershed. Given the limited contour information available, it is very difficult to precisely delineate the actual Spanish Creek watershed but an approximation is given in Figure 5.

In addition to the spring water, a source of water for the Spanish Creek is certainly water originating from the Spanish Creek watershed itself. During heavy rainfall, this contribution will also be from sheetflow[3] draining into the creek system. The contributions of the actual watershed, combined with the cave/spring input are modest as is shown by the fact that even in the rainy season; the water in the Spanish Creek is very much near stagnant. This apparently minimal input cannot explain the, sometimes massive, floods that are experienced on nearly annual basis. According to many residents of Rancho Dolores, these floods can be explained by the fact that there supposedly exists a direct link between Laboring Creek and the Spanish Creek. Such a direct link does not exist but yet there

[3] Water flowing on top of the soil surface.

appears to be some truth in this assumption, most likely the Laboring Creek will burst its bank and the overflow ends up in the Spanish Creek.

Along the upper reaches of the Eastern Branch of the Spanish Creek, there is evidence of massive sheet flow (Meerman et al. 2004). These signs existed of leaves, branches and other organic debris deposited on one side of trees and shrubs. Interestingly, these signs were found on the high banks overlooking the stream, approximately 20 ft above the actual creek bed! The general direction of this sheet flow was south to north.

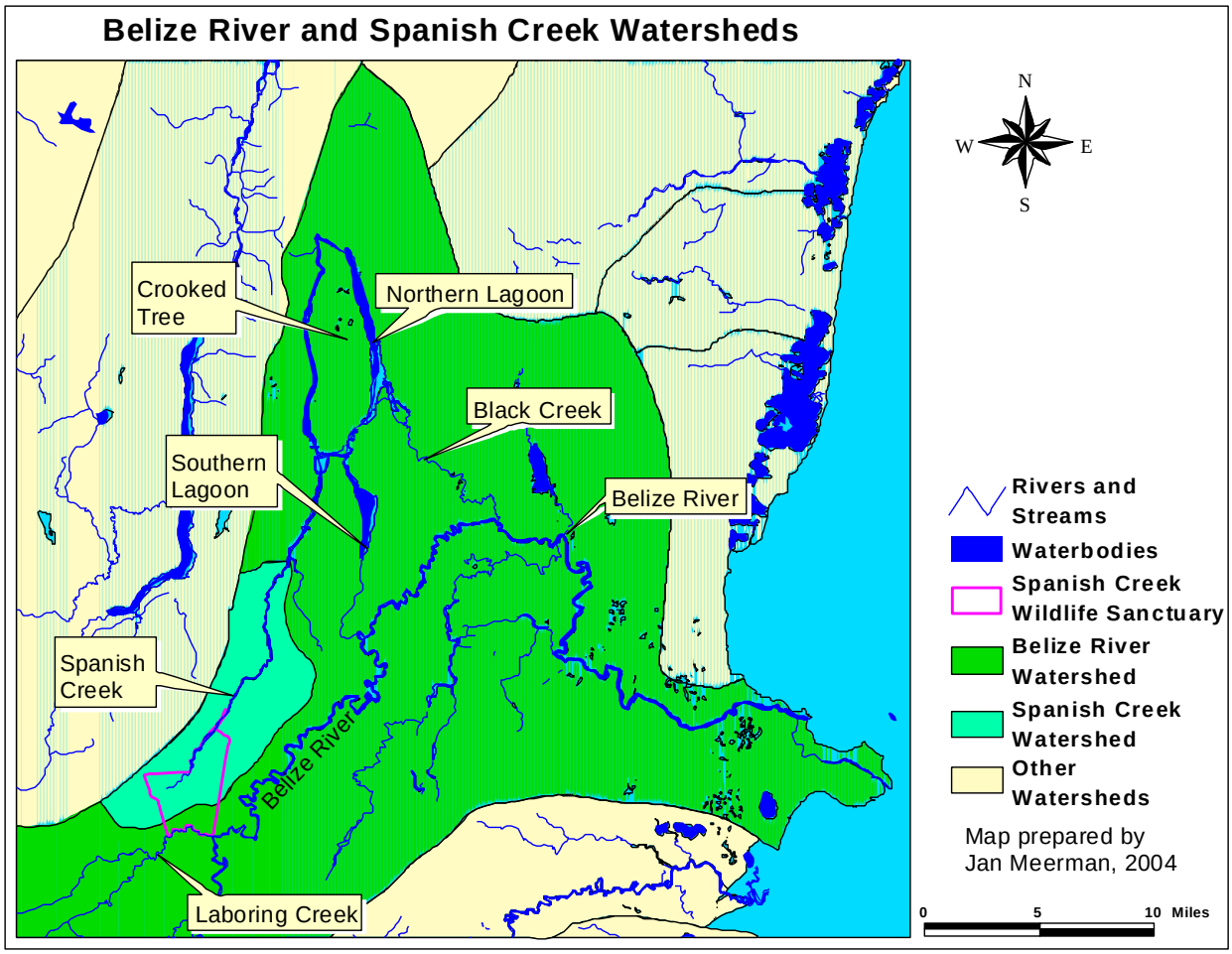


Figure 5. Belize River and Spanish Creek Watersheds

A plausible explanation for this sheet flow would be overflow from Laboring Creek during times the Belize River (and thus also the Laboring Creek) are flooded. At such moments, The Belize River/Laboring Creek would indeed have a link with the Spanish Creek, not by means of an actual tributary/stream but through a shallow sheet of water overflowing the Laboring Creek into the Spanish Creek drainage.

Even during the rainy season the Spanish Creek can have any appearance of a stagnant creek, with barely if any flow. The explanation for this is that the water level in the Spanish Creek is not normally the result of actual water input but more by backing up from the Crooked Tree Lagoon. The Spanish Creek drains in the Crooked Tree Lagoon system and from there on drains through the Southern and Northern

Lagoon to the Black Creek and then into the Belize River (fig. 5). In essence, high water levels in the Spanish Creek reflect backed up waters from the Crooked Tree Lagoons.

Although the creek system is an important feature of the SCWS, it is largely influenced by processes well outside the project area.

2.4.3. Geology

There are no published geological studies that deal specifically with the Spanish Creek Wildlife Sanctuary (SCWS), apart from the overview geological map of Belize (Cornec, 1985, 1986, 2002, represented in Figure 6 below). The study by King et al (1992) provides an important source of information on the soils, the underlying geological formations of this area and the general evolution of landforms in Northern Belize. Further geological information can be gleaned from various unpublished sources, e.g. oil well reports (Rancho Dolores -1, Anchutz well report) and associated surveys [to be found in the library of the Geology & Petroleum Department, Belmopan]. The area of SCWS is currently not included in an oil prospecting license, but a contract was held by Parenco until 2013.

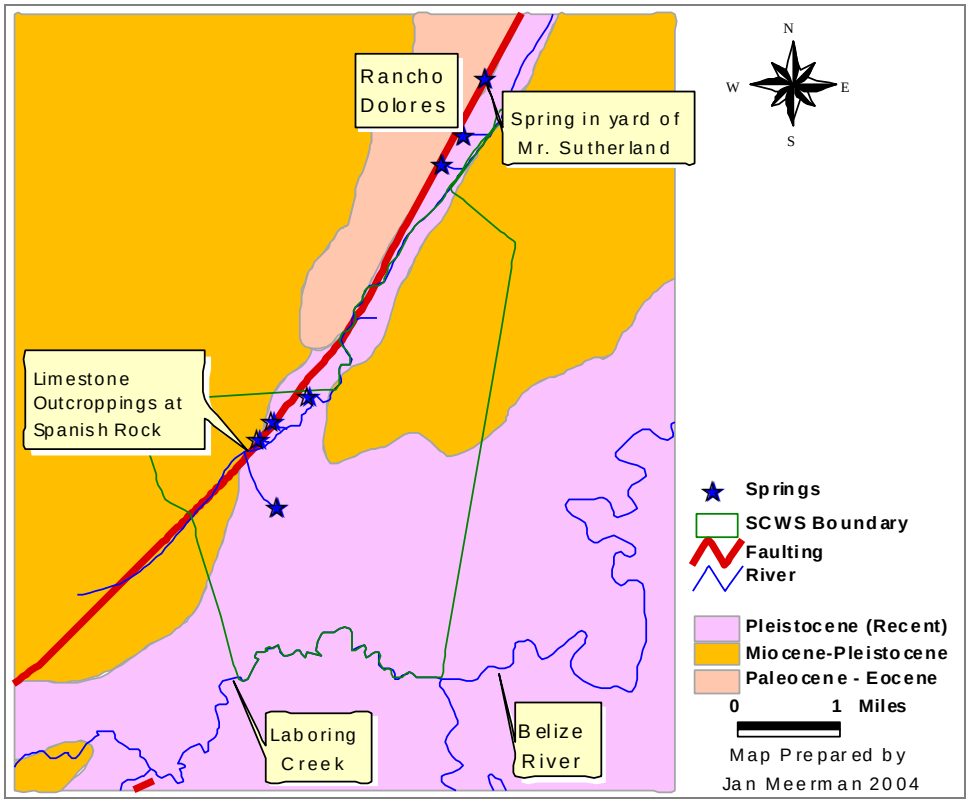


Figure 6. Geology of the Spanish Creek Wildlife Sanctuary

Geological setting

The SCWS is located in the southern part of the northern coastal plain of Belize. In geologic terms this coastal plain is underlain by several thousand meters of limestones deposited in a shallow marine basin known as the Yucatan Carbonate Platform. This vast limestone basin extends from the northern edge of the Maya Mountains northwards into Mexico and essentially comprises the bedrock of the entire Yucatan peninsula and into the Petén of Guatemala. As a depositional basin the Yucatan Platform existed from the early Cretaceous into the latest Tertiary, almost 100 million years. The limestone bedrock found in the SCWS is believed to have been deposited 24-5 million years ago during the Miocene.

Geology along Spanish Creek

The best exposures of the subsoil geology of the SCWS can be seen along Spanish Creek which flows northwards through the area. Around Rancho Dolores the banks of the creek show little other than typical overbank deposits of clay and silt put down during flood stages of the creek (recent Pleistocene).

Figure 7. Limestone outcroppings just south of Spanish Rock

However, 6.5 kilometers upstream (south) of Rancho Dolores, Miocene limestone bedrock is exposed beneath a 5 m (approximately 15 feet) thick clay sequence. The upper 2 meters or so of the clay are brown, grading downwards into plastic, grey clay. This clay overlies a tan, dense, re-crystallized and well bedded limestone. The uppermost layers of the limestone appear to be less distinctly bedded and friable[4]. Beneath this layer, the limestone is very hard and can only be broken with a hammer. The texture of a freshly broken surface of this limestone, when seen through a hand lens, is best described as sucrosic[5]. This is typical of limestones affected by the solution and re-deposition of calcium carbonate as small crystals into minute pore spaces in the limestone rock. This process of solution and re-deposition is called karstification. The limestone quarry just west of Rancho Dolores (on Paleocene – Eocene deposits) shows an excellent example of highly re-crystallized and karstified limestone. Fine, large crystals of calcite (mineral collector quality) are abundant in this quarry. Reddish brown paleo[6]-soils fill small caves and other solution fissures in the limestone.

Figure 8. "Spanish Rock"

At Spanish Rocks, 7 kilometers south of Rancho Dolores on Spanish Creek, the limestone bedrock forms prominent outcrops on the banks and in the creek (Fig. 8). On the west bank of Spanish Creek the layers or beds of limestones can been seen to be tilted into the river. This tilting is caused by a NE-SW trending fault that has created the northeast course of the river. Also here, just south of Spanish Rocks the Spanish Creek splits into two main tributaries, and faulted and weakly folded, bedded limestones are well exposed near the confluence.

Towards the south of the SCWS, nearing Laboring Creek, the soils become shallower and limestone outcroppings become visible in the landscape. This may be due to sheet erosion during rainy season which has scoured off much of the top soil (see under Chapter 2.4.2.: Hydrology).

Tectonics[7] has played an important role in forming the landscape of the SCWS. As pointed out by King et al (1992) “Spanish Creek provides the most spectacular drainage reversal. Firstly, instead of continuing into Western Lagoon, it breached the interfluve[8] to drain towards Northern Lagoon (Crooked Tree

[4] Crumbly

[5] Appears like cemented grains of sugar

[6] Fossilized

[7] Faulting

[8] The region of higher land between two rivers that are in the same drainage system.

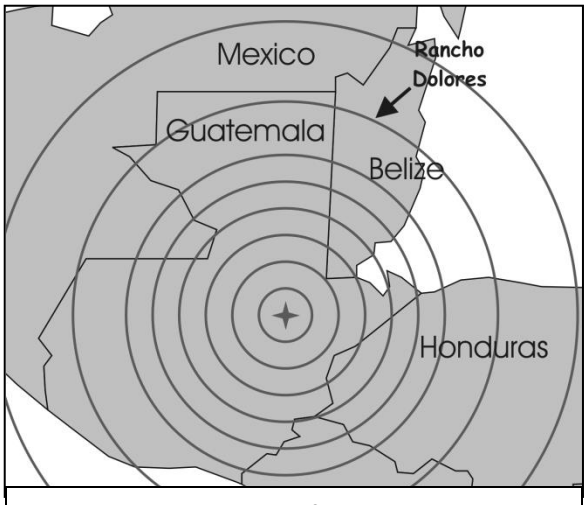


Figure 9. Epicenter of February 4, 1976 Earthquake

Lagoon System), and then reverses direction completely to drain south through Black Creek to join the Belize River.

The faulting is also demonstrated by a number of small springs situated just west of the Spanish Creek. These springs are exactly in line with the geological fault line (Fig 6). One of these springs (no more than a seepages really), is situated in the front yard of Mr. Alvin Sutherland's plot. Interestingly, Mr. Sutherland claims that this spring hadn't been always flowing. It suddenly opened in February 4, 1976, immediately after a strong earthquake (Magnitude 7.5) in Guatemala (Fig. 9), in which 23,000 people were killed in that country. Mr. Sutherland remembers the day exactly since his wife was giving birth that day.

2.4.4. Soils

The agricultural value of the land in the Belize River Valley is presented in Figure 10 (based on King et. al., 1989). The soils with the highest and medium agricultural potential are limited to the alluvial soils along the Belize River and the creeks. The high sandy riches, characterized by the broken ridge vegetation have a very low agricultural potential according to King: these soils need substantial input of capital and technical expertise to make farming projects successful. The hatched areas are areas already under cultivation in August 2015.

Wetness, flooding, availability of nutrients are the dominant limitations of all soils in the project area (King et. al., 1989), even the soils with the highest and medium agricultural potential. Recommended land use was chiefly citrus and rice on the best soils, and rice and pasture on the soils with limited potentials. The latter soils were also recommended for pine growth or were deemed unsuitable for any agricultural use. It must be understood that King based his agricultural potential classification on the level of agricultural techniques and capital available in 1980-ies; today we see agricultural developments taking place in Belize which were unthinkable 25 years ago but are possible thanks to modern techniques, the availability of modern equipment and large capital investments. Examples of large scale developments in the Belize River Valley are an upcoming cattle ranching project between Rancho Dolores and Lemonal, covering about 5000 acres land. Another large tract of land, north of Lemonal and bordering the Spanish Creek is for sale. These developments could drastically change the landscape of the area and have major impacts on the watershed of the Spanish Creek. Question will be how the local population will benefit from these developments.

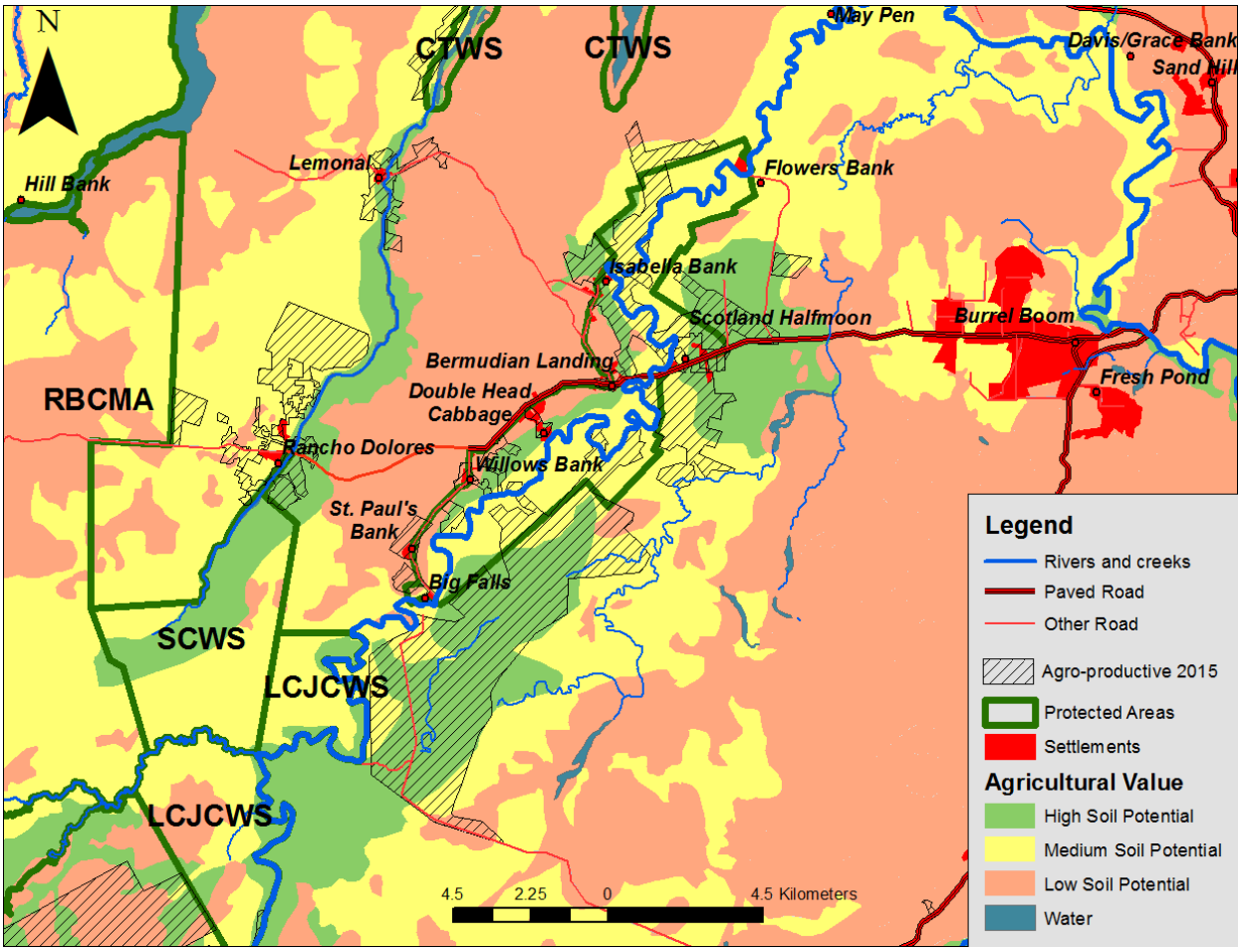


Figure 10. The Agriculture Potential of the Project Area, based on King et. al. 1989

Present day farming in the Belize River Valley is mostly restricted to cattle ranching. In Isabella Bank, cattle are kept in fenced pastures but elsewhere it is common to let the animals roam free. The area is not a centre of vegetable farming, some will say this is because of the 'old days' when food was imported but never grown in the country, and as a consequence there is no tradition to produce crops. However the omnipresence of free roaming cattle destroying any crops has much to do with this as well.

An attempt to grow sugarcane was made in Isabella Bank. 500 acres sugarcane was planted but apparently, after cutting the cane, it was not delivered at the Tower Hill sugar mill. The potential of growing sugarcane in the Belize River Valley is limited because of the long distance of the cane fields to the mill, which would make transportation expensive, and the fact that cane production in the two northern districts already exceeds the milling capacity of the factory

2.5. Biodiversity of the SCWS

2.5.1. Ecosystems and Flora

A total of 219 plant species were identified at least up to genus level during fieldwork carried out as part of the ecological assessment (Meerman et al. 2004). This number includes species identified on transects but also includes some species that were noted elsewhere in the park. Clearly, many more plants (especially herbs) remain to be recorded. But at least, some of the more dominant tree species can be expected to have been identified. The list of species can be found in Appendix 2.

Figure 11. Mr. Augustin Howe with Christiana africana sample

One of the more interesting finds was the tree *Christiana africana* of the Tiliaceae family (fig. 11). This tree has a very unusual distribution. It is found commonly in Africa (hence the name) but also in Brazil and a few isolated locations in Central America. The tree had been reported from Belize on previous occasions (Orange Walk District) but it is considered rare. Some authors (Balick et al, 2000), consider it an introduced species. The location where it was found in the SCWS can not easily be explained as resulting from cultivation. Whatever it's origin, the species appears to be established in Belize, even if it remains rare.

Another special species is the vine *Corynostylis arborea* from the Violaceae (Violet) family (Fig. 12). This vine is rarely reported but is very common in the tangled vegetation along the shores of the Spanish Creek. The flowers have a very unusual shape. The fruits are rounded and about 2" in diameter and is sometimes referred to as "Monkey Apple".

Figure 12. Flowers of the "Monkey Apple" Corynostylis arborea.

One species: *Swietenia macrophylla*, Large-Leaved Mahogany, is listed as Vulnerable in the 2001 IUCN Red List. This species has been subject to heavy logging pressure in the past, and adult specimens are now uncommon in the SCWS.

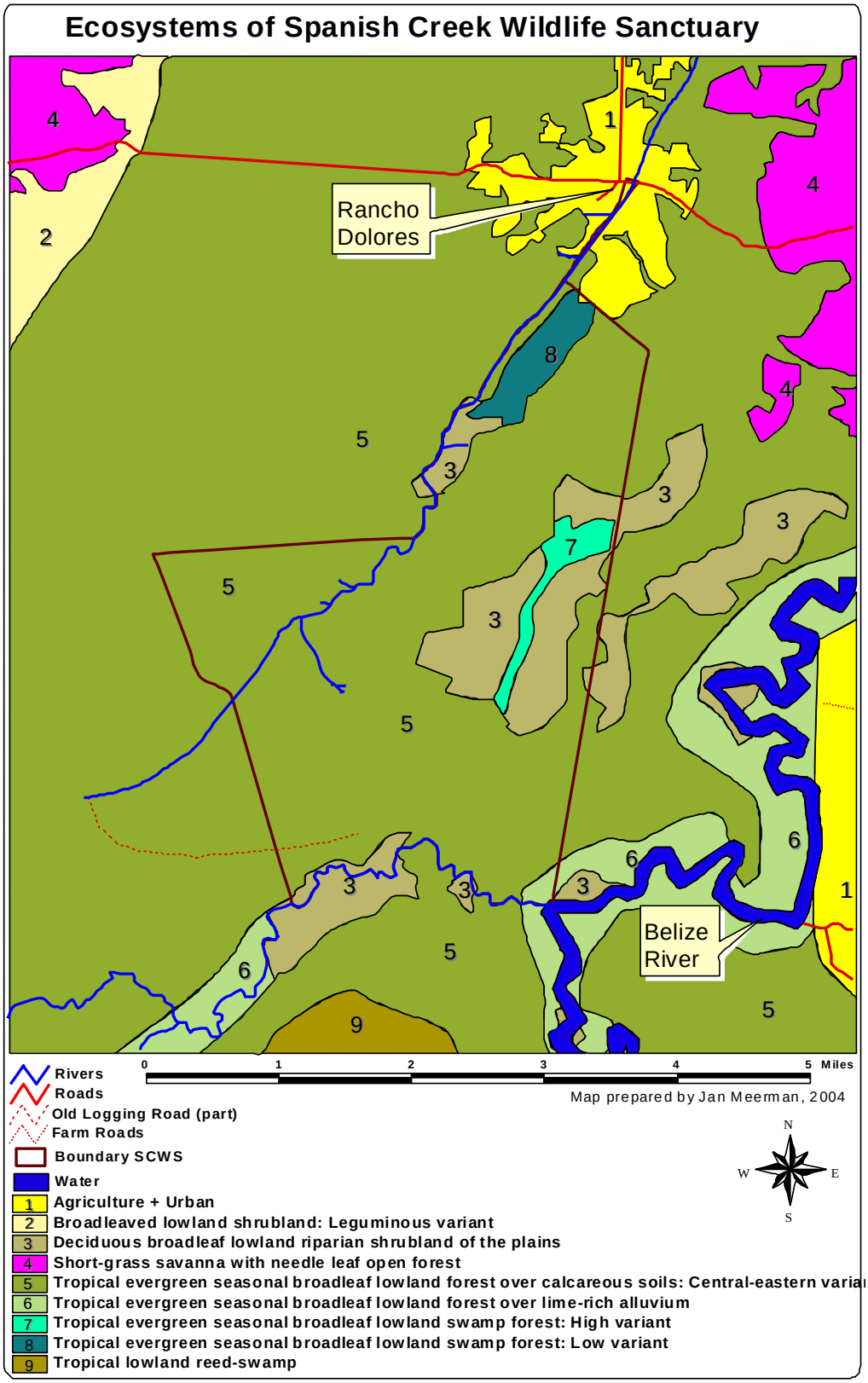


Figure 13. Ecosystems of SCWS as established during the Ecological Assessment (Meerman et al., 2004)

Based on the REA survey, five main ecosystems were recognized in the Spanish Creek Wildlife Sanctuary (Fig. 13). These ecosystems are characterized as follows:

Table 4. Ecosystem Descriptions (Based on Meerman & Sabido, 2001)

Tropical evergreen seasonal broadleaf lowland forest over calcareous soils: Central-eastern Variant. UNESCO Code: IA2a(1)(b)CE
Geology and soil: Over calcareous rock. Mostly well drained.
Fire exposure: Limited to areas with slash and burn cultivation.
Description: Level, fairly well drained forest 15-20 m tall on limestone soils, locally deciduous.
Frequent plant species: include Acacia spp., Bursera simaruba, Coccoloba spp., Crysophila stauracantha, Cupania sp., Guettarda combsii, Lonchocarpus castilloi, Manilkara zapota, Pouteria sp., Sabal mauritiiformis, Simarouba glauca, Swietenia macrophylla and Vitex gaumeri.
Local SCWS conditions: The most important and widespread ecosystem. Locally strongly dominated by Cohune Attalea cohune.

Deciduous broadleaf lowland riparian shrubland of the plains. UNESCO Code IIIB1b(f)P
Geology and soil: Found on alluvial deposits. Outcrops of calcareous rock occur, but generally the alluvial deposits are deep and there is no bedrock visible. The soils are mostly well drained.
Fire exposure: Frequently exposed to human induced fires.
Description: Found along riversides where disturbance may be natural, such as the displacement by a river after flooding, or it may be anthropogenic as when land is cleared and left fallow.
Frequent plant species: Tall graminoids (reeds, rushes, and sedges) mix with shrubs, and many types of ruderal communities.
Local SCWS conditions: Strongly dominated by Spiny Bamboo Guadua longifolia. Much of this ecosystem, where along the Spanish Creek, burned during the 2003 fire event.

Tropical evergreen seasonal broadleaf lowland swamp forest: High variant. UNESCO Code: IA2g(1)(a)T
Geology and soil: Over calcareous rock. Ill drained
Fire exposure: Limited to areas with slash and burn cultivation.
Description: This forest type is low in stature with a broken canopy with a distinctive deciduous element. Where the canopy is open there is a distinctive herbaceous layer dominated by sedges sometimes including Scleria bracteata.
Frequent plant species: Frequently encountered trees include Amyris elemifera, Bactris spp., Bucida buceras, Calophyllum brasiliense, Croton pyramidalis, Croton reflexiflora, Dracaena americana, Metopium brownei, Coccoloba reflexiflora, Coccoloba acapulcensis, Coccoloba cozumelensis, Manilkara zapota, Gliricidia sepium, Ouratea nitida, Sabal mauritiiformis, Simarouba glauca, Swietenia macrophylla and Zygia sp. Thick woody vines are sometimes present. Includes some areas that are locally called "bajos". Logwood Haematoxylon campechianum, typically occurs in the wetter, more open sections.
Local SCWS conditions: Limited to a narrow strip in the east of the project area (along old stream course?) Dominated by Swamp Kaway: Pterocarpus officinalis.

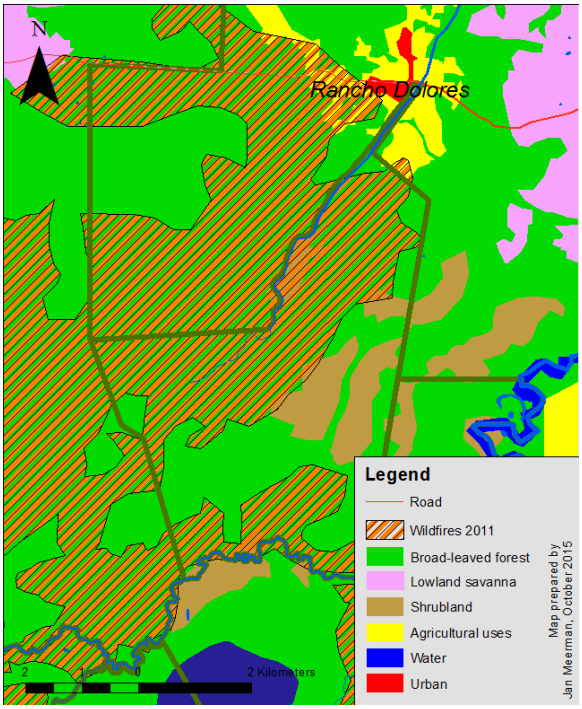
Tropical evergreen seasonal broadleaf lowland swamp forest: Low variant. UNESCO Code: IA2g(1)(a)L
Geology and soil: Generally over calcareous rock. Some hog-wallow micro-relief exists as a result of repeated wetting and drying of the soil. Ill drained, often waterlogged for part of the year.
Fire exposure: Limited to areas with slash and burn cultivation.
Description: Swampy stands of low, thin stemmed trees and shrubs without emergents.
Frequently encountered trees include Acacia sp., Acoelorraphe wrightii (usually occurring in dense clumps), Bucida buceras, Calliandra sp., Calyptranthes sp., Cameraria latifolia, Chrysobalanus icaco, Clidemia sp., Crescentia cujete, Erythroxylum guatemalense, Haematoxylon campechianum, Hampea trilobata, Helicteres guazumifolia, Hirtella racemosa, Hymenocalis littoralis, Licania hypoleuca, Miconia spp., Mimosa hemendieta, Mouriri exilis, Rinorea sp., Xylopia frutescens and Zygia sp.
Local SCWS conditions: Restricted to a narrow piece along the eastern shore of the river, close to Rancho Dolores. Was dominated by low shrub, mainly Logwood brush: Dalbergia glabra. The entire ecosystem was burned during the 2003 fire event.

Tropical evergreen seasonal broadleaf lowland forest over lime-rich alluvium UNESCO Code: IA2a(1)(b)K
Geology and soil: Soils are deep, calcium rich and usually sandy. Moderately well drained
Fire exposure: Limited to areas with slash and burn cultivation.
Description: This very mixed assemblage is found on the middle terraces of many rivers and streams.
Frequent plant species: Frequently encountered species are: Acoelorrhaphe wrightii, Atalea cohune, Bactris major, Bactris mexicana, Belotia campbellii, Calathea lutea, Calophylum brasiliense, Ceiba pentandra, Chrysophyllum oliviforme, Coccoloba belizensis, Coccoloba schiedeana, Costus guanaiensis, Cupania belizensis, Desmoncus orthacanthos, Ficus sp., Guarea sp., Hampea trilobata, Heliconia latispatha, Luhea speciosa, Lysiloma bahamense, Manilkara sp., Maranta arundinaceae, Pimenta dioica, Pouteria sp., Pterocarpus rohrii, Sabal mauritiiformis, Samanea saman, Schizolobium parahybum, Simarouba glauca, Spondias mombin, Stemmadenia donnell-smithii, Swietenia macrophylla, Tabebuia rosea, Tabernaemontana arborea, Virola koschnyi, Vitex gaumeri, Vochysia hondurensis, Zanthoxylum sp., Zuleania guidonia. The species are a mixture of lowland, moist dependent and somewhat more drought tolerant species. This ecosystem appears to be a favored habitat for the Yucatan Black Howler Monkey Alouatta pigra.
Local SCWS conditions: Restricted to the Belize River shores, and of minimal importance in the SCWS. Within the project area , the ecosystem was not surveyed.

The most widespread ecosystem is the “Tropical evergreen seasonal broadleaf lowland forest over calcareous soils: Central-eastern Variant”. This is a broadleaf forest over soils based on limestone. The ecosystem is not homogenous. The lack of relief causes many swampy spots with vegetation that could conceivably be labeled a “swamp forest”, but in general these swampy spots are too small or too ill defined to warrant separation. The wet spots are typically characterized by a “hog wallow[9]” relief of the soil and an abundance of Pokenoboy (Bactris) palms, Kaway (*Pterocarpus officinalis*) and Spiny Bamboo (*Guadua longifolia*).

The dryer sections of the forest have a more diverse vegetation but are characterized by Cohune palms (*Attalea cohune*), at places cohune is so dominant that the forests are called a “Cohune Ridge”

[9] Soil characterized by an uneven micro-topography caused by frequent wetting (swelling) and drying (shrinking) of the soil.



As a follow up on Hurricane Richard in 2010, much of the SCWS fell victim to wildfires in 2011 (Fig. 14). Some patches were relatively spared, but effectively all the "Cohune Ridge" within the Tropical Evergreen Seasonal Broadleaf Lowland Forest over Calcareous Soils was burned. As a result all the main forest ecosystems within the SCWS are now essentially secondary forests.

From a distance the forest might appear healthy, but upon closer inspection, the canopy consists of a dense layer of Cohune Palms interspersed with Trumpet Tree (Cecropia) and other pioneer species (Figure 15)

Figure 14. Extent of 2011 wildlife fires

Figure 15. Aerial view of the SCWS with a dense cover of Cohune palms with Cecropia and other pioneer species interspersed

2.5.2. Aquatic Ecosystems

The draft "Belize Aquatic Systems Map" (Esselman et al. 2003) lists two classifications for the Spanish Creek:

- "Headwater Stream" for the lower reaches of the river and
- "Freshwater Lagoon Complex" for the upper reaches (around Rancho Dolores).

The 2nd classification type may seem surprising, but the lower reaches (starting just south of Rancho Dolores) do have certain lacustrine[10] elements: the water is slow flowing if not stagnant during most of the year and the water level is influenced by the nearby lagoon systems rather than by actual stream input (see section on Hydrology).

Also these two classifications match very well with the (aquatic) ecosystem classifications described in the Belize Ecosystems Map (Meerman & Sabido 2001) (Table 5).

Table 5. Aquatic Ecosystem Descriptions based on Meerman & Sabido, 2001.

Rooted underwater communities of flowing water
Geology and soil: Variable
Water Regime: Inundated year through but water level may fluctuate strongly.
Description: Related to "Rooted floating leaf communities of fresh water lakes", but in flowing water and without the floating leaf component. Little researched in Belize and mostly too limited in extend to be mapped.
Frequently encountered species: Common species in the New River include Vallisneria americana and Cabomba palaeformis. Habitat of the endangered Central American River Turtle Dermatemys mawi.
Local SCWS conditions: Ecosystem starts just south of Rancho Dolores. Only aquatic plant is Cabomba palaeformis. Home of the "Jute" snail Pachychilus glaphyrus.

Rooted floating leaf communities of fresh water lakes
Geology and Soil: Variable
Water Regime: Inundated year through but water level may fluctuate strongly. Some lakes my occasionally dry up during the dry season.
Description: Distinctive aquatic assembly of freshwater lakes, lagoons and slow flowing rivers. Due to its often linear occurrence difficult to map but to be expected in most shallow freshwater habitats. Good examples can be found in the New River and Crooked Tree Lagoons.

[10] Lake

Rooted floating leaf communities of fresh water lakes
Frequently encountered species: Typical species include Nymphaea ampla, free floating Utricularia spp. and blue green algae The shores are often rimmed with Eleocharis spp.
Local SCWS conditions: Near shore areas of the Spanish Creek once it becomes wider belongs to this eocystem. Typical aquatic plants include Utricularia foliosa and Nymphaea ampla. Home of the large Applesnail Pomacea flagellata.

Headwater stream:

It is difficult to pin down the transformation point of "Headwater Stream" to "Freshwater Lagoon Complex". Clearly everything upstream from Spanish Rock is "Headwater Stream".

The Headwater Stream has little or no submerged vegetation. The only species noted was *Cabomba palaeformis*. The water here is shallow and there is usually some flow, even when it is dry. This flow is most obvious where limestone surfaces.

The "Jute" snail *Pachychilus glaphyrus* is a conspicuous component especially further upstream, above the confluences of the two main branches of the Spanish Creek. The fish fauna consists mostly of smaller fish species such as Cichlasoma meeki, Cichlasoma salvini, Cichlasoma spilurum, Astyanax aeneus, Heterandia bimaculata and Xipophorus helleri. Based on local information, it is possible that Cichlasoma intermedium can be found here as well.

Crocodiles (*Crocodylus moreletii*) do occur here. But during the survey we could confirm only immature individuals.

Figure 16. Utricularia foliosa (Submerged leaves shown). The dark dots on the fine leaves are "bladders" that are capable of trapping and digesting tiny aquatic organisms. The yellow flowers are produced above the water surface.

Freshwater Lagoon Complex:

In the lower reaches of the Spanish Creek there is often barely any current except during wet periods. Vegetation is dominated by the water lily *Nymphae ampla*. Other submerged vegetation includes Cabomba palaeformis and the carnivorous *Utricularia foliosa*. *Salvinia minima* is an uncommon free-floating plant.Typical partly submerged vegetation just below the shore line includes the "prickle" *Mimosa pellita* and *Solanum tampicense*.

The Applesnail *Pomacea flagellata* is a noticeable component here and an important food source for much of the aquatic wildlife. An unidentified bivalve was also noted here. The fish fauna is more diverse here than in the headwater stream and includes many "commercial" species that are heavily sought after by the residents of Rancho Dolores. Some species noted here *Anguila rostrata, Ophisternon aenigmaticum, Cichlasoma friedrichsthali, Cichlasoma synspillum, Cichlasoma robertsoni, Cichlasoma uropthalmus, Hyphessobrycon compressus, Oreochromis niloticus, Petenia splendida, Poecilia mexicana, Megalops atlanticus, Ictalurus furcatus, Belenox belizanus* and *Gambusia sexradiata*.

The fish fauna is probably depauperate to some extent, given the constant pressure put on it by the local residents. Heavy fishing and hunting pressure was already reported by Walker & Walker (2000) could not be confirmed. Also the presence of a reproducing Crocodile population (see section on Reptiles) points to a fairly healthy fish (=prey species) population.

In this part of the river, Crocodiles *Crocodylus moreletii*, do occur and are fairly easily seen. The Hickatee *Dermatemys mawii* should also be expected here, but the lack of any observations indicate that this species might have been hunted to near local extinction (See section on Reptiles).

2.5.3. Fauna

Invertebrates

The most interesting invertebrates recorded were the mollusks (fig. 17). In the headwater streams, the "Jute" *Pachychilus glaphyrus* was very common, while in the lower reaches the Applesnail *Pomacea flagellata* was abundant. The shells of this species were among the largest the consultant has ever recorded in Belize! Also a bivalve mollusk was noted (*Elliptio* sp.?). All these species are an important source of food for the local wildlife, from Crocodiles through Limpkins and Otters.

Pomacea flagellata

Pachychilus glaphyrus

Elliptio sp.?

Figure 17. Some mollusks found in the SCWS

Fish

Fish was sampled during the ecological assessment (Meerman et al, 2004). The total number of fish species recorded during the Rapid Environmental Assessment (REA) was 19 (see Appendix 2). Greenfield and Thomerson (1997) list an additional 6 species for the Spanish Creek, while there may be an additional 2 species based on local information, bringing the total to 25 or possibly 27 species.

Bay Snook *Petenia splendida*

Tilapia *Oreochromis niloticus*

Tuba *Cichlasoma synspilum*

Crana' *Cichlasoma urophthalmus*

Green Gial *Cichlasoma salvini*

Mosmos *Cichlosoma friedrichsthali*

Cichlasoma spilurum?

Night and Day, *Cichlasoma robertsoni*

Moko Jek *Cichlasoma meeki*

Figure 18. Some Cichlid Fishes Identified in the Spanish Creek. Pictures: J.Meerman.

Of interest is the Tilapia; *Oreochromis niloticus*, a recently introduced species which is now very common in the Spanish Creek. First records of Tilapia are as recent as 1998. Immediately after the floods caused by Hurricane Mitch in November 1998, large congregations of Tilapia were noted.

No baseline data exist on which a relative abundance could be based. It is likely however, that given the constant pressure put on it by the local residents, the population density of fish is lower than its natural potential. The small size of the average catch by local fishers (often women), does imply a high pressure.

Amphibians

The number of amphibians noted during the ecological assessment (Meerman et al, 2004) was very small. Both *Incilius valliceps* and *Rhinella marina* were noted near Rancho Dolores, but in the actual Spanish Creek Wildlife Sanctuary only two species were recorded. The frog *Lithobates vaillanti* was noted in low numbers along the smaller tributaries of the Spanish Creek. Calls of Red-Eyed tree frogs (*Agalychnis callidryas*) were recorded near the confluence of the 2 main Spanish Creek Tributaries.

Figure 19. Red-Eyed Tree Frog Agalychnis callidryas

Reptiles

Relatively few reptiles were observed during the REA (Meerman et al., 2004). The Basilisk lizard or "Cock Maklakka" *Basiliscus vittatus* is fairly commonly seen along the river. The Wish-Willy *Ctenosaura similis* occurs in the village of Rancho Dolores but is not expected to enter the SCWS since this does not provide any suitable habitat for this species. The three most interesting species of the SCWS are the Morelet's Crocodiles, the Hickatee, and the Green iguana.

The Morelet's Crocodile *Crocodylus moreletii* was once listed as endangered, but numbers have increased to such an extent that the species is now listed as "Lower Risk" in the 2001 IUCN Red Data List.

During the ecological assessment, this Crocodile was found to be fairly common along the Spanish Creek. Based on the 2004 report, it may appear that the up stream habitat is more conducive for baby crocodiles. The nesting areas should also be sought here.

Figure 20. Baby Morelet's Crocodile (15 Jan. 2004)

There have been reports of crocodiles near the village becoming a nuisance. A very likely explanation for this phenomenon is the fact that people clean their fish in the river (particularly under the bridge) and leave the offal there. This offal serves as an easy food source for crocodiles that are now learning that presence of people equates to free food becoming available. Many of the mentioned "close encounters" could merely be crocodiles waiting for "handouts", more seriously they could become demanding of food, ultimately biting the hand that feeds them.

The Hickatee *Dermatemys mawii*, is still listed as "Endangered" (IUCN 2001). Historically, there used to be a healthy population in the Spanish Creek and Rancho Dolores residents still recall the days when these turtles were common. No Hickatees were noted during the 2004 REA. Some residents mentioned that Hickatees are becoming scarce but others claimed that there are still plenty of Hickatees but they are harder to catch (Boomsma, 2015). A country wide survey of the Hickatee, carried out in April-May 2010 (Rainwater, 2010) showed that the Hickatee is heavily depleted in most of Belize, although some healthy populations remained in areas under some form of protection. The 2010 report concluded that the current level of Hickatee harvesting as being unsustainable.

The Green Iguana *Iguana iguana* was found to be fairly uncommon, but still occasionally seen along the lower reaches of the river. Informants noted that this species was not heavily hunted near Rancho Dolores. They are too uncommon here to make hunting profitable. The reason for this scarcity remains unclear. Most likely it is due to the absence of suitable nesting sites (sandy spots), or the too frequent disturbance of such nesting sites by people hunting for egg laying females.

The SCWS has three more reptile species that are listed in the 2001 IUCN Red List:

Kinosternon acutum, Tabasco Mud Turtle, (Lower Risk /near threatened)

Staurotypus triporcatus, Loggerhead (not to be confused with the marine Loggerhead), (Reported in Walker & Walker 2000) (Lower Risk /near threatened)

Trachemys scripta, Bocatora, (Lower Risk /near threatened)

Possibly of great importance to several of the Red Data listed reptiles, are the few sand bars that can be found in the Spanish Creek. Such sites are often prime nesting sites for Turtles, Iguanas and sometimes even Crocodiles. These sandbars are formed and maintained during flood events. They fall dry during the dry season but are submerged during most of the wet season.

Figure 21. Same sand bar during the wet season (January 16, 2004). Looking North.

Figure 22. Sand bar in the dry season (May, 1 2003). Looking south

For the benefit of these animals, it is important that such sandbars are protected and disturbance is avoided. Specifically, these sand bars should not be used for camping or mining of sand.

Birds

During the REA (Meerman et al., 2004) a total of 223 bird species was identified over the course of the survey which lasted several months. This figure is quite impressive for a limited survey such as this. And no doubt, more species can be added with continued data collection.

In September 2014, Peter Herrera conducted a bird count around Spanish Creek and observed a total of 73 bird species on a single day.

The 40 most persistently encountered bird (throughout the year, in most habitats, not taking into account the number of birds observed per record), were:

- Black-headed Trogon
- Brown Jay
- Blue-gray Tanager
- Yellow-billed Cacique
- Plain Chachalaca
- Short-billed Pigeon
- Olive-throated Parakeet
- Great Kiskadee
- Lesser Greenlet
- Spot-breasted Wren
- Yellow-winged Tanager
- Yellow-throated Euphonia
- White-collared Seedeater
- Thick-billed Seedfinch
- Grayish Saltator
- Melodious Blackbird
- Great Tinamou
- Turkey Vulture
- Pale-vented Pigeon
- Blue Ground-Dove
- White-fronted Parrot
- Red-lored Parrot
- Slaty-tailed Trogon
- Ivory-billed Woodcreeper
- Dusky Antbird
- Black-faced Anttrush
- Northern Bentbill
- Yellow-olive Flycatcher
- Bright-rumped Attila
- Boat-billed Flycatcher
- Social Flycatcher
- Couch's Kingbird
- White-breasted Wood-Wren
- Long-billed Gnatwren
- Clay-colored Trush
- Red throated Ant Tanager
- Green-backed Sparrow
- Black-cowled Oriole
- Yellow-tailed Oriole
- Montezuma Oropendola

One bird observed is listed as vulnerable in the IUCN Red Data Book[11]: The Great Curassow (*Crax rubra*) The Great Currasow is certainly resident but the 2004 ecological assessment found it to be very rare. This rarity is probably resulting from heavy hunting pressure.

[11] http://www.iucnredlist.org/details/22678521/0

Figure 23. Agami Heron (Picture: Jan Meerman)

The most noteworthy bird recorded was no doubt the Agami heron (Fig 23). This rare bird is listed as "Vulnerable"[12] by the IUCN and was frequently recorded during the 2004 REA and is also listed in the 2014 species list by Peter Herrera. It was also seen during a fieldtrip in September 2015.

The presence appears to be seasonal. Jones (2003) mentions that they are present throughout Belize during the "dry" season. He also lists nesting colonies in the Toledo district; in 2014 a nesting colony was discovered in the Runaway Creek Private Protected Area in the Belize District. The species is apparently not known to nest in the Spanish Creek area.

The relative ease with which this species can be observed could prove to be a main attraction for the SCWS.

The bird diversity in general, especially along the Spanish Creek is probably the main touristic attraction of the SCWS.

[12] http://www.iucnredlist.org/details/22697200/0

Present day, bird records are typically being recorded in the online database called eBird[13].

An analysis of records on eBird[14] revealed a very limited number of entries into the database for SCWS. Actually all records shown are from either the 2004 REA, Peter Herrera in 2014 or from the fieldwork carried out by the consultants in 2015. While not all birders do record their records in eBird, the analysis shows that the SWCS is not a known or frequented birding location.

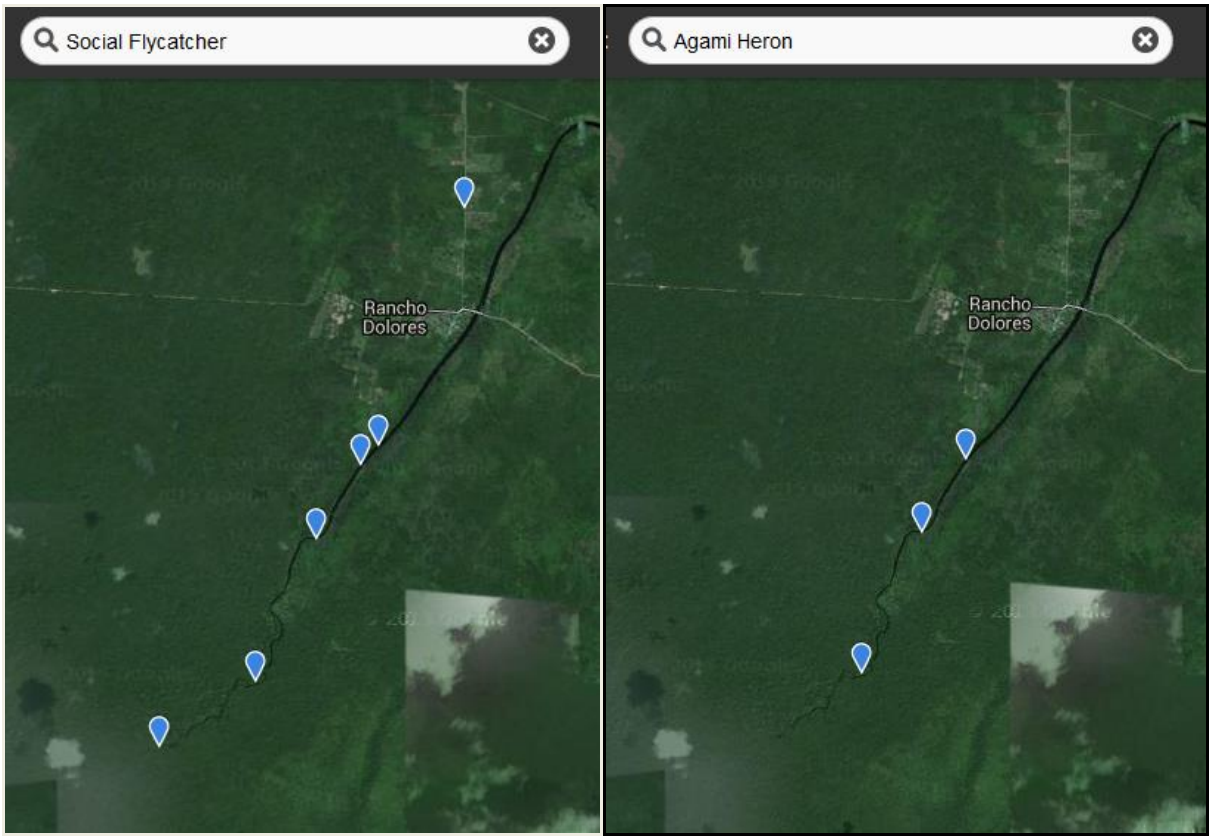


Figure 24. Two screenshots from eBird (October 25, 2015) showing all locations in SCWS with bird records. To the left is a common, ubiquitous bird, the Social Flycatcher and to the right is a rare species, the Agami Heron.

[13] http://www.ebird.org

[14] Analysis carried out October 25, 2015

Mammals

Spanish Creek Wildlife Sanctuary appears to be home to a typical assortment of Belizean forest fauna (species list in Appendix 2). Most conspicuous are the Black Howler Monkeys (*Alouatta pigra*, "Endangered" – IUCN)[15] which were heard and often seen during every single trip into the sanctuary. Spider Monkeys also occur in the SCWS but they are more difficult to see.

Other species recorded during the REA (Meerman et al, 2004) include:

Figure 25. Tapir Track, 17 January 2004.

- Kinkajou
- Four-eyed opossum
- Agouti
- Nine-banded Armadillo
- Paca (Gibnut)
- Red Brocket Deer (Antelope)
- White-nosed Coati,
- Collared Peccary,
- White-lipped Peccary
- Central American Tapir and
- Neotropical River Otter
- Ocelot,
- Puma and/or Jaguar

More recently, in 2012 and 2014, teams from Panthera (Foster, Pers. Comm.) operated wildlife cameras in the general area but not within the SCWS. Species of general interest that were recorded included:

- Agouti,
- Coati
- Collared peccary
- Common opossum
- Curassow
- Jaguar
- Jaguarundi
- Ocellated Turkey
- Ocelot
- Paca
- Puma
- Raccoon
- Red-Brocket Deer
- Squirrel
- Tapir
- Tayra
- White-tailed Deer

[15] http://www.iucnredlist.org/details/914/0

2.5.4. Past and Present Research

There are no records of past or ongoing scientific research within the confines of the SCWS.

2.6. Cultural and socio-economic value of SCWS

2.6.1 Community and Other Stakeholder Use

A separate Social and Livelihood Assessment was carried out for the villages: Bermudian Landing, Double Head Cabbage, Flowers Bank, Isabella Bank, Lemonal, Rancho Dolores, Scotland Halfmoon, St. Pauls Bank, and Willows Bank (Boomsma, 2015). The findings of this assessment are summarized here.

Based on the assessment, the main livelihood activities of the CBS villages include: small-scale agriculture (milpa or plantation farming); small-scale cattle rearing; employment in nature-based tourism (primarily in the village of Bermudian Landing); small-scale coconut oil and cohune nut oil (*Attalea cohune*) production; cashew and cashew product sales; and outside wage employment (primarily in or around Belize City).

Natural Resources

Wyman (2008) in a broad survey of 135 households in the CBS reported the following key results:

- 63% of households had at least one family member who works outside of the CBS.
- 33% of the households received remittances from family members who have left Belize and live and work in the U.S. Remittances totalled $95,850 BZE (approx US $ 47,925) over the course of one year, accounting for 28.5% of their total income. Of the 33% of households receiving remittances (45 households total), 11 households reported remittances as the only source of monetary income

The assessment primarily focused on the use of natural resources and the state of those resources. Based on this assessment the natural resources most used by the local people are the following:

- Cohune nuts
- Popte seeds
- Bayleaf
- Hickatee
- Iguana
- Fish
- Construction sticks incl. logwood fence posts
- Bush meat

These resources and their use will be discussed below.

Cohune nuts:

(*Attalea cohune*) A few families make cohune oil for their own use; extra oil may be sold to friends and family. An attempt was made to produce oil on a commercial basis, the oil factory is located in Flowers Bank that is located in an area rich in cohune palms.

A mature cohune palm can produce 2,000 sizeable nuts. The kernels make up 10% of the weight of a nut. The kernels contain as much as 70 % oil, one hundred sizeable nuts yield a quart of oil. The hardest part of the extraction is the removal of the kernel from the nut once that has been broken. Machinery is available for drying and crushing of the nuts, but the removal of the kernel remains handwork.

The extracted oil can be used for cooking purposes but also for the production of soap. The nut shells can be made into charcoal, which could be used as a fuel, or used as mulch in ornamental gardens.

Several efforts to establish a cohune oil factory have been made during the past century. In 1929, an oil extraction factory was established in Punta Gorda. An attempt was made to increase the abundance of cohune on 19,000 acres. At one time this business employed 1,000 workers but after the Great Depression set in, the project collapsed. (Bridgewater, 2012)

Popte seeds

The palmetto palm (*Acoelorraphe wrightii)* is a common plant from the broken ridge. It does not occur in any number within the Spanish Creek Wildlife Sanctuary. The palmetto palm trunks are used as building material although without treatment it will not last long. Usually with celebrations, palms are cut and placed along the streets as decoration. The seeds of the palm, the so-called popte seeds, are of medical importance due to the presence of certain chemicals that have cancer treatment capacities. Popte seeds are collected and sold to an exporter; the measurement volume is the contents of a bucket, one bucket of seeds will pay around BZ $ 35.—(2015). The amount of seeds harvested per day, depends on the density of the palms per hectare, the maturity of the palms and annual fluctuations in fruit bearing.

Collection of seeds should not have a major impact on the palms but in some cases collectors cut tall palms down, in order to collect the seeds. The palms grow in clusters and after cutting down the tall palms, young off shoots will take over. But it will take considerable time before these young palms will be flowering, because the palm is a slow growing species.

The yield of seeds of *Acoelorapphe wrightti* is not documented but a similar palm species Cabbage palmetto (*Sabal palmetto*) produces large numbers of fruits and seeds each year. In a cabbage-palm hammock in southwest Florida, an estimated 1,530,000/ha of ripe fruits (620,000/acre) were produced per year.[16]

Bayleaf

Bayleaf are the leaves of the Bayleaf palm (*Sabal mauritiiformis*), which is commonly used for thatching roofs of resorts all over the country but especially in coastal areas and the cayes. Harvesting of the leaves could be sustainable if only a few leaves were cut per palm, but it becomes more common that all

[16] http://www.na.fs.fed.us/pubs/silvics_manual/volume_2/sabal/palmetto.htm

but one or two leaves are cut from one plant. For cutting bayleaf from national and private lands, a permit is required and royalties must be paid to the Forest Department (Bridgewater, 2012). Within the project area, there is little Bayleaf used but outsiders do come in to harvest large volumes. Sometimes local people are hired to cut the leaves.

A well designed roof has a pitch of minimal 45°, depending on the size of the leaves; a minimum of 20 leaves per m² roof surface is required. In other words, thousands of leaves are needed to create a roof over a medium sized building. A roof thatched in the correct way, will last dozens of years.

The palm is common in the SCWS, but it is also growing elsewhere in the project area. Harvesting of the leaves has a great impact on the forest; trails are opened up which later on allow access to hunters. If over-harvested, palms will reproduce in a lower rate and ultimately the palms will become scarce.

The very similar *Sabal yapa* also occurs in the SCWS but this species produces leaves that are of inferior quality.

Hickatee

Hickatee or Central American river turtle (*Dermatemys mawii*) is traditionally eaten by the Creole communities in the Belize River Valley. Some of the interviewees noted that Hickatees are becoming scarce but others claimed that there are still plenty Hickatees but they are harder to catch. However, a country wide survey of the Hickatee, carried out in April-May 2010 (Rainwater, 2010), came to a rather more negative conclusion. This survey was a follow up on a survey done in the early 1980s (Moll, 1986[17]), that found the Hickatee still common to abundant in sparsely populated areas but declining in more developed areas. The 2010 survey showed that the Hickatee is heavily depleted in most of Belize; however in locations that were under some form of protection, some healthy populations remained.

The 2010 report concluded that the current level of Hickatee harvesting as being unsustainable. The authors made the following recommendations:

1. Increase law enforcement to curb illegal harvest of *Dermatemys* and other wildlife and protect riparian habitats. Priority should be given to localities where *Dermatemys* is still common to abundant.

2. Initiate more extensive surveys to better determine the status of *Dermatemys* in Belize and prioritize localities for more intensive protection. Surveys should be a collaborative effort between the Belizean government, university faculty and students, NGOs, and other interested parties.

3. Initiate a conservation education program, particularly in towns and villages adjacent to *Dermatemys* habitat. This education program should attempt to raise public awareness of wildlife conservation,

[17] Moll, D. 1986. The distribution, status, and level of exploitation of the freshwater turtle *Dermatemys mawei* in Belize, Central America. Biological Conservation 35:87–96.

inform villagers of the protected status of wildlife in Belize, instil general conservation values, and stress the global uniqueness of *Dermatemys* (its endemism to a small area within Meso-America).

4. Initiate a pilot captive breeding program. Such a program should focus on generating hatchlings that can be head-started and released to help restore depleted wild populations. A pilot captive breeding program with the focus on collecting data regarding the reproductive biology of Hickatees is carried out at the Hickatee Conservation and Research Center stationed at BFREE research station in Bladen[18].

The Miami Zoo, in collaboration with the Lamanai Field Research Center, is studying the natural history of the Hickatee[19]. A Hickatee Activity Guide was created for distribution to educate school children in Belize about the turtle and its plight. So far, more than 3000 guides have been distributed through the efforts of many partners, including the Belize Fisheries Department. In addition, more than 2000 Hickatee stickers and temporary tattoos were created and have helped to spark an interest in children[20]

In 2010, the Hickatee Conservation and Monitoring Network was established, this will function as a platform to exchange information about the Hickatee.

Fish

The depletion of fish resources was of great concern to all interviewed people. The practice of using seine nets was mentioned, this method will completely deplete the water bodies from any fish. Undersized fish is taken and not returned to the water, and in some cases, the small fish is also sold. It was mentioned that staff of the Fisheries Department do come out when cases of poaching are reported, but not all the time. Fly fishing was once practiced in the Spanish Creek close to Lemonal, but today that is discontinued because of the absence of game fish.

The Spanish Creek in the Sanctuary is not a major source of fish, and as such the role it plays in local fisheries is limited to replenishing fish to depleted creeks and lagoons

Iguana

The Green Iguana (*Iguana iguana*) still appears to be present in most areas. Collection of eggs buried along the riverbanks sometimes lead to the practice of burning the riverine vegetation which can lead to destructive wildfires. The custom to hunt gravid females and egg collecting is potentially very damaging for the future of the green iguana.

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[18] http://www.turtlesurvival.org/component/taxonomy/term/summary/115/45#.VfH-x_Tko8I

Retrieved 10 September 2015

[19] http://www.waza.org/en/site/conservation/waza-conservation-projects/overview/Hickatee-conservation-initiative

[20] http://zoomiamiconservation.com/project/Hickatee-conservation-initiative/

Construction sticks, including logwood

The shortage of durable fence posts was mentioned by community members. The preferable material for fence posts is dry Logwood (*Haematoxylum campechianum);* green (fresh) logwood is not as long lasting as the dry wood.

But logwood became scarce, and people tend to harvest dry and green logwood alike. Logwood habitat is restricted to small areas along streams and in wetlands. Logwood habitat is limited within the SCWS, but trees have been cut in the past.

An acceptable alternative for logwood is madre de cacao (*Gliricidia sepium*), which will form a living fence once the cuttings take root. But also madre de cacao is scarce in the area. Gumbo limbo, another tree species that is used for making a living fence, is less preferred because the fast growing tree will grow around the barbed wire, which will then easily break as result of the plant saps rusting the wire.

Bush meat

Eating bus meat is very popular all over Belize, this in spite of the fact that it generally more expensive than store bought meat, particularly chicken. The whole Central Belize Wildlife Corridor (of which SCWS is part of) is hunted; a survey carried out by Panthera/ERI/FD in 2015 revealed that the entire 1,200 km² was being hunted with the exception only a few very wet or urban areas. The areas most frequented most by hunters are along the rivers and streams (R. Foster, pers.com.)

At the moment, gibnut is the preferred game meat, closely followed by deer. Peccary, collared as well as white lipped, are very scarce. But when word goes around that a herd of peccaries is around, hunters will lose no time to go out and try to hunt these animals.

In 1994, a survey amongst CBS landowners was carried out regarding their attitude towards hunting. It became clear that the majority of the landowners were hunting. But even then, many persons mentioned that less game is evident in the area than 10 years before, and many people were concerned with the increase in commercial hunting. See Table 7.

In spite of its popularity, for most users of bush meat very few people depend on it as their main source of protein (Foster et al., 2014), instead hunting and the consumption of bush meat is mostly a result of it being deeply engrained in the local culture. Increasingly though, hunting is becoming an economic activity due to the demand from restaurants and tourist lodges.

It becomes more popular to offer game meat in restaurants, from roadside eateries to high end diners. Such promotion will lead to an increase demand for game meat, which could create an opportunity for some people to economically benefit, but at the same time could deplete wildlife resources if the carrying capacity for the extraction of game meat is exceeded. But nobody knows what the present status of wildlife is; let alone who many animals can be extracted on a sustainable level.

Table 6. CBS participants perception on game availability in 1994 (Hartup, 1994)

Table 4. CBS participants' attitudes on game availability and hunting regulations

Question/responses	*n*	%
More or less game now than 10 years ago?		
More	4	8
Less	42	89
Explanation?		
Overhunting	27	64
Market hunting	13	31
Habitat loss or disturbance	7	17
Lack of protection or laws	4	9
Improved hunting techniques	3	7
Poaching	1	2
Do not know	1	2
Any laws and restrictions?		
Various seasons or bans	47	98
Current laws inadequate	11	23
Hunting licence required	5	10
Current laws too strict	2	4
What can be done to increase game?		
Legal protection and enforcement	35	81
Decrease hunting	12	28
Increase employment	3	7
Habitat management	2	5
Nothing	3	7

Farming

A large percentage of households are involved in agriculture, mostly cattle rearing but also chicken rearing, farming are forms of agriculture engagement.

The agricultural value of the land in the Belize River Valley is highly variable. The soils with the highest and medium agricultural potential are limited to the alluvial soils along the Belize River and the creeks. The high sandy riches, characterized by the broken ridge vegetation have a very low agricultural potential according to King et al., (1989): these soils need substantial input of capital and technical expertise to make farming projects successful. Wetness, flooding, availability of nutrients are the dominant limitations of all soils in the project area (King et. al., 1989), even the soils with the highest and medium agricultural potential. Recommended land use was chiefly citrus and rice on the best soils, and rice and pasture on the soils with limited potentials. The latter soils were also recommended for pine growth or were deemed unsuitable for any agricultural use.

Examples of large scale developments in the Belize River Valley are an upcoming cattle ranching project between Rancho Dolores and Lemonal, covering about 5000 acres land. Developments such as these could drastically change the landscape of the area and have major impacts on the watershed of the Spanish Creek.

Present day farming in the Belize River Valley is mostly restricted to cattle ranching. In Isabella Bank, cattle are kept in fenced pastures but elsewhere it is common to let the animals roam free. The area is not a centre of vegetable farming, some will say this is because of the 'old days' when food was imported but never grown in the country, and as a consequence there is no tradition to produce crops. However the omnipresence of free roaming cattle has much to do with this as well.

An attempt to grow sugarcane was made in Isabella Bank. 500 acres sugarcane was planted but apparently, after cutting the cane was not delivered at the Tower Hill sugar mill. The potential of growing sugarcane in the BelRiv is limited because of the long distance of the cane fields to the mill, which would make transportation expensive.

Based on the Belize Livestock Registry, a database maintained by the Belize Livestock Producers Association, it was found that 20.5 % of the households in the project area together own 1,633 head of cattle, and combined they own 8,333 acres of pasture. The density of cattle per acre is low: 0.2 animal/acre (or 5 acre per animal). According to the CEO of the BLPA (A. Macpherson, pers. com.), the carrying capacity of an improved pasture with proper management on the broken ridge soil is one animal per three acres, and on the alluvial soils one head per acre. Compared with the present situation, the extent of the cattle industry in the Belize River Valley has still room for increase, without the need to clear more land for additional pastures. Eventually, this may happen if the cattle boom continues, but for the short term future this is not expected to happen. A very conservative estimate of the value of the present herd in the BelRiv area is around BZ$3,000,000. (1633 animals, average weight 700 lbs, price per pound BZ 2.75)

The upcoming change in legislation will curtail the custom of free roaming animals which is still prevalent. There will be a demand for the erection of fences (fence posts, wire, electrical fencing), watering holes if cattle is not allowed free access to rivers and creeks anymore, which from an environmental and conservation point of view is supported.

The BLPA has been instrumental in the training of its members in improved cattle and pasture management. With the promotion of the cattle industry, which could improve people's livelihood greatly, attention should be given how this grow goes together with environmental and conservational issues, for instance the protection of the watershed (66 ft. river and creek reserves, the conservation of the Howler Monkey habitats, the Hickatee and Green Iguana breeding and feeding grounds). The risk of increased deforestation is a clear threat as the result of increased cattle ranching.

Table 7. Use of natural resources in the target area, compilation

Resource	Use by population in Belize River Valley	Location of source : ecosystem or locality	Need to extract source from SCWS	Notes
Cohune nuts	a. household level b. artisanal production for local consumption c. commercial extraction in cohune oil factory in Flowers bank	a. back yards b. back yards c. wider area around Flowers Bank, broadleaf forest	a. none b. none c. None, cohune trees are very common closer to Flowers Bank. Supplying nuts from the SCWS is too far to be cost-effective	a. the processing of cohune oil is very labour intensive, few people take the time to produce the oil b. In Isabella Bank, a local man produces the oil in an artisanal way. The oil is marketed locally, and in neighbouring villages. Occasionally, gallons with oil are shipped to the US c. The cohune oil project in Flowers bank has received additional support (via CCCCC organization). A small tractor has been purchased to facilitate the transport from cohune nuts to the factory
Cohune leaves	a. household level: occasional, especially for small projects or temporary events b. large projects: not used	a. back yard	a. none	b. Cohune leaves are at the moment not a preferred thatching material. The leaves are not as long lasting as Bayleaf leaves.
Bamboo	Occasionally, small scale for temporary sheds, rafts and souvenirs	Bamboo patches along the river and creeks	none	In Rancho Dolores, bamboo (mostly exotic species) is cultivated by a private enterprise This is partly done for the production of furniture. Native bamboo is not suitable for the production of high quality furniture.

Resource	Use by population in Belize River Valley	Location of source : ecosystem or locality	Need to extract source from SCWS	Notes
Popte (palmetto) seeds	a. seeds b. stems	Broken ridge	none	No palmetto grows in the SCWS
Bayleaf (Sabal)	a. domestic use b. commercial collection for outside the area	Broadleaf forest	To fulfil the commercial demand from outside, leaves maybe extracted from certain parts of the SCWS	Bayleaf is not commonly used in the local villages. The Nature Reserve Lodge in Bermudian Landing has its buildings covered with thatch roofs made of Bayleaf. This Bayleaf was obtained from a large private property between Rancho Dolores and Lemonal that is clearing the land for agriculture. The commercial extraction is organized by people from outside the area that hire locals to cut and collect the leaves. The leaves are primarily destined for coastal and cayes areas (tourism related facilities). People remarked that this resource is getting scarce; leaves are collected from national land and vacant private properties. One person noted that the leaves are also cut in SCWS
Botan	Very little use locally and elsewhere	Broadleaf forest	To fulfil the demand from outside, trunks maybe extracted from certain parts of the SCWS	Botan is the tall, straight trunk of the Bayleaf palm. In this stage, the leaves of the palm become smaller and are not suitable anymore for thatching. The botan stage is also the reproductive phase of the palm. Palms do not coppice (sprout back after cutting)

Resource	Use by population in Belize River Valley	Location of source : ecosystem or locality	Need to extract source from SCWS	Notes
Hickatee	a. domestic use b. commercial use	Belize River, Mussel Creek, Spanish Creek, lagoons. Deeper water.	To fulfil the short term demand, people are tempted to harvest Hickatee within the SCWS. But Hickatee has become extremely rare in the sanctuary	Some interviewees claim that the Hickatee is very scarce. Others remarked that the Hickatee is still common but the animals are harder to catch. Most interviewees admitted to eat Hickatee but did not catch them on a commercial scale, referring to the law which does not allow having more than three animals in possession. But others hunt Hickatee on a commercial scale, using nets to empty sections of lagoons.
Iguana	a. domestic use b. commercial harvesting by outsiders for sale outside the project area	Along rivers, streams and broken ridge	None	Iguana's are locally common, at other locations more scarce. In general, where landowners have a presence on their property, iguanas are more abundant than on National Lands and vacant properties. Landowners may harvest iguana's for domestic use but will not allow large scale harvesting (at least not for free)
Fish	a. domestic use b. commercial use, usually by completely depleting of all fish species of all sizes	a. all open water, mostly done by line and hook b. predominantly in lagoons where the soft bottom allows the use of set nets Favourite habitats mentioned by the	None	Indiscriminately harvesting of fish in the upper reaches of the Spanish Creek happens in the dry season when the flow of the creek stops and only pools and puddles with the fish remains Overfishing of these creeks was mentioned, illegal use of set nets depletes the creeks from fish of all sizes. Outsiders were named as culprits, one person was carrying fish of all sizes over the border to Guatemala (Y. Urbina, pers.com)

Resource	Use by population in Belize River Valley	Location of source : ecosystem or locality	Need to extract source from SCWS	Notes
		interviewees were: Mussel Creek and Labouring Creek/ Whitewater lagoon		
Construction sticks	a. domestic use b. commercial use	Broadleaf forest	None	Sticks are sold for BZD 3 apiece. Some local people cut the sticks and sell them to outsiders. There is little construction occurring in the project area but the demand for sticks comes from the urban areas and the cayes
Hardwoods	a. domestic use b. commercial use c. logwood (for fence posts)	a. own land or adjacent vacant parcels b. large estates cleared for farming. Mennonites buy logs from land owners c. Spanish Creek watershed near Lemonal	a. none b. none To fulfil the short term demand, people are tempted to cut logwood within the SCWS. But logwood is rare in the sanctuary, it is more common down stream	Interviewees mentioned low density of hardwoods which makes logging operations inefficient. Logwood: logwood stands are quickly disappearing, trees are cut in every stage (green and dry) while green logwood posts do not last long. The use of fence posts for pastures is more common in the Isabella Bank and Scotland Halfmoon villages. Elsewhere, the majority of the cattle roam free over the properties. Another potential fencepost is made of madre de cacao, which will result in a living fencepost if properly done. The availability of madre de cacao is limited to the Spanish Creek watershed (acc. to one interviewee. Elsewhere in the country, madre de cacao is found in broke ridge, lowland broadleaf areas).

Resource	Use by population in Belize River Valley	Location of source : ecosystem or locality	Need to extract source from SCWS	Notes
Bush meat	a. domestic use b. semi commercial (sale of extra meat to local families) c. commercial extraction (especially for sale outside project area)	For all three categories: Hunting takes place in all habitats, also within protected areas (pers. com. Yahaira Urbina). Riversides were favourite for hunting gibnut, deer in the broken ridge.	Hunting practices take place in all habitats, all over the project area. SCBS does not have exclusive habitats, animals present in the sanctuary are common outside it.	Hunting is a common pastime. It is estimated that more than ## persons living in the target area hunt (Yahaira Urbina, pers. com.). Hunting is done to supplement the diet because people appreciate game meat. Not so much as a necessity to ensure animal protein is part of their diet. The cost of bush meat is higher than the price of chicken. Some people may sell/give part of the meat to friends and families. Only a small group of residents hunt for financial gain. But it was mentioned several times that it are outsiders that hunt large scale. Acc. to Edgar Correa (wildlife officer FD), it becomes more common that game meat is offered in restaurants and lodges on the cayes and along the coast.

2.6.2 Archaeological Sites

Fieldwork in 2004 (Meerman et al., 2004) revealed no archaeological sites. An archaeological site was visited but based on GPS readings, it was situated within the Rio Bravo Conservation and Management Area. Nevertheless, it seems likely that at least minor archaeological sites do exist within the confinements of the SCWS, a fact corroborated by comments from Rancho Dolores inhabitants. But no coordinates are known.

2.6.3 Tourism and Recreation Use

Some tourism activity is present in the project area. A study by Wyman in 2008 concluded that for the CBS, 35 households with a total of 222 persons were involved in this activity. Tourist activity can be separated into the following two groups:

1. Day visits
    a. Tourists who travel by themselves
    b. Tourists that stay elsewhere and come with an organized tour
    c. Cruise ship tourists
2. Overnight stays
    a. Tourists that made their own arrangements
    b. Tourists that made reservations through the CBS website

The tourism infrastructure in the area is rather limited. Accommodation of a few cabanas is available in Bermudian Landing and homestay accommodation that can be arranged through the CBS Women's group. The homestay program has 10 participants in the seven CBS communities (situation 2015). For 45 US $, a couple can stay overnight with the local family, dinner and breakfast is included in the price. The homestay can only be arranged through the CBS. The homestay program is promoted on the CBS website, but no details about the various accommodations, host families, and costs are not available on the site (info retrieved 16 September 2015).

Several persons interviewed mentioned that touroperators/tourguides come with their guests, only to launch their canoes into the river using the launch sites within villages, but leave the village without any spinoff for the local population.

A local entrepreneur, whose family established a multi-functional enterprise (open air restaurant, gift shop, arts and crafts workshop, bath rooms, provide guided walks on the banks of the Belize River) offers the taxi drivers and tour operators a commission, a practice not employed by the CBS Women Group.

Restaurants are almost non-existent, a family operation (Ecolution Tours) in Bermudian Landing provides lunches to cruise ship visitors and passers-by, but it is unclear if they also provide this service on ship free days.

There is no tourist accommodation in Rancho Dolores although there is potential infrastructure available in the buildings and boats from the RDEDG, to offer daytime activities to tourists.

Figure 26 shows the increase of tourists to Belize over the years. Apparent is the sudden surge in visits starting in 2002, this is the result of the increase of cruise ships landing in Belize. For short time, the CBS could attract cruise ship tourists but after 2009, the numbers of visitors dropped. At the same time, cruise lines had developed their own attractions in the country, which were promoted on board of the ships. The CBS is still visited by cruise tourists but the operators negotiated large discounts on the standard admission fee; a local cultural group demonstrating traditional Creole dances is not paid by the operator but is dependent on the tips the tourists will donate (J. Young, pers. com.).

Figure 26. Total visitors to Belize and to CBS (overnight visitors and cruise ship tourists (Lyon, 2013))

Year	Total Visitors to Belize	Total Visitors to CBS	% of Total Visitors
1998	190,238	4,500	2.37%
1999	214,926	4,000	1.86%
2000	253,898	5,000	1.97%
2001	244,072	4,500	1.84%
2002	519,209	6,500	1.25%
2003	795,770	9,000	1.13%
2004	1,082,330	17,000	1.57%
2005	1,036,904	13,000	1.25%
2006	903,239	N/A	N/A
2007	875,551	N/A	N/A
2008	842,378	N/A	N/A
2009	937,466	2,119	0.22%
2010	1,003,503	1,222	0.12%
2011	978,141	4,548	0.46%
2012	917,869	2,156*	N/A

Source: Community Baboon Sanctuary, Belize Tourism Board, Caribbean Tourism Organization

*Total through June 2012

The participation of Rancho Dolores in the tourism industry is virtually non-existent.

A new tourism development is underway on the east bank of the southern lobe of the New River Lagoon. A canal has been dredged where a landing dock is under construction to facilitate the transfer of cruise ship tourists unto boats that will bring them to the Lamanai Archaeological site. The boarding capacity of the dock is 200 people in half and hour (3-4 tour buses), 45 ft. boats with passenger capacity of 50 people can use the canal.

To reach the dock, buses will carry the tourists in 45 minutes from Belize City via Bermudian Landing and Lemonal to the dock. The road to Lemonal is a public road, beyond Lemonal the road leads over private property. It is not clear if the facilities will be open for use by non cruise ship tourists. Neither which entity will maintain the unpaved road between Bermudian Landing and Lemonal. Neither if the villages in the Belize River Valley will be targeted as destination for these tours carrying cruise ship tourists to Lamanai.

2.6.4 Other Economic Use

There is no other direct economic use of the protected area.

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2.6.5 Education Use

The SCWS has been used as a backdrop for environmental education efforts spearheaded by both Programme for Belize and the Community Baboon Sanctuary.

3 Analysis of Conservation Targets and Threats

3.1. Conservation Target

3.1.1. Identification of Conservation Targets

It is difficult to address all conservation issues in order to maintain biodiversity and ecosystem services within any given protected area. It is more effective to focus management activities around Conservation Targets (specific subjects such as an ecosystem or species). Thus Conservation Targets are important for developing, implementing, assessing an adaptive management of protected areas. For the SCWS a total of seven (7) Conservation Targets have been identified. These are summarized in Table 9.

Table 8. The SCWS Conservation Targets summary, justification and ecosystem impact

Conservation Target	Justification	Species, communities or Ecological Systems represented by Conservation Target
Biological connectivity - biological corridor	Habitat fragmentation is a constant threat to biodiversity conservation. The SCWS forms an integral part in providing a biological corridor with PAs in the south and north of the country, contributing directly to the functioning of the Central Belize Biological Corridor. It also provides biological connectivity with other protected areas as viable populations of White-lipped Peccary, Ocellated Turkeys, large cats and deer are reported to exist in the SCWS. It also links the CBS activities through their St. Pauls Bank extension into the LCJCWS.	Keeping biological connectivity will help in maintaining viable wildlife populations that are of conservation concern and or important to local communities. It will also provide for the migration of species from PAs in the south to the north or vice versa.
Watershed Protection	The SCWS serves as the head waters for the Spanish Creek Watershed which is important to serve as a natural flood control mechanism and provides water for domestic	Protection of the watershed will lead indirectly? to the conservation of endangered species such as the Morelet's Crocodile, Hickatee, Black Howler

Conservation Target	Justification	Species, communities or Ecological Systems represented by Conservation Target
	and agricultural use. The watershed also forms an integral part in the livelihoods of people as it provides fish and other aquatic life.	and Spider Monkeys, Agami Heron; plus many other species of flora and fauna of importance to local communities.
Agami Heron (birds in general)	The Agami Heron is considered to be a rare and endangered species and indicator of healthy riparian forests and overall watershed health. It is the flag ship species for the SCWS.	The Agami Heron is commonly sighted along the riparian forest within the SCWS. Its protection will lead to the conservation of riparian forests (highly threatened ecosystem due to agriculture and residential developments) and overall watershed conservation.
Game Species	Villagers have traditionally been harvesting bush meat for subsistence purposes. Within the SCWS and immediate forested areas are known to still have viable populations of large game animals such as White-lipped Peccary, White-tail Deer, Ocellated Turkey, Crested Guan and Great Curassow but these populations are in decline due to hunting pressure and habitat destruction.	Declines in abundance of large game species is symptomatic of hunting pressure and/or habitat fragmentation. Effective protection of large game species will benefit other large mammals such as Jaguar, Puma and Tapir. Decline in game species will lead to an increase in human – predator conflicts.
Fish Communities	Communities have traditionally used fish as a source of protein and consider fishing a regular activity. Target fish stocks are in decline such as Tuba, Base Snook and Tarpon. The extreme dry season of 2015 has lead to stronger than usual extraction of fish and may be interfering with reproductive activities of fish.	Conservation of fish communities will go hand in hand with watershed protection and maintenance of riparian forests which will positively contribute to the overall health of terrestrial and aquatic ecosystems in the SCWS. It will also lead to the protection of bird communities and crocodile populations that depend on Spanish Creek fish resources.
Hickatee	Traditionally harvested by villagers But presently an endangered species throughout its range..	Protection of Hickatee will lead to the conservation and protection of the whole water system and

Conservation Target	Justification	Species, communities or Ecological Systems represented by Conservation Target
	Within the wildlife sanctuary, the species was rarely sighted but it is reportedly more common further downstream in the Freshwater Lagoon Complex, where in recent history there are reports of fishers fishing 5 to 7 individuals in one day but such harvests are very rare nowadays. The Rationalization Exercise of the Belize National Protected Areas System (Wildtracks, 2013) lists Spanish Creek as one of the areas for specific species protection of the Hickatee.	associated riparian forests which will in turn contribute to the overall biological connectivity of the SCWS. It is important to include the community of Lemonal in any effort.
Sustainable Tourism	The SCWS is considered a hot spot for Agami Heron sighting and birding in general. The Spanish Creek is also a water system with a fly fishing potential for Tarpon and other sport fish.	The development of a nature base sustainable tourism in the area will contribute to adding value to nature, providing an incentive for the community to engage in biodiversity conservation: biodiversity conservation as a source of income would be dependent on the existence and healthy status of species. If more community members are employed in the tourism sector, they will become less dependent on the **direct** consumption and use of natural resources

3.1.2. Assessment of Conservation Target Viability

Conservation planning requires the ability to assess the status of conservation targets over time, to enable planners and PA managers to monitor whether management actions are successful in bringing about the desired changes. A Viability Rating System has been used to describe the present status of the SCWS Conservation Targets in section 3.1.1 in a standardized manner allowing comparison over time and between sites.

Conservation target status has been assessed using the viability ranking below.

Viability Ratings (Adapted from TNC 5-S System)	
Very Good	Requires little of no human intervention to maintain conservation targets at an acceptable level (eg. healthy, breeding populations, minimally impacted ecosystems)
Good	May require some human intervention to maintain conservation target at acceptable level (eg. reducing/ preventing hunting pressure)
Fair	Requires human intervention - if unchecked, the conservation target will be seriously degraded
Poor	If allowed to remain in the present status, restoration or preventing local extinction will be impossible

The Conservation Targets Viability Ranking Assessment is presented in Table 10. It represents the best realistic assessment possible based on information provided.

Table 9. The SCWS Conservation Target viability assessment summary.

SCWS Conservation Targets - Indicators for Viability Ranking			
Conservation Target	Current Rating	Goal	Justification for Rating, Goal and Indicator
Biological Connectivity - biological corridor	Very Good	Very Good	**Justification:** Forest cover within the PA and associated riparian forests are contagious with other adjacent protected areas such as the LCJCSW and RBCMA but fragmentation is occurring outside of these areas
			Goal: Very Good. To maintain forest cover and connectivity that facilitates the movement of wildlife.
			Indicators: Forest cover change within the SCWS and its immediate surroundings from year to year. Number and area of deforestation patches.

SCWS Conservation Targets - Indicators for Viability Ranking			
Conservation Target	Current Rating	Goal	Justification for Rating, Goal and Indicator
Watershed Protection	Very Good	Very Good	**Justification:** General forest cover and riparian forest cover is contiguous within the SCWS but becoming fragmented further downstream; no apparent anthropogenic water contaminants within the SCWS
			Goal: Very Good. To maintain healthy forest cover and riparian forests along Spanish Creek and associated water bodies.
			Indicators: Change in forest cover and riparian forest cover from year to year. Number and area of riparian forest clearings from year to year. Water quality parameters

SCWS Conservation Targets - Indicators for Viability Ranking			
Conservation Target	Current Rating	Goal	Justification for Rating, Goal and Indicator
Agami Heron	Very Good	Very Good	**Justification:** An endangered species regarded as flagship species of the PA and population regarded to be viable
			Goal: Very Good: To maintain a viable Agami Heron population in the SCWS
			Indicators: Number of Agami Herons sightings per patrol. Number of active Agami Heron nests recorded per year.

SCWS Conservation Targets - Indicators for Viability Ranking			
Conservation Target	Current Rating	Goal	Justification for Rating, Goal and Indicator
Game Species	Fair	Good	**Justification:** Large groups of White-lipped Peccary are still being recorded within the SCWS and large game animals are frequently sighted but are under pressure from hunting which is believed to be seriously affecting population viability
			Goal: Good. To maintain viable game species population by significantly reducing hunting pressure.
			Indicators: Number and percentage of patrols per year in which hunting evidence is recorded. Species and abundance of wildlife recorded per patrol

SCWS Conservation Targets - Indicators for Viability Ranking			
Conservation Target	Current Rating	Goal	Justification for Rating, Goal and Indicator
Fish Communities	Fair	Good	**Justification:** Due to unregulated fishing, stocks have been reduced significantly where some species such as Tarpon and Tuba are now considered very rare within the Spanish Creek.
			Goal: Good. Traditional fishing has been an integral part of community livelihood but recent market demand has turned into a more unregulated commercial fishing. With increase law enforcement fishing can be regulated allowing for species recovery.
			Indicators: Number of gill nets and fish traps observed per patrol. Monitoring of local fish harvests form community fishers. Number of fishers observed per patrol.

SCWS Conservation Targets - Indicators for Viability Ranking			
Conservation Target	Current Rating	Goal	Justification for Rating, Goal and Indicator
Hickatee	Fair	Good	**Justification:** An endangered species traditionally fished whose abundance is decreasing severely and rarely sighted within the SCWS limits where fishing of more than one individual per day only appears to have been a historical event.
			Goal: Good. Maintain a viable population of Hickatees
			Indicators: Number of turtle traps recorded per patrol. Number of hickatee sightings per patrol. Number of hickatees taken by villagers (size, sex).

SCWS Conservation Targets - Indicators for Viability Ranking			
Conservation Target	Current Rating	Goal	Justification for Rating, Goal and Indicator
Sustainable Tourism	poor	good	**Justification:** The SCWS is considered a good spot for Agami Heron sighting and birding in general. The Spanish Creek has fly fishing potential for Tarpon and other sport fish but fish populations are under pressure due to over fishing.
			Goal: Good. Initiate and maintain a sustainable tourism project in the Rancho Dolores community
			Indicators: Number of tourists visiting (day visits, overnights) per year. Number of villagers employed in the tourism project. Number of tourism establishments (home stays, gift shop, canoe rental, etc...) in the community

3.2. Threats to biodiversity

Understanding the historical, active, and potential threats to Conservation Targets and biodiversity in general is important in order to devise sound conservation and management strategies by PA managers.

A threat analysis was prepared by the Central Belize Corridor-Conservation Action Plan, 2015 and the results are reproduced below.

THREATS	TARGETS					
	Jaguar & Puma	White-lipped Peccary	Savanna & Pine Savanna	Freshwater Ecosystems	Broadleaf Forest	Summary Threat Rating
Clear Cutting	High	Very High	Medium	High	High	Very High
Unsustainable Hunting	Low	Very High	Medium		Medium	High
Illegal Logging					High	Medium
Community Expansion			High		Medium	Medium
Fires			Medium	Low	Medium	Medium
Natural Disasters			Medium		High	Medium
Legal Logging					High	Medium
Lack of Food/Prey	High					Medium
Clearing for Milpa	Medium	High			Low	Medium
Habitat Conversion			High			Medium
Improper Garbage Management				High		Medium
Reduced Water Flow				High		Medium
Agricultural Runoff				High		Medium

Following is a review of the main threats more specifically for within and around the SCWS following the criteria developed by WCS.

Area	Rate the area of the threat (how much of the conservation target area it affects) using the following ranking - each ranking is associated with a score that is incorporated into the analysis	
Proportion of Area Affected Ranking		
Criteria	Score	
Area	4	Will affect throughout >50% of area
	3	Widespread impact, affecting 26 - 50% of the area
	2	Localized impact, affecting 11 - 25% of the area
	1	Very localized impact, affecting 1 - 10% of the area

Severity	Rate the severity of the threat - hoe intense or great the impact is - using the following ranking	
Severity Ranking		
Criteria	Score	
Severity	3	Local eradication of target possible
	2	Substantial effect but local eradication unlikely
	1	Measurable effect on density or distribution
	0	None or positive

Urgency	What is the likelihood of the threat occurring over the next five years? This can be ranked on a scale of:	
Urgency Ranking		
Criteria	Score	
Urgency	3	The threat is occurring now and requires action
	2	The threat could or will happen between 1 - 3 years
	1	The threat could happen between 3 - 10 years
	0	Won't happen in > 10 years

3.2.1. Deforestation

Deforestation is by en large the most important threat to Biodiversity in Belize. Belize has traditionally boasted a healthy forest cover. Around Belize's Independence in 1981, forest cover was at 1.6 million hectares or nearly 75%. By 2005, there still was as much as 1,338,577 ha of forest in Belize (Meerman et all. 2005) and the annual deforestation rate was 0.5%.

Since then, deforestation in Belize appears to have accelerated. It is estimated that between March 24, 2013, and January 30, 2014, a total of 9,290 hectares of Belize's forest have been stripped, putting Belize's forest cover at about 60% in early 2014 (Cherrington, pers. comm.). Much of this deforestation has actually occurred within the Belize River Valley area.

As yet, deforestation within the SCWS is not an issue. But in the general area, the area considered the Central Belize Biological Corridor, deforestation is progressing as a steady pace. See Figures 27 and 28 for a comparison between the 2004 and 2005 situations.

Figure 27. Forest Cover in 2004

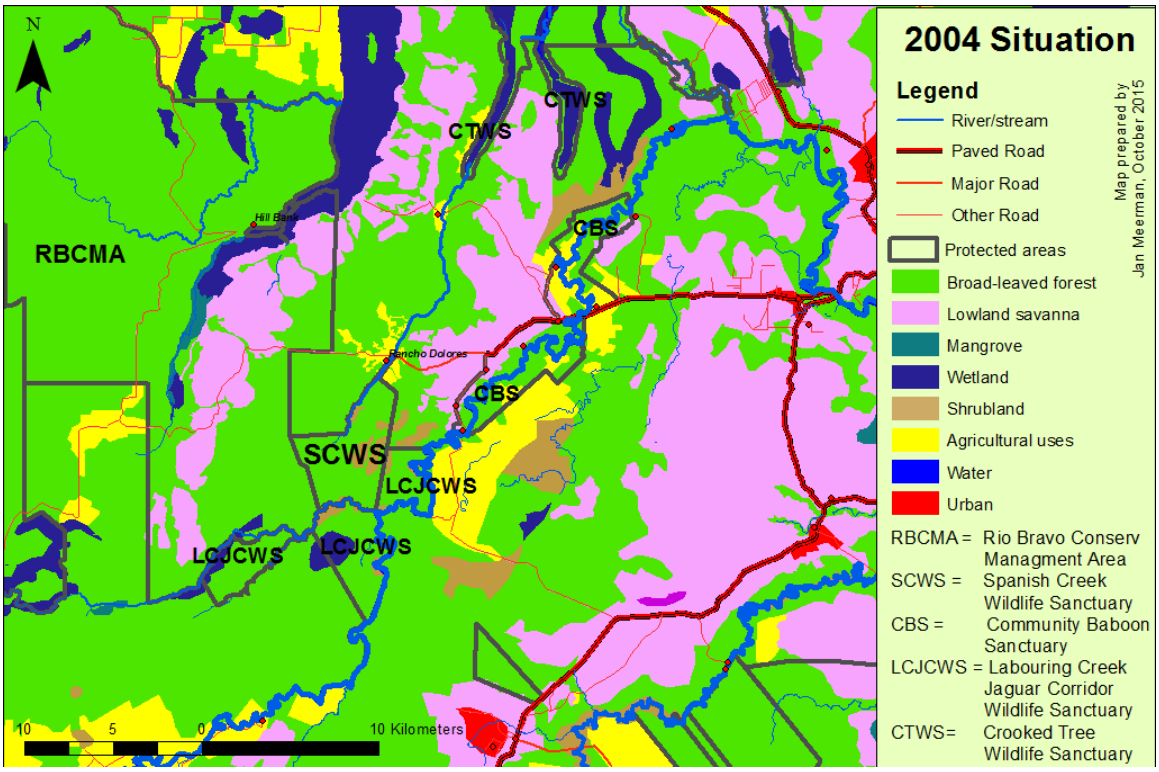
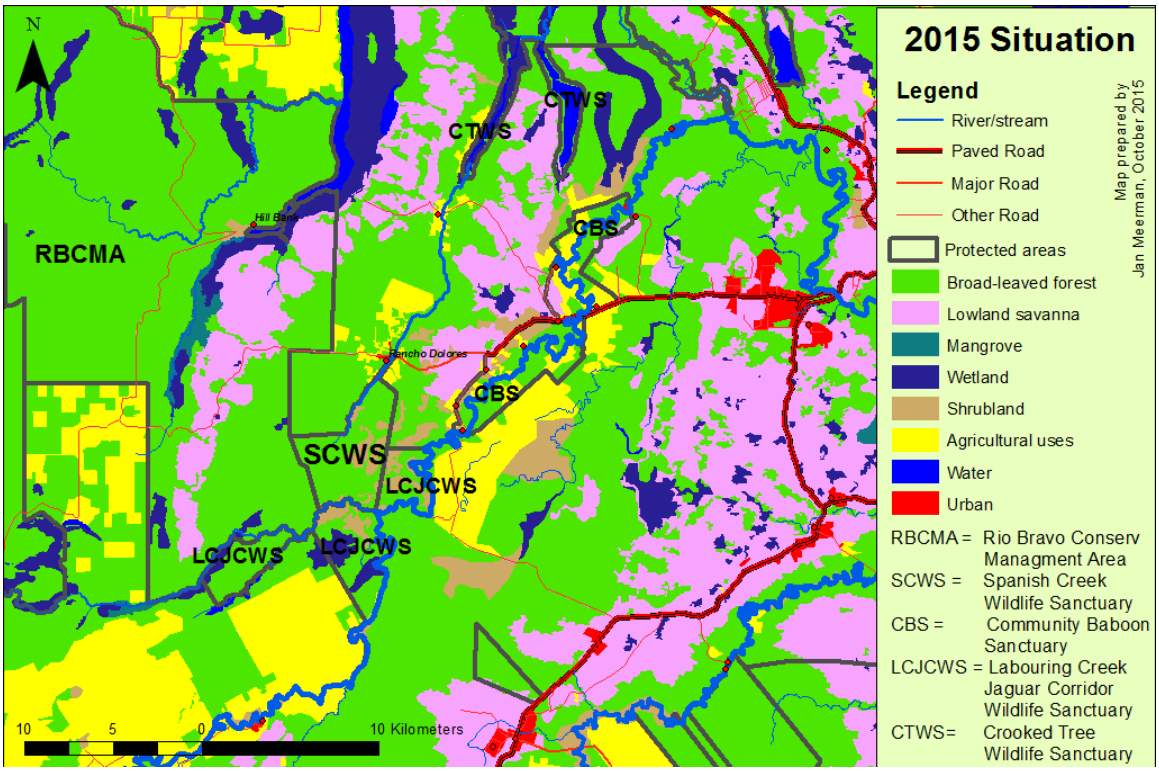


Figure 28. Forest Cover in 2015



Threat: Deforestation/ habitat fragmentation		
Ongoing pressure to convert natural forest systems into cattle pasture, agricultural lands, human settlements and other anthropogenic uses		
Status	Active	
Target	All forested areas (forest types): Anthropogenic deforestation within the SCWS is almost nonexistent but outside the PA it is a threat to all forested areas (broad-leaved forests, riparian forests).	
Source	**Direct**: land holders converting forested areas into other uses **Indirect**: demand for cattle and agricultural products on the international market and enabled by the cattle sweep	
Area	Score = 3	Although deforestation is nonexistent within the SCWS, it is ongoing in the immediate surrounding where large parcels of land are being cleared for cattle ranching and agriculture. This pattern of deforestation will have great negative impacts on watershed protection
Severity	Score = 2	Depletion of wildlife populations within the SCWS is unlikely due to the connection of SCWS to other large PA.
Urgency	Score = 3	Deforestation in the Belize River watershed is ongoing both on a small and large scale
Management Action	Liaison with Ministry of Agriculture and Natural Resources to work with cattle ranchers to implement environmental friendly practices such as sylvopastoral systems and agro-ecological practices. Liaison with DoE enforcement of river reserves, biological corridor principles Declare the biological corridors	

3.2.2. Wildfires

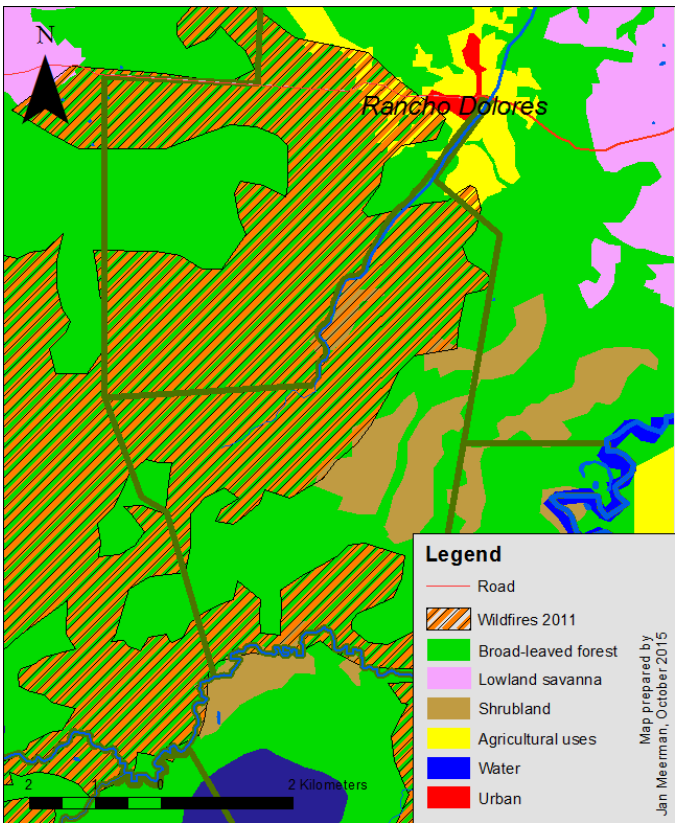


Figure 29. Extent of 2011 Wildfires

Wildfires have proven to be a major issue in the management of the SCWS. Already the 2004 REA (Meerman, 2004) mapped extensive fires in the SCWS, apparently started by hunters attempting to clear river side vegetation in order to access Iguana nesting sites.

After hurricane Richard in 2010, the conditions were ideal for fires, there was much fuel in the form of downed trees and branches, an abundance of Cohune Palms and an unusually dry dry season. As a result, in 2011, extensive wildfires tormented Central Belize and the SCWS was not exempted and large sections of the SCWS burned (Figure 29).

Threat: Wildfires		
Forest fires are common in areas at close proximity to cattle pastures, agricultural lands, deforested areas and hurricane damaged forests.		
Status	Active	
Target	Forested areas around the general area of sanctuary and hurricane damaged forests in SCWS, all forested areas in close proximity to cattle pastures and agricultural lands.	
Source	**Direct:** Land holders clearing forested areas for other land uses **Indirect**: Forests damaged by hurricanes and tropical storms, international demand for cattle and agricultural products, hunting (particularly for iguana's and deer)	
Area	Score = 4	Normally broad-leaved forests are not at risk of forest fires but due to hurricane damage and agricultural development outside of PA, large areas are at risk.
Severity	Score = 2	Fire damaged areas reforest relatively quickly but composition alters dramatically and biodiversity levels drop.
Urgency	Score = 1	Normally broad-leaved forests are not at risk of forest fires but due to hurricane damage and agricultural development outside of PA, some areas are at risk. Also recent drought seasons have been more severe than before
Management Action	Developing early warning systems. Development of fire prevention and fighting unit. Education with farmers and cattle ranchers fire prevention systems. Opening and maintenance of fire lines at wildfire risk areas Training in fire fighting techniques	

3.2.3. Hunting

The BC-CAP Taskforce (2015) mentions that unsustainable hunting scored as a threat for most targets inclusive of freshwater systems, in which unsustainable hunting of the freshwater river turtle, *Dermatemys mawii*, locally known as 'hickatee', was highlighted by stakeholders as a main threat during the overall consultations.:

Threat: Hunting		
Increasing demand for game meat combined with habitat destruction is leading to unsustainable extraction levels of game species.		
Status	Active	
Target	Game species: large and medium size game species such as Paca, Armadillo, White-lipped Peccary, Collared Peccary, Red-brocket Deer, White-tail Deer, Crested Guan, Curassow, Ocellated Turkey	
Source	**Direct:** Hunters from community and surrounding villages and seasonal workers from larger land holdings, lack of enforcement **Indirect**: Lack of economic opportunities, for many people game meat is a an additional source of protein	
Area	Score = 4	Illegal hunting is occurring throughout the area and on neighbouring lands
Severity	Score = 2	Hunting has been on a traditional basis by community members but reports indicate that individuals from other villages are more frequently engaging in hunting for a commercial purpose. Larger game species like White-lipped Peccary are frequent by water bodies thus hunters can target these easier.
Urgency	Score = 3	It is constantly occurring and if not addressed hunters will have major impacts on the abundance of target game species
Management Action	Demarcation of PA boundaries. Erection of 'No Hunting' signs at hot spot areas. Increase patrols in hunting areas. Public awareness on hunting regulations. Monitoring of relative abundance of target species. Zoning of PA for community usage (fishing). Liaison with large landowners to enforce no hunting regulations to their workers.	

3.2.4. Fishing

The CBC-CAP Taskforce (2015) mentions that unsustainable fishing of the freshwater river turtle, *Dermatemys mawii*, locally known as 'hickatee', was highlighted by stakeholders as a main threat during the overall consultations. The Community Baboon Sanctuary Management Plan (Lyon, 2013 states that "In the past 5 years, there has been strong external fishing and hunting pressures on fish, reptiles and wildlife. In particular, there has overexploitation of fisheries in Mussel Creek as well as of hickatee and Morelet's crocodile". Other users have complained about blockage of the Spanish Creek with Seine nets which has led to the virtual disappearance of Tarpon amongst others.

Threat: Fishing		
Occurring throughout the Spanish Creek within and outside of the PA .		
Status	Active	
Target	Fish species and Hickatee	
Source	**Direct:** Fishers from own community and Valley communities plus outsiders **Indirect**: Lack of economic opportunities, for villagers, fish is a major source of protein. No law enforcement. Increased demand for undersized fish to be used as fishfood	
Area	Score = 4	Fishing is occurring throughout the Spanish Creek and associated water bodies.
Severity	Score = 2	Overfishing has lead to the decrease in abundance of target species; many fish species are reported to be rare. Recent severe drought periods have helped in overfishing as fish populations are concentrated in water holes.
Urgency	Score = 3	Fishing is an active threat and requires attention in order to prevent local eradication of target species such as Tuba, Tarpon and Hickatee, all species reported to have become very rare in recent times
Management Action	Demarcation of PA boundaries. Erection of No Fishing signs at hot spot areas. Increase river patrols. Public awareness on fishing regulations and closed season. Zoning of PA for community usage. Liaison with Fisheries Department to enforce fisheries regulations Reclassification to Wildlife Sanctuary II status would allow traditional subsistence fishing depending on a licence system. This appears to be an appropriate reclassication as long as commercialized fishing and fishing by outsiders can be prevented. Also, no netting of any kind should be allowed, only hook and bait.	

3.2.5. Petroleum exploration

The area of SCWS is currently not included in an oil prospecting license, but the contract was held by Parenco until 2013 and before that by Belize Natural Energy. Both companies did exploration within the Sanctuary, the most obvious impact being the creation of seismic survey lines which created access into otherwise remote areas.

Threat: Petroleum exploration		
There are no active oil wells in the area but exploration activities have occurred and most likely will continue due to governments interest in oil exploration and exploitation. No exploration contracts currently exist within the Spanish Creek WS.		
Status	Active	
Target	All terrestrial and aquatic habitats	
Source	**Direct:** Oil exploration concessioners conducting seismic testing and oil drilling; Potential oil spills **Indirect**: Interest of government in oil exploration and exploitation. Market demand and price for petroleum	
Area	Score = 4	Sanctuary is located within an active petroleum exploration zone, as does the other protected areas and private lands around it but oil drilling and seismic testing lines are localized.
Severity	Score = 1	No active petroleum extraction is happening within and or around sanctuary, thus difficult to quantify the impact. But if it does happens, impacts are localized
Urgency	Score = 1	No immediate threat but is potential
Management Action	Liaison with Petroleum Department to have a more proactive planning of where oil exploration is likely to cause the least impact. Develop oil exploration guidelines. Liaison closely with oil exploration companies to assure best practices are followed and compliance with environmental laws. If seismic activities are undertaken, draft specific contracts. For seismic lines within SCWS: EIA needed	

3.2.6. Water pollution

Threat: Water pollution		
Not a major issue at the moment but recent agricultural developments and land clearing outside of PA has the potential of increasing water contamination.		
Status	Active	
Target	Spanish Creek and associated water bodies	
Source	**Direct:** Chemical and fertilizer pollution resulting from agricultural developments; sedimentation resulting from deforestation **Indirect**: use of pesticides and herbicides	
Area	Score = 4	Due to the dynamic nature of running water bodies, pollution spreads rapidly from head waters downstream.
Severity	Score = 1	Not a major issue and there is information on water quality but recent agricultural developments (Santander Group and others) use pesticides and other chemicals by aerial application. Potential eutrification by overland sheetflow in periods of flooding of the Belize River/laboring Creek
Urgency	Score = 1	No immediate threat but is potential
Management Action	Liaison with Agriculture Department to enforce best practices to farmers and cattle ranchers. Liaison with Department of the Environment for environmental law enforcement (water quality testing of the Santander Group plantation) Record any sign of eutrification in the Spanish Creek.	

3.2.7. Natural disasters

Threat: Natural disasters (hurricanes, tropical storms, droughts, floods, fires)		
These are ongoing threats that cannot be prevented but can be prepared for to reduce direct and indirect impacts		
Status	Active	
Target	All terrestrial and aquatic areas: Natural disasters such as hurricanes, tropical storms, droughts and flooding are constant threats to the biodiversity and communities in the area	
Source	**Direct:** Wildlife mortality and injury or damage **Indirect**: Reduced abundance of wildlife species due to habitat modification and displacement Dead bio mass is fire risk for coming years	
Area	Score = 4	When natural disasters happen it impacts the entire area. The side effects can last for years
Severity	Score = 2	Impacts to biodiversity are dependent on the intensity and frequency of natural disasters but most impacts to conservation targets are short to medium term. Natural disasters also impact the social and economical factors of community members which in return impact remaining natural resources.
Urgency	Score = 1	Natural disasters cannot be prevented but you can be prepared; so having a natural disaster management plan is key.
Management Action	Development of natural disaster management plan. Familiarize all stakeholders to natural disaster management plan. Mapping of flooding and fire risk areas.	

It is important to prioritize threats to indicate where financial and human resources need to be focused by managers. Based on the criteria ratings used above, the threat to the identified conservation targets that have the greatest impact are fishing and hunting followed by deforestation (Table 11). Water pollution and petroleum exploration have the least impact based on the present conditions but if not addressed can have severe negative impacts on biodiversity and ecosystem services. For example if the issue with water pollution is not addressed this will impact water quality and reduce the abundance of fish stocks and associated

aquatic life to an almost zero existence if situation is severe. Wildfires may completely change the dynamics and species composition of an area but due to existing ecosystems in the sanctuary (abundant cohune palm), wildfires are of considerable concern and can happen following the passing of hurricanes and tropical storms. This was the case during the dry season of 2011 following the year hurricane Richard devastated central Belize.

Table 10. Ranking of threats to the SCWS conservation targets

Threats	Criteria Rating			Total: Area x Severity x Urgency	Rank
	Area	Severity	Urgency		
Fishing	4	2	3	24	1
Hunting	4	2	3	24	2
Deforestation/habitat fragmentation	3	2	3	18	3
Wildfires	4	2	1	8	4
Natural disasters	4	2	1	8	5
Water pollution	4	1	1	4	6
Petroleum Exploration	4	1	1	4	7

3.3. Strategies to reduce threats

Table 11 presents the strategies and actions to reduce the identified threats to Conservation Targets.

Table 11. Strategies and actions ro reduce threats to Conservation Targets

Strategies and actions to reduce threats	Hunting	Fishing	Deforestation	Wildfires	Natural disasters	Water pollution	Oil Exploration
Strategy: Capacity building and institutional strengthening of the SCWS management ***Actions***: • capacity building of RDEDG BoD; • hiring of protected area manager; • attract volonteers for various tasks and training • establishment of a financial management system;							
Strategy: Become efficient in law enforcement activities within SCWS ***Actions***: • hiring of park wardens and have them trained as special constables; • implement S.M.A.R.T. Patrol systems; • coordinate with FD, PfB and Police Department to conduct strategic patrols, • conduct annual aerial flight with Lighthawk for illegal activity detection, • training and capacity building of PA wardens; • acquisition of appropriate warden equipment							

Strategies and actions to reduce threats	Hunting	Fishing	Deforestation	Wildfires	Natural disasters	Water pollution	Oil Exploration
Strategy: Implement a a watershed management plan for the SCWS ***Actions:*** • participate in national/regional watershed initiatives; • Include Lemonal community in the strategy • identify and map land use activities in and around the PA, • identify and contact land owners within watershed; • public education on watershed protection and management; • Promote environmental friendly land uses, respect for 66ft riverine buffer.							
Strategy: Reduce hunting and fishing within the PA ***Actions***: • control access to the PA (from main road, river landin) • increase patrolling in hunting and fishing hot spots, • build public awareness on objectives of PA, • build public awareness how the community can benefit from the presence of PAs • erect no hunting and fishing signs, • implement permit system for household fishing in the river • eradicate the use of fishing traps and seine nets • demarcate the boundaries of the reserve, • post SCWS signs at appropriate locations							

Strategies and actions to reduce threats	Hunting	Fishing	Deforestation	Wildfires	Natural disasters	Water pollution	Oil Exploration
Strategy: Implement management zones ***Actions***: • implement the proposed management zones for the PA,							
Strategy: Liaise with community members and land owners to implement best land development and management t practices ***Actions***: • liaison with landowners to develop and implement land development maps; • build public awareness on environmental friendly development activities; • include the Lemonal community in • facilitate the implementation of environmental friendly development activities, erosion prevention, respect for 66ft riverine buffers etc.							
Strategy: Expand conservation efforts beyond the boundaries of the sanctuary. ***Actions***: • liaise and coordinate with PfB, CBS, Panthera, FD, Ellenby Property • include the community of Lemonal in conservation efforts (fishing, hickatee) • support the CBS in efforts to link CBS with LCJCWS • extend conservation activities along the entire Spanish Creek, including the Lemonal community in these efforts							

Strategies and actions to reduce threats	Hunting	Fishing	Deforestation	Wildfires	Natural disasters	Water pollution	Oil Exploration
Strategy: Develop and implement eco-tourism activities around and within the PA. ***Actions***: • liaise with Village Council, PfB, BTIA, BTB • prioritize eco-tourism activities for the area, • develop and implement a business and marketing plan; • community beautification projects, • attract birders to the sanctuary, by organizing special birdwatching events for tourguides and high profile birders • organize special birding trips in conjunction with PfB, focusing on both Agami Heron and Yellow-headed Parrots. • improve "visibility" of the community, place proper signage etc. • training and capacity development for villages in tourism related subjects; • develop tourism facilities in PA (trail, camp site).							
Strategy: Strengthening of the position of SCWS within the national protected areas system of Belize ***Actions***: • identify potential conservation partners and NGOs, develop partnership with appropriate conservation partners and NGO, carry out exchange programs with partners • foster collaboration with local, national and regional conservation partners and NGOs							

Strategies and actions to reduce threats	Hunting	Fishing	Deforestation	Wildfires	Natural disasters	Water pollution	Oil Exploration
Strategy**:* Reduce impacts of natural disasters ***Actions: • Identification and mapping of flooding areas; • development of a natural disaster management plan; • fire prevention plan							

3.4. Monitoring of Success of Conservation Targets

Table 12 can be used by the protected area managing authorities to monitor the success of their management actions towards achieving the conservation of the identified conservation targets.

Table 12. Matrix for the monitoring of success of conservation targets

Strategy	Target	What to monitor	How to monitor	Indicator
Capacity building and institutional strengthening of the SCWS management	Co-management organization is capable of conducting day to day management	Monthly reports of PA Manager and wardens	PA situation reports	Hiring of PA manager, volunteer(s). Number of reports.
Become efficient in law enforcement activities within SCWS	To reduce/prevent illegal activities committed in the PA	Illegal activities within the PA	Review of patrol reports Use of S.M.A.R.T[21] Patrol reports	Number of illegal activities committed in the PA
Implement a watershed management plan for the SCWS	RDEDG successful in addressing watershed related issues	Activities within the watershed that have detrimental effect on the creek	Minutes of meetings of RDEDG Participation in National/regional watershed initiatives	Spanish Creek Watershed still functional and free of inpacts

[21] The Spatial Monitoring and Reporting Tool (SMART) is designed to improve overall law enforcement effectiveness in established conservation areas and management zones. SMART enables the collection, storage, communication, and evaluation of data on: patrol efforts (e.g. time spent on patrols, areas visited and distances covered), patrol results (e.g. snares removed, arrests made), and threat levels. When effectively employed to create and sustain information flow between ranger teams, analysts, and conservation managers, the SMART Approach can help to substantially improve protection of wildlife and their habitats.

Strategy	Target	What to monitor	How to monitor	Indicator
Reduce hunting and fishing within the PA	Protect terrestrial and aquatic fauna of the SCWS	Monitor number of patrols to hotspot area.	Patrol reports.	Patrols reporting illegal hunting or fishing.
Implement management zones	Implementation of specific management for identified management zones	Implementation of activities based on management zones	Implementation of management plan activities	Adherence to specific management plans of management zones
Liaise with community members and land owners to implement best land development and management practices	Lessen the negative environmental impact from land development	Meetings with landowners. Stakeholder involvement	Minutes of meetings. PA Manager reports Pledges signed	Number of land owners participating in environmental sustainable development activities
Expand conservation efforts beyond the boundaries of the sanctuary.	Increase connectivity with surrounding PAs, in particular the CBS and LCJCWS	Meetings with relevant stakeholders. .	Minutes of formal and informal meetings.	PA expansion concept note presented to FD. Map of new areas to be included.
Develop and implement eco-tourism activities around and within the PA.	Increased income resulting from tourism activities within the village and the PA	Visitation to area. Tourism related infrastructure Stakeholders involvement	Review of visitors log book. Meetings with stakeholders.	Number of visitors to PA and RD. Trail network development. Tourism related infrastructure, restaurants, licensed guides

Strategy	Target	What to monitor	How to monitor	Indicator
Strengthening of the position of SCWS within the national protected areas system of Belize	Develop working partnerships with recognized national and or international conservation.entities	Meetings with partners. Partnerships documents e-bird reports.	Minutes of meetings with partners.	Increased public exposure and recognisition as expressed in guidebooks and websites Number of partnerships developed.
Reduce impacts of natural disasters	Implementation of a natural disaster management plan.	Effectiveness of disaster management plan.	Minutes of meetings with DMC. Reports of DMC.	Mapping of areas at risk of flooding and fires. Development of a natural disaster management plan. Post-disaster status reports

4 Management and Organizational Background

4.1. Rancho Dolores Environmental and Development Group Background

The Rancho Dolores Environmental and Development Group Ltd. (RDEDG) Is a community based non-profit organization. It is a limited liability company registered and incorporated under the Laws of Belize and registered under the Revised 2000 NGO Act, Chapter 315 of the Laws of Belize.

The **Vision** of the RDEDG is:

> The Rancho Dolores Environmental and Development Group unifies villagers to transform local attitudes towards the sustainable use of the White Water Lagoon and Spanish Creek areas, to improve the quality of life of surrounding communities while preserving natural and cultural heritage.

Equipped with the vision the **Mission** of the RDEDG is:

> The Rancho Dolores Environmental and Development Group is a community based non profit NGO that promotes the conservation of Spanish Creek Wildlife Sanctuary through environmental education, volunteerism and sustainable economic development of Rancho Dolores and surrounding villages.

The RDEDG has a minimal six member Board of Directors (BoD) which is responsible for the overall governance of the organization, which works in a voluntary and unpaid capacity. Major responsibilities for the BoD are:

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

Based on the RDEDG StrategicPplan 2011 - 2014, the NGO has the following strenghts:

- ✓ Core of dedicated Board Members
- ✓ An established sanctuary which the group had co-managed
- ✓ Have a co-management agreement for the management of the SCWS with the Forest Department
- ✓ Internet and cellular connection for effective communication
- ✓ Community support for the RDEDG

- ✓ Basic infrastructure in place (administration office/ visitor center, library, store room and arts and craft center)
- ✓ Support from the Belize Forest Department

The weaknesses/ challenges that the RDEDG faces are:

- ✓ Lack of cohesion among Board Members as it relates to dedication and commitment
- ✓ Weak communication between villagers and with Board Members
- ✓ Weakness in marketing
- ✓ Weakness in proposal writing
- ✓ Financial constraints limiting their management capacity of area

4.2. Review of Previous Management Programs

An assessment of the previous management plan was carried out, based on the 61 success indicators outlined in the same plan (Appendix 1). The basic assessment scale used for the evaluation is as follows:

Rating	Description
Succeeded	The objective was met successfully
Improved	The objective was not completely met, but the situation was improved
No Change	The objective was not met, and there was no change in status
Worse	The objective has not been met, and the status has deteriorated

The management plan evaluation indicated that 34.4% of management was successfully accomplished while more than half of the objectives were not met. Overall 45.9% of the managing objectives were positively impacted by managing authority (Table 13).

Table 13. Percentage success for previous management plan

	Succeeded	Improved	No Change	Worse
Total # of objectives (of 61)	21	7	32	1
% of total # of objectives	34.4 %	11.5%	52.5%	1.6%
% # objectives with positive change	45.9%		NA	
% # objectives with negative change	NA		54.1	

The RDEG was most successful in meeting the management objectives under the Administration and Maintenance Program where 60% of the objectives were successfully met, followed by the Resource Management and Protection Program. On the other hand the RDEG was very weak in the Human Resource and Research, and Monitoring Programs where respectively 77.8% and 72.7% of the programs' objectives were 'not met with no change was observed' (Table 14).

The only program that had an indicator graded as "worse" was in the Infrastructure Development Program, where before the RDEDG have camping platforms within the SCWS and at the present moment these are non-existent as they were destroyed by flooding. No further attempt has been made to reconstruct the camping grounds.

Table 14. Past Management Plan Program Rating

Program	Total # Objectives	Succeeded		Improved		No Change		Worse	
		# Objectives	%	# Objectives	%	# Objectives	%	# Objectives	%
Resource management and protection Program	16	6	38%	3	18%	7	43%	0	0%
Human Use Program	9	1	11%	1	11%	7	77%	0	0%
Infrastructure Development Program	6	3	50%	0	0%	2	33%	1	17%
Community Development Program	9	3	33%	2	22%	4	45%	0	0%
Research and Monitoring Program	11	2	18%	1	9%	8	73%	0	0%
Administration and Maintenance Program	10	6	60%	0	0%	4	40%	0	0%

4.3. Current Management Structure

2015 Board of Directors Rancho Dolores Environmental and Development Group Ltd.

Chairperson:	Mr. Dirk Sutherland
Assistant Chair:	Mrs. Marilyn Lopez
Secretary:	Mrs. Rosalind Joseph
Assistant Secretary:	Mrs. Angie Tucker
Treasurer:	Mr. Ramon Pott
Assistant Treasurer:	Mrs. Carol Sutherland
Counselor:	Miss Lin Smith
Counselor:	Mr. Edwin Sutherland

5 The Management Plan

5.1. Management Goal

Management Goal for the Spanish Creek Wildlife Sanctuary

GOAL

The Spanish Creek Wildlife Sanctuary functions as a key link within the Central Belize Biological Corridor and is recognized within the Selva Maya region for its intrinsic natural and cultural values, whilst contributing to local development, and enhancing and maintaining its ecological integrity.

5.2. Management constraints and limitations

The Rancho Dolores Environmental and Development Group Ltd. has limited management experience and appears to have problems with internal communication and delegation of responsibilities. This is hardly surprising, since, without a budget, there was little need for that. But these short comings will affect any future effort towards a structural management of the SCWS. It is therefore advisable to revisit the leadership structure of the group, possibly attract additional members (broaden the experience base, and include for example members from PfB and CBS) and follow some capacity building training. It needs to be noted that funding for such capacity training is available within the KBA project but requires a formal proposal.

Greatest challenge of all for the management of the SCWS is to create some level of sustainability for the Protected Area. While the PA is unlikely to become completely self-sustainable, it is too important within the Central Belize Biological Corridor to allow it to falter and therefore some level of self-sustainability needs to be created. This can be in the form of creating an interest for the PA. At the moment, there is little knowledge about the PA amongst the general public and therefore little “Love”.

Tourism development is seen as the “magic potion” for creating sustainability and creating an image for the PA. But tourism is a complicated business, requiring constant attention and adaptation to the ever evolving needs and expectations of the international tourist. The example of the nearby Community Baboon Sanctuary is illustrative. In spite of an established international image, international exposure, a distinct and unique tourism package and a geographically favorable location, the CBS has a hard time maintaining a steady tourist flow.

Within this management plan birding tourism has been identified as the most likely option that could start to build a tourism package. The SCWS in itself may be too limited in its options (effectively restricted to the river and with the Agami Heron as its main highlight), so

partnerships need to be created, this can be with the CBS but also with PfB. From the SCWS it is a short drive to the PfB where in a savanna setting there will be opportunities to observe threatened Yellow-headed Parrots, another birding highlight.

5.3. Management Zones

The 2004 REA (Meerman et al., 2004) made some recommendation on potential management zones. At this stage there is no need to change those findings. This zoning plan consists of 2 zones, one being the tourism use zone and the other being the wilderness zone. The tourism use zone is also the area impacted by the fire, and unfortunately the fire damage will affect the appreciation of this zone.

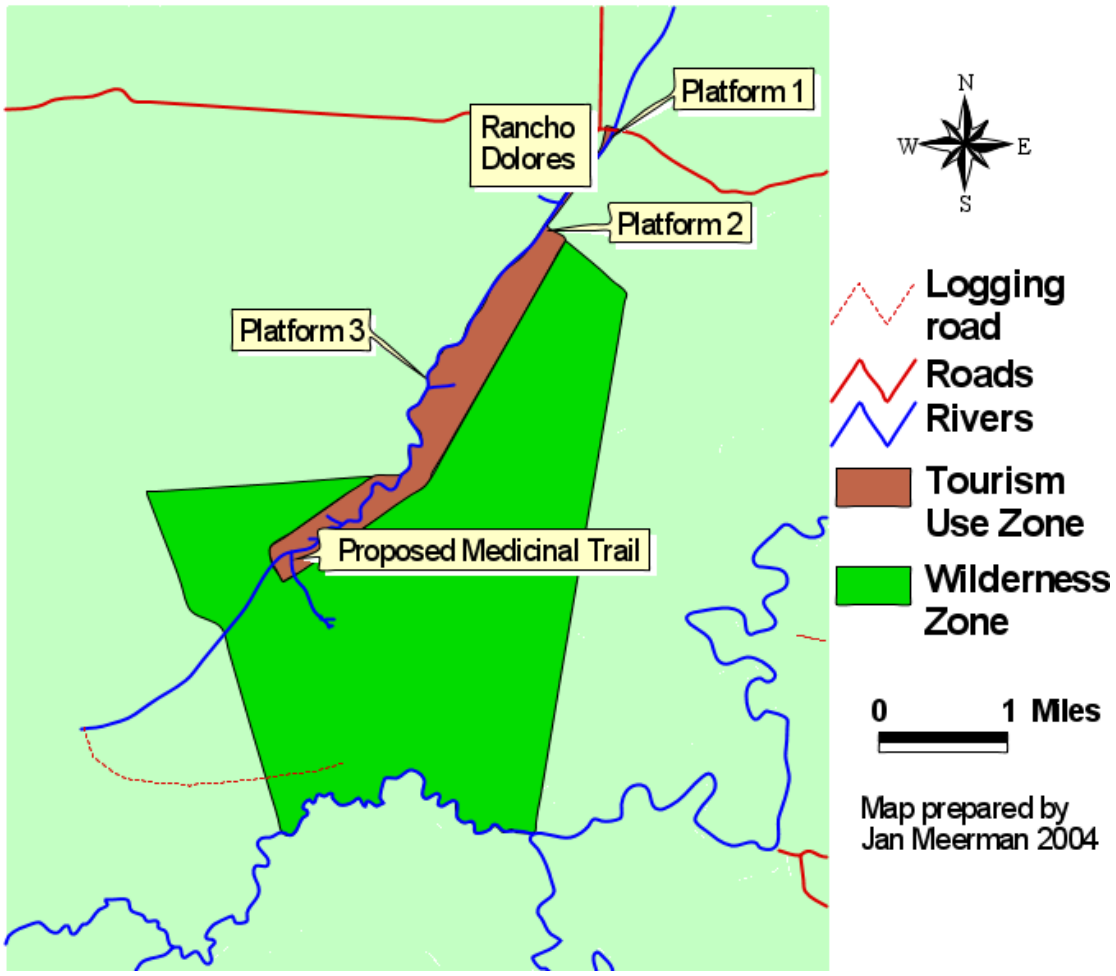


Figure 28. Proposed zonation of the SCWS from the 2004 REA.

The river itself is the principal means of access to the sanctuary, the tourism use zone is therefore more or less decided by default. The tourism use zone used to have camping

platforms (see Fig. 28), but at this stage it is questionable whether these would need to be re-installed..

The Wilderness zone needs to be managed as such. With no infrastructure and as few trails as possible. These are the areas of high importance to wildlife and their survival should not be further threatened by trails that only create easy access to hunters.

The river itself should be a management zone in it self. Important issues here are:

- Crocodiles: These are important tourism assets. Yet, in order to prevent conflicts, their presence near the village should not be encouraged (see section on reptiles).
- Fish: These are an important local resource. The entire river south of the bridge is essentially SCWS and out of bounds for fishing. This will be difficult to enforce, but a local extraction and sports fishing zone could be created for the river north of the 3rd platform.
- Turtles: An attempt should be made to establish whether there is still a viable Hickatee population, and management should be put in place to protect this turtle by establishing a no-take zone and respecting closed seasons.
- An investigation should be made into the importance of sand bars as nesting sites for reptiles and facilitate their protection.

5.4. Limits of Acceptable Change

At the present moment tourism visitation within the SCWS is almost non-existent but has been identified as one of the Key Result Areas in the RDEDG Strategic Plan and also highlighted in this management plan. With increasing visitation comes the potential of increase impacts to the environment, presenting the dilemma of how the PA can generate a sustainable financial tourism income without causing significant damage or deterioration to the resources that attract the tourist. Limits of Acceptable Change is a framework aim to help PA managers take decisions on the amount of change that is acceptable. It considers that change is inevitable once the PA is opened to public use.

Due to the non-existence of tourism related infrastructure in the SCWS, most of the Limits of Acceptable Change Analysis is not applicable but the following was developed as a proactive approach.

Biodiversity Impacts			
Management concerns	Acceptable limits	Monitoring Indicators	Management Actions
Deterioration of trails	No trail deterioration or soil degradation	Number of muddy areas greater than 3 m in length in each trail	Development of trail network base on topography to minimize soil erosion and compaction. Development and implementation of users guidelines. Limit size of tour groups.
		Number of short cuts made by visitors on trails	
		Number of eroded areas longer than 2 m on each trail	
Disturbance of Agami Herons	Absolute no disturbance to Agami Herons	Abundance of Agami Heron Sightings per patrol trip	Establish and enforce minimum distance limits for Agami heron observations especially during nesting.
		Behavioural observations of the heron when observed	
		Abundance of Agami Herons nests per year	
Feeding of wildlife	Absolute no feeding of wildlife	Signs of wildlife feeding along Spanish Creek	Enforcement of no feeding to wildlife regulations. Erection of 'No Feeding of Wildlife' signs
Deterioration of campsites	No deterioration of campsite or river	Area cleared for campsite	Develop and implementation of camping regulations. Monitoring of visitors while at camping sites Inspection of soil conditions at campsite Construct sanitary facilities
		Physical damage to trees within and around campsite	
		Garbage left behind	
		Contamination of campsite with excrements	
		No laundrying in river	
		Soil erosion at campsite grounds	
Disturbance of wildlife	Minimal to no disturbance of wildlife	Abundance of wildlife sightings on trails and campsites	Recording of wildlife sightings on trails and campsites. Implementation of no wildlife
		Number and abundance of	

	endangered species recorded on trails and campsite	disturbance regulations; Enforce absolute no playing of wildlife vocalization recordings within and around SCWS.
	Abundance of degraded habitat species recorded around trails and campsites	

Social Impacts			
Management concerns	Acceptable limits	Monitoring Indicators	Management Actions
Tourist wondering on private properties in and around the community	All tourists need to keep on trails and designated community areas	Frequency of tourist wondering on private properties	Provide clear guidelines before and upon arrival; Tour guides and tour operators enforce regulations.
Inappropriate dressing code and behavior by tourist	All tourist should dress appropriate and avoid use of disrespectful language or behavior	Frequency of tourist dressed in inappropriate clothing Abundance and frequency of tourist showing misbehavior	Provide clear guidelines before and upon arrival; Tour guides and tour operators enforce regulations.
Poor solid waste management	No improper disposal of waste on trials, camping ground and villages	Abundance and quantity of trash collected at trails, campsite and designated tourist areas in community	Enforce no littering policy; Enforce the "pack it out and pack it all in" policy, meaning no trash to be left in area by visitors; Inform tour guides and tour operators about littering policy before they bring tourists to site.
Tourists harassed by villagers	No harassing of tourists at all	Number of complaints by tourists	Provide clear information where tourists can find services, directions etc.

5.5. Management Programs, Strategies and Objectives

Note: Costs have been indicated as relative costs with the following key:

0 – 100 B$ 

100 – 500 B$ 

500 - 1000 B$ 

1000 - 5000 B$ 

5000 – 10,000 B$ 

10,000 – 50,000 B$ 

Since costs can never be estimated with a great deal of confidence and are subject to many variables, it is important to have at least a ballpark idea of what the individual costs of all the management program elements are.

If the total management program could be implemented over the next 5 years, the combined costs would be approximately B$ 320,000.--. Based on the size of the PA, the relatively low level of imminent threats, plus the current management capacity of the co-management agency, it is unlikely that this amount of funding will be realized.

Therefore, the listing below represents a full scale of activities that should be undertaken when sufficient human and financial resources are available. Realizing that this will not always be the case, the most **critical** components of the management programs and strategies are marked in **red**. An attempt was also made to identify management actions that are stand-alone making them potential candidates to attract funding on a project bases; these are identified by underlining.

5.5.1. Institutional Management and Strengthening Program

Governance Development Sub-Program				
Objective 1: By 2016, re-vitalize the RDEDG and develop a governance structure for the SCWS that incorporates the multiple stakeholders within the area and ensures an effective and transparent decision-making structure				
Management Actions	Present Status	Desired Status	Year	People/entities
Improve management capacity of RDEDG	Management capacity of the RDEDG is limited	Improve management capacity of the RDEDG	2016	RDEDG, FD, PACT, APAMO, CBS.
Reclassify the SCWS into a Wildlife Sanctuary II category	Current status does not allow for local fishing	Status will allow for fishing as it is a traditional extractive activity by community members	2016	GOB, FFSD

Financial Management Sub-Program				
Objective 1: Strengthen RDEDG's internal financial processes in order to exhibit sound financial management and to show accountability, transparency and good governance in the financial management of SCWS programs				
Management Actions	Present Status	Desired Status	Year	People/entities
Implement accounting software (such as QuickBooks) to strengthen RDEDG's internal financial management system	RDEDG's accounting is partially out-sourced	RDEDG has an internal financial management system	2016	RDEDG, donor agencies
Prepare and disseminate Annual Reports (including Audited Financial Statements) for RDEDG's operations	Unknown	RDEDG's audited financial statements disseminated annually	2016	RDEDG

5.5.2. Fundraising Program

Fundraising Program				
Objective 1: Develop and institute a fundraising program geared at diversifying SCWS's funding base				
Management Actions	Present Status	Desired Status	Year	People
Prepare grant proposals to support the implementation of SCWS's management programs	Presently grant proposal writing capacity is limited	RDEDG's grant portfolio is expanded and diversified	2016 and beyond	RDEDG, CBS, APAMO, consultants
Identify potential donor agencies and cultivate/strengthen donor relations	Donor portfolio for RDEDG is limited	RDEDG's grant portfolio is expanded and diversified	2008 and beyond	RDEDG

5.5.3. Strategic Networks and Partnerships Program

Strategic Networks and Partnerships Program				
Objective 1: Strengthen collaborative relations with partner organizations, and with local and international NGOs to broaden RDEDG's scope of interaction				
Management Actions	Present Status	Desired Status	Year	People/entities
Institute membership and participation in national, regional and international organizations, to strengthen and support RDEDG's management efforts. CBS and PfB are critical partners.	RDEDG is a member of APAMO. Informal cooperation with CBS and PfB is in place	RDEDG's participation in national and regional networks is expanded and maintained	2016 and on going	RDEDG, CBS, PfB
Objective 2: Facilitate local and regional exchange programs geared at strengthening the SCWS management capacity of RDEDG				
Organize and conduct annual community exchanges (farmers, educators, tour guides/operators)	Presently mostly organized by PfB and CBS	Community exchanges are formalized and conducted annually	Ongoing	RDEDG, PfB, CBS

5.5.4. Administrative Program

General Administration Sub-Program				
Objective 1: Develop an effective management structure				
Management Actions	Present Status	Desired Status	Year	People/entities
Develop an effective management structure for SCWS	RDEDG's management structure is inadequate to address SCWS's management	RDEDG's management structure is strengthened	2016	Part time persons? Volunteer(s)
Hiring of a Protected Areas Manager	No protected areas manager exists	A protected areas manager is hired	2016 and ongoing	
Develop close liaison and co-operation in management efforts with the RBCMA, the LCJCWS and the CBS	Involved in the Central Belize Biological Corridor project	RDEDG's conservation efforts are in line with the management of surrounding PA's	2016 and on going	RDEDG, Panthera, FD, CBS, PfB
Develop partnership agreements with PfB, Panthera, CBS and the Ellenby property for co-ordination of research, education and patrolling activities	RDEDG has informal partnership arrangements with various organizations	RDEDG has partnership agreements with all its neighboring land management agencies	2016 and on going	RDEDG, FD, PfB, Panthera, CBS and the Ellenby property
Objective 2: Maintain baseline administration activities				
Maintain baseline administration activities	RDEDG's headquarters is located in Rancho Dolores	RDEDG maintains a headquarters that provides support to SCWS management	2016 and ongoing	RDEDG
Prepare Annual Work Plans Monitoring and Review Sub-Program)	No medium-term strategic plan or management plan is in place	Annual work plans are based on RDEDG's strategic plan and SCWS's management plan	2016 and ongoing	RDEDG

Staff Recruitment and Retention Sub-Program				
Objective 1: Ensure that SCWS has sufficient qualified staff for effective management and biodiversity conservation, depending on the available budget				
Management Actions	Present Status	Desired Status	Year	People/entities
Conduct a comprehensive staff needs assessment for effective management of the SCWS	RDEDG no staff	There is a clear understanding of the ideal staff composition for RDEDG and SCWS	2016	RDEDG, consultants
Prepare clear and detailed Terms of Reference (job descriptions) for all staff posts and mini-mum qualifications	None	Detailed job descriptions and minimum qualifications for each staff post	2016	RDEDG

Human Resources Management Sub-Program				
Objective 1: Strengthen the management of SCWS's Human Resources in order to ensure that RDEDG has the capacity to effectively implement the SCWS management plan.				
Management Actions	Present Status	Desired Status	Year	People/entities
Conduct a comprehensive training needs assessment (identification of gaps)	A short term training needs assessment has been conducted	There is a comprehensive need assessment for RDEDG	2016	RDEDG, consultants
Institute training for staff in priority needs	No plan in place	Staff engage in training based on the management plan	2016 and ongoing	RDEDG
Assess potential safety and liability issues within SCWS, and ensure safety of visiting researchers, students and staff	Not in place	Visitor safety is one of the top priorities of SCWS management	2016	RDEDG, consultants

Equipment Procurement and maintenance Sub-Program				
Objective 1: Ensure adequate administration infrastructure and planning				
Management Actions	Present Status	Desired Status	Year	People/entities
Develop and implement a five-year infrastructure development plan	Development of SCWS infrastructure taking place in the absence of a plan	New SCWS infrastructure and facilities follow guidelines of the infrastructure development plan	2016	RDEDG, FD, CBS, donor agencies
Develop equipment procurement procedure manual	None	Implementing equipment procurement procedures	2018	RDEDG, Apamo
Maintenance of existing infrastructure and equipment	No budget, no plan	RDEDG HQ is well-equipped and equipment well maintained. Maintenance schedules and reports are updated All maintenance and repairs are documented and receipts filed	2016	RDEDG, FD, donor agencies

Marketing Sub-Program				
Objective 1: Improve the public image of and promote RDEDG and SCWS				
Management Actions	Present Status	Desired Status	Year	People/entities
Raise the international profile of SCWS.	RDEDG is not well known	SCWS is hailed as a model community managed PA	2020	RDEDG
Development of a website for RDEDG and SCWS	Websites are being developed for RDEDG/SCWS	Website upgraded	2016	RDEDG, APAMO, consultants

Marketing Sub-Program				
Objective 1: Improve the public image of and promote RDEDG and SCWS				
Management Actions	Present Status	Desired Status	Year	People/entities
Maintenance of web site	None	Website has up to date content RDEDG is able to maintain the website	2016	RDEDG
Marketing Plan for the SCWS	Outdated business plan exists	Business plan in place	2016	RDEDG, APAMO, consultants
Promote the SCWS as a highly rated birding location	None Only few e-bird reports	SCWS is recognized as a prime site where the Agami Heron can be seen Weekly e-bird reports filed	2016	RDEDG

Monitoring and Review Sub-Program				
Objective 1: Annual review of management activities				
Management Actions	Present Status	Desired Status	Year	People/entities
Review of management effectiveness on annual basis, for submission to Forest Department	Baseline management effectiveness report completed	Improved SCWS management, based on annual management effectiveness reports	2016 and ongoing	RDEDG, consultants
Review of 'Measures of Success' monitoring (linked to Research and Monitoring Sub-Program)	Occasional self-analysis	Annual measures of success analysis using standardized (national) methodology	2016 and ongoing	RDEDG, Monitoring Consultant
Review of research and monitoring activities	Not applicable	Focused research and monitoring, based on management effectiveness	2016 and ongoing	RDEDG, consultants

Monitoring and Review Sub-Program				
Objective 1: Annual review of management activities				
Management Actions	Present Status	Desired Status	Year	People/entities
		evaluation		
Review of education and public awareness activities	Monitoring success is done through 'RARE' methodology	Focused education and public awareness, based on management effectiveness evaluation	2016 and ongoing	RDEDG, consultants
Review of community participation activities	Not applicable	Focused community outreach, based on management effectiveness evaluation	2016 and ongoing	RDEDG, consultants

Objective 2: Periodic review of management plan				
Management Actions	Present Status	Desired Status	Year	People/entities
Ensure monitoring information feeds back into adaptive management planning activities	Not applicable	Updated SCWS Management Plan	Ongoing	RDEDG,
Review Management Plan after 5 years	Not applicable	Management Plan comprehensively reviewed in 2020	2020	RDEDG, consultants
Full management effectiveness assessment for submission to Forest Department at end of 5 years	Baseline management effectiveness report completed	Comprehensive management effectiveness report submitted to FD	2020	RDEDG, consultants

5.5.5. Research and Monitoring Program

Research & Monitoring Sub-Program See also Natural Resource Management Program.				
Objective 1: Fill in knowledge gaps				
Management Actions	**Present Status**	**Desired Status**	**Year**	**People/entities**
Create and implement information management database to contain all research, (biodiversity, water quality etc.) monitoring and socio-economic data, to assist with adaptive management	No effective in-house system for own data and external data scattered	In house data management system links with National Monitoring Institute if and when implemented	2017	RDEDG
Strengthen cross linkages with other organizations involved in research in Belize and the region	Already contacts but no formal mechanism for data exchange	Formalized data exchange protocols	2016 and ongoing	Part of manager task
Develop baseline data for the SCWS through biodiversity surveys and mapping activities.	Abundant data but dispersed throughout Belize and abroad. Only data in BERDS are in standardized format	Complete spread of Geo-referenced biodiversity data	2017	As part of regular patrol and monitoring activities; tourguides; tourist, REA-Consultants
Develop in house skills in database and GIS management	One member of the Board has basic skills	Manager + 1 back up staff have received training in Database and GIS management	2017	Manager + 1 extra staff.
Objective 2: Develop monitoring programs covering conservation targets				
Management Actions	**Present Status**	**Desired Status**	**Year**	**People/entities**
Develop and implement Biodiversity Research Inventory and Monitoring (BRIM) Framework for identified conservation targets in the SCWS	None	BRIM developed and implemented; serving local and national needs	2016	PA Manager and Wardens, researchers

Objective 3: Develop "measures of success" monitoring protocol, to verify success of conservation strategies				
Development and implementation of 'Measures of Success' monitoring program, to verify success of conservation strategies, incorporating limits of acceptable change	None	Annual measures of success analysis using standardized (national) methodology	2017	Manager, Monitoring Consultant
Objective 4: Provide incentives and infrastructure for further research				
Coordinate with Panthera, CBS, PfB for research programs and priorities.	None	Frequent interactions between organizations	2017	Manager CBS, Panthera, PfB
Facilitate research into population structure and densities of key wildlife species including Jaguar, White-lipped Peccary and Hickatee	Cooperation exists, but RDEDG not yet in a position to actively facilitate research	RDEDG successful in attracting researchers / institutions to carry out research into key species; research needs defined	2009	RDEDG, Manager, NGO's, Monitoring Consultant, UB-ERI National Biodiversity Monitoring Institute if and when in pl
Encourage socia-economic research in the Rancho Dolores community and how it impacts the SCWS management and visa versa	None	Partnership with researchers and active research program in the SCWS areas	2016 and beyond	Researchers and research institutions national and international

5.5.6. Natural Resource Management Program

General Biodiversity Management Sub-Program				
Objective 1: Provide the framework for effective biodiversity management of the protected area				
Management Actions	Present Status	Desired Status	Year	People/entities
Patrol the PA	No wardens	Wardens present for day to day management activities	2018	RDEDG, Funders 
Clearly demarcate the boundaries in critical areas	Partly completed	All critical areas identified and boundary demarcated. Note that there is uncertainty whether clearing boundary lines is a good action in all cases	2017	Volunteer work? Wardens when available 
Institute a watershed management approach for the management of the SCWS and surrounding area	Not implemented, idea in place	Functional watershed management approach	2018 and beyond	RDEDG, Belize River Valley Communities 
Implement management zones	No management zones	Management zones identified and implemented	2017 and beyond	Long term project 
Monitor on an annual basis using GIS tools, land use change (deforestation) within the general area	Occasional overflights (Lighthawk), on foot patrols	Annual analysis of land use change using remote sensing methods in combination with overflights and patrols	2017 and beyond	Manager, Monitoring Consultant, National Monitoring Institute if and when in place 

General Biodiversity Management Sub-Program				
Objective 1: Provide the framework for effective biodiversity management of the protected area				
Management Actions	Present Status	Desired Status	Year	People/entities
Integrate research and monitoring results into the adaptive management process	NA	Formalized data exchange protocols, mechanism in place to incorporate results in management	2017 and beyond	Manager
Training of wardens as special constables, in green laws and evidence collection and reporting	None	Wardens are verse with green laws and evidence gathering and reporting	2016 and beyond	RDEDG, Police
Develop and implement enforcement plan	None	Formalized enforcement plan incorporating FD, Fisheries, and Police.	2017	RDEDG, FD, Fisheries, Police
Prioritize enforcement of existing regulations and encourage cooperation of communities towards this objective	Ad hoc	Effective enforcement with support from communities	2016 >	RDEDG, FD, Fisheries Police
Use of Spatial Monitoring and Reporting Tool (S.M.A.R.T.) for protected areas management	Not used	S.M.A.R.T is fully integrated into the law enforcement patrols and used for analyzing effectiveness of management	2016 and beyond	RDEDG
Warden exchange visits with other PA such as YCT and FCD	Minimal staff exchange	Coordinated staff exchange to share experiences	2017 and beyond	RDEDG, other PA managers
Liaise with FD on enforcement issues	Done but not effective	FD active and effective in	2016 and beyond	RDEDG, FD

General Biodiversity Management Sub-Program				
Objective 1: Provide the framework for effective biodiversity management of the protected area				
Management Actions	Present Status	Desired Status	Year	People/entities
		enforcement issues		
Liaise with management bodies of adjacent protected areas towards joined? enforcement	Done but not effective	Active reciprocal involvement in the enforcement in all adjacent protected areas	2016 and beyond	RDEDG, FD, Panthera, CBS, PfB
Develop and implement joined? forces operation manual	Not applicable	Joined? forces operation manual developed and operational	2016 and Beyond	RDEDG, Police Department, Fisheries Department, PfB, Forest Departement
Work closely and effectively with local communities	Some meetings held but not structured	Communities recognize and respect SCWS and its regulations	2016>	RDEDG
Develop and implement a fire management plan; Develop capacity and infrastructure for fire prevention and control	None in place	Fire management plan implemented with infrastructure in place	2016 and beyond	RDEDG, FD, PfB

Species Protection Sub-Program				
Objective 1: Protect native flora and fauna species present within the Spanish Creek Area				
Management Actions	Present Status	Desired Status	Year	People/entities
Collaborate with other national and regional initiatives towards conservation of all species of conservation concern	Actions not coordinated	Effective coordination of all initiatives geared towards the conservation of species of concern	2016 and beyond	RDEDG, FD, Panthera, CBS

Extractive Use Sub-Program				
Objective 1: Maintain commercial species at ecologically and commercially viable levels ***SEE 5.5.6.1 for details.***				
Management Actions	Present Status	Desired Status	Year	People/entities
Understanding of the carrying capacity of wildlife population in the BelRiv area in regards to hunting pressure Understanding the demand for bush meat by customers outside the BelRiv area Formulating measures to safeguard the availability of bushmeat for future generations Increased understanding of the importance of protected areas in regards to the healthy wildlife populations that will allow sustainable hunting practices	No information, Downwards trend of availability	Understanding of the carrying capacity of wildlife population in the BelRiv area in regards to hunting pressure Understanding the demand for bush meat by customers outside the BelRiv area Increased understanding of the importance of protected areas in regards to the healthy wildlife populations that will allow sustainable hunting practices	2016 and beyond	Panthera, UB-ERI National Biodiversity Monitoring Institute 
Monitor fishing activities by residents of Rancho Dolores As under wildlife. See 5.5.6.1. for further details.	Limited monitoring and not coordinated	Database with up-to-date information 1. survey to establish extraction rates 2. discussions with the	2016 and beyond	RDEDG - manager, Fisheries Dept. 

Extractive Use Sub-Program				
Objective 1: Maintain commercial species at ecologically and commercially viable levels ***SEE 5.5.6.1 for details.***				
Management Actions	Present Status	Desired Status	Year	People/entities
		fishing community about measures to safeguard the availability of fish and Hickatee for future generations Wildlife conservation programs within the communities about the function of protected areas in the replenishment of wildlife populations that are hunted		
Reduce user impact	None	Management zoning implemented	2017	RDEDG, FD

5.5.6.1. Increase the availability of natural resources (bush meat) to the local residents and to local outlets (To be conducted in regional context)

Project title	Increase the availability of natural resources (bush meat) to the local residents and to local outlets
Objective	To ensure that future generations Belize River residents can participate in the old tradition of eating bush meat.
Components of the project:	1. survey amongst hunters to record their preys 2. survey amongst customers to define the magnitude of the use of bush meat 3. discussions with the hunting community about measures to safeguard the availability of bush-meat for future generations 4. wildlife conservation programs within the communities about the function of protected areas in the replenishment of wildlife populations that are hunted
Expected outcomes	Understanding of the carrying capacity of wildlife population in the BelRiv area in regards to hunting pressure Understanding the demand for bush meat by customers outside the BelRiv area Formulating measures to safeguard the availability of bushmeat for future generations Increased understanding of the importance of protected areas in regards to the healthy wildlife populations that will allow sustainable hunting practices
Expected impact of the project	The hunting community will have a fair proportional share of game that can be hunted on a sustainable level Game can be harvested in a legal, controlled and sustainable level to satisfy the demand of commercial enterprises Wildlife will be respected and not hunted in protected areas and during closed seasons Livestock depredation will reduce, less human - predator conflicts.
Risks	Current legislation may not allow for the implementation of some of the results and recommendations.

Already in 1994, CBS community members mentioned that the amount of game was declining (Hartup, 1994). This perceived decline may be caused by a number of reasons and combination of causes ranging from habitat destruction, improved mobility of hunters, commercial hunting and/or over-hunting. There exists no knowledge about the actual levels of wildlife and what sustainable levels of harvest would be. This proposed project does not aim to prohibit hunting, but to study the amount of game meat that can be extracted from the area without depleting the source. During their project "Testing methods to reduce livestock predation", members of the UB-ERI and Panthera research group spoke with hunters about hunting practices. Amongst the hunters there was a willingness to share their information about the wildlife they had killed, also the idea of setting quota for hunting wildlife was at first glance received favourable. This UB-ERI and Panthera study indicates the technical and social feasibility for a study such as this.

5.5.6.2. Increase the availability of natural resources (Fish and Aquatic Turtles) to the local residents and to local outlets (To be conducted in regional context)

Much of the game meat extraction is aimed at "Gibnut" (Paca: *Cuniculus paca*), other species are also threatened by excessive hunting/collecting in the past and present. The Hickatee or Central American river turtle (*Dermatemys mawii*) is traditionally consumed in the Belize River Valley around Easter, but recently the meat is also being offered during festivals elsewhere in the country. Hickatee levels have decreased all over the country, only in very secluded rivers and lagoons, viable populations were encountered (Rainwater et. al., 2010). Recently, efforts are being made to rear the Hickatee. In first instance the objectives of these efforts were to study the reproduction cycle of the animals and the development of the young turtles. There are no efforts to rear Hickatees commercially, nor are such plans considered viable at this stage. The best protection of the Hickatee is to protect the breeding grounds, enforce the present legalization, educate the population about the vulnerability of the Hickatee population, and convince the Belize Tourist Board not to promote eating vulnerable game meat. Again, hunting and consuming of Hickatee are not being prohibited completely, but a licensing system should be developed for hotels, lodges, restaurants, which should be enforced. Much of the Hickatee caught in the area will be consumed in other parts of Belize which would make the implementation of a project more problematic due to the outside pressure on the resource.

Local fisheries are equally being threatened by over harvesting with much of the sales outside the project area. Again, complication implementation of any resource management projects due to the outside pressure on the resource.

Green Iguana's (*Iguana iguana*) are locally abundant, but in other places almost depleted. The tradition to harvest eggs or catch gravid females is not sustainable but part of the culture. Iguanas could be part of this project but are less of a priority.

Project title	Increase the availability of natural resources (fish, Hickatee) to the local residents and to local outlets
Objective	To ensure that future generations Belize River residents can participate in the old tradition of eating fish and Hickatee.
Components of the project:	1. survey to establish extraction rates 2. discussions with the fishing community about measures to safeguard the availability of fish and Hickatee for future generations 3. wildlife conservation programs within the communities about the function of protected areas in the replenishment of wildlife populations that are hunted
Expected outcomes	Understanding of the carrying capacity of fish and Hickatee in the BelRiv area in regards to the extraction pressure Understanding the demand for fish and Hickatee by customers outside the BelRiv area Formulating measures to safeguard the availability of fish and Hickatee for future generations Increased understanding of the importance of protected areas in regards to the healthy wildlife populations that will allow sustainable hunting and fishing practices
Expected impact of the project	The fishing community will have a fair proportional share of fish and Hickatee that can be extracted on a sustainable level Fish and Hickatee can be harvested in a legal, controlled and sustainable level to satisfy the demand of commercial enterprises Fish and Hickatee will be respected and not extracted from within protected areas and during closed seasons
Risks	Current legislation may not allow for the implementation of some of the results and recommendations.

Petroleum exploration Sub-Program				
Objective 1: Minimize ecological impact of current and future oil exploration activities				
Management Actions	Present Status	Desired Status	Year	People/entities
Liaise closely with Petroleum Department and DOE regarding the issuing of oil exploration licenses or seismic surveys	Infrequent	Standard procedures for involvement of PA management in the issuing of prospecting licenses.	2016 and beyond	RDEDG, FD, Dept of Petroleum 
Liaise with any petroleum company as to use a best practices approach and prevent impacts on wildlife and general ecology of the overall area		Oil companies have working relationship with RDEDG and allow them to monitor and evaluate activities; monitoring arranged and financed through EIA process	2016 and beyond	RDEDG, FD, Dept of Petroleum. Payment through EIA compliance plan 

5.5.7. Protection and Surveillance Program

Demarcation Sub-Program				
Objective 1: Clearly identify the SCWS as a protected area to prevent incursions based on ignorance				
Management Actions	Present Status	Desired Status	Year	People/entities
Clearly demarcate the boundaries in critical areas NOTE-See Natural Resource Management Program	Partly completed	All critical areas identified and boundary demarcated. Note that there is uncertainty whether clearing boundary lines is a good action in all cases and locations	2017	Volunteer work? 
Patrol the PA Note. As in Natural Resource Management Program	No wardens	Wardens present for day to day management activities	2018	RDEDG, Funders 

Patrolling Sub-Program				
Objective 1: Deter and correct any incursions into the SCWS, and manage and monitor legal activities				
Management Actions	Present Status	Desired Status	Year	People/entities
Create and implement information management database to contain all research, monitoring and socio-economic data, to assist with adaptive patrol management	Not existent	Sufficient hard and software available (S.M.A.R.T.) to start and maintain databases, trained staff and dedicated manager in place	2017	RDEDG, Funding agencies. 
Develop and implement an enforcement plan	Not existent	Enforcement plan developed and implemented	2016 and beyond	RDEDG, FD, Fisheries Dept. APAMO 

Patrolling Sub-Program				
Objective 1: Deter and correct any incursions into the SCWS, and manage and monitor legal activities				
Management Actions	Present Status	Desired Status	Year	People/entities
Use of Spatial Monitoring and Reporting Tool (S.M.A.R.T.) for protected areas management	Not used Note: See Natural Resource Management Program	S.M.A.R.T is fully integrated into the law enforcement patrols and used for analyzing effectiveness of management	2016 and beyond	RDEDG
Formation of an external multi-agency "Surveillance and Enforcement Team" that reacts to serious enforcement issues	First steps taken	Enforcement plan developed and implemented	2017	BDF, Police, FD, Immigration, IoA, RDEDG, PACT, APAMO
Warden exchange visits with other PA such as YCT and FCD	Minimal staff exchange	Coordinated staff exchange to share experiences	2017 and beyond	RDEDG, other PA managers

Fire Management Sub-Program				
Objective 1: Prevent damage to conservation targets as a result from wildfires (either through lightning strike, escaped agricultural fires, campfires and/or arson)				
Management Actions	Present Status	Desired Status	Year	People/entities
Develop and implement fire management plan; develop capacity and infrastructure for fire prevention/control	Non-existent but there are funds available within the KBA project.	Fire management plan implemented with infrastructure in place Staff trained in basic fire fighting techniques	2016 and beyond	RDEDG, FD, CBS, PfB
Institute a community based fire watch and suppression program	Non existent, some villagers have training in natural disaster management. PfB is eager to establish a fire watch relationship	Operational community fire watch program with basic equipment present	2016 >	RDEDG, Rancho Dolores Villagers, PfB, CBS

Develop and implement fire early warning systems	Non existent	Functional early warning fire system	2017 and beyond	RDEDG, Belize River Valley Communities, PfB, CBS

5.5.8. Infrastructure Management Program

Infrastructure Development Sub-Program				
Objective 1: Ensure adequate infrastructure is in place to support SCWS management and carry out protection and scientific monitoring activities				
Management Actions	Present Status	Desired Status	Year	People/entities
Evaluate office and administrative needs to support operational efficiency	None	Office and Administrative needs documented	2016	RDEDG
Develop and implement five year infrastructure development plan	None	Infrastructure development plan in place and implemented	2016	RDEDG, Consultants
Establish hard and software infrastructure in order to be able to maintain an information management database which contain all research, (biodiversity, water quality etc.) monitoring and socio-economic data, to assist with adaptive management	Moderate infrastructure at Rancho Dolores	Sufficient hard and software available to start and maintain databases and trained staff available	2017	RDEDG, Funding agencies.
Development of trail network both for tourism and surveillance patrols	Limited mostly for surveillance purposes	Adequate trail network constructed and mapped both for surveillance and tourism	2016>	RDEDG

Objective 2: Ensure adequate equipment is in place to support SCWS management and carry out enforcement and monitoring activities				
Management Actions	Present Status	Desired Status	Year	People/entities
Improve enforcement equipment and capabilities	Basic equipment	Communication structure in place, tested and functional.	2016 and beyond	RDEDG, FD, CBS, Police
Equip and maintain staff, surveillance, research, education and accommodation facilities	Basic infrastructure present	Seamless "catering" mechanism in place	2016 > ongoing	RDEDG
Provide sufficient first aid materials and emergency rescue materials at key points within the management area	Limited infrastructure	Main office equipped with appropriate first aid and rescue materials + trained staff	2016 and beyond	RDEDG
Maintain an efficient inventory of equipment and supplies	Present	Efficient inventory of equipment and supplies in place and maintained	2016 and beyond	RDEDG
Obtain and maintain adequate transportation means for enforcement and monitoring	1 Boat, 1 4WD ATV, 4 Canoes	Transportation infrastructure in synch with needs assessment	2016 and beyond	RDEDG

Infrastructure Use Training Sub-Program				
Objective 1: Ensure that SCWS staff are adequately trained to operate and maintain SCWS infrastructure and facilities				
Management Actions	Present Status	Desired Status	Year	People/entities
Develop in house skills in database and GIS management See also Administrative Program	One staff member has basic skills	Data-manager + 1 back up staff have received training in Database and GIS	2016 - 2017	Manager + 1 extra staff.; Training
Develop in house skills in S.M.A.R.T. See also Protection and surveillance progframme	No skills available	Data-manager + 1 back up staff have received training in Database and GIS	2016	Manager + 1 extra staff.; Training
Provide first aid and Jungle Rescue training	Basic skills present	Members trained in jungle rescue and first aid; CBS rescue team is in place	2016 and beyond	RDEDG, Tour Guide Ass., Caves Branch
Provide training in law enforcement patrolling tactics	Minimal	RDEDG law enforcement team trained in patrolling tactics	2016 and beyond	RDEDG, Police Department, Forest Departement

5.5.9. Public Use Program

Public Use Sub-Program				
Objective 1: To increase tourism, research and education activity within the SCWS and to achieve some level of economic sustainability through expansion of tourism and research that is compatible with biodiversity conservation				
Management Actions	Present Status	Desired Status	Year	People/entities
Develop and implement a five-year tourism development plan	None	Tourism Development Plan designed and ready to be implemented (educational research area, low impact, no garbage regulations etc)	2016	RDEDG, Consulting team
Increase signage within the Belize River Valley. See also 5.6.7.1.	Inconsistent	Tourists (national and international) have no problem finding SCWS or other destinations	2016	RDEDG, CBS, KBA, BTB, BTIA.
Evaluate options and finalize the decision on the location of facilities and infrastructure associated with education and research	Ongoing though not within the frame of a development plan	Tourism Development Plan designed and ready to be implemented	2017	RDEDG, Consulting team
Continue training of licensed tour guides and aspirants	Some licensed tour guide live in RD	Choice of trained tourguides present within the community	2016 - 2017	RDEDG, BTB
Liaise with BTB, BTIA and Tour Guide Associations to promote SCWS as a tourism destination	Limited initiative	Public Use Infrastructure designed and ready to implement	2017 and beyond	RDEDG

Public Use Sub-Program				
Objective 1: To increase tourism, research and education activity within the SCWS and to achieve some level of economic sustainability through expansion of tourism and research that is compatible with biodiversity conservation				
Management Actions	Present Status	Desired Status	Year	People/entities
Establish and enforce low-impact, no-garbage and other visitor regulations	Not applicable	Low-impact, no-garbage regulation developed and enforced	2017 and beyond	RDEDG
Provide sufficient first aid materials and emergency rescue materials	Limited infrastructure	Main office equipped with appropriate first aid and rescue materials + trained staff	2016 and beyond	RDEDG
Creation and maintenance of trails and ensure proper signage	Under development	Trail network designed based on zonation plan and local topography and in place including proper signage	2018 and beyond	RDEDG, FD

5.5.9.1. Improve exposure of the villages

The BelRiv area is blessed with good access but may be difficult to navigate for tourists and other visitors from outside the area. Some signposting is available, but could be expanded on.

Project title	Stop hiding the Belize River Valley
Objective	Increase the visibility of the BelRiv area to tourists who travel with their own or public transport
Components of project:	Signage along the George Price and Philip Goldson Highways, and the Burrel Boom road to indicate directions into the BelRiv area Signage along the main road to indicate the turn offs to the various villages Signage at the entrances of the residential areas of the villages, indicating the name of the village Maps of the villages indicating shops, attractions, activities etc. Signage in the villages indicating where certain facilities are available Built bus stops at strategic point, take an example in the bus stop at the Flowers bank-main road junction
Expected outcomes	Tourists and other visitors are able to find what they are looking for and can make well informed decisions where to go
Expected impact of the project	Remote villages and out of the way facilities are easier to find and have a better change to benefit from tourism
Risks	Signage needs maintenance

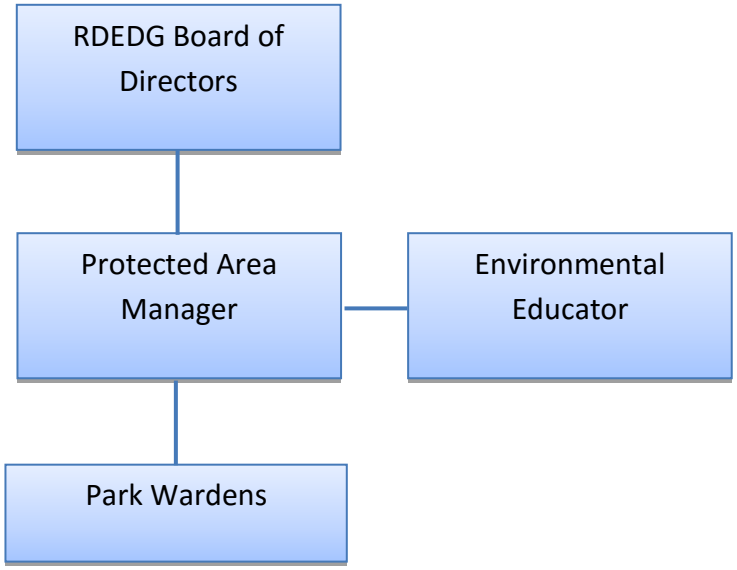
5.5.10. Community Development and Environmental Education Program

Community Development and Outreach Subprogram				
Objective 1: By 2019, at least 2 communities representing buffering communities of the SCWS are involved in conservation and sustainable livelihood activities				
Management Actions	Present Status	Desired Status	Year	People/entities
Develop community development action plan	None in place	Community development action plan developed and implemented in Lemonal and St. Pauls	2017 and beyond	RDEDG, Rancho Dolores, Ministry of Rural Development
Carry out field trips that provide a first hand experience of conservation activities within the SCWS and other core areas	Minimal, few school visits	Active community and school visitation program	2016 and beyond	RDEDG
Conduct adult outreach programming	Community meetings but not coordinated	Developed and implemented community outreach program	2016 and beyond	RDEDG

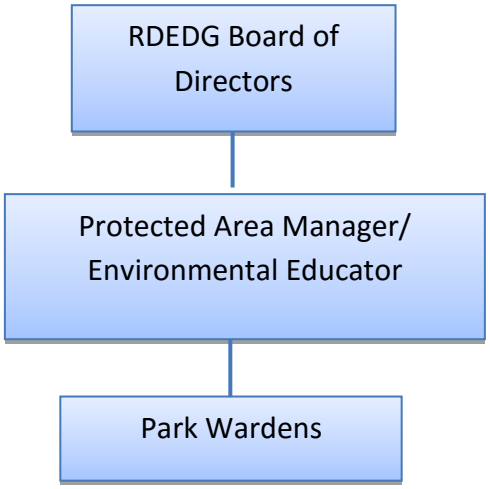
Environmental Education Sub-Program				
Objective 1: By 2019, 75% of the inhabitants of the 9 target communities will know that the SCWS performs valuable environmental functions.				
Management Actions	Present Status	Desired Status	Year	People/entities
Community consultations via surveys and focal group meetings	No coordinated community consultation	Community consultation processed, developed and implemented	2016 and beyond	RDEDG
Hiring of environmental educator	No official post	Environmental educator hired and maintained	2016	RDEDG
Develop environmental education (EE) outreach plan	Not available	Environmental education action plan developed and implemented	2016 and beyond	RDEDG, Environmental Educator
School visits to SCWS	Minimal at the moment	Increased school visitation to SCWS	2016 and beyond	RDEDG, Ministry of Education
Production of EE materials	Minimal material	EE material developed and distributed	2016 and beyond	RDEDG
Design key environmental awareness messages and conduct non-informal education	Concepts but not formalized	Environmental awareness plan implemented	2016 and beyond	RDEDG

5.6. Recommended Management Structure

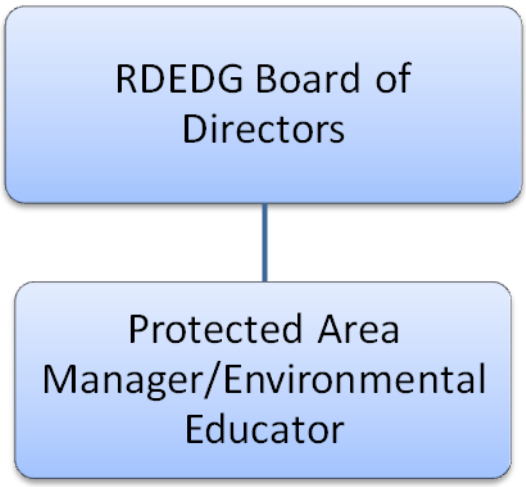
The following is an idealized management structure in case of a maximum human and financial resource. Several variants on this structure will be discussed that will identify potential structures based on varied funding scenarios.



Conceivably, the functions of the protected area manager and the environmental educator could be merged into one:



And clearly the number of Park Wardens can be flexible. The size of the SCWS warrants a maximum of 4 wardens that would operate in pairs and in shifts. In the case of truly minimal resources even these park wardens are dispensable:



In the latter case, the protected area manager will totally rely on Police, Fisheries Department and Forest Department for any enforcement activity, but nevertheless, there will be a form of management that ensures that contacts with the Forest Department, Fisheries Department and Police Department, as well as with NGO partners are being maintained, that there is a line communication in case of incursions or calamities, that funding opportunities can be pursued, etc.

The functions of the various positions are summarized in Table 15. This table is indicative only.

Table 15. Management Functions and Tasks

Position	Responsibilities/ Duties
RDEDG Board of Directors	• Oversee and guide all activities. This board already exists, but a review of membership and duties is recommended. Ideally the board memberships base should be expanded (and include members of CBS and PfB) and be chaired by someone that has both the capacity and the availability to direct the board. Individual tasks should be clearly defined.
Protected Area Manager	• Oversees daily management of SCWS • Daily supervision of park wardens • Organize, oversee and support contractors and or consultants • Authorized staff payments and other expenses • Manage financial resources of RDEDG • Oversee field and transportation equipment proper usage and maintenance. • Execution of project activities as related to SCWS management • Design patrol surveillance routes • Analyze patrol data on S.M.A.R.T. • Develop adaptive management actions base on patrol results and environmental conditions • Oversee monitoring of conservation target threats • Develop action plans for project execution • Development and oversee enforcement of users regulations • Liaison with Forest Department, Fisheries Department and Police Department to improve law enforcement • Develop and foster partnership and working relationship with other national, regional and international organizations • Coordinate community fire prevention and suppression unit meetings and activities

	• Coordinate joint enforcement surveillance patrols • Preparation of annual reports • Prepare project proposals • Reporting to Donors • Develop partnership agreements • Identify and foster funding sources • Coordinate special activities such as AGM
Environmental Educator	• Environmental Education Action Plan execution • Coordinate school and community visits to the SCWS • Develop environmental education material • Conduct environmental education presentation in schools and communities • Design signs to be place in community and the SCWS • Conduct environmental awareness surveys • Promote the importance of the SCWS by conducting presentations to key stakeholders • Public outreach of environmental laws • Develop trail interpretive material Note that this role can be assumed by the Protected Area Manager
Park Wardens	• Demarcation of the SCWS boundaries • Conduct surveillance patrols • Prepare reports of surveillance activities • Enforce regulations • Development and maintenance of trails and campsites • Collect biodiversity data • Conduct biodiversity surveys based on conservation targets • Monitor visitors activities will in the SCWS • Assist researchers in the field

5.7. Monitoring and Review

The following monitoring and review process is presented as the mechanism for tracking progress of the management plan's implementation and ensuring compliance with assigned responsibilities within the management plan. The process includes the following steps:

- The SCWS Manager, RDEDG Environmental Educator and Board Chairperson collect monthly updated individual objective summary/status reports (see Annex 1) from responsible employees, members, volunteers (including Board of Directors) and consultants.
- The PA Manager ensures that all objectives have been accounted for.
- The PA Manager, based on consultation and in coordination with the Chairperson and any Program Manager(s), makes note of unfinished objectives (shortfalls), needs for readjustments of outcomes and target dates (reforecasts), meetings to be called, etc., on a bi-monthly basis.
- Based on program managers' reports, the PA Manager documents progress of strategic plan implementation in a brief inter-organizational memorandum on a quarterly basis to all management plan participants. Also a shortened non-detailed version should be included in the organizational newsletter.
- Review of management plan implementation should be a regular agenda item at staff and Board meetings.
- The management plan is to be generally monitored through quarterly meetings with the Forest Department, internal planning sessions and a mid-term evaluation.
- Progress of management plan implementation is to be evaluated annually by the Board. Such evaluation may be facilitated by external consultants.

The management plan is a living document and the RDEDG needs to constantly review its management actions through the development of annual operation plans and engage in adaptive management. The table below (Table16) is a matrix that can be easlily used by the RDEDG to monitor the progress of their management by comparing the present status against the desired outcomes (desired status) of the outlined management actions. To be more effective the matrix needs to be developed following the program and sub-program management actions layout. This will allow identifying strong and weak management programs, and thus focusing resources into the right areas.

Table 16. Example of monitoring and evaluation matrix to assess management plan implementation progress

Management actions implementation tracking							
Management Action	**Present Status**	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Yr 5**	**Desired outcome**
Develop an effective management structure for SCWS	RDEDG's management structure is inadequate to address SCWS's management constraints and limitations						RDEDG's management structure is strengthened
Hiring of a Protected Areas Manager	No protected areas manager exists						A protected areas manager is hired
Develop close liaison and co-operation in management efforts with the Rio Bravo Conservation Area, the Labouring Creek Jaguar Corridor Wildlife Sanctuary and the CBS	Involved in the Central Belize Biological Corridor project						RDEDG's conservation efforts are in line with the management of surrounding PA's
Develop partnership agreements with PfB, Panthera, CBS and the Ellenby property for co-ordination of research, education and patrolling activities	RDEDG has informal partnership arrangements with various						RDEDG has partnership agreements with all its neighboring land management agencies

Management actions implementation tracking							
Management Action	**Present Status**	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Yr 5**	**Desired outcome**
Maintain baseline administration activities	RDEDG's headquarters is located in Rancho Dolores						RDEDG maintains a suitable headquarters that provides support to SCWS management
Prepare Annual Work Plans (linked to Monitoring and Review Sub-Program)	Annual work plans are prepared, but no medium-term strategic plan or management plan is in place						Annual work plans are based on RDEDG's strategic plan and SCWS's management plan

5.8. Timeline-Activity Schedule

To be effective and efficient in the management of the SCW it is important to set timeframes for conducting strategic actions. The strategic management actions are those previously identified in Section 3.3 Strategies to Reduce Threats, which are umbrella like and aim to achieve the SCWS conservation goals. Table 17 presents the timeframe necessary to achieve management strategies. It is important to keep in mind that the management plan is a living document and thus leads to adaptive management. Thus the time frame of some of the management strategies may change based on present or future circumstances.

Table 17. Timeline by year for the implementation of management strategies in section 3.3. to reduce threats

Strategies for management	Year of Implementation				
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Capacity building and institutional strengthening of the SCWS management					
Become efficient in law enforcement activities within SCWS					
Implement a watershed management approach to the PA.					
Reduce hunting and fishing within the PA					
Create and implement management zones					
Liaison with land owners to implement best development practices					
Expand conservation efforts beyond the boundaries of the sanctuary.					
Develop and implement eco-tourism activities around and within the PA.					
Liaison with the Department of Agriculture and Rural Development for the implementation of agroecological practices.					
Foster the implementation of alterative livelihoods					
Foster collaboration with local, national and regional conservation partners and NGOs					
Implementation of natural disaster management plan					

The timeline for the implementation of all management actions for each management program is integrated in Chapters 5.5.1 to 5.5.10.

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7 Appendices

7.1. Appendix 1: Measures of success

The following table summarizes the measure of success/ accomplishment made by the RDEDG on the management of the SCWS since the 2003 management plan (thus covering the period 2004-2015.

RESOURCE MANAGEMENT AND PROTECTION PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
1) Hiring of a manager		**X**			Past coordinators mostly on a volunteer basis; for a period of one year through funding from PACT there was a manager until June of 2015, at the moment the Board of Directors of Rancho Dolores Environmental Company Ltd. is effectively in charge of the overall sanctuary management
2) Hiring of two wardens		**X**			For much of the Sanctuary history, wardens have been on and off active and often on a volunteer basis. A grant from PACT provided funds for two paid wardens for a year, project ended in June 2015.
3) Liaise with law enforcement agencies	**X**				Mostly with the Belize Forest Department. Many times when the FD is informed of illegal activities in the area, no response is received. When FD visits the sanctuary it is mostly during the dry season, and these visits are mostly brief. FD gives positive feedback to organization based on their management practices. RDEDG has a good relationship

RESOURCE MANAGEMENT AND PROTECTION PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
					with PfB where they venture in outreach with schools, invited for workshops and field visits to PfB. With community there were summer camps for children and provided some trainings community members.
4) Developed an environmental outreach program			**X**		mainly for community due to timing, conducted only during three occasions, school kids visit the site occasional; no formal educational plan developed.
5) Develop an emergency plan			**X**		no emergency plan developed for park but there exists a community emergency action plan for natural disasters (Hurricanes, floods); most members are trained as first aid responders and for natural disaster response. The RDEC and villagers are more concerned with high flooding events after hurricanes and takes even months to water level go normal and this leads biting insect outbreaks (mosquitoes, sand flies, bottle-ass)
6) Establish a communication system		**X**			had base radio but not operational at the moment. There is good cellphone coverage (Digicell and SMART) in village and within the sanctuary. Since Digicell built a repeating tower at Bermudian Landing Smart signal has been weak. PfB has a fix line phone for communication if needed to be

RESOURCE MANAGEMENT AND PROTECTION PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
					contacted by RDEC, they also have radios
7) Collaborate with surrounding agencies	**X**				work with FD, PfB, local community government; have consultation with the Belize Central Corridor initiative, Jaguar Corridor but not much activities shared
8) Maintenance of boundary lines	**X**				lines are kept open, last opened in 2014 so are noticeable in environment; signs were erected along river boundary but not on terrestrial border with PfB and Jaguar Corridor. Group recommends that boundary lines need reopening so to prevent overgrowing
9) Develop protocol for research			**X**		there is the existence of no research framework or protocol, although some research has been conducted on the area by third parties. For example thesis work by students from ECOUR and Universite de Sherbrooke, a copy of that work is in library; the student came through APAMO communications
10) Conduct regular patrols	**X**				for a year had 4 wardens doing patrols, then volunteers do from time to time, BoD do patrols; patrols objectives are to detect poaching (fishing), campers doing illegal activities such as littering

RESOURCE MANAGEMENT AND PROTECTION PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
					and feeding of wild animals. Even though wardens are special constable, they can not arrest, so they need the support of the police, venture the group finds very difficult to coordinate. Wardens not armed; poachers come for 3 or more days so they can be detained by setting check points;
11) Annual aerial surveys			**X**		some have flown area but once not routine just to observe the habitat
12) Base line study for flora and fauna	**X**				yes and REA has been done
13) Research priority list			**X**		none existent, priority list as identified by RDEC: maya mounds, Agami heron (birds), Spider Monkeys, Medicinal plants, why study these: birds = due to high diversity for birdwatchers, to learn behavior of Agami Heron, marketing of site as birding zone, stress importance of site as KBA, for environmental education objectives
14) Demarcate boundary	**X**				Yes, has been done
15) Fire fighting equipment			**X**		no equipment was acquired

RESOURCE MANAGEMENT AND PROTECTION PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
16) Develop a fire fighting plan			**X**		None
Sub-total	6	3	7	0	
Percent	37.5%	18.7%	43.8%	0%	

HUMAN USE PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
1) Develop safety guidelines			**X**		not aware of any in existence
2) Develop trail interpretative materials			**X**		there was a concept to develop trails but this was not accomplished so no interpretive material was produced however there was the production of a sanctuary flier and brochure.
3) Promote marketing program			**X**		there was no marketing for area. The once museum is now a store room. The group however had a website and fliers developed. BTB has a recently developed ideas for valley communities tourism

HUMAN USE PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
					projects and RDEC wants to capitalized on initiative for marketing
4) Liaise with BTB tour companies and tour operators			**X**		There was no attempt to do this. The Community Baboon Sanctuary has Rancho Dolores as a destination.
5) Investigate vendor concessions			**X**		none
6) Production of park trail map			**X**		None
7) construct and erect signage	**X**				a few signs indicating rout to SCWS, one by river, many have dropped
8) Develop trash removal plan			**X**		
9) Explore other recreational opportunities		**X**			small maya mounds, crocodile night spotting, fly fishing but all activities have not received visitors nor has there been adequate marketing
Sub-total	1	1	7	0	
Percent	11.1%	11.1%	77.8%	0%	

INFASTRUCTURE DEVELOPMENT PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
1) Renovation of office quarters	**X**				yes, office space has been improved, paining of buildings and maintenance of compound.
2) Construction of an education centre	**X**				yes, office serves as education centre
3) Construction of 5 trails			**X**		None
4) Establish picnic area			**X**		None
5) Establishment of camping grounds				**X**	NO, there were 4 platforms but flood destroyed them, not constructed any more
6) Obtain canoes	**X**				4 canoes, have a skiff with a 15 Hp outboard engine and an ATV
Sub-total	3	0	2	1	
Percent	50%	0%	33.3%	16.7%	

COMMUNITY DEVELOPMENT PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
1) Hire locals for casual labour	**X**				locals were active but mostly as volunteers some get stipend when funds available

COMMUNITY DEVELOPMENT PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
2) Regular meeting	**X**				constant meetings are held to discuss way forward for group in terms of management of sanctuary but funds are a limiting factor. Some BoD members say to many meetings are held.
3) Village day			**X**		None
4) Train tour guides	**X**				yes, about 6 licensed bird and tour guides, but guides go to city to guide with cruise ship industry, PfB willing to help in birding training
5) Explore concession related activities			**X**		None
6) Promote bed and breakfast			**X**		had idea but not active, willing to revive program; 2 to 3 pax per participating family
7) Develop community beautification program			**X**		No attempt made
8) Develop community outreach program		**X**			some activities for community outreach such as school visits but no plan was developed.
9) Promote arts and		**X**			initially promoted although

COMMUNITY DEVELOPMENT PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
craft					artisans are found in village and the once museum building serves as the artisan centre to do and showcase work in case visitors arrive
Sub-total	3	2	4	0	
Percent	33.3%	22.2%	44.5%	0%	

RESEARCH AND MONITORING					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
1) Produced list of perceived biological gaps			**X**		No such activity has been done. RDEG suggests the study of insect diversity for functions in environment
2) Conduct vegetation and floristic survey	**X**				most has been done through REA
3) Maintain faunal observation records			**X**		not kept, just bird listing from Peter Herrera, available on ebird
4) Faunal inventory		**X**			some (birds, plants) mainly from REA conducted
5) Developed annual bird count			**X**		NONE
6) Conduct hydrological monitoring of			**X**		anecdotal observations on water levels especially of

RESEARCH AND MONITORING					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
Spanish Creek					flooding regains
7) Liaise with meteorology department and conduct meteorological monitoring in Rancho Dolores			**X**		None
8) Coordinate with the institute of archaeology on Maya site research			**X**		NO, no study conducted, villagers know of their existence
9) Conduct sociological survey			**X**		None
10) Establish a resource library	**X**				Yes but not well organized topics various
11) Maintain wildlife observation logbook			**X**		None
Sub-total	2	1	8	0	
Percent	18.2%	9.1%	72.7%	0%	

ADMINISTRATION AND MAINTENANCE PROGRAM					
Objective	**Measure of success of implementation**				**Comments**
	Succeed	**Improved**	**No Change**	**Worse**	
1) Development of annual operational plan			**X**		None
2) Maintenance of trails			**X**		None
3) Maintenance of equipment and buildings	**X**				Yes
4) Maintenance of financial records	**X**				Yes; for donors and funders
5) Monthly reports	**X**				Yes
6) Attend meetings	**X**				yes very often
7) Mid-term management plan review			**X**		None
8) Regular equipment inventories	**X**				Yes
9) Training sanctuary staff	**X**				yes on availability
10) Promote and institutionalize an advisory committee			**X**		None
Sub-total	6	0	4	0	
Percent	60%	0%	40%	0%	
Total Objectives: 61	21	7	32	1	
Percent	34.4%	11.5%	52.5%	1.6%	

7.2. Appendix 2: Species Lists

Derived from the 2004 REA (Meerman et al., 2004) with a few additions based on new records.

Plants			
Family	Species	Local Name	Uses
Anacardiaceae	Astronium graveolens	Jobillo	Medicinal
Anacardiaceae	Metopium brownei	Black Poisonwood	Medicinal
Anacardiaceae	Spondias mombin/radlkofleri	Hog Plum	Medicinal
Annonaceae	Annona primogenia	Wild custard apple	Medicinal
Apocynaceae	Aspidosperma megalocarpon	White Mylady	
Apocynaceae	Stemmadenia donnell-smithii	Cojoton	Medicinal
Apocynaceae	Thevetia ahouai		Medicinal
Araceae	Anthurium schlechtendalii	Cola de faisan	Medicinal
Araceae	Dieffenbachia oerstedii	Dumb Cane	
Araceae	Monstera sp.		
Araceae	Philodendron radiatum	rare	Medicinal
Araliaceae	Dendropanax arboreus		Medicinal
Arecaceae	Attalea cohune	Cohune	Medicinal
Arecaceae	Bactris major	Pokenoboy	Medicinal
Arecaceae	Bactris sp.	Pokenoboy	
Arecaceae	Chamaedorea tepejilote	Pakaya	Medicinal
Arecaceae	Chamaeodorea oblongata		
Arecaceae	Chamaeodorea seifrizii		
Arecaceae	Cryosophila stauracantha	Give and Take	Medicinal
Arecaceae	Desmoncus orthacanthos	Basket tie-tie	
Arecaceae	Roystonea regia	Cabage Palm	Timber
Arecaceae	Sabal mauritiiformis	Bayleaf	Thatch
Arecaceae	Sabal yapa[22]	Male Bayleaf	
Aristolochiaceae	Aristolochia maxima	Guacu	Medicinal
Aristolochiaceae	Aristolochia trilobata	Contribo	Medicinal
Asclepiadaceae	Asclepias curassavica	Polly Redhead	Medicinal
Asteraceae	Unknown		
Bignoniaceae	Amphitecna breedlovei	Calabash	
Bignoniaceae	Tabebuya chrysanta	Cortez	Medicinal
Bignoniaceae	Tabebuya rosea	Mayflower	Medicinal
Bignoniaceae	Unknown vine		
Bixaceae	Cochlospermum vitifolium	Wishwilly Cotton	Medicinal
Bombacaceae	Ceiba pentandra	Cotton	Medicinal
Bombacaceae	Ochroma pyramidale	Balsa	

[22] Added during 2015 Management Plan fieldwork

Plants			
Family	Species	Local Name	Uses
Bombacaceae	Pachyra aquatica	Provision Bark	Medicinal
Bombacaceae	Quararibea funebris		
Boraginaceae	Cordia bicolor	White Salmwood	
Boraginaceae.	Heliotropium indicum.		Medicinal
Boraginaceae.	Heliotropium sp.		
Bromeliaceae	Aechmaea tilandsioides		
Bromeliaceae	Androlepis skinneri		
Bromeliaceae	Bromelia pinguin	Pinuela, Pinwing	Medicinal
Bromeliaceae	Vriesea sp.		
Burseraceae	Bursera simaruba	Gumbo Limbo	Medicinal
Burseraceae	Protium copal	Copal	Medicinal
Cabombaceae	Cabomba palaeformis	Woodpeck, Squirrel tail	
Cactaceae	Rhipsalis baccifera		
Caesalpinioideae	Bauhinea herrerae		Medicinal
Caesalpinioideae	Caesalpina bonduc		Medicinal
Caesalpinioideae	Cassia grandis	Bokut	Medicinal
Caesalpinioideae	Dialium guianense	Ironwood	
Caesalpinioideae	Schizolobium parahyba	Quamwood	
Caesalpinioideae	Senna sp.		
Caesalpinioideae	Unknown vine	Senna like vine	
Capparaceae	Crateva tapia		Medicinal
Caricaceae	Carica papaya	Papaya	Medicinal
Cecropiaceae	Cecropia peltata	Trumpet	Medicinal
Chrysobalanaceae	Hirtella racemosa		
Clusiaceae	Callophyllum brasiliense	Santa Maria	Medicinal
Clusiaceae	Clusia (lundellii?)		
Clusiaceae	Vismia macrophylla	Ringworm Stick	Medicinal
Combretaceae	Bucida buceras	Bullettree	Medicinal
Combretaceae	Combretum laxum		
Combretaceae	Terminalia amazonia	Nargusta	
Convolvulaceae	Aniseia martinicensis		
Convolvulaceae	Ipomoea (squamosa/trifida?).	Morning glory	
Convolvulaceae	Ipomoea alba	Potato slip	Medicinal
Costaceae	Costus pulverulentus		Medicinal
Cucurbitaceae	Psiguria triphylla		
Cyperaceae	Scleria bracteata	Cutting Grass	
Cyperaceae	Scleria sp.?		
Dilleniaceae	Unknown		
Euphorbiacea.	Phyllanthus sp. (acuminatus?).		Medicinal
Euphorbiaceae	Adelia barbinervis		
Euphorbiaceae	Croton ? (Achiote like)		
Euphorbiaceae	Croton sp.		

Plants			
Family	Species	Local Name	Uses
Euphorbiaceae	Margaritaria nobilis		
Euphorbiaceae	Sapium laterifolium		
Euphorbiaceae	Sebastiana adenophora/confusa	White Poisonwood	
Euphorbiaceae ?	Unknown	Redwood?	
Flacourtiaceae	Casearia sylvestris	Shaggy Bark	Medicinal
Flacourtiaceae	Pleuranthodendron lindenii		
Flacourtiaceae	Unknown		
Flacourtiaceae	Zuelania guidonia	Waterwood	Medicinal
Gesneriaceae	Unknown[23]		
Haemodoraceae	Xiphidium caeruleum	White Iris small	
Heliconiaceae	Heliconia latispatha		
Lacistemaceae	Lacistema aggregatum		
Lauraceae	Nectandra sp.?	Timbersweet	
Lemnaceae	Lemna	Puskots	
Lentibulariaceae	Utricularia foliosa	Woodpeck, Squirrel tail	
Loganiaceae	Strychnos sp.	Chicoloro	Medicinal
Malvaceae	Hampea trilobata		Medicinal
Marantaceae	Calathea lutea	Waha leaf	Medicinal
Marantaceae	Calathea sp.		
Marantaceae	Maranta arundinaceae	Arrow root	Medicinal
Marcgraviaceae	Souroubea sp.		
Melastomataceae	Clidemia sp		Medicinal
Melastomataceae	Miconia argentea	White Maya	
Melastomataceae	Miconia impetiolaris		
Melastomataceae	Miconia sp.		
Melastomataceae	Mourirri exilis		
Melastomataceae	Mourriri myrtiloides		
Meliaceae	Guaerea glabra		Medicinal
Meliaceae	Guarea sp.		
Meliaceae	Swietenia macrophylla	Mahogany	Medicinal
Meliaceae	Trichilia havanensis		Medicinal
Meliaceae	Trichilia padilla		
Meliaceae	Trichilia sp		
Mimosoideae	Acacia glomerosa	Prickly yellow	Medicinal
Mimosoideae	Acacia sp.		
Mimosoideae	Acacia sp.	Bullhorn Acacia	Medicinal
Mimosoideae	Cojoba arborea		

[23] Added during 2015 Management Plan fieldwork

Plants			
Family	Species	Local Name	Uses
Mimosoideae	Entrolobium cyclocarpon	Tubroos	Medicinal
Mimosoideae	Inga pavoniana	Tamatama bribri	Medicinal
Mimosoideae	Inga sp.		
Mimosoideae	Mimosa pellita	Sensitive weed	
Mimosoideae	Pithecellobium sp 2.		
Mimosoideae	Pithecellobium sp.		
Mimosoideae	Zygia conzattii	Turtlebone	
Mimosoideae	Zygia gigantifolia.		
Mimosoideae ?	Unknown	Red Fowl	
Mimosoideae ?	Unknown	John Crow Wood	
Moraceae	Brosimum alicastrum	Ramon	Medicinal
Moraceae	Castilia elastica	Rubber	
Moraceae	Ficus maxima		Medicinal
Moraceae	Ficus sp.	Matapalo	
Moraceae	Ficus sp.		
Moraceae	Pseudolmedia sp.		Medicinal
Moraceae	Trophis racemosa		Medicinal
Myristicaceae	Virola koschnyi	Banak	
Myrsinaceae	Ardisia cf. compressa		
Myrtaceae	Calyptranthus sp.		Medicinal
Myrtaceae	Eugenia sp.		Medicinal
Myrtaceae	Pimenta diocia	Allspice	Medicinal
Myrtaceae	Unknown		
Nyctagynaceae	Pisonia aculeata	Hawknail	Medicinal
Nymphaeaceae	Nymphaea ampla	Tumtum	Medicinal
Ochnaceae	Ouratea sp.		
Olacaceae	Heisteria media		
Orchidaceae	Epidendrum imatophyllum		
Orchidaceae	Oeceoclades maculata		
Orchidaceae	Sarcoglottis sp.		
Orchidaceae	Vanilla planifrons		
Papilionoideae	Acosmium panamensis	Billy Web	Medicinal
Papilionoideae	Aeschynomene deamii		
Papilionoideae	Andira inermis		Medicinal
Papilionoideae	Dalbergia glabra	Logwood brush	Medicinal
Papilionoideae	Lonchocarpus guatemalensis		
Papilionoideae	Lonchocarpus pentaphyllus		
Papilionoideae	Lonchocarpus sp.		

Plants			
Family	Species	Local Name	Uses
Papilionoideae	Machaerium sp.		Medicinal
Papilionoideae	Pterocarpus officinalis	Swamp Kaway	Medicinal
Papilionoideae	Pterocarpus rohrii	Mountain Kaway	
Papilionoideae	Swartzia cubensis	Bastard Rosewood	Medicinal
Passifloraceae	Passiflora biflora		Medicinal
Passifloraceae	Passiflora coriaceae		Medicinal
Passifloraceae	Passiflora serratifolia		
Passifloraceae.	Passiflora foetida (lanuginosa?),		Medicinal
Piperaceae	Peperomia sp.		
Piperaceae	Piper jacquemontianum		Medicinal
Piperaceae	Piper sp.		
Piperaceae	Piper sp. 2		
Poaceae	Guadua longifolia	Spiny Bamboo	
Poaceae	Rhipidocladum sp.		
Polygalaceae	Secundaria diversifolia?	Guingeo	Medicinal
Polygonaceae	Coccoloba barbadensis		Medicinal
Polygonaceae	Coccoloba belizensis	Grape	
Polygonaceae	Coccoloba diversifolia		Medicinal
Polygonaceae	Coccoloba spp.	Uva	
Rhamnaceae	Colubrina arborescens	Carbon	Medicinal
Rhizophoraceae	Cassipourea guianensis	Waterwood	Medicinal
Rubiaceae	Amaioua corymbosa		
Rubiaceae	Faramea occidentalis		
Rubiaceae	Guettarda combsii	Glassywood	Medicinal
Rubiaceae	Guettarda sp?		
Rubiaceae	Hamelia rovirosae		
Rubiaceae	Morinda royoc		Medicinal
Rubiaceae	Psychotria poeppigiana	Hotlips	Medicinal
Rubiaceae	Psychotria spp.		
Rubiaceae	Randia aculeata		Medicinal
Rubiaceae	Simira salvadorensis	Redwood	
Rubiaceae	Uncaria tomentosa	Una de Gato	Medicinal
Saliviniaceae	Salvinia minima	Tumtum	
Sapindaceae	Allophyllus cominia		
Sapindaceae	Cupania belizensis	Grande Betty	Medicinal
Sapindaceae	Cupania rufescens		
Sapindaceae	Matayba apetala	Boyob	
Sapindaceae	Paulinea sp.		
Sapindaceae	Sapindus saponaria		Medicinal
Sapindaceae	Unknown		
Sapotaceae	Chrysophyllum	Chikeh	Medicinal

Plants			
Family	Species	Local Name	Uses
	mexicanum		
Sapotaceae	Manilkara chicle	Chiquibull	
Sapotaceae	Manilkara zapota	Chicosapote	Medicinal
Sapotaceae	Pouteria campechiana		Medicinal
Sapotaceae	Pouteria reticulata		
Sapotaceae	Pouteria sapota	Mamey	Medicinal
Sapotaceae	Sideroxylon sp.		Medicinal
Schizaceae	Lygodium venustum	Wirewris	
Selaginellaceae	Selaginella sp.		
Simaroubaceae	Simarouba glauca	Negrito	Medicinal
Solanaceae.	Cestrum racemosum	Night Bloom	
Solanaceae.	Solanum campechiense.		
Solanaceae.	Solanum tampicense		
Sterculiaceae	Guazuma ulmifolia	Bay Cedar	Medicinal
Tiliaceae	Christiana africana		
Tiliaceae	Luehea seemani		
Tiliaceae	Luehea speciosa		
Tiliaceae	Mutingia calabura		Medicinal
Tiliaceae	Trichospermum grewiifolium	Narrow leaf Moho	
Ulmaceae	Ampelocera hottlei		
Urticaceae	Phenax?		
Verbenaceae	Aegephila monstrosa		Medicinal
Verbenaceae	Cornutia pyramidata		Medicinal
Verbenaceae	Vitex gaumeri	Yashnik, Fiddlewood	Medicinal
Violaceae	Rinorea sp.		Medicinal
Violaceae.	Hybanthus calceolaria.		
Violaceae.	Corynostylis arborea.	Monkey Apple	
Vitaceae	Vitis tiliaefolia	Watervine	Medicinal
Zamiaceae	Zamia prasina	Bullrush	
Zingiberaceae	Renealmia aromatica	Wild ginger	

Fish		
Family	Species	Common Name
Anguillidae	*Anguila rostrata*	Conger Eel
Antherinidae	*Antherinella sp.*	
Ariidae	*Ariopsis assimilis*	Catfish
Characidae	*Astyanax aeneus*	Billam
Characidae	*Hyphessobrycon compressus*	Billam
Cichlidae	*Cichlasoma friedrichsthali*	Mosmos
Cichlidae	*Cichlasoma intermedium?*	
Cichlidae	*Cichlasoma meeki*	Moko Jek
Cichlidae	*Cichlasoma robertsoni*	Night and Day
Cichlidae	*Cichlasoma salvini*	Green Gial
Cichlidae	*Cichlasoma spilurum*	
Cichlidae	*Cichlasoma synspillum*	Tuba
Cichlidae	*Cichlasoma uropthalmus*	Crana'
Cichlidae	*Oreochromis niloticus*	
Cichlidae	*Petenia splendida*	Bay Snook
Ictaluridae	*Ictalurus furcatus*	Bakra
Ictaluridae	*Species*	Tiger Bakra
Megalopiidae	*Megalops atlanticus*	Tarpon
Pimelodidae	*Rhamdia guatemalensis*	Buttersea
Pimelodidae	*Rhamdia laticauda*	Buttersea
Poeciliidae	*Belenox belizanus*	
Poeciliidae	*Gambusia sexradiata*	Poopsie
Poeciliidae	*Heterandia bimaculata*	
Poeciliidae	*Phallichthys fairweatheri*	
Poeciliidae	*Poecilia mexicana*	Poopsie
Poeciliidae	*Xipophorus helleri*	
Rivulidae	*Rivulus tenuis*	
Synbranchidae	*Ophisternon aenigmaticum*	Mudeel

Amphibians		
Family	Species	Common Name
Bufonidae	*Bufo marinus*	Marine Toad
Bufonidae	*Incilius valliceps*	Gulf Toad
Bufonidae	*Rhinella marinus*[24]	Marine Toad
Hylidae	*Agalychnis callidryas*	Red-eyed Tree Frog
Ranidae	*Lithobates vaillanti*	Spring Chicken
Leptodactylidae	*Leptodactylus melanonotus*[25]	Black-backed Frog

[24] Added during 2015 fieldwork for the Management Plan

Reptiles		
Family	Species	Common Name
Crocodiles		
Crocodylidae	*Crocodylus moreleti*	Aligator
Lizards		
Corytophanidae	*Basiliscus vittatus*	Jesus Christ Lizard, Maklaka
Corytophanidae	*Corythophanes sp.*	Old man lizard
Iguanidae	*Iguana iguana*	Bamboo Chicken
Snakes		
Boidae	*Boa constrictor*	
Colubridae	*Clelia clelia*	Fishermen Clapansaya
Colubridae	*Drymarchon corais*	Blacktail
Colubridae	*Drymobius margaritiferus*	Guinea hen
Colubridae	*Imantodes cenchoa*	Cohune Ridge Tommy Goff
Colubridae	*Leptophis mexicanus*	Greenhead
Colubridae	*Ninia sebae*	Bead and Coral
Colubridae	*Oxybelus aeneus*	Tie-tie Snake
Colubridae	*Oxybelus fulgidus*	Green Tommy Goff
Colubridae	*Spilotes pullatus*	Bocatora Clapansaya
Colubridae	*Scaphiodontophis annulatus*	Double snake
Colubridae	*Lampropeltis triangulum*	Bead and Coral
Colubridae	*Ficimia publia*	House Tommy Goff
Elapidae	*Micrurus diastema*	Bead and Coral
Viperidae	*Crotalus durissus*	Rattlesnake
Viperidae	*Bothrops asper*	Yellow Jaw
Viperidae	*Atropoides numifer*	Jumping Tommy Goff
Turtles		
Dermatemydidae	*Dermatemys mawii*	Hickatee
Emydidae	*Trachemys scripta*	Bocatora
Emydidae	*Rhinoclemmys areolata*	Blackbelly turtle
Kinosternidae	*Kinosternon acutum*	Swanka
Kinosternidae	*Staurotypus triporcatus*	Loggerhead
Kinosternidae	*Claudius amgustatus*	Swamp loggerhead

[25] Added during 2015 fieldwork for the Management Plan

Birds			
English Name	Scientific name	Local name(s)	Notes
TINAMOUS - TINAMIDAE			
Great Tinamou	*Tinamus major*	Blue-footed partridge	
Little Tinamou	*Crypturellus soui*	Bawley	
Thicket Tinamou	*Crypturellus cinnamomeus*	Partridge	Herrera 2014
Slaty-breasted Tinamou	*Crypturellus boucardi*	Red-footed partridge	
GREBES - PODICIPEDIDAE			
Least Grebe	*Tachybaptus dominicus*	Diving dopper, Diving dabbler	
PELICANS - PELECANIDAE			
Brown Pelican	*Pelecanus occidentalis*	Pelekin	
CORMORANTS - PHALACROCORACIDAE			
Neotropic Cormorant	*Phalacrocorax brasilianus*	Shag	
ANHINGAS - ANHINGIDAE			
Anhinga	*Anhinga anhinga*	Snake bird, Shag	
FRIGATEBIRDS - FREGATIDAE			
Magnificent Frigatebird	*Fregata magnificens*	Man-o-war, Rabio	
HERONS - ARDEIDAE			
Bare-throated Tiger Heron	*Tigrisoma mexicanum*	Barking gaulin	
Great Blue Heron	*Ardea herodias*	Full pott, Garza morene	
Great Egret	*Ardea alba*	Gaulin, Garza blanca	
Snowy Egret	*Egretta thula*	White Gaulin, Garza blanca	
Little Blue Heron	*Egretta caerulea*	Blue Gaulin, Garza morene	
Tricolored Heron	*Egretta tricolor*	Crabcatcher, Garza morene	
Cattle Egret	*Bubulcus ibis*	Gaulin, Garza blanca	
Green Heron	*Butorides virescens*	Green-backed Heron, Poor Joe	
Agami Heron	*Agamia agami*	Blue jacket	
Black-crowned Night-Heron	*Nycticorax nycticorax*		
Yellow-crowned Night-Heron	*Nyctanassa violacea*	King carpenter	
Boat-billed Heron	*Cochlearius cochlearius*	Spoon-billed carpenter	
IBISES AND SPOONBILLS - THRESKIORNITHIDAE			
White Ibis	*Eudocimus albus*	White curlew, Cocito	

Birds			
English Name	Scientific name	Local name(s)	Notes
STORKS - CICONIIDAE			
Wood Stork *	*Mycteria americana*	John Crow Curlew, Galletan	
AMERICAN VULTURES - CATHARTIDAE			
Black Vulture	*Coragyps atratus*	John Crow, Sope	
Turkey Vulture	*Cathartes aura*	Doctor John Crow, Sope	
King Vulture	*Sarcoramphus papa*	King John Crow, Sope real	
SWANS, GEESE AND DUCKS - ANATIDAE			
Black bellied Whistling-Duck	*Dendrocygna autumnalis*		
Muscovy Duck *	*Cairina moschata*		
KITES, HAWKS, EAGLES AND ALLIES - ACCIPITRIDAE			
Osprey	*Pandion haliaetus*	Billy hawk, Jincho	
Gray-headed Kite	*Leptodon cayanensis*		
Snail Kite	*Rostrhamus sociabilis*		
Plumbeous Kite	*Ictinia plumbea*		
Black collared Hawk	*Busarellus nigricollis*	Fishing hawk	
Common Black-Hawk	*Buteogallus anthracinus*	Water hawk	
Roadside Hawk	*Buteo magnirostris*	Chicken Hawk	
Short-tailed Hawk	*Buteo brachyurus*		
Black-and-white Hawk-Eagle	*Spizastur melanoleucus*		
Black Hawk-Eagle	*Spizaetus tyrannus*		
Ornate Hawk-Eagle *	*Spizaetus ornatus*	Curassow hawk	
FALCONS AND ALLIES - FALCONIDAE			
Collared Forest-Falcon	*Micrastur semitorquatus*		
Laughing Falcon	*Herpetotheres cachinnans*	Guaco	
Bat Falcon	*Falco rufigularis*	Lion hawk	
GUANS AND CURASSOWS - CRACIDAE			
Plain Chachalaca	*Ortalis vetula*	Cockycrow, Cocrico	
Crested Guan	*Penelope purpurascens*		
Great Curassow *	*Crax rubra*	Faisan, Pajouil	
PHASANIDAE - TURKEYS AND PHEASANTS			
Ocellated Turkey	*Meleagris ocellata*	Turkey	Panthera
RAILS, GALLINULES AND ALLIES RALLIDAE			
Ruddy Crake	*Laterallus ruber*	Dodging bull	
Gray-necked Wood Rail	*Aramides cajanea*	Top-na-chick, Gallinola	

Birds			
English Name	Scientific name	Local name(s)	Notes
FINFOOTS - HELIORNITHIDAE			
Sungrebe	*Heliornis fulica*		
LIMPKINS - ARAMIDAE			
Limpkin	*Aramus guarauna*	Clucking hen	
JACANAS - JACANIDAE			
Northern Jacana	*Jacana spinosa*	Georgie bull	
SANDPIPERS AND ALLIES - SCOLOPACIDAE			
Black-necked Stilt	*Himantopus mexicanus*		Herrera 2014
Spotted Sandpiper	*Actitis macularia*	Shaky batty	
PIGEONS AND DOVES - COLUMBIDAE			
Feral Pigeon	*Columba livia*		
Pale-vented Pigeon	*Columba cayennensis*	Red mangrove pigeon	
Scaled Pigeon	*Columba speciosa*	Mountain pigeon	
Red-billed Pigeon	*Columba flavirostris*		
Short-billed Pigeon	*Columba nigrirostris*	Tres pesos pigeon	
Plain-breasted Ground-Dove	*Columbina minuta*		
Ruddy Ground-Dove	*Columbina talpacoti*	Turtle dove	
Blue Ground-Dove	*Claravis pretiosa*		
White-tipped Dove	*Leptotila verreauxi*		
Gray-fronted Dove	*Leptotila rufaxilla*		
Gray-Chested Dove	*Leptotila cassini*		
Ruddy Quail-Dove	*Geotrygon montana*		
PARROTS - PSITTACIDAE			
Olive-throated Parakeet	*Aratinga nana*	Aztec Parakeet, Keetie	
Brown-hooded Parrot	*Pionopsitta haematotis*		
White-crowned Parrot	*Pionus senilis*		
White-fronted Parrot	*Amazona albifrons*		
Red-lored Parrot	*Amazona autumnalis*		
Mealy Parrot	*Amazona farinosa*	Watch-out Parrot	
Yellow-headed Parrot	*Amazona oratrix*	Yellow-head	
CUCKOOS - CUCULIDAE			
Squirrel Cuckoo	*Piaya cayana*	Pe-quam	
Striped Cuckoo	*Tapera naevia*		
Pheasant Cuckoo	*Dromococcyx phasianellus*		

Birds			
English Name	Scientific name	Local name(s)	Notes
Groove-billed Ani	*Crotophaga sulcirostris*	Cowboy Blackbird, Chel	
TYPICAL OWLS - STRIGIDAE			
Vermiculated Screech-Owl	*Otus guatemalae*	Monkey bird	
Mottled Owl	*Ciccaba virgata*		
NIGHTHAWKS AND NIGHTJARS - CAPRIMULGIDAE			
Pauraque	*Nyctidromus albicollis*	Who-you, Xpuhuy	
Yucatan Nightjar	*Caprimulgus badius*	Xpuhuy	
POTOOS - NYCTIBIIDAE			
Northern Potoo	*Nyctibius jamaicensis*	Six-month Bird	
SWIFTS - APODIDAE			
Vaux's Swift	*Chaetura vauxi*		
Lesser Swallow-tailed Swift	*Panyptila cayennensis*		
HUMMINGBIRDS - TROCHILIDAE			
Long-tailed Hermit	*Phaethornis superciliosus*		
Stripe-throated Hermit	*Pygmornis longuemareus*		
Scaly-breasted Hummingbird	*Phaeochroa cuvierii*		
Wedge-tailed Sabrewing	*Campylopterus curvipennis*		
White-necked Jacobin	*Florisuga mellivora*		
White-bellied Emerald	*Amazilia candida*		
Azure-crowned Hummingbird	*Amazilia cyanocephala*		
Rufous-tailed Hummingbird	*Amazilia tzacatl*		
Buff-bellied Hummingbird	*Amazilia yucatanensis*		
TROGONS - TROGONIDAE			
Black-headed Trogon	*Trogon melanocephalus*	Ramatutu	
Gartered Trogon	*Trogon violaceus*	Peche amarillo	
Slaty-tailed Trogon	*Trogon massena*		
MOTMOTS - MOMOTIDAE			
Blue-crowned Motmot	*Momotus momota*	Good Cook	
KINGFISHERS - ALCEDINIDAE			
Ringed Kingfisher	*Ceryle torquata*		
Belted Kingfisher	*Ceryle alcyon*		
Amazon Kingfisher	*Chloroceryle amazona*		

Birds			
English Name	Scientific name	Local name(s)	Notes
Green Kingfisher	*Chloroceryle americana*		
American Pygmy Kingfisher	*Chloroceryle aenea*		
PUFFBIRDS - BUCCONIDAE			
White-necked Puffbird	*Notharchus macrorhynchos*		
TOUCANS - RAMPHASTIDAE			
Collared Aracari	*Pteroglossus torquatus*	Phyllis, Medio Pito	
Keel-billed Toucan	*Ramphastos sulfuratus*	Billbird, Pito real	
WOODPECKERS - PICIDAE			
Golden-fronted Woodpecker	*Melanerpus aurifrons*	Carpenter, Che'ko'	
Smoky-brown Woodpecker	*Veniliornis fumigatus*		
Golden-olive Woodpecker	*Piculus rubiginosus*		
Chestnut-colored Woodpecker	*Celeus castaneus*		
Lineated Woodpecker	*Dryocopus lineatus*	Colonte'	
Pale-billed Woodpecker	*Campephilus guatemalensis*	Father Red-cap	
OVENBIRDS - FURNARIIDAE			
Rufous-breasted Spinetail	*Synallaxis erythrothorax*		
Plain Xenops	*Xenops minutus*		
WOODCREEPERS - DENDROCOLAPTIDAE			
Tawny-winged Woodcreeper	*Dendrocincla anabatina*		
Ruddy Woodcreeper	*Dendrocincla homochroa*		
Strong-billed Woodcreeper	*Xiphocolaptes promeropirhynchus*		Fieldwork. 2015
Wedge-billed Woodcreeper	*Glyphorynchus spirurus*		Fieldwork. 2015
Olivaceus Woodcreeper	*Sittasomus griseicapillus*		
Northern Barred-Woodcreeper	*Dendrocolaptes sanctithomae*		
Ivory-billed Woodcreeper	*Xiphorynchus flavigaster*		
TYPICAL ANTBIRDS - THAMNOPHILIDAE			
Great Antshrike	*Taraba major*		
Barred Antshrike	*Thamnophilus doliatus*		
Dot-winged Antwren	*Microrhopias quixensis*		
Dusky Antbird	*Cercomacra tyrannina*		

Birds			
English Name	Scientific name	Local name(s)	Notes
ANTTHRUSHES AND ANTPITTAS - FORMICARIIDAE			
Black-faced Anttrush	*Formicarius analis*		
TYRANT FLYCATCHERS - TYRANNIDAE			
TYRANNULETS, ELAENIAS AND ALLIES - ELAENIINAE			
Yellow-bellied Tyrannulet	*Ornithion semiflavum*		
Northern Beardless-Tyrannulet	*Camptostoma imberbe*		
Greenish Elaenia	*Myiopagis viridicata*		
Yellow-bellied Elaenia	*Elaenia flavogaster*		
Ochre-bellied Flycatcher	*Mionectes oleaginus*		
Northern Bentbill	*Oncostoma cinereigulare*		
Common Tody-flycatcher	*Todirostrum cinereum*		
Eye-ringed Flatbill	*Rhynchocyclus brevirostris*		
Yellow-olive Flycatcher	*Tolmomyias sulphurescens*		
Stub-tailed Spadebill	*Platyrinchus cancrominus*		
FLUVICOLINE FLYCATCHERS - FLUVICOLIINAE			
Royal Flycatcher	*Onychorhynchus coronatus*		
Ruddy-tailed Flycatcher	*Terenotriccus erythrurus*		
Sulphur-rumped Flycatcher	*Myiobius sulphureipygius*		
Greater Pewee	*Contopus pertinax*		
Eastern Wood-Pewee	*Contopus virens*		
Tropical Pewee	*Contopus cinereus*		
Least Flycatcher	*Empidonax minimus*		
Black Phoebe	*Sayornis nigricans*		
Vermilion Flycatcher	*Pyrocephalus rubinus*	Robin redbreast	
TYRANNINE FLYCATCHERS - TYRANNINAE			
Bright-rumped Attila	*Attila spadiceus*		
Dusky-capped Flycatcher	*Myiarchus tuberculifer*		
Brown-crested Flycatcher	*Myiarchus tyrannulus*		
Great Kiskadee	*Pitangus sulphuratus*	Kiskadee	
Boat-billed Flycatcher	*Megarynchus pitangua*	Kiskadee	
Social Flycatcher	*Myiozetetes similis*	Katy-yu-baby-di-cry	
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*		
Piratic Flycatcher	*Legatus leucophaius*		
Tropical Kingbird	*Tyrannus melancholicus*		
Couch's Kingbird	*Tyrannus couchii*		
Eastern Kingbird	*Tyrannus tyrannus*		

Birds			
English Name	Scientific name	Local name(s)	Notes
TITYRAS AND BECARDS (INCERTAE SEDIS)			
Nothern Schiffornis	*Schiffornis turdinus*	(Thrushlike Manakin)	
Rose-throated Becard	*Pachyramphus aglaiae*		
Masked Tityra	*Tityra semifasciata*	White Woodpecker	
Black-crowned Tityra	*Tityra inquisitor*		
MANAKINS - PIPRIDAE			
White-collared Manakin	*Manacus candei*	Cohune popper	
Red-capped Manakin	*Pipra mentalis*		
VIREOS - VIREONIDAE			
White-eyed Vireo	*Vireo griseus*		
Mangrove Vireo	*Vireo pallens*		
Yellow-throated Vireo	*Vireo flavifrons*		
Red-eyed Vireo	*Vireo olivaceus*		
Yellow-green Vireo	*Vireo flavoviridis*		
Tawny-crowned Greenlet	*Hylophilus ochraceiceps*		
Lesser Greenlet	*Hylophilus decurtatus*		
Green Shrike-Vireo	*Vireolanius pulchellus*		
Rufous-browed Peppershrike	*Cyclarhis gujanensis*		
JAYS AND CROWS - CORVIDAE			
Green Jay	*Cyanocorax yncas*	Cling-cling	
Brown Jay	*Cyanocorax morio*	Piam-piam	
SWALLOWS - HIRUNDINIDAE			
Purple Martin	*Progne subis*		
Gray-breasted Martin	*Progne chalybea*		
Tree Swallow	*Tachycineta bicolor*	Christmas bird	
Mangrove Swallow	*Tachycineta albilinea*		
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*		
Barn Swallow	*Hirundo rustica*		
WRENS - TROGLODYTIDAE			
Spot-breasted Wren	*Thryothorus maculipectus*	Katy-yu-baby-di-cry	
House Wren	*Troglodytes aedon*		
White-bellied Wren	*Uropsila leucogastra*		
White-breasted Wood-Wren	*Henicorhina leucosticta*		

Birds			
English Name	Scientific name	Local name(s)	Notes
GNATCATCHERS - SYLVIIDAE			
Long-billed Gnatwren	*Ramphocaenus melanurus*		
Blue-gray Gnatcatcher	*Polioptila caerulea*		
Tropical Gnatcatcher	*Polioptila plumbea*		
SOLITAIRES, THRUSHES AND ALLIES - TURDIDAE			
Swainson's Thrush	*Catharus ustulatus*		
Wood Thrush	*Hylocichla mustelinus*		
Clay-colored Trush	*Turdus grayi*	Brown Cusco	
White-throated Robin	*Turdus assimilis*		
MOCKINGBIRDS, THRASHERS AND ALLIES - MIMIDAE			
Gray Catbird	*Dumetella carolinensis*		
Tropical Mockingbird	*Mimus gilvus*	Nightingale	
WOOD WARBLERS - PARULIDAE			
Tennessee Warbler	*Vermivora peregrina*		
Yellow Warbler	*Dendroica petechia*	(including Mangrove Warbler)	
Chestnut-sided Warbler	*Dendroica pensylvanica*		
Magnolia Warbler	*Dendroica magnolia*		
Black-throated Green Warbler	*Dendroica virens*		
Yellow-throated Warbler	*Dendroica dominica*		
Grace's Warbler	*Dendroica graciae*		
Cerulean Warbler	*Dendroica cerulea*		
Black-and-white Warbler	*Mniotilta varia*		
American Redstart	*Setophaga ruticilla*		
Prothonotary Warbler	*Protonotaria citrea*		
Worm-eating Warbler	*Helmitheros vermivorus*		
Ovenbird	*Seiurus aurocapillus*		
Northern Waterthrush	*Seiurus noveboracensis*		
Louisiana Waterthrush	*Seiurus motacilla*		
Kentucky Warbler	*Oporornis formosus*		
Common Yellowthroat	*Geothlypis trichas*		
Hooded Warbler	*Wilsonia citrina*		
Golden-crowned Warbler	*Basileuterus culicivorus*		
Yellow-breasted Chat	*Icteria virens*		
BANANAQUIT - COEREBIDAE			
Bananaquit	*Coereba flaveola*		
TANAGERS - THRAUPIDAE			

Birds			
English Name	Scientific name	Local name(s)	Notes
Gray-headed Tanager	*Eucometis penicillata*		
Red crowned Ant Tanager	*Habia rubica*		
Red throated Ant Tanager	*Habia fuscicauda*		
Summer Tanager	*Piranga rubra*		
Scarlet Tanager	*Piranga olivacea*		
Blue-gray Tanager	*Thraupis episcopus*	Bluebird	
Yellow-winged Tanager	*Thraupis abbas*		
Scrub Euphonia	*Euphonia affinis*		
Yellow-throated Euphonia	*Euphonia hirundinacea*		
Olive-backed Euphonia	*Euphonia gouldi*		
Red-legged Honeycreeper	*Cyanerpes cyaneus*		
EMBERIZINES - EMBERIZIDAE			
Blue-black Grassquit	*Volatinia jacarina*		
Slate-colored Seedeater	*Sporophila schistacea*		
Variable Seedeater	*Sporophila americana*		
White-collared Seedeater	*Sporophila torqueola*	Ricey, Grassy bird	
Thick-billed Seedfinch	*Oryzoborus funereus*		
Green-backed Sparrow	*Arremonops chloronotus*		
CARDINALS AND ALLIES - CARDINALINAE			
Grayish Saltator	*Saltator coerulescens*		
Buff-throated Saltator	*Saltator maximus*		
Black-headed Saltator	*Saltator atriceps*		
Black-faced Grosbeak	*Caryothraustes poliogaster*		
Blue-black Grosbeak	*Cyanocompsa cyanoides*		
Blue Bunting	*Cyanocompsa parellina*	Rice Bird	
Dickcissel	*Spiza americana*		
BLACKBIRDS AND ALLIES - ICTERIDAE			
Melodious Blackbird	*Dives dives*		
Great-tailed Grackle	*Quiscalus mexicanus*	Blackbird	
Bronzed Cowbird	*Molothrus aeneus*		
Black-cowled Oriole	*Icterus prosthemelas*	Banana bird	
Orchard Oriole	*Icterus spurius*	Banana bird	
Yellow-backed Oriole	*Icterus chrysater*	Banana bird	
Yellow-tailed Oriole	*Icterus mesomelas*	Banana bird	
Baltimore Oriole	*Icterus galbula*	Northern Oriole, Banana bird	
Yellow-billed Cacique	*Amblycercus holosericeus*	Bamboo Cracker	
Montezuma Oropendola	*Psarocolius montezuma*	Yellow tail	

Mammals				
Order	Family	Species	Common Name	Local Name
MARSUPIALS - DIDELPHIMORPHIA				
	Opossums - Didelphidae			
		Didelphis marsupialis.	Common Opossum	Possum, Zorro, Tlacuache
		Philander opossum	Gray Four-eyed Opossum	Common Gray Four-eyed Opossum, Four-eyes
XENARTHRANS - XENARTHRA				
	Anteaters - Myrmecophagidae			
		Tamandua mexicana	Northern Tamandua	Antsbear, Oso hormiguero
	Armandilos - Dasypodidae			
		Dasypus novemcinctus	Nine-banded Armadillo	Nine-banded Long-nosed Armandillo, Armadilly, Dilly, Ouetch
BATS - CHIROPTERA				
	Sac-winged Bats - Emballonuridae			
		Rhynchonycteris naso	Proboscis Bat	Brasilian long-nosed Bat
	Leaf-nosed Bats - Phyllostomidae			
		Uroderma bilobatum	Common Tent-making Bat	
MONKEYS - PRIMATES				
	Cebidae			
		Alouatta pigra	Yucatan Black Howler-Monkey	Mexican Black Howler Monkey, Baboon, Saraguato
		Ateles geoffroyi	Central-American Spider-Monkey	Monkey, Mono
CARNIVORES - CARNIVORA				
	Dogs - Canidae			
		Urocyon cinereoargenteus	Gray Fox	Gato de Monte
	Cats - Felidae			
		Herpailurus yagouaroundi	Jaguaroundi	Halari, Onza, Leoncillo
		Leopardus pardalis	Ocelot	Tiger-cat, Tigrillo
		Leopardus wiedii	Margay	Tiger-cat, Tigrillo, Tigrillito
		Puma concolor	Puma	Red Tiger, Leon
		Panthera onca	Jaguar	Tiger, Tigre, Balum
	Weasels - Mustelidae			
		Lontra longicaudis	Neotropical River Otter	*Lutra longicaudis*, Southern River Otter, Water dog, Perro de Agua

Mammals				
Order	Family	Species	Common Name	Local Name
		Conepatus semistriatus	Striped Hog-nosed Skunk	Polecat, Zorrillo
		Eira barbara	Tayra	Bush dog, Perro del monte, Cabeza blanca
		Galictis vittata	Grison	Bushdog, Waterdog, Huron
		Mustela frenata	Weasel	Long-tailed Weasel
	Raccoon Family - Procyonidae			
		Potos flavus	Kinkajou	Nightwalker, Mico de noche, Martucha
		Nasua narica	Coatimundi	White-nosed Coati, Coati mundi, Quash, Pisote, Tejon
		Procyon lotor	Raccoon	Northern Raccoon, Racoon, Mapache
PERISSODACTYLS - PERISSODACTYLA				
	Tapir - Tapiridae			
		Tapirus bairdii	Baird's Tapir	Central American Tapir, Mountain Cow, Danto, Tzimin
ARTIODACTYLS - ARTIODACTYLA				
	Peccaries - Tayassuidae			
		Pecari tajacu	Collared Peccary	*Tayassu tajacu*, Peccary, Queqeo
		Tayassu pecari	White-lipped Peccary	Wari, Warree, Jawilla
	Deer - Cervidae			
		Mazama americana	Red Brocket	Antelope, Cabrito
		Odocoileus virginianus	White-tailed Deer	Savanna Deer, Venado.
RODENTS - RODENTIA				
	Porcupines - Erethizontidae			
		Coendou mexicanus	Mexican Porcupine	Mexican hairy Porcupine, Puercoespin
	Pacas - Agoutidae			
		Agouti paca	Paca	Gibnut, Tepesquintle
	Squirrels -Sciuridae			
		Sciurus deppei	Deppei's Squirrel	Squirrel
	Agoutis - Dasyproctidae			
		Dasyprocta punctata	Central American Agouti	Rabbit, Indian Rabbit, Guatusa, Liebre