Strategic Management Plan

Columbia River Forest Reserve

2011 – 2015

DRAFT

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Acknowledgments

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1. Introduction

Background and Context

Belize is recognized as having some of the least impacted protected areas in Mesoamerica. Columbia River Forest Reserve has always been considered one of these, and is situated on the south facing slopes of the Maya Mountains Massif, contributing approximately 148,303 acres (60,015 hectares) to the 1,260,000 acres of intact forest cover of the Massif.

Columbia River was first established as a Forest Reserve in June 1954 (SI 33 of 1954), in recognition of both its importance for watershed protection and for its timber resources. Its boundaries were redefined a number of times, most recently in (SI 115 of 1997) to allow for community farming extensions, The Forest Reserve is considered to be equivalent to an IUCN Category VI area – a protected area managed mainly for the sustainable use of natural ecosystems (IUCN, 1994).

A number of biological assessments of Columbia River Forest Reserve (pre- and post-Hurricane Iris) recognized the national and international biodiversity importance of the protected area (Matola et. al., 1991; Parker et. al. 1993; Meerman & Matola, 1997; Meerman, 2004; Walker and Walker, 2008; Walker, 2009.), and its critical role in watershed protection in southern Belize. The wet forests on the windward slopes of the southern Maya Mountains Massif are considered to be the most species-rich in Belize, and include both lowland and upper elevation species, with approximately 80% of both 'Tropical evergreen broad-leaved submontane forest on steep karstic hills' and 'Tropical evergreen broad-leaved submontane forest on rolling karstic hills' in Belize occurring within the Forest Reserve's boundaries.

Columbia River Forest Reserve is considered an important component of Belize's National Protected Areas System in system-level planning initiatives under the National Protected Area Policy and System Plan project (NPAPSP, 2005), as part of the Maya Mountains Massif (MMM), the Maya Mountains Marine Corridor (MMMC) and the and the Maya Golden Landscape (MGL) Development Strategy). The amphibian species assemblages on the 700m plateau, and the plant species assemblages of Little Quartz Ridge, at approximately 900m, show affinities to the highlands of Guatemala, whilst the karst hill tops are floristically more similar to the Antillean flora, both reflecting the tectonic history of the Central American isthmus, where continental plates have collided. It has also recently been demonstrated to be unique in Belize based on initial surveys of the amphibian fauna, with the potential to rate as an "Alliance for Zero Extinction" site. Under the Technical Assessment of the Maya Mountains Massif, the same

northern portion of the Forest Reserve was highlighted as a priority conservation area, falling within the MMM system level Conservation Zone.

Whilst Columbia River Forest Reserve has been managed in the past primarily as a timber extraction resource, with restricted access and few benefits to the local communities, this strategic management plan, developed under the Forest Department, has been developed with the focus on the Forest Reserve's role within a system of integrated landscape management. It also incorporates the concepts of the National Protected Areas Policy and System Plan – particularly those of access and benefits for local stakeholders, and mechanisms for participatory input into management planning and implementation by those most affected by management decisions for Columbia River Forest Reserve.

Purpose and Scope of Plan

The management of Columbia River Forest Reserve has been guided in the past by its categorization as a Forest Reserve (under the Forest Act, 1982), being set aside:

> *for the protection of forests for management of timber extraction and/or the conservation of soils, watersheds and wildlife resources*

This is the second management plan for the Forest Reserve (the first, a draft management plan, was produced in 1994 (Bird, 1994), and seeks to protect the resources of the Reserve whilst also exploring options for economic benefit of adjacent communities through sustainable resource use and management.

The document follows the ***National Management Plan Framework*** required by the National Protected Area Policy and System Plan (NPAPSP, 2006), and includes general information on the physical and biological attributes of the protected area, documents the current uses and management problems, defines the goals and objectives, summarizes conservation planning outputs, outlines specific management programmes, including a revised zoning plan, sets in place the means for measuring effectiveness of implementation, and recommends an implementation schedule. The Plan is designed to guide the management of the Forest Reserve through the next five years, providing a framework for both broad management activities as well as more specific research and monitoring activities. The management programmes are based on the best data and scientific knowledge available, with the integration of information from previous and current ecological assessments, the conservation planning workshops, and community review.

It takes into consideration the system-level planning initiatives of the area – the Maya Mountains Massif and the Maya Mountain Marine Corridor, including zoning and conservation

planning recommendations, and incorporates the principles of system level collaboration towards more effective management.

The plan has been developed with the participatory input of the majority of the stakeholder communities adjacent to the protected area (San Vicente, San Jose, Na Lum Cah, Crique Jute, San Pedro Columbia, San Miguel, Indian Creek, Golden Stream and Medina Bank), through a series of meetings, workshops and interviews with community members, and input from the tourism and industrial resource extraction sectors. This is in line with national and international recommendations that recognize the following premises (Beltran, 2000):

> *"Protected areas will survive only if they are seen to be of value…to the nation as a whole, and to local people in particular*
>
> *Government and protected area managers should incorporate customary resource use and indigenous land tenure, as well as control systems, as a means of enhancing biodiversity conservation*
>
> *Knowledge, innovations and practices of indigenous peoples have much to contribute to the management of protected areas"*

The Management Planning process incorporates a number of key concepts contained in the sustainable resource benefit principles adopted by IUCN and WWF…

- Compatibility between protected area objectives and those of indigenous and traditional peoples
- Rights of traditional peoples to the traditional use of their lands and resources
- Recognition of the decision making institutions and mechanisms of indigenous and traditional peoples
- Access of indigenous peoples to the benefits associated with protected areas

Fernandez-Baca et. al., 2007

…and seeks to increase community participation in management decisions, to promote access to and sustainable management of the resources, whilst aligning this with the national framework for protected areas in Belize.

The Plan recognizes that there is currently a land conflict within the area, with a number of communities with rapidly increasing populations wishing to expand their agricultural areas into the Forest Reserve. This is further complicated by the Maya Land Rights issues, with the Maya Leaders' Alliance leading the movement towards recognition of the Maya rights to the lands they occupy, and rights to continue to use other lands such as Columbia River Forest Reserve for traditional activities such as hunting, fishing and gathering foods, medicinal plants and materials used in the construction of houses, and for sustaining the Maya culture and economy. It also takes into consideration the ten point agreement signed between the Government of Belize and the Maya People of Southern Belize in 2000.

The management plan also seeks to ensure ***integrated landscape management***, with recognition of the landscape values of the Forest Reserve, particularly in ensuring continued water security security and improved local livelihoods for Toledo, through planning that is set within a framework of landscape-scale sustainable development objectives, over appropriate spatial and temporal scales, and a focus on developing mechanisms for integrated decision making, with restructuring of past legal and institutional fragmentation between civil society organizations to build consensus towards sustainable use.

Integrated management will be reliant on building a strong foundation over the next few years, with capacity building, support and increased communication and collaboration between all stakeholders.

It is recommended that operational plans should be developed on an annual basis, based on the framework provided by this management plan, and an annual review of implementation success be conducted, to allow for adaptive management over the five year period.

2. Current Status

2.1 Location

Map 1: Location of the Columbia River Forest Reserve

Columbia River Forest Reserve is situated in Toledo District, in southern Belize (Map 1), and is the most southerly of the protected areas within the Maya Mountains Massif system. It occupies approximately 148,303 acres (60,015 hectares), and is centred on UTM coordinates 282923 East and 1811974 Nnorth (UTM Zone 16N, NAD 1927), and is managed directly by the Forest Department. The western boundary of the reserve follows the Belize-Guatemala border, and it is bordered to the north by the Chiquibul National Park and Bladen Nature Reserve. To the east, the border is contiguous with that of the Deep River Forest Reserve, whilst to the south lies a landscape of agriculture, forest and villages.

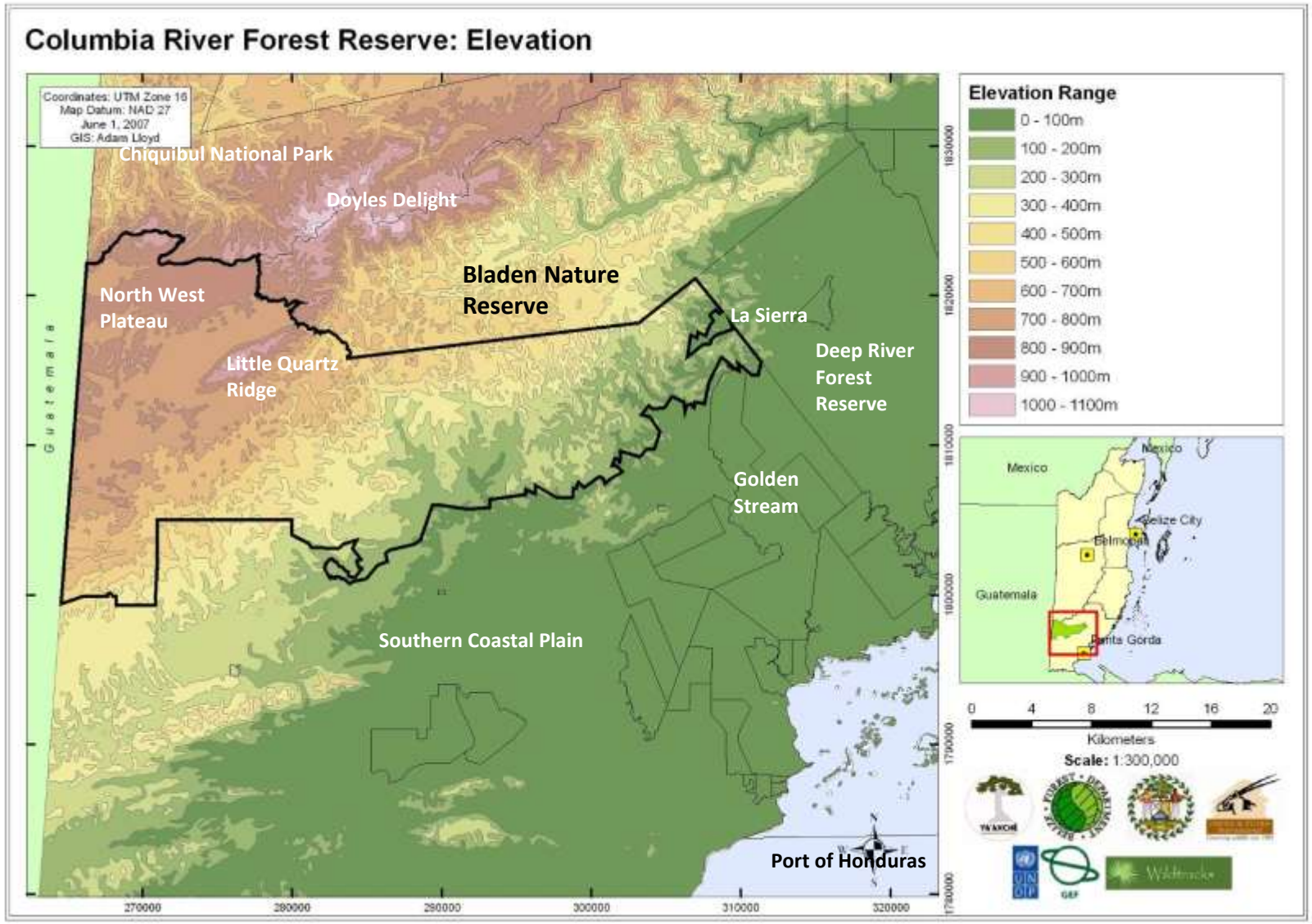
The Forest Reserve is part of the Maya Mountains Massif – the mountainous uplands that form the core of Belize, with watersheds flowing eastwards to the southern coastal plain (Map 2)

Columbia River Forest Reserve was first established in June 1954 by Statutory Instrument 33, with an area of 110,720 acres. In May 1977, it was reduced to 102,965 acres (SI 40 of 1997). The most recent redefinition of the boundaries was in 1997 (SI 115 of 1997), extending the area of the Forest Reserve to the north east, with the incorporation of the south-western portion of the Maya Mountain Forest Reserve, and a realignment of the southern boundary in areas where agricultural incursions had occurred. The La Sierra area was also dereserved, to allow for the development of an archaeological station under the Dunham project. Following opposition from Medina Bank, however, the area did not become an Archaeological Reserve, and is now used for agriculture by the community.

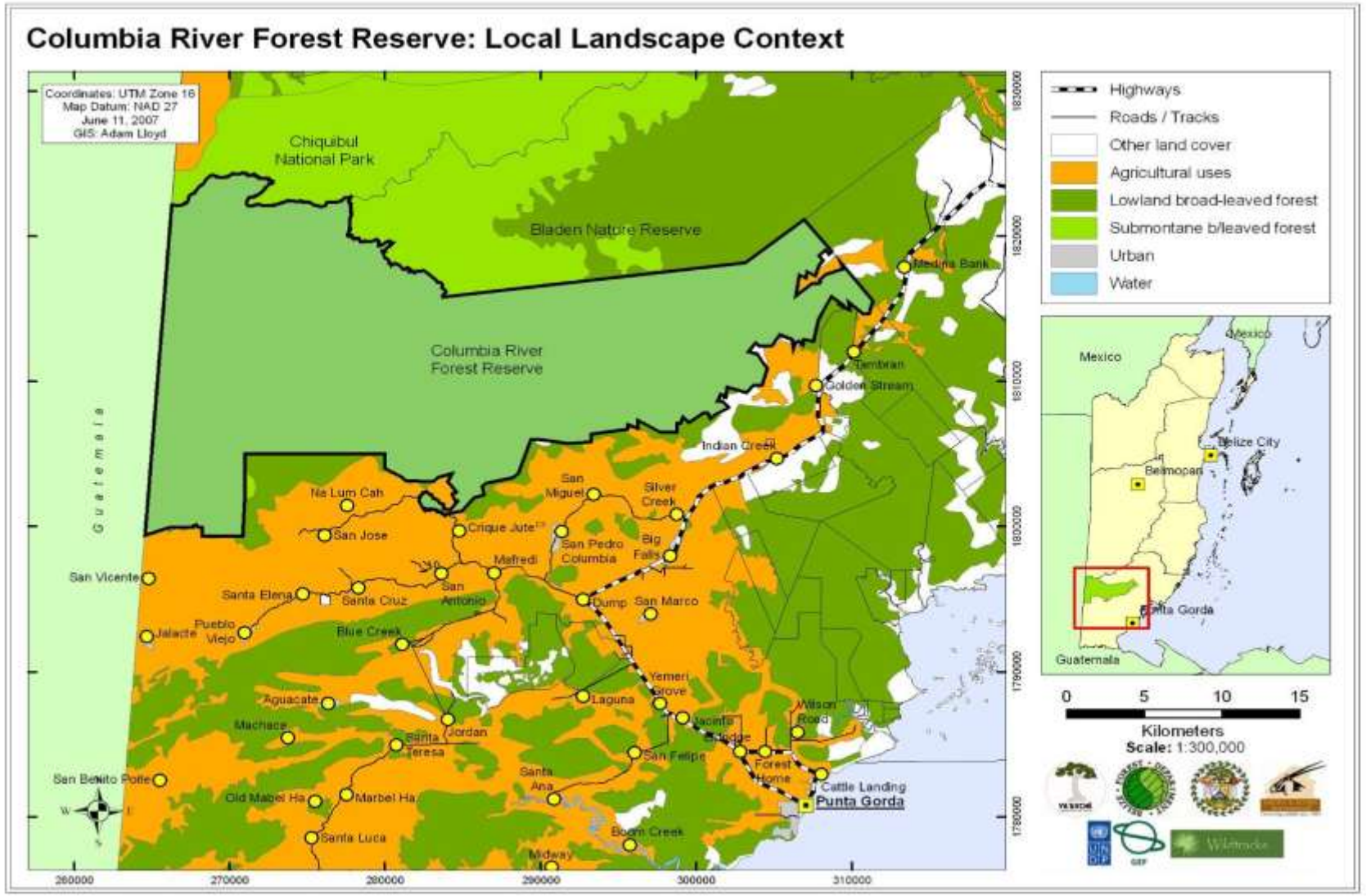
Punta Gorda, the administrative centre for this district, lies approximately 40km in a straight line southeast from the Forest Reserve. Punta Gorda is a multicultural town with a population estimated at approximately 5,300 (CSO, 2007 estimate), surrounded by traditional Ketchi and Mopan Maya villages.

The nearest communities to Columbia River Forest Reserve within Belize are spread along the southern border of the protected area – eleven Maya villages highlighted as important stakeholders, many still reliant on forest resources for house construction, medicinal plants, subsistence hunting and other food supplements. There are also adjacent communities on the Guatemala side, with illegal incursions placing significant pressure on the natural resources and integrity of the Forest Reserve (Map 3).

A number of access routes created by past logging initiatives facilitate entry to the Forest Reserve, with primary access points through San Jose and San Pedro Columbia, both of which are located on roads that run west from the Southern Highway.



Map 2: Landscape Context / 1



Map 3: Landscape Context / 2

2.2 Regional Context

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

The entire Mesoamerican region has suffered from an alarming rate of deforestation, with as much as two thirds of the forest having been converted into agricultural land within the last 50 years, much of which has then often been degraded by unsustainable agricultural practices and cattle-farming. Belize, with its relatively low population, and large areas of intact natural vegetation, plays an important role in the survival of many of the threatened species of Mesoamerica, and is an important waypoint for Nearctic and Neotropical migrants.

Until recently, Belize had escaped most of the more destructive land clearance, but in the south of the country large cattle farms are now appearing alongside the more established citrus, banana and rice farms. The population of the country is increasing at a rate of 2.21% per year (CIA, 2008), resulting in increasing pressure on land and natural resources.

Belize is a signatory to several international agreements concerning issues such as environmental management and development, and effective management of Columbia River Forest Reserve contributes to meeting these commitments (Table 1).

A number of other international conventions and agreements have also been signed by Belize, relevant to Columbia River Forest Reserve, and its role in assisting in fulfillment of Belize's commitments:

- UNESCO Man and the Biosphere Programme (1990)
- International Plant Protection Convention (Rome, 1951)

Table 1: International agreements with relevance to Columbia River Forest Reserve	
International Agreement	**Ways in which CRFR assists in meeting these obligations**
Convention on Biological Diversity (Rio de Janeiro, 1992) Ratified in 1993 *To conserve biological diversity to promote the sustainable use of its components, and encourage equitable sharing of benefits arising from the utilization of natural resources.*	Columbia River Forest Reserve (CRFR) is an important part of the national protected areas system, protecting biodiversity and threatened species. The current Management Planning initiative focuses also on benefits to stakeholder communities, and participation in future management of the resources on which they are dependent.
United Nations Framework Convention on Climate Change (New York, 1992) *Aims to reduce global warming and to reduce greenhouse gas emissions throughout the world.*	Belize is identified by the 1994 National Inventory as a net remover of CO_2, the high percentage of vegetation cover estimated to be absorbing 6 billion tons of CO_2 a year against a total emission estimated at 3 million tons tons (1st report to IPCC, 2002). Greenhouse Gas emissions are considered to have increased by 27.3%, by 2000, the second reporting period (2nd report to IPCC, draft), yet the area under forest cover remained relatively constant. The continued maintenance of Columbia River Forest Reserve contributes to the high national percentage of vegetation cover – part of Belize's adaptation and mitigation commitments as an Annex II country – and will become increasingly more important in the future in fulfilling Belize's global commitments to balancing emissions on the global scale.

Several regional endeavours have been agreed upon to help balance environmental concerns and development, with the creation of the **Central American Commission for Environment and Development (CCAD)** in 1989, the **Convention for the Conservation of Biodiversity and Protection of Priority Wilderness Areas in Central America** (developed at the XII Central American Summit, in Managua, 1992)**,** and the **Regional Alliance for Sustainable Development (ALIDES)** (1994) (Table 2). The Government of Belize reaffirmed its commitment to ALIDES at the First Mesoamerican Congress on Protected Areas in Managua (2003) through the signing of the Managua Declaration (Ministry of Natural Resources, 2003).

In addition to these agreements is PARCA (the Environmental Plan for Central America), established in 1999 with the aim of strengthening regional environmental management through regional planning strategies and environmental standards. This is further strengthened through more specific bilateral and multilateral agreements focused on transboundary protected areas between Belize and its neighbours.

Maya artifacts are covered under the **Convention on the Protection of Archaeological, Historical and Artistic Heritage of American Nations** (1976).

Table 2: Regional agreements with relevance to Columbia River Forest Reserve	
Regional Agreement	**Ways in which CRFR assists in meeting these obligations**
Alliance for the Sustainable Development of Central America (ALIDES) (1994) *Regional alliance supporting sustainable development initiatives.* ▪ *To increase regional integration for economic, social and political development, and environmental management.* ▪ *To promote the establishment of a biological corridor linking protected areas throughout Central America.*	The National protected Area Policy and System Plan (Meerman and Wilson: 2005) and Maya Mountains Massif Technical Assessment (Walker et. al. 2007) both highlight the Maya Mountains Massif, including CRFR, as a critical forest node for connectivity of protected areas in Mesoamerica.
Central American Commission for Environment and Development (CCAD) (1989) *Regional organisation of Heads of State responsible for the environment from each Central American country, formed under ALIDES.* ▪ *To improve quality of life in Central America through sustainable use of natural resources, control of pollution and reversal of environmental degradation, through policies on environment and development, encouraging participation from the public, capacity building of institutions and to develop funding mechanisms.* *CCAD implemented and manages the Mesoamerican Biological Corridors Programme, which aims to establish corridors of natural vegetation throughout Central America to link protected areas. A central concept of the programme is sustainable development.*	The current management planning initiative encourages community participation and input into the planning process, with the objective of increasing benefits and opportunities for local stakeholders. Columbia River Forest Reserve itself is a critical component of the Maya Mountains Massif, one of the key forest nodes identified within the Mesoamerican Biological Corridor, highlighted for its importance in the maintenance of biodiversity in Central America. .
Convention on the Conservation of Biodiversity and the Protection of Priority Wilderness Areas in Central America (Managua, 1992) *To conserve biological resources in Central America and to recognise their value for economic and social development.* ▪ *To recognise and preserve the knowledge held by indigenous groups in the region that contributes to conservation and the sustainable use of resources.*	Columbia River Forest Reserve protects biodiversity resources and critical watershed functionality that are recognised for their importance at both local and national level. Whilst past management concentrated on forestry extraction, the future management goal includes mechanisms to assist local communities to benefit from these resources.

2.3 National Context

2.3.1 Legal and Policy Framework

Columbia River Forest Reserve is a national protected area, most recently redefined by Statutory Instrument 115 of 1997 under the Forest Act (1982), and currently managed directly by the Forest Department.

History of establishment

Columbia River Forest Reserve was first established under the Forest Protection Act in June 1954 by Statutory Instrument 33, with an area of 110,720 acres. It has, since then, undergone two further amendments – the first in May 1977, when the size was reduced to 102,965 acres (SI 40 of 1977), and more recently with a redefinition of the boundaries in 1997 (SI 115 of 1997), extending the area of the Forest Reserve to the north east, with the incorporation of the south-western portion of the Maya Mountain Forest Reserve, and a realignment of the southern boundary where agricultural incursions had occurred.

The La Sierra area was also dereserved to allow for the development of an archaeological station under the Dunham archaeological project. The area is now used for agriculture by Medina Bank.

Site Status

Columbia River is designated as a Forest Reserve. This is one of five distinct categories of protected area under the mandate of the Forest Department (under the Ministry of Natural Resources), which has the responsibility for the establishment and management of all five of these categories, each of which has specific restrictions strictly defined by law (Table 3). Of the five, the Forest Reserves category is the only one to be designated under the Forests Act (1927), and the only one permitting extractive activities.

The Forest Reserve designation is for the protection of forests for sustainable management of timber extraction, whilst also conserving soils, watersheds and wildlife resources. It allows for research, tourism and education and, unlike the categories that fall under the National Parks System Act, also for harvesting of natural resources (primarily timber), if conducted sustainably.

Table 3: Categories of Protected Areas in Belize			
Category	**Legal Foundation**	**Purpose**	**Activities Permitted**
Nature Reserve	National Parks System Act, 1981	To protect biological communities or species, and maintain natural processes in an undisturbed state.	Research, education
National Park	National Parks System Act, 1981	To protect and preserve natural and scenic values of national significance for the benefit and enjoyment of the general public.	Research, education, tourism
Natural Monument	National Parks System Act, 1981	To protect and preserve natural features of national significance.	Research, education, tourism
Wildlife Sanctuary	National Parks System Act, 1981	To protect nationally significant species, biotic communities or physical features.	Research, education, tourism
Forest Reserve *Columbia River Forest Reserve*	**Forests Act, 1927**	**To protect forests for management of timber extraction and/or the conservation of soils, watersheds and wildlife resources.** *CRFR was designated under this category*	**Research, education, tourism, sustainable extraction**

Under the NPAPSP, the equivalent IUCN designation is considered to be **Category VI: A protected area managed mainly for the sustainable use of natural ecosystems.** This is defined as an:

> ***"Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time, a sustainable flow of natural products and services to meet community needs."***

With the following management objectives

1. To protect and maintain the biological diversity and other natural values of the area in the long term;

2. To promote sound management practices for sustainable production purposes;

3. To protect the natural resource base from being alienated for other land-use purposes that would be detrimental to the area's biological diversity; and

4. To contribute to regional and national development.

Under the IUCN guidelines, it is suggested that management should be "undertaken by public bodies with an unambiguous remit for conservation, and carried out in partnership with the local community; or management may be provided through local custom supported and advised by governmental or non – governmental agencies".

National Planning Strategies

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

The overall goals of both the National Biodiversity Strategy and the NPAPSP reflect the national objectives - ecological and economic sustainability over the long term, and recognize the need to build both human and institutional capacity to effectively manage the biodiversity resources within Belize. There are also moves towards decentralisation of the management of these resources, with a strong focus on co-management partnerships, community-based participation and equitable benefit from conservation efforts.

Legal Framework

The conservation framework of Belize is supported by a number of laws designed to protect wildlife and national heritage within the country. The **Forests Act** (1927) and **National Parks System Act** (1981) are responsible for the establishment and management of protected areas, and the **Wildlife Protection Act** (1981) addresses the need to protect wildlife resources within Belize. All three are administered by the Forest Department, under the Ministry of Natural Resources.

Archaeological sites are protected under the **Ancient Monuments and Antiquities Act** (1971), administered by the National Institute of Culture and History, under the Ministry of Tourism, Civil Aviation and Culture.

The **Mines and Minerals Act** (1989) and the **Petroleum Act** (1991), which regulate the exploration and extraction of all non-renewable resources, govern the exploration for and extraction of non-renewable natural resources. These Acts regulate activities such as prospecting. Little Quartz Ridge, in particular, has been highlighted for its mineral potential.

The legislation under the **Agricultural Fires Act** (1958), whilst seldom implemented, does provide a mechanism for addressing poorly managed agricultural fires, which are of significant concern along the southern border of the protected area, where land clearance for farmland is occurring.

Whilst the above are the legislative Acts most relevant to Columbia River Forest Reserve, there are others, such as the **Fisheries Act** (1948), administered by the Fisheries Department, under the Ministry of Agriculture. This is the principal governing legislation to regulate the fishing industry, being directly concerned with maintaining sustainable fish stocks. Whilst it is primarily focused on the marine environment, it does also provide legislation for the protection of freshwater species. The **Environmental Protection Act** (1992) was drawn up under the Department of the Environment (Ministry of Natural Resources), with the aim of ensuring that development initiatives within Belize are planned to minimize their environmental impact. This legislation is in place to provide a framework for ensuring developments such as the Belize Hydroelectric Development and Management Company (BHD) dam, proposed for the Bladen Nature Reserve / Columbia River Forest Reserve boundary, are planned, sited and constructed through a due process of permits and multi-agency communication that takes into consideration the ecological implications of such developments.

There is currently significant fragmentation in decision making, with these different Acts falling under different Ministries. This is being addressed through the **National Protected Areas Policy and System Plan** (NPAPSP; Figure 1), under which a single directive body – the National Protected Areas Committee – has been established. NPAC includes representatives from different ministries in an attempt to bridge some of the communication gaps that have caused significant problems for protected areas in the past. More recently, the Policy Coordination & Planning Unit has been tasked to strengthen NPAC and ensure a greater level of inter-departmental communication and coordination than has been the case to date. It may still, however, be some time before Government demonstrates a meaningful commitment to the NPAPSP, and before NPAC becomes functional.

National Protected Area Policy Declaration

Recognizing that:

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

And that:

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

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

General Principles:

The Government of Belize shall:

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

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

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

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

NPAPSP, 2005

Figure 1

2.3.2 Land Tenure

Columbia River Forest Reserve is national land, designated as a protected area under the mandate of the Forest Department, with any activity within the protected area requiring approval.

Within the landscape context, the Forest Reserve protects the headwaters within a landscape spectrum that stretches from tropical broadleaf forest, through agricultural lands, urban areas, coastal strand and shallow coastal waters, to seagrass and coral reef (Map 2), interconnected by rivers that flow from the Forest Reserve to the sea.

Land tenure in the adjacent villages includes lease land holdings and informal community lands, with traditional village boundaries and land use practices still respected by the majority of the community members. Households often use 25 to 50 acre parcels, used for small scale agriculture, and any unallocated national land is used for resource extraction in a communal manner, with the Alcalde and the Chairman exercising some management over the resources. National lands adjacent to the villages (including Columbia River Forest Reserve) are used primarily for hunting, fishing, and house material extraction. Community and private lands are gradually encroaching into the buffering forest forming the southern margin of the Forest Reserve, with some agricultural incursions into the Forest Reserve itself

There is currently a land tenure conflict in Southern Belize that has implications on management of Columbia River Forest Reserve, with the Maya Leaders Alliance leading the movement towards an equitable land governance system for the traditional Maya communities, with control of resource use for sustainable development.

Maya Leaders Alliance
Mission Statement

> ***To identify Maya land use and occupancy in southern Belize so as to develop an equitable land governance system that asserts our control and ownership of ancestral lands and resources to ensure the sustainable development of our people.***

It is important to note the following points 6, 7, 8 and 9 from the Ten Point Agreement signed between the Maya Leaders[1] and the Government of Belize in 2000,

6. That the GOB recognizes that the Maya People have rights to lands and resources in southern Belize based on their long-standing use and occupancy.

[1] Toledo Maya Cultural Council, the Toledo Alcaldes Association, the K'ekchi Council Of Belize, the Toledo Maya Women's Council and the Association Of Village Council Chairpersons - collectively described in the Ten Point Agreement as the Maya Leaders Representing The Maya Peoples Of Southern Belize

7. That the first consideration of the partnership between the GOB and the Maya Leaders will be the establishment of a program to address the urgent land needs of the Maya communities of the south, including the surveying and distribution of lands or establishing and protecting communal lands, depending on the various needs of the Maya communities. The GOB and the Maya leaders shall develop, within four (4) months after the signing of this agreement, a framework and target dates, as well as administrative and other measures for the implementation of the programme.

8. That the second consideration of the Partnership shall be to develop within four (4) months after the completion of the paragraph (7) objectives, a framework and target dates to resolve other matters of mutual concern, including: a. Sustainable management of natural resources within the 'Maya traditional land use areas', and equitable distribution of their benefits amongst the Maya communities; b. Protection of Maya cultural practices and management of Maya cultural heritage; c. Reform and status of community governance institutions; and d. Other issues as agreed upon by the GOB and the Maya Leaders.

9. That the Partnership shall, with mutually agreed upon technical assistance as appropriate, review and make recommendations about applications for large land leases, licenses for logging or oil exploration or extraction, assess their social, environmental and cultural impacts, and make recommendations about their conditions and status.

From: Ten Points of Agreement: The Government of Belize and the Maya Peoples of Southern Belize (2000)

Whilst this Management Plan is not developed specifically as part of the Government commitments under this agreement, it is in line with its principles, as one of the aims of the integrated landscape management process is to ensure increased access to, and control of, traditional natural resources by the buffering communities.

2.3.3 Evaluation of Protected Area

Columbia River Forest Reserve provides a number of critical ecosystem and landscape functions at both national and regional level, as part of one of the largest remaining contiguous blocks of forest in Central America. It is recognized for its contribution towards the maintenance of the matrix of tropical broadleaf forests that are characteristic of northern Mesoamerica, but are

currently greatly diminished in comparison with the historic range, and was highlighted under the Technical Assessment for the Maya Mountains Massif as a key biodiversity area (Map 4).

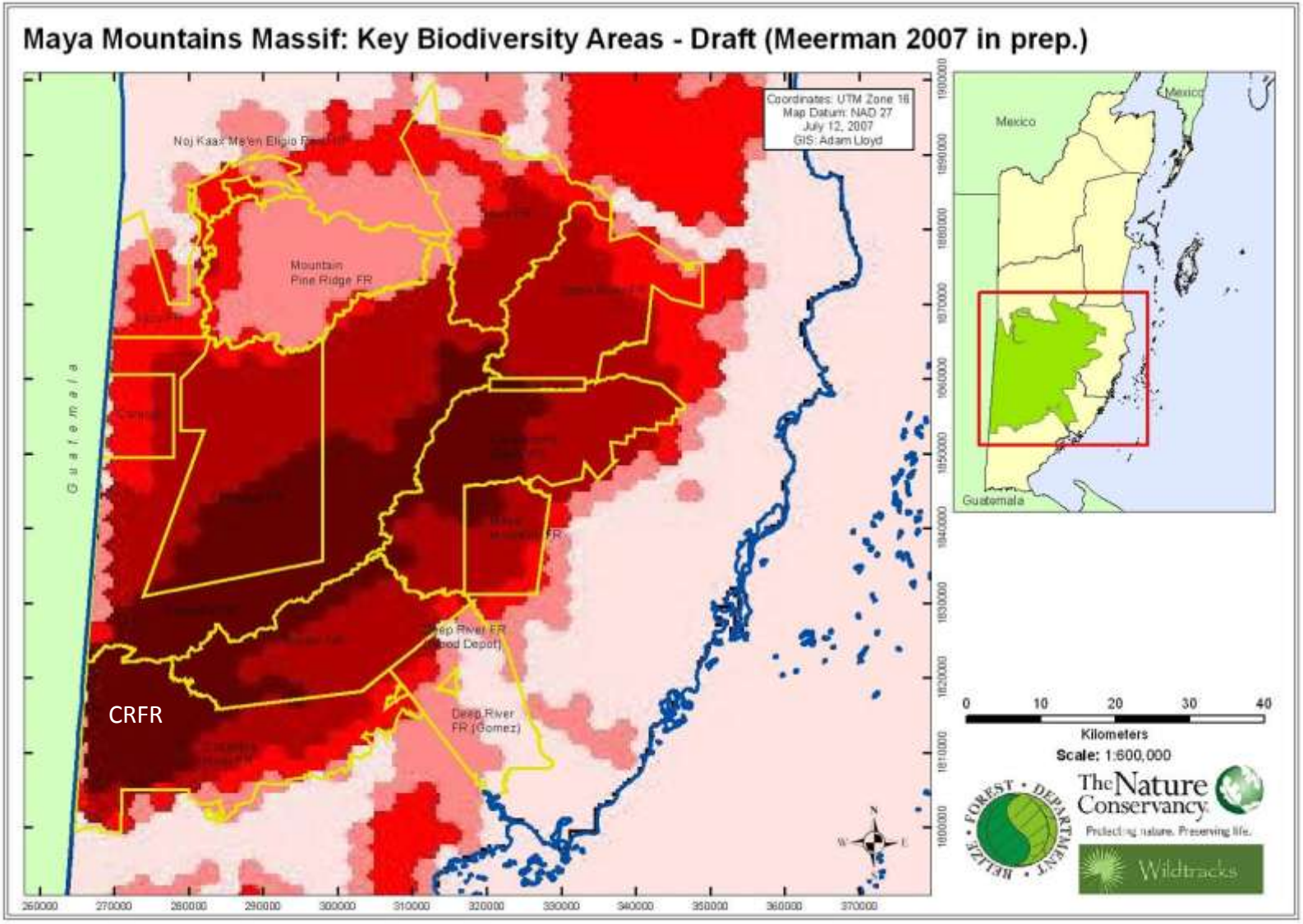
Previous assessments have highlighted the value of the area:

> *Based on the preliminary results of floral and faunal surveys in the Columbia River Forest Reserve, we can say without any hesitation that the evergreen forests of this area (and contiguous areas such as the Upper Bladen River and Upper Raspaculo River basin to the north) are of great national and international importance as a reservoir of biological diversity. Our studies strongly suggest that the most species-rich plant and animal communities in Belize occur in the wet forests at 600-900 m on the windward slopes of the southern Maya Mountains in the Toledo District.*
>
> **Parker et. al. 1993**

..which is further supported by the biodiversity component of the Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) process, conducted as part of the Maya Mountain Massive system level technical assessment (Walker and Walker, 2008).

Threatened Species: Columbia River Forest Reserve protects a unique assemblage of species within Belize...including three Critically Endangered species – Morelet's Treefrog (*Agalychnis moreletii*), Coffeus Rain Frog (*Craugastor coffeus*) and the cycad species *Zamia prasina*. Also recorded from the Forest Reserve are ten Endangered species - including the charismatic black howler monkey (*Alouatta pigra*) and Baird's tapir (*Tapirus bairdii*) (IUCN, 2008), and fifteen Vulnerable species (Table 4). A number of Near Threatened species are recorded in the area – jaguar and white lipped peccary among them, though conservation planning meetings with local communities suggest that game species numbers are much reduced, with extensive hunting, especially in the western part of the Forest Reserve, from communities on the Guatemalan side of the border.

In conjunction with the rest of the Maya Mountains Massif, it is considered to provide a minimum dynamic area for all but the largest vertebrate species. Many of the National Species of Concern (NPAPSP, 2005) are also present in the area, including the five species of cats and the popular game species (including white-lipped peccary), as well as a restricted range sub-species of the Central American spider monkey.



Map 4: Key Biodiversity Area

Table 4: Species of Concern of Columbia River Forest Reserve			
Common Name	**Species Name**	**IUCN Status[1]**	**Belize Status[2]**
Critically Endangered			
Morelet's Treefrog	*Agalychnis moreletii*	Critically Endangered	Critically Endangered
Coffeus Rain Frog	*Craugastor coffeus*	Critically Endangered	Critically Endangered
Cycad species	*Zamia prasina*	Critically Endangered	Data Deficient
Endangered			
Black Howler Monkey	*Alouatta pigra*	Endangered	Vulnerable
O'Donnell's Salamander	*Bolitoglossa odonnelli*	Endangered	Endangered
Bromeliad Treefrog	*Bromeliohyla bromeliacia*	Endangered	Critically Endangered
Sabrinus Rainfrog	*Craugastor sabrinus*	Endangered	Endangered
Sanderson's Rainfrog	*Craugastor sandersonii*	Endangered	Endangered
Fringe-limbed Treefrog	*Ecnomiohyla minera*	Endangered	Critically Endangered
Baird's Tapir	*Tapirus bairdii*	Endangered	Vulnerable
	Trichilia brevilfora	Endangered	
Fiddlewood, Yax-Nik	*Vitex gaumeri*	Endangered	
	Zanthoxylum procerum	Endangered	
Vulnerable			
	Aegiphila monstrosa	Vulnerable	
Van Gelder's Bat	*Bauerus dubiaquercus*	Vulnerable	Vulnerable
Cedar	*Cedrela odorata*	Vulnerable	
Limestone Rainfrog	*Craugastor psephosypharus*	Vulnerable	Endangered
Leprus chirping frog	*Eleutherodactylus leprus*	Vulnerable	Near Threatened
Cerulean Warbler	*Dendroica cerulea*	Vulnerable	Vulnerable
Keel-billed Motmot	*Electron carinatum*	Vulnerable	Vulnerable
Leprus Chirping Frog	*Eleutherodactylus leprus*	Vulnerable	Data Deficient
Crested Guan	*Penelope purpurascens*		Vunerable
Chucpte	*Persea schiedeana*	Vulnerable	
	Pouteria amygdalina	Vulnerable	
King Vulture	*Sarcoramphus papa*		Vulnerable
Mountain Pimento	*Schippia concolor*	Vulnerable	Least Concern
	Sideroxylon stevensonii	Vulnerable	
Mahogany	*Swietenia macrophylla*	Vulnerable	Vulnerable

[1]IUCN Redlist, 2008 (downloaded, October, 2009)
[2]Species of National Concern (Provisional). Meerman, 2005 (NPAPSP output); National Amphibian Conservation Action Plan, Walker, in prep.

The Forest Reserve is considered to contribute significantly to the representativeness of the protected area system, containing over 80% of Belize's ***Tropical evergreen broad-leaved submontane forest on steep karstic hills*** (as mapped in Meerman, 2004), 79% of the ***Tropical evergreen broad-leaved submontane forest on rolling karstic hills***, and over 50% of the ***Tropical evergreen broad-leaved lowland hill forest on rolling karstic terrain*** and ***Tropical evergreen broad-leaved lowland hill forest, Calophylum variant*** present in Belize. It harbours a diverse flora, much within largely pristine ecosystems, recognized as part of the biodiversity hotspot of Central America (Conservation International, 2005), much of which has been extensively cleared or severely degraded elsewhere in the region.

Landscape Function: The Forest Reserve is considered particularly important in its role of watershed protection, with the headwaters of five river systems originating within the protected area, supplying the coastal plain communities and agricultural areas of southern Belize, as well as a portion of Guatemala. The catchment functions of the intact forest canopy of the watershed are recognised by the local communities, as is the importance of maintaining this cover for future water security – not just for the buffer communities, but for the entire Toledo coastal plain – both urban and rural populations, and agricultural areas.

The Forest Reserve is part of the Maya Mountains Massif, one of the largest remaining contiguous blocks of forest in Central America. The Maya Mountains Massif (MMM) is recognized for its role in maintenance of the matrix of tropical broadleaf forests that are characteristic of northern Mesoamerica, but are currently greatly diminished in comparison with the historic range. Until recently, the area was considered to be maintaining the full range of natural processes and disturbance regimes, and to be functioning within the range of acceptability, with minimal human intervention

Columbia River Forest Reserve is critical in the maintenance and viability of protected areas on the southern coastal plain, providing there is connectivity for species movement through forest corridors such as that envisioned under the Golden Stream watershed initiative through Ya'axché Conservation Trust and TIDE private lands, linking them with the CRFR and MMM (Map 5).

Critical Ecosystem Functions of Columbia River Forest Reserve

Direct Products

- *Food*
- *Medicines*
- *Building materials*
- *Craft Materials*
- *Commercial Timber*
- *Xaté*

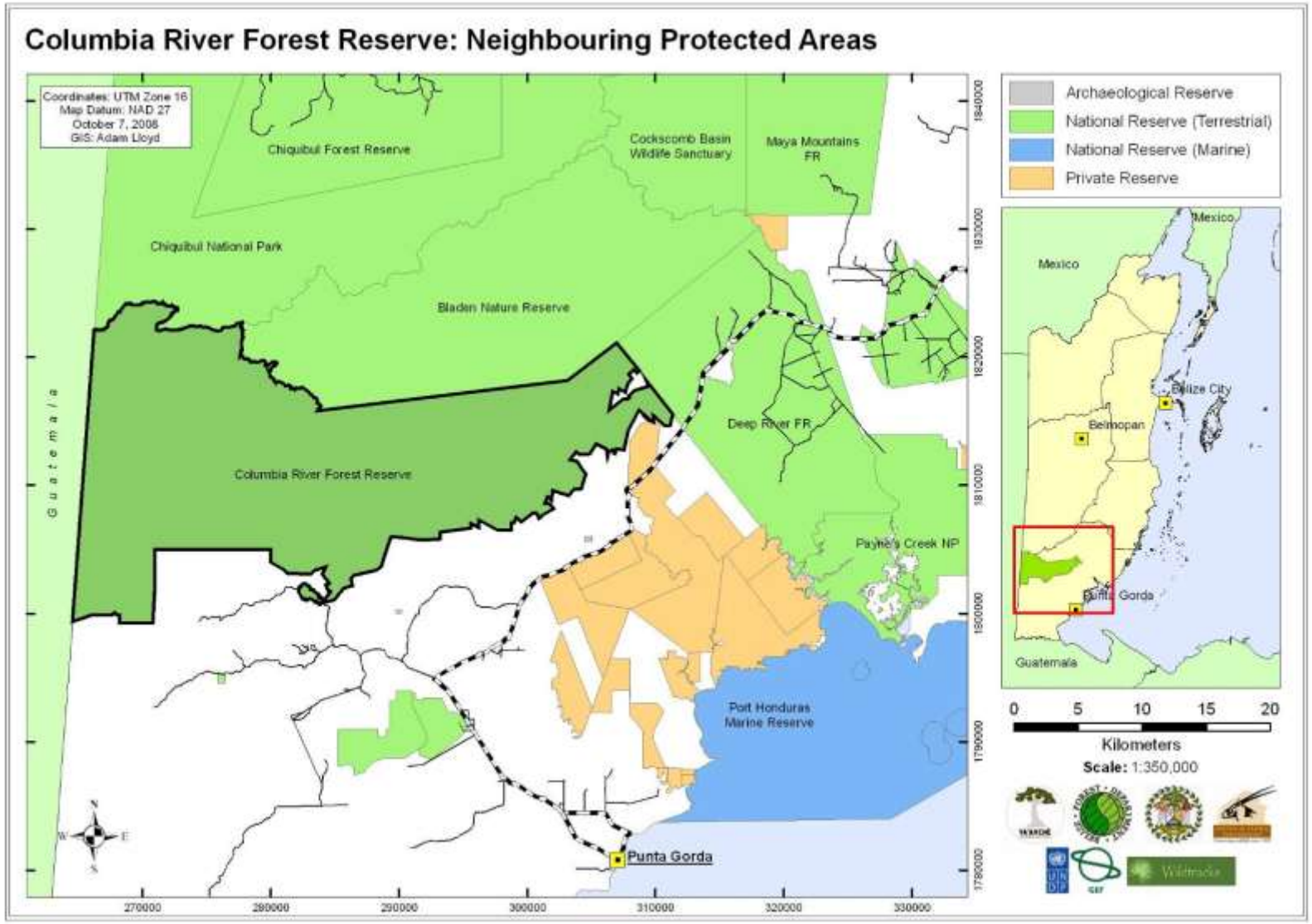
Ecosystem Services

- *Air and Water Purification*
- *Climate Maintenance*
- *Drought and Flood Control Cycles*
- *Nutrient Cycling*
- *Economic Value – Tourism*
- *Pollination*

Inspirational and Cultural Attributes

- *Cultural products (eg. copal)*
- *Aesthetic Landscapes*
- *Spiritually significant caves*
- *Relaxation*
- *Traditional folklore*
- *National Emblems*
  - *Keel-Billed Toucan*
  - *Baird's Tapir*
  - *Mahogany*
  - *Black Orchid*

Ecosystems Services: Communities also have the potential to benefit more directly through this management planning process, through access and control of community resource use areas, as part of a larger integrated landscape. The forest has been important traditionally for hunting, and harvesting of building materials and medicinal plants, and these resources are still of great importance to the local communities today. It is recognised, however, that if traditional use is to continue, there need to be mechanisms in place to balance this with sustainability, and a concerted effort to exercise control over illegal incursions from Guatemala. This is also important if key stakeholder communities are to benefit from the tourism potential of the area.



Map 5: Connectivity

2.3.4 Socio-Economic Context

Belize has a low population currently estimated at approximately 301,270 (CIA, 2008; Figure 2), of which 52% are urban dwellers (CSO, 2004). Population densities are low, with just over 12 persons per sq. km., concentrated mostly on the northern plain, southern coastal plain, Belize Valley and Stann Creek Valley, with much of the remaining country being less suited to habitation, with inundated wetlands in the coastal plains and steep terrain in the Maya Mountains. It is a country of many ethnic cultures, with Mestizo, Creole, Maya and Garifuna being the major population groups. The Maya occupants of Belize, the descendants of the Central American civilization that was at its height approximately 2,000 years ago, are subdivided into three ethnic groups – the Yucatec Maya of the north, the Mopan Maya of the west and south, and the Ketchi of the southern regions.

Figure 2: Belize Demographic Statistics (Average)

Population estimate (2008)	301,270
Population density (2004)	12.3 /sq. km.
Annual growth rate (2008)	2.2%
Birth rate (2007)	25 per 1000
Mortality rate (2007)	4.3 per 1000
Fertility rate (2007)	3 children per woman
Life expectancy (2007)	76
Below Poverty level (2002)	33.5%
Literacy rate (2002)	94%
Unemployment rate (2007)	12.1%
GDP (bn Bz$) (2007)	2.6

Ref: CSO 2000 Census Ministry of Health
CSO, Mid-term 2004
CSO, Poverty Assessment Report, 2002
UNICEF, 2007
Labour Force Survey, 2007
World Bank, 2008
CIA, 2008

There is an ongoing emigration of Belizeans to the United States – generally those from urban areas who have completed secondary school or have professional training. There is also a significant influx of Central American refugees – primarily from Guatemala and Honduras - contributing approximately 13% towards the total population of Belize and resulting in the relatively high population growth rate of 2.3%. At the present rate of immigration, it has been calculated that the population of Belize will double in twenty-six years, with much of this immigrant sector tending to be rural-based with low levels of education, placing far greater stress on the natural resources than currently exists. This is already being seen in communities such as San Pedro Columbia, where the growing population and changing agricultural practices are exhausting the community lands available.

Toledo District, within which Columbia River Forest Reserve is located, is the most southerly of the six districts, and the poorest, with 79% of the population of 26,800 considered to be unable to maintain a minimum standard of living, compared with the national average of 33.5% (CSO, 2004). With limited economic and industrial activities within this southern-most district, there is little infrastructural development, nor are there associated support services. Unemployment is high (16.4% as compared with the national average of 12.1%), and there is a high reliance on natural resources, with much of the population living at a subsistence level, dependent on milpa farming. The population is predominantly rural-based, with a fertility rate of 5.6 children per

woman, far above the national average of 3.0, resulting in higher population growth rate than other districts of Belize.

The economy of Belize has, in the past, been based largely on agriculture, with banana, sugar and citrus forming some of the traditional exports that contribute significantly towards the GDP (Table 5). This has recently been exceeded by revenue from oil extraction, with Belize's current primary export being crude petroleum. There is also an increasing reliance on the tourism industry, which is considered a major foreign exchange earner, and one of the fastest growing sectors in Belize, with over 840,000 tourists arriving in Belize in 2008 (BTB, 2009). Only a small percentage of these visitors (and associated economic benefits) reach Toledo District, though tourism interest is increasing following intensive targeted marketing.

Major Exports of Belize (2006 / 2007)		
	2006 Bz$ million	2007 Bz$ million
Marine Products	86.02	42.16
Sugar	100.07	88.14
Citrus Concentrate	108.99	117.44
Bananas	50.59	41.46
Garments	36.59	18.79
Papayas	31.01	26.07
Crude Petroleum	88.56	142.62
Other	34.58	31.20
Total	536.41	507.88
		CSO (2008)

The Belize GDP and Labour Force		
	GDP Composition by Sector (%) (2007 est.)	Labour Force (Occupation) (%) (2005 est.)
Agriculture	21.3%	22.5%
Industry	13.7%	15.2%
Services	65%	62.3%
		CIA (2007)

Table 5: Exports, GDP and Labour Force Statistics

Citrus, banana, shrimp and cattle are the major, large-scale agricultural industries on the southern coastal plain. They dominate not only the land use patterns, but also the economy of the area. The banana industry, the second major agricultural industry in the area, is Toledo's largest employer – and a source of about 10% of total employment countrywide. It is also a major contributor to the GDP (Table 5) – however, market uncertainties and high production costs are affecting both production and marketing (Caribbean Banana Exporters Association, 2003).

The large agricultural developments of the Toledo coastal plain – banana and citrus in particular, are a focus for the immigration of Central American seasonal workers, attracted to the area by the employment opportunities presented by the farms. With low wages, there is a heavy incentive for these workers to supplement their diet with game meat, increasing the stress on the protected area through illegal hunting and fishing, particularly in the eastern portion of the Forest Reserve.

Large cattle farms are also starting to appear on the coastal plain, and even in the community lands that border the Forest Reserve, changing the land use and ownership patterns. Agricultural development, whether large banana or citrus farms, or smaller community

farmlands, is the primary cause of major land use changes around the Columbia River Forest Reserve, with clear felling of forest, and associated decreased water availability and increased wildfire risks, with anthropogenic fires entering the protected area on an annual basis, resulting in large areas of degraded soils supporting extensive tracts of *Heliconia* on the degraded soils.

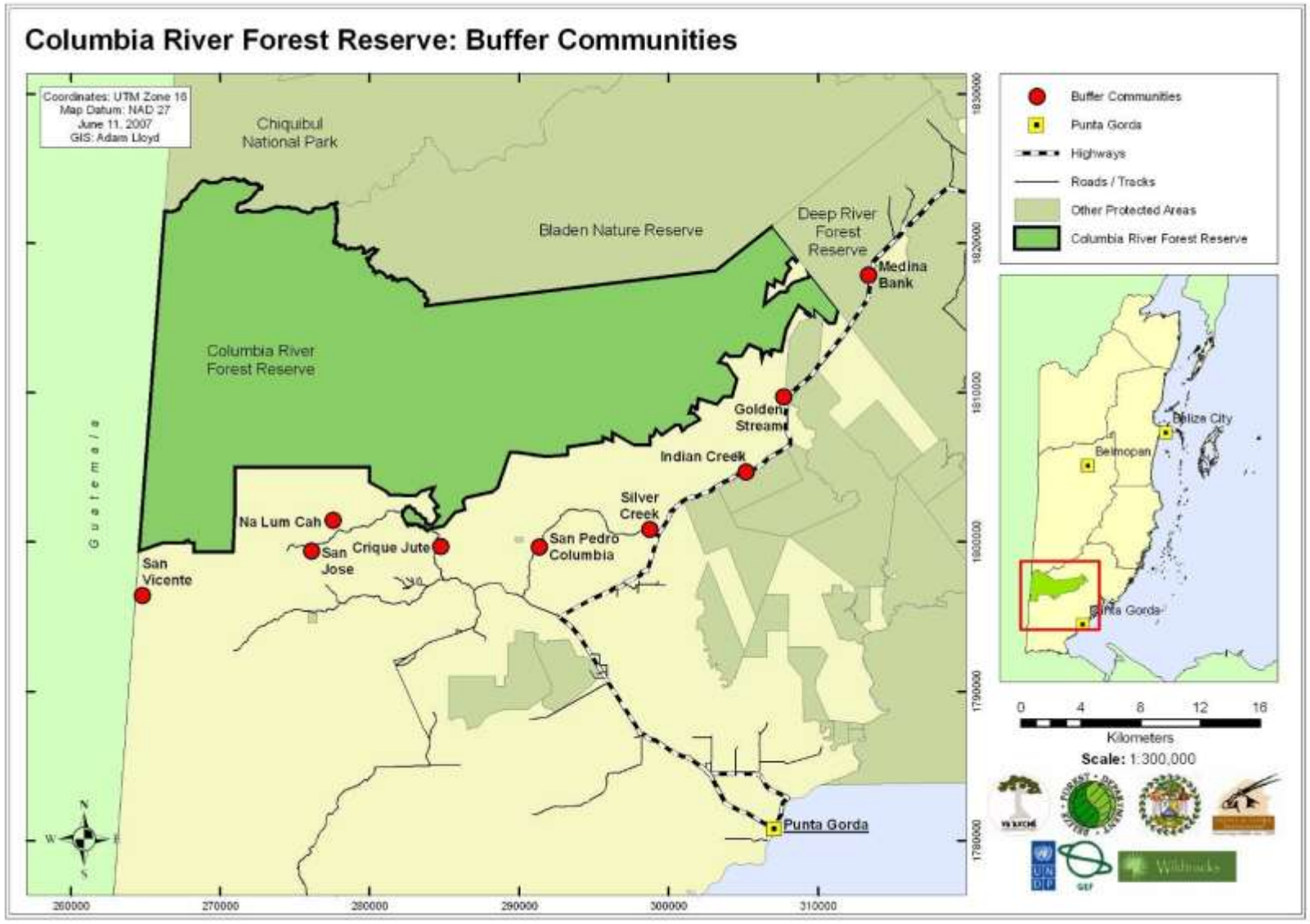
Stakeholder Communities

Twelve stakeholder communities have been identified under the management planning process as users of the traditional natural resources of the Forest Reserve (Table 6; Map 6). Nine of these were fully participatory in the management planning process. Of the remaining three, Big Falls, Silver Creek and San Antonio, Big Falls opted out of the process, as community consultations showed that very few people accessed the resources of the Forest Reserve, resulting in a low level of interest in the process. The decision of non-participation by Silver Creek was based on community-perceived conflicts with the Maya Land Rights initiative. San Antonio was not initially recognized as a stakeholder, based on distance from the protected area boundary. However, following consultations in Crique Jute and Nah Lum Cah, it was acknowledged that there is also significant access to the area by the San Antonio community for natural resource extraction. Whilst not included in the initial management planning process, strategic actions have been developed to integrate San Antonio into the management plan implementation.

Community Perception of Columbia River Forest Reserve

During the series of participatory workshops, community stakeholders were asked for their opinions as to the values of Columbia River Forest Reserve. There was general agreement on the importance of Columbia River Forest Reserve in its role in protecting the watershed, and providing traditional natural resources such as construction materials (cohune, house posts and sticks, tying vines), game meat, and also of the importance of maintaining the forest for its heritage values (Table 6; Table 7).

A basic stakeholder assessment identifies those key stakeholders that are affected or affect the Columbia River Forest Reserve (Table 8).



Map 6: Buffering Communities

Table 6: Stakeholder Communities of Columbia River Forest Reserve				
Community	**Population Estimate**	**Primary Occupations**	**Activities that impact CRFR**	**Recognized Values of Columbia River Forest Reserve**
San Vicente Established: 1987 Ketchi	432 (2009 est.) 73 Households	Farming (beans and corn), Livestock (pigs, 6 families have cattle). Youths 'job out'[2]	Construction materials, food (pacaya etc.) medicinal plants, minimal hunting	▪ CRFR is an effective watershed, attracting rain, important for the water sources for the area - rain no longer comes to San Vicente itself, as the farmers have removed much of the forest. Don't want to see Belize like other countries with no effective watersheds ▪ The forest is life – the Forest Reserve should remain protected for provision of food (game meat, pacaya, mountain cabbage cohune etc.), building materials (sticks, thatch leaves, vines) and water, for the use of present and future generations. Resources from the forest are organic healthier than the meat from the shops ▪ Tourism resource – caves and Maya sites ▪ Cultural resources – ceremonial value of cave (San Vicente), Maya sites ▪ Wildlife- important that future generations are able to enjoy what CRFR has to offer ▪ Medicinal plants ▪ Natural beauty
San Jose Established: 1940's Mopan	1,300 (2009 est.) 160 Households	Farming (vegetables, corn, rice), livestock (cattle and pigs). Women's crafts. Some 'job out' – shrimp farms, construction work, BDF, police	Construction materials, food (pacaya medicinal plants, jute, 'give and take' for brooms, palm seeds for export, minimal hunting and fishing, tourism	
Na Lum Cah Established: 1987 Mopan	63 (2009 est.) 12 Households	Live stock, farming (corn, beans rice, ground food, cacao, cabbage, tomatoes), Youths 'job out'	Construction materials, food (pacaya, jute, etc.) medicinal plants, minimal hunting	
Crique Jute Mopan	610 (2009 est.)	Farming, Crafts. Many also 'job out'	Construction materials, food (pacaya, jute, etc.) medicinal plants, hunting	
San Pedro Columbia Established: 1930 Ketchi, Mopan + Hispanic	1,792 (2009 est.) 485 Households	Livestock, farming	Construction materials, food, medicinal plants, hunting	▪ Way of life – ensuring continued access to natural resources - game species, pacaya etc., medicinal plants, building materials ▪ Cultural values – caves, archaeological sites, religious sites ▪ For future generation – that resources and forest will still be there ▪ Potential for jobs
San Miguel Established: 1950 Ketchi + Mopan	560 (2009 est.) 85 Households	Farming (corn, rice and beans), Livestock – some cattle. 25% of community 'job out'	Construction materials, food, medicinal plants, hunting	

[2] 'Job out' Working outside of the community, often for two weeks at a time

Table 6: Stakeholder Communities of Columbia River Forest Reserve				
Community	**Population Estimate**	**Primary Occupations**	**Activities that impact CRFR**	**Recognized Values of Columbia River Forest Reserve**
Indian Creek Established: 1965	360 (2009 est.) (Primarily Mopan & Ketchi)	Farming, tour guide	Construction materials, hunting, medicinal plants	▪ A good place for hunting and fishing ▪ Food resources – game species, pacaya etc. ▪ Building materials – still some resources despite hurricane impacts. Bayleaf, timber trees ▪ Watershed protection ▪ Tourism resources – streams, waterfalls ▪ Xaté ▪ Wildlife ▪ Good soil for milpas
Golden Stream Established: 1970	210 (2009 est.) (Primarily East Indian with some Maya)	Mechanize Rice farming, livestock	Hunting, medicinal plants (have construction materials in community lands – closer)	
Medina Bank Established: 1989	1,300 (2009 est.) (Maya - Ketchi & Mopan, Hispanic, Creole & East Indian)	Farming, Shop-keeping, Teaching, Construction Work, Livestock	Hunting, medicinal plants (have construction materials in community lands – closer)	
Non-Participatory Stakeholder Communities				**Comments**
Big Falls Established: 1920	1,300 (2009 est.) (Maya - Ketchi & Mopan, Hispanic, Creole & East Indian)	Farming, Shop-keeping, Teaching, Construction Work, Livestock		CRFR considered of little importance to Big Falls – opted out of the process
Silver Creek Established: 1969 Primarily Ketchi	410 (2009 est.)			Concerned about the implications of participation on land claims within the protected area
San Antonio	1,600 (2009 est.) (Primarily Maya Mopan)	Farming, shop-keeping, construction work	Fishing and to some degree hunting, recreational use	Not included within the original identification of stakeholders – impact defined during the planning process.

Table 7: Community Perceptions and Opinions	
Community Group	**Community Concerns**
San Vicente, San Jose, Na Lum Ca, Crique Jute	▪ Logging concessions – opening of wide roads, destroying trees, grass is starting to invade, block streams. ▪ Logging concessions given to large companies – no replanting, not environmentally friendly, and no benefit to local communities. Leave farm roads in worse state ▪ If these large logging companies, which are not environmentally friendly, can get a logging concession, why not local people, who use more environmentally friendly methods? ▪ Need better protection of the forest resources from Guatemalans – loggers, hunters and xatéros ▪ Need to regulate hunting within the Forest Reserve – currently indiscriminate and non-sustainable ▪ Some Guatemala immigrants do not respect the Forest Reserve, don't respect the laws. Important to have some management authority to look after the Forest Reserve if people are to respect it ▪ Agricultural incursions. Example: Some farmers (2-3 San Vicente) have already entered the FR, have done milpa, fallen the forest, harvested corn, now have this as wamil. Should they be allowed to continue? ▪ Increasing cattle farming in peripheral area
Medina Bank, Golden Stream, Indian Creek, Silver Creek	▪ Presence of Guatemalans in CRFR, removing the resources without being stopped, whilst Belizeans are not able to. Need to protect the borders against incursions from Guatemala ▪ Poor management – needs better management, with multiple use
San Pedro Columbia, San Miguel, Big Falls	▪ How this management process will affect the Maya land claim within CRFR...particularly as some communities no longer have sufficient agricultural land for the community ▪ Xatéros – why should they have access , when Belizeans haven't ▪ Current management is not effective – future management may reduce access rather than increase it – concerns about access for the 10% of the communities that hunt ▪ Sometimes the communities lose resources to others – the examples given include their lack of consultation and involvement in the process of archaeological excavation rights, and the lack of consultation for last minute changes to the Hydromaya project. Resources such as these should remain as a benefit to the community ▪ Foreign investors/tourism initiatives are taking the tourism benefits – these initiatives also don't stop in communities to allow sale of crafts etc. and other benefit - barrier to development within communities ▪ Damage caused by logging machinery to roads, streams, steep slopes etc. ▪ Political interference ▪ The need for someone / some organization who will facilitate the implementation of the management plan – who will stand for the communities and look after their interests

A Stakeholder Assessment was completed for the primary stakeholders of Columbia River Forest Reserve (Table 8).

Table 8: Stakeholder Analysis for Columbia River Forest Reserve				
Stakeholder	**Influence or Impact of CRFR on Stakeholder**		**Influence or Impact of Stakeholder on CRFR**	
Community Stakeholder	▪ Water catchment – provides water security ▪ Protection of game and fish resources, ensuring continued viability of traditional hunting and fishing ▪ Protection and provision of traditional natural resources – construction materials, food etc. ▪ Tourism resource with potential benefits to communities ▪ Regulation of traditional harvesting activities within traditional natural resource use areas	+ + + + -	▪ General support of the concept of CRFR ▪ Hunting and fishing within the protected area ▪ Harvesting of natural resources - construction materials, food, medicinal plants ▪ Collection of non-timber forest products within the protected area for commercial gain ▪ Agricultural incursions into the protected area ▪ Poor fire management in lands adjacent to the protected area boundary	+ - - - - -
Long term Timber Concession Holders	▪ Source of valuable timber resources ▪ Seed stock for future sustainability	+ +	▪ Presence may deter illegal xatéro incursions ▪ Provide employment for local communities, reducing community need for harvesting of natural resources ▪ Poor harvesting practices impact water courses and cause erosion on steep slopes ▪ Facilitation of access by xatéros through creation of trail network	+ + - -
Xaté Concession Holders	▪ Source of valuable xaté leaves	+	▪ Presence may deter illegal xatéro incursions ▪ Provide employment for local communities, reducing community need for harvesting of natural resources ▪ Xaté concessions may lead to hunting or fishing within CRFR if not managed properly	+ + -
Hydroelectric Stations	▪ Forested water catchment area provides sufficient water for hydro-electricity generation	+	▪ Removal of forest cover ▪ Reduction of water quality ▪ Closure of area to local community resource harvesting ▪ Opening of road increases access to CRFR, with associated illegal activities	- - - -
Southern Plain Communities	▪ Water catchment – provides water security for the communities and agricultural areas in the watersheds of the Columbia River Forest Reserve ▪ Adds to scenic beauty of Toledo and provides potential tourism resource	+ +	▪ Generally support the conservation goals of CRFR ▪ Hunt illegally in the Forest Reserve	+ -

Table 8: Stakeholder Analysis for Columbia River Forest Reserve				
Stakeholder	**Influence or Impact of CRFR on Stakeholder**		**Influence or Impact of Stakeholder on CRFR**	
ITVET (Institute for Technical and Vocational Training)	▪ Provides on-site resources used in vocational training – eg. mahogany plantation used by Recreational Tourism Department	+	▪ Management of the 51 acre CRFR mahogany plantation ▪ Working with local cacao growers in buffer communities with demonstration plot, towards better agro-forestry practices (part of Central American Cacao Project) ▪ Potential to monitor access along the Santa Cruz road	+ + +
Ya'axché	▪ The east portion of CRFR is targeted as part of the Ya'axché integrated landscape management planning initiatives, towards effective conservation of the Golden Stream Watershed	+	▪ Implementation of strategies for effective conservation and sustainable use, both for Columbia River Forest Reserve and at landscape level ▪ The Ya'axché's Sustainable Land Use Management and Community Outreach and Livelihoods programmes work in some of the CRFR buffer communities, towards increasing conservation awareness and more effective management of the watershed ▪ Works towards poverty alleviation in CRFR's buffer communities.Provide facilitating framework for collaboration and communication between all stakeholders	+ + +
Toledo Healthy Forest Initiative	▪ CRFR provides a forest resource that forms part of the forest matrix target focus for THFI activities	+	▪ Seeks sustainable resource use of CRFR and surrounding landscape towards environmental stability and poverty alleviation	+
Toledo Institute for Development and Environment	▪ CRFR is considered part of the Maya Mountain Marine Corridor, a ridge to reef concept for implementation of landscape scale conservation strategies		▪ Identification and implementation of strategic interventions towards more effective management of biodiversity and environmental service functions of CRFR ▪ Training and implementation of fire management protocols along the CRFR boundary, and in adjacent, buffering agricultural areas ▪ Implementation of strategies towards improved pesticide use and control on the MMMC coastal plain ▪ Implementation of strategies towards improved conservation of cultural and archaeological sites ▪ Provide facilitating framework for collaboration and communication between all stakeholders	+ + + + +

Table 8: Stakeholder Analysis for Columbia River Forest Reserve				
Stakeholder	**Influence or Impact of CRFR on Stakeholder**		**Influence or Impact of Stakeholder on CRFR**	
Local Tour Guides	▪ Benefit from having Columbia River Forest Reserve as a tourism resource ▪ Income from using CRFR for tourism	+ +	▪ Support the conservation goals of CRFR ▪ Provide interpretation for visitors, facilitating overall visitor appreciation ▪ If well trained, assist with visitor management within the protected area through in-depth briefings ▪ If poorly trained, can result in poor visitor management and increased impact on biodiversity	+ + + -
Local/National Tour Operators	▪ Benefit from the potential of CRFR as a destination for natural history / adventure tourism ▪ Income from using CRFR for tour groups	+ +	▪ Provide marketing at a local and national level, and send visitors to the protected area, increasing stakeholder support for CRFR ▪ Support the conservation goals of CRFR	+ +
BTIA	▪ Benefit from having CRFR as a potential venue for natural history / adventure tourism – helps promote Belize in international press	+	▪ Provide international marketing for Toledo as a tourism destination	+
Visitors: Tourists / Expedition Groups	▪ Have the potential to enjoy CRFR as a tourism destination – particularly for adventure tourism	+	▪ Presence may deter illegal activities in active area ▪ Use local community tour guides, supporting the local economy and reducing local need for harvesting of natural resources ▪ Buy crafts and use facilities on offer in local communities – support income-generating efforts in buffer communities ▪ Impact trails, particularly in wet season ▪ Have a negative impact on wildlife behaviour and distribution, however small ▪ Cultural impact on local communities	+ + + - - -
Illegal Guatemalan Transboundary Resource Users	▪ Provides an expansive natural resource area for extraction of commercial resources – xaté, logs, game meat, copal etc. ▪ Provides uncultivated soils for agriculture	+ +	▪ Illegal incursions result in transboundary security issues, impacting potential for tourism in area ▪ Removal of timber, xaté game species and other natural resources ▪ Agricultural incursions into CRFR	- - -

Table 8: Stakeholder Analysis for Columbia River Forest Reserve				
Stakeholder	**Influence or Impact of CRFR on Stakeholder**		**Influence or Impact of Stakeholder on CRFR**	
Government of Belize	▪ CRFR included within National Protected Areas System	+	▪ Support for surveillance and enforcement efforts	+
	▪ CRFR assists in fulfilling commitments under CBD	+	▪ Support for payment for environmental services – a potential source of finance	+
	▪ Income generation from timber and xaté concessions	+	▪ Financial support through PACT	+
	▪ Provides local employment opportunities	+	▪ Possibility of dereservation by Ministerial Fiat	-
	▪ Environmental services	+	▪ Limited financial ability to fulfill effective management responsibilities	
	▪ Reduces land available for local community use	-		

2.4 Physical Environment of Management Area

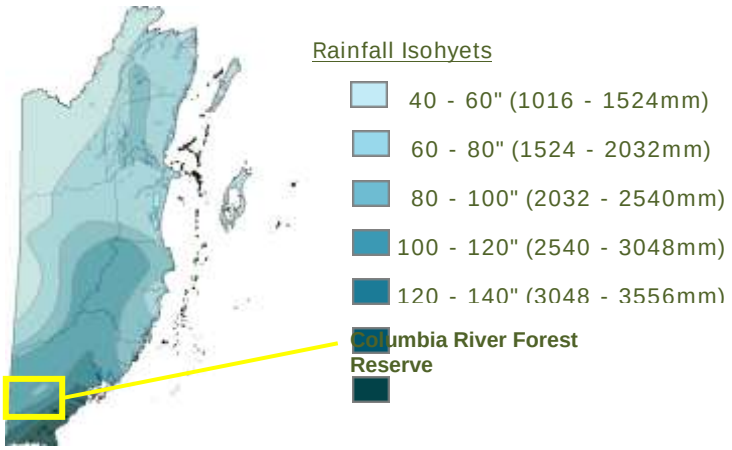
2.4.1 Climate

Belize lies within the outer tropical geographical belt, with a noticeable variation in average monthly temperatures. It can be divided into two climatic regimes – subtropical in the northern lowlands and central inland areas, and tropical in the southern Stann Creek and Toledo regions. Columbia River Forest Reserve is situated in the latter.

Weather records have been maintained at the Belize Foundation for Environment and Education (BFREE), 15 km to the north-east, and provide information as to the climate of the east facing slopes of the southern Maya Mountains.

Rainfall

Columbia River Forest Reserve lies within the wettest half of the country, with an annual rainfall averaging between 330cm and 406cm per annum (Map 7). Rainfall is further influenced by the protected area's location on the east-facing slopes of the Maya Mountains, with the northeast trade winds picking up moisture over the Caribbean Sea, then depositing it as heavy orographic precipitation, as the moist air is forced higher as it moves eastwards over the higher regions of the Maya Mountains.



Map 7: Rainfall belts in Belize

Base Map from BERDS (Biodiversity and Environmental Resource Data System)

There is a noticeable dry season that stretches from February through to mid-May (Figure 3; BFREE, 2000 and 2002). During this period, the minimum monthly rainfall is as low as 0.24cm (recorded in March 2002).

The dry season is followed by a wetter season (June to December / January), with rainfall reaching a high of 55cm in July. The wet season is not punctuated by the mini dry season seen in the more northern areas of Belize in the month of August, possibly due to the location of CRFR on the eastern slope of the Maya Mountain, catching orographic rainfall as the trade winds blow inland.

The majority of rain falls within the hurricane season, associated with passing tropical storms - particularly in July, August, September and October, though this season now appears to be extending in to November as well.

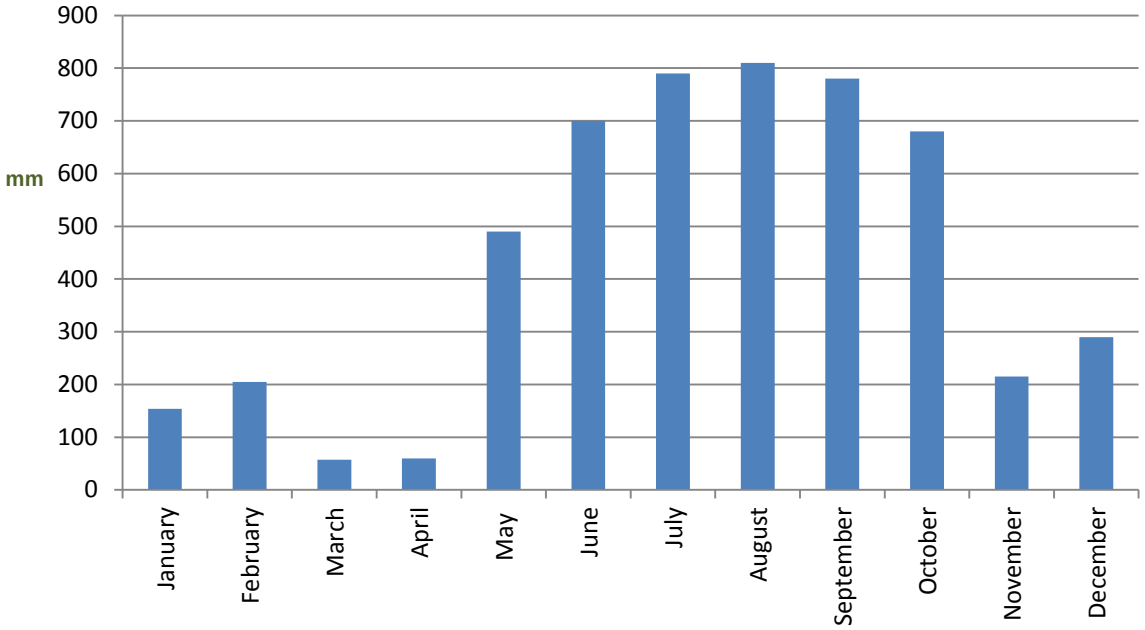


Figure 3: Rainfall

Data Source: Rainfall Data (BFREE, 2000 / 2002)

Rainfall varies throughout the year, with the highest rainfall occurring between June and December, peaking in July, August and September during the tropical storm season. The dry season has minimum rainfall levels are recorded in April.

Temperature

Belize has an average annual temperature of approximately 25°C, with cooler temperatures between November and February associated with weather systems from the north, and warmer between April and June. The temperature in coastal areas is moderated by breezes from the sea, while inland temperatures are more extreme, with cooler average minimum temperatures and warmer average maximum temperatures. Temperature is also affected within the Columbia River Forest Reserve area by altitude, with cooler temperatures in higher parts of the Maya Mountains.

Weather Systems

Belize is affected by three very distinct seasonal weather systems:

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

Trade Winds

These are the prevailing winds of the area, blowing from the north east to east and rarely exceeding 10 to 15 knots. This wind keeps the coastal areas cooler than the inland areas. Belize is also affected by two climatic disturbances – 'northers' and tropical storms.

Northers

These are cool air masses that move down from North America between November and April, bringing cooler temperatures and on occasion, heavy wind and rain.

Tropical Cyclones

Tropical cyclones are non-frontal low pressure systems, with organised circulations, occurring between June, and extends until November, bringing tropical waves, tropical storms and the more damaging hurricanes (with sustained winds exceeding 75mph). These storms originate over warm seas, and develop into a cyclonic form that can be very destructive. Whilst Belize has escaped the majority of hurricanes spawned within the Caribbean and Atlantic in the last hundred years, hurricanes have periodically caused extensive damage to the area in the past. Of recent note for CRFR is Hurricane Iris (2001), which caused extensive vegetation destruction and soil erosion on the east facing karst hill slopes and along much of the southern half of the Reserve – impacts which have been greatly exacerbated by subsequent anthropogenic fire.

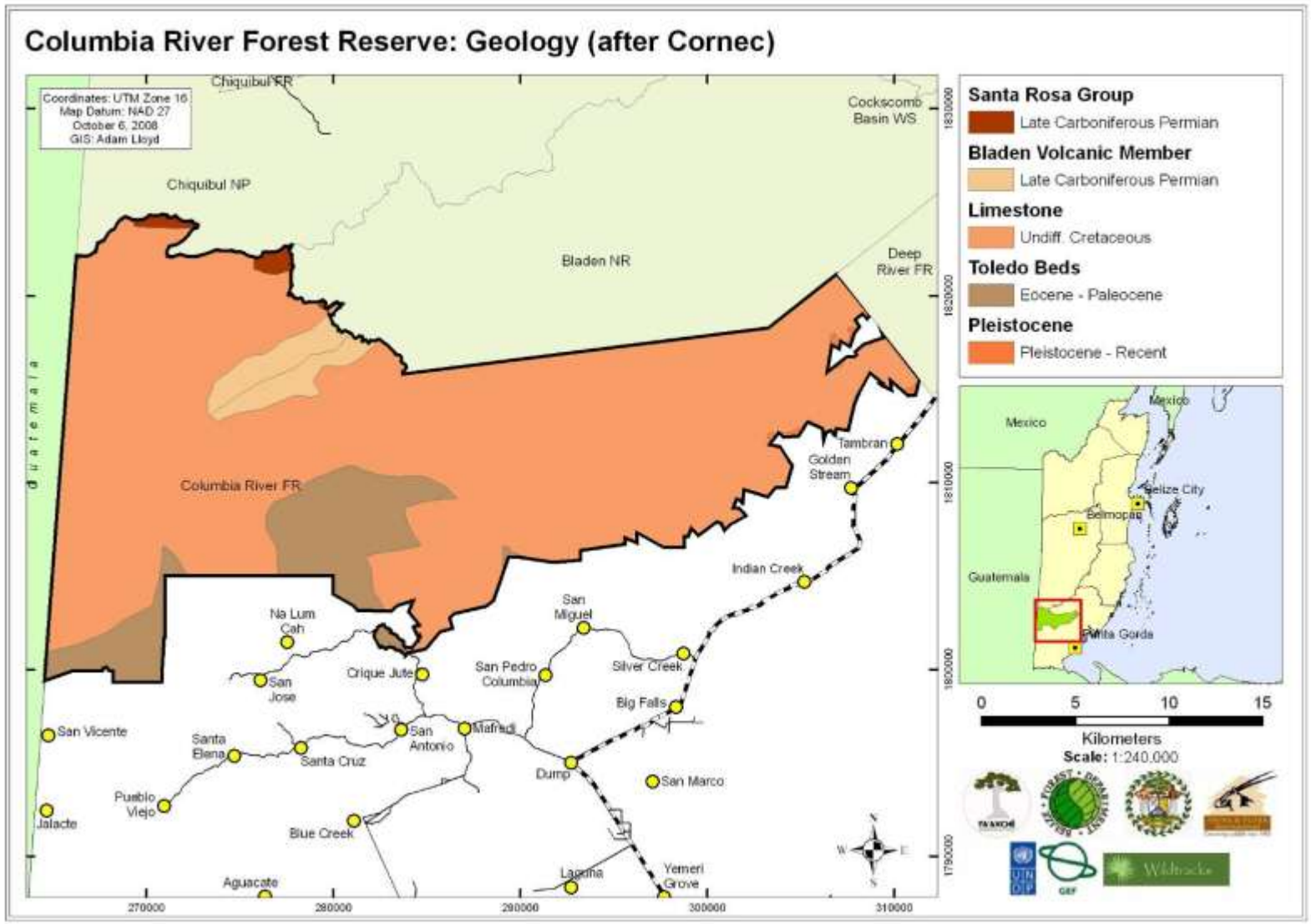
2.4.2 Geology

The majority of the bedrock of the Columbia River Forest Reserve is composed of limestone, laid down between 65 and 136 million years ago during the early Cretaceous Period, when oceanic waters flooded the area depositing the fossiliferous limestones over the entire Maya Mountains (Table 9).

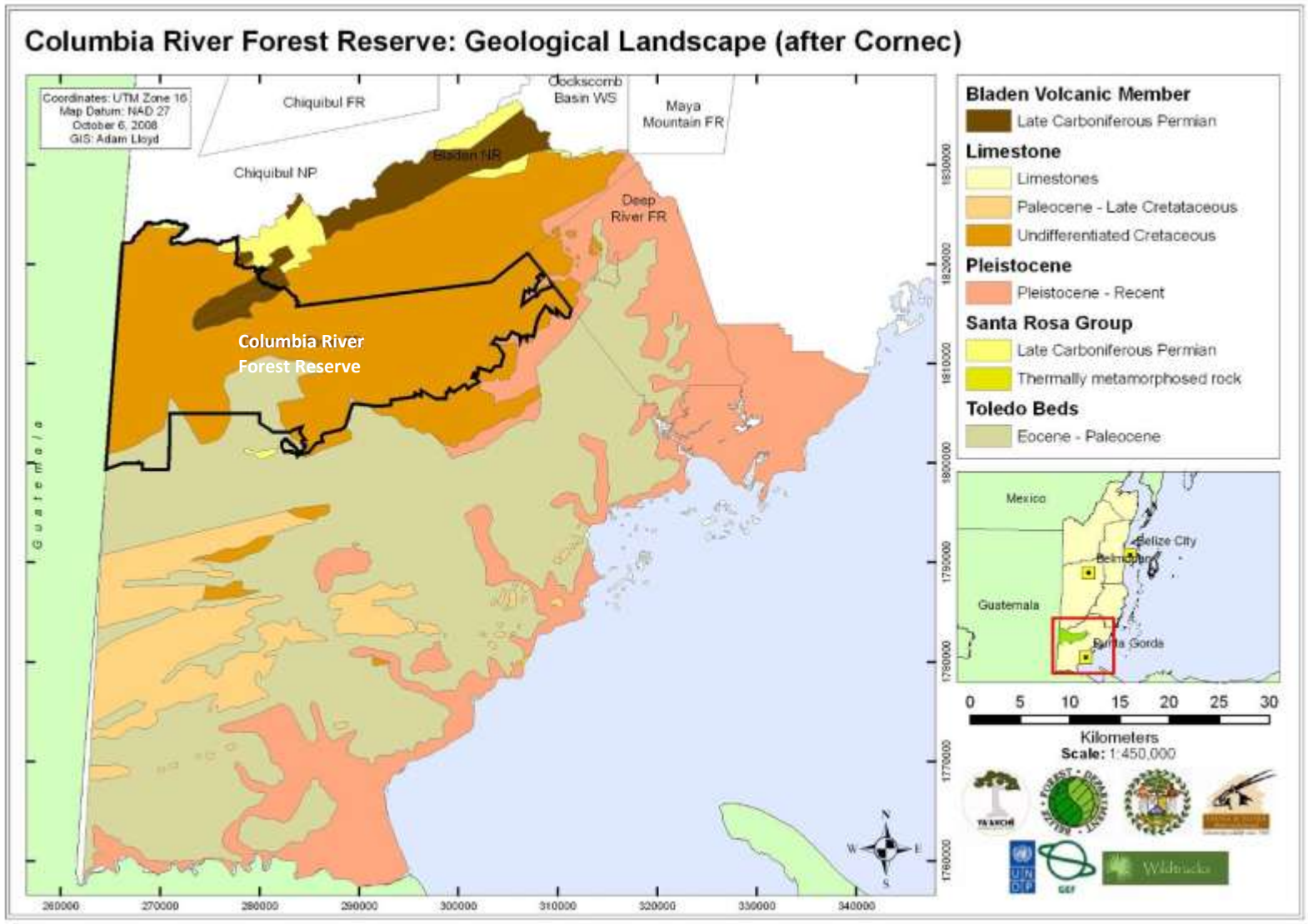
Time Scale of Formation of CRFR Geology			
Era	**Period**	**Time Span (million years ago)**	**Geological Activity**
Palaeozoic Era	Permian	225 – 570	Belize covered by a shallow ocean. Sedimentary rocks of the Santa Rosa Group deposited. Volcanic activity in the CRFR/Bladen area
	Carboniferous		
Mesozoic Era	Triassic Period	190-225	Tectonic uplifts and folding of sedimentary rocks, forming Maya Mountains. Granite intrusion occurs, with contact metamorphosis of adjacent sedimentary rocks to form slate and quartzite
	Jurassic Period	136 – 190	Rift valleys form with erosion of Maya Mountains
	Cretaceous Period	65 – 136	Marine inundation by oceanic water covers the Maya Mountains with limestone.
Cenozoic Era	Tertiary Period	2 – 65	Renewed uplift of Maya Mountains creating present high relief topography. Coastal zone sediments deposited. Erosion of Cretaceous limestone
	Quaternary Period	0 – 2 million	Continued erosion of limestone sequence from Maya Mountains, incision of mountains by streams and rivers

Table 9: Time Scale of Formation of CRFR Geology

In all but the north west corner, the limestone topography is rugged - steep, conical hills pocked by vertical-sided sinkholes, underground streams and caves. Water is scarce in this karst landscape, especially during the dry months, resulting in the presence of a vegetation type adapted to seasonally drier conditions, and a seasonal migration of wildlife to the lowlands. Smaller streams emerge as springs within the hill slopes then disappear underground again after flowing a short distance – characteristic of this limestone topography. The more undulating limestone scenery of north-western Columbia River Forest Reserve forms a plateau at around 700m elevation, and is a far wetter system, supporting plant and amphibian species assemblages unknown from elsewhere in Belize, but bearing affiliations with the highlands of Guatemala and Honduras (Map 8; Map 9).



Map 8: Geology of Columbia River Forest Reserve



Map 9: Geological Landscape of the Columbia River Forest Reserve

The Maya Mountain Divide itself, the crest separating the CRFR from the Chiquibul forest, is of metamorphosed sedimentary rocks, known as the Santa Rosa Group, with localized granite intrusions, forming the very highest points of Columbia River Forest Reserve. This was formed from tectonic uplift along a major fault system – the Quartz Ridge / Bladen Fault - during the Triassic period, accompanied by intrusion by granite. A volcanic intrusion, an extension of the porphrytic Bladen Volcanic Member composed of lavas and associated extrusive volcanic sediments, forms the Little Quartz Ridge.

2.4.3 Soils

Two major soil and land use studies have taken place in Belize – the first a comprehensive study of the whole country by Wright et. al. (1959), looking at soils and associated vegetation assemblages in great detail. The second is a more recent study by King et. al. (1986) based on Wright et. al. (1959) but using techniques such as satellite imagery to update the original report. Soils within Columbia River Forest Reserve are largely dependent on the underlying geology, and can be divided broadly into soils derived from limestone rocks, and acidic soils with granitic origins (Table 10; Map 10: Map 11).

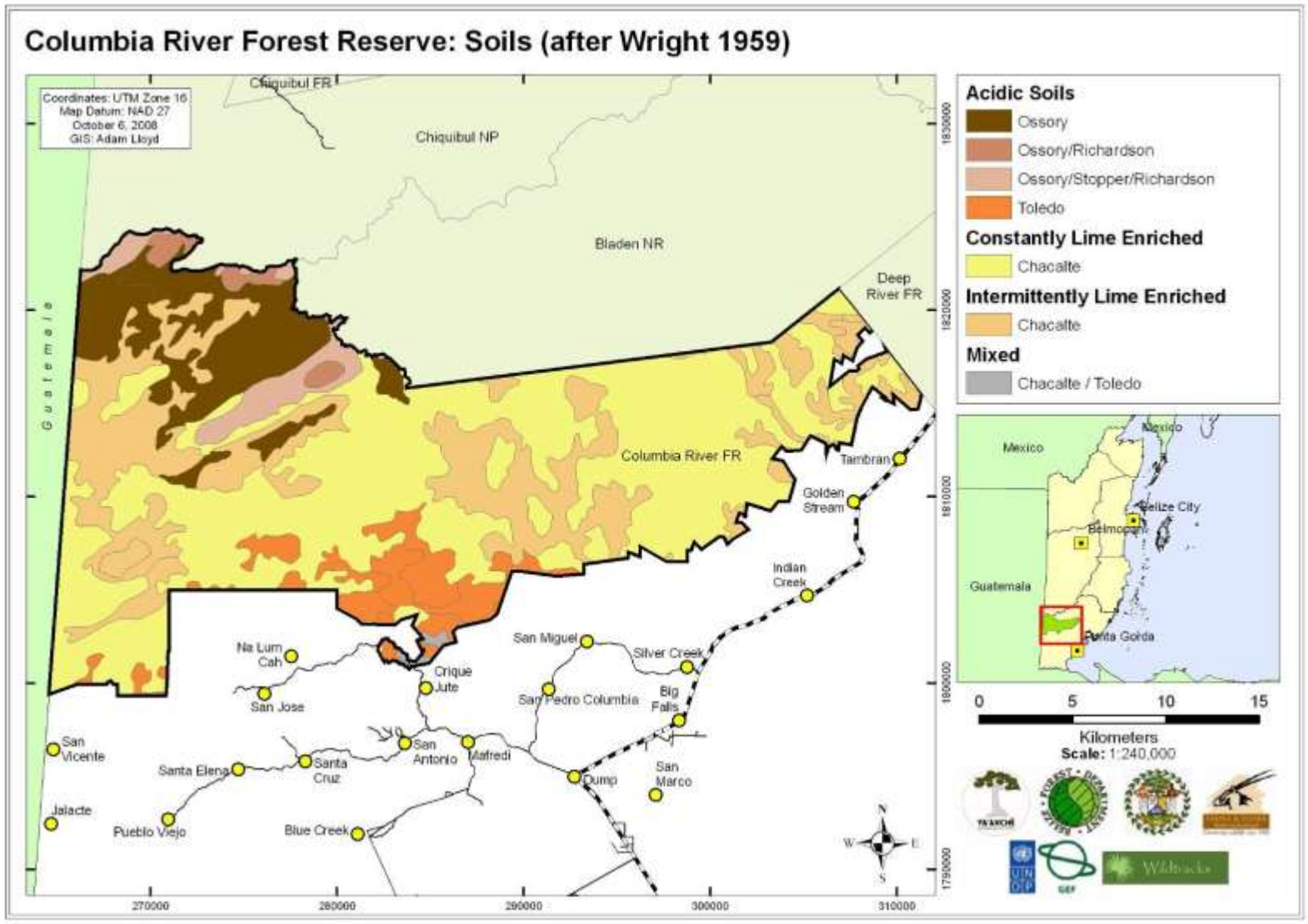
Constantly Lime Enriched Soils and **Intermittently Lime Enriched Soils**

These are soils of the Toledo Foothills - densely dissected, steeply sloping limestone hills. Much of the land consists of karst topography of sloping towers and sink holes, produced by differential limestone solution. The steeper regions, with very shallow soils, are prone to erosion, and therefore unsuitable for agriculture.

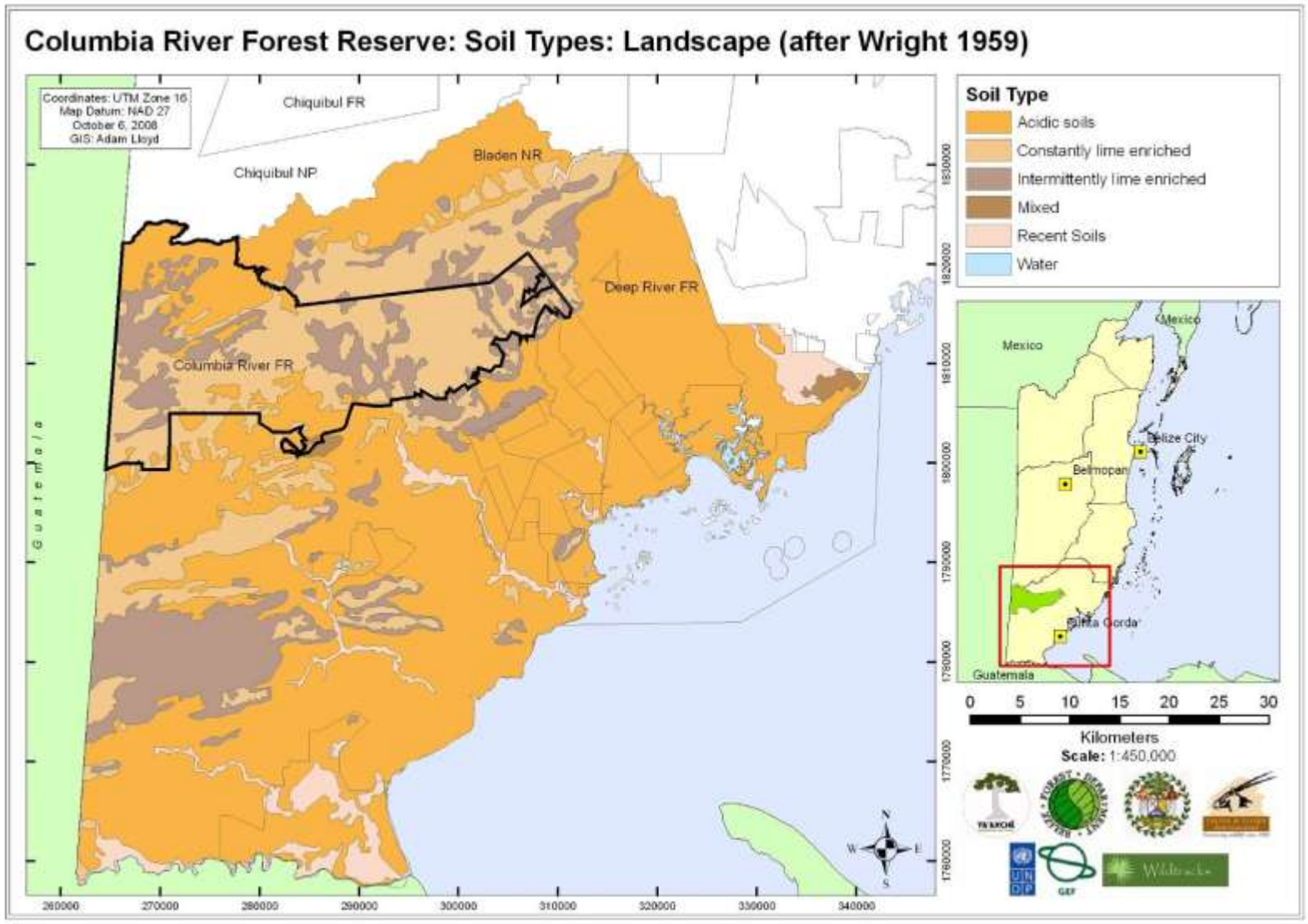
Acidic Soils

The small pockets of acidic soils are derived from the steep granite mountainous crest of the Maya Mountains – over 25° angle between 80 and >1,000m altitude, and overlie Santa Rosa Group metasediment rocks, producing non-alluvial, shallow soils on the slopes, or deeper colluvial deposits that collect at the base of the hillslopes following erosion. Vegetation characteristic of this soil type is tropical evergreen submontane palm forest over non-calcareous rocks and tropical evergreen broadleaf submontane forests over non-calcareous rocks.

Table 10: Soils of Columbia River Forest Reserve (after King et. al. 1986, 1993)		
Soil Suite	**General characteristics**	**Location**
Acidic Soils		
Ossory	Acidic red and grey leached soils of the Maya Mountains, derived from Santa Rosa sediments. Shallow and stony, and poorly developed.	Primarily on the north west plateau behind and to the west of Little Quartz Ridge, and in the Esperanza area on the Columbia River / Bladen boundary.
Richardson	Very acidic, generally deeper red and yellow leached soils of the main divide of the Maya Mountains, derived from, the Bladen volcanic, and confined to outcrops of this parent rock.	Associated with the Bladen volcanic outcrops, this soil type is found on Little Quartz Ridge and the main divide of the Maya Mountains
Stopper	Red, yellow and grey gritty loams and clays with low nutrient content, derived from granite, of the rolling and rugged basins of the Maya Mountains. Granitic outwash deposits in foothills.	Within Columbia River Forest Reserve, this soil type is found on Little Quartz Ridge and the main divide of the Maya Mountains
Toledo	Brown, grey and reddish clays and loams in uplands and coastal lowlands of Toledo, derived from the more easily eroded clastic sediments of the Toledo Beds, resulting in more rolling terrain.	Pockets of soils formed within the foothills of the Columbia River Forest Reserve, the most extensive being to the north of Crique Jute, and including the mahogany plantation of ITVET.
Lime Enriched		
Chacalte	Constantly lime enriched, neutral/alkali shallow and stony clays, derived from Cretaceous limestone, in karstic locations. Prone to shrinking and cracking in dry season. Deeper soils accumulate in the inter-karstic basins, with heavy, sticky clay sub-soils.	Broad spread soil type across the main portion of Columbia River Forest Reserve, particularly in the inter-karstic basins.
	Intermittently lime enriched, slightly acidic shallow and stony clays, derived from Cretaceous limestone, in karstic locations.	Found on the karstic hillslopes of Columbia River Forest Reserve



Map 10: Soil of Columbia River Forest Reserve



Map 11: Soil of Columbia River Forest Reserve

2.4.4 Hydrology

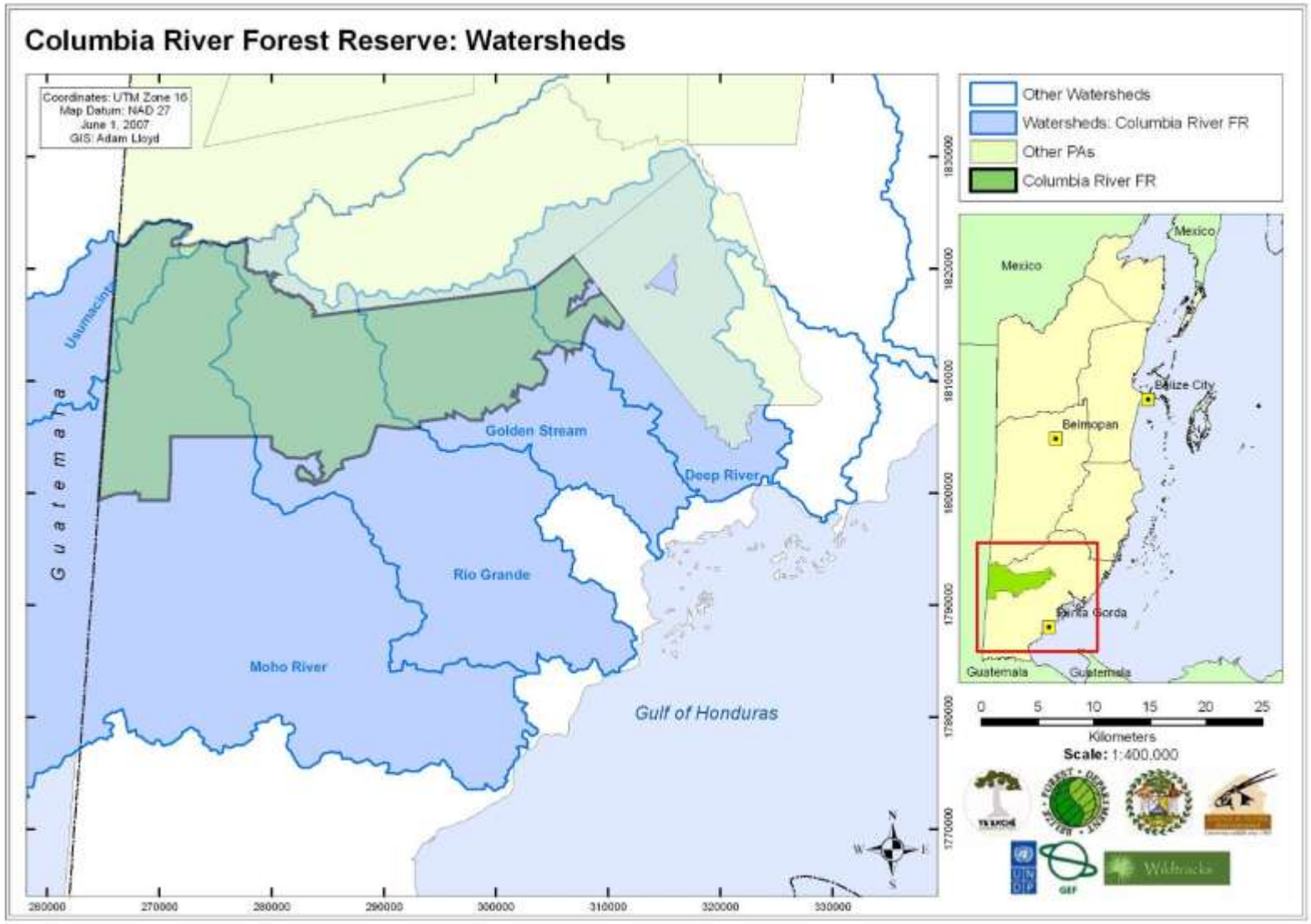
The Forest Reserve protects the headwaters of six watersheds (the Deep River, Golden Stream, Moho River, Monkey River, Rio Grande and Usumacinta watersheds), providing water for communities downstream in both Belize and Guatemala. Five of these watersheds drain into the Port of Honduras, with a critical role in the maintenance of the health of the Belize Barrier Reef in Southern Belize, part of Belize's serial World Heritage Site.

Within the hydrological context of southern Belize, two out of the three upper watersheds that appear to be of critical biodiversity importance occur within Columbia River Forest Reserve - the upper reaches of the Moho River and Rio Grande (the Central River). The third is the Bladen Branch of Monkey River in Bladen Nature Reserve. The upper reaches of these three rivers all originate from the Core Preservation Zone of the Maya Mountains Massif, also identified as having the highest national biodiversity under the Key Biodiversity Assessment (Meerman, 2007). Those of Columbia River Forest Reserve – the upper Moho and Central Rivers - drain pristine forest areas that are the only known locality in Belize for critically endangered and endangered amphibian species, forests that are likely to also be floristically unique in Belize, with species affiliation with the forests of the highlands of Guatemala and Honduras.

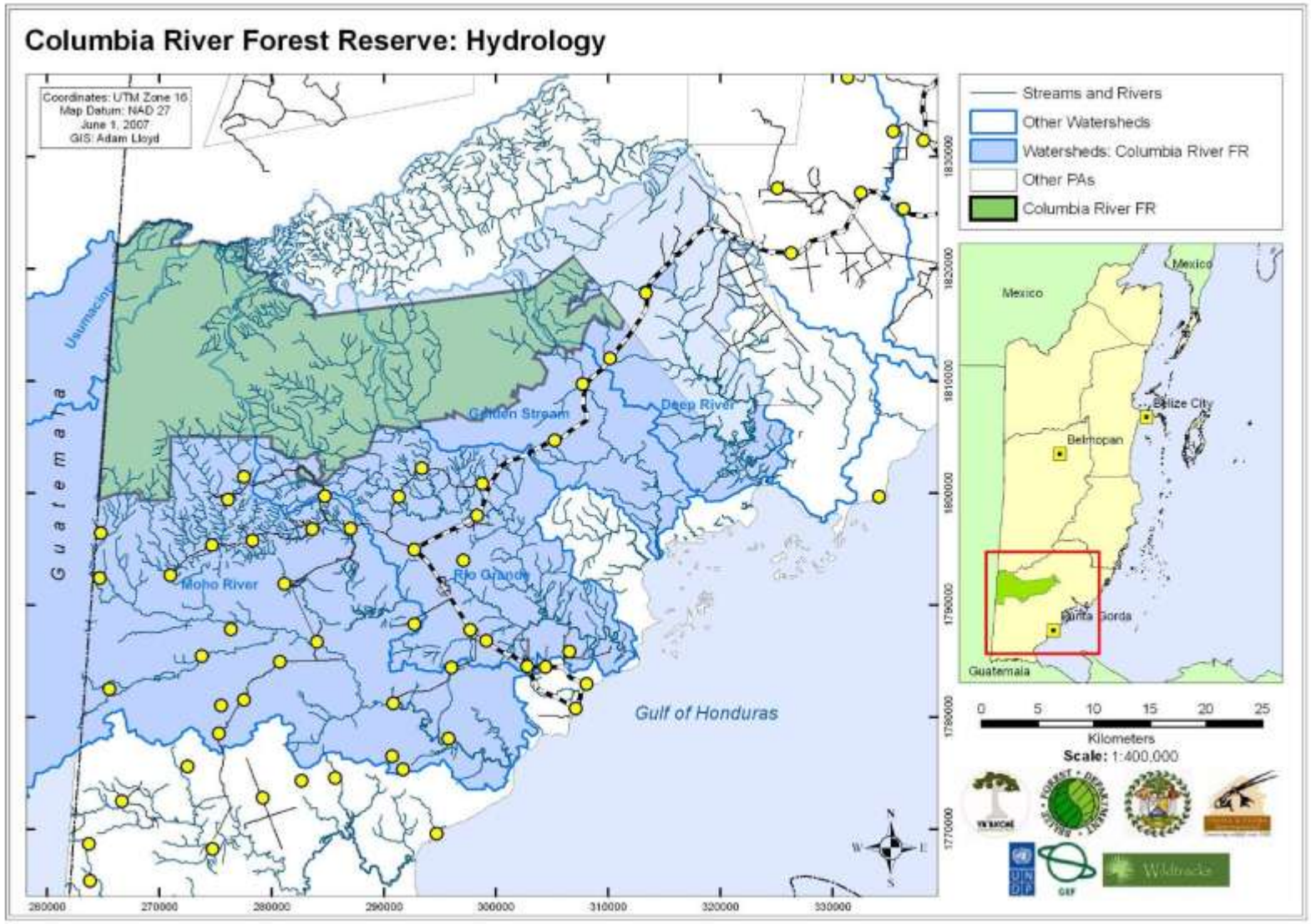
The upper reaches of Central River, in the heart of the most biodiverse area of Belize, drains from both Little Quartz Ridge and the Main Divide of the Maya Mountains Massif. It flows several kilometers through pristine forest and then plunges into a cave system – and is believed to re-emerge to join the Rio Grande in the lower foothills. With the drop into the cave system, Central River is effectively isolated from upstream migration of flora and fauna – such that populations of fish and freshwater invertebrates, and possibly even riparian amphibians, are likely to be genetically isolated from those downstream, with a significant possibility that separate species may have evolved there over the millennia. This watershed, lying centrally in the Core Preservation Zone of the Maya Mountains Massif and the highest priority area of the Key Biodiversity Areas of Belize, has the potential to be raised even further in profile if new and endemic species are found to occur there.

Communities in Belize Reliant on CRFR Watershed Functionality

- Indian Creek
- San Jose
- San Antonio
- Santa Cruz
- Santa Elena
- Pueblo Viejo
- Blue Creek
- Aguacate
- Santa Teresa
- San Benito Poite
- Santa Luca
- Big Falls
- San Pedro Columbia
- San Miguel
- San Vicente
- Jacinto
- Crique Jute
- Machaca
- San Felipe
- Santa Ana
- Wilson Road
- Medina Bank
- Golden Stream
- Silver Creek
- San Marco
- Mafredi
- Jalacte
- Laguna
- Eldridge
- Na Lum Cah
- Old Mabel Ha
- Marbel Ha
- Jordan
- Midway
- Dump
- Tushville
- Boom Creek
- Tambran
- Yemeri Grove



Map 12: Hydrology of the Columbia River Forest Reserve



Map 13: Hydrology of the Columbia River Forest Reserve and associated landscape

2.5. Biodiversity of Management Area

Columbia River Forest Reserve is recognized for its contribution towards the maintenance of the matrix of tropical broadleaf forests that are characteristic of northern Mesoamerica, but are currently greatly diminished in comparison with historic ranges. A total of 57 species of mammal, 190 bird species, 26 amphibians and 41 reptiles and over 800 species of plant have been recorded within the Forest Reserve to date.

The Forest Reserve has been highlighted as a key biodiversity area (Meerman, 2007), protecting a unique assemblage of species within Belize, including three Critically Endangered species – Morelet's treefrog (*Agalychnis moreletii*), Coffeus rain frog (*Craugastor coffeus*) and the cycad species *Zamia prasina*. Also recorded from the Forest Reserve are ten Endangered species - including the charismatic black howler monkey (*Alouatta pigra*) and Baird's tapir (*Tapirus bairdii*) (IUCN, 2008), and a further fifteen Vulnerable species. A number of Near Threatened species are recorded in the area, including the wide ranging jaguar and white lipped peccary, dependent on the tropical forest connectivity offered by the Maya Mountains Massif. A new species of cycad, *Zamia decumbens*, a Belize endemic, has recently been described from CRFR and a number of other localities within the Maya Mountains Massif - and is scheduled to be classified as critically endangered. Such discoveries will certainly continue as more research is undertaken in the upper elevation plateau of north-west CRFR. Indeed this area of the Reserve is likely to be the most biodiverse locality in Belize, harbouring critically endangered and endangered species found nowhere else in the Country.

2.5.1 Ecosystems

Within the 148,303 acres (60,015 hectares) of the Columbia River Forest Reserve lies a rich mosaic of 12 natural ecosystems (Table 11; Map 14: Map 15) – a diverse assemblage of broadleaf forest ecosystems over an elevational gradient from <100m to >1,000m, with rivers and creeks draining the ridge tops to the Bay of Honduras. Columbia River is particularly important in its coverage of tropical wet broadleaf forests – wetter and less seasonal than much of the forest across the Maya Mountains Massif, and as such including flora and fauna not found in the more seasonal forests. Of the 8 broadleaved forest ecosystems, 4 include over 50% of the total national coverage. Whilst the forests of CRFR have been more extensively studied than those of most other protected areas of the Massif, the submontane forests are clearly very diverse and harbour many species not known to occur elsewhere in Belize. Brief studies of submontane forest of Little Quartz Ridge yielded 35 new vascular plant species for Belize, representing 5 genera (Holst et al. 1997), and clearly many more are yet to be added. It is clear that the submontane forests of Columbia River and the contiguous Bladen Nature Reserve are unique in Belize, with significant portions being identified as highest priority for Biodiversity conservation within the Key Biodiversity Areas Assessment (Meerman, 2009), and within the Core Preservation Zone of the Maya Mountains Massif (Walker &

Walker, 2008). Some of the tall wet forests northwest of Little Quartz Ridge are amongst the most pristine in Belize, largely sheltered from hurricane impacts, some of these submontane wet forest trees reach over 50m in height, and may never have been logged. Given the unique flora and fauna of these forest types, and the very high proportion of their national coverage occurring in Columbia River, it is clear that this reserve plays an absolutely critical role in the conservation of Belize's biodiversity.

Ecosystem	Acres
Tropical evergreen broad-leaved alluvial forest on calcareous soils	1,310
Tropical evergreen broad-leaved lowland hill forest on rolling karstic terrain	28,752
Tropical evergreen broad-leaved lowland hill forest on steep karstic terrain	27,705
Tropical evergreen broad-leaved lowland hill forest, Calophylum variant	11,945
Short-grass savanna with scattered needle-leaved trees	726
Deciduous broad-leaved lowland disturbed shrubland	3,449
Deciduous broad-leaved lowland riparian shrubland in hills	40
Tropical evergreen broad-leaved submontane forest	17,120
Tropical evergreen broad-leaved submontane forest on rolling karstic hills	23,080
Tropical evergreen broad-leaved submontane forest on steep karstic hills	25,628
Tropical evergreen broad-leaved submontane palm forest	5,542
Agriculture	2,934
Rivers and creeks	72
Total:	**148,303**

Table 11: Ecosystems of Columbia River Forest Reserve (Meerman, 2004)

Two ecosystems have been identified as being endemic to the Maya Mountains Massif (Map 16):

- Tropical evergreen broad-leaved submontane palm forest – with 18.6% of its national coverage occurring in CRFR

- Tropical evergreen broad-leaved submontane forest on rolling karstic hills – with 70.6% of its national coverage occurring in CRFR

This 'endemism' is somewhat misleading, resulting in part from bi-national variation in terminology, the formerly contiguous (and presumably similar) forest in Guatemala has largely been cleared for cattle pasture, with remaining tracts being highly fragmented.

Wright, et. al. (1959) mapped a small area of 'savanna' just south of Machiquila in north-western CRFR, occurring on loose sandy soils. This was subsequently identified as a lowland pine savanna within the National Ecosystem Map – though the

classification as "lowland" is now considered incorrect. This relatively small tract is almost certainly the result of past fire impacts, and given the historical human landscape context, the fires responsible were likely to have been caused naturally, by lightning strikes. Whilst pine was evidently present some decades ago (Wright et. al. 1959) the area is now primarily grassland with a few scattered broadleaf trees, suggesting eradication of the pines by frequent fires, and a subsequent colonization by broadleaf trees.

Tropical evergreen broad-leaved lowland hill forest on rolling karstic terrain	
Belize Ecosystems Legend Code:	1
Broad Ecosystem	Lowland broadleaved wet forest
Area mapped in CRFR:	28,752 acres
Percentage of national coverage:	52.9%
The area within CRFR under this ecosytsem represents a very significant portion (52.9%) of the total national coverage in Belize, as mapped by Meerman & Sabido (2004). Covering a large central portion of CRFR, it was heavily impacted by Hurricane Iris, and much is now in the early stages of regeneration. Currently the system has a broken canopy, and timber stocks are believed to be significantly depleted as a result of the hurricane damage. Generally the forest canopy is higher on the undulating terrain than on the steeper slopes, historically with trees up to 40m in height – though few currently reach over 30m. The species composition, topography, and condition of the forest placed this ecosystem at the core of the long-term forest harvesting plan, though sustainable timber harvest is not now conisdered possible for at least another 15-20 years. The southern portion of this ecosystem is impacted by agricultural incursions from the village of San Pedro Columbia. Predominant species include: *Aspidosperma* spp, *Attalea cohune, Brosimum alicastrum, Calophyllum brasiliense, Calyptrogyne ghiesbreghtiana, Crysophila stauracantha, Guarea glabra, Hirtella americana, Manilkara zapota, Sideroxylon foetidissimum, Ouratea lucens, Pimenta dioica, Pouteria amygdalina, Pouteria durlandii, Sabal mauritiiformis, Sebastiana tuerckheimiana, Spondias radlkoferi, Tabebuia rosea, Trichilia minutiflora, Trichilia moschata,* and *Vatairea lundellii.*	

Tropical evergreen broad-leaved lowland hill forest on steep karstic terrain	
Belize Ecosystems Legend Code:	2
Broad Ecosystem	Lowland broadleaved wet forest
Area mapped in CRFR:	27,705acres
Percentage of national coverage:	29.8%
Species composition of this forest is similar to that of the lowland hill forest on rolling karstic terrain though, being better drained, tends to have rather higher proportions of species such as *Manilkara zapota* and *Spondias radlkoferi.* In areas that escaped the most severe impacts of Hurricane Iris, trees reach up to 30m in height – rather lower than those on less steep terrain. Despite the high rainfall in CRFR, this ecosystem is very prone to anthropogenic fire.	

Tropical evergreen broadleaf lowland hill forest: *Calophyllum* variant	
Belize Ecosystems Legend Code:	4
Broad Ecosystem	Lowland broadleaved wet forest
Area mapped in CRFR:	11,945
Percentage of national coverage:	52.6%
Found in the southern reaches of central CRFR, north of San Jose Village, this occurs on relatively steep terrain, and therefore has had varying scales of impact from Hurricane Iris, with forest on the leeward slopes suffering significantly less than that on the windward side. Canopy height was generally between 20 – 30m prior to the 2001, though few of the larger trees now remain. Common tree species include: *Acosmium panamense*, *Aspidosperma cruenta*, *Attalea cohune, Calophyllum brasiliense*, *Dialium guianense*, *Erblichia odorata*, *Guarea glabra*, *Licania platypus*, *Pouteria mammosa*, *Pterocarpus officinalis*, *Simarouba glauca*, *Spondias radlkoferi Symphonia globulifera Terminalia amazonia*, *Virola koschnyi*, *Vismia ferruginea*, *Vochysia hondurensis*, and *Xylopia frutescens*.	

Tropical evergreen broad-leaved submontane forest on rolling karstic hills	
Belize Ecosystems Legend Code:	8
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in CRFR:	23,080
Percentage of national coverage:	79.6%
This ecosystem occurs on much of the less steep terrain in western CRFR, including an approximately 2km plateau along the south-eastern base of Little Quartz Ridge, as well as the area around Edward Central, and others to the south and north-west of that camp. It is a relatively tall forest, with a canopy of 25-30m, and taller emergents, though it has been significantly impacted by Hurricane Iris and subsequent salvage logging operations. Common species in this ecosystem, on the south side of Little Quartz Ridge include: *Euterpe precatoria, Ilex belizensis, Lacisterma agregatum, Miconia impetiolaris, Ouratea lucens, Psychotria elata, Psychotria simiarum, Pouteria campechiana, Pouteria amygdalina, Protium sp., Protium copal, Pseudolmedia spuria, Quercus sp., Sloanea tuerckheimii, Sideroxylon floribundum, Stemmadenia donnell-smithii, Strynchnos panamensis, Symphonia globulifera, Terminalia amazonia, Trophis racemosa, Virola koschnyi*, and *Vochysia hondurensis*. Tree ferns are abundant in this ecosystem.	

Tropical evergreen broad-leaved submontane forest on steep karstic hills	
Belize Ecosystems Legend Code:	9
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in CRFR:	25,628
Percentage of national coverage:	80.1%
There is significant species overlap between this ecosystem and that found on the less steep, rolling limestone terrain. Trees on the steeper slopes tend to be of smaller diameter and shorter in height than those on the less steep terrain. 80% of the national coverage of this ecosystem lies within CRFR, where it is limited to the western half of the reserve, on the steeper slopes over 500m elevation.	

Tropical evergreen broad-leaved submontane forest over non-calcareous rocks	
Belize Ecosystems Legend Code:	10
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in CRFR:	17,120
Percentage of national coverage:	26.6%
This ecosystem, identified as being endemic to the Maya Mountains Massif, occurs north-west of Little Quartz Ridge up to the Main Divide. It also extends across the border into Guatemala, but under a different nomenclature (result in its 'endemic' status) – though broadscale clearance in Guatemala has resulted in the clearance of much of this ecosystem type. It occurs above 500m elevation, and is one of the wettest most pristine and least studied forests in Belize. Some of the tallest trees here exceed 50m in height - sheltered by Little Quartz Ridge, all but the most southerly portion of this forest escaped the ravages of Hurricane Iris in 2001, but it is now being impacted by illegal Guatemalan logging incursions. Characteristic species include *Aspidosperma cruenta, Calophyllum brasiliense, Euterpe precatoria, Simarouba glauca, Swietenia macrophylla, Terminalia amazonia, Vismia macrophylla, Vochysia hondurensis* and *Xylopia frutescens.*	

Tropical evergreen broad-leaved submontane palm forest	
Belize Ecosystems Legend Code:	11
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in CRFR:	5,542
Percentage of national coverage:	18.6%
Nearly a fifth of the national coverage of this ecosystem, endemic to the Maya Mountains of Belize, occurs on Little Quartz Ridge, in CRFR. The flora here is very distinctive from other forests, with numerous new species records for Belize being identified here – including 35 vascular plant species across 5 genera (Holst, B., 1997). Common species on the summit of Little Quartz Ridge include: *Euterpe precatoria, Colpothrinax cookii, Magnolia sp., Miconia hondurensis, Miconia impetiolaris, Morinda panamensis, Nectandra globosa, Nectandra cuspida, Pseudolmedia spuria, Pterocarpus officinalis, Psychotria capitata, Physchotria elata, Psychotria poeppigiana, Psychotria trichotoma, Pouteria reticulata, Quercus sp., Roupala montana, Sloanea tuerckheimii, Sloanea meianthera, Synecanthus fibrosus, Terminalia amazonia, Zinowiewia pallida, Xylopia frutescens*, and *Zanthoxylum riedelianum*. Tree ferns are abundant in this ecosystem.	

Tropical evergreen broad-leaved alluvial forest on calcareous soils	
Belize Ecosystems Legend Code:	14
Broad Ecosystem	Lowland broadleaf wet forest
Area mapped in CRFR:	1,310
Percentage of national coverage:	4.2%
In CRFR, this ecosystem is confined to the floodplain of a tributary of the Columbia Branch, north of Sapodilla Hill, north of Crique Jute. This riparian forest ecosystem is one of the preferred habitats for the Yucatan howler monkeys and Baird's tapir. Common plants include *Acosmium panamense, Astrocaryum mexicanum, Bactris mexicana, Attalea cohune, Brosimum sp., Calyptrogyne ghiesbreghtiana Calophyllum brasiliense, Castilla elastica, Ceiba pentandra, Celtis schippii, Dendropanax arboreus, Desmoncus staurocanthos, Dialium guianense, Ficus spp., Inga affinis, Ochroma pyramidale, Pouteria spp., Protium schippii., Pterocarpus rohnii, Quararibea funebris, Sabal mauritiiformis, Schizolobium parahybum, Simira salvadorensis, Symphonia globulifera* and *Vochysia hondurensis.*	

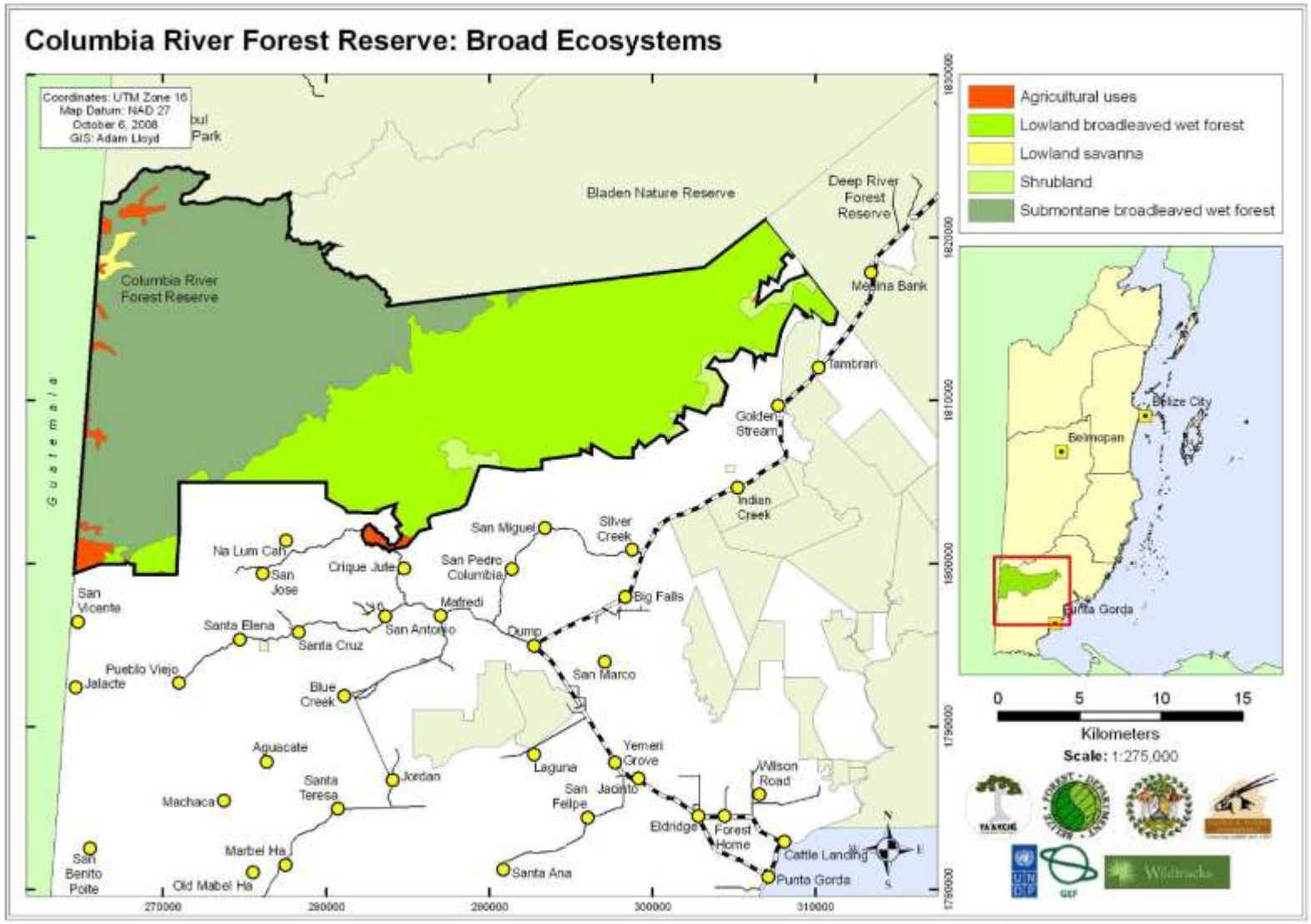
Tropical evergreen seasonal needle-leaf submontane forest	
Belize Ecosystems Legend Code:	39
Broad Ecosystem	Submontane Pine Forest
Area mapped in CRFR:	726
Percentage of national coverage:	1.65%
Previously mapped as 'Short-grass savanna with scattered needle-leaved trees' (which typically occurs below 500m elevation), this ecosystem occurs at approx 800m in the north-western corner of CRFR, and is almost certainly the result of past and present fire impacts. The fact that it was mapped in the 1950's as a pine-dominated ecosystem (Wright, et. al., 1959) indicated that the initial fire was probably not anthropogenic in origin, as the Guatemalan communities responsible for current incursions and fires did not exist then. It is characterized by a strong dominance of *Pinus caribaea*, with common broadleaf trees include *Agarista* sp., *Byrsonima crassifolia, Clethra occidentalis, Clusia massoniana, Schippia concolor, Terminalia amazonia* and various *Quercus* spp.	

Deciduous broad-leaved lowland disturbed shrubland	
Belize Ecosystems Legend Code:	58
Broad Ecosystem	Shrubland
Area mapped in CRFR:	3,449
Percentage of national coverage:	7.6%
Occurring in a number of isolated patches on the southern boundary of eastern CRFR, this ecosystem is the result of anthropogenic impacts from farming and / or fires associated with adjacent communities. Species composition varies, depending upon topography, drainage, and the persistence of anthropogenic impacts, but can be characterized by the predominance of weed species.	

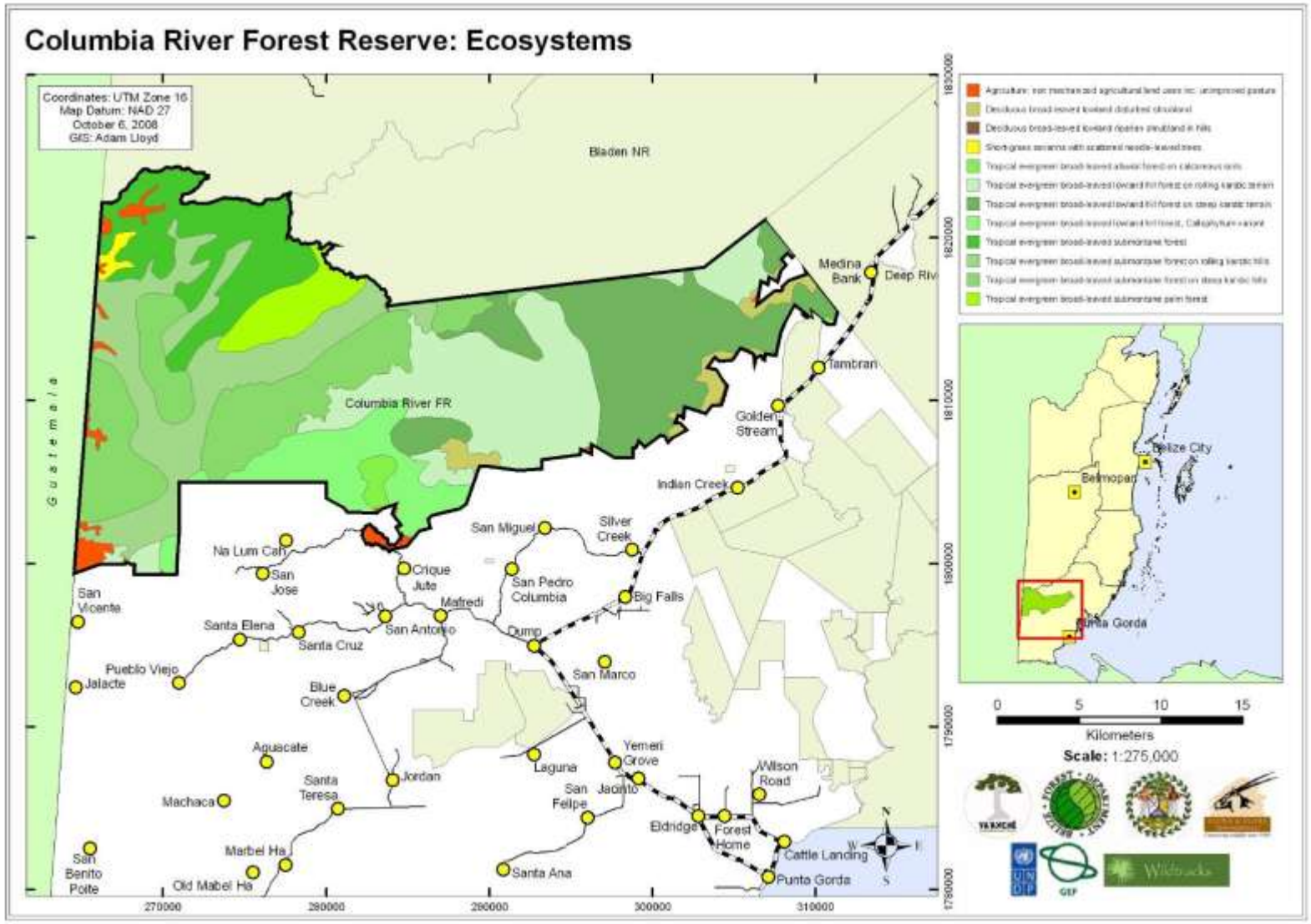
Deciduous broad-leaved lowland riparian shrubland in hills	
Belize Ecosystems Legend Code:	61
Broad Ecosystem	Shrubland
Area mapped in CRFR:	40
Percentage of national coverage:	0.6%
A small tract of this ecosystem occurs along the banks of the Central River, along the boundary between CRFR and the Bladen Nature Reserve. In this location, the ecosystem is undoubtedly of natural origin, caused by flood events along Central River, sweeping across the low floodplain, mostly on the western bank. Here a predominant plant is *Heliconia latispatha*, occurring in a dense shrub layer, occurring under tall *Schizolobium parahybum, Cecropia obstusifolia Castilla elastica* and *Ceiba pentandra* trees.	

River	
Belize Ecosystems Legend Code:	77
Broad Ecosystem	Water
Area mapped in CRFR:	72 (calculated)
Percentage of national coverage:	
The aquatic riverine ecosystems of CRFR are not mapped within the National Ecosystem Map, presumably as these upper watershed tributaries and branches are below the width threshold used in that initiative. Spanning five watersheds (Rio Usumacinta, Moho River, Rio Grande, Golden Stream and Deep River), the vegetation of these upper drainages are likely to vary significantly from one another, but no work has been conducted in these systems to date.	

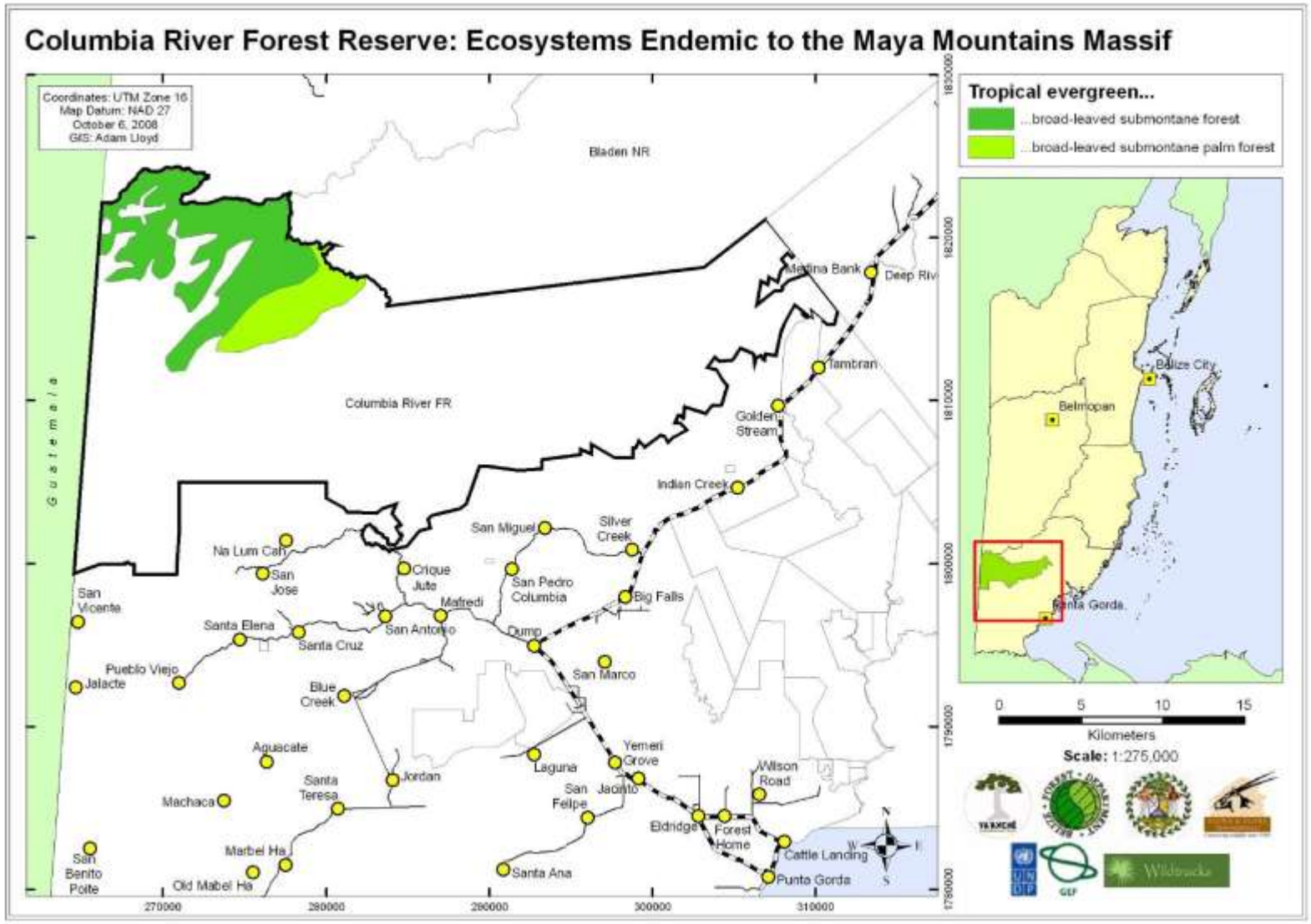
Agriculture	
Belize Ecosystems Legend Code:	79
Broad Ecosystem	Agricultural uses
Area mapped in CRFR:	2,934
Percentage of national coverage:	N/A
The vast majority of farming incursions in the CRFR are along the border with Guatemala, and result from illegal Guatemalan incursions. Past agricultural incursions from Belizean communities were excised from the Reserve in boundary realignments, though there are some scattered subsequent (illegal) farming incursions from San Vicente, and from San Pedro Columbia in areas close to the Rio Grande.	



Map 14: Broad Ecosystems of Columbia River Forest Reserve



Map 15: Ecosystems of Columbia River Forest Reserve



Map 16: Ecosystems of Columbia River Forest Reserve that are restricted to the Maya Mountains Massif in Belize

2.5.2 Flora

Over 800 species of plant have been recorded within Columbia River Forest Reserve - the flora of this area has received more attention than that of most other protected areas within the Maya Mountains Massif. Whilst being far from comprehensive, studies to date provide extensive species lists, analysis of the species composition and species richness of vegetation assemblages on and adjacent to Little Quartz Ridge (Shawe, 1997), and overview of the regional context of its flora (Holst, 1997). Holst observed that:

> "*Plant diversity in general for the Little Quartz Ridge is high for Belize and, along with the divide [the Main Divide], is almost certainly the highest in the country. This is due to the wide range of topography of the Maya Mountains (400-1140m), strongly different types of bedrock (granite, volcanic, limestone and others), relatively high rainfall, and a low degree of human disturbance. …the flora of the upper parts of the ridge is an excellent example of mid-montane Central American forests, which in other parts of their range have been heavily disturbed by agricultural activities."*

Columbia River Forest Reserve has therefore been shown to harbour a diverse flora, much within largely pristine ecosystems, and representative of the biodiversity hotspot of Central America that has been so extensively cleared or severely degraded elsewhere in the region. The plant list generated by Holst includes a total of 452 genera and 801 species of Spermatophytes and Bryophytes – possibly the most extensive plant list for any reserve in Belize. Undoubtedly, many will be added to the list with further studies, but this is indicative of both the very high diversity, and the quality of research undertaken in the past. The Esperanza Camp area has been highlighted as the next priority area for further botanical studies (Shawe, 1997).

2.5.3 Fauna

58 species of mammal, 190 species of birds and 67 herptiles (41 reptiles and 27 amphibians) are confirmed to date as present within Columbia River Forest Reserve (Table 12). When taking into account records for the contiguous Bladen Nature Reserve to the north east, Columbia River Forest Reserve and Bladen are expected to have significant species overlap, with most species recorded in Bladen expected to occur in the Forest Reserve, particularly with some of the species recorded in the sub-montane and montane forest areas of the Main Divide. This would increase the number of species considered present to 110 species of mammal, 250 species of birds and at least 92 herptiles – still considered a conservative estimate of the likely level of biodiversity of these taxa in this area.

Columbia River Forest Reserve protects a unique assemblage of species within Belize...including three Critically Endangered species – Morelet's Treefrog (*Agalychnis moreletii*), Coffeus Rain Frog (*Craugastor coffeus*) and the cycad species *Zamia prasina*. Also recorded from the Forest Reserve are ten Endangered species - including the charismatic black howler monkey (*Alouatta pigra*) and Baird's tapir (*Tapirus bairdii*) (IUCN, 2008), and fifteen Vulnerable species. A number of Near Threatened species are recorded in the area – jaguar and white lipped peccary among them, though conservation planning meetings with local communities suggest that game species numbers are much reduced, with extensive hunting, especially in the western part of the Forest Reserve, from communities on the Guatemalan side of the border. A further 2 are considered of international concern at sub-species level (the Central American spider monkey *(Ateles geoffroyi spp. yucatanensis*) and the tayra (*Eira barbara ssp. senex*)). Also present within the Forest Reserve is the (*Lithobates juliani*), a Belize endemic Maya Mountain frog

Table 12: Vertebrate species breakdown for CRFR

Vertebrate Group	No. Species (CRFR)	No. Species (CRFR/ BNR)	No. Species (Belize)
Mammals	58	93	163
Birds	190	250	574
Reptiles	41	68	125
Amphibians	27	24	44

Ya'axché has been monitoring selected bird and mammal populations in Eastern CRFR, using fixed transects, increasing the knowledge of the biodiversity available for effective management.

Mammals

With its forested slopes, valleys and rugged limestone landscapes, Columbia River Forest Reserve is home to a wide variety of mammal species typical of tropical moist broadleaf forest. Of the 163 species of mammal recorded within Belize (Jacobs et. al. 1998) that could potentially be found in the protected area based on the assumption of similar ecosystems, 58 species are recorded as present within the Forest Reserve itself (Annex 2).

When the entire Maya Mountain block of south and east-slope protected areas of contiguous ecosystems is considered (Columbia River Forest Reserve, Bladen Nature Reserve and Cockscomb Basin Wildlife Sanctuary), the number of species known to be present increases to 110 – 67% of the total number of mammal species recorded for Belize, (McCarthy 1987, McCarthy et. al. 1993, McCarthy and Blake 1987, Miller; 1999; Emmons 1993) – all with the potential to be present in Columbia River Forest Reserve.

A number of species of international concern have been recorded from Columbia River Forest Reserve (Table 13). The Yucatan black howler (*Alouatta pigra*), one of the two endangered species recorded from the area, is endemic to a small area of the Yucatan Peninsula, Belize and the Petén. This species was decimated by a yellow fever epidemic in 1956/1957 that swept through the *Alouatta* population throughout most of the country. Pockets of viable populations remained, including those in Columbia River Forest Reserve, whilst in other areas further north, such as Cockscomb Basin Wildlife Reserve, the epidemic was compounded by other impacts such as the effects of Hurricane Hattie in 1961, and by local hunting pressure, extirpating the local population by 1978 (Horwich et. al 1993). The second primate species, the Central American spider monkey (*Ateles geoffroyi*), appears to be more restricted to the forested hill slopes, overlapping less with areas of human impact. The Belize sub-species, *Ateles geoffroyi yucatanensis,* is listed as 'Vulnerable' (IUCN, 2005), reflecting the decreasing population in the region, primarily through habitat destruction.

Table 13: Mammal Species of Concern of Columbia River Forest Reserve

Common Name	Species Name	IUCN Status[1]	Belize Status[2]
Endangered			
Black Howler Monkey	*Alouatta pigra*	Endangered	Vulnerable
Baird's Tapir	*Tapirus bairdii*	Endangered	Vulnerable
Vulnerable			
Van Gelder's Bat	*Bauerus dubiaquercus*	Vulnerable	Vulnerable

[1]IUCN Redlist, 2008 (downloaded, October, 2009)
[2]Species of National Concern (Provisional). Meerman, 2005 (NPAPSP output); National Amphibian Conservation Action Plan, Walker, in prep.

Baird's Tapir *(Tapirus bairdii)*, is the largest herbivore present in Columbia River Forest Reserve, and tends to be associated particularly with riparian areas where it grazes on the herbaceous vegetation. Whilst listed as an 'Endangered' species internationally (IUCN, 2005), it is widespread in Belize, where it is seldom hunted (however, there have been reports of tapir being killed for meat both by xatéros, and by Garifuna in the adjacent Bladen area (community consultations). The main threat to this species in Belize is considered to be the increasing land use change, with the destruction of suitable habitat - the protection of significant tracts of unfragmented riparian vegetation and other suitable habitat is now considered a priority for its continued survival.

The variegated squirrel (*Sciurus variegatoides*) has been recorded from Columbia River Forest Reserve and the adjacent Chiquibul (Matola, 1992; Rodgers et. al, 1991, Matola 1989), in addition to the Deppe's squirrel (*Sciurus deppei*), which is found throughout forested areas of Belize. Described locally as 'large

and dark', or 'black' (Muschamp, pers. com.), *S. variegatoides* appears to be restricted to forested areas adjacent to the south western border of Belize and Guatemala. Twenty nine species of bat have been recorded to date by a combination of surveys by McCarthy, in the late 1980's, and Miller in 1999, with a further seven species expected to occur here.

The cacomistle (*Bassariscus sumichrasti*) has been recorded from Columbia River Forest Reserve, as have the tayra (*Eira Barbara*) and all five of the cat species, suggesting that there is a good prey base to support these key predators (Marlin, pers. com.).

Two peccary species are recorded from Columbia River Forest Reserve, the collared peccary (*Tayassu tajacu*) and the white-lipped peccary (*Dicotyles pecari*). Populations of white-lipped peccary are considered to have been recovering following the impacts of Hurricane Iris, though local and Guatemalan hunting pressure is reported to be high in areas distant from the communities. The larger *D. pecari*, travels in large herds, and requires extensive contiguous areas of unfragmented broadleaf forest (20,000 hectares being estimated as the minimum dynamic area to support a viable population (TNC, 2006)) – the Maya Mountain block of contiguous protected areas contributes significantly to the conservation of these species, ensuring that there is sufficient broadleaf forest in the overall area to maintain this key species. Records of white-lipped peccary in the higher altitude areas of the Maya Divide in Columbia River Forest Reserve (Meerman and Matola, 1997) suggest that they may also move from one drainage system to another over the mountain passes of the Maya Divide, maintaining a genetically diverse population throughout the Maya Mountain block of protected areas.

Mammal distribution in the karst area is reported as seasonal, with many larger species such as white lipped and collared peccary migrating to the coastal plains along the riparian forest routes as the water sources start to dry up in the steep limestone hills during the dry season (Wright et. al. 1958; Muschamp, 1995; community consultations, 1995 and 2009). As the coastal savannas become flooded during the wet season, these species then move back to the foothills once again. Predators, principally jaguar, are thought to follow this migration. Whilst this has been possible in past years, the current rate of fragmentation of forest habitat and increase in human presence, with the agricultural development along the Southern Highway and the associated hunting pressure, is making this migration less viable, isolating the eastern hill slopes from the coastal areas, with their more accessible water sources. Initiatives such as Ya'axché's Golden Stream Corridor Preserve and TIDE's Block 127 provide the crucial link between the two, and will be an important factor in the long term viability of larger mammal species in this south eastern area of Columbia River Forest Reserve.

Birds

Whilst only 190 bird species have been recorded to date within the boundaries of Columbia River Forest Reserve, based on surveys conducted within the protected area (Conservation International, 1993; Meerman, 1997), this is anticipated to climb to as many as 357 species, from knowledge of species recorded in the adjacent Bladen Nature Reserve (Brokaw and Lloyd Evans, 1987; Iremonger and Sayer, 1994) and Doyle's Delight (Teul, 2004)) – representing 62% of the total bird species currently recorded for Belize. Three species are considered of international concern – the migratory cerulean warbler (*Dendroica cerulean*), the great currassow (*Crax rubra*)and the keel-blled motmot (*Electron carinatum*), and a further two, of national concern – the crested guan (*Penelope purpurascens*) and the king vulture (*Sarcoramphus papa*).

Table 14: Species of Concern of Columbia River Forest Reserve

Common Name	Species Name	IUCN Status[1]	Belize Status[2]
Vulnerable			
Cerulean Warbler	*Dendroica cerulea*	Vulnerable	Vulnerable
Keel-billed Motmot	*Electron carinatum*	Vulnerable	Vulnerable
Great Curassow	*Crax rubra*	Vulnerable	Vulnerable
Crested Guan	*Penelope purpurascens*		Vunerable
King Vulture	*Sarcoramphus papa*		Vulnerable

[1]IUCN Redlist, 2008 (downloaded, October, 2009)
[2]Species of National Concern (Provisional). Meerman, 2005 (NPAPSP output); National Amphibian Conservation Action Plan, Walker, in prep. (2009)

Figure 4: Higher Elevation Species of CRFR / Doyle's Delight

Brown Violet-ear
Stripe-tailed Hummingbird
Keel-billed Motmot
Emerald Toucanet
Plain Antvireo
Slaty Antwren
Tawny-throated Leaftosser
Slate-colored Solitaire
White-throated Robin
Common Bush-Tanager
White-winged Tanager
Elegant Euphonia
White-vented Euphonia
Shining Honeycreeper

Columbia River Forest Reserve contains a wide variety of ecosystems – from the tall tropical forests of the western plateau to the higher elevations of Little Quartz Ridge and the Maya Mountains, resulting in the high species richness observed within the area. Many of the species are lowland broadleaf forest generalists, found throughout much of Belize, but the higher remote and inaccessible elevations of Columbia River Forest Reserve and Doyle's Delight provide habitats for species such as the scaly-throated foliage gleaner (*Anabacerthia variegaticeps*) (Doyle's Delight Expedition,1989), and tawny-throated leaftosser (Figure 4; Doyle's Delight Expedition,1993; Little Quartz Ridge, Jones, 1997). Two neotropical migrants - Chuck-Will's-widow (*Caprimulgus carolinesis*) and the warbling vireo (*Vireo galvus*) - were also recorded for the first time, in Columbia River Forest Reserve in 1992 (Conservation International, 1993), in the higher elevation areas.

It is uncertain how important these upper elevations are for migratory birds – one school of thought suggests that they may be an important stopover point (Parker et. al. 1993), whilst subsequent data collected during the Little Quartz Ridge Expedition in 1997 noted the scarcity of migrants, suggesting that the lowland broadleaf forests play a more important role in the migratory routes of North American species (Jones, 1997).

Two large resident game bird species, the great curassow (*Crax rubra*) and crested guan (*Penelope purpurascens*) are both present in Columbia River Forest Reserve - both these species, along with their more common relative, the plain chachalaca, are representatives of the Cracidae family – the most threatened of the Neotropical bird families. Cracids are important seed dispersers and are a major protein source for local communities. Within Belize, both the curassow and the guan are locally common, though the heavy hunting pressure both from local communities and associated with Guatemalan xatéros has resulted in reduced populations of both species, as noted by the 1992 and 1997 expeditions to the Forest Reserve, with reports that game species were unexpectedly scarce in even the upper elevations, suggesting increasing hunting pressure, with relatively easy access from Guatemala. This has been exacerbated by the impact of Hurricane Iris in 2001, and subsequent salvage logging, which have significantly reduced the number of fruiting trees – an important food source for these and other fruit-eating birds.

Of particular note is the presence of a number of species in the protected area considered endangered or vulnerable, and in need of protection within Belize (Figure 5). These include the keel-billed motmot (*Electron carinatum*), the great curassow (C*rax rubra*) and the Cerulean Warbler (*Dendroica cerulea*) - species of significant conservation concern, and listed as 'vulnerable' by IUCN (through BirdLife International). The keel-billed motmot is limited geographically to Central America, where it was found historically from southeastern Mexico to western Costa Rica. It is now considered very rare or absent within most of its historic range, with remaining populations concentrated in Belize and Nicaragua. It occurs in relatively low densities, even within optimal habitat, and requires large expanses of undisturbed habitat to ensure viable populations. In Belize it is mostly associated with the higher elevations of the Maya Mountains, in areas of steep terrain intersected by streams. It is thought that there may be fewer than 10,000 individuals remaining in the wild, with some estimates placing this figure at closer to 2,500 (BirdLife International, 2000). The population is facing a continuing decline as its forest habitat is further fragmented and destroyed, and is reliant on connectivity of protected areas, such as those of the Maya Mountain Massif for its survival. These areas of Belize are thought by some to be the last stronghold of this species (Jones et. al. 2001). The great curassow has been extirpated throughout much of its former range as a result of habitat loss and hunting. Whilst Belize is the only country in the region to allow the hunting of this species, and illegal poaching within the protected areas is evidently significantly impacting most populations, this species does still exist in the Columbia River Forest Reserve area. The 'near threatened' harpy eagle (*Harpia harpyia*) has also been recorded from the adjacent Bladen (Marlin, pers. com., 2006), and the rare solitary eagle (*Harpyhaliaetus solitarius*) has been recorded from the adjacent Doyle's Delight, with a high probability that its range includes Columbia River Forest Reserve.

Figure 5: Bird Species of International Concern of the Maya Mountain Block

Vulnerable	
Keel-billed Motmot	*Electron carinatum*
Great Curassow	*Crax rubra*
Cerulean Warbler	*Dendroica cerulea*
Lower Risk/ Near Threatened	
Olive-sided Flycatcher	*Contopus cooperi*
Solitary Eagle	*Harpyhaliaetus solitarius*
Painted Bunting	*Passerina ciris*
Golden-winged Warbler	*Vermivora chrysoptera*

IUCN Red List, 2009

The ornate hawk-eagle (*Spizaetus ornatus*), the rarest of the three hawk-eagles found in Belize, is found in very low densities and, like the keel-billed motmot, requires vast areas of unbroken forest in order to survive. From a global perspective, this species is not considered threatened or endangered at present, although with continued forest clearance, it may become globally threatened in the future.

Amphibians

A total of 27 species of the current 44 species of amphibians known to be present in Belize have been reported as present in Columbia River Forest Reserve, considered the most critical protected area in Belize for the viability of many amphibian species (Annex 3). The Forest Reserve harbours a very diverse amphibian fauna, with the potential to include 90% of all species known from Belize, including populations of all 11 of the threatened amphibian species of Belize (2 Critically Endangered, 5 Endangered and 4 Vulnerable) – with the possible exception of *Craugastor alfredi*.

Threatened Amphibian Species of Columbia River Forest Reserve	
Species	**IUCN status**
Agalychnis moreletii	CR
Craugastor coffeus[1,3]	CR
Bolitoglossa odonnelli[2,3]	EN
Bromeliohyla bromeliacia[3]	EN
Ecnomiohyla minera[3]	EN
Craugastor sabrinus	EN
Craugastor sandersoni	EN
Craugastor psephosypharus	VU
Incilius macrocristatus[3]	VU
Eleutherodactylus leprus	VU
To be Confirmed	
C. alfredi Possible – recently found in Chiquibul	VU

[1] A new species record for Belize, found in CRFR. Provisional identification is *Craugastor coffeus* – a critically endangered species previously known only from the highlands of Honduras. Museum work *may* find the CRFR specimen to be a separate new species, in which case it will also be categorized as critically endangered.
[2] A salamander from Doyle's Delight has been attributed to this species – another new record for Belize. (Stafford, et. al., submitted).
[3] Species whose known ranges in Belize to date are confined to Columbia River Forest Reserve.

Table 15: Threatened Amphibians of CRFR

Five of these threatened species have been found in Belize *only* in Columbia River Forest Reserve (Table 15), all within the north-west upper elevation plateau and surrounding ridges, part of an amphibian species assemblage that is unique in Belize – and which has a strong species affiliation with the Highlands of Guatemala and Honduras. The unique 700m+ elevation plateau, sheltered from easterly storms by Little Quartz Ridge, then stretches up to the Main Divide, over 1,000m above sea level, forming a long high ridge separating it from the Chiquibul National Park to the north. There can be little doubt that additional new species records for Belize will be found here with further surveys, and a number of these species are considered unlikely to occur in other protected areas in Belize – highlighting CRFR's critical role in the conservation of Belize's threatened amphibians.

In Belize the 700+m plateau adjacent to Little Quartz Ridge is the only known locality for the critically endangered coffeus rainfrog (*Craugastor coffeus*), the endangered bromeliad treefrog (*Bromeliohyla bromeliacia*) and fringe-limbed treefrog (*Ecnomiohyla minera*), as well as the vulnerable large-crested toad (*Incilius macrocristatus*) and near threatened snouted robber frog (*Craugastor rostralis*).

The very rarely encountered limestone rainfrog (*Craugastor psephosypharus*), listed as vulnerable by IUCN (IUCN, 2009) was first found in Columbia River Forest Reserve (where it was locally common in the early 1990's), with three individuals subsequently recorded within and adjacent to the Bladen Nature Reserve, and two juveniles being recorded in north-west CRFR in 2008 and 2009. A combination of factors including elevation, topography, rainfall, geology, and (possibly) historical lack of human impact are likely to be responsible for these species occurring in this area and nowhere else in Belize.

Also a new record for Belize is a salamander recorded from Doyle's Delight, attributed to the species *Bolitoglossa odonnelli (*Stafford, et al*, submitted)*. It is projected that further surveys of CRFR will increase the amphibian list to a total of 39 species – approximately 90% of the Belize's total. In addition, another species of rainfrog and two salamanders have been recorded within CRFR and are believed to be new for Belize, but are still to be confirmed.

Whilst there is increasing data on the unique species assemblage discussed above, many of the common ubiquitous lowland species are still prominently absent from the current species list or CRFR – reflecting the lack of surveys within the more disturbed secondary vegetation along the southern reaches of the Reserve. Most will occur within the Forest Reserve - even those considered human commensals are likely to occur in the highly impacted south-eastern portion of the area.

Depending on the outputs of the current taxonomic study of specimens from the Little Quartz Ridge area of CRFR, it is considered likely that this area will qualify as Belize's first (and possibly only) AZE-Site – under the Alliance for Zero Extinctions. The likelihood of this prioritized conservation rating further emphasizes the unique nature and critical role of this area of the Forest Reserve – already prioritized under the Technical Assessment of the Maya Mountains Massif (Walker, et. al, 2008) and under the Key Biodiversity Assessment (Meerman, 2007).

Reptiles

To date, 41 reptile species have been recorded within Columbia River Forest Reserve, with the likelihood of another 31 or more species still to be recorded. Combined with the 39 amphibian species known or expected to occur within Columbia River Forest Reserve, the total herpetofaunal species richness of 110+ species demonstrates this to be amongst Belize's most bio-diverse areas. The Forest Reserve's reptile fauna remains relatively poorly known – reflecting the limited survey time spent in Columbia River Forest Reserve and the likelihood of there being few common species and many rare ones that will require extensive surveys to be detected.

A systematic global assessment of the conservation status of reptiles has yet to be completed, and to date, few of Belize's species have been assessed in this regard. As with the amphibian fauna, Columbia River Forest Reserve is considered particularly important in the conservation of reptile species (such as the snapping turtle, *Chelydra serpentina*) of wetter rainforests that occur only in the southern and south-eastern portion of the Maya Mountains Massif, species largely confined to forested upper elevations (for example, , and species restricted to primary or very old-growth forest. Several reptile

species, such as the eyelash palm pitviper (*Bothriechis schlegelii*), rarely encountered elsewhere in Belize, are amongst those already recorded in the protected area, demonstrating the importance of this Forest Reserve in reptile conservation. CRFR lies towards the northern limit of the range of several reptiles – species whose habitats have suffered considerable reduction elsewhere in the region; as such Columbia River Forest Reserve is of regional importance in providing relatively extensive habitat for species that are under severe threat from habitat destruction elsewhere in their ranges.

There can be little doubt that extended surveys of the reptile fauna will add the approximately 30+ species expected to occur in the Forest Reserve, but also additional species records new for Belize. As with the amphibian fauna, the reptile fauna of the north-west plateau around Little Quartz Ridge is likely to include highland species currently known from the highlands of Guatemala and Honduras, but not yet recorded in Belize. The limited footprint and short duration of herpetological assessments conducted to date only give a brief insight into the overall likely diversity of reptile species within this unique area of Belize. An extended survey spanning 3-4 months in this area would help define the herpetofaunal community and allow a more detailed analysis of its regional significance.

2.5.4 Past and Present Research

Past research is summarized in the Columbia River Forest Reserve Research Synthesis (Meerman, 2006). This outlines several research initiatives within the area, starting as early as the 1920's, when L. H. Ower, a geologist, first examined the area for its mineral resources. Since then, there have been several research expeditions into the area, focused on the biological and cultural resources (Table 15), each adding to the knowledge of the resources of the Forest Reserve.

Following the merging of Columbia River Forest Reserve and a part of the Maya Mountain Forest Reserve, an intensive period of research began, focusing on the standardized monitoring of tree growth, with the establishment of permanent sampling plots. Parallel with this was the collection of non-timber forest species within the sampling plots, and research into the medicinal properties of some of these plant species.

A biodiversity baseline was established in 1987, when a rapid assessment was conducted, incorporated into an expedition to Doyle's Delight (Matola, 1989), followed by a rapid ecological assessment in 1991 (Matola, 1991), which included exploration of a number of caves in the area and cataloging archaeological artifacts. A more detailed multi-disciplinary assessment of the biodiversity was conducted in 1992 under the Conservation International Rapid Assessment Program (Parker et. al, 1993), followed by another multi-disciplinary expedition to the Little Quartz Ridge area in 1997 (Meerman et. al., 2003). Between the time frame of these two major expeditions, a number of smaller studies were also conducted in the area.

The Maya Mountains Archaeological Project (1994 – 2000), under Dunham, located and inventoried a number of archaeological sites and artifacts within both Columbia River Forest Reserve and the adjacent

Bladen Nature Reserve, including the Esperanza sites. This resulted in the establishment of a research station at La Sierra, though the project was to close soon after and La Sierra abandoned. The project produced a number of annual reports that shed important light on the historical use of the area by the Maya.

In 2001, Hurricane Iris caused extensive destruction to the forest, with an estimated 60% to 75% of trees damaged or felled to the south east of the protective karstic ridges. This effectively stopped access to the Forest Reserve, and therefore also planned research activities. A damage assessment was of the area was conducted in 2001, and further field-based assessment in 2004 (Meerman, 2001; Meerman, 2004). The damage extended to the permanent sampling plots, and was further exacerbated by unregulated salvage operations within the area.

Research focus then shifted to the newly emerging non-timber forest product – xaté, with two studies concluding that xaté harvesting within the Columbia River Forest Reserve would not be practical in the post hurricane re-growth (Meerman, 2004; Wicks et. al., 2006).

Amphibian surveys were conducted in the Little Quartz Ridge area in 2008 and 2009, assessing amphibian populations, their viability and threats . This work identified new amphibian species for Belize, and highlighted this portion of Columbia River Forest Reserve as being unique in Belize (Walker P. in prep., 2009).

Most recently, in January 2010, a rapid ecological assessment was conducted of the Columbia River Forest Reserve / Bladen Nature Reserve Central River area, to establish a partial baseline for future assessments of environmental and social impacts of the proposed hydropower scheme on Central River.

The Research Synthesis (Meerman, 2006) made a number of recommendations for future research within the area:

- Field verification of ecosystems
- Biodiversity data collection of all major groups: plants, fish, amphibians, reptiles, birds and mammals.
- Caves and cave fauna, particularly bats.
- Research in higher elevation areas
- Monitoring of hurricane damage recovery process, as it is critical for the understanding of ecosystem variation and resilience in this area.
- Monitoring and data collection needs to continue on pre-existing vegetation transects and permanent sampling plots.
- Short term studies for guiding management:
    - Timber species
    - Rare and endemic species such as the various karst obligates
    - Critical wildlife species as per the current monitoring protocols

A full list of research outputs is presented in Annex 1

2.6 Cultural and Socio-Economic Values of Management Area

The outputs of the Maya Mountains Massif socio-economic assessment (Catzim, 2008) show that of all the stakeholder communities, those in the Toledo District depend most heavily on the natural resources, influenced primarily by the poverty level in this area. Without poverty alleviation initiatives and increased employment opportunities in the communities bordering the Columbia River Forest Reserve, there will always be a heavy dependence on the natural resources, and the increasing forest clearance outside the protected areas will inevitably lead to increasing problems of incursions for game meat, building materials and medicinal plants.

The assessment also shows that all communities are aware of the existence of the protected area, but generally feel excluded, with no short or long term tangible economic benefits. The communities value the natural resources they extract from the Reserve, and value the Reserve as a source of materials that are in increasingly short supply outside the boundaries of the Reserve. There is an increased awareness of the importance of Columbia River Forest Reserve in the maintenance of water security, which has resulted in an increase of local support for the maintenance of the forest cover – however there is currently only limited awareness of the other environmental services provided by the Reserve: flood and erosion control, climate buffering, clean air, etc.

Private sector involvement in extractive industries in the Columbia River Forest Reserve has been primarily focused on logging of tropical hardwoods in the past, shifting from the traditional short-term logging concessions to long-term forest licenses, encouraging sustainable use and investment in reforestation. However the large scale destruction of timber resources resulting from the impacts of Hurricane Iris resulted in a shift to salvage logging licenses, which have been poorly implemented, with monitoring of the license areas by Forest Department being limited by financial and human constraints. This has significantly reduced the future timber value of the area, with the removal of seed trees, and no long term planning towards future restoration.

The relatively newly formed Belizean xaté industry that has yet to become effectively established and sustainable, and has resulted in significant conflicts of interest, with local concession holders employing Guatemalan harvesters, who harvest both for the legal Belize trade and the illegal transboundary trade. This has resulted in a moratorium being declared on xaté extraction until more effective mechanisms can be established. There is also local community harvesting of cycad and palm seeds for the ornamental plant trade.

There are currently few financial mechanisms in place to provide sustainability for the Forest Reserve, at the site level, with taxes and license fees from these extractive industries not being reinvested in the resource management.

2.6.1 Community and Stakeholder Use

This management plan seeks to ensure ***integrated landscape management***, with recognition of the landscape values of the Forest Reserve, particularly in ensuring continued water security for Toledo, through planning that is set within a framework of landscape-scale objectives, over appropriate spatial and temporal scales, and a focus on developing mechanisms for integrated decision making, with restructuring of past legal and institutional fragmentation between civil society organizations to build consensus towards sustainable use.

An important component of this is the community landscape that borders the Columbia River Forest Reserve. The Poverty Assessment report (NHDAC, 2004) estimates that 79% of the population in Toledo rates as poor, as compared with 27.4% and 34.6% in Cayo and Stann Creek Districts respectively. The 2005 Poverty Map for Belize states:

> *"the populated centres in Toledo District have the highest concentration of poverty, as most of them lie in the 75 to 100% incidence of poverty. They are located on the southwest part of Toledo, on the Maya Mountains…"*

The communities have a heavy reliance on the natural resources of their community landscape, both within and outside the Forest Reserve. This is based primarily on three resources – food, house construction materials and medicinal plants

- ***Food***

  In the buffer communities, meeting food expenses is highlighted as the greatest financial difficulty, with three out of five households expressing difficulty in meeting food costs (Catzim, 2008). The majority of Maya households grow their own rice, corn and beans, and many rely on hunting and fishing to provide an important protein source for families, primarily targeting the two species of peccary, deer and gibnut (paca), as well as freshwater fish, crayfish, and jute snails. A number of broadleaf forest plant species are also harvested for their nutritional properties – for example cabbage palm (*Euterpe precatoria*) and pacaya (*Chamaedorea tepejilote*).

  Currently, the some of the natural resources are still being harvested from national lands, outside of the Columbia River Forest Reserve, and no community is currently solely dependent on natural resources from within the protected areas.

- ***Building materials***

  Buffer communities utilize bush sticks for construction, bay leaves or cohune leaves for roofing, hard woods for siding and vines for tying, and depend heavily on these materials, harvesting them from the forests. This is currently primarily from outside the protected area, but increasing

forest clearance has led to incursions into Columbia River Forest Reserve. Legal cutting of building materials is permitted within this extractive reserve through the Forest Department office in Toledo, but monitoring of extractive activities is difficult with the limited staff and financial resources available.

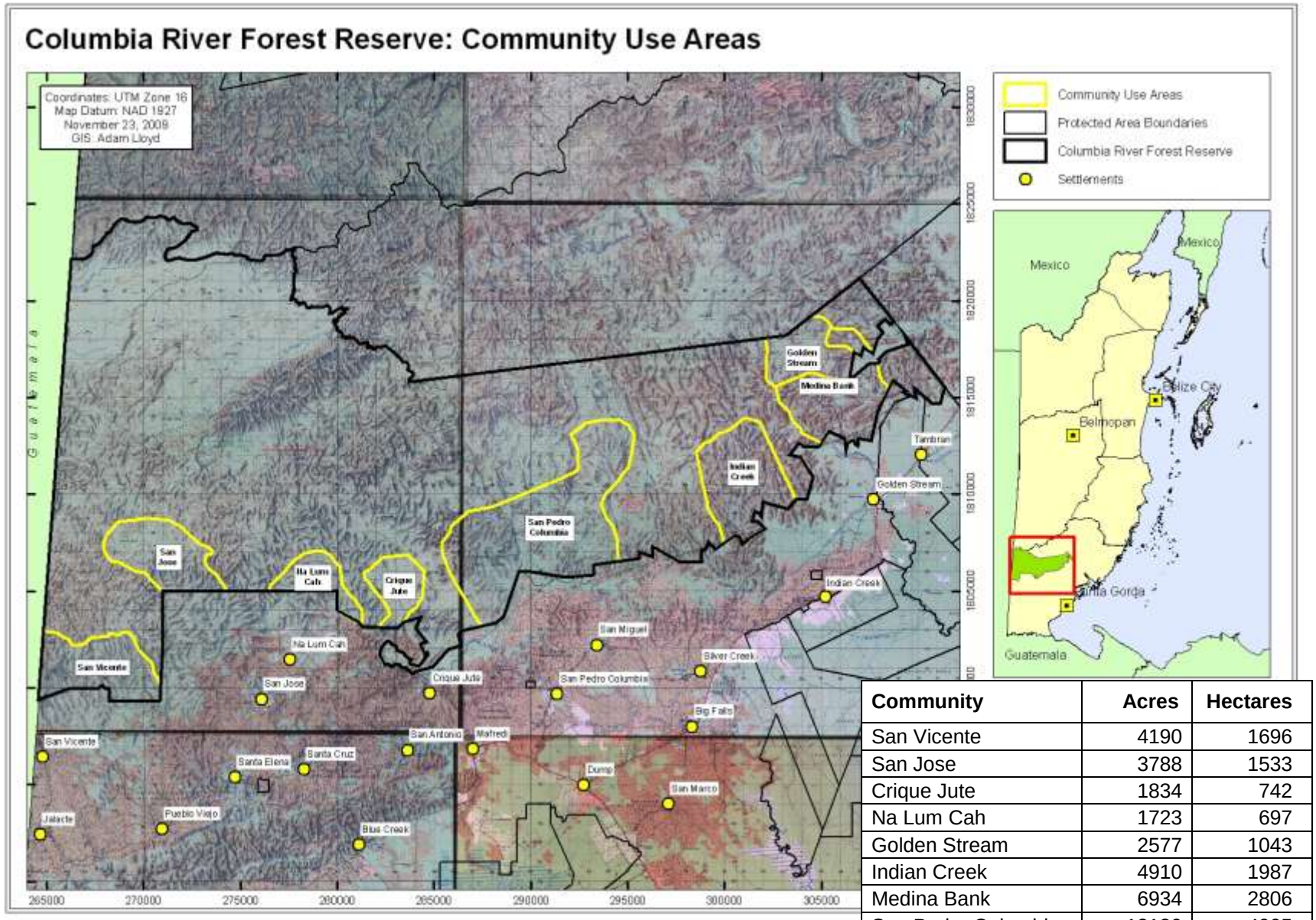
- ***Medicinal purposes***

  All communities indicated that they still depend on medicinal plants for basic illnesses such as headache, cough, cold or fever, with extraction from forest areas.

A series of meetings was therefore held with the stakeholder communities to define stakeholder use of the natural resources at landscape level, including use of Columbia River Forest Reserve. Four communities have been highlighted below as those with the most potential to successfully implement any initiative targeted at sustainable natural resource use within the community landscape, each with discrete natural resource use areas within CRFR that don't overlap with those of other communities.

- San Vicente
- San Jose Columbia
- Na Lum Cah
- Crique Jute

Community profiles were developed for each of these communities to provide a greater understanding of the landscape in which the communities exist, to provide a foundation for the development of community sustainable natural resource management plans for specific community use areas.



Community	Acres	Hectares
San Vicente	4190	1696
San Jose	3788	1533
Crique Jute	1834	742
Na Lum Cah	1723	697
Golden Stream	2577	1043
Indian Creek	4910	1987
Medina Bank	6934	2806
San Pedro Columbia	12120	4905

Map 17: Current Community Use areas of Columbia River Forest Reserve

San Vicente

San Vicente is the most westerly of the Maya communities that lie adjacent to the Columbia River Forest Reserve. This farming community was established in 1987 by ten families who moved to the area from a variety of origins, including San Benito Poite, Otoxcha Dolores, Blue Creek and Guatemala in search of better soils for corn production. The population currently stands at 432 (73 households), focused on the production of beans and corn for sale in Guatemala, with six families also involved in small scale cattle production, again for sale over the border.

Community lands of approximately 3,000 acres extend to the border of the Forest Reserve, the majority of which has been cleared for farming. There are concerns that there is not sufficient land for the younger generation, as the village lands are hemmed in on all sides, with expansion prevented not just by the presence of the Forest Reserve, but also by the community lands of Jalacte and Pueblo Viejo. The village leaders are now trying to negotiate with these two communities for more land.

In 1987, when the community was established, game species were abundant in the area, but with the difficulty of obtaining licenses for guns, hunting pressure was considered to be low, with families concentrating on household pigs and chickens to provide meat. There are still very few hunters within the community, and game species are considered to have declined significantly in both the community lands and the adjacent Forest Reserve – a situation blamed on heavy hunting pressure from Guatemalan communities. Jute are harvested from the creeks for sale in Guatemala, but the streams in the area are too small to provide fish for the table.

Some forest products are harvested – pacaya, chaya and building materials - thatch leaves, sticks and tying vines among them. The community has retained small forested areas near the village to supply some of its needs, particularly thatch, as the Forest Reserve is too far for easy transportation of larger forest products. Where land has been cleared and planted with grass for cattle, cohune has been left, though it would appear that the majority of the palms in these open fields are starting to yellow and die.

When asked for their views on Columbia River Forest Reserve, the following points were brought up by the participants:

- Maintenance of the forest cover is very important as it regulates the rainfall patterns in the area, and is the community's main source of water. It also provides natural resources such as tie-tie and bayal.

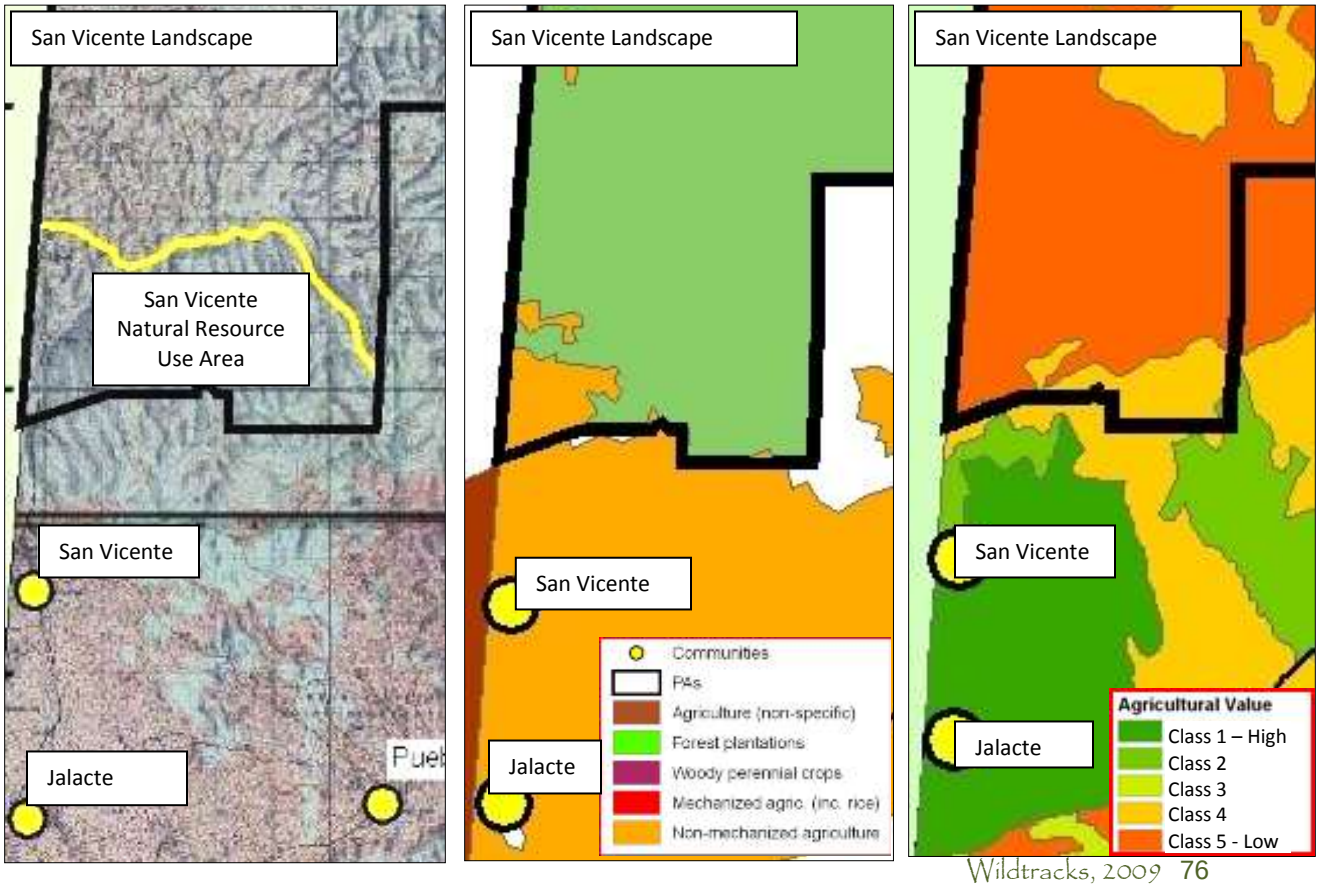
- It was felt that the Government was correct in placing the Forest Reserve under protection, but that there needs to be better management if the natural resources are to be maintained, particularly with the level of incursions from Guatemala

- If it is properly managed, it is felt that the community will be able to benefit from forest products in the long term - particularly through sustainable management of building materials.

- It was felt that improving protection of the resources of the Forest Reserve is important, and that management could be improved if the San Vicente community could participate in active surveillance and enforcement. Mechanisms proposed included use of the powers of the Alcalde to enforce Forest Reserve regulations, particularly if sustainable use of the resources by the community can be integrated into the management plan.

  Despite the recognition of the future requirements for farmland expansion, the meeting participants didn't feel that they needed to extend into the Forest Reserve in the short term, as currently there is no immediate critical shortage of land. They recognise the conflict of community farmland requirements and the value of the forest for its environmental services and natural resources, and would like to continue extracting building materials whilst maintaining the forest structure.

- It was felt that although the forest has been cleared in the Santa Rosa area, it will regenerate to a forest structure in five to ten years, but it would need the presence of local rangers, given the responsibility of ensuring that the Guatemalan incursions are reduced / halted. There was interest in conducting a community agro-forestry project there to start the regeneration process and provide a presence.



Most Critical Threats identified by San Vicente:

- Guatemalan incursions into Forest Reserve – illegal hunting, xaté and timber harvesting and farming (e.g. as previously in the Santa Rosa area)
- Land crises in communities adjacent to the Forest Reserve (including San Vicente)
- Pasture Expansion – changing land use patterns around San Vicente, with purchase of larger tracts of land for clearance for cattle farming

Management Recommendations by San Vicente:

- Clear boundary line: Cement posts delineate the southern limit of the Forest Reserve in the San Vicente area, but the boundary has not been cleared since 1985, and is still covered by tree falls following Hurricane Iris. There was a strong recommendation for re-clearance of the line, as this would increase the respect for the Forest Reserve. It was also recommended that the line be cleared on the western boundary, to provide clear delineation between Belize and Guatemala. Some of the cement boundary posts were removed by people from the Santa Rosa settlement.

- Signs should be placed at major entry points on boundaries (both southern and with Guatemala) – critical entry points can be identified by the community leaders. Participation of leaders in informing community of location of boundaries, and enforcement of community-backed 'no farming' incursion regulations within Columbia River, through the Alcalde system.

- Construct and man a Conservation Post at Santa Rosa with collaboration of BDF / police, Forest Department and with community participation

- Development of community access and management agreement for the area of Columbia River Forest Reserve associated with San Vicente, with sustainable resource management objectives, and development of regulations by the community in partnership with Forest Department, as part of the management planning process

- Currently two farms cross the boundary - investigate possibility of redrawing boundaries slightly further back to exclude these two areas, and allow for some future land requirements. The community leaders realise that this is in conflict with their wish to retain the forest cover, and that this may not be a realistic option, but would like the community needs for farmland extension to be take into consideration.

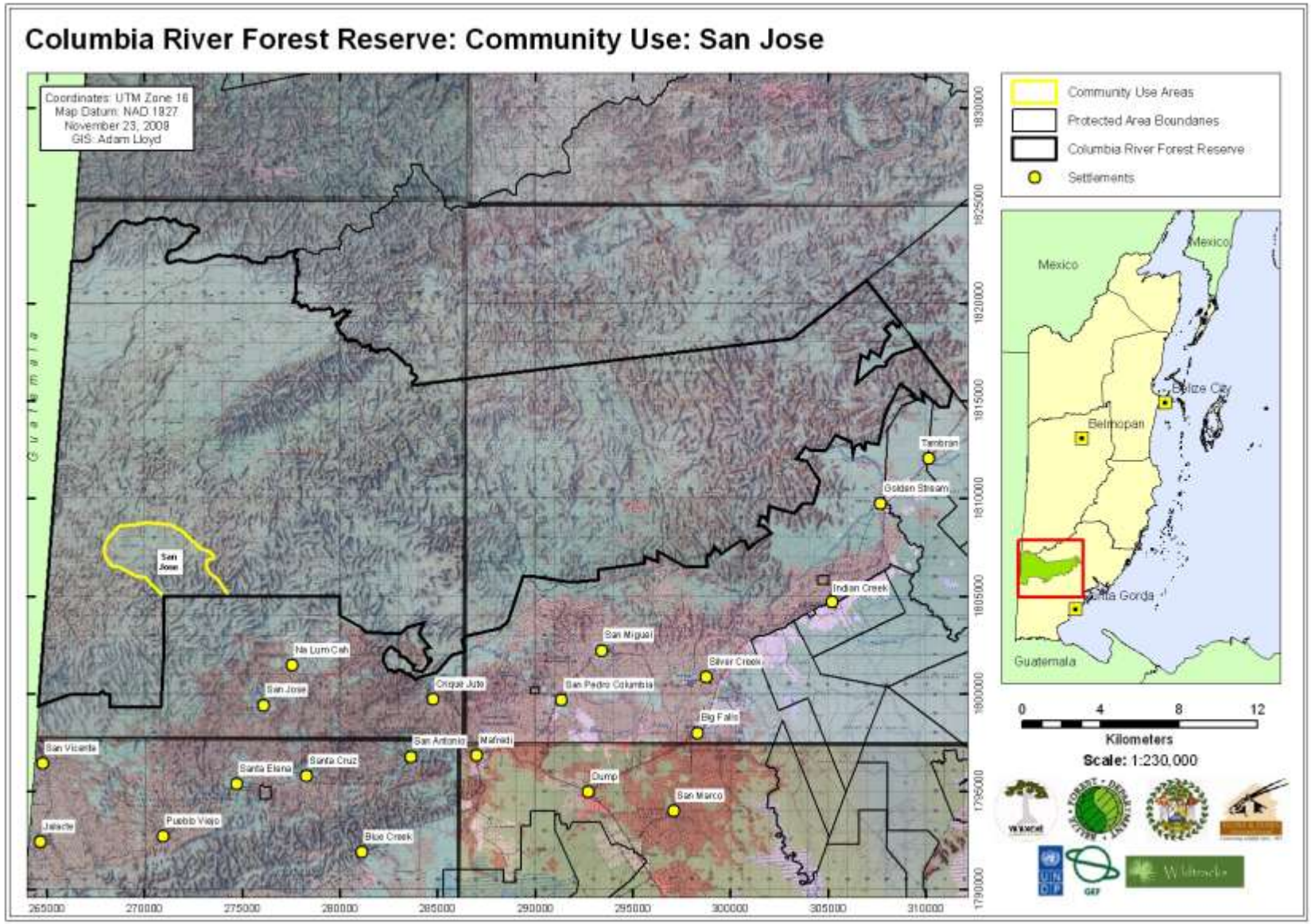
- Investigate possibility of community agro-forestry initiatives within limits of cleared Santa Rosa area, with associated matahambre, cacao, and timber species.

San Jose

San Jose is one of the oldest Maya communities that lie adjacent to the Columbia River Forest Reserve, being established in the 1940's by families who moved to the area from alqulos' (scattered milpa farms in the forest of the San Antonio area) attracted by the access to clean water and abundant game resources. The population currently stands at over 1,000 (160 households), focused on agriculture (slash and burn and matahambre production of corn, beans and rice), with some cattle.

The community lands are not delineated – current knowledge of the lands is limited to those leased by individuals, each person being allocated 30 acres. There are still lands available for expansion, and a buffer of forest exists between the farmlands and the Forest Reserve. The majority of households are supported through farming – a combination of slash and burn and matahambre, with some expansion into cattle farming. Beans are sold both in Punta Gorda and over the border in Guatemala. Pigs and chickens are raised for local consumption, small game species are taken for household use, whilst larger species such as white-lipped peccary (waori / warree), which provide surplus meat, are sold within the community for $3 per lb. There are, however, increasing numbers of people (the majority of young people) who 'job out' – on the shrimp farms, in the Belize Defense Force, construction etc.

The Forest Reserve and adjacent forested areas provide the community with natural resources – building materials (cohune, sticks, tie-tie), medicinal plants, give and take leaves for brooms, food (pacaya), and palm and cycad seeds (including *Chamaedorea, Euterpe* and *Ceratozamia*) for export for horticulture. There is hunting, focusing on white-lipped peccary (waori) and paca (gibnut), which are still present in the area, though hunting pressure from San Jose has decreased as these species is only found far inside the boundaries of the Forest Reserve, and numbers were affected by Hurricane Iris, and the subsequent reduction in availability of fruiting trees. Game birds such as great curassow and crested guan are now reported to be scarce, following increasing hunting pressure, both locally and from Guatemalan xatéros. Xatéro activity was first noted five to six years ago, and is currently reported close to the community.



Map 18: Current Community Use area – San Jose

Whilst fish once formed part of the diet, numbers of harvestable species are reported to have declined, with few large individuals.

When asked for their views on Columbia River Forest Reserve, the following points were brought up:

- The Forest Reserve should remain under protection for its value in watershed protection, and the availability of natural resources (building materials, game species etc.) for community access.

- The community values the Forest Reserve as a tourism resource for community tourism initiatives – currently, about 100 visitors a year use the San Jose TEA guesthouse, visiting the forest and caves in the area, and / or taking a cultural tour. The area also attracts researchers and students.

- They also feel that it is important for future generations to have access to, and know, the resources that currently exist

- There is currently not effective management in place at the moment – community complaints on illegal incursions are not responded to, and there are increasing farming incursions, xatéro activity and poor commercial logging practices.

- The community would be interested in participating in management of local forest resources within their area of influence.

Recommendations

- The boundary of the Forest Reserve needs to be delineated – many people are not aware of where it lies. Following boundary clearance, there needs to be an awareness programme for the community

- Logging practices need to be better controlled, with replanting of trees.

- The community would like to participate in the management of the area of Columbia River Forest Reserve that they access, with community surveillance and enforcement in liaison with FD, BDF and police.

- Community enforced regulations restricting hunting to set seasons

- Effective actions against xatéro incursions into the area, with increased BDF activity, particularly in the Machiquila area

- If San Jose is able to actively participate in management of their natural resources, they would like to see commercial logging excluded from their area of community interest, with a community forest restoration initiative in place

Na Lum Cah

Na Lum Cah, the smallest of the Maya communities that lie adjacent to the Columbia River Forest Reserve, was established in 1987 by families who moved to the area from San Antonio for better access to their leased farm lands. The population currently stands at 63 (12 households), focused on the production of corns, beans rice, ground food cacao and vegetables (cabbage, tomatoes etc.), for family use and for sale in Punta Gorda and the other communities. Farming methods include the use of mucuna (*Mucuna prurins*) as a green manure, to assist in rebuilding soils. Whilst farming is the principle occupation, the majority of the young people 'job out', living outside the community for a week / two weeks at a time, working in schools, the Belize Defense Force and construction.

The leased lands total 2,500 acres, with each family having 50 acres. 50 acres have also been designated for village and village expansion, and 50 acres are maintained as forest for natural resource use (thatch leaves, sticks, pacaya, medicinal plants etc.). A 500 yard buffer of forest lies between the community lands and the Forest Reserve, with limited hunting of gibnut and white-lipped peccary, though the majority of hunting occurs within the farmlands. There is also harvesting of jute from the creeks for home use, but creeks in the area are too small to provide fish. The community appears highly organized, with regulations such as that preventing the practice of free-ranging pigs within the village.

The condition of the forest adjacent to Na Lum Cah was heavily impacted by Hurricane Iris, with trees falling on the boundary line, making it hard to identify. The hurricane also impacted the game species, following the reduction in food availability, though populations are now thought to be recovering.

When asked for their views on Columbia River Forest Reserve, the following points were brought up:

- It is good to have the Columbia River Forest under protection, as it protects the watershed, prevents erosion of soils, and provides natural resources – medicinal plants, food, and construction materials

- The Forest Reserve has the potential as a tourism resource for future generations, with sink holes and caves. Currently, however, no one in the community has a tour guide license.

- The community leaders feel that the community is willing to participate in improving management, and proposed the concept of community rangers to assist with enforcement

Most Critical Threats identified by Na Lum Cah:

- Escaped fire from poorly managed agricultural-associated burning in the San Antonio area is considered the highest threat. It is considered that San Antonio farmers no longer practice good fire management, with little communication with other farmers when areas are to be burnt. These fires have spread across the boundary into the Forest Reserve

- Erosion caused by use of heavy logging equipment on steep slopes, despite Forest Department regulations to the contrary

- Guatemalan incursions into the Forest Reserve – illegal hunting, xaté and timber harvesting (though this activity has not been reported close to the community as yet)

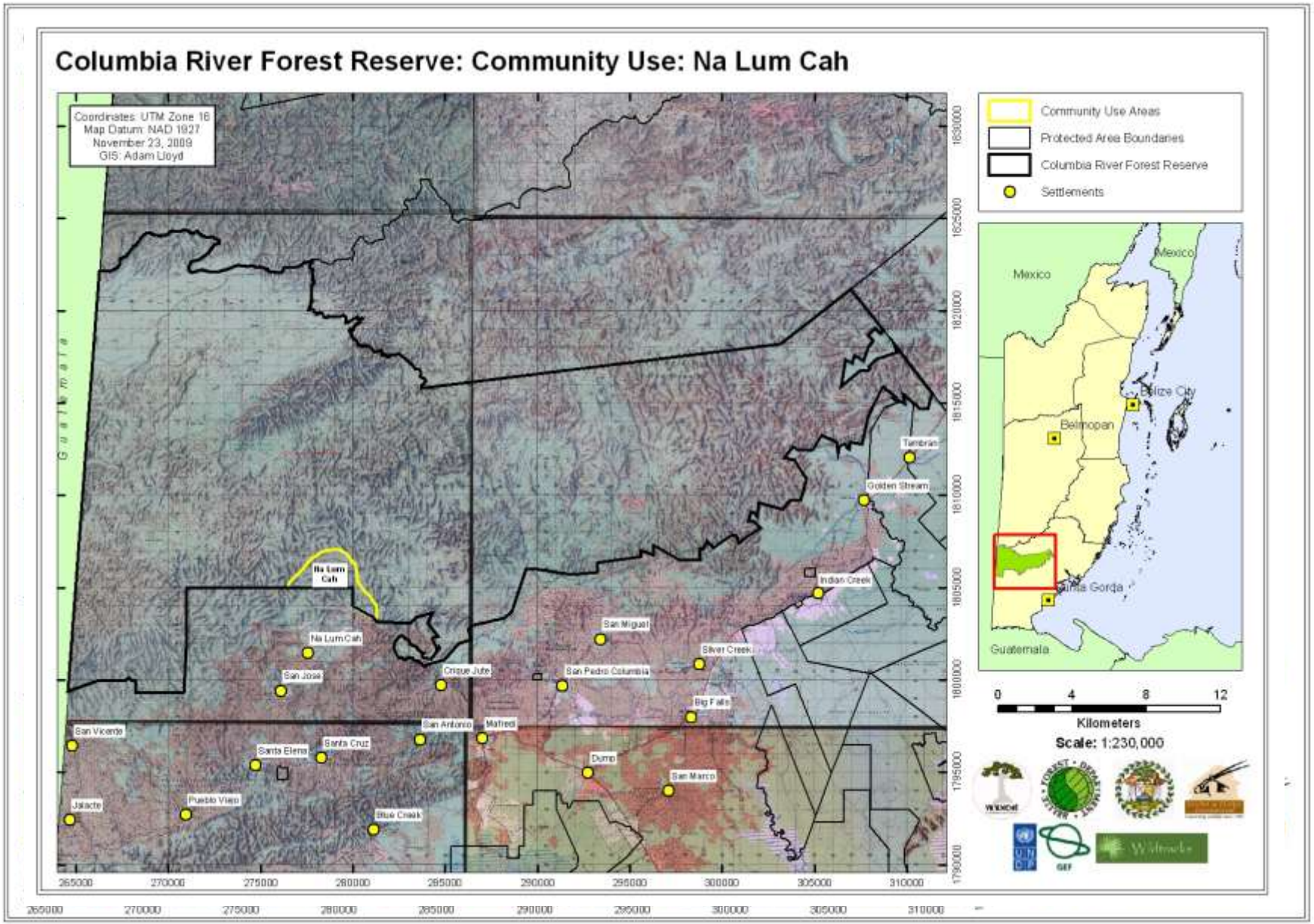
Recommendations:

- Effective enforcement of regulations controlling logging on steep slopes – if conducted, should only be with lower impact chainsaws, and only in dry season

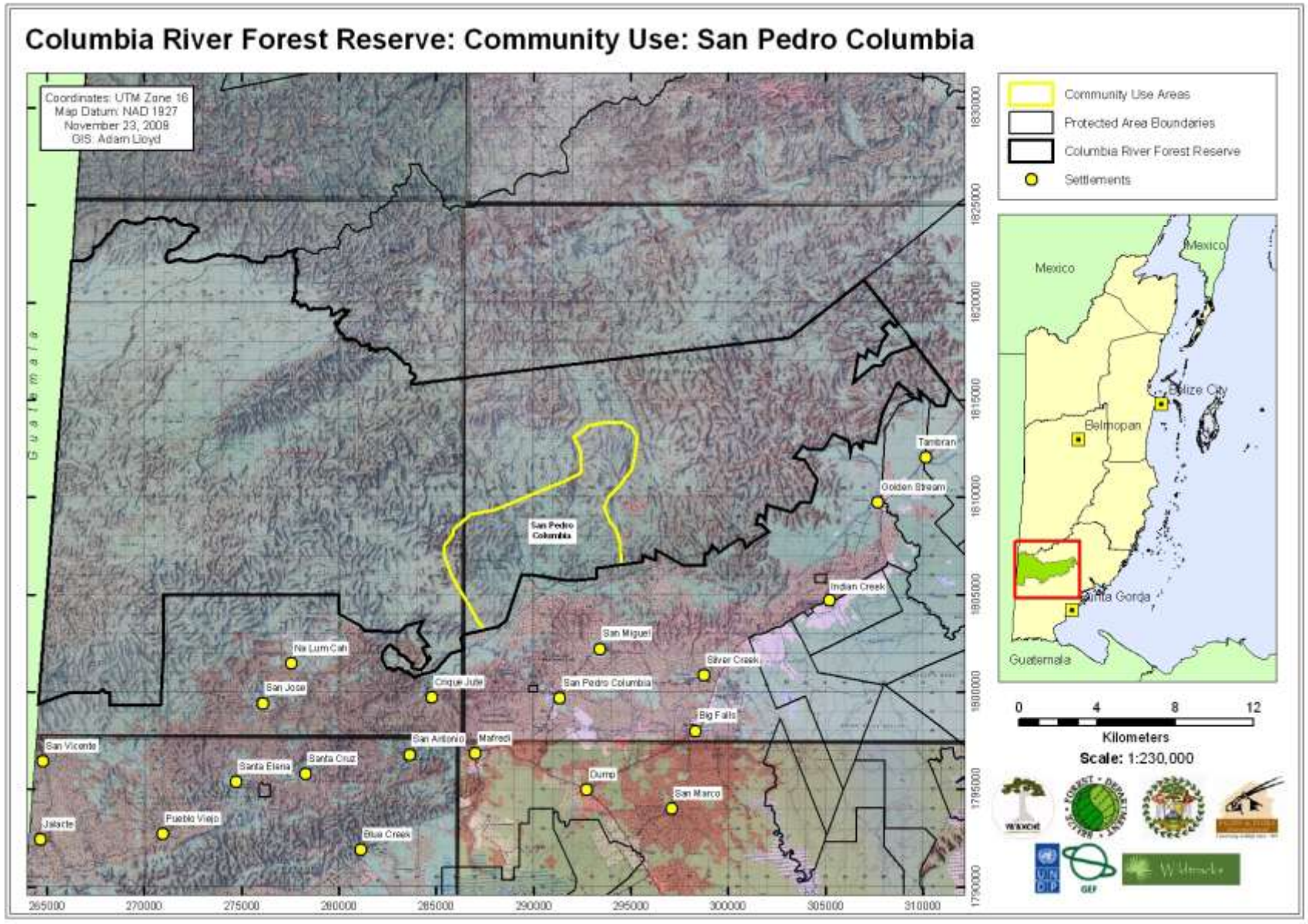
- Investigation of tourism potential of Columbia River Forest Reserve for Na Lum Cah, and capacity building

- Community participation in management

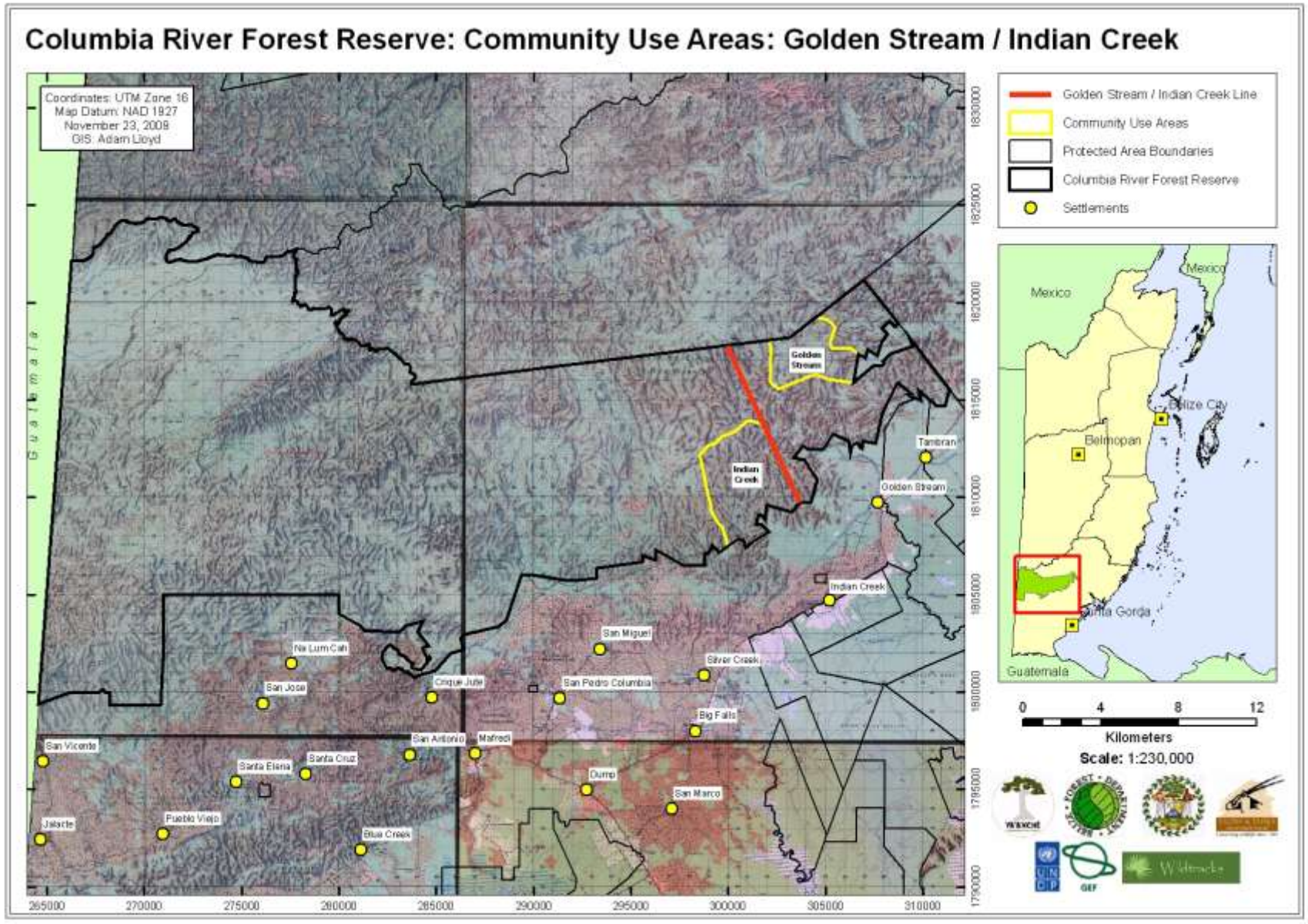
- Sustainable natural resource use and management of the adjacent Forest Reserve area by the Nah Lum Cah community



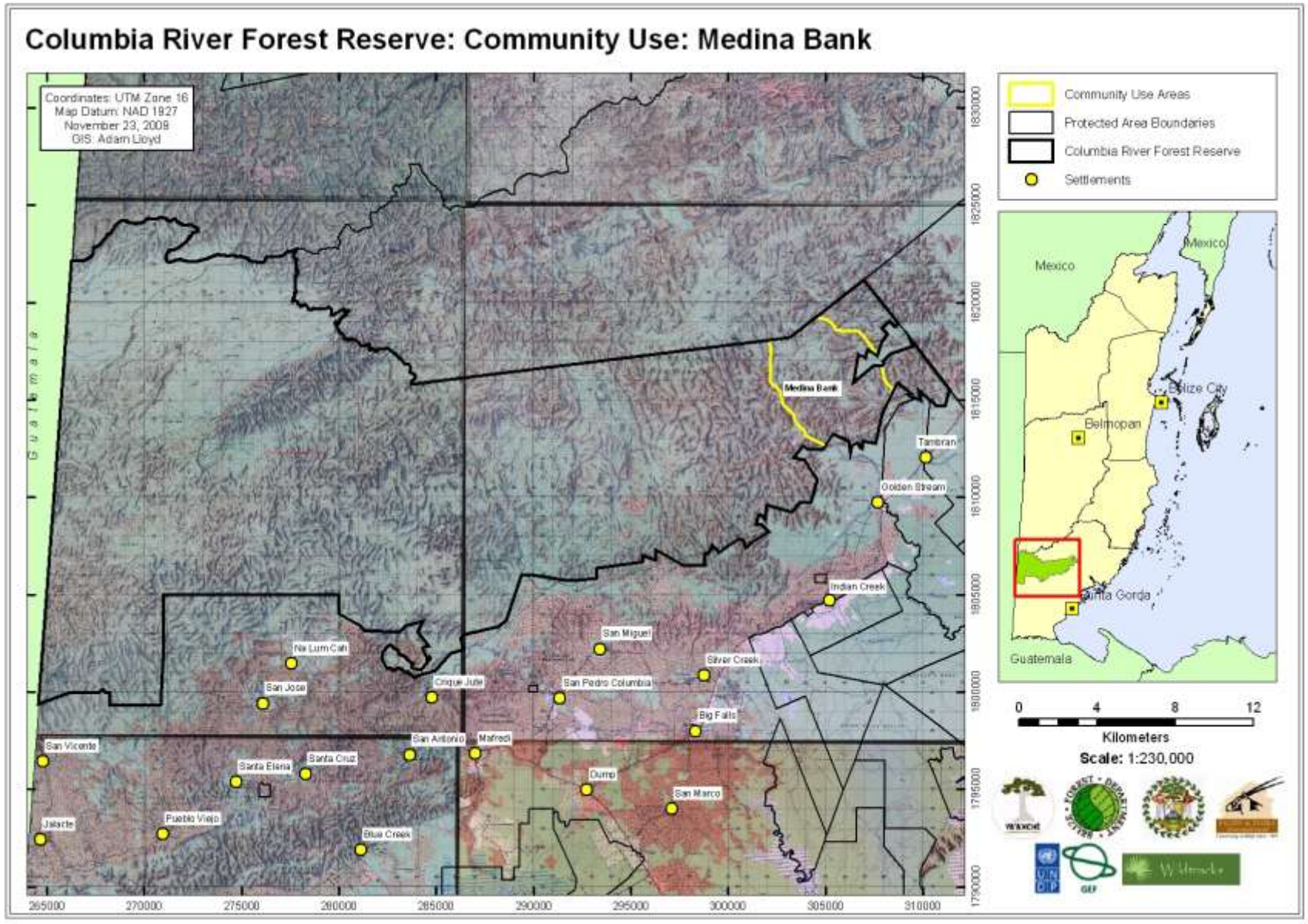
Map 19: Current Community Use area – Crique Jute



Map 20: Current Community Use area – San pedro Columbia



Map 21: Current Community Use area – Golden Stream / Indian Creek



Map 22: Current Community Use area – Medina Bank

2.6.2 Archaeological Sites

Columbia River Forest Reserve is within the southern Belize sub-region, which covers a large geographic area encompassing Sibun and Sittee River Forest Reserves, and all those protected areas on the east-facing slopes of the Maya Mountains. Whilst 200 sites have been identified and mapped within the sub-region, archaeological data for is very disparate, and for some of these areas, practically nonexistent, particularly for the more inaccessible lands adjacent to the Maya Mountain Divide.

For many years it was assumed that the steep and rugged terrain of the east-facing slopes of the southern Maya Mountains Massif would have been of little interest to the Ancient Maya, with difficult access and little cultivatable land. However, exploration in the early 1900's by chicleros and mahogany extractors suggested that the Maya had indeed settled the Bladen system, later confirmed by the Maya Mountain Archaeological Project (MMAP), which worked in the Esperanza and Bladen areas for two successive years (1993 and 1994). The Maya Mountains, including Columbia River Forest Reserve, contain a variety of raw materials that are known to have been exploited by the ancient Maya, including deposits of granite, volcanics, volcaniclastics, mudstone, siltstone, limestone, pyrites, slate and hematite for mirrors; high quality clays for ceramics; and a host of other minerals for pigments. Economic activities are believed to have focused on resource exploitation and exchange (Dunham et al. 1989; Graham 1983, 1987; Hammond 1975, 1981; Leventhal 1990, 1992; MacKinnon 1989; McKillop and Healy 1989; Wanyerka 2004), with this considerable resource diversity providing the Maya of the south with substantial economic benefits, with trade and exchange playing an important role in the rise of so many regional centers along the foothills of the Maya Mountain.

The karstic landscape is dotted with caves and sink holes, many of which show evidence of Maya use, as documented by past expeditions to the area (Matola, 1991). Any potential agricultural land within the Forest Reserve shows indications of past settlement – such as the archaeological site associated with the La Sierra area and Esperanza. Whilst the density of settlement is considered low in comparison with the coastal plain, during the Late Terminal Classic (AD 700 – 900) virtually all inhabitable land is considered to have been occupied. The Esperanza valley was highlighted for its high mineral values, and the southeast portion of the area, which straddles the Bladen Nature Reserve / Columbia River Forest Reserve boundary, is thought to have been heavily settled with three sites identified that will have influenced the landscape of CRFR in this area (Dunham, 1994).

Two are inside Bladen Nature Reserve, in its south western-most corner. "Chac Bolai," situated on the valley floor of the Central River, is a moderately sized site found to consist of a large civic plaza, connected by a causeway to low temple mounds, with minor adjoining causeways. To the south lies "K'antulai," located by a large sinkhole on the primary access

route between Bladen and Columbia River Forest Reserve, straddling the mountain pass, and thought to have regulated the movement of people and goods into the Esperanza area during the Late Terminal Classic era. Unlike the majority of other sites, this fortress-like settlement, consisting of a long chain of structures (including a main, central plaza flanked by large structures), lies in an area of poor soils, distant from the nearest water supplies (Dunham 1994). This area is currently under threat from a proposed hydro-electricity facility development, with potential bulldozing of the fortress walls for access further upstream. The current access road poses a threat, increasing ease of access for looters. Another site, Tziminche, has been highlighted by Medina Bank as a potential tourism resource, located near one of the characteristic sink holes of the area north of La Sierra.

Detailed information is available for sites that lie in the foothills and on the southern coastal plain, along the Southern Highway – for example, Nim Li Punit, Xnaheb, Lubaantun, Hokeb Ha Cave, Uxbenca and Pusilha, and is considered to reflect that of the communities within the actual Maya Mountains Massif, providing an insight into the history of the area (Awe, 2008). These population centres are thought to have started declining by the start of the Postclassic period (1000AD), and when Europeans arrive at the start of the 16th century, their reports only hint at the presence of limited and ephemeral native settlements in the area (Awe, 2008). However, the discovery of a Mixtec style vessel during the 1994 fieldwork in the adjacent Bladen Nature Reserve indicates that the settlements had wide ranging contacts, even when much of the southern lowland populations were in decline (Dunham, 1994).

The isolated plateau in the north west of the Forest Reserve also has good agricultural soils, with the potential for sustaining a Maya population. However, little work has been conducted in the area to confirm the presence of ceremonial sites, and extensive logging and xaté incursions from Guatemala may well have resulted in the looting of any structures and removal of artifacts.

Archaeological sites were discussed in the Technical Assessment of the Biodiversity and Cultural Resources of the Maya Mountains Massif (Awe, 2008), and in the Maya Mountain Marine Corridor CAP (Meerman and Salas, 2008). Community consultations also provided more input on archaeological resources within the area.

2.6.3 Tourism and Recreation Use

Whilst the Columbia River Forest Reserve has a high potential for tourism, the current security issues associated with illegal Guatemalan incursions into the area are effectively preventing meaningful recreational (or other) use. Before the increasing pressures within the area from the Guatemalan side of the border, expeditions have historically been conducted out of San Jose, with local guides leading groups such as Trekforce across the Main Divide to Caracol.

All community tourism stakeholders have expressed concern on taking tourists into the area whilst there is still a significant Guatemalan presence. However, small groups are continuing to trek to Doyles Delight and the Main Divide, led by Sun Creek Lodge and IBTM Tours, unaccompanied by the recommended BDF support team despite the security context of the Forest Reserve.

Despite the continuing security issues, many of the stakeholder communities have expressed interest in use of the natural and cultural resources of the Columbia River Forest Reserve for community tourism initiatives. Perhaps the most developed community vision is that of Medina Bank, which is seeking a partnership with the Institute of Archaeology to re-establish La Sierra as an archaeological field station and tourism destination (La Sierra was first established as a base for archaeological explorations, and now lies within the Medina farming enclave).

Community	Identified Tourism Resources
San Jose	Maya Divide, Doyle's Delight
Na Lum Cah	Waterfall on Crique Negro
Crique Jute	Mountain Cow Creek, Tzimin Che, Quail Bird Creek
San Pedro Columbia	Sosil Ha (archaeological site), Chan Pon (cave close to large sink hole), La Cumbre (sink hole), La Lagunita
Medina Bank	Tziminche (archaeological site) and associated sink hole
Indian Creek	Source of Billum Creek

Table 16: Identified Community Tourism Resources

2.6.4 Other Economic Use

Columbia River Forest Reserve was established to protect the watershed and timber resources of the area. More recently, xaté has been identified as a commercially exploitable natural resource, and one community is engaged in the harvesting of palm and cycad seeds (primarily the giant cycad – *Ceratazamia robusta*) for export.

Timber Resources

Timber resources of Columbia River Forest Reserve have long been under the management of the Forest Department, which declared the area as protected in 1954. Extensive logging occurred within the first twenty years, removing the majority of the primary timber species – cedar (*Cedrela odorata*), mahogany (*Swietenia macrophylla*) and rosewood (*Dalbergia stevensonii*) (Meerman, 2006). In 1997, the Columbia River Forest Reserve was extended to include a portion of the Maya Mountain Forest Reserve, under the Forest Planning and

Management Project, and a management plan was developed for sustainable management of timber resources of the area, using a series of 40 logging blocks, or 'compartments'. A long-term forest license was issued to Atlantic Industries Ltd., and sequential harvesting of the easternmost compartments was conducted until the devastating impacts of Hurricane Iris severely impacted forest structure in 2001.

Short term salvage logging concessions were given out following the impacts of Hurricane Iris, with little monitoring of extraction, due to the limited human and financial resources available to the Forest Department. Communities have voiced concern over the methods used by the salvage operations and the impacts caused, citing machinery working on steep gradients, with resulting erosion of slopes, blocking of water courses by logging tracks, and harvesting of important seed trees.

Recommendations:

- Any timber concession application being considered should have the approval of the proposed Columbia River Forest Reserve Management Committee

- Timber concession agreements should be restricted to the timber harvesting blocks, and not overlap with the community sustainable use areas, nor with the Core Preservation Zone

- Timber harvesting operations in this area should have the support of an appointed system-level specialist Enforcement Task Force of the BDF, as recommended under the Technical Assessment of the Maya Mountains Massif.

- Timber harvesting be conducted under a long-term forest license, and follow the principles of the Code of Practice for Timber Harvesting for Long-Term Forest Licenses in Belize.

- The 40 timber harvesting blocks identified in the previous management plan (Bird, 1994) need to be redesigned and re-scheduled as necessary to:

  (i) Prioritize sustainable timber harvesting along the border in north west CRFR, within the area defined for Managed Resource Use under the Technical Assessment of the MMM, with minor adjustment to incorporate recently discovered unique biodiversity values in the Forest Reserve
  (ii) Allow time for the regeneration of timber resources in the remaining forest blocks, following the significant impacts of Hurricane Iris (2001)
  (iii) Re-align the southernmost forest harvesting blocks where they overlap with the proposed Community Natural Resource Use Management Zones (15 of

the current 40 blocks) and to include adjacent qualifying areas to attain an overall harvesting footprint of 15,000 hectares

- The long-term concession be awarded on the basis of either a 40-year harvesting cycle of 40 x 375 hectare compartments, or on a 30-year harvesting cycle of 30 x 500 hectare compartments
- The long-term concession be awarded in an open and transparent bidding process to the best qualified applicant and that preferential employment (for the westernmost harvesting compartments) within the demarcating, scouting, cutting and milling operations should be given to the residents of San Vicente, and San Jose - the adjacent buffer communities.

Xaté resources

The most highlighted non-timber product currently being extracted from the Maya Mountains Massif is Xaté, the *Chamaedorea* palm leaf that is exported for the international cut-flower trade. Although to a lesser degree by Belizean communities, it is a major source of income for Guatemalan communities; so much so, that they are willing to illegally enter Belizean to harvest this product. The xaté industry is estimated to be worth in excess of Bz$4 million annually (Bridgewater, et. al. 2007) – a significant economic resource that has been illegally harvested from across the border for several years, along with significant amounts of game (and non-game) meat. This illegal transboundary extraction has not only robbed Belize of a potentially lucrative industry and employment opportunities and other socio-economic benefits, but has also had far-reaching severe impacts on the biodiversity of the protected areas of the Maya Mountains Massif - especially that of the protected areas lying along the Belize / Guatemala border (Columbia River Forest Reserve and the Chiquibul National Park and Forest Reserve to the north). In an effort to counter the problem, Forest Department issued xaté-harvesting concessions to Belizean companies, in an attempt to keep the resource and economic benefits in-country, and introduce a system of regulation and monitoring towards sustainability in the industry, with the development of a suite of good regulations to be followed by xaté concessionaires.

However, these objectives cannot be achieved as long as the parallel (and sometimes integral) illegal trade in xaté continues. Until illegal harvesting of xaté can be stopped, the mechanism of using xaté concessions to regulate xaté harvesting cannot work, as even legal concessionaires have no vested interest in following the regulations, knowing that anything not harvested (sustainably) by their crews will be subsequently harvested illegally by Guatemalan xatéros.

Reflecting the fact that xaté extraction concessions have not worked as an effective mechanism for establishing controlled, sustainable use of xaté, the Forest Department has

recently put all such concessions on hold. The primary requirement is to re-secure Belize's border, and then re-establish regulated and monitored long-term xaté-extraction concessions, following the existing regulations and additional recommendations of Bridgewater et. al. (2007). Furthermore, any such concessions should be directed towards the local stakeholder communities – so as to fulfill the recommendations of the National Protected Areas Policy and System Plan regarding access to economic opportunities by local communities.

Recommendations:

- Re-secure Belize's border and prevent illegal transboundary harvesting of natural resources
- A more detailed inventory of xaté abundance, distribution and densities than is currently available, particularly of areas where there is estimated to be a significant density of the current favoured species.
- Re-establish regulated and monitored xaté-extraction long-term concession mechanism, following the Forest Department's regulations, with the addition of strategies recommended by Bridgewater et.al. (2007)
- Ensure effective surveillance and monitoring of any xaté extraction, and if this is not feasible, to continue the moratorium on xaté extraction
- Preferentially award such concessions to qualifying stakeholder communities, preferably through the community committees established to manage resource use in the community sustainable resource use areas
- Investigate the feasibility of establishing xaté plantations on existing forested farm lands – there has been an initiative under Ya'axché to investigate xaté as a potential alternative income source at community level, with establishment of xaté plantations in existing forests as opposed to cleared lands.

Agro-forestry

Agro-forestry activities such as organic cacao production are favoured as sustainable community initiatives because of their low impact level, whilst providing relatively significant financial returns. In the case of organic cacao, the market is secure with demand exceeding current production levels, making this a very viable and sustainable activity. Cacao is now well established as an agro- industry among the buffer communities of Columbia River Forest Reserve, and there is interest in using similar agro-forestry initiatives to assist in forest restoration in fire-degraded areas on the southern margin of the protected area to re-establish the forest canopy.

Hydro-electric Facility Development

There is broad acceptance that Belize needs more electricity generation capacity, and general agreement that hydro-electricity generation will form a significant portion of this expansion, but it is also felt that such developments should be undertaken in a fully transparent process, follow due process and comply with all relevant policies, and should include biodiversity considerations at least on the same level as geological and logistical practicality in the decision-making process. It is recognized that the Columbia River Forest Reserve has a number of rivers flowing to the southern coastal plains that have the potential to be used for the generation of hydro-electric power, important in the future for the development of Belize. However, there have been concerns about the impacts of such hydro-facility developments on water quality, and the lack of due process that has occurred during past and present developments.

The Hydro-Maya hydro-electricity facility, constructed to the south of Columbia River Forest, upstream of San Miguel, has been cited by villagers of San Miguel as the cause of significantly reduced water quality, with the water no longer being drinkable, and bathing causing skin rashes. San Miguel villagers state that they agreed to 50 acres of their village lands to be set aside for the Hydro-Maya Facility, but that the final excised area was 250 acres, the extra 200 acres being taken without their consent.

In 2009, the same company (Belize Hydroelectric Development Management Company Limited (BHD)) was issued an initial letter of consent for assessment of hydro-electricity generation potential from GoB, which has raised broad objections from both the local stakeholder communities and conservation NGOs for a number of reasons. Work started in 2009, including the bulldozing of a road into this part of the Core Preservation Zone of the Maya Mountains Massif – an area where environmental impacts are to be avoided and the only permissible use activities are education and research. This was without consultation with local stakeholder communities, nor allegedly with permission from either the Forest Department (as the responsible authority for the Forest Reserve), nor with the Department of the Environment (as the authority responsible for ensuring minimal environmental impact). It was subsequently halted by a stop order until the necessary permits were issued and the environmental impacts of initial activities assessed. The target area lies within the Central River watershed, which forms the boundary between the Columbia River Forest Reserve and the Bladen Nature Reserve, and is an important component of the Core Preservation Zone – highlighted as one of the most important areas for biodiversity not only in Columbia River Forest Reserve, but also in Belize. Now operating under a scientific research permit from the Forest Department, the company has resumed its studies of the hydro-potential of the Central River.

Recommendations:

- Biodiversity conservation considerations should form an integral and high-level component of any decision-making process concerning hydro-electricity (and other) developments within the Maya Mountains Massif – in a transparent and structured assessment process that recognizes national, regional and global commitments, the prioritization of the watersheds, and evaluates the least-impact preferred option.
- Existing system-level conservation plans and zonation, such as that of the Technical Assessment and Conservation Action Plan for the Maya Mountains Massif should be upheld as far as possible, with hydro-electricity (and other)developments avoiding the highest protection areas (such as the Core Preservation Zone) unless there is no national alternative
- A system-level assessment of the relative biodiversity importance of all watershed of the Maya Mountains Massif should be conducted to allow prioritization in relation to biodiversity importance at both the national and regional levels, and potential for human impact. This should be integrated into informed decision-making on the siting of future hydro-facilities watersheds of the Maya Mountains Massif.
- Once the current hydrological studies are completed in the Esperanza area, there should be a moratorium on all hydro-electricity generation development within the protected areas of the Maya Mountains Massif until the watershed assessments have been completed
- A Payment for Environmental Services system should be investigated for implementation for any hydro-facility built within Columbia River Forest Reserve.

2.6.5 Research and Education Use

Current research in the area is severely restricted by the security issues related to the high level of Guatemalan activity within the area, particularly towards and beyond the Little Quartz Ridge area. However, a number of recent studies have been completed.

2008 Cycads

The Belize Tropical Forest Studies in conjunction with the Montgomery Botanical Center conducted studies of the cycads of Columbia River Forest Reserve, and of the wider Maya Mountains Massif - research that resulted in the description of two new species (*Zamia decumens* and *Z. meermannii*), and the reclassification of another.

2008 / 2009: National Amphibian Conservation Action Plan

Baseline assessments have been conducted in the CRFR as part of the development of the National Amphibian Conservation Action Plan. Within CRFR these have been focused on the Core Protection Zone, including the Little Quartz Ridge area - both to the west (north-east of Union Camp) and to the east, in the Esperanza Camp area. Three assessments have yielded significant information on this unique area, including new species records for Belize (some potentially new to science), the identification of species affiliations with the Highlands of Guatemala and Honduras, the determination of the unique composition of the amphibian fauna of this area, and its potential qualification as Belize's first site to qualify under the Alliance for Zero Extinctions (AZE).

3. Conservation Planning

This conservation planning section looks at the species and ecosystems of concern, at the threats that impact them, and the strategies that can be used both within the Forest Reserve and at landscape scale to abate these threats.

3.1 Conservation Targets

Seven **Conservation Targets,** or elements, were chosen to represent and encompass the biodiversity and cultural values of the area, and to provide a basis for setting goals, developing strategies and actions, and monitoring success.

For the purposes of the conservation planning process, the selected biodiversity and cultural targets were required to meet the following criteria, where possible (adapted from TNC, 2007):

- **Targets should represent the biodiversity and cultural heritage of the site.** The focal targets should represent or capture the array of ecological systems, communities, species and sites / artefacts of cultural importance at the project area and the multiple spatial scales at which they occur.

- **Targets reflect ecoregion or other existing conservation goals**. Focal targets should reflect efforts at the regional and national level where they exist, such as system level conservation plans, the National Protected Areas System Plan and associated Gap Assessment, the National Biodiversity Action Plan, the Technical Assessment and Conservation Action Plan for the Maya Mountains Massif, the National Biological Corridors Programme and national cultural heritage priorities. Focal targets that are grounded in the reasons for the project area's current status of protection, and the identification of the Forest Reserve as incorporating a portion of one of Belize's Key Biodiversity Areas (Meerman, 2009).

- **Targets are viable or at least feasibly restorable**. Viability (or integrity) indicates the ability of a conservation target to persist for many generations. If a target is on the threshold of collapse, or conserving a proposed target requires extraordinary human intervention, it may not represent the best use of limited conservation resources. The targets selected for Columbia River Forest Reserve are currently rated as either **FAIR** or **GOOD**

Conservation targets may be species, species assemblages or ecosystems that are selected as representing the biodiversity of a protected area – such that strategic actions, taken to ensure their

continued viability and reduce the pressures impacting them, will adequately address the needs of the system as a whole.

3.1.1 Identification of Conservation Targets

A series of conservation planning workshops was conducted in the buffer communities, with the participation of local community leaders and resource users. Additional meetings were also held with research, logging and tourism stakeholders. After an overview of the concept of conservation targets, and as a first step in the Conservation Planning process, participants suggested a number of potential conservation targets that they felt represent and encompass the biodiversity and cultural values of the area, and to provide a basis for setting goals, developing strategies and actions, and monitoring success.

An initial list of 22 potential targets considered by stakeholders to be of biological or cultural importance was first generated (Table 17), and the targets from the system level conservation plans (MMM and MMMC) were reviewed. The final target selection was developed based on this initial list, with potential targets being combined or nested into a list of seven conservation targets (Table 18), each representing or capturing the array of ecological systems, communities and species of the Forest Reserve, including all those highlighted in the preliminary list.

The justification for Conservation Target selection, and a summary of the species, communities and ecological system represented by these targets is summarized in Table 19.

Potential Conservation Targets for Columbia River Forest Reserve

Water security / watershed protection
Game Species
Fish
Pacaya
Mountain Cabbage
Cohune for thatch
Tie Tie
Archaeological sites
Rivers and creeks
Jute
Cultural resources (caves)
Medicinal plants
Wildlife
Natural Resources
Fish
Bayleaf
Xate
Commercial Timber resources
Natural beauty
Upper Elevation Amphibians
Tropical broadleaf submontane palm forest
Tropical evergreen broadleaf submontane forest

Table 17

Focal Conservation Targets for Columbia River Forest Reserve

1. Watershed Functionality
2. Broadleaf Forest
3. Game Species
4. Non-commercial Forest Products
5. Commercial Forest Products
6. Upper Elevation Species
7. Cultural Resources

Table 18

Table 19: Conservation Targets

Conservation Target	Justification for Target Selection	Species, Communities or Ecological Systems Represented by Target
Watershed Functionality	Maintenance of the forest canopy and role in ensuring water security - considered the most important role of CRFR by all community stakeholders. In the buffer communities of the east CRFR, water quality has been or is threatened by the construction of hydroelectricity developments.	Maintenance of the water cycle, and therefore of all species (plant and animal) currently existing within the CRFR, as well as the human populations and agricultural areas on the coastal plain to the south-east. Watershed functionality is also important for maintaining estuarine systems, healthy reefs and other marine ecosystems offshore. The fish species that support the local freshwater fisheries – primarily cichlids and machaca (Mountain Mullet). Jute, the snail harvested from the creeks. The riparian ecosystems that protect the soils of the creek banks.
Broadleaf Forest	More specific than maintenance of the forest canopy for watershed functionality, this target seeks to maintain the ecological integrity and complexity of the broadleaf forest of CRFR	Species that have a touristic value – orchid, bird and mammal species, including the Endangered Baird's Tapir and the regional endemic – the Yucatan black howler monkeys. Scenic values of the broadleaf forest
Game Species	Species considered of cultural importance, targeted by local hunters. Also considered a proxy indicator of trophic integrity[3]	Great curassow, crested guan, paca, white-tailed and red brocket deer, collared and white lipped peccary, armadillo, agouti, tinamou.
Non-commercial Forest Products	Species traditionally harvested by communities for community use (for construction, food, medicinal or ceremonial purposes).	For example, pacaya, mountain cabbage, medicinal plants, copal, construction materials (cohune tie-tie, bayleaf, stick etc.)
Commercial Forest Products	Species harvested commercially under concession agreements with Government	Commercial timber species – including mahogany, cedar and rosewood; Xaté

[3] The jaguar was originally selected, but monitoring of this species is likely to be difficult within the security context of CRFR

Table 19: Conservation Targets / 2		
Conservation Target	**Justification for Target Selection**	**Species, Communities or Ecological Systems Represented by Target**
Upper Elevation Species	Higher-elevation areas of CRFR (from 500m to over 1,000m) protect higher altitude forest, with the presence of a number of species not found in the lower forest slopes. Of particular importance are the upland amphibians. Of note are amphibian species of CRFR that are not known from any other locality in Belize. Additionally, some threat reduction strategies are specific to this group.	Restricted upland ecosystems – Tropical broadleaf submontane palm forest and Tropical evergreen broadleaf submontane forest A number of threatened amphibians restricted to these higher elevations, highlighted for their globally declining populations, and because they are recognized as good indicators of airborne and waterborne issues. *Agalychnis moreletii (CR)* *Bolitoglossa odonnelli (EN)* *Bromeliohyla bromeliacia (EN)* *Craugastor coffeus (CR)* *Craugastor sabrinus (EN)* *Craugastor sandersoni (EN)* *Craugastor psephosypharus (VU)* *Eleutherodactylus leprus (VU)* *Incilius campbelli,* (*NT*) *Incilius macrocristatus* (*VU*) *Rana juliani (NT, Endemic)* Higher elevation bird species including the keel-billed motmot, scaly-throated foliage-gleaner and the tawny-throated leaftosser.
Cultural Resources	Maya sites, caves, sinkholes and waterfalls, aesthetic and spiritual values	CRFR, with extensive karstic scenery, has numerous sink-holes, arches and cave systems, about which information is very limited. Maya ceremonial sites are known to be associated with some, or most of these. The primary forest, limestone cliffs and clear rivers north of Little Quartz Ridge have exceptional aesthetic value.

3.1.2 Assessment of Conservation Target Viability

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

- Current status assessment
- Baseline against which changes in the status of each focal conservation target can be monitored over time, allowing the Columbia River Forest Reserve Management Committee (CRFRMC) to measure success of its management strategies, compare the status of a specific focal target with future conditions, and with other projects in Belize / Central America that focus on that target
- basis for the identification of current and potential threats to a target and identifies past impacts that require mitigation actions
- basis for strategy design, prioritization of conservation actions, and a framework for monitoring

Viability is assessed for each conservation target, to give a reflection of abundance and condition within the Forest Reserve. Community and stakeholder workshops and meetings provided input into the rating of each target as Very Good, Good, Fair, or Poor, based on site specific knowledge of the ecosystems and species selected, local knowledge and social conditions, using the viability ratings developed by TNC.

Viability Ratings

Very Good:	Requires little or no human intervention to maintain conservation target at acceptable level (e.g. healthy, breeding populations, minimally impacted ecosystems)
Good:	May require some human intervention to maintain conservation target at acceptable level (e.g. 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

(Adapted from TNC CAP Process)

Justification is provided for the current viability rating, and a future viability goal is determined that is considered feasible within the 5-year term of the management plan, assuming the identified strategic actions are successfully implemented. Viability indicators are also listed, to enable the co-management agency to monitor viability on an ongoing basis (Table 20).

Table 20: Conservation Target Assessment			
Conservation Target	**Current Rating**	**Goal**	**Justification for Rating, Goal and Indicator**
Watershed Functionality	**GOOD**	**VERY GOOD**	***Justification:*** Watershed functionality has been affected by poor practices by salvage logging companies following Hurricane Iris, with blocked creeks and damaged creek banks. Water flow and quality have also been affected by the HydroMaya facility on a tributary of the Rio Grande, 750m south of CRFR.
			Goal: VERY GOOD. All logging practices abide by FD regulations pertaining to maintenance of water courses. All hydroelectricity facilities comply with relevant policies and employ best practices
			Potential Indicators: Water flow; water quality; number of rivers / creeks within CRFR affected by development impacts
Broadleaf Forest	**FAIR**	**GOOD**	***Justification:*** Hurricane damage, causing a shift towards predominance of pioneer species, and exacerbated by poorly controlled salvage logging. Increased clearance of broadleaf forest – current and past farming incursions, both from communities to the south, and from Guatemala. Large-scale illegal logging in north west plateau, and smaller illegal logging incursions from Belizean communities. Impacts from escaped fire from agricultural burning.
			Goal: GOOD: Broadleaf forest will take time to recover, but is regenerating slowly with protection. Mahogany / cedar / rosewood seedlings coming up. All future logging is legal, and conducted based on sound sustainability plans.
			Potential Indicators: Area affected by logging incursion from Guatemala; number and scale of illegal logging incursions per annum; area affected by fires within the pa per annum; acres of broadleaf forest cleared for agriculture within pa boundaries.
Game Species	**FAIR**	**GOOD**	***Justification:*** Game species – deer, peccary, armadillo, agouti, curassow, tinamou and paca (gibnut) are all decreased in numbers due to hurricane, salvage logging impacts and hunting pressure (both binational and local).
			Goal: GOOD…increased numbers of game species, providing replenishment to adjacent areas
			Indicators: Number of game species sightings

Table 20: Conservation Target Assessment /2			
Conservation Target	**Current Rating**	**Goal**	**Justification for Rating, Goal and Indicator**
Non-Commercial Forest Products	**FAIR**	**GOOD**	***Justification:*** Communities are harvesting these products, and report that levels, whilst affected by hurricane impacts, are still considered to be present and viable
			Goal: GOOD…natural resources of CRFR are managed sustainably. Transboundary incursions are halted
			Indicators: Availability of pacaya, cut leaf stems of bayleaf, cut stems of mountain cabbage palm,
Commercial Forest Products	**FAIR**	**GOOD**	***Justification:*** Much of the forest was significantly affected by Hurricane Iris and subsequent salvage logging activities. The timber of the remaining forest in good condition, to the north west, is being illegally harvested by Guatemalans. Xaté is being harvested under concession, but is poorly regulated, and >50% is estimated to be illegally harvested and going to Guatemala.
			Goal: GOOD. Illegal incursions from Guatemala are halted, and any concession given for the area is long term and incorporates sustainability of resources at its core.
			Indicators: Level of illegal logging by Guatemalan incursions – new logging tracks, cut stumps, area free of such impacts; presence and strength of concession agreement; proportion of xaté plants over-harvested
Upper Elevation Species	**GOOD**	**GOOD**	***Justification:*** Upper elevation species and ecosystems are not currently affected significantly by direct anthropogenic landscape change within the Forest Reserve. However, there is evidence of agrochemical pollution, deposited by orographic rainfall, that may have significant implication for the health of amphibians in the upper elevations
			Goal: To maintain intact ecosystems in the upper elevations and reduce the agrochemical impacts on these areas
			Indicators: Area > 500m under natural forest cover; amphibian species presence, relative abundance and health; levels of agrochemical pollution in upper elevation areas

Table 20: Conservation Target Assessment /3			
Conservation Target	**Current Rating**	**Goal**	**Justification for Rating, Goal and Indicator**
Cultural Resources	**GOOD**	**GOOD**	***Justification:*** The majority of the aesthetic resources, such as waterfalls, are in pristine conditions. However, there has been looting of Maya artifacts from caves and archaeological structures.
			Goal: To maintain cultural resources in the current state without further degradation
			Indicators: Number of identified aesthetic resources remaining in pristine condition. Proportion of caves and archaeological structures without further looting

The results of the workshop outputs on Conservation Target viability are summarized (Table 21), and proposed management strategies developed, targeted at increasing viability ratings over time.

Table 21: Conservation Targets – Current Rating		
Conservation Target	**Current Rating**	**Goal**
Watershed Functionality	**GOOD**	**VERY GOOD**
Broadleaf Forest	**FAIR**	**GOOD**
Game Species	**FAIR**	**GOOD**
Non-commercial Forest Products	**FAIR**	**GOOD**
Commercial Forest Products	**FAIR**	**GOOD**
Upper Elevation Species	**GOOD**	**GOOD**
Cultural Resources	**GOOD**	**GOOD**

Summary of Conservation Target Viability – Prioritization

Using the Viability Ratings, it is possible to prioritize the conservation importance of each of the Conservation Targets within the Columbia River Forest Reserve, to assist decision making in allocation of funding and future project targets.

Priority	Conservation Target	Viability Rating
High Priority	*Broadleaf Forest*	Fair
	Non-commercial Forest Products	Fair
	Commercial Forest Products	Fair
	Game Species	Fair
Medium Priority	*Watershed Functionality*	Good
	Upper Elevation Species	Good
	Cultural Resources	Good

3.2 Threats to Biodiversity

A threat analysis was conducted in 2009 for the biodiversity assessment process, with input from the stakeholder community members knowledgeable of the protected area – particularly community leaders, hunters and fishermen. This was supplemented by technical information developed during the system level Conservation Action Planning for the Maya Mountains Massif and Maya Mountain Marine Corridor.

3.2.1 Identified Threats

Outputs from the threat assessment identified eight threats as impacting the Forest Reserve (Table 22). These were then assessed using a series of three criteria to allow prioritization of conservation actions and resources towards mitigating those identified as the most critical threats.

This assessment rated:

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

following the methods outlined below (Figure 6).

Threats identified as impacting Columbia River Forest Reserve

- Unsustainable Hunting and Fishing
- Unsustainable Harvesting of Commercial Forest Products
- Unsustainable Harvesting of Non-Commercial Forest Products
- Agricultural Incursions
- Fire
- Adjacent Land Use Change
- Transboudary incursions (logging, hunting, xate, agricultural)
- Climate Change
- Hydro-electric facility development
- Agrochemical Pollution
- Looting of Maya Artifacts
- Dereservation

Table 22

Figure 6: Rating Critical Threats

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

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

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

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

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

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

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

Threats to biodiversity of the Columbia River Forest Reserve

Unsustainable Harvesting of Commercial Forest Products	***Status: ACTIVE***		
	Target: COMMERCIAL FOREST PRODUCTS		
	Threats (*Direct*)*:* ▪ Unsustainable extraction of timber resources ▪ Unsustainable extraction of xaté ▪ Uncontrolled extraction of other forest products for commercial purposes ▪ Transboundary logging incursions		
	Source (Indirect Threat)***:*** ▪ Limited capacity for effective monitoring and enforcement of past extraction licenses ▪ Short-term outlook of concession holders ▪ High poverty levels in Guatemala border communities ▪ Permeable border with insufficient enforcement against Guatemalan incursions		
	Area	***3***	Salvage logging has occurred throughout more than 25% of the area – as has xaté extraction
	Severity	***2***	There has been a measureable effect on commercial timber species, and the removal of even the seed trees may increase the severity level for some species once assessments are completed
	Urgency	***2***	A moratorium currently exists on logging within the area until the management plan is in place
	Management Goal: *Sustainable harvesting of commercial forest products, providing socio-economic benefits to buffer communities* ***Management Strategies:*** **Strategy 1:** Formation of Columbia River Forest Reserve Management Committee (CRFRMC) with representation from stakeholder communities **Strategy 2:** Seek sound and sustainable long term concession agreement for extraction of timber resources – the concession agreement also needs to be approved by the CRFRMC, using a transparent bidding process to identify best-qualified applicant **Strategy 3:** Effective monitoring and enforcement of any timber concession given within CRFR, especially with respect to protection of slopes and water courses **Strategy 4:** Tighten monitoring and enforcement of xaté concession implementation, including permitting of identified xatéros **Strategy 5:** Engage local authorities and other conservation organizations towards effective surveillance and enforcement against Guatemalan incursions, and strengthening of the border		

Threats to biodiversity of the Columbia River Forest Reserve

Unsustainable Harvesting of Non-Commercial Forest Products

Status: ACTIVE

Target: NON-COMMERCIAL FOREST PRODUCTS

Threats (*Direct*)*:*

- Reduced populations of traditional construction materials
- Reduced populations of traditional plant foods
- Reduced populations of medicinal plants
- Impacts on ceremonial products (eg. copal)

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

- Traditional construction, food, medicine and ceremonial use
- Low income levels in stakeholder communities
- Lack of alternatives to supplementation of diet through harvesting of traditional food items
- High cost of food and medicines, and poor access to medical treatment
- Continuing traditional ceremonial practices

Area	***2***	Affects community traditional use areas (though it should also be recognized that there are also transboundary impacts on these resources)
Severity	***1***	There is currently a measurable effect, but it is not considered substantial, as several communities still have these resources in their community areas
Urgency	***3***	It is occurring now and requires action

Management Goal: *To maintain viable traditional resources through effective sustainable harvesting*

Management Strategies:

Strategy 1: Development and approval of Sustainable Traditional Natural Resource Use Management Plans and regulations per community use area, to include initial assessment of resources present

Strategy 2: Effective surveillance and enforcement of community use areas by communities

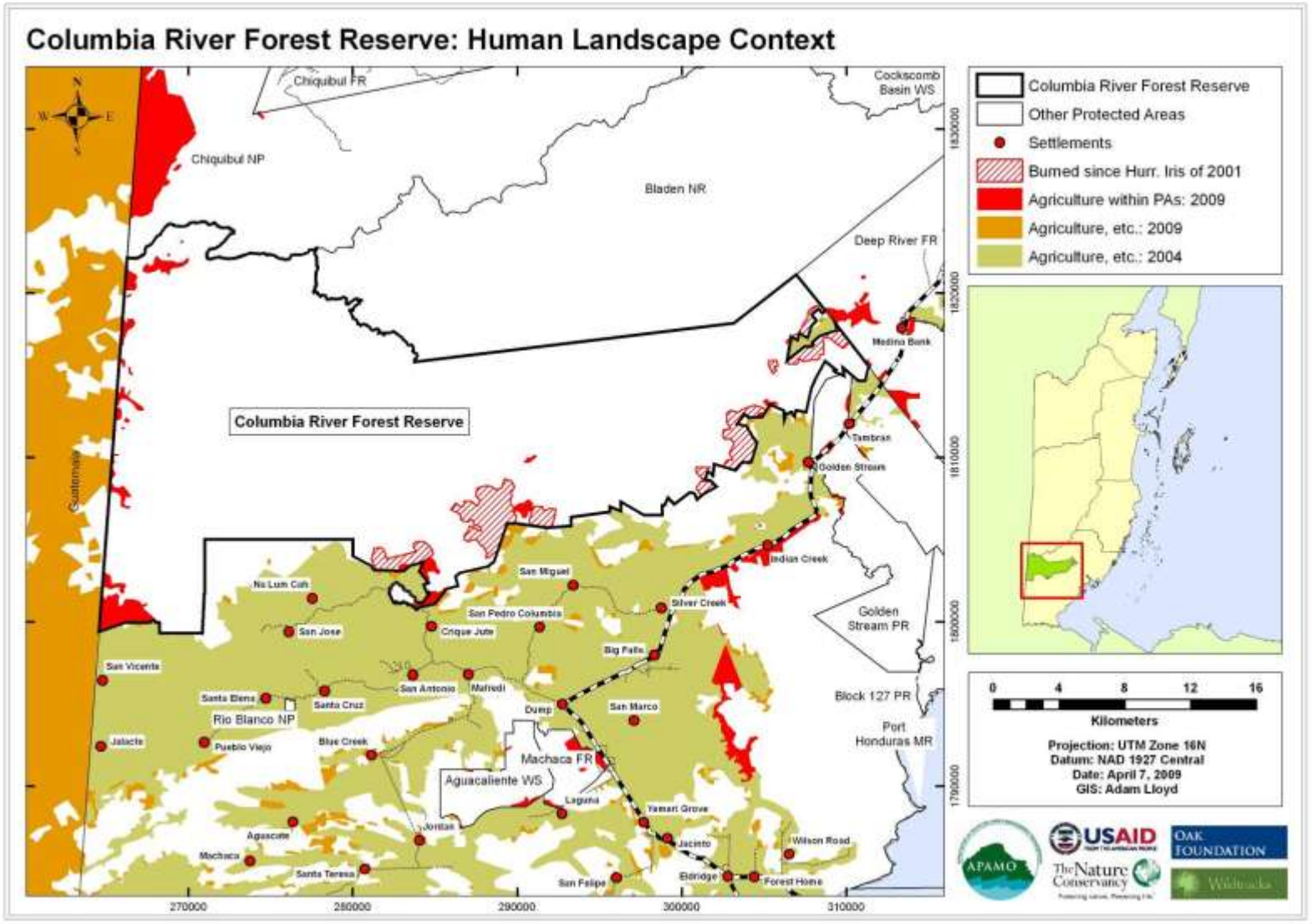
Strategy 3: Seek funding to support community managed resource use areas

Strategy 4: Investigate mechanisms for increasing opportunities for income generation

Strategy 5: Engage local authorities and other conservation organizations to assist in the strengthening of the border

Threats to biodiversity of the Columbia River Forest Reserve

Agricultural Incursions	***Status: ACTIVE***		
	Target: BROADLEAF FOREST; WATERSHED FUNCTIONALITY; GAME SPECIES; NON-COMMERCIAL FOREST PRODUCTS; COMMERCIAL FOREST PRODUCTS;		
	Threats (*Direct*)*:* ▪ Removal of broadleaf forest ecosystems ▪ Removal of environmental services of Broadleaf forest canopy in maintaining watershed and biodiversity ▪ Increased fire risks		
	Source (Indirect Threat)***:*** ▪ Reduced availability of agricultural land in adjacent community lands ▪ Poor farming practices resulting in extensive land use ▪ Limited opportunities for alternative incomes		
	Area	*2*	Less than 25 % of the total area (approximately 3,520 acres
	Severity	*3*	Land use change from forest to agriculture removes 100% of the majority of the targets
	Urgency	*3*	Threat is happening now and requires action
	Management Goal: *To prevent unplanned agriculture within the Forest Reserve and reduce the negative impacts of past agricultural incursions* ***Management Strategies:*** **Strategy 1:** Clearly demarcate CRFR boundary **Strategy 2**: Assist farmers to engage in more effective farming methods (eg. mulch farming rather than slash & burn, alternative crops), to reduce area required for community farmland **Strategy 3:** Investigate mechanisms for rehabilitation of agricultural soils within community lands **Strategy 4:** Engage Department of Agriculture to assist with developing agricultural alternatives for the communities **Strategy 5:** Implement agro-forestry projects in agricultural incursion areas towards replacement of forest canopy structure and watershed functionality **Strategy 6:** Effective surveillance and enforcement against unplanned and transboundary agricultural incursions		



Map 23: The Human Landscape Context of Columbia River Forest Reserve

<table>
<tr><th colspan="4">Threats to biodiversity of the Columbia River Forest Reserve</th></tr>
<tr><td rowspan="7">Fire</td><td colspan="3">Status: ACTIVE</td></tr>
<tr><td colspan="3">Target: BROADLEAF FOREST</td></tr>
<tr><td colspan="3">Threats (Direct):
▪ Reduced capacity of forest to regenerate
▪ Reduced soil viability
▪ Impacts on species within burnt forest – death, removal of habitat</td></tr>
<tr><td colspan="3">Source (Indirect Threat):
▪ Burning for clearance of illegal agricultural areas within CRFR
▪ Poor fire practices in adjacent farmlands
▪ Lack of respect for values of CRFR broadleaf forest</td></tr>
<tr><td>Area</td><td>1</td><td>Gradually encroaching from marginal areas, but still less than 25%</td></tr>
<tr><td>Severity</td><td>3</td><td>Local eradication of target possible</td></tr>
<tr><td>Urgency</td><td>3</td><td>Threat is occurring each year and requires action</td></tr>
<tr><td colspan="3">Management Goal: Effective fire management within Columbia River Forest Reserve and adjacent areas

Management Strategies:

Strategy 1: Develop a fire management plan for CRFR in collaboration with the the Southern Belize Fire Working Group, and under the framework of the National Fire Policy for Belize, and implement in collaboration with other organizations, towards better fire management

Strategy 2: Increase fire awareness in all buffer communities, targeted particularly at farmers

Strategy 3: Engage Department of Agriculture to enforce existing laws on agricultural fires, in collaboration with Village Chairman and Alcalde

Strategy 4: Amend and strengthen the Forests Act to incorporate Forest Fire Regulations with realistic penalties and implement with effective enforcement

Strategy 5: Advocate for inclusion of fire management within a National Sustainable Land Use Policy, based on ILM

Strategy 6: Increased capacity for fire management in Toledo building on past initiatives and through provision of fire control & management training to community members

Strategy 7: Investigate and implement mechanisms to re-forest fire impacted areas through agro-forestry to restore forest canopy and watershed functionality</td></tr>
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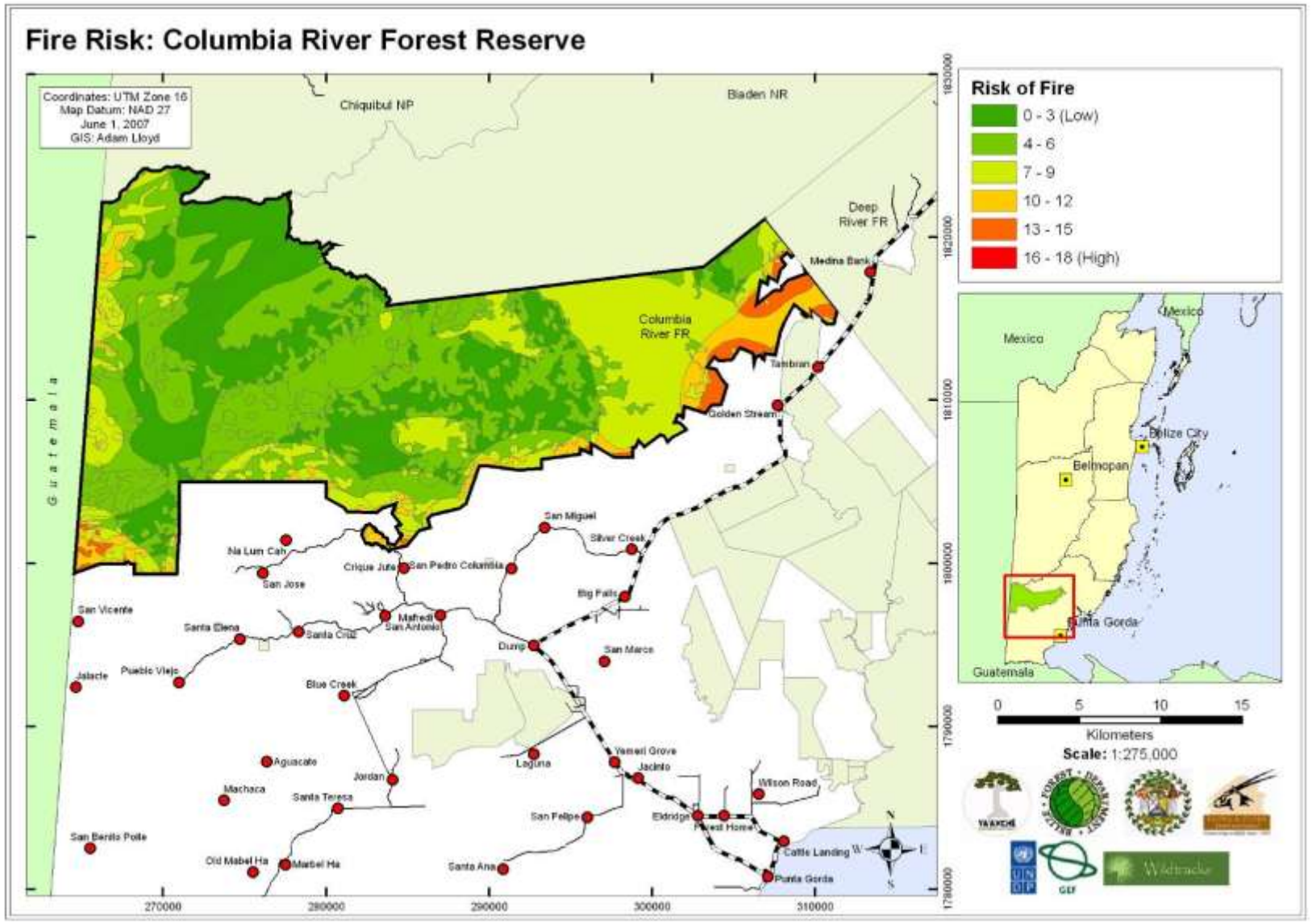
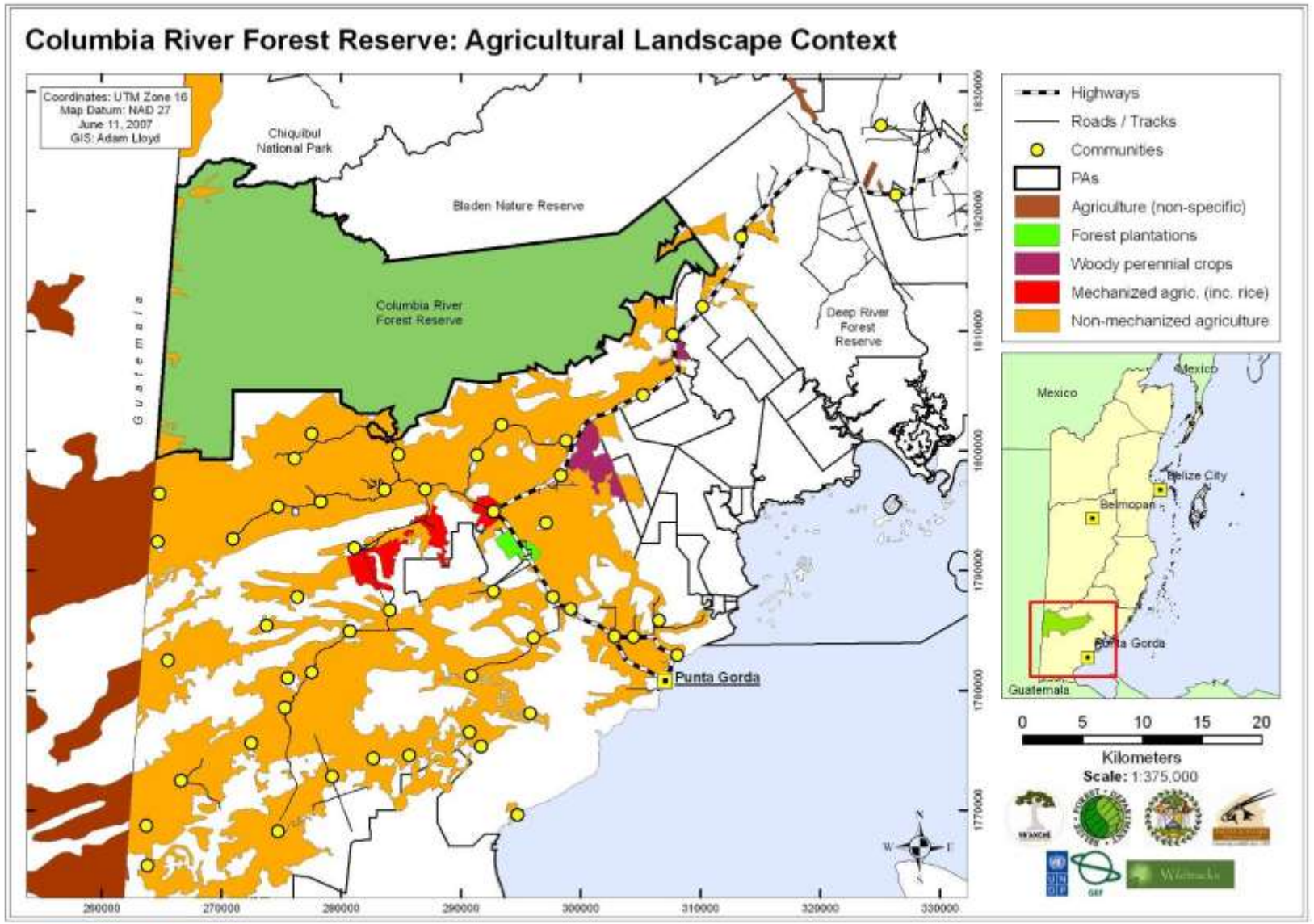


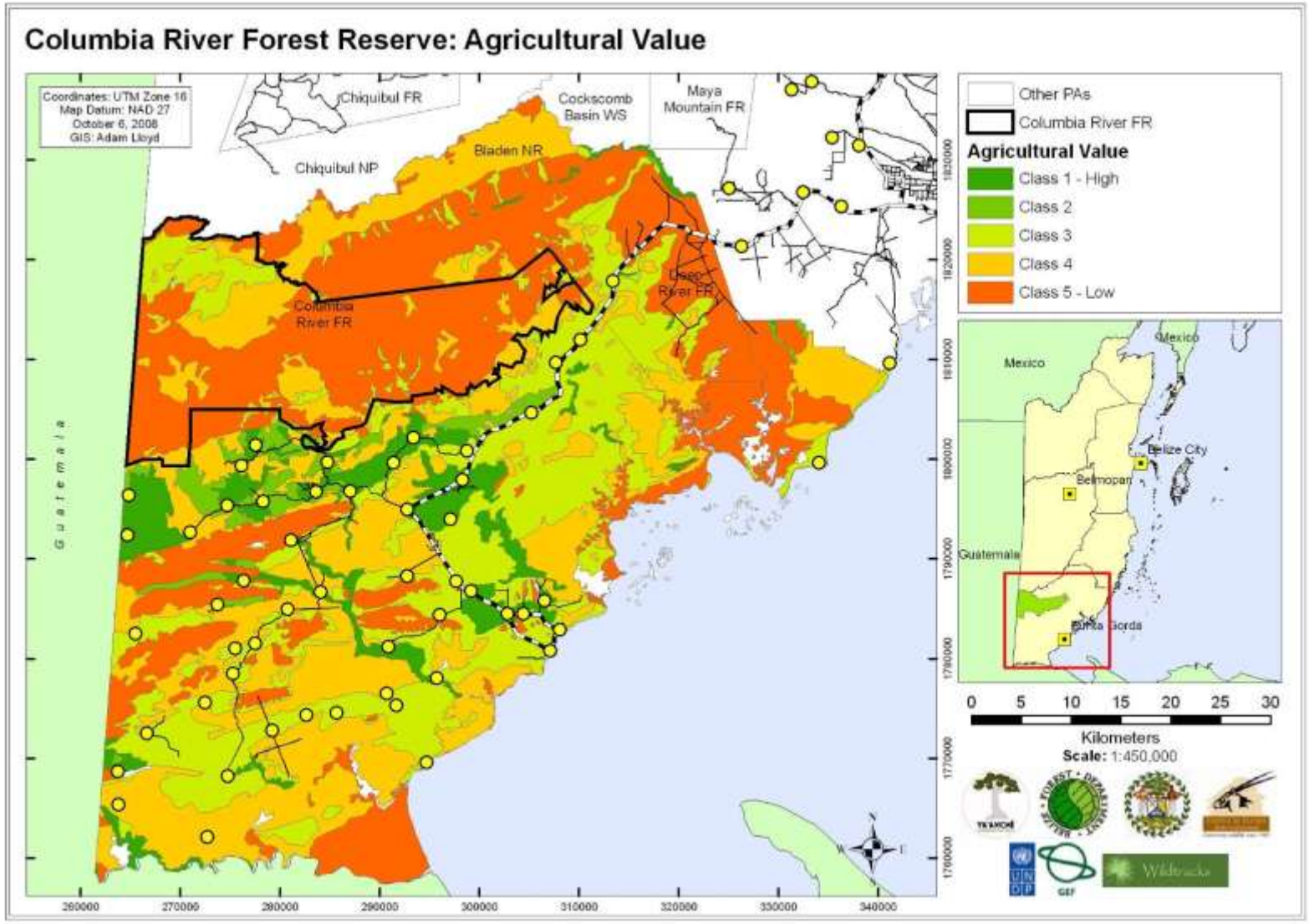
Map 24: Level of Fire Risk within the Columbia River Forest Reserve (Data: Meerman)

Threats to biodiversity of the Columbia River Forest Reserve

Adjacent Land Use Change	***Status: ACTIVE***		
	Target: BROADLEAF FOREST, WATERSHED FUNCTIONALITY		
	Threats (*Direct*)*:* ▪ Changes in rainfall patterns through clearance of forest cover on coastal plain ▪ Increased temperature and decreased humidity within the watershed ▪ Increased fire risk ▪ Increased accessibility		
	Source (Indirect Threat)***:*** ▪ Changes in landscape use and land ownership ▪ Increasing promotion of cattle farming in Toledo District ▪ Human population growth ▪ Lack of national Land Use Policy		
	Area	4	Will affect cloud cover in upper areas, and water availability in lower areas
	Severity	1	Whilst the changes in rainfall are measureable and anecdotal evidence already suggests drying of cattle areas, it would be hard to measure changes to broadleaf forest over the short term
	Urgency	3	Land clearance for cattle farming is increasing exponentially
	Management Goal: *To assist Belizean communities within the watersheds of Columbia River Forest Reserve to better manage their lands towards future water security* ***Management Strategies:*** **Strategy 1:** Provision of agricultural development support towards best land use practices, with increased socio economic benefit **Strategy 2**: Increase awareness and lobby with Department of Agriculture re. long term negative socio-economic and environmental impacts of cattle ranching **Strategy 3:** Investigate and implement mechanisms for increasing productivity and sustainability within current agricultural footprint **Strategy 4:** Investigate and implement mechanisms for rehabilitating degraded lands towards a return to agricultural productivity **Strategy 5:** Support national poverty alleviation mechanisms **Strategy 6:** Support and participate in the development of a National Land Use Policy		



Map 25: Agricultural Landscape Context of Columbia River Forest Reserve



Map 26: Agricultural Land Values in and adjacent to Columbia River Forest Reserve

Threats to biodiversity of the Columbia River Forest Reserve

Transboundary Incursions

Status: ACTIVE

Target: COMMERCIAL FOREST PRODUCTS, NON- COMMERCIAL FOREST PRODUCTS, GAME SPECIES, BROADLEAF FOREST, CULTURAL RESOURCES

Threats (*Direct*)*:*

- Reduced timber, xaté and other non-timber resources
- Reduced viability of game species, food and medicinal plant populations
- Security concerns for visitors to CRFR

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

- High poverty levels in Guatemala border communities
- Illegal, large scale commercial extraction of commercial timber resources, xaté and other non-timber forest products, for illegal export and sale in Guatemala
- Permeable border with insufficient enforcement against Guatemalan incursions

Area	4	Illegal Guatemalan activities occur throughout CRFR
Severity	2	Whilst the impacts are significant, and extraction is for short term benefit, it is unlikely that targets will be eradicated
Urgency	3	Incursions are occurring now

Management Goal: *To prevent transboundary incursions from Guatemala and associated removal of natural resources from CRFR*

Management Strategies:

Strategy 1: Lobby for increased political support for effective enforcement along border with Guatemala

Strategy 2: Actively support and participate in current multi-agency collaboration within the Maya Mountains Massif for synergized approach to increased enforcement along border with Guatemala

Strategy 3: Strengthen multi-agency patrols along the Adjacency Zone through increased resources, with the participation and collaboration of BDF, Police, FD, Immigration, IoA, Ya'axché and FCD

Strategy 4: Support the establishment of a system-level surveillance and enforcement task force for deployment to critical hotspots for illegal activity within the MMM

Strategy 5: Support maintenance of a permanent security / Forest Department presence at the Machiquila Conservation Post, including upgrading of main access road for fast response

Threats to biodiversity of the Columbia River Forest Reserve

Hydro-electricity Facility development

Status: ACTIVE

Target: WATERSHED FUNCTIONALITY, BROADLEAF FOREST

Threats (*Direct*)*:*

- Alteration of water flow
- Alteration of water quality
- Reduced extent of broadleaf forest
- Disturbance in core protection area

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

- Reduced drinking water quality
- Fragmentation of broadleaf forest ecosystems and increased access, through road construction into CRFR
- Clearance of habitat in footprint of hydro-electricity facility sites in core protection zone

Area	2	Effects are localized within CRFR to the footprint of the hydro-electric facility and the downstream watercourse
Severity	2	A similar scheme upstream from San Miguel is reported to have caused significant alteration of water quality.
Urgency	3	Un-permitted incursions are occurring now

Management Goal: *To ensure watershed functionality and continued water flow and quality to the coastal plain and stakeholder communities*

Management Strategies:

Strategy 1: Assessment of CRFR watersheds to prioritize relative biodiversity values and provision of environmental services, to inform decision-making processes on hydroelectric facility siting and development

Strategy 2: Lobby for recognition and compliance with MMM zone regulations, with no hydro-electric power facility development in Core Preservation Zone

Strategy 3: Work with DoE to mandate compliance with international environmental standards by current and future hydropower developments

Strategy 4: Ensure that any permit process for hydro-electricity facility development within the CRFR follows due process and includes review by the CRFRMC

Strategy 5: Collaborate with communities towards the maintenance of the 66' buffer of natural vegetation at the sides of creeks and rivers

Threats to biodiversity of the Columbia River Forest Reserve

Agrochemical Pollution

Status: ACTIVE

Target: UPPER ELEVATION SPECIES, WATERSHED FUNCTIONALITY

Threats (*Direct*)*:*

- Reduced water quality
- Increased susceptibility of threatened amphibian species to chytrid infection
- Transport throughout water system to reef

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

- Use of agrochemicals on coastal plain to east, transported and deposited in CRFR through orographic rainfall

Area	3	Assumed to be most concentrated in the upper elevation areas of deposition, but also spread throughout
Severity	2	Measureable amounts of agrochemicals have been recorded within MMM, but levels and impacts in CRFR are not yet known
Urgency	3	Agrochemical transport into CRFR through orographic rainfall is assumed to be occurring now

Management Goal: *To reduce agrochemical pollution within the CRFR watersheds*

Management Strategies:

Strategy 1: Identify major environmental pollutants and establish a baseline in upper elevation areas, and exiting river systems, for future monitoring and implement on-going monitoring

Strategy 2: Support initiatives that encourage adoption of best management practices in major polluting agro-industries, and the population in general, through increasing awareness, regulations and international technical and financial support

Strategy 3: Investigate feasibility of adoption of use of less volatile, less toxic agrochemicals in the agro-industries and local farms

Strategy 4: Lobby for greater enforcement against illegal importation of restricted / controlled chemicals

Threats to biodiversity of the Columbia River Forest Reserve

Dereservation	***Status: POTENTIAL***		
	TARGET: ALL TARGETS		
	Threats (*Direct*)*:* ▪ Reduced viability of all conservation targets ▪ Reduced watershed functionality		
	Source (Indirect Threat)***:*** ▪ Political will in response to voter pressure ▪ Community pressure for access to more agricultural land ▪ Limited awareness within Government of critical nature of CRFR in terms of water security		
	Area	3	Could range from 5% to 100%, but greatest probability is below 50%
	Severity	3	Whatever area came to be dereserved would be subject to forest clearance
	Urgency	2	Lands are already rumoured to be allocated within CRFR, but this is still to be confirmed
	Management Goal: *To maintain the environmental services of CRFR in the long term, for the benefit of all stakeholders* ***Management Strategies:*** **Strategy 1:** Lobby to strengthen system level management, to prevent the by-passing of the due process associated with dereservation of areas in the MMM **Strategy 2:** Promote greater communication, cooperation and collaboration between Forest Department and Lands Department **Strategy 3:** Increase awareness among policy makers of provision of environmental services by CRFR to stakeholder communities		

Threats to biodiversity of the Columbia River Forest Reserve

Looting of Maya Artifacts

Status: ACTIVE

TARGET: CULTURAL RESOURCES

Threats (*Direct*)*:*

- Removal of Maya artifacts from caves and Maya structures
- Destruction of Maya artifacts

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

- High value of Maya artifacts and available market – particularly in Guatemala
- High poverty levels in Guatemala border communities
- Permeable border with insufficient enforcement against Guatemalan incursions
- Increased road access to Esperanza

Area	2	Unknown, but estimated to be below 50%, and probably below 25%, due to inaccessibility
Severity	3	When a cave or structure is looted, 50 – 100% of artifacts will be taken or destroyed
Urgency	3	Looting is occurring within CRFR

Management Goal: *To preserve the cultural resources of CRFR for future generations, in collaboration with the Insitute of Archaeology*

Management Strategies:

Strategy 1: Map and catalogue cultural resources of CRFR, in collaboration with the Insitute of Archaeology

Strategy 2: Strengthen surveillance and enforcement against illegal activities within CRFR

Strategy 3: Ensure control over access points – eg. a manned barrier where the road to the proposed hydro-electricity facility has been constructed.

Strategy 4: Protection of archaeological structures in the Esperanza area through community participation in surveillance and enforcement in collaboration with the Insitute of Archaeology

Prioritizing Threats

Once the threat assessment has been completed, it is important to prioritize threats, to indicate where financial and human resources need to be most focused. This is done through the National Management Plan Framework prioritization process.

The threats are listed, and for each threat, the scores are transferred from the previous threat assessment tables (Table 23).

Threats	*Criteria Rankings*			*Total Ranking*
	Area	*Severity*	*Urgency*	
Transboundary Incursions	4	2	3	***24***
Agricultural Incursions	2	3	3	***18***
Agrochemical Pollution	3	2	3	***18***
Dereservation	3	3	2	***18***
Looting	2	3	3	***18***
Unsustainable Harvesting of Commercial Forest Products	3	2	2	***12***
Adjacent Land Use Change	4	1	3	***12***
Hydro-electricity Facility development	2	2	3	***12***
Fire	1	3	3	***9***
Unsustainable Harvesting of Non-Commercial Forest Products	2	1	3	***6***

Table 23: Threat scores and Ranking

The threat with the highest total threat score is ranked as the highest threat. This places **transboundary incursions** from communities on the Guatemalan side of the border as the highest priority.

The contribution of each threat across the full range of targets is also assessed to assist in prioritizing strategies (Table 24).

Threats	Targets						
	Watershed Functionality	Broadleaf Forest	Game Species	Non-Commercial Forest Products	Commercial Forest Products	Upper Elevation Species	Cultural Resources
Dereservation							
Adjacent Land Use Change							
Transboundary Incursions							
Agricultural Incursions							
Agrochemical Pollution							
Unsustainable Harvesting of Commercial Forest Products							
Hydro-electricity Facility development							
Fire							
Unsustainable Harvesting of Non-Commercial Forest Products							
Looting							

Table 24: Threat Contribution per Conservation Targets

3.3 Strategies to Reduce Threats

During the threat assessment process, the primary cross cutting strategies were identified for effective management of the Columbia River Forest Reserve (Table 25).

Primary Cross Cutting Strategies	Watershed Functionality	Broadleaf Forest	Game Species	Non-Commercial Forest Products	Commercial Forest Products	Upper Elevation Species	Cultural Resources
Formation of Columbia River Forest Reserve Management Committee							
Lobby GOB for effective enforcement of Belize border: all (except perhaps watershed functionality							
Engage local authorities, NGOs and communities towards strengthening of border							
Development of long term concession agreement for sustainable extraction of timber resources, using best practices, with effective monitoring and enforcement							
Engagement of community leaders and development of Sustainable Natural Resource Use Plans and regulations per community							
Effective surveillance and enforcement of community natural resource use areas							
Increase opportunities for income generation in stakeholder communities							
Clearly demarcate CRFR boundary							
Assist farmers in developing more effective farming methods							
Implement agro-forestry projects in agricultural incursion areas							

Table 25: Cross Cutting Strategies

Primary Cross Cutting Strategies	Watershed Functionality	Broadleaf Forest	Game Species	Non-Commercial Forest Products	Commercial Forest Products	Upper Elevation Species	Cultural Resources
Work with agricultural sector and related partners to reduce use of toxic agro-chemicals							
Increase fire awareness and effective fire management in buffer areas							

Table 25: Cross Cutting Strategies

4. Management Planning

4.1 Management and Organizational Background

Current Management

Columbia River Forest Reserve is currently under the direct administration of the Forest Department (Ministry of Natural Resources), with a central office located in Belmopan. District Forest Stations are located in most districts – Machaca Forest Station is the operational headquarters for Toledo District, including oversight of the Columbia River Forest Reserve.

The Forest Department was first established in 1927, and 'oversees the conservation, protection, management and utilization of Belize's forest resources and its biodiversity, whilst ensuring that the productive capacity of the forests for both goods and services is maintained or enhanced for the sustainable development of the Belizean people.'

Three Forest Officers are stationed at Machaca Forest Station to manage not only Columbia River Forest Reserve, but also all other Forest Department related issues in the District (logging and petty permits etc.). An estimated 5% of their time is spent specifically on Columbia River Forest Reserve related issues (Novelo, pers. com.)

Pre-Hurricane Iris, the CRFR was managed under a 20 year forest license – a long term logging concession - under Atlantic Industries Ltd. (AIL), signed in 1995 (FD, 2007). This followed the guidelines set out in the draft management plan for the Columbia River Forest Reserve (Bird, 1995), the long term nature of this license being designed to provide security of timber supply for the licensee in order to promote investment in management. This license was to be renewed after ten years, in 2005, though the impacts of Hurricane Iris resulted in a cessation of sustainable logging activities, and the granting of salvage licenses to a number of companies. The status of the AIL contract renewal is currently in dispute, and a number of other entities have also shown interest in taking on a long term concession for the area. It should be noted, however, that Columbia River Forest Reserve can only support a single logging concession, especially following realignment of logging compartments to allow for community sustainable natural resource use concessions.

There is currently no community participation in management – even in an advisory role – despite the heavy reliance of the buffer communities on the natural resources.

4.2 Review of Previous Management Effectiveness

Forest Department staff participated in a review of management effectiveness for Columbia River Forest Reserve in 2006, and again in 2009, using the Management Effectiveness Tracking Tool developed under the NPAPSP.

Individual Indicators*		
Indicator Category	**Average Score 2006****	**Average Score 2009****
1. Resource Information	2.08	2.67
2. Resource Administration, Management and Protection	2.78	2.00
3. Participation, Education and Socio-Economic Benefit	1.64	2.07
4. Management Planning	1.60	1.33
5. Governance	3.00	3.33
6. Human Resources	1.71	1.38
7. Financial and Capital Management	1.88	1.12
Overall	2.10	1.95

***** Indicators and Indicator categories used are from Young et. al., 2005
** out of a possible score of 4

Table 26: Summary of outputs from assessment of Management Effectiveness, 2006 and 2009

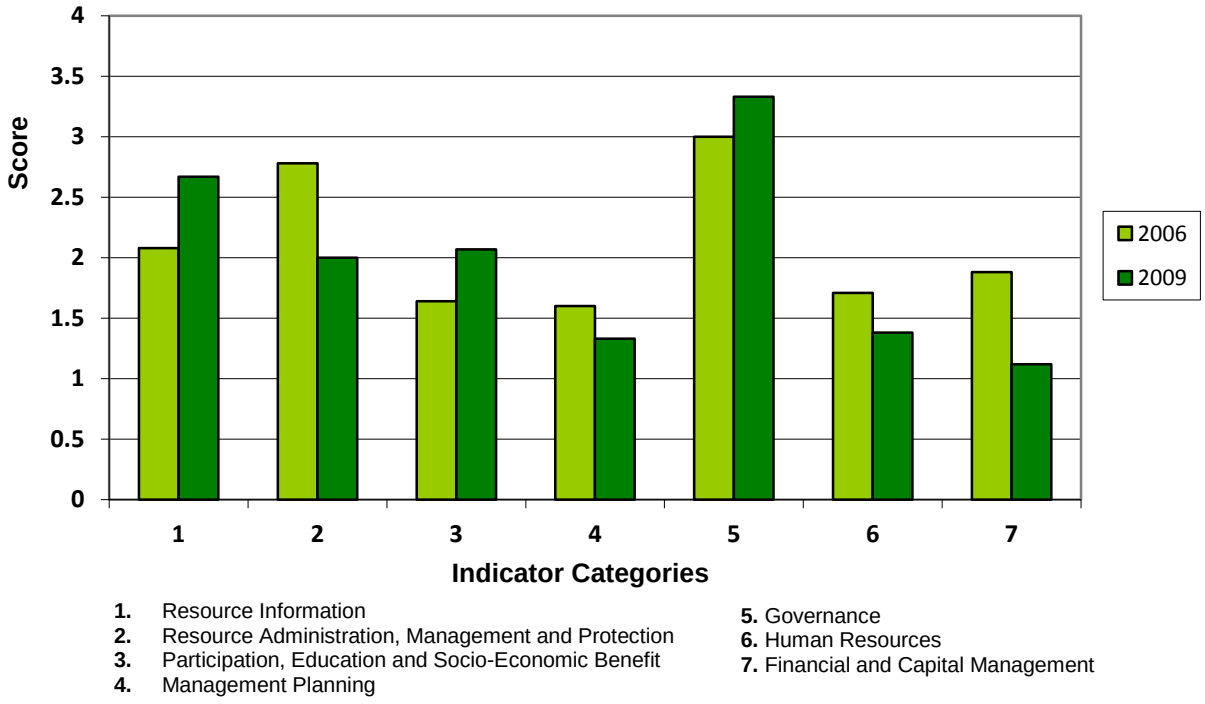


Figure 7: Range of Indicator Category average scores for management effectiveness of Columbia River Forest Reserve (2006 and 2009)

Overall, management effectiveness as decreased since 2006, from 2.10 to 1.95 (out of a possible score of 4). This is considered a reflection on the limited staff availability and leadership within the Machaca Forest Station, the lack of effective and sustainable management of the timber resources through the engagement of an active, current, long term logging concession holder, limited engagement of stakeholder communities, and absence of a current management plan.

Resource Information

Columbia River Forest Reserve has been the focus of two system level conservation planning initiatives and is an integral part of the Golden Stream Watershed Project, resulting in an increased focus on ensuring that there is biodiversity information available for the Reserve. This is reflected in the increased rating for this indicator over the three year period from 2006 to 2009. However, it is accepted that further work still has to be completed – four areas under this section are identified as in need of further strengthening:

- Inventory of archaeological resources, in collaboration with the Insitute of Archaeology
- Information on resource use and occupancy
- Inventory of social, cultural and economic
- Inventory: Tenures and claims

Resource Administration, Management and Protection

Whilst the legal status of the protected area is considered to be very strong, and the procedures for issuing of permits is rigorous, management and protection of the natural resources is considered to have decreased since 2006, reflected in the increasing incursions from Guatemala. Ongoing claims from Maya communities for recognition of land rights and limited surveillance and enforcement activities also rate poorly within this Section, as does the management of the limited tourism visitation that occurs in the area. The areas most in need of strengthening are identified as:

- Visitor and tourism monitoring programme
- Tenures and claim and conflict resolution
- Surveillance activities
- Enforcement activities
- Visitor and tourism management activities

Participation, Education and Stakeholder Benefit

These indicators show some improvement since 2006, though the management of the protected area still scores only just above 2.00. There is strength in stakeholder engagement by Forest Department through the petty permit and logging license processes, but under the current Forest Department policies, no developed communication strategy to keep stakeholders informed and involved, and no integration of stakeholders in decision making, even in an advisory role. There are also few (if any) legal socio-economic benefits resulting from the area (though illegal community use for natural resource

harvesting is still ongoing). There is, however, a high level of recognition of the protected area benefits in the buffering communities, particularly in terms of watershed protection, partly as a result of the high level of awareness of the subsistent reliance on the resources, and partly as a result of past NGO awareness activities in the area.

Areas identified as most in need of strengthening include:

- Communication activities
- Existence of a socio-economic benefits strategy
- Sustainable use for economic benefit
- Employment in activities related to the protected area
- Educational activities
- Local actors leading protected area management
- Volunteer programme
- Existence of capacity building strategies

Management Planning

Management of Columbia River Forest Reserve is considered to have weakened in the area of management planning, with no operational planning or monitoring and evaluation process in place, with all indicators scoring below 3.00. All areas are therefore considered in need of strengthening, with particular focus on the following:

- Operational planning
- Identification of long term management needs
- Programme monitoring and evaluation
- Research Programme

Governance

With Columbia River Forest Reserve under the direct management of the Forest Department, Governance is considered a strength of management, scoring above 3.00 in all three relevant indicators. The Forest Department does not yet actively seek participation from Stakeholder communities through Advisory Committees or other mechanisms, though it is considered that this would strengthen future management.

Human Resources

Columbia River Forest Reserve needs strengthening in the majority of the indicator areas under Human Resources, with an average score of 1.38 (rating as Fair). Whilst there is a Forest Department presence at Machaca Forest Station, this is primarily for administration of permit applications and logging concessions for the whole of Toledo District. The protected area lacks dedicated staff, with no site manager, and no operational staff.

- Qualified site manager
- Site manager availability
- Operational Staff
- Human resource assessment
- Training and development activities
- Staff satisfaction

Financial and Capital Management

Columbia River Forest Reserve lacks any dedicated site-level financial structure, with very little annual investment in management (either in terms of human or financial resources). Whilst past logging concessions have generated funds from royalties and taxes, these are not re-invested into the management of the protected area. This Indicator Section rating as Fair, with an average score of 1.13. All indicators would benefit from significant strengthening, with the following as the highest priorities:

- Funding adequate for management
- Revenue generation
- Financial management
- Infrastructure
- Equipment
- Maintenance

Recommendations

1. Dedicated staff coordinating management
2. Establishment of the a committee consisting of Forest Department and stakeholders responsible for management decisions
3. Site-level annual operational plans developed, dedicated to Columbia River Forest Reserve, guided by the management plan, and implemented by CRFR coordinator/manager and dedicated staff
4. Engagement and participation of community stakeholders through community management committees and regulated sustainable use areas under concession agreements
5. Development and implementation of Transboundary Enforcement Plan with input from multiple stakeholders (for example: BDF, FCD, Police, Department of Immigration, Department of Foreign Affairs)

6. Agreement with long term logging concession holder, using a transparent bidding process to identify best-qualified applicant

4.3 Management Goals

The primary goal of the management of the Columbia River Forest Reserve since its establishment has been to ensure the maintenance of the health of the forest ecosystem and its productive capacity (Bird, 1994), giving protection to the watersheds originating in the Columbia River Forest Reserve and the high biodiversity while allowing for the sustainable extraction of economically important hardwood species.

A series of ten objectives were developed to achieve this in the 1994 draft management plan (Bird, 1994):

1. Establishing the administrative capacity to manage the Forest Reserve
2. Produce an economic evaluation of the Forest Reserve
3. Obtain local community support for forest management
4. Protect fragile land on steep slopes
5. Protect water supplies
6. Protect forest wildlife and biological diversity
7. Optimize revenues compatible with both the sustained production of hardwood timber and the socio-economic well being of the local communities
8. Sustain the supply of other forest products
9. Promote forest based tourism
10. Conduct research to support the above objectives

Adapted from Bird (1994)

However, following the devastating effects of Hurricane Iris, the emphasis towards sustainable timber harvest must now include a greater focus on forest regeneration / restoration, and a continued focus on the increasingly important need for watershed protection and community participation.

Long Term Vision

This management plan is based on the concepts of maintenance of watershed functionality for current and future water security in the face of climate change; increased community participation through community control and management of current natural resource areas, and agroforestry initiatives in the agricultural incursion and fire-damaged areas, to promote forest restoration and management;, the signing of a long term logging concession outside of these community natural resource use management areas, with the adoption of the Timber Harvesting Protocol (van der Hout, 2008), focused on replanting and research activities.

4.4 Management Strategies

4.4.1 Regulations

Under the Forest Department, Forest Reserves have clearly defined regulations concerning resource use and extraction. Other laws also provide regulations on the use of natural resources (the Wildlife Protection Act, The Fisheries Act, Mines and Minerals Act, Petroleum Act).

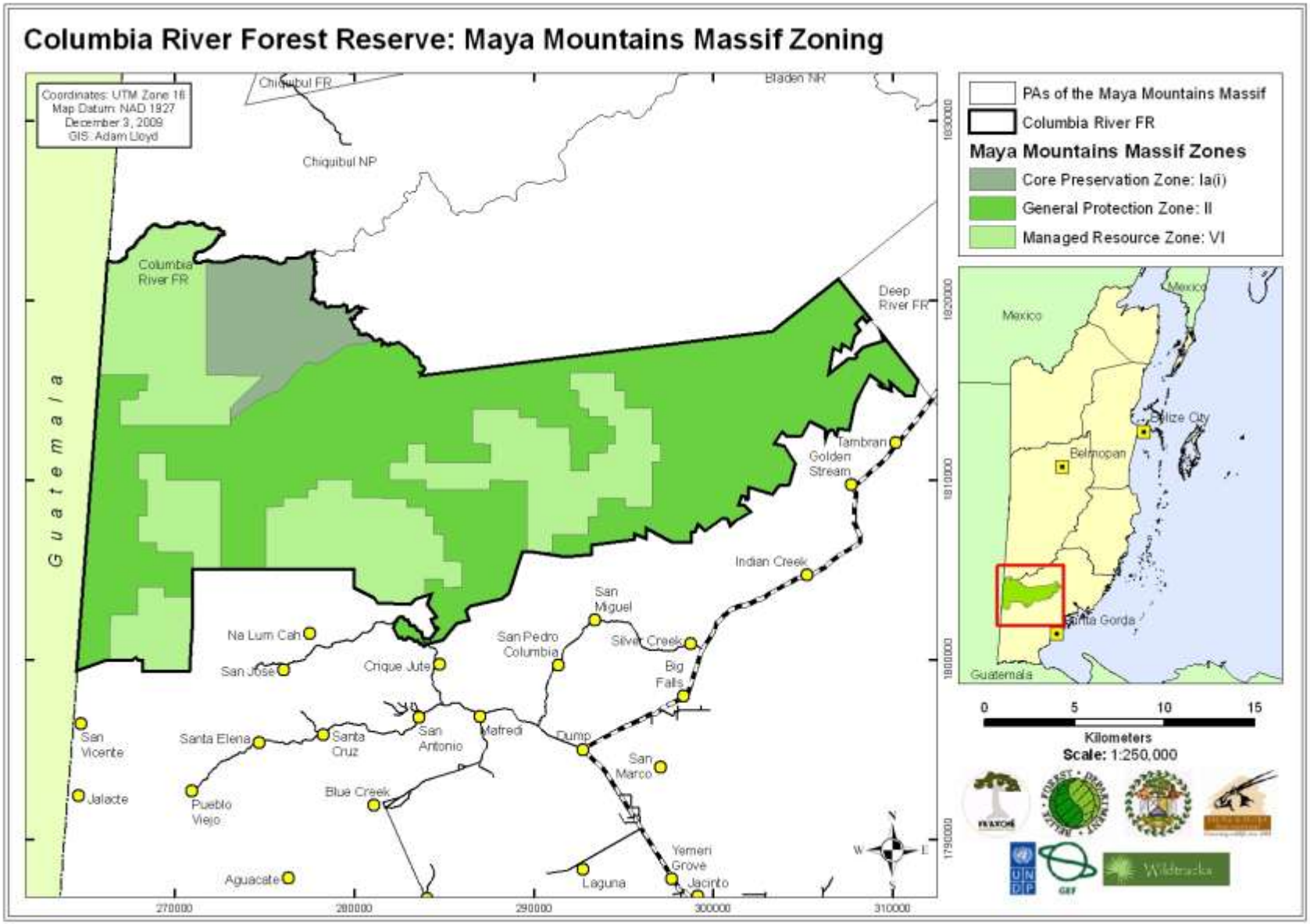
There are also regulations under the MMM system level management zoning that are relevant to the Forest Reserve. However, there are no current site-specific regulations for Columbia River Forest Reserve – their development will be undertaken during the first of the five year implementation period by the Columbia River Forest Reserve Management Committee, to guide the committee in management of the natural resources.

4.4.2 Management Zones

Management zones are guided first and foremost by the system level zones of the Maya Mountains Massif, under which three zoning categories have been developed – the Core Preservation Zone, General Protection Zone and the Sustainable Resource Extraction Zone (Table 27; Map 22, Map 23). Each system-level zone has specific regulations and objectives that are incorporated into the site-level zoning and planning.

Management Zones of Columbia River Forest Reserve, under the Maya Mountains Massif zoning plan	
Core Preservation Zone	
Strict Core Preservation Zone (i) Restricted use area for core biodiversity and cultural resource protection, with critical management activities (including prioritized surveillance and enforcement) and research.	**CRFR:** The Little Quartz Ridge area and part of the old growth forest to the northwest, with a small realignment of the zone boundary to reflect most recent biodiversity data.
Core Preservation Zone (ii) Restricted use area open to researchers. Some areas may be opened for controlled, low impact, guided, tourism, where site-level management permits	**CRFR:** Not present in CRFR
Core Preservation Zone (iii) Restricted use area open to management activities, researchers, with enhanced surveillance and enforcement activities.	**CRFR:** Not present in CRFR
General Protection Zone	
General Protection Zone General biodiversity and cultural resource protection, with visitor access for tourism, education and research. Provides a buffer for the Core Preservation Zone	**CRFR:** Those slopes outside the Core Preservation Zone greater than 25 degrees for distances of 100m or more down slopes
Sustainable Resource Extraction Zone (VI)	
Managed Resource Zone General biodiversity protection area designated for sustainable extraction of timber and non-timber forest products.	**CRFR:** The revised timber extraction blocks and those areas highlighted for Sustainable Natural Resource Use by buffer communities

Table 27: Management Zones of the Maya Mountains Massif and Columbia River Forest Reserve



Map 27: System level zoning (MMM) as relevant to Columbia River Forest Reserve

Core Preservation Zone (i)

Equivalent to IUCN category 1a.

Columbia River Forest Reserve includes a key portion of the Strict Core Preservation Zone, highlighted under the Key Biodiversity Assessment as perhaps the most important biodiversity area in Belize (Meerman, 2007), with the greatest number of threatened species. This is supported by recent studies on amphibian populations in the area, raising the profile with the identification of several new species for Belize including a second Critically Endangered, two more Endangered and one more Vulnerable species, and possibly two new to science. The area immediately west of Little Quartz Ridge is evidently unique in Belize, with amphibian species affiliations with the highlands of Guatemala and Honduras, and may qualify as Belize's only site to be recognized as an AZE Site under the Alliance for Zero Extinctions - depending on current taxanomic analysis. This supports and reinforces its prioritization within the KBA Assessment, which was based largely on other unique records of endangered amphibians in the nearby Gloria Camp area. Following research in the Little Quartz Ridge area, it is recommended that this zone be extended slightly to part of the plateau (Map 23; Walker, pers. ob. 2009).

Any regulations put in place should be fully compliant with those associated with Core Preservation Zone.

Management Zones for Columbia River Forest Reserve			
Zone		**Objective**	**Regulations/Guidelines**
IUCN Category 1a			
Ia(i)	***Strict Core Preservation Zone (i)*** Restricted use area for core biodiversity and cultural resource protection, with critical management activities (including prioritized surveillance and enforcement) and research.	▪ To preserve habitats, ecosystems and species in a pristine state, with minimal human impact ▪ To maintain ecological, biological and hydrological processes and functionality ▪ To maintain genetic resources in a dynamic and evolutionary state ▪ To maintain landscape features and protect areas of particularly fragile habitat or those with threatened or rare species, or features of cultural importance ▪ To allow surveillance and enforcement, and carefully planned research and environmental monitoring activities	▪ No entry, except by management, surveillance and enforcement personnel, permitted researchers ▪ Minimal impact research under special permission from Forest Department, Institute of Archaeology (dependent on research target) and site-level protected area co-managers ▪ No collecting of flora, fauna or inorganic material other than by approved researchers (as defined within the Research Policy document) with the permission of Forest Department, in consultation with site-level protected area co-managers ▪ Effective, prioritized surveillance and enforcement program
Current Critical Threats ▪ Hydro-electricity facility construction in Esperanza area ▪ Incursions from Guatemala for logging, xaté extraction, hunting and looting			

Table 28:Management Zones of Columbia River Forest Reserve

General Protection Zone

Equivalent to IUCN category II

The General Protection Zone within Columbia River Forest Reserve covers those area that have slopes with gradients over 25 degrees for distances of 100m or more (Bird, 1994), and have been highlighted as important for biodiversity protection and watershed functionality, and are considered too steep to be effectively logged without environmental impact.

Managed Resource Use Area

Equivalent to IUCN category II

The Managed Resource Use Area encompasses land suitable for timber extraction - those areas with a slope of less than 25 degrees. Three primary resource uses are covered within this management plan – sustainable timber extraction, xaté extraction, and traditional use of natural resources by communities - though this doesn't mean that other options can't also be considered.

The need to establish a significant management presence in Columbia River Forest Reserve has been highlighted throughout the management planning process, with the current on site management vacuum exacerbating the incursions by Guatemalans, who have virtually unrestricted access to illegally harvest timber, xaté, game species, and remove artifacts from archaeological sites. Part of the solution to this situation is the resumption of legal use of the natural resources of CRFR by Belize – including timber resources. Concurrent with this is the need to significantly increase enforcement of the laws of Belize within CRFR – preventing illegal incursions and activities of Guatemalans currently capitalizing upon the porous border and lack of security and management presence.

Timber Resources

It is recommended that:

- Timber harvesting operations in this area should have the support of an appointed system-level specialist Enforcement Task Force of the BDF, as recommended under the Technical Assessment of the Maya Mountains Massif.

- Timber harvesting be conducted under a long-term forest license, and follow the principles of the Code of Practice for Timber Harvesting for Long-Term Forest Licenses in Belize.

- The 40 timber harvesting blocks identified in the previous management plan (Bird, 1994) need to be redesigned and re-scheduled as necessary to:

(i) Prioritize sustainable timber harvesting along the border in north west CRFR, within the area defined for Managed Resource Use under the Technical Assessment of the MMM, with minor adjustment to incorporate recently discovered unique biodiversity values in the Forest Reserve

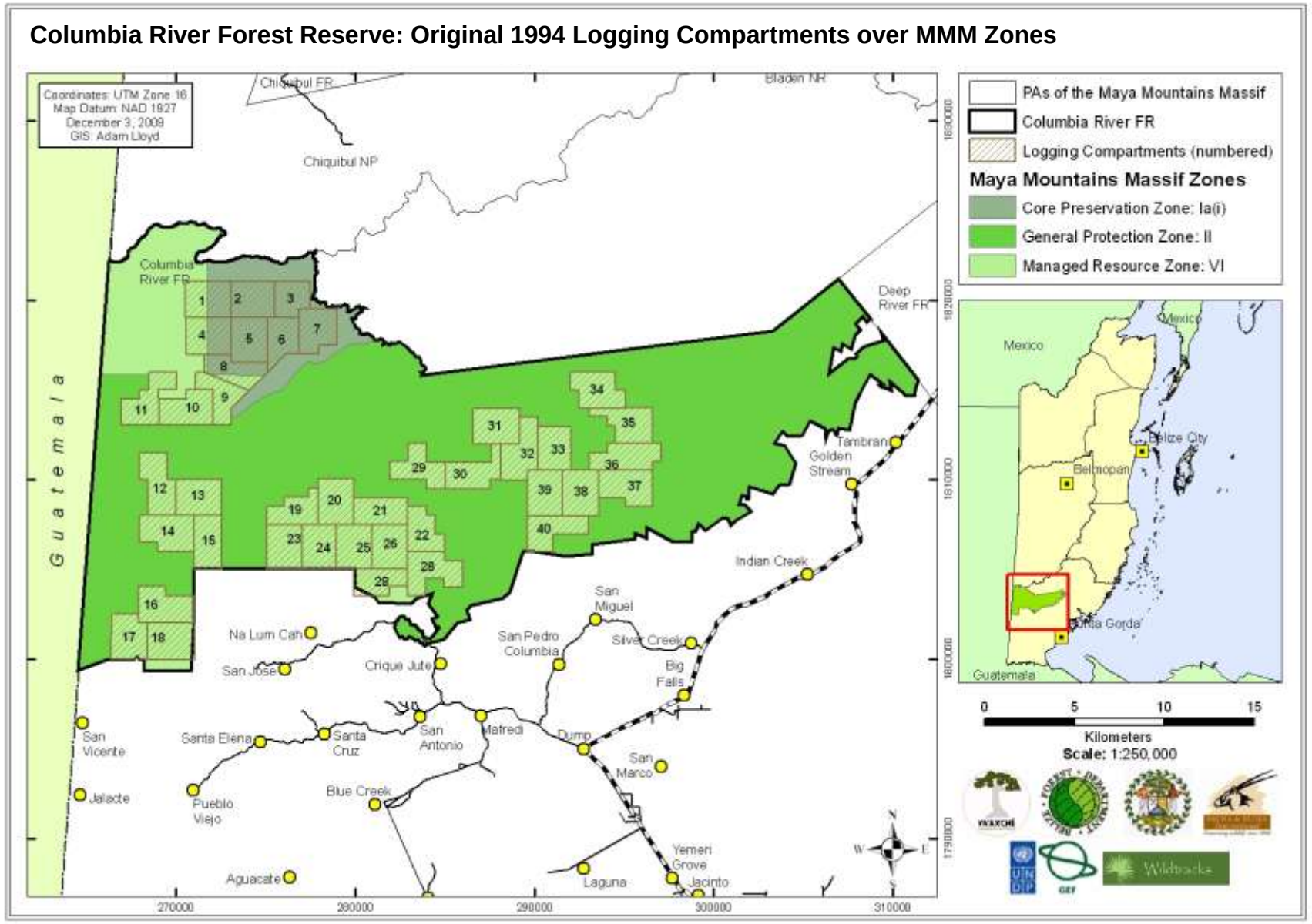
(ii) Allow time for the regeneration of timber resources in the remaining forest blocks, following the significant impacts of Hurricane Iris (2001)

(iii) Re-align the southernmost forest harvesting blocks in areas where they overlap with the proposed Community Natural Resource Use Management Zones (15 of the current 40 blocks).

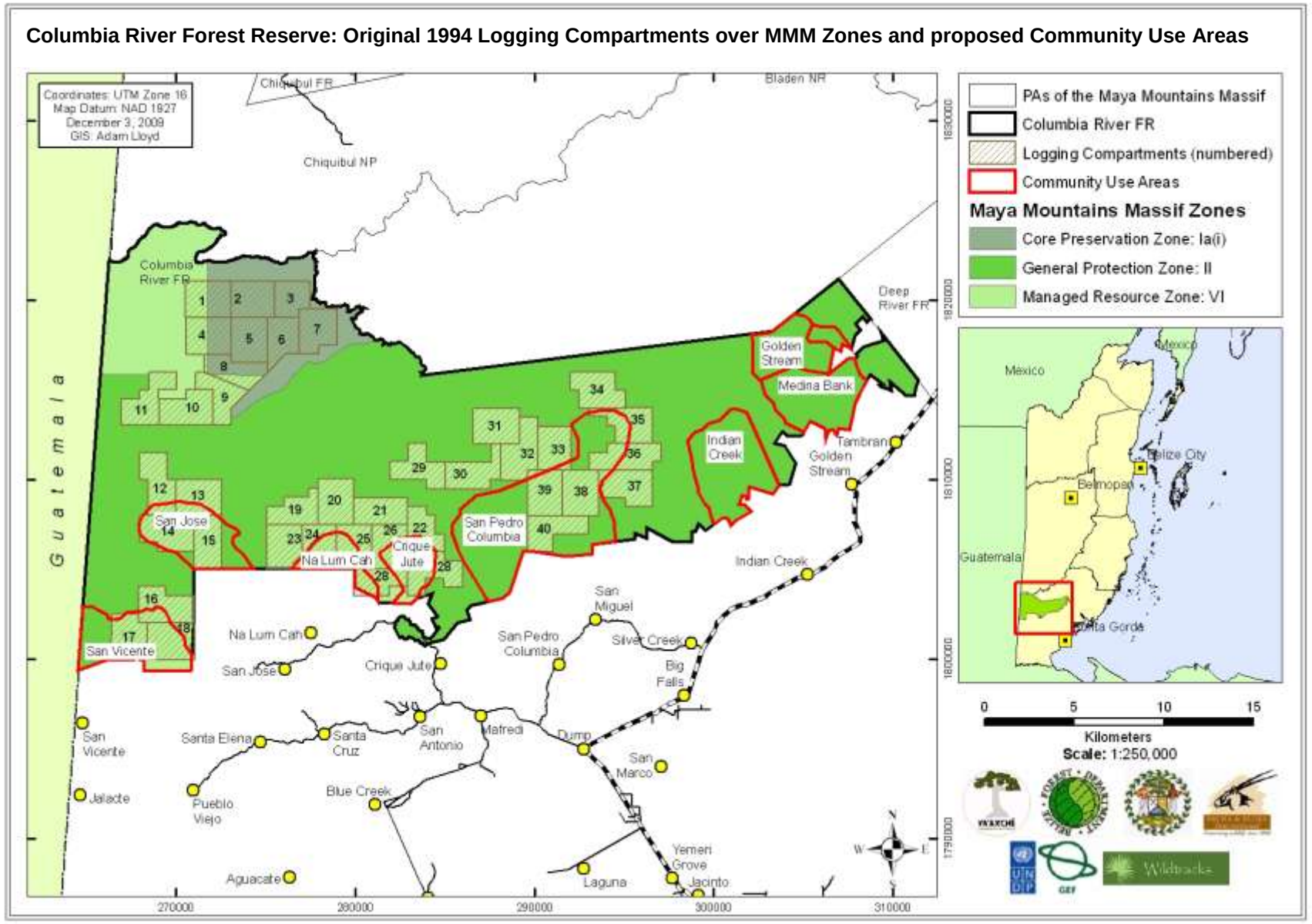
Excising proposed community Sustainable Natural Resource Use Management areas from the long-term forest license footprint would remove approximately 7,500 ha from the 20,000 ha within the currently defined 40 harvesting blocks. Re-alignment of timber concession areas, whilst still following the principles of the Sustainable Forest Management Plan (SFMP) might make another 2,500 ha available for harvesting to give a total of approximately 15,000 ha. Following the recommendations of the Code of Practice for Timber Harvesting for Long-Term Forest Licenses, these 15,000 acres should then be divided into 40 x 375 ha blocks, to be harvested on a 40-year rotation. Given the economics and investments for sustainable harvesting operations, and the fact that the initial 40 year rotation was based on a conservative estimate of timber growth rates (van der Hout, 2008), another option for consideration would be that the structure of the proposed long-term forest license for CRFR be changed to a 30-year rotation of 30 x 500 ha blocks, and be reviewed at the end of the first 30-year cycle to determine whether growth rates have resulted in sustainability. Additionally, irrespective of rotation cycle, there is scope to extend the area delineated for timber extraction into adjacent areas with a slope of less that 25% (outside the proposed traditional natural resourse use areas), and thereby increase somewhat the total area available for sustainable timber management.

Following the principles of the Code of Practice for Timber Harvesting for Long-Term Forest Licenses:

- The area designated for timber production should be demarcated, inventoried and compartmentalized, and the stocking value be known *a priori*, by the timber concessionaire.
- The conditions of a long term timber license should include the preparation of a Sustainable Forest Management Plan (SFMP) for the license area in accordance with sustainable forest management principles and also an Annual Plan of Operation (APO) for each calendar year. Every year, an Annual Cutting Permit is issued to the licensee for the harvesting of commercial timber subsequent to the approval of the APO for such year. The Licensee is required to take all reasonable measures to minimize environmental and other damage.
- The preparation of an SFMP must be based on a concrete forest inventory with a sampling rate of 1-2% depending on the variability of the forest stands. The preparation of the APO must be based on a 100% pre-harvest inventory or stock survey of the Annual Cutting Compartment (ACC).

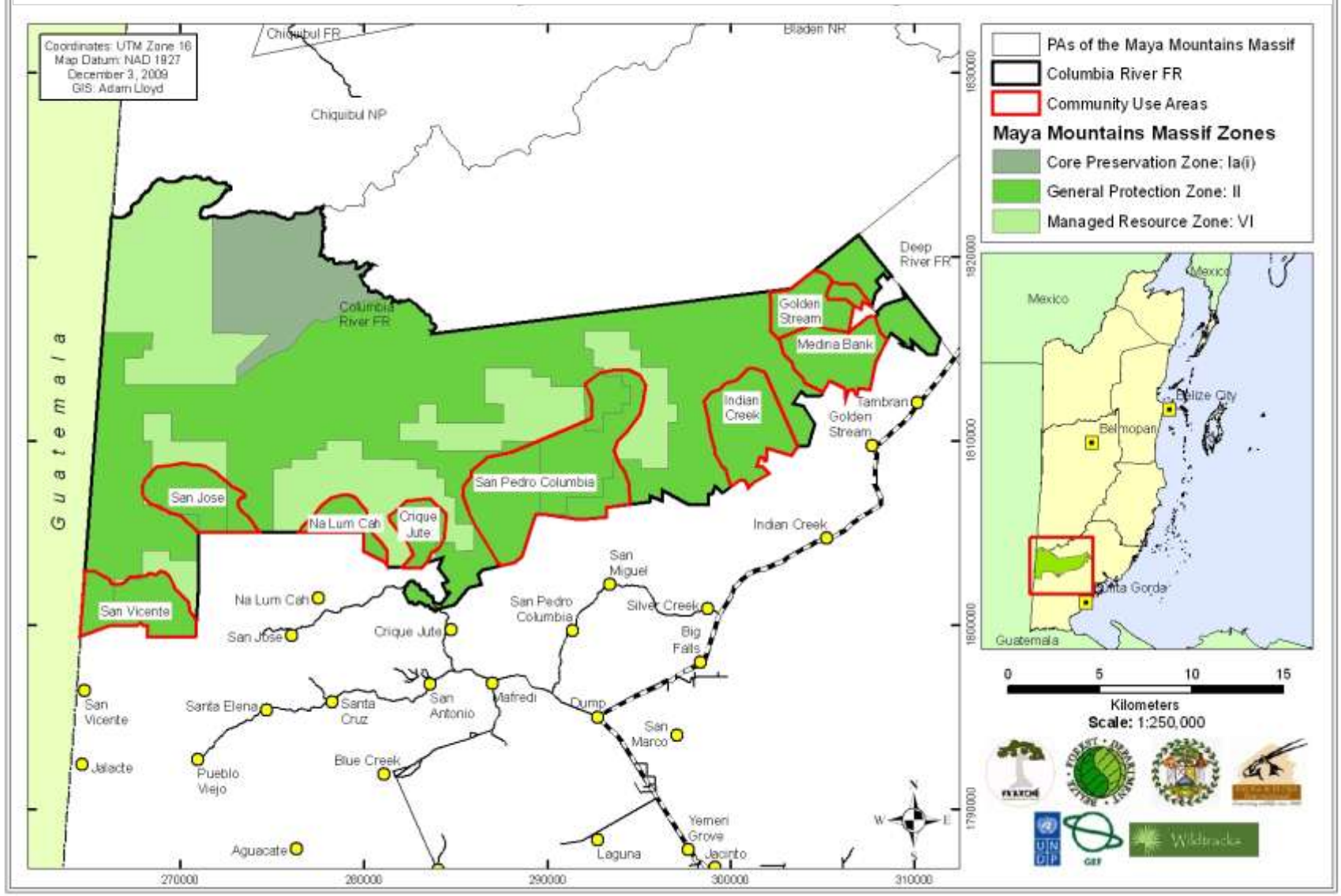


Map 28: Columbia River Forest Reserve: Original 1994 Logging Compartments over MMM Zones



Map 29: Columbia River Forest Reserve: Original 1994 Logging Compartments over MMM Zones and proposed Community Use Areas

Columbia River Forest Reserve: Managed Resource ExtractionAreas (including proposed Community Use and Timber Extraction areas) over MMM Zones



Map 30: Columbia River Forest Reserve: Managed Resource ExtractionAreas (including proposed Community Use and Timber Extraction areas) over MMM Zones

Additionally, in line with the ethos of the National Protected Areas Policy, and with the 10 points of agreement between the Government of Belize and the Maya Leaders' Alliance, economic benefit opportunities associated with these natural resources should be available to local communities. In this regard, provision should be made within the conditions of the long-term forest license for CRFR for there to be *meaningful* benefits to the nearest stakeholder communities. Therefore, if the identified 10 – 13 forest blocks (of either 500 ha or 375 ha) in north-western CRFR are to be logged first, there should be a clause for preferential employment within the demarcating, scouting, cutting and milling operations should be given to the residents of San Vicente, and San Jose.

Xaté

It is recommended that:

- Xaté concessions should be put on hold to allow time or analysis of sustainability and for a cost-benefit study , based on the conservation of biodiverisity, to be conducted
- The xaté concession should be re-evaluated in light of the findings that there is currently insufficient xaté within the Columbia River Forest Reserve for sustainable harvest (Meerman, 2004) and that there is concern that much of the xaté that is being harvested is going to Guatemala
- Any xaté concession should exclude the community natural resource use areas
- If a xaté concession is renewed for the area, it should be approved by the CRFRMC, and be carefully monitored, all harvesting permits should be cancelled and re-issued to avoid the current issue of licensed Guatemalan harvesters operating illegally within the area on invalid licenses

Community Natural Resource Use Areas/ Land Use Planning

One of the core concepts under which this management plan has been developed is to explore opportunities and develop site-specific strategies for each buffer community to both reduce pressure on the reserve and maximize benefits for buffer communities. This includes identification of current and traditional uses of the Reserve, as well as alternative low impact land use activities within and adjacent to the Reserve. It also seeks to identify mechanisms for allowing regulated access by communities to traditional natural resources for sustainable use, whilst maintaining the environmental services of the protected area, and within the context of the community landscape.

The plan examines Columbia River Forest Reserve in the context of the wider landscape, including the socio-economic situation of the stakeholder communities. It is impractical to consider the conservation of the biodiversity of CRFR separately from the human landscape. The continuing level of poverty in most of the stakeholder communities dictates continued dependence on available natural resources – whether harvested legally or not: which has to be factored into conservation planning. Rapid population growth has resulted in extensive clearance of unprotected forests over the last 2 decades and, along with the impacts of Hurricane Iris, has significantly eroded areas avaible for natural resource extraction. Traditional agricultural practices, sustainable with a very low population density, become non-tenable and unsustainable with current population size – degrading soils and establishing a relentless need for more and more 'virgin' land for agriculture. Within the framework of integrated landscape management, the continued conservation of the biodiversity of CRFR can only be assured if the stakeholder communities receive adequate support to develop and implement more productive and sustainable agricultural practices, rehabilitate degraded agricultural soils, and value CRFR for its environmental services – including the sustainable supply of natural resources. Strategies and actions to facilitate a move towards modified agricultural techniques towards greater productivity and sustainability in the stakeholder communities are outlined in the management programmes.

There is also a need to establish formalized and regulated sustainable management of natural resources within Columbia River Forest Reserve for those resources already used by communities.

It is recommended that:

- Community Natural Resource Use Areas be managed under concession arrangements with Forest Department, per community, established under the current framework of natural resource extraction concessions
- A facilitating organization be engaged to facilitate the community management process, with a 5 to 10 year capacity building plan in place to guide and strengthen the community management process
- A facilitating organization be engaged to assist with development of community sustainable use plans for the concession areas
- Extraction levels within sustainable use plans should be based on a comprehensive assessment of resources available, and follow the standards for sustainable extraction established under the Community Sustainable Resource Use Plans

Tourism Concessions

If the severe security issues can be adequately addressed by the Government of Belize, there is considerable scope for tourism development within CRFR: the combination of some of the most

aesthetically pleasing primary forests in Belize, combined with dramatic karstic scenery and pristine rivers and creeks, are a tremendous resource that has barely been tapped to date, with the potential to both provide economic benefits to local communities and management funding for the Reserve. This resource should not be under-valued: strategic actions in this regard include the investigation by the Forest Department into the potential for leasing out a development and management concession(s) for an upper-end eco-friendly jungle lodge within the non-extractive areas of the Reserve.

Such investment, and continuous management presence (with appropriate security) would supplement proposed sustainable timber harvesting operations in adjacent forest tracts as a sustainability mechanism, and act to further discourage illegal Guatemalan incursions.

It is recommended that concessions such as these need to be:

- approved by the CRFRMC;
- be located outside the community natural use areas (unless in direct agreement with the relevant community
- need to show potential for providing meaningful local employment and benefits.
- should not have exclusive use of areas
- provision should be made for community access to those resources identified by local tour guides, with access agreements between all tourism stakeholders.
- any tourism concessions should be tightly regulated, with stringent conditions controlling all aspects of use to ensure minimal negative impacts.
- contribute towards the environmental education and outreach programme

4.4.3 Limits of Acceptable Change

At present there are no carrying capacities set for tourism-related activities within Columbia River Forest Reserve – and with the current security issues, the level of tourism over the next five years is unlikely to have a significant impact on the biodiversity. It has, however, been recognized that Limits of Acceptable Change will need to be established as visitor trails and facilities are established in the area in the future.

Whilst not considered under the Limits of Acceptable Change programme, a similar assessment procedure will be used in the CRFR Community Natural Resource Use areas within the individual community Land Use Plans, to provide guidance for resource extraction levels.

Similarly, any long-term forest license should be granted only after approval of a Sustainable Forest Management Plan (SFMP), including an Annual Plan of Operation (APO) that is based on a 100% stock survey, to ensure compliance with Forest Department sustainability and impact policies.

4.4.4 Management Constraints and Limitations

During the management planning process, a number of priority management constraints were identified as adversely affecting the management of the Columbia River Forest Reserve.

- **Personnel and Equipment**

  For effective management, there needs to be a dedicated CRFR Management Committee, with a team of support staff, at least during the initial two-year establishment phase. This needs to be supported by the FD staff of Machaca Forest Station.

  Some of the staffing gaps can be filled through partnerships and collaborations – for example, surveillance and enforcement can be strengthened through building on the current collaboration with the Belize Defense Force, and developing improved communication and early-alert systems with participating communities.

  The CRFR Management Committee also needs to be equipped and have infrastructure in place for effective implementation of the management plan.

  Recommended Management Actions:

  - Establish Columbia River Forest Reserve Management Committee
  - Ensure administrative and operational support of the CRFR Management Committee through the Forest Department
  - Hire a CRFRMC Coordinator for initial two year period to establish the CRFRMC and implement management plan
  - Identify and contract a person/organization (Community Management Committee Coordinator) to guide and facilitate the establishment of the community co-management process and sustainable land use plans for a minimum of a two year period
  - Seek agreement with Ya'axché Conservation Trust (or similar NGO) for facilitation of establishment of management structure and Management Committee, and implementation of management activities
  - Seek agreement with Ya'axché Conservation Trust (or similar NGO) for facilitating establishment of community management groups, development of sustainable land use plans and mechanisms for representation on CRFR Management Committee

- **Enforcement**

The lack of a continuous, on-site presence committed to addressing transboundary security issues; infrastructure, transport and equipment limitations; and the remoteness of much of the protected area are seen as severe constraints to the effective management of the Forest Reserve.

Recommended Management Actions:

- Continue and increase collaboration with Belize Defense Force for addressing transboundary security issues
- Continue and increase collaboration with FCD towards effective systematic addressing of transboundary security issues
- Develop, approve and implemented sustainable resource use plans per community for identified CRFR community resource use areas, with effective monitoring and enforcement by communities, in collaboration with Forest Department
- Increase communication and collaboration with communities for participation in surveillance and enforcement activities
- Investigate potential for integrating community surveillance and enforcement activities in community natural resource use areas under the fajina system

- **Stakeholder Involvement in Management Decisions**

The establishment of a functional and effective Columbia River Forest Reserve Management Committee, with representation from all major stakeholder sectors, particularly the buffer communities and concession holders, will provide an engagement and participation mechanism that has, previously, been lacking within the Forest Department management structure, but has been used very successfully under the Belize Fisheries Department.

There is increasing meeting-fatigue on the part of communities in Toledo district, with many organizations seeking their presence at consultative meetings, but with little visible output from the consultation activities, and often no apparent changes in management procedures following their recommendations.

Recommended Management Actions:

- Ensure visible results from recommendations arising from community consultations, and feedback on areas of concern
- Increase stakeholder participation in management decisions, management and monitoring activities through representation on the CRFR Management Committee
- Develop effective Communication Plan for keeping communities and other stakeholders informed of management activities.

- **Outreach and Environmental Education**

Environmental Education has not been a strength of the Forest Department, yet it is an important component of effective management and general stakeholder engagement. In the case of Columbia River Forest Reserve, it is better addressed by other, non-governmental organizations, through collaborative partnerships.

The focus of the Outreach and Environmental Education programme needs to be on the essential environmental services the Forest Reserve provides – particularly its important role in future water security for the southern coastal plain, and the implications of climate change. These activities should be supported by commercial resource users, including tourism and timber concessionaires.

Until the security situation has been improved, there is little scope for educational activities within the protected area itself, though there would be the potential for small scale interpretive centres in the participating communities.

Recommended Management Actions:

- Develop interpretive materials for CRFR focusing on its role in maintaining the water cycle and water security
- Work with other partners (Ya'axché Conservation Trust, FCD, TIDE, SATIIM) to reach stakeholders with educational and outreach activities
- An easy support mechanism should be developed to enable timber concession holders to support outreach activities, to be included within long term licences.

4.5 Management Programmes and Objectives

The Columbia River Forest Reserve has been managed directly by the Forest Department since its establishment, with logging and, more recently xaté concessions, issued to commercial partners. The changing landscape following Hurricane Iris in 2001 resulted in large scale removal of the forest cover, followed by poorly regulated salvage logging.

The area is included within two system-level Conservation Action Plans – the Maya Mountains Massif and the ridge-to-reef Maya Mountains Marine Corridor - and is therefore guided by the relevant outputs, objectives and strategies of thse planning processes (Figure …). The east portion of CRFR is also targeted under the Golden Stream Watershed project, as part of the watershed – outputs of the GSW management strategy are therefore also incorporated where relevant.

The programmes and objectives recognize that there needs to be closer collaboration with buffer communities, and a focus on integrating community sustainable natural resource use within the area, through management agreements. This has to be conducted in close collaboration with the Village Councils and Alcaldes of the stakeholder communities. Several of the management activities are specifically focused on establishing mechanisms to facilitate community participation, whilst also ensuring that the conservation planning activities are implemented effectively.

Key to the success of the implementation of the programmes are strategic partnerships and clear, constant and effective communication.

It should be borne in mind that the Programmes of a Management Plan are interconnected over space and time, supporting each other and forming a whole that is greater than the single parts. As such, Management Programmes cannot be considered individually, but must be seen in terms of a bigger picture – the integrated management of Columbia River Forest Reserve towards the fulfillment of the Management Objectives (Figure…).

Management Programmes

There are seven programmes within the overall Management Strategy for the Columbia River Forest Reserve, following the framework provided by the MMM system level assessment:

A. **Natural and Cultural Resource Management Programme**
B. **Resources Use Management Programme**
C. **Research and Monitoring Programme**
D. **Community Development and Outreach Programme**
E. **Public Use Programme**
F. **Administration Programme**

When prioritizing activities within these programmes, the results of the Conservation Planning have been taken into account:

Priority	Conservation Target	Viability Rating
High Priority	*Non-commercial Forest Products*	Fair
	Commercial Forest Products	Fair
	Game Species	Fair
	Broadleaf Forest	Fair
Medium Priority	*Watershed Functionality*	Good
	Upper Elevation Species	Good
	Cultural Resources	Good

The management programmes also take into account recommendations voiced during the three workshops conducted as part of the planning process (Annex 6)

A. Natural and Cultural Resource Management Programme

Vision

To ensure the continued maintenance of biodiversity and hydrological processes to promote and maintain watershed functionality, viable ecosystems and populations of all species within the Columbia River Forest Reserve.

Management Goals:

- To provide the framework for effective natural resource management
- To ensure effective surveillance and enforcement
- To maintain watershed functionality for future water security
- To increase the viability of conservation targets

Objective	Activity Areas
To provide the framework for effective natural resource management	▪ Establish a Columbia River Forest Reserve management committee (CRFRMC) to develop and implement regulations for Columbia River Forest Reserve ▪ Ensure that any permit review process within the CRFR follows due process and includes review by the CRFRMC ▪ Increase communication, participation and collaboration with stakeholder communities ▪ Increase communication, participation and collaboration with other conservation organizations ▪ Demarcate and maintain survey lines in areas of conflict on boundaries ▪ Ensure awareness of boundaries of conservation area and regulations ▪ Increase effectiveness of surveillance and enforcement activities (national and binational) ▪ Establish monitoring programme for threats
To ensure effective surveillance and enforcement	▪ Engage local authorities and other conservation organizations towards effective surveillance and enforcement against Guatemalan incursions, and strengthening of the border ▪ Effective surveillance and enforcement of community use areas by communities ▪ Lobby for increased political support for effective enforcement along border with Guatemala ▪ Support the establishment of a system-level surveillance and enforcement task force for deployment to critical hotspots for illegal activity within the MMM ▪ Support maintenance of a permanent security presence at the Machiquila Conservation Post, including upgrading of main access road for fast response ▪ Investigate feasibility of a guard post /security check point at ITVET to monitor activity within the CRFR

Objective	Activity Areas
To maintain watershed functionality	**Watershed Functionality** ▪ Increase awareness among policy makers of the importance of environmental services to communities buffering the Maya Mountains Massif, especially in the area of watershed protection ▪ Raise awareness in buffer communities of the role of CRFR in water security for communities and agricultural areas in associated watersheds on the coastal plain ▪ Implement agro-forestry projects in agricultural incursion areas towards replacement of forest canopy structure and watershed functionality ▪ Lobby for recognition and compliance with MMM zone regulations, with no hydro-electric power facility development in Core Preservation Zone ▪ Work with DoE to mandate compliance with international environmental standards by current and future hydropower developments
To increase the viability of Conservation Targets of the Columbia River Forest Reserve	▪ Effective surveillance and enforcement against transboundary agricultural incursions ▪ Investigate potential reforestation projects on exhausted community lands adjacent to PAs – to increase availability of natural resources outside the protected areas ▪ Develop a fire management plan for CRFR in collaboration with the the Southern Belize Fire Working Group, and under the framework of the National Fire Policy for Belize ▪ Increase Fire Awareness in all buffer communities, targeted particularly at farmers ▪ Engage Village Chairmen, Alcaldes and Department of Agriculture to enforce existing laws on agricultural fires ▪ Work with other organizations within Toledo towards better fire management ▪ Increase capacity for fire management in Toledo building on past initiatives and through provision of fire control & management training to community members ▪ Investigate and implement mechanisms to re-forest fire impacted areas through agro-forestry to restore forest canopy and watershed functionality ▪ Exclude standing live seed trees from salvage logging licenses, in the event of future hurricanes ▪ Lobby for the National Protected Areas Act to support and strengthen the National Protected Areas System Plan, to prevent the by-passing of the due process associated with dereservation of areas in Columbia River Forest Reserve ▪ Promote greater communication, cooperation and collaboration between Forest Department and Lands Department ▪ Increase awareness among policy makers of provision of environmental services by CRFR to stakeholder communities

Objective	Activity Areas
To increase the viability of Conservation Targets of the Columbia River Forest Reserve	▪ Support initiatives that encourage adoption of best management practices in major polluting agro-industries, and the population in general, through increasing awareness, regulations and international technical and financial support
	▪ Investigate feasibility of adoption of use of less volatile, less toxic agrochemicals in the agro-industries and local farms ▪ Lobby for greater enforcement against illegal importation of restricted / controlled chemicals

Objective	Activity Areas
Provide policies for mitigation of future potential impacts	▪ Explore feasibility of developing a long term policy and plan in case a mining or oil exploration permit should be issued for CRFR

B. Resource Use Management

Vision

To ensure the long term sustainable use of the natural resources of the Columbia River Forest Reserve.

Management Goals:

- To provide the framework for sustainable use of natural resources
- To establish Sustainable Natural Resource Use Areas per Community

Objective	Activity Areas
To provide the framework for effective concession management	▪ Conduct assessments of existing timber and non-timber resources within CRFR ▪ Seek sound and sustainable long term concession agreement for management and extraction of timber resources – in consultation with the proposed CRFRMC , using transparent bidding process to identify best-qualified applicant ▪ Effective monitoring and enforcement of any timber concession given within CRFR, especially with respect to protection of slopes and water courses ▪ Tighten monitoring and enforcement of xaté concession implementation, including permitting of identified xatéros (if xaté concessions are renewed) ▪ Investigate potential to use modified concession agreements as the framework for community management of community natural resource use areas
To establish Sustainable Natural Resource Use Areas per Community	▪ Hire a coordinator/facilitator to work with the communities, to provide technical input ▪ Assist communities to establish management committees ▪ Build community capacity for natural resource use management ▪ Assist communities to assess the natural resources of their traditional use areas and define their natural resource use areas ▪ Assist communities to develop Sustainable Natural Resource Use Management Plans and regulations per community use area…concession? ▪ Investigate mechanisms for management agreements between communities and the Government of Belize - ▪ Seek funding and a mentoring agency/facilitator to provide facilitating support and oversight for community managed resource use areas

C. Research and Monitoring Programme

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

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

Objective	Activity Areas
Establish an effective framework for research and monitoring	▪ Create and maintain management database for research, monitoring and socio-economic data, with outputs designed for ease of integration into adaptive management ▪ Strengthen cross linkages with other organizations involved in research in the Maya Mountains Massif, Maya Mountains Marine Corridor, in Belize generally and in the region ▪ Collaborate with other organizations for integrated research and monitoring activities ▪ Integrate MMM and MMC system level monitoring programmes into CRFR Research and Monitoring Programme for relevant conservation targets ▪ Train community management participants in monitoring protocols for use in community resource use areas
Ensure priority baseline information is available on the natural resources for effective management decision-making	▪ Assessment of biodiversity in Core Preservation Area, towards qualification as an AZE[4] site ▪ Include game species in monitoring activities ▪ Monitor hunting activity within CRFR ▪ Monitor level of transboundary incursions within CRFR ▪ Establish status and distribution of species of concern for CRFR (Critically Endangered, Endangered and Vulnerable) ▪ Integrate National Amphibian Conservation Action Plan into monitoring programme ▪ Map archaeological and cultural sites (including caves and sink holes), in collaboration with the Insitute of Archaeology ▪ Assess CRFR watersheds to prioritize relative biodiversity values and provision of environmental services, to inform decision-making processes on hydroelectric facility siting and development ▪ Establish long term water monitoring for CRFR, to feed into national water monitoring initiatives

Objective	Activity Areas
Ensure priority baseline information is available on the natural resources for effective management decision-making	▪ Identify major environmental pollutants and establish a baseline in upper elevation areas, and exiting river systems, for future monitoring and implement on-going monitoring ▪ Develop and implement water monitoring for pesticide contamination in orographic rainfall areas
Address information gaps highlighted by Research Synthesis (Meerman, 2006)	▪ Field verification of ecosystems ▪ Biodiversity data collection of all major groups: plants, fish, amphibians, reptiles, birds and mammals. ▪ Caves and cave fauna, particularly bats. ▪ Research in higher elevation areas ▪ Monitoring of hurricane damage recovery process, as it is critical for the understanding of ecosystem variation and resilience in this area. ▪ Monitoring and data collection needs to continue on pre-existing vegetation transects and permanent sampling plots. ▪ Short term studies for guiding management: ▪ Timber species ▪ Rare and endemic species such as the various karst obligates ▪ Critical wildlife species as per the current monitoring protocols
To provide a safe environment for research	▪ Create a safe environment for research activities ▪ Train local pool of community research assistants ▪ Ensure all researchers are aware of the rules and regulations of the Forest Department

[4] Alliance for Zero Extinction

D. Community Development and Outreach Programme

Vision: To increase short, medium and long term socio-economic benefits for stakeholder communities, with increased community participation in the management of Columbia River Forest Reserve, and regulated access to natural resources for sustainable use, whilst maintaining the environmental services of the protected area, and within the context of the community landscape.

The Community Development and Outreach Programme covers the following areas:

- General Awareness
- Facilitation of establishment of effective community management committees per community
- Reduction of pressure on the natural resources of CRFR through effective management of adjacent agricultural lands
- Reduction of pressure on the natural resources of CRFR through increased socio-economic opportunities

Objective	Activity Areas
General Awareness	▪ Clearly define the role CRFR plays within the landscape ▪ Raise awareness of the environmental services and benefits provided by CRFR – particularly its importance in water security ▪ Maintain strong links, collaboration and open communication between all stakeholders, CRFRMC and Forest Department ▪ Develop an easy support mechanism to enable timber concession holders to support outreach activities, to be included within long term licences.

Facilitate the establishment of effective community management committees per community	▪ Hire a Community Management Committee Coordinator to facilitate the community co-management process and build capacity of the management committees
	▪ Work with the community leaders to establish a clear ToR for the community management committees
	▪ For those communities identified as targeted during the pilot phase (San Vicente, San Jose, Na Lum Cah, and Crique Jute):
	  ▪ Facilitate the establishment of management committees
	  ▪ Provide capacity building support for developing effective organizational procedures and policies for each the community management committee
	  ▪ Build community capacity for conservation awareness and natural resource use management

Objective	Activity Areas

Facilitate the establishment of effective community management committees per community	▪ For those communities identified as targeted during the pilot phase (San Vicente, San Jose, Na Lum Cah, and Crique Jute):
	  ▪ Provide technical facilitation to each community for the development of Integrated Land Use Plans, to include the natural resource use areas of CRFR
	▪ Assist communities to define their traditional use areas and assess the status of their natural resources For those communities identified as targeted during the pilot phase (San Vicente, San Jose, Na Lum Cah, and Crique Jute) (continued):
	  ▪ Within the framework of each community Land Use Plan, develop clear regulations, surveillance, enforcement and monitoring activities, focused on the sustainable management of the resource use areas of CRFR, to be approved by Forest Department and the CRFRCM before implementation
	▪ For the remaining communities, facilitate resolution of overlapping resource use areas, before initiating

Reduce pressure on the natural resources of CRFR through increased socio-economic opportunities	▪ Conduct a capacity needs assessment to identify mechanisms for increasing opportunities for income generation in local communities ▪ Identify co-operative marketing opportunities for crafts generated within the communities ▪ Identify other craft /natural resource product opportunities that have market potential and provide skills training and marketing ▪ Support national poverty alleviation mechanisms being implemented by other organizations in the Toledo District through collaborative efforts
Reduce pressure on the natural resources of CRFR through effective management of agricultural lands	▪ Provide agricultural development support to stakeholder communities towards best land use practices, towards increased economic benefit, and integrate into Community Land Use Plans ▪ Assist farmers to engage in more effective farming methods (eg. mulch farming rather than slash & burn, alternative crops), to reduce area required for community farmland ▪ Investigate mechanisms for rehabilitation of degraded agricultural soils within community lands ▪ Engage Department of Agriculture to assist with developing realistic and more land-efficient agricultural alternatives for communities ▪ Increase awareness and lobby with Department of Agriculture re. long term negative socio-economic and environmental impacts of cattle ranching ▪ Investigate and implement mechanisms for increasing productivity and sustainability within current agricultural footprint ▪ Support and participate in the development of a National Land Use Policy

E. Public Use (Tourism and Recreation) Programme

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

The Public Use Programme covers the following areas:

- General Management of Tourism and Recreation Use
- Facilitation of Community Tourism
- Increasing Awareness in Users of Rules and Regulations

Objective	Activity Areas
General Management of Tourism and Recreation Use	▪ Create a safe environment for public use ▪ CRFRMC to draft clear rules and regulation for visitors, in collaboration with Forest Department and Belize Tourism Board ▪ Maintain accurate visitor records (Local and International), as well as records of visitor activities, and any enforcement action needed in respect to tourism visitation ▪ Develop effective mechanisms for visitor fee collection, in collaboration with Forest Department ▪ Develop conflict resolution mechanisms and in-house skills for dealing with public use conflicts ▪ Investigate potential for tourism concessions within CRFR (outside the Core Preservation Zone), in collaboration with Forest Department and Belize Tourism Board ▪ All tourism activities to be approved by CRFRMC and Forest Department and Belize Tourism Board
Facilitation of Community Tourism	▪ CRFRMC to develop Community Tourism Plan in collaboration with community management committees, Forest Department and Belize Tourism Board ▪ Locate funding for implementation of capacity building, training and infrastructure requirements identified in Community Tourism Plan ▪ Assist communities in the development of identified visitor attractions – trails and infrastructure, and training in use ▪ Assist communities in marketing tourism activities associated with CRFR, in collaboration with the Belize Tourism Board
Increase Awareness of Rules and Regulations of the protected area	▪ Ensure all CRFR staff and communities are aware of the rules and regulations of the protected area ▪ Ensure tour guides and tour operations using CRFR are aware of management zones, and rules and regulations ▪ Increase good practices awareness among tour guides

F. Administration Programme

Vision: To ensure that the necessary administration structure is in place for the support of management activities within Columbia River Forest Reserve.

The Administration Programme covers a number of areas:

- Developing the framework for effective management of CRFR
- Facilitation of the establishment of effective Community Management Committees per community
- Administration Procedures
- Integration of community participants into staff for management of CRFR
- Infrastructure
- Health and Safety
- Financial Sustainability
- Marketing
- Annual Review of Operational / Work Plan
- Monitoring and Evaluation

Objective	Activity Areas
Develop the framework for effective management of CRFR	▪ Develop effective management structure for CRFR ▪ Formation of Columbia River Forest Reserve Management Committee (CRFRMC) with effective and balanced representation from key stakeholders, including buffer communities ▪ Hire CRFRMC Coordinator for initial two year period to establish the CRFRMC and initiate implementation of management plan ▪ Hire a Community Management Committee Coordinator to facilitate the community co-management process and development of community Sustainable Land Use Plans ▪ Develop Memorandum of Agreement between Forest Department, CRFRMC and community management committees for increased collaboration and support ▪ Ensure adequate equipment and staff are available for effective management ▪ Investigate options for co-management by an existing NGO, creation of an NGO from the CRFRMC, or direct management by Forest Department ▪ Ensure close liaison and collaboration with system-level initiatives under the Maya Mountains Massif and Maya Mountain Marine Corridor
Facilitate the establishment of effective community management committees per community	▪ Facilitate establishment, equipping and capacity building of community management committees (see Community Development) ▪ Ensure Community Management Committees have clear roles, established within a ToR ▪ Investigate feasibility of incorporating management activities within community use areas within the fajina system

Objective	Activity Areas
Administration Procedures	▪ CRFRMC to develop a five year Strategic Plan, in collaboration with Forest Department, to guide Operational Plans and management activities ▪ CRFRMC Coordinator to develop Annual Operational / Work Plan and budget in November of each year, based on management plan activities ▪ CRFRMC Coordinator to develop Annual Report, for submission to CRFRMC, Forest Department and community management committees, at the end of each year
Integrate community participants into staff for management of Columbia River Forest Reserve	▪ Ensure the Reserve Manager is trained in forest resource management ▪ Ensure relevant staff (including community committee members) have sufficient administrative training for effective general management, fundamental accounting, budget and proposal preparation ▪ Ensure relevant staff (including community committee members) have sufficient surveillance and enforcement training to be effective ▪ Ensure relevant staff members (including community committee members) are trained in operation and maintenance of reserve equipment ▪ Ensure relevant staff (including community committee members) have sufficient training in monitoring protocols for effective monitoring ▪ Ensure relevant staff (including community committee members) are trained in conflict resolution, consensus building and communications skills ▪ Ensure all field staff (including community committee members) are trained in First Aid ▪ Ensure on-site staff have adequate support from CRFRMC, Forest Department and from community management com ▪ Equip staff (including community rangers) with uniforms
Infrastructure	▪ Identify five-year infrastructure and equipment requirements and locate funding / develop collaborative partnerships to provide identified priorities ▪ Improve surveillance and enforcement access to OP and critical areas ▪ Ensure that the width of any road is minimized to limit fragmentation of forest habitat ▪ Ensure that any road or other infrastructure is located to minimize erosion impacts on steep gradients, and are not routed through the Core Preservation Zone ▪ Ensure that any infrastructure is located to minimize erosion impacts on steep gradients, and is not located within the Core Preservation Zone ▪ Ensure CRFRMC Coordinator has the necessary administrative infrastructure for effective management ▪ Ensure CRFR has the necessary vehicles and equipment for effective management ▪ Ensure infrastructure for effective surveillance and enforcement for transboundary issues is in place and adequately manned and maintained ▪ Ensure all infrastructure is adequately maintained

Objective	Activity Areas
Health and Safety	▪ Assess potential health and safety issues associated with operating within CRFR, and develop Health and Safety manual and policies ▪ Ensure safety of staff, community members, visiting researchers, concession holders and tourists within CRFR ▪ Ensure staff (including community volunteers) are trained in First Aid ▪ Ensure an effective Emergency Response Plan is in place (including hurricane, flood and security events), and staff trained in implementation ▪ Ensure safety procedures and emergency rescue systems are in place
Financial Sustainability	▪ Develop Five-year plan towards financial sustainability ▪ Investigate potential for royalties and fees from CRFR concessions to be retained by CRFRMC ▪ In collaboration with Forest Department develop and implement mechanisms for effective entrance fee collection for tourism visitation, to be retained by CRFRMC
Marketing	▪ Raise international profile of CRFR as a pilot site for integrated landscape management, with stakeholder participation and economic benefit ▪ Develop of website ▪ Market community tourism values of CRFR, in collaboration with BTB ▪ Market research values of CRFR, in collaboration with BTB
Annual Review of Work	▪ Review of implementation success of Annual Operational/Workplan ▪ Review of outputs of research and monitoring activities ▪ Review of outputs of education and outreach activities ▪ Review of outputs of community integrated land use plan implementation activities ▪ Review of outputs of community participation activities ▪ Review of outputs of community socio-economic benefit activities ▪ Review of outputs of concessions
Monitoring and Evaluation	▪ CRFRMC and CRFRMC Coordinator to evaluate progress against Operational / Work Plan at end of every second month ▪ Ensure monitoring information feeds back into adaptive management ▪ Review management plan after 2.5 years ▪ Review management plan after 5 years ▪ Review management effectiveness every 2 years

4.6 Monitoring and Review

Monitoring and evaluation are integral components of any management system and annual evaluations of reserve management are recommended. In the development of this management plan, the action areas are relatively specific, simplifying the process of monitoring success of implementation, and providing a mechanism for continual tracking of management activities, through annual review by CRFRMC, the Forest Department, and the community natural resource area management committees.

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

It is suggested that a monitoring and evaluation tracking matrix be developed for the activities under the management programme, following the outline example (Table 29).

Tracking of Management Action Implementation								
Management Actions		Present Status	1st Year	2nd Year	3rd Year	4th Year	5th Year	Desired Status
A1	Establish the Columbia River Forest Management Committee (CRFRMC)	No management committee in place, and no representation of communities in management						Functional, active CRFRMC with effective participation of communities in natural resource management of CRFR
A2	Ensure that any permit review process within the CRFR follows due process and includes review by the CRFRMC	Permits are issued without due process						All permits are issued following due process, and are approved by the CRFRMC
A3	Increase communication, participation and collaboration with stakeholder communities	There is very little communication with stakeholder communities						Stakeholder communities are fully informed of activities regarding CRFR

Table 29: Management Tracking Matrix (Layout Example)

4.7 Timeline

A timeline should be developed for management activities by the new CRFRMC, once established. However, a proposed timeline is included here for priority cross cutting strategies highlighted by Conservation Planning (Table 30).

Primary Cross Cutting Strategies	1st Year	2nd Year	3rd Year	4th Year	5th Year
Formation of Columbia River Forest Reserve Management Committee					
Development of long term concession agreement for sustainable extraction of timber resources, with initial assessment of resources, and using best practices, with effective monitoring and enforcement					
Engage local authorities, NGOs and communities towards strengthening of border, and enforcement through the alcaldes					
Engagement of community leaders and development of Sustainable Natural Resource Use / Land Use Plans and regulations per community					
Effective surveillance and enforcement of community natural resource use areas					
Increase opportunities for income generation in stakeholder communities					
Clearly demarcate CRFR boundary					
Assist farmers in developing more effective farming methods					
Implement agro-forestry projects in agricultural incursion areas					
Increase fire awareness and effective fire management in buffer areas					

Table 30: Timeline for Priority Cross Cutting Strategies

4.8 Financing

Columbia River Forest Reserve, in its current state, is not financially self-sustaining. To establish the infrastructure for integrated landscape management, with the CRFR fulfilling the role of watershed protection and sustainable natural resource extraction, will require grant funding, to build the capacity of the CRFR Management Committee for effective management of the protected area. Ongoing financial sustainability options are limited by the current transboundary security issues. However, the non-financial benefits this management plan seeks to achieve for the communities, and the applicability of the sustainable natural resource use management regime as a model for other protected areas within the system, should attract funding for implementation, as it addresses key conservation and development issues.

It is recommended that the viability of engaging in a payment for environmental services or carbon sequestration scheme is explored in detail, either at site level, or as part of the Maya Mountains Massif. A system-wide negotiated carbon sequestration scheme for the Maya Mountains Massif, for example, has the potential to provide very adequate financing for all needed system-wide management improvements into the long-term.

Recommended Management Actions:

- Seek grant funding for establishing CRFR Management Committee structure and community management committees
- Seek grant funding for developing integrated community land use plans, with inclusion of CRFR natural resource use areas
- Work with other partners of the MMM and MMMC to seek system level funding
- Investigate the viability of payment for environmental services (PES) and carbon sequestration as long term funding mechanisms

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Annex 2: Mammal Species of Columbia River Forest Reserve					
Common Name	**Scientific Name**	**IUCN Global Status**	**IUCN Sub-species Status**	**CITES**	**National Status**
Didelphimorphia					
Didelphidae					
Common Opossum	*Didelphis marsupialis*				
Four-eyed Opossum	*Philander opossum*				
Water Opossum	*Chironectes minimus*	NT			
Alston's Mouse Opossum	*Micoureus alstoni*	NT			
Xenartha					
Dasypodidae					
Nine-banded Armadillo	*Dasypus novemcinctus*				
Chiroptera					
Noctilinoidae					
Greater Fishing Bat	*Noctillio leporinus*				
Mormoopidae					
Common Mustached Bat	*Pteronotus parnelli*				
Lesser Mustached bat	*Pteronotus personatus*				
Davy's Naked-backed Bat	*Pteronotus davyi*				
Phyllostomidae					
Common Sword-nosed Bat	*Lonchorhina aurita*				
	Micronycteris brachyotis				
	Micronycteris megalotis				
	Phylloderma stenops				
	Phylloderma discolor				
Davis Round-eared Bat	*Tonatia evotis*				
	Tonatia saurophila				
	Mimon bennettii				
	Mimon crenulatum				
Fringe-lipped Bat	*Trachops cirrhosus*				
Woolly False Vampire Bat	*Chrotopterus auritus*				
Common Long-tongued Bat	*Glossophaga soricina*				
	Carollia brevicauda				
Seba's Short-tailed Bat	*Carollia perspicillata*				
Wrinkle-faced Bat	*Centurio senex*				
Thomas' Fruit-eating Bat	*Artibeas watsoni*				
Jamaican fruit-eating Bat	*Artibeus jamaicensis*				
Toltec Fruit-eating Bat	*Artibeus toltecus*				
	Vampyressa pusilla				
	Vampyressa caraccioli				
	Platyrrhinus helleri				

Mammal Species of Columbia River Forest Reserve / 2					
Common Name	**Scientific Name**	**IUCN Global Status**	**IUCN Sub-species Status**	**CITES**	**National Status**
Vespertilinodae					
Hairy-legged Myotis	*Myotis keasyi*				
Van Gelder's Bat	*Bauerus dubiaquercus*				
Northern Yellow Bat	*Lasiurus intermdius*				
Molossidae					
Pallas' mastiff bat	*Molossus molossus*				
Primates					
Cebidae					
Yucatan Black Howler	*Alouatta pigra*	EN		I	VU
Central American Spider Monkey	*Ateles geoffroyi*			II	VU
			VU		
Rodentia					
Sciuridae					
Variegated Squirrel	*Sciurus variegatoides*				
Deppe's Squirrel	*Sciurus deppei*				
Agoutidae					
Central American Agouti	*Dasyprocta punctata*			III	
Paca	*Agouti paca*			III	
Muridae					
Alfaro's Rice Rat	*Oryzomys alfaroi*				
Northern Climbing Rat	*Tylomys nudicaudus*				
??	*Ototylomus hassi*				
Geomytidae					
Hispid Pocket Gopher	*Orthogeomys hispidus*				
Carnivora					
Procyonidae					
White-nosed Coati	*Nasua narica*			III	
Kinkajou	*Potos flavus*			III	
Cacomistle	*Bassariscus sumichrasti*				
Mustelidae					
Tayra	*Eira Barbara*		VU	III	
Felidae					
Jaguarundi	*Herpailurus yaguarondi*			I	
Ocelot	*Leopardsu pardalis*			I	VU
Margay	*Leopardus wiedii*			I	VU
Puma	*Puma concolor*	NT		I	NT
Jaguar	*Panthera onca*	NT		II	NT

Mammal Species of Columbia River Forest Reserve / 3					
Common Name	**Scientific Name**	**IUCN Global Status**	**IUCN Sub-species Status**	**CITES**	**National Status**
Perissodactyla					
Tapiridae					
Baird's tapir	*Tapirus bairdii*	EN		I	VU
Artiodactyla					
Tayassuidae					
Collard Peccary	*Pecari tajacu*			II	
White-lipped Peccary	*Dicotyles pecari*			II	VU
Cervidae					
White-tailed Deer	*Odocoileus virginianus*				
Red brocket Deer	*Mazama americana*	DD			

Annex 2b: Potential Mammal Species of Columbia River Forest Reserve					
Common Name	**Scientific Name**	**IUCN Global Status**	**IUCN Sub-species Status**	**CITES**	**National Status**
Didelphimorphia					
Didelphidae					
Virginia Opossum	*Didelphis virginianus*				
Central American Wooly Opossum	*Caluromys derbianus*				
Mexican Mouse Opossum	*Marmosa mexicana*				
Robinson's Mouse Opossum	*Marmosa robinsoni*				
Xenartha					
Myrmecophagidae					
Northern Tamandua	*Tamandua mexicana*				
Chiroptera					
Emballonuridae					
Proboscis Bat	*Rhynchonycteris naso*				
Greater White-lined Bat	*Saccopteryx bilineata*				
Lesser White-lined Bat	*Saccopteryx leptura*				
Least Sac-winged bat	*Balantiopteryx io*	NT			VU
Lesser Dog-like Bat	*Peropteryx macrotis*				
Greater Dog-like Bat	*Peropteryx kappleri*				
Northern Ghost Bat	*Diclidurus albus*				
Mormoopidae					
Ghost-faced Bat	*Mormoops megalophylla*				
Phyllostomidae					
Brazilian Big-eared Bat	*Micronycteris microtis*				
Schmidt's Big-eared Bat	*Micronycteris schmidtorum*				
Niceforo's Bat	*Trinycteris nicefori*				
Cozumel Golden Bat	*Mimon cozumelae*				
Pale Spear-nosed Bat	*Phyllostomus discolor*				
Great False Vampire Bat	*Vampyrum spectrum*				
Underwood's Long-tongued Bat	*Hylonycteris underwoodi*				
Little Yellow-shouldered Bat	*Sturnira lillium*				
Short-tailed Fruit Bat	*Carollia soweli*				
Intermediate Fruit-eating bat	*Artibeius intermedius*				
Great Fruit-eating Bat	*Artibeus lituratus*				
Pygmy Fruit-eating Bat	*Dermanura phaeotis*				
Common Tent-making Bat	*Uroderma bilobatum*				
Hairy Big-eyed Bat	*Chiroderma villosum*				
Little Yellow-eared Bat	*Vampyressa thyone*				

Potential Mammal Species of Columbia River Forest Reserve					
Common Name	**Scientific Name**	**IUCN Global Status**	**IUCN Sub-species Status**	**CITES**	**National Status**
Desmodontidae					
Common Vampire Bat	*Desmodus rotundus*				
Natalidae					
Mexican Funnel-eared Bat	*Natalus stramineus*				
Vespertilinodae					
Argentine Brown Bat	*Eptesicus furinalis*				
Central American Yellow Bat	*Rhogeessa tumida*				
Southern Yellow Bat	*Lasiurus ega*				
Molossidae					
Underwood's Mastiff Bat	*Eumops underwoodi*				
Black mastiff bat	*Molossus rufus*				
Primates					
Cebidae					
Yucatan Black Howler	*Alouatta pigra**	EN		I	VU
Central American Spider Monkey	*Ateles geoffroyi*			II	VU
			VU		
Rodentia					
Sciuridae					
Yucatan Squirrel	*Sciurus yucatanensis*				
Agoutidae					
Paca	*Agouti paca*			III	
Heteromyidae					
Forest Spiny Pocket Mouse	*Heteromys desmarestianus*				
Muridae					
Rusty Rice Rat	*Oryzomys rostratus*				
Hispid Cotton Rat	*Sigmodon hispidus*				
Big-eared Climbing Rat	*Ototylomus phyllotis*				
Vesper Rat	*Nyctomis sumichrasti*				
Erethizontidae					
Mexican Porcupine	*Coendou mexicanus*				
Lagomorpha					
Leporidae					
Forest Rabbit	*Sylvilagus brasiliensis*				
Carnivora					
Canidae					
Grey Fox	*Urocyon cinereoargenteus*				

Procyonidae					
Northern Racoon	*Procyon lotor*				
Mustelidae					
Greater Grison	*Galictis vittata*				
Spotted Skunk	*Spilogale putorius*				
Striped Hog-nosed Skunk	*Conepatus semistriatus*				
Long-tailed Weasel	*Mustela frenata*				
Neotropical River Otter	*Lutra longicaudis*	DD		I	VU

- Where a species occurs in both Cockscomb Basin Wildlife Sanctuary and Columbia River Forest Reserve, it is presumed to occur in Bladen Nature Reserve
- Where a species occurs in the BFREE land, it is considered to occur in Bladen Nature Reserve
- National Status: Critical Species, NPAPSP, Meerman 2005

Date Sources: Iremonger and Sayer, 1994; Brokaw and Lloyd-Evans, 1987; Brewer; Arrigoni; Neobat; BFREE, 2005 (pers. com.)

Annex 3: Amphibian Species of Columbia River Forest Reserve

Species Present in CRFR	English Name	IUCN 2008
Plethodontidae		
Bolitoglossa dofleini	Doflein's Salamander	NT
Bolitoglossa mexicana	Mexican Mushroomtongue Salamander	LC
Bolitoglossa odonnelli	O'Donnell's Salamander	EN
Bolitoglossa rufescens	Northern Banana Salamander	LC
Oedipina elongate	C. American Worm Salamander	LC
Leptodactylidae		
Craugastor chac	Chac's Rainfrog	NT
*Craugastor coffeus**	Coffeus Rainfrog	CR
Craugastor laticeps	Broadhead Rainfrog	NT
*Craugastor psephosypharus***	Limestone Rainfrog	VU
*Craugastor rostralis**	Snouted Robber Frog	NT
Craugastor sabrinus	Sabrinus Rainfrog	EN
Craugastor sandersoni	Sanderson's Rainfrog	EN
Eleutherodactylus leprus	Leprus Chirping Rainfrog	VU
Bufonidae		
Incilius campbelli	Campbell's Rainforest Toad	NT
*Incilius macrocristatus**	Large-crested toad	VU
Incilius valliceps	Gulf Coast Toad	LC
Rhinella marina	Cane Toad	LC
Hylidae		
Agalychnis callidryas	Red-eyed Treefrog	LC
Agalychnis moreletii	Morelet's Treefrog	CR
*Bromeliohyla bromeliacia**	Bromeliad Treefrog	EN
Dendropsophus microcephala	Yellow Treefrog	LC
*Ecnomiohyla minera**	Fringe-limbed Treefrog	EN
Smilisca baudinii	Common Mexican Treefrog	LC
Smilisca cyanosticta	Blue-spotted Mexican Treefrog	NT
Centrolenidae		
Hyalinobatrachium fleischmanni	Fleischmann's Glass Frog	LC
Ranidae		
Lithobates juliani	Maya Mountain Frog	NT
Litohbates vaillanti	Rainforest Frog	LC

*Only recorded in Belize from CRFR
**Only recorded in Belize from CRFR and Bladen Nature Reserve

Annex 3b: Potential Amphibian Species of Columbia River Forest Reserve		
Species	**English Name**	**IUCN 2008**
Plethodontidae		
Bolitoglossa occidentalis	Southern Banana Salamander	LC
Rhinophrynidae		
Rhinophrynus dorsalis	Burrowing Toad	LC
Leptodactylidae		
Craugastor alfredi	Alfred's Climbing Rainfrog	VU
Leptodactylus fragilis (labialis)	White-lipped Frog	LC
Leptodactylus melanonotus	Sabinal Frog	LC
Hylidae		
Dendropsophus ebraccata	Hourglass Treefrog	LC
Dendropsophus microcephala	Yellow Treefrog	LC
Scinax staufferi	Stauffer's Treefrog	LC
Tlalohyla loquax	Mahogany Treefrog	LC
Tlalohyla picta	Painted Treefrog	LC
Trachycephalus venulosus	Veined Treefrog	LC
Microhylidae		
Gastrophryne elegans	Elegant Narrowmouth Frog	LC

Annex 4: Reptile Species of Columbia River Forest Reserve

Species	English Name	IUCN 2008
Chelydridae		
Chelydra serpentina	Snapping Turtle	
Kinosternidae		
Kinosternon leucostomum	White-lipped Mud Turtle	
Eublepharidae		
Coleonyx elegans	Yucatan Banded Gecko	
Gekkonidae		
Sphaerodactylus glaucus	Dwarf Gecko	
Thecadactylus rapicauda	Turnip Tail Gecko	
Corytophanidae		
Basilicsus vittatus	Brown Basilisk	
Corytophanes cristatus	Smoothhead Helmeted Basilisk	
Laemanctus longipes	Eastern Casquehead Iguana	
Iguanidae		
Iguana iguana	Green Iguana	
Phrynosomatidae		
Sceloporus variablis	Rosebelly Lizard	
Polychrotidae		
Anolis biporcatus	Neotropical Green Anole	
Anolis capito	Bighead Anole	
Anolis lemurinus	Ghost Anole	
Anolis rodriguezii	Smooth Anole	
Anolis sagrei	Brown Anole	
Anolis tropidonotus	Greater Scaly Anole	
Anolis uniformis	Lesser Scaly Anole	
Scincidae		
Mesoscincus schwartzei	Schwartze's Skink	LC
Sphenomorphus cherriei	Brown Forest Skink	
Teiidae		
Ameiva festiva	Middle American Ameiva	
Xantusiidae		
Lepidophyma flavimaculatum	Yellow-spotted Night Lizard	
Lepidophyma mayae	Maya Night Lizard	
Boidae		
Boa constrictor	Boa Constrictor	
Colubridae		
Amastridium veliferum	Rustyhead Snake	
Coniophanes fissidens	White-lipped Spotbelly Snake	
Coniophanes imperialis	Black-striped Snake	LC
Dendrophidion vinitor	Barred Forest Racer	
Drymarchon melanurus	Indigo Snake	LC
Drymobius margaritiferus	Speckled Racer	
Imantodes cenchoa	Blunthead Tree Snake	
Lampropeltis triangulum	Milk Snake	

Reptile Species of Columbia River Forest Reserve			
Species		**English Name**	**IUCN 2008**
Colubridae			
	Leptophis ahaetulla	Parrot Snake	
	Pliocercus elapoides	False Coral Snake	LC
	Rhadinaea decorata	Adorned Graceful Brown Snake	
	Sibon nebulata	Cloudy Snail Sucker	
	Stenorrhina degenhardtii	Degenhardt's Scorpion-eating Snake	
	Tantilla schistosa	Red Earth Centipede Snake	
	Xenodon rhabdocephalus	False Fer-De-Lance	
Viperidae			
	Atropoides mexicanus	Jumping Pitviper	
	Bothriechis schlegelii	Eyelash Palm-Pitviper	
	Bothrops asper	Fer-de-Lance	

Annex 4b: Potential Reptile Species of Columbia River Forest Reserve

Species	English Name	IUCN 2008
Dermatemydidae		
Dermatemys mawii	Central American River Turtle	CR
Kinosternidae		
Claudius angustatus	Narrow-ridge Turtle	
Staurotypus triporcatus	Mexican Giant Musk Turtle	LR
Emydidae		
Rhinoclemmys areolata	Furrowed Turtle	NT
Trachemys venusta	Slider	LR
Gekkonidae		
Sphaerodactylus millepunctatus	Spotted Dwarf Gecko	
Corytophanidae		
Corytophanes hernandezii	Hernandez's Helmeted Basilisk	
Polychrotidae		
Anolis sericeus	Silky Anole	
Scincidae		
Mabuya unimarginata	Central American Mabuya	
Plestiodon sumichrasti	Sumichrast's Skink	
Teiidae		
Ameiva undulata	Rainbow Ameiva	
Colubridae		
Adelphicus quadrivirgatus	Middle American Earth Snake	DD
Leptodeira frenata	Rain Forest Cat-eyed Snake	LC
Leptodeira septentrionalis	Northern Cat-eyed Snake	
Leptophis mexicanus	Mexican Parrot Snake	
Mastigodryas melanolomus	Lizard Eater	LC
Ninia sebae	Redback Coffee Snake	
Oxybelis aeneus	Mexican Vine Snake	
Pseudoelaphe flavirufa	Tropical Rat Snake	
Pseustes poecilonotus	Puffing Snake	LC
Scaphiodontophis annulatus	Guatemalan Neckband Snake	
Senticolis triaspis	Peninsular Rat Snake	
Sibon dimidiata	Slender Snail Sucker	LC
Sibon sanniola	Pygmy Snail Sucker	LC
Spilotes pullatus	Tiger Tree Snake	
Tantillita lintoni	Linton's Dwarf Short-Tailed Snake	LC
Thamnophis proximus	Western Ribbon Snake	
Tretanorhinus nigroluteus	Orange-belly Swamp Snake	
Tropidodipsas sartorii	Terrestrial Snail Sucker	
Elapidae		
Micrurus hippocrepis	Maya Coral Snake	
Viperidae		
Porthidium nasutum	Rainforest Hognose Pitviper	LC

Annex 5: Birds Recorded in Chiquibul Forest Reserve / 1

Species		Status	Habitats	CRFR	DD	Bladen
Great Tinamou	*Tinamus major*	fP	BFM,BFL	x		x
Little Tinamou	*Crypturellus soui*	fP	SC	x		x
Slaty-breasted Tinamou	*Crypturellus boucardi*	fP	BFM,BFL	x		x
Turkey Vulture	*Cathartes aura*	cP	SA,O	x		x
King Vulture	*Sarcoramphus papa*	uP	BFM,BFL	x	x	x
Hook-billed Kite	*Chondrohierax uncinatus*	uP	BFM,BFL	x		x
Swallow-tailed Kite	*Elanoides forficatus*	uS	BFM,BFL,O	x	x	x
Double-toothed Kite	*Harpagus bidentatus*	uP	BFM,BFL	x		x
White Hawk	*Leucopternis albicollis*	uP	BFL,O	x		x
Great Black-Hawk	*Buteogallus urubitinga*	uP	BFM,BFL,O	x	x	x
Black Hawk-Eagle	*Spizaetus tyrannus*	uP	BFM,BFL,O	x	x	x
Ornate Hawk-Eagle	*Spizaetus ornatus*	rP	BFM,BFL,O	x	x	x
Barred Forest-Falcon	*Micrastur ruficollis*	uP	BFM,BFL	x	x	x
Collared Forest-Falcon	*Micrastur semitorquatus*	uP	BFM,BFL	x	x	x
Plain Chachalaca	*Ortalis vetula*	cP	BFL,BFM	x	x	x
Crested Guan	*Penelope purpurascens*	cP	BFM,BFL	x	x	x
Great Curassow	*Crax rubra*	uP	BFM,BFL	x	x	x
Spotted Wood-Quail	*Odontophorus guttatus*	uP	BFM,BFL	x	x	x
Short-billed Pigeon	*Columba nigrirostris*	cP	BFM,BFL	x	x	x
Ruddy Ground-Dove	*Columbina talpacoti*	cP	SC	x		x
Blue Ground-Dove	*Claravis pretiosa*	cP	BFM,BFL	x	x	x
Ruddy Quail-Dove	*Geotrygon montana*	fP	BFM,BFL	x	x	x
Gray-fronted Dove	*Leptotila rufaxilla*	cP	BFM,BFL	x		x
Gray-chested Dove	*Leptotila cassini*	cP	BFM,BFL	x		x
Olive-throated Parakeet	*Aratinga nana*	cP	BFM,BFL	x	x	x
Brown-hooded Parrot	*Pionopsitta haematotis*	cP	BFM,BF	x		x
White-crowned Parrot	*Pionus senilis*	cP	BFM,BFL	x	x	x
White-fronted Parrot	*Amazona albifrons*	rV	BFL,SA	x		x
Mealy Parrot	*Amazona farinosa*	cP	BFM,BFL	x	x	x
Squirrel Cuckoo	*Piaya cayana*	cP	BFM,BFL	x		x
Groove-billed Ani	*Crotophaga sulcirostris*	cP	SC	x		x
Vermiculated Screech-Owl	*Otus guatemalae*	uP	BFM,BFL	x	x	x
Crested Owl	*Lophostrix cristata*	rP	BFM,BFL	x		x
Spectacled Owl	*Pulsatrix perspicillata*	uP	BFM,BFL	x		x
Central American Pygmy-Owl	*Glaucidium griseiceps*	uP	BFM.BFL	x		x
Mottled Owl	*Ciccaba virgata*	cP	BFM.BFL	x	x	x
Common Nighthawk	*Chordeiles minor*	oT	SA,O	x		x
Common Pauraque	*Nyctidromus albicollis*	cP	BFM,BFL	x	x	x
White-collared Swift	*Streptoprocne zonaris*	fP	O	x	x	x
Vaux's Swift	*Chaetura vauxi*	cP	O	x	x	x
Long-tailed Hermit	*Phaethornis superciliosus*	cP	BFM,BFL	x	x	x
Little Hermit	*Phaethornis longuemareus*	cP	BFM,BFL	x		x

Birds Recorded in Chiquibul Forest Reserve / 2

Species		Status	Habitats	CRFR	DD	Bladen
Wedge-tailed Sabrewing	*Campylopterus curvipennis*	cP	BFM,BFL	x		x
Violet Sabrewing	*Campylopterus hemileucurus*	uP	BFM	x	x	x
White-necked Jacobin	*Florisuga mellivora*	fP	BFM.BFL,L	x	x	x
Violet-crowned Woodnymph	*Thalurania colombica*	lP	BFM	x		x
White-bellied Emerald	*Amazilia candida*	cP	BFM,BFL	x	x	x
Azure-crowned Hummingbird	*Amazilia cyanocephala*	lP	PW	x	x	x
Rufous-tailed Hummingbird	*Amazilia tzacatl*	cP	SC,SA	x		x
Purple-crowned Fairy	*Heliothryx barroti*	uP	BFM, BFL	x		x
Black-headed Trogon	*Trogon melanocephalus*	cP	BFL.BFM	x		x
Violaceous Trogon	*Trogon violaceus*	cP	BFM,BFL	x		x
Collared Trogon	*Trogon collaris*	fP	BFM,BFL	x	x	x
Slaty-tailed Trogon	*Trogon massena*	cP	BFM,BFL	x		x
Green Kingfisher	*Chloroceryle americana*	cP	LA	x		x
Blue-crowned Motmot	*Momotus momota*	cP	BFM,BFL	x	x	x
Keel-billed Motmot	*Electron carinatum*	uP	BFM,BFL	x	x	x
White-necked Puffbird	*Notharchus macrorhynchos*	uP	SC	x		x
White-whiskered Puffbird	*Malacoptila panamensis*	uP	BFM,BFL	x		x
Rufous-tailed Jacamar	*Galbula ruficauda*	fP	BFM,BFL	x		x
Emerald Toucanet	*Aulacorhynchus prasinus*	fP	BFM	x		x
Collared Aracari	*Pteroglossus torquatus*	cP	BFM,BFL	x		x
Keel-billed Toucan	*Ramphastos sulfuratus*	cP	BFM,BFL	x		x
Black-cheeked Woodpecker	*Melanerpes pucherani*	cP	BFM,BFL	x		x
Smoky-brown Woodpecker	*Veniliornis fumigatus*	fP	BFM,BFL	x	x	x
Chestnut-colored Woodpecker	*Celeus castaneus*	uP	BFM,BFL	x		x
Lineated Woodpecker	*Dryocopus lineatus*	cP	BFM,BFL	x		x
Pale-billed Woodpecker	*Campephilus guatemalensis*	cP	BFM,BFL	x	x	x
Buff-throated Foliage-gleaner	*Automolus ochrolaemus*	fP	BFM,BFL	x	x	x
Plain Xenops	*Xenops minutus*	cP	BFM,BFL	x	x	x
Scaly-throated Leaftosser	*Sclerurus guatemalensis*	uP	FM,BFL	x	x	x
Tawny-winged Woodcreeper	*Dendrocincla anabatina*	fP	BFM,BFL	x	x	x
Ruddy Woodcreeper	*Dendrocincla homochroa*	fP	BFM,BFL	x		x
Olivaceous Woodcreeper	*Sittasomus griseicapillus*	fP	BFM,BFL	x	x	x
Wedge-billed Woodcreeper	*Glyphorynchus spirurus*	fP	BFM,BFL	x		x
Northern Barred-Woodreeper	*Dendrocolaptes sanctithornae*	fP	BFM,BFL	x		x
Ivory-billed Woodcreeper	*Xiphorhynchus flavigaster*	cP	BFM,BFL	x		x
Spotted Woodcreeper	*Xiphorhynchus flavigaster*	fP	BFM	x	x	
Streak-headed Woodcreeper	*Lepidocolaptes souleyetii*	uP	BFM,BFL	x	x	x
Barred Antshrike	*Thamnophilus doliatus*	cP	SC	x		x

Birds Recorded in Chiquibul Forest Reserve / 3

Species		Status	Habitats	CRFR	DD	Bladen
Russet Antshrike	*Thamnistes anabatinus*	uP	BFM	x		x
Plain Antvireo	*Dysithamnus mentalis*	fP	BFM,BFL	x		x
Slaty Antwren	*Myrmotherula schisticolor*	fP	BFM	x	x	x
Dot-winged Antwren	*Microrhopias quixensis*	cP	BFL	x		x
Dusky Antbird	*Cercomacra tyrannina*	cP	SC	x	x	x
Black-faced Antthursh	*Formicarius analis*	cP	BFM,BFL	x	x	x
Yellow-bellied Tyrannulet	*Ornithion semiflavum*	fP	BFM,BFL	x		x
Greenish Elaenia	*Myiopagis viridicta*	fP	BFM, BFL	x		x
Yellow-bellied Elaenia	*Elaenia flavogaster*	cP	PW,SA	x		x
Ochre-bellied Flycatcher	*Mionectes oleagineus*	cP	BFM,BFL	x	x	x
Sepia-capped Flycatcher	*Leptopogon amaurocephalus*	fP	BFM,BFL	x		x
Paltry Tyrannulet	*Zimmerius vilissimus*	lP	BFL	x		x
Northern Bentbill	*Oncostoma cinereigulare*	cP	BFM,BFL	x	x	x
Eye-ringed Flatbill	*Rhynchocyclus brevirostris*	uP	BFM,BFL	x		x
Yellow-olive Flycatcher	*Tolmomyias sulphurescens*	cP	BFM,BFL	x		x
Stub-tailed Spadebill	*Platyrinchus cancrominus*	cP	BFM,BFL	x	x	x
Royal Flycatcher	*Onychorhynchus coronatus*	uP	BFM,BFL	x		x
Ruddy-tailed Flycatcher	*Terenotriccus erythrurus*	uP	BFM,BFL	x		x
Sulphur-rumped Flycatcher	*Myiobius sulphureipygius*	cP	BFM,BFL	x	x	x
Olive-sided Flycatcher	*Contopus cooperi*	uT	BFM,BFL	x		x
Tropical Pewee	*Contopus cinereus*	fP	BFM,BFL	x	x	x
Eastern Wood-Pewee	*Contopus virens*	vT	BFM,BFL	x		x
Yellow-bellied Flycatcher	*Empidonax flaviventris*	fW	BFM,BFL	x		x
Least Flycatcher	*Empidonax minimus*	fW	SC	x		x
Bright-rumped Attila	*Attila spadiceus*	cP	BFM,BFL	x	x	x
Rufous Mourner	*Rhytipterna holerythra*	uP	BFM,BFL	x		x
Dusky-capped Flycatcher	*Myiarchus tuberculifer*	cP	BFM,BFL	x		x
Great Crested Flycatcher	*Myiarchus crinitus*	fW	BFM,BFL	x		x
Great Kiskadee	*Pitangus sulphuratus*	cP	SC	x		x
Boat-billed Flycatcher	*Megarynchus pitangua*	cP	BFM,BFL	x	x	x
Social Flycatcher	*Myiozetetes similis*	vP	SC	x		x
Streaked Flycatcher	*Myiodynastes maculatus*	lS	BFM,BFL	x		x
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*	cS	BFM,BFL	x		x
Tropical Kingbird	*Tyrannus melancholicus*	cP	PW,SA	x		x
Thrush-like Schiffornis	*Schiffornis turdinus*	cP	BFM,BFL	x	x	x
Rufous Piha	*Lipaugus unirufus*	uP	BFM,BFL	x	x	x
Cinnamon Becard	*Pachyramphus cinnamomeus*	fP	BFM,BFL	x		x
Rose-throated Becard	*Pachyramphus aglaiae*	uP	BFL,PW	x		x
Masked Tityra	*Tityra semifasciata*	cP	BFM,BFL	x		x
White-collared Manakin	*Manacus candei*	cP	BFL	x	x	x
Red-capped Manakin	*Pipra mentalis*	cP	BFM,BFL	x	x	x

Birds Recorded in Chiquibul Forest Reserve / 4

Species		Status	Habitats	CRFR	DD	Bladen
White-eyed Vireo	*Vireo griseus*	cW	SC	x		x
Yellow-throated Vireo	*Vireo flavifrons*	cW	BFM,BFL	x		x
Philadelphia Vireo	*Vireo philadelphicus*	uT	BFL	x		x
Red-eyed Vireo	*Vireo olivaceus*	cT	BFM,BFL	x		x
Yellow-green Vireo	*Vireo flavoviridis*	cS	BFM, BFL	x		x
Tawny-crowned Greenlet	*Hylophilus ochraceiceps*	cP	BFM,BFL	x	x	x
Lesser Greenlet	*Hylophilus decurtatus*	vP	BFM,BFL	x		x
Green Shrike-Vireo	*Vireolanius pulchellus*	cP	BFM, BFL	x	x	x
Green Jay	*Cyanocorax yncas*	uP	BFL,PW	x	x	x
Brown Jay	*Cyanocorax morio*	cP	BFL,PW	x		x
Gray-breasted Martin	*Progne chalybea*	cS	O	x		x
Mangrove Swallow	*Tachycineta albilinea*	lP	LA	x		x
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	fP	BFM,BFL	x	x	x
Band-backed Wren	*Campylorhynchus zonatus*	lP	BFM,BFL	x		x
Spot-breasted Wren	*Thryothorus maculipectus*	vP	BFM,BFL	x	x	x
White-breasted Wood-Wren	*Henicorhina leucosticta*	vP	BFM,BFL	x	x	x
Long-billed Gnatwren	*Ramphocaenus melanurus*	cP	BFM,BFL	x		x
Tropical Gnatcatcher	*Polioptila plumbea*	fP	BFM,BFL	x		x
Swainson's Thrush	*Catharus ustulatus*	fT	BFM,BFL	x	x	x
Wood Thrush	*Hylocichla mustelina*	cW	BFM,BFL	x	x	x
Clay-colored Robin	*Turdus grayi*	cP	BFL,SC	x		x
Gray Catbird	*Dumetella carolinensis*	cW	BFM,BFL	x	x	x
Tennessee Warbler	*Vermivora peregrina*	fW	BFM,BFL	x		x
Blue-winged Warbler	*Vermivora pinus*	uW	BFM,BFL	x		x
Yellow Warbler	*Dendroica petechia*	cW	SC	x		x
Chestnut-sided Warbler	*Dendroica pensylvanica*	cW	BFM,BFL	x		x
Magnolia Warbler	*Dendroica magnolia*	cW	BFM,BFL	x	x	x
Black-throated Green Warbler	*Dendroica virens*	fW	PW,SC	x	x	x
Yellow-throated Warbler	*Dendroica dominica*	cW	PFM,PFL	x	x	x
Black-and-white Warbler	*Mniotilta varia*	cW	BFM,BFL	x	x	x
American Redstart	*Setophaga ruticilla*	cW	BFM,BFL	x	x	x
Prothonotary Warbler	*Protonotaria citrea*	uT	BFL,LA	x		x
Worm-eating Warbler	*Helmitheros vermivorus*	uW	BFM,BFL	x	x	x
Ovenbird	*Seiurus aurocapillus*	fW	BFM,BFL	x	x	x
Northern Waterthrush	*Seiurus noveboracensis*	cW	LA	x	x	x
Louisiana Waterthrush	*Seiurus motacilla*	uW	LA	x	x	x
Kentucky Warbler	*Oporornis formosus*	cW	BFM,BFL	x		x
Common Yellowthroat	*Geothlypis trichas*	cW	SC	x		x
Hooded Warbler	*Wilsonia citrina*	cW	BFM,BFL	x	x	x
Wilson's Warbler	*Wilsonia pusilla*	uW	BFM,BFL	x	x	x
Golden-crowned Warbler	*Basileuterus culicivorus*	cP	BFM,BFL	x	x	x
Yellow-breasted Chat	*Icteria virens*	uW	SC	x		x

Birds Recorded in Chiquibul Forest Reserve / 5

Species		Status	Habitats	CRFR	DD	Bladen
Black-throated Shrike-Tanager	*Lanio aurantius*	uP	BFM,BFL	x		x
Red-crowned Ant-Tanager	*Habia rubica*	cP	BFM,BFL	x	x	x
Red-throated Ant-Tanager	*Habia fuscicauda*	vP	BFM,BFL	x		x
Summer Tanager	*Piranga rubra*	cW	BFM,BFL	x		x
Crimson-collared Tanager	*Ramphocelus sanguinolentus*	fP	SC	x		x
Scarlet-rumped Tanager	*Ramphocelus passerinii*	cP	SC	x		x
Blue-gray Tanager	*Thraupis episcopus*	vP	BFL,PFL	x		x
Yellow-winged Tanager	*Thraupis abbas*	cP	BFM,BFL	x	x	x
Yellow-throated Euphonia	*Euphonia hirundinacea*	cP	BFM,BFL	x	x	x
Olive-backed Euphonia	*Euphonia gouldi*	cP	BFM,BFL	x	x	x
Golden-hooded Tanager	*Tangara larvata*	cP	BFL,PW	x		x
Green Honeycreeper	*Chlorophanes spiza*	fP	BFM,BFL	x	x	x
Shining Honeycreeper	*Cyanerpes lucidus*	uP	BFM	x	x	x
Red-legged Honeycreeper	*Cyanerpes cyaneus*	cP	BFM,BFL	x	x	x
White-collared Seedeater	*Sporophila torqueola*	vP	SC,SA	x		x
Orange-billed Sparrow	*Arremon aurantiirostris*	cP	BFM,BFL	x	x	x
Green-backed Sparrow	*Arremonops chloronotus*	cP	BFL,SC	x		x
Grayish Saltator	*Saltator coerulescens*	cP	SC	x		x
Buff-throated Saltator	*Saltator maximus*	cP	BFL	x		x
Black-headed Saltator	*Saltator atriceps*	cP	BFL	x		x
Black-faced Grosbeak	*Caryothraustes poliogaster*	cP	BFM,BFL	x	x	x
Blue-black Grosbeak	*Cyanocompsa cyanoides*	cP	BFM,BFL	x	x	x
Blue Grosbeak	*Passerina caerulea*	cT	SC	x		x
Indigo Bunting	*Passerina cyanea*	cT	SC	x		x
Baltimore Oriole	*Icterus galbula*	cW	BFM, BFL	x		x
Chestnut-headed Oropendola	*Psarocolius wagleri*	lP	BFL	x		x
Montezuma Oropendola	*Psarocolius montezuma*	cP	BFL	x		x

Status

Legend

v = very common
c = common
f = fairly common
u = uncommon
o = occasional
l = local

P = permanent resident
S = seasonal resident
V = visitor
T = transient (migrant)
W = winter resident
X = one or two records only

CRFR Columbia River Forest Reserve
DD Doyle's Delight

Habitat Preferences

Legend (Adapted from Jones and Vallely, 2001)

BFM	Submontane broadleaf forest
BFL	Lowland broadleaf forest
PFM	Submontane pine forest
PFL	Lowland pine forest
SC	Scrub, low second growth
SA	Savanna
WL	Wetland habitats with emergent vegetation
LA	Lagoons, ponds, rivers, streams
O	Overhead/aerial

Annex 5b: Birds Potentially in Chiquibul Forest Reserve / 1

Species		Status	Habitats	DD	Bladen
Wood Stork	*Mycteria americana*	oV	LA	x	x
Black Vulture	*Coragyps atratus*	cP	SA,O		x
Plumbeous Kite	*Ictinia plumbea*	uS	BFM,BFL,O		x
Gray Hawk	*Asturina nitida*	fP	BFL,SC,O		x
Common Black-Hawk	*Buteogallus anthracinus*	fP	SC		x
Roadside Hawk	*Buteo magnirostris*	fP	SC,SA,O		x
Laughing Falcon	*Herpetotheres cachinnans*	fP	PW,SC,SA		x
Bat Falcon	*Falco rufigularis*	uP	SC,O	x	x
Black-and-white Owl	*Ciccaba nigrolineata*	uP	BFL		x
Scaly-breasted Hummingbird	*Phaeochroa cuvieri*	uP	BFM,BFL		x
Green-breasted Mango	*Anthracothorax prevostii*	fP	AG		x
Buff-bellied Hummingbird	*Amazilia yucatanensis*	?P	SC,SA		x
Ringed Kingfisher	*Ceryle torquata*	lP	LA		x
Amazon Kingfisher	*Chloroceryle amazona*	lP	LA		x
American Pygmy Kingfisher	*Chloroceryle aenea*	uP	LA		x
Ladder-backed Woodpecker	*Picoides scalaris*	fP	PFL		x
Golden-fronted Woodpecker	*Melanerpes aurifrons*	cP	SC		x
Rufous-breasted Spinetail	*Synallaxis erythrothorax*	fP	SC		x
Northern Beardless Tyrannulet	*Camptostoma imberbe*	lP	PFL,SC		x
Black Phoebe	*Sayornis nigricans*	lP	LA		x
Brown-crested Flycatcher	*Myiarchus tyrannulus*	cS	BFL,PW		x
Piratic Flycatcher	*Legatus leucophaius*	cS	BFL		x
Eastern Kingbird	*Tyrannus tyrannus*	vT	BFL		x
Gray-collared Becard	*Pachyramphus major*	rP	BFL		x
Black-crowned Tityra	*Tityra inquisitor*	uP	BFL		x
Gray-cheeked Thrush	*Catharus minimus*	uT	BFM,BFL		x
Golden-cheeked Warbler	*Dendroica chrysoparia*	?			X
Black-throated Blue Warbler	*Dendroica caerulescens*	x	SC		x
Blackburnian Warbler	*Dendroica fusca*	fT	BFM,BFL	x	x
Swainson's Warbler	*Limnothlypis swainsonii*	x	BFL		x
Rufous-capped Warbler	*Basileuterus rufifrons*	lP	PW		x
Gray-headed Tanager	*Eucometis penicillata*	fP	BFM, BFL		x
Rose-throated Tanager	*Piranga roseogularis*	?	BFL		
Hepatic Tanager	*Piranga flava*	lP	PW		x
Scarlet Tanager	*Piranga olivacea*	cT	BFM,BFL		x
Scrub Euphonia	*Euphonia affinis*	uP	SC,SA		x
Variable Seedeater	*Sporophila americana*	vP	SC,SA		x
Painted Bunting	*Passerina ciris*	oT	SC		x
Melodious Blackbird	*Dives dives*	vP	SC		x
Yellow-backed Oriole	*Icterus chrysater*	lP	PW		x
Black-cowled Oriole	*Icterus prothemelas*	cP	BFL, PFL		x
Hooded Oriole	*Icterus cucullatus*	?	SC		x

Birds Potentially in Chiquibul Forest Reserve / 1

Species		Status	Habitats	DD	Bladen
Audubon's Oriole	*Icterus graduacauda*	?	?		x
Yellow-tailed Oriole	*Icterus mesomelas*	uP	SC, LA		x
Yellow-billed Cacique	*Amblycercus holosericeus*	cP	BFL,PW		x

Status

Legend

v = very common	**P** = permanent resident
c = common	**S** = seasonal resident
f = fairly common	**V** = visitor
u = uncommon	**T** = transient (migrant)
o = occasional	**W** = winter resident
l = local	**X** = one or two records only

CRFR Columbia River Forest Reserve
DD Doyle's Delight

Habitat Preferences within Bladen

Legend (Adapted from Jones and Vallely, 2001)

BFM	Submontane broadleaf forest
BFL	Lowland broadleaf forest
PFM	Submontane pine forest
PFL	Lowland pine forest
SC	Scrub, low second growth
SA	Savanna
WL	Wetland habitats with emergent vegetation
LA	Lagoons, ponds, rivers, streams
O	Overhead/aerial

Annex Six

Columbia River Forest Reserve

Management Planning Process

A Forest Department Initiative

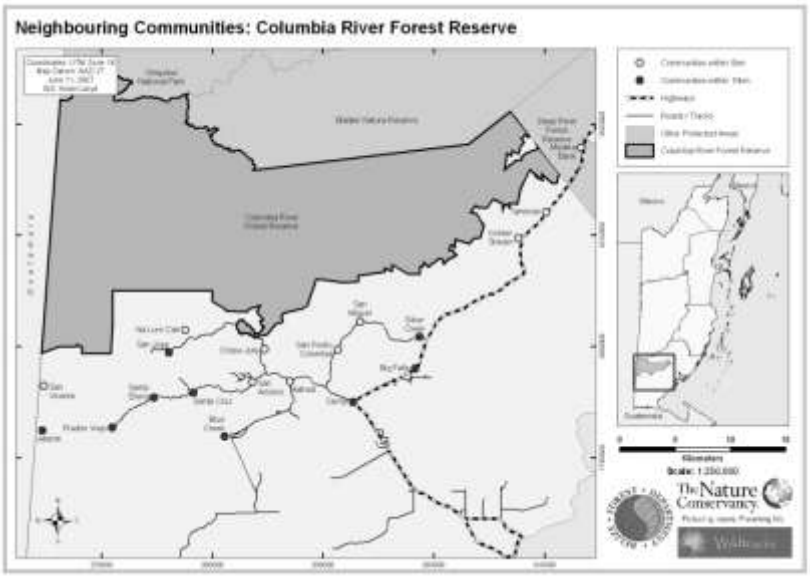
The Objective of the Management Planning for the Columbia River Forest Reserve is to:

- provide a five-year framework for strategic management actions to be implemented by the co-management agencies to ***maximize biodiversity conservation*** of Columbia River Forest Reserve and ***provide mechanisms for buffer communities and other stakeholders to benefit through sustainable resource use***, in close liaison with the Forest Department

This will be achieved through:

- community workshops and stakeholder target group meetings - forums for participatory input into the development of a vision, goals and objectives for future management, based on ***sustainable use of natural resources and short, medium and long term community benefits, whilst maintaining the environmental services of the management area*** (watershed protection and protection of natural and cultural resources)

Wildtracks Workplan,
Columbia River Forest Reserve, 2008
Forest Department / UNDP



This management planning process for Columbia River Forest Reserve is a Forest Department initiative. Stakeholder input and participation in the planning from communities, from tour guides, from the timber industry and from technical experts is a critical part of the development of the Management Plan. To assist stakeholders in making an input during the management planning period from November 2008 to April 2009, there will be a series of:

- Four community workshops
- Meetings with communities and other stakeholders
- Meetings with the Forest Department
- Individual interviews with key stakeholders

We invite you to contribute towards the management planning process, and to participate in the implementation of the Management Plan once it is in place, for the benefit of communities and other stakeholders.

This document is the first in a series produced at the request of the eleven CRFR Stakeholder Communities, to provide an ongoing summary of the outputs of the management planning process, and facilitate communication and collaboration between communities towards future community participation in sustainable resource management and benefit from the Forest Reserve. This document summarises the outputs of Workshop One.

What is the Value of the Forest Reserve?

With eleven communities identified as key stakeholders of the Columbia River Forest Reserve, it is important that the voice of each community can be heard clearly. It has therefore been decided that the most effective method for Workshop One is to work with groups of three to four communities through three identical workshops with an average participation of 20 – 25 people, than to have a single workshop with between 60 an 80 participants. Also identified during consultations is the importance of ensuring the results of these workshops are circulated among all eleven communities, through this and subsequent summary documents.

Community Group 1: San Vicente, San Jose, Na Lum Ca, Crique Jute

- CRFR attracts rain – rain is important for the water sources for the area - rain no longer comes to San Vicente, as the farmers have removed much of the forest. Don't want to see Belize like other countries with no effective watersheds
- The forest is life – the Forest Reserve should remain protected for provision of food (game meat, pacaya, mountain cabbage cohune etc.), building materials (sticks, thatch leaves, vines) and water, for the use of present and future generations. Resources from the forest are organic – not like the meat from the shops – healthier
- Tourism resource – caves and Maya sites
- Cultural resources – ceremonial value of cave (San Vicente), Maya sites
- Wildlife, not just for food, but it is important that future generations are able to enjoy what CRFR has to offer
- Medicinal plants
- Natural beauty

Community Group 2: Medina Bank, Golden Stream, Indian Creek, Silver Creek

- A good place for hunting and fishing
- Food resources – game species, pacaya etc.
- Building materials - – still some resources despite hurricane impacts. Bayleaf, timber trees
- Watershed protection
- Tourism resources – streams, waterfalls
- Xate
- Wildlife
- Good soil for milpas

Community Group 3: San Pedro Columbia, San Miguel, Big Falls

- Way of life – ensuring continued access to natural resources
- Food resources (game species, pacaya etc.)
- Medicinal plants
- Building materials
- Cultural values – caves, archaeological sites, religious sites
- For future generation – that resources and forest will still be there
- Potential for jobs

Columbia River Forest Reserve

What are the Concerns of the Stakeholders?

Community Group 1: San Vicente, San Jose, Na Lum Ca, Crique Jute

- Logging concessions – opening of wide roads, destroying trees, grass is starting to invade, block streams.
- Logging concessions given to large companies – no replanting, not environmentally friendly, and no benefit to local communities. Leave farm roads in worse state
- If these large logging companies, which are not environmentally friendly, can get a logging concession, why not local people, who use more environmentally friendly methods?
- Need better protection of the forest resources from Guatemalans – loggers, hunters and xateros
- Need to regulate hunting within the Forest Reserve – currently indiscriminate and non-sustainable
- Some Guatemala immigrants do not respect the Forest Reserve, don't respect the laws. Important to have some management authority to look after the Forest Reserve if people are to respect it
- Agricultural incursions. Example: Some farmers (2-3 San Vicente) have already entered the FR, have done milpa, fallen the forest, harvested corn, now have this as wamil. Should they be allowed to continue?
- Security concerns for tourism – Guatemalan loggers and xateros

Community Group 2: Medina Bank, Golden Stream, Indian Creek, Silver Creek

- Presence of Guatemalans in CRFR, removing the resources without being stopped, whilst Belizeans are not able to. Need to protect the borders against incursions from Guatemala
- Poor management – needs better management, with multiple use

Community Group 3: San Pedro Columbia, San Miguel, Big Falls

- How this management process will affect the Maya land claim within CRFR...particularly as some communities no longer have sufficient agricultural land for the community
- Xateros – why should they have access , when Belizeans haven't
- Current management is not effective – future management may reduce access rather than increase it – concerns about access for the 10% of the communities that hunt
- Sometimes the communities lose resources to others – the examples given include their lack of consultation and involvement in the process of archaeological excavation rights, and the lack of consultation for last minute changes to the Hydromaya project. Resources such as these should remain as a benefit to the community
- Foreign investors/tourism initiatives are taking the tourism benefits – these initiatives also don't stop in communities to allow sale of crafts etc. and other benefit - barrier to development within communities
- Damage caused by logging machinery to roads, streams, steep slopes etc.
- Political interference
- The need for someone who will facilitate the implementation of the management plan – who will stand for the communities and look after their interests
- Potential threat of mineral or oil exploitation within the Forest Reserve

Columbia River Forest Reserve

Recommendations for Improving the Areas of Concern

The first workshop also provided a forum at which community members could put forward recommendations for improving future management effectiveness, and reducing the areas of concern. The following provides a summary of the primary outputs:

Mechanisms for Community Participation in Management Planning an Implementation

- Need to have a CRFR management body strengthened through community representation, with equal standing with other members (not just in an advisory role)
- Management body should have membership that is strong enough to stand up to political intervention - NOT politicians...Management board should agree no politics
- Needs to be Memorandum of Agreement between communities for working on management plan and commitment for implementation
- Effective management needs to be in place for sustainable use to work
- Concern of compensation for community representatives – loss of work… Realistically, whilst representatives are committed, they will not be able to attend meetings if they cannot replace their days earnings and transport costs.
- Communities need to inform their representatives what they want to see happen – two way communication
- Want clear agreements with Government in black and white...eg. no industrial logging concessions
- Each community should be leading drive to confront their concerns (eg. San Vicente...lead actions against xatéro), in liaison with Forest Department

Guatemalan Incursion Issues

- BDF need to do more regular border checks – not frequent enough at the moment. Priority requirement for frequent border patrols against Guatemala logging (and other incursions)...who will do this?
- Security forces in collaboration with village leaders
- Village leaders can provide information to BDF / police / immigration on security issues that security forces can act upon
- Village members can act as guides / part of patrols. BDF don't always patrol hotspots. With village participation, patrols would be more effective
- Logistics and cost – accessibility problem. No permanent road...so longer patrols – better access needed – all weather road, 4-wheel drive vehicle (but this would bring other problems)
- If logging road through San Jose (for example) is improved for security access, there should be a barrier, where people need to be stopped, and entry could be controlled.
- Community participation through salaried community rangers

Logging Concessions

- Communities recommend that no more logging concessions are granted to large companies in community-impact areas, or concessions using large logging machinery
- Any new license has to be based on a sound management concession, whether large concession or a community concession
- Monitoring and Compliance Unit (MCU) being formed in FD to regularly monitor forest concessions –FD would like community input to the MCU - with community participation in monitoring concessions.
- Regulation of community concessions – who would regulate? how?
- Better communication between FD / communities over logging issues

More effective surveillance and enforcement

- Effective system of liaison and rapid response between communities and BDF
- Community participation in surveillance and enforcement, with community rangers to accompany BDF
- All weather roads needed into key areas of CRFR, better transportation, to move quickly in response to community reports
- Xatéros –Need to strengthen the BDF, lobby the Government to get serious - for effective patrols, political will.
- BDF need to be there both night and day...Conservation Post

Annex Seven: Forest Department Correspondance re. Strategic Management Plan

FOREST DEPARTMENT
Ministry of Natural Resources and the Environment
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sfm@mnrei.gov.bz
wildlife@mnrei.gov.bz

July 9, 2010

Mr. Paul Walker
Wildtracks
Sarteneja Village
Corozal District

Dear Mr. Walker,

The Forest Department has reviewed the draft Colombia Forest Reserve Management Plan and has compiled the following comments for consideration and incorporation:

1. Management plans for forest reserves must follow the forest management plan outline developed by the Forest Department. The plan is not written in the required format. Rather it follows more closely the management plan framework and outline developed under the NPAPSP for national parks etc. It therefore should be labeled a "Strategic Management plan for the Colombia River Forest Reserve".

2. Given that this area holds forest reserve status, it is understood that long term sustainable forest management should be implemented, and that this will be done through the granting of a long term sustainable forest management license and the development of a sustainable forest management plan.

3. The strategy suggests that there is a need to establish formalized and regulated sustainable management of natural resources within Columbia River Forest Reserve for those resources already used by communities.

4. Atlantic Industries Limited apparently was not consulted; they continue to have vested interest in CRFR, claiming to have legal rights to the management of the CRFR. The FD's position is that the management plan developed by the Forest Planning and Management Project is no longer valid after the effects of Hurricane Iris and consequently the license was null and void by force majeure. The FD still considers AIL a stakeholder in the CRFR.

5. The strategy stated that "the 40 timber harvesting blocks identified in the previous management plan (Bird, 1994) need to be redesigned and re-scheduled as necessary". The future sustainable management plan should detail concrete recommendations for re-delineating the blocks.

6. The strategy states that "Following the recommendations of the Code of Practice for Timber Harvesting for Long-Term Forest Licenses, these 15,000 acres should then be divided into 40 x 375 ha blocks, to be harvested on a 40-year rotation……another option for consideration would be that the structure of the proposed long-term forest license for CRFR be changed to

1

a 30-year rotation of 30 x 500 ha blocks, and be reviewed at the end of the first 30-year cycle to determine whether growth rates have resulted in sustainability." 375 ha at best is about 1/3 of the necessary size of a logging compartment. Even the larger acreage recommended of 500 ha is not sufficient and there is no evidence to support a reduction in the cutting cycle from 40 to 30 years.

7. The strategy should include the compartment maps from the past management plan overlaid with the new suggested zoning, compartments and community use area.

8. The section "Threat to biodiversity of the CRFR" –
   - Fire
     - Strategy 5: a National Fire policy for Belize has been endorsed and institutionalized
     - There is no mention of the development of a fire plan. It is not clearly stated if/how CRFR will fit in the fire plan being developed by the Southern Belize Fire Working Group?
   - Dereservation
     - Strategy 1: The CRFR is declared under Forest Act not the NPSA.
   - Looting
     - Any work in relation to archeological sites should be in collaboration with the Institute of Archaeology.
   - Border issues/trans-boundary Incursions
     - Any reference to bi-national collaboration and activities?

9. Page 133 – Management goal states the following:
   - *"However, these original objectives, targeted at forest management for extraction, are no longer considered relevant following the devastating effects of Hurricane Iris, and forest restoration and increased community participation is now considered to be two of the primary objectives for the future."* While management objectives may have shifted with the destruction caused by Hurricane Iris, forest management is still a main focus of the CRFR. Management must therefore be geared towards rehabilitation and sustainability of the forest resources.

10. The strategy mentions that the CRFRMC will approve concessions and other activities in the reserve. The legal mandate over management decisions and activities within the CRFR will remain with the Forest Department. Other committees or entities such as the CRFRMC can be consulted and recommendations put forward for consideration during the decision making process. Any other process would require legislative amendments, which have not detailed in this strategy.

11. The Natural Resources Use Area being contemplated for each of the 11 communities and the manner in which it is proposed to be managed can become cumbersome and too complex to manage especially recognizing the shortage of FD resources and staff. A management approach of this nature does not exist and there is no manual to guide the process. What products will be extracted from these areas?

2

12. Any future long term forest license holder should be obligated to contribute to the environmental education program and boundary demarcation.

13. Any tourism activity in the reserve should be done in consultation with the BTB and FD – Policy, Rules, Regulations.

14. The strategy should provide recommendation as to the resources required to manage the reserve. Hiring a coordinator requires money, where will this come from?

15. While an appointed system-level specialist Enforcement Task Force of the BDF for timber harvesting may be deemed as necessary, the practicality of it is questionable given the current trends with austerity measures in the Government. Any consideration of financial sustainability in the management of the reserve?

It is hoped that these comments will help to improve and strengthen the document. Do not hesitate to contact us for clarification or further comment.

Sincerely,

Wilbert Sabido
Chief Forest Officer

cc. Ms. Lisel Alamilla
Executive Director
YCT

Mr. Raul Chun
Forest Resource Planning and Management Programme
Forest Department

Mrs. Hannah St. Luce Martinez
Protected Areas Officer
Forest Department

File

Annex Eight: Wildtracks Response to Forest Department

Wildtracks
Conservation, Education and Research

P.O. Box 278
Belize City
Belize
Tel: 614-8244
office@wildtracksbelize.org

Wilbur Sabido.
Chief Forest Officer,
Forest Department,
Forest Drive,
Belmopan.

16th July 2010

Dear Mr. Sabido,

Thank you for the feedback from your staff regarding the draft management plan for the Columbia River Forest Reserve. For clarity, I've responded below to each of the individual comments, and have made amendments where appropriate in the Plan. I trust that these meet with your agreement, but would be happy to discuss any with which you may have remaining concerns.

1. As the scope of the TOR and goals of the management plan are more closely aligned with the structure of the NPAPSP management plan framework for protected areas, than that of the Sustainable Forest Management Plan, particularly in the breadth of social participation, it was agreed early in the planning stage that the format of the NPAPSP management plan framework would be followed. This was discussed and approved by the primary technical stakeholders participating in the plan, including Forest Department staff. If this decision is now considered differently, the consultants have no problem re-titling the plan as a Strategic Plan rather than a Management Plan.

2. This is as per the recommendations of the Plan: "Timber harvesting be conducted under a long-term forest license, and follow the principles of the Code of Practice for Timber Harvesting for Long-Term Forest Licenses in Belize." (page 139).

3. As is broadly recognized, non-permitted and non-regulated regulated resource extraction by local communities has been taking place for many years – in some instances since prior to the establishment of the Reserve. Such ad hoc resource extraction, recognized at least in part by the Supreme Court of Belize, does not facilitate monitoring to ensure sustainability, nor necessarily equitable access to those resources. In line with the TOR for the Plan, considerable effort was expended on community consultations to develop an understanding of the need and benefits

resulting from regulation of current and future resource extraction by stakeholder communities. This concept received the backing of 10 out of 11 of the stakeholder communities, and was strongly endorsed and encouraged by Darrell Novelo, the attending Forest Officer.

4. Consultations were held with Wayne Bardalez of Atlantic Industries Ltd., and with stakeholder communities about AIL. Furthermore, AIL and another potential applicant for a LTFL requested that the Plan make recommendations regarding which company should be awarded a license. Evaluation of the role and TOR of the Plan supported making recommendations relating to how such a license should be awarded (including requirements to "follow the principles of the Code of Practice for Timber Harvesting for Long-Term Forest Licenses in Belize"), but not on which applicant should be awarded it. The consultants recognized that such decision-making is the role of the CFO.

5. Agreed. Recommendations and mapping are included in the Plan as to the overall areas that should be zoned for a LTFL (page 138). The requirement to delineate boundaries of each of the annual compartments within these overall areas is seen as being a central activity within the development of the Sustainable Forest Management Plan as required under the recommendations of this Plan, and that this and a concrete forest inventory should be completed before an Annual Plan of Operations can be prepared. These actions do not fall within the TOR of this Plan, and are beyond its scope. If the Forest Department feels that this delineation should be highlighted as a separate activity (page 140), then it can be added.

6. Valid discussion – though following that line of argument the initial annual logging compartments were also too small to be commercially viable – which is not supported by the consultations with past concession holders. The Plan sought to reach workable compromises that would be acceptable to the various stakeholder sectors, in which it succeeded. The two options re. 40 x 375 ha versus 30 x 500 ha compartments reflect the potential conflicts between commercial viability and biological sustainability. As noted (page 140) by van der Hout, the 40 year cycle was based on conservative estimates of tree growth – the implication being that a shorter-term cycle *may* be sustainable. The two options are therefore presented for the Forest Department to determine which is the preferred option. A third alternative, not presented in the Plan, would be for a LTFL to be issued covering two forest reserves, thereby increasing the qualifying land available for sustainable timber management. If the Forest Department would like this third option to be included within the Plan, in line with the recommendations of the NPAPSP regarding consolidation of management units, then it can be included.

7. This will be added to the Plan, as it was developed in order to make the recommendations.

8. i. Fire: The development of a fire management plan can be added to the 7 strategies designed to tackle the threat of fire – some of which would then become actions within that strategy.
ii. Dereservation: Noted, wording will be amended to better reflect that.

iii. Indeed, any such actions can *only* be implemented in collaboration the Institute of Archaeology. This was taken as an accepted fact, but will be added for clarification.
iv. Given the challenges facing bi-national collaboration and activities to reduce transboundary incursions, it is the conclusion of the Plan that these are better tackled at a higher level than by the site management of CRFR. As such, strategies developed are focused on supporting current and proposed system-level initiatives that include such bi-national activities – in particular strategy 2: **"**Actively support and participate in current multi-agency collaboration within the Maya Mountains Massif for synergized approach to increased enforcement along border with Guatemala". If Forest Department would prefer such activities to be brought to site-level management planning, then a specific strategy in that direction can be added.

9. The clarification will be made. It is agreed that a management objective is sustainable timber extraction, and that a post-hurricane regeneration / restoration period is needed in some areas to allow that. The re-designation of the timber extraction areas, and order of harvesting, is recommended in that direction. Text will be amended to more clearly state this.

10. Agreed. Text will be amended to include concessions being awarded in consultation with the proposed CRFRMC.

11. It is recognized that oversight of the monitoring and management of the proposed Sustainable Traditional Natural Resource Use areas will require additional resources than the Forest Department currently has – this is reflected in strategy 3: "Seek funding to support community managed resource use areas". The need to have a structured and approved plan to govern such extraction is encompassed in strategy 1: "Development and approval of Sustainable Traditional Natural Resource Use Management Plans and regulations per community use area, to include initial assessment of resources present".

12. Agreed, and inserted (page 140).

13. Agreed, and inserted (page 143).

14. The resources to manage the Reserve will depend on many factors, many beyond the scope and capacity of the Forest Department alone. The development of the various collaborative partnerships (e.g. with LTFL holders, stakeholder communities, the BDF, etc.) will be critical to the development of effective management of CRFR. The incorporation of concrete steps towards the integration of regulated traditional resource use, and the support of the majority of local stakeholder communities is attractive at national, regional and international levels – and should provide access to financing that would not otherwise be available. The sourcing of such funding streams would be the responsibility of the proposed CRFRMC, with the presumption that an appointed NGO lead/facilitating agency would source initial seed funds.

15. The establishment and deployment of the proposed system-level specialist Enforcement Task Force of the BDF would require additional financing over and above that currently allocated for the BDF. Given the enormity of the impacts of trans-boundary incursions on Belize's natural resources within the MMM, the economic losses to the Country, and the implications on the Belize / Guatemala Differendum of lack of convincing and concrete actions by GoB to deter such incursions, the financing of such a unit by GoB should be a national priority. Additionally, international NGOs have, and still, discuss financing such an initiative – if appropriate political will is demonstrated. That will is not yet evident in either of Belize's mainstream political parties, and must therefore be lobbied for at all levels: without it neither governmental nor private sector funding will be available.

As per our contractual agreements with the Ya'axche Conservation Trust, we will submit the draft "Strategic Management Plan" to Ya'axche and to the Forest Department with these current revisions and additions, but are happy to make further amendments if you see the need.

Best regards,

Paul Walker.