



**A Technical Assessment of
Threats and Opportunities
of the Maya Mountains Massif**
April, 2008



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Acknowledgments

Over 100 participants took part in this Technical Assessment...and we would like to thank all of them - those who participated in the CAP workshops, associated technical meetings, community meetings and RAPPAM process - for ensuring that this output is as accurate as possible, based on the data available.

In particular, we would like to thank the other members of the Core Planning Team for their continued support and input:

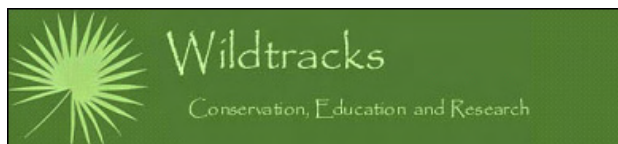
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...those community, public and private sector individuals who contributed towards the outputs of the RAPPAM and CAP Threat Assessment and Situation Analysis workshops.

...and, as always, Adam Lloyd, for producing the maps

A full list of participants is included within the **Summary – A Technical Assessment of the Maya Mountains Massif** report



Technical Assessment of the Maya Mountains Massif – Threats and Opportunities Prepared by:
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A Technical Assessment of Threats and Opportunities of the Maya Mountains Massif

Introduction

This report is one of a series of five produced for the **Forest Department** of Belize and **The Nature Conservancy** (Belize), and summarise the current knowledge and status of the Maya Mountains Massif, and provide recommendations towards more effective management through system-level direction, strategies and programmes:

1. Summary – A Technical Assessment of the Maya Mountains Massif System
2. Management Capacities within the Maya Mountains Massif System
3. A Technical Assessment of the Biodiversity of the Maya Mountains Massif System
4. **A Technical Assessment of the Threats and Opportunities of the Maya Mountains Massif System**
5. Socio-Economic Analysis of the Maya Mountains Massif System

The **Technical Assessment of Threats and Opportunities of the Maya Mountains Massif** uses both the Conservation Action Planning process (TNC, 2007) and the RAPPAM¹ assessment (WWF, 2003) to assess impacts on the biodiversity of the Maya Mountains Massif, identifying critical threats at both site and system level, and providing a means for ranking and prioritization.

It investigates both national and bi-national threats and issues, and develops recommendations based on the outputs of the assessments. This is further strengthened through the inputs from a Situation Analysis stakeholder workshop, which also identified key stakeholders and opportunities linked to the biodiversity and cultural conservation targets, and the threats that impact them.

¹ RAPPAM: Rapid Assessment and Prioritization of Protected Area Management (WWF, 2003)

Contents

Contents

1.0	Conservation Action Planning: Assessment of Critical Threats	1
	1.1 CAP Assessment of Critical Threats	3
2.0	Critical Threats to Biodiversity	7
	2.1 Clearance within the Maya Mountains Massif	7
	2.2 Unsustainable harvesting of xate by illegal Guatemalan xateros	10
	2.3 Subsistence hunting by illegal Guatemalan xateros	10
	2.4 Other Highlighted Threats	11
3.0	Rapid Assessment and Prioritization of Protected Areas Management (RAPPAM) Process	19
	3.1 Introduction	19
	3.2 Critical threats Identified under the RAPPAM process	19
	3.3 Summary of Critical Impacts	24
	3.4 Impacts per Protected Area	26
4.0	Specific Threats to Cultural Targets	31
	4.1 Strategic Responses to threats to Cultural Resources	32
5.0	Situation Analysis	33
6.0	Strategic Recommendations	44
Annexes	Annex One: Calibrated RAPPAM Assessment Form	
	Annex Two: RAPPAM Results per impact	
	Annex Three: CAP Threat Assessment	

Maps

Map 1	Agricultural Incursions into the Maya Mountains Massif	9
Map 2	Land Clearance for Agriculture, adjacent to Cockscomb Basin Wildlife Sanctuary	13
Map 3	Connectivity indicators for the Maya Mountains Massif	15
Map 4	Connectivity over the Hummingbird Highway (Sibun Forest Reserve to Manatee Forest / Runaway Creek / Peccary Hills)	16
Map 5	Connectivity over the Western highway (Manatee Forest / Runaway Creek / Peccary Hills to Rio Bravo)	17
Map 6	Contiguity with broadleaf forest in Complejo III, Guatemala	18
Map 7	Dam inundation areas within the Maya Mountains Massif	21

Figures

Figure 1	RAPPAM Scope of Pressures and Threats across the protected areas of the Maya Mountains Massif System	22
Figure 2	Combined, Averaged 'Degree of Pressure and Threat' Averaged Scores per Protected Area within the Maya Mountains Massif systems	26
Figure 3	Major Pressures / Threats on the five most impacted protected areas of the Maya Mountains Massif system (RAPPAM Assessment, 2007)	28
Figure 4	Comparison of 'Degree of Pressure and Threat' Averaged Scores per Protected Area within the Maya Mountains Massif systems (RAPPAM Assessment, 2007)	29
Figure 5	Major Pressures / Threats per Protected Area Category	29

Tables

Table 1	Summary of Critical Threats	24
Table 2	Summary of major pressures and threats on the five most heavily impacted protected areas (RAPPAM Assessment, 2007)	27

1.0 Conservation Action Planning: Assessment of Critical Threats

Introduction

Mesoamerica has been recognised under several recent ecoregional planning initiatives as one of the richest biodiversity areas on this planet, ranking second only to the tropical Andes in terms of diversity and endemism (CEPF, 2004). Despite contributing only one percent to the world's terrestrial land area, Mesoamerica is thought to have seventeen percent of all known terrestrial species, with the highest diversity recorded globally for reptiles and second highest for amphibians (CEPF, 2004). This species richness and diversity is due in part to the geological history of the area, forming a transition zone between three biogeographically distinct regions – the Nearctic, Neotropical and the Caribbean.

Whilst Belize, with its relatively low topography, lacks many of the endemic species found in high altitudes in the adjacent highland areas of Guatemala, Honduras and Mexico, it is regionally important in its role in maintaining viable populations of many species considered threatened throughout their range, and providing a critical landscape function within Mesoamerica as one of only a few remaining large, intact, contiguous forest blocks within the region. The current low human population density and the network of natural ecosystems within the protected areas system has resulted in Belize providing an important service in the maintenance of regional biodiversity.

Several key reports have recently been produced on the biodiversity of Belize – the Protected Areas System Analysis and the Gap Analysis (both conducted as part of the National Protected Areas Policy and System Plan, NPAPSP, 2005), the identification of Key Biodiversity Areas (Meerman, 2007 – draft), and national reports – the National Biodiversity Strategy, the National Protected Areas System Plan and Policy and the findings from the National Biological Corridors Programme. Each of these assessments highlight the critical importance of the Maya Mountains as one of three national priority areas important in maintaining these high levels of biodiversity. The functioning ecosystems and intact natural vegetation with relatively few human impacts; the range of ecosystems over an altitudinal gradient, with connectivity from mountain ridge to the coastal areas and the Belize Barrier Reef, highlighted for its importance for marine conservation in Mesoamerica; and the importance of the environmental services – the watershed functions, the carbon sequestration functions, the hydrological processes – all add to the importance of these protected areas. Also recognised is its importance as a regional priority under The Nature Conservancy ecoregional planning, and as part of the Selva Maya Corridor identified under the CEPF ecoregional planning for northern Mesoamerica as the second largest contiguous area of tropical rainforest in the Americas, after the Amazon (CEPF, 2004).

The presence of large numbers of jaguars, considered until recently to be at natural carrying capacity within the protected areas system, suggests that the trophic structure has remained largely intact, with viable populations of prey species. This, however, is changing as pressures, particularly from Guatemala, for natural resources and land drives inhabitants from border

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Critical Threats Assessment 17th July, 2007

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communities to enter Belize, through much of the remote Chiquibul and Columbia River forest regions, and harvest these resources to the point of depletion. Increased population pressures and higher levels of poverty within the Belize southern coastal plain communities of Toledo District, are also identified as resulting in a high dependence on the natural resources of the Maya Mountains Massif, with low incomes, low employment opportunities, poor access to education and reliance on subsistence agriculture, being highlighted as primary causes.

Also of importance are the archaeological and cultural resources of the Maya Mountains Massif - in general, the Maya Mountains Massif represents one of the most poorly studied archaeological regions of Belize, as a result of poor accessibility, the rugged nature of a great part of the terrain, and the challenging logistics to conduct archaeological research in this mountainous region. However, current knowledge suggests that the area was once important to the Maya, with the establishment of Caracol, a major site thought to have been occupied from about the end of the Middle Preclassic period (400 B.C.) through to the Terminal Classic 800-900 A.D., covering more than 25 square kilometers (Chase and Chase, 2001). Satellite communities such as Minanha also sprung up in the more fertile areas of the system, with associated agricultural terracing. Cave systems of ceremonial significance still contain artifacts placed there by the ancient Maya. The more rugged, less fertile areas were also considered to be important for a variety of raw materials that were exploited by the ancient Maya, including vast deposits of granite, volcanics, volcanoclastics, mudstone, siltstone, limestone, pyrites, slate and hematite for mirrors; high quality clays for ceramics; and a host of other minerals for pigments. This considerable resource diversity provided 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.

In more recent times, however, there have been an increasing number of impacts on the Maya Mountains Massif, despite the rugged terrain and remoteness. The assessment of critical threats took part in two phases – first as part of the **Rapid Assessment and Prioritization of Protected Areas Management (RAPPAM)** developed under the WWF's Forests for Life programme (WWF, 2003). This provided an in-depth assessment of site-specific stresses and threats, with input from protected area managers, co-managers and local stakeholder participants, analysing how impacts differ in scope and severity across the system. This then fed into the landscape-scale assessment of threats to the Maya Mountains Massif as a system, using the **TNC Conservation Action Planning process**, through the CAP2 workshop, held on 17th July, 2007. The TNC CAP processes allows for an analysis of how threats affect the selected biodiversity targets, enabling a prioritization for strategic actions. The two protocols compliment each other's outputs, and together provide a comprehensive view of past, present and perceived impacts to the Maya Mountains Massif.

1.1 CAP Assessment of Critical Threats

The RAPPAM process identified fourteen threats considered critical to at least one of the fourteen protected areas of the Maya Mountains Massif, each being assessed as a ‘**pressure**’ (past impact on the system), and ‘**threat**’ (the future potential impact). Results of pressure and threat occurrence across the system show that five major impacts are considered to be relevant to all the protected areas: **Illegal Hunting, Unsustainable / illegal Xate harvesting, Harvesting of Non-Timber Products (excluding xate), Unsustainable / illegal Logging and Mining / Oil Exploration.**

A summary of the results from the RAPPAM process were presented at the CAP2 workshop, to provide an overview of the site specific threats identified by each of the protected area management and co-management bodies of the Maya Mountains Massif.

The CAP2 workshop focused on the Maya Mountains Massif system as a whole, and assessed stresses and threats at both the technical and site levels, with representation from researchers, forestry, and both protected area management and field staff. The summary results from the planning process provide each conservation target with a threat status rating (Table 1).

Only one conservation element is rated as **Very High**, reflecting the particularly heavy pressure on xate from illegal harvesting for the Guatemalan xate trade:

- **Forest Products**

Four conservation targets are rated as **High**:

- **Pine Forest and Savanna**
- **Aquatic and Riparian Ecosystems**
- **Upper Elevation Amphibians**
- **Subterranean Systems**

The remaining four conservation elements are rated as having a threat status of **Medium** (Table 1).

The CAP process assesses the stress and the source of stress for each conservation target, using the following definitions:

- **Stress** – The impaired aspects of conservation targets that result directly or indirectly from human activities (e.g., low population size, reduced extent of forest system; reduced river flows; increased sedimentation; lowered groundwater table level). Generally equivalent to degraded key ecological attributes (e.g., habitat loss).
- **Source of Stress (Direct Threat)** – The proximate activities or processes that directly have caused, are causing or may cause stresses and thus the destruction, degradation and/or impairment of focal conservation targets (e.g., logging).

Conservation Action Planning Assessment of Critical Threats for the Maya Mountains Massif (CAP2)

Conservation Target Threat Status:

Very High

- Forest products (including xate)

High

- Pine forest and savanna
- Aquatic and riparian ecosystems
- Upper elevation amphibians
- Subterranean systems

Medium

- Broadleaf forest
- Jaguar
- Archaeological Sites
- Aesthetic landscapes

Critical Threats

- Forest clearance within the Maya Mountains Massif (illegal agricultural incursions and settlement, dam inundation and road construction)
- Unsustainable harvesting of xate by illegal Guatemalan xateros
- Subsistence hunting by illegal Guatemala xateros

Medium Threats

- Fire
- Hydroelectricity systems
- Climate change
- Environmental pollution
- Southern Pine Bark Beetle
- Chytrid fungus
- Unsustainable harvesting of xate – Belize concession holders
- Land use change in adjacent areas
- Looting and vandalism

Overall threat status: High

Rating Criteria for Stresses

Severity - The level of damage to the conservation target that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

- **Very High:** The threat is likely to destroy or eliminate the conservation target over some portion of the target's occurrence at the site.
- **High:** The threat is likely to seriously degrade the conservation target over some portion of the target's occurrence at the site.
- **Medium:** The threat is likely to moderately degrade the conservation target over some portion of the target's occurrence at the site.
- **Low:** The threat is likely to only slightly impair the conservation target over some portion of the target's occurrence at the site.

Scope - The geographic scope of impact on the conservation target at the site that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

- **Very High:** The threat is likely to be widespread or pervasive in its scope and affect the conservation target throughout the target's occurrences at the site.
- **High:** The threat is likely to be widespread in its scope and affect the conservation target at many of its locations at the site.
- **Medium:** The threat is likely to be localized in its scope and affect the conservation target at some of the target's locations at the site.
- **Low:** The threat is likely to be very localized in its scope and affect the conservation target at a limited portion of the target's location at the site.

Rating Criteria for Sources of Stress

Contribution - The expected contribution of the source, acting alone, to the full expression of a stress (as determined in the stress assessment) under current circumstances (i.e., given the continuation of the existing management/conservation situation).

- **Very High:** The source is a very large contributor of the particular stress.
- **High:** The source is a large contributor of the particular stress.
- **Medium:** The source is a moderate contributor of the particular stress.
- **Low:** The source is a low contributor of the particular stress.

Irreversibility - The degree to which the effects of a source of stress can be restored.

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

TNC, 2007

Outputs from the CAP2 workshop assessed threats and provided a means of prioritization of conservation actions and resources towards those impacts identified as critical threats. This was achieved through analyzing the stresses in terms of scope and severity, and the sources of stress through assessment of contribution and irreversibility.

Three critical threats, were identified, being rated as **High** using the CAP process:

- **Forest Clearance within the Maya Mountains Massif (Illegal agricultural incursions, and settlement, dam inundation, and road construction)**
- **Unsustainable harvesting of xate by illegal Guatemalan xateros**
- **Subsistence hunting by illegal Guatemalan xateros**

Table 1: Summary Results Threats Across Targets 1 - 15		Broadleaf Forest	Pine Forest and Savanna	Aquatic and Riparian Systems	Upper Elevation Amphibians	Forest Products	Jaguar	Archaeological Sites	Aesthetic Landscapes	Subterranean Sites	Overall Threat Rank
1	Forest clearance within MMM (Agricultural Incursions / Dams etc.)	Low	High	Medium	-	Very High	Medium	Low	Low	-	High
2	Unsustainable harvesting - illegal Guatemalan xateros	-	-	-	-	Very High	-	-	-	-	High
3	Subsistence hunting (xateros)	High	-	High	-	-	Medium	-	-	-	High
4	Fire	Low	High	Medium	-	-	-	-	Low	Low	Medium
5	Hydroelectricity systems	-	-	High	-	-	-	Low	-	-	Medium
6	Changes in weather patterns (Climate change)	-	-	-	High	-	-	-	-	-	Medium
7	Environmental pollution	-	-	-	High	-	-	-	-	-	Medium
8	Pests and diseases - Southern Pine Bark Beetle	-	High	-	-	-	-	-	-	-	Medium
9	Pests and Diseases - Chytrid Fungus	-	-	-	High	-	-	-	-	-	Medium
10	Unsustainable harvesting - Belize xate concession holders	-	-	-	-	High	-	-	-	-	Medium
11	Land use change in adjacent areas (human settlements, farming, trails etc.)	Medium	-	-	-	-	Medium	-	Low	-	Medium
12	Looting and vandalism	-	-	-	-	-	-	Medium	-	Medium	Medium
13	Local hunting	Low	-	Medium	-	-	Low	-	-	-	Medium
14	Uncontrolled visitation	-	-	-	-	-	-	Low	Low	Medium	Low
15	Unsustainable and Illegal logging	Low	Medium	-	-	Low	-	-	-	-	Low
16	Roads / infrastructure	-	-	-	-	-	-	Low	Medium	-	Low
Threat Status for Targets and Project		Medium	High	High	High	Very High	Medium	Medium	Medium	Medium	High

Threats Across Targets 16 – 21 (continued)		Broadleaf Forest	Pine Forest and Savanna	Aquatic and Riparian Systems	Upper Elevation Amphibians	Forest Products	Jaguar	Archaeological Sites	Aesthetic Landscapes	Subterranean Sites	Overall Threat Rank
17	Mines and minerals - exploration/extraction	-	-	-	-	-	-	-	Medium	-	Low
18	Unsustainable harvesting - Belizean xateros	-	-	-	-	Medium	-	-	-	-	Low
19	Weathering	-	-	-	-	-	-	Medium	-	-	Low
20	Pet trade	-	Low	-	-	-	Low	-	-	-	Low
21	Killing of jaguars in areas of human conflict	-	-	-	-	-	Low	-	-	-	Low
21	Tourism development	-	-	Low	-	-	-	-	-	-	Low
Threat Status for Targets and Project		Medium	High	High	High	Very High	Medium	Medium	Medium	Medium	High

Table 1: CAP2 Output - Summary of CAP Threat Assessment

2.0 Critical Threats to Biodiversity

2.1 Clearance within the Maya Mountains Massif (Agricultural Incursions, Settlements, Dam Inundations)

Agricultural Incursions

Three sources of agricultural incursions within the Maya Mountains were identified:

- ***Large-scale land clearance along the Belize / Guatemala border by communities in the Peten, Guatemala***
- ***Clearance for citrus in the valleys of the Sibun / Sittee Forest Reserves***
- ***Clearance for small scale agriculture in the Vaca and Columbia River Forest Reserve***

Large-scale land clearance along the Belize / Guatemala border

Agricultural incursions along the Belize / Guatemala border by Guatemalan farmers has been an ongoing concern, with 280 acres (110ha) of forest clearance for agriculture being first noted in the Caracol and Rio Blanco areas in 1987. In 1990, incursions spread to within half a mile of Caracol, threatening both the biodiversity and eco-tourism potential – Belize responded, allowing farmers to harvest their crops before removing the farming camps. This was of little deterrent, however, as by 1994, the area cleared for farming had increased to 1,710 acres (690 ha) – a rate of increase of approximately 200 acres per year (FCD, October, 2007).



This trend has continued in more recent years, with considerable large-scale forest clearance for agriculture east of the Adjacency Zone, by farmers from communities in Peten, with at least 13,510 acres (5,470 ha) clearance for agriculture having been identified along the border area, in Caracol Archaeological Reserve, Chiquibul National Park and Columbia River Forest Reserve (FCD, 2007).



Agricultural incursions – illegal farms in Chiquibul National Park (FCD, 2007)

One of the root causes of the problem lies with the land ownership system in Guatemala, with large land holdings preventing small farmers migrating into the area from obtaining land, forcing them eastwards, into Chiquibul. There are also several parcels of land allocated by the Guatemala Government within Belize prior to the current agreements, where land ownership is still to be resolved within Guatemala. The long term border dispute between Guatemala and Belize, and weak governance and law enforcement in the southern Peten area, also exacerbate the situation.

The Belize Defence Force fly over the area on a semi-regular basis, but the information on agricultural incursions takes time to filter down to the management organizations, with a recognized need for better liaison. This has been consistently improving during the time frame of this project, with the recent construction of an Observation Post at Rio Blanco, and an increasing number of bi-national patrols.

The probability of continuing agricultural incursions, (and the often associated logging incursions) is very high, as the farmers have few other options open to them, and there is an apparent unwillingness to protect sovereign rights by the Government of Belize. However, the level of activity should decrease as the area is more effectively monitored, and enforcement activities are actively implemented.

A set of recommended steps were proposed by FCD for restoring the integrity of the Maya Mountains Massif (FCD, October, 2007):

- Establish a permanent presence on the southern edge of the Chiquibul National Park in the Rio Blanco area as soon as possible.
- Obtain a labor force to include civilians to accelerate the destruction of the plantations.
- Maintain the military presence in the area permanently, and include representation from the police
- Upgrade the road so as to facilitate entrance of military personnel and ranger presence to Rio Blanco area for monitoring and surveillance.
- Request OAS for assistance in becoming more proactively involved with the community members of Monte Los Olivos in regards to Governments position of “no tolerance”.
- Institute more serious fines for any illegal Guatemalans found in the area in order to demonstrate the firm steps being taken by the Government of Belize.
- Request CONAP for assistance in informing the community members of the infractions and the fines that can be imposed upon them under their participation in the bi-national workplan.

The majority of these recommendations are already being implemented.

Clearance for citrus in the valleys of the Sibun / Sittee Forest Reserves

The Sibun and Sittee River Forest Reserves are both highlighted as critical management gaps (RAPPAM, 2007), and are subjected to increasing pressure from agricultural incursions, as citrus plantations spread into the fertile river valleys. With no on-site management presence, no long-term management plans and few incentives for maintaining these two protected areas in their entirety, the boundaries are gradually being realigned to allow for the citrus incursions, despite the critical nature of Sibun Forest Reserve for connectivity of the Maya Mountains Massif with the Selva Maya forest block to the north.

Clearance for small-scale agriculture in the Vaca and Columbia River Forest Reserve

Politically-motivated pressure for land has resulted in land allocations within the Vaca Forest Reserve, following the increased ease of access with the construction of a road to the Mollejon Dam. Watershed integrity has been compromised with clearance to the edge of the Macal River. Allocations such as these are normally followed by dereservation of those parts of the protected area

Large Scale Land Clearance along the Belize / Guatemala border

Chiquibul National Park

- 7,725 acres (3,126 ha)
 - Monte los Olivos
 - Nueva Armenia
 - Las Flores del Chiquibul

Vaca Forest Reserve

- 4,000 acres
 - El Rondon
 - Arenal
 - Nuevo Paraiso

Caracol Archaeological Reserve

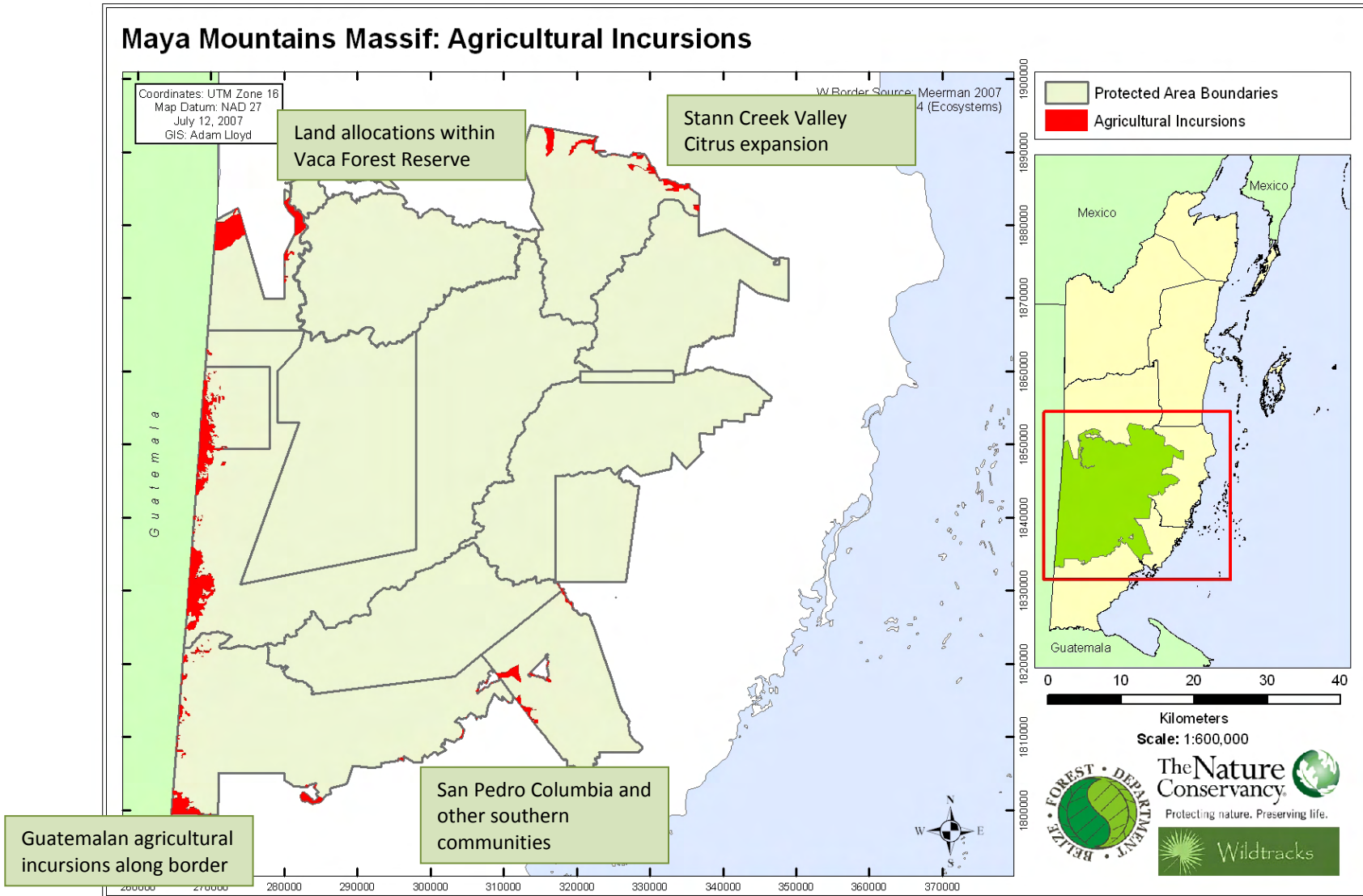
- 3,300 acres (1,337 ha)
 - El Retiro
 - Nuevo Paraiso

Columbia River Forest Reserve

- 2,485 acres (1,006 ha)
 - El Retiro
 - Nuevo Paraiso

These figures are based on mapping of the total agricultural landscape – areas cleared for agriculture on a rotational basis, and adjacent forest impacted by agricultural fires.

Data from FCD, October, 2007; Meerman, 2007.



Map 1: Agricultural Incursions into the Maya Mountains Massif

2.2 Unsustainable Harvesting of Xate by Illegal Guatemalan Xateros

Illegal harvesting of xate leaves (*Chamaedorea ernesti-augusti*) and the associated hunting and looting activities, have become significant impacts on the biodiversity and cultural resources of much of the western portion of the Maya Mountains Massif. Reports from Guatemala suggest that harvesting of xate started as early as 1972, in the Rio Blanco area. Large scale xate harvesting is thought to have started in the Chiquibul in 1995, with xateros first being recorded in the Ceibo Chico area in 1996. By 2000, the number of xateros is considered to have leveled off, with between 1,000 and 1,500 xateros operating in the area since then.



Xate being transported in Chiquibul (Las Cuevas)

The pressure comes primarily from Guatemala, where the US\$6.2 million xate industry has been active for over 40 years, and is well established (IRG-USAID, 2006), providing palm leaves for the cut flower industry in the United States and Europe (Bridgewater et. al. 2006). On the Guatemala side of the border, xate populations have been significantly reduced through over-exploitation, exacerbated by the clearance of forest for large scale cattle ranches, encouraging xateros to cross the border and harvest in Belize's forests.

Xateros are considered to be active throughout the Chiquibul area (National Park and Forest Reserve), where xate is present, (N. Uck, CNP)

The professional xateros are known to divide the area into sections, and rotate harvesting, in an effort to maintain sustainability. However, many teams are active in the Chiquibul area, and include young people who are just learning the trade, and who will cut more than just the prime leaves, reducing sustainability. Sub-standard leaves are also cut to be added to the bundles to surround and protect the prime leaves, with the result that of a bundle of 40 leaves, possibly 25% or less are of sufficient quality for export.

Recovery time is considered to be relatively fast, with leaves re-growing in about 3 months after harvesting, if they are left to recover. However, viability of xate plant populations is considered to be heavily impacted by harvesting of seeds and, more recently, seedlings, for sale to xate plantations in Guatemala (FD, CONAP, 2007).

2.3 Subsistence Hunting by Illegal Guatemalan Xateros

Hunting in the Chiquibul forest is primarily linked to xatero activity (though a small number of sport hunters did at one time come into the area from San Ignacio using the logging trails, primarily during dry season). It is thought that the current pressure on game species from xatero activity is driving the wildlife further toward the mountainous areas in the south and east (C. Rosas, CNP), and reductions in white-lipped peccary (*Tayassu pecari*) populations - a primary game species - have been noted, with



Scarlet macaw feathers in xatero camp area, Chiquibul NP (FCD)

populations in the Chiquibul area being reported to be estimated at 10% of former levels (N. Bol, Las Cuevas). This fall in numbers is also reflected in camera trap data, which indicates a sharp decline in white-lipped peccary trap events between 2002 and 2003 (M. Kelly), though until further data is available, it would be difficult to attribute this solely to xatero activity, as long-term migrations are also thought to occur by this species (Fragoso, 2004). Similar patterns are also being noted in other species, including jaguar, with an estimated decrease in jaguar densities (M. Kelly, pers. com.).

A number of species not traditionally hunted within Belize are also at risk from xateros – remnants of parrots have been reported from xatero

campsites, including scarlet macaw (*Ara macao*) feathers, a species of national concern, with a population considered to be between 150 and 200 individuals (Jones, 2003; Gentle, pers. com., 2007), the endangered Baird’s tapir (IUCN, 2007) and the regionally vulnerable Spider Monkey (*Ateles geoffroyi ssp. yucatanensis*).

2.4 Other Highlighted Threats

Mining / Oil exploration/extraction

Of the entire area of the Maya Mountains Massif, the intrusive and meta-sedimentary rocks of the Maya Mountain Divide, bounded by volcanics to the south and Upper Cretaceous limestones to the north, are highlighted as of the greatest potential mineral interest, with the coastal plain Deep River Forest Reserve identified as the only potential petroleum exploration area (Table 7; Geology and Petroleum Department, pers. com.).

There has historically been a significant lack of communication and cohesive planning policies within the Ministry of Natural Resources, with extractive mining being permitted within a National Park which, under the National Protected Area System legislation, cannot be used for extractive purposes. Whilst identified here as a threat, mineral and oil exploration should also be recognized as an opportunity when identifying financial sustainability mechanisms.

Geology and Petroleum Department Mission Statement To accelerate the development of Belize’s non-renewable resources through the creation of vibrant Mineral and Petroleum Sectors, with the assistance of private, national and international investors, cognizant of environmental costs, thereby improving the welfare of Belizeans into the 21st Century	Protected Area Name	Value	Mineral Resources
	Sibun Forest Reserve	Low	Aggregate extraction
Vaca Forest Reserve	Low	Dimension stone – granite, gneiss – metamorphic. Tiles, countertops etc. Limited information on minerals - potential for some minerals	
Chiquibul National Park	High	All minerals, gold, lead, zinc, base metals, heavy metals...need to be inventoried. Steeper slopes. Intrusions, igneous areas. Lower areas not as interesting	
Chiquibul Forest Reserve	High		
Maya Mountain Forest Reserve	Unknown		
Bladen Nature Reserve	High	Heavy metals, base metals. Little information available	
Victoria Peak Natural Monument	Unknown		
Sittee River Forest Reserve	Low	Fill materials – clays, metasedimenta	
Columbia River Forest Reserve	Unknown	Little Quartz Ridge – base metals, heavy metals?	
Cockscomb Basin Wildlife Sanctuary	Unknown		
Caracol Archaeological Reserve	Low		
Deep River Forest Reserve	High	Petroleum. Low for sand. Not draining anywhere that has interesting aggregates	
Mountain Pine Ridge Forest Reserve	High	Handicraft slate, garnets, semi-precious stones, dimension stone, barite (very dense, used in drilling muds, fillers etc., some ceramic industries. Handicraft industry – slate - because of accessibility. Artisanal extraction	
Noj Kaax Me’en Eligio Panti			

Table 7: Protected Area Value for Mineral and Petroleum Resources (Data: Geology and Petroleum Department, 2007)

(96 acres), which has recently been renewed for another 5 years, and extended in September, 2007, to cover 160.25 hectares (396 acres), to give the mining company mining rights to the total area of alluvial fan associated with the Ceibo Chico drainage system.

Current exploration methods are considered of low footprint and moderate impact, with digging and sifting of alluvial soils. The relatively small pits created are refilled with the sieved soil, sediment load in the river is minimised where possible, and no chemicals are reported to be used in the sieving process (Moore, pers. com.). A 2 km wide zone in the upper area of the drainage system is thought to contain the host rock for the residual gold in the drainage system (Erin Ventures, 2007), and the most recent amendments to the mining license allow for open pit and underground mining of any lode deposit discovered, following approval from the Department of Geology and Petroleum of detailed mining plans.

To date, residual gold has been recovered in both the Ceibo Chico drainage and the Chiquibul drainage, which runs parallel, 2 km to the north. Down river, in Guatemala, gold extraction from the Chiquibul River is also currently being conducted. It is expected that gold prospecting in the Ceibo Chico area of the National Park will continue to be an ongoing activity, though the level of impact may well become much higher if exploration activities result in the location of the main source vein, the aim of current efforts.

Also of concern is the widening and upgrading of the old logging track into the Ceibo Chico area from the Caracol Road, increasing accessibility to the Chiquibul Forest area (both the National Park and the Forest Reserve), and acting a barrier to some deep forest species, fragmenting the broadleaf forest node.

Exploration permits were also granted to three other companies for 2004 (Allied International Minerals Ltd., Orion Ltd., and Pan African International Co. Ltd.) for the Chiquibul area, (Anderson, U.S. Geological Survey Minerals Yearbook - 2004), and a recent application for mineral prospecting across the Maya Mountains Massif has been submitted with particular interest in Little Quartz Ridge, within the Columbia River Forest Reserve.

Oil Exploration

Whilst the terrain and geology of the majority of the Maya Mountains Massif is unsuitable for petroleum extraction, Deep River Forest Reserve, the only protected area to lie within the southern coastal plain, is encompassed within the oil prospecting concession of US Capital Energy Belize Ltd (Figure 2). Whilst current seismic survey activities are limited to the most southerly portion of the concession area, the potential for oil extraction throughout the concession area, including the southern portion of Deep River Forest Reserve, cannot be ignored.

Gold Production in the Chiquibul

Erin Ventures - 2007 Update

- Commercial-scale gold recovery commenced in October, 2007
- Production goal is 28,000 cubic yds of material per month
- Recovery rates average 0.48 gram of Au/cubic yds, worth US\$11.26 (at US\$730/ounce Au)
- Direct recovery costs average approx. US\$1.96/cubic yds
- Pre-production trials of gold dredge recovered 448.8 oz of raw gold
- 751.3 oz of raw gold has been recovered in total since exploration began
- Exploration is underway to establish drill targets within the 2 km wide zone that appears to be the host for the alluvial gold being recovered

Total Gold Recovered: 751.3 ounces

www.erinventures.com, 2007

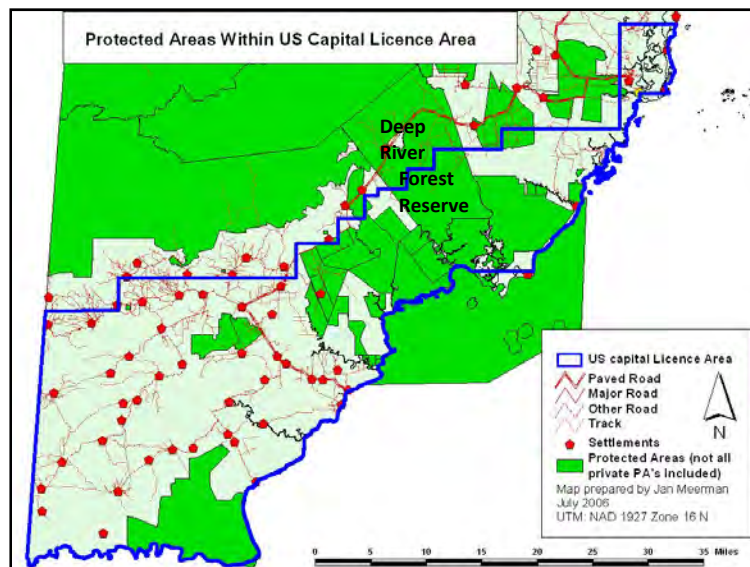
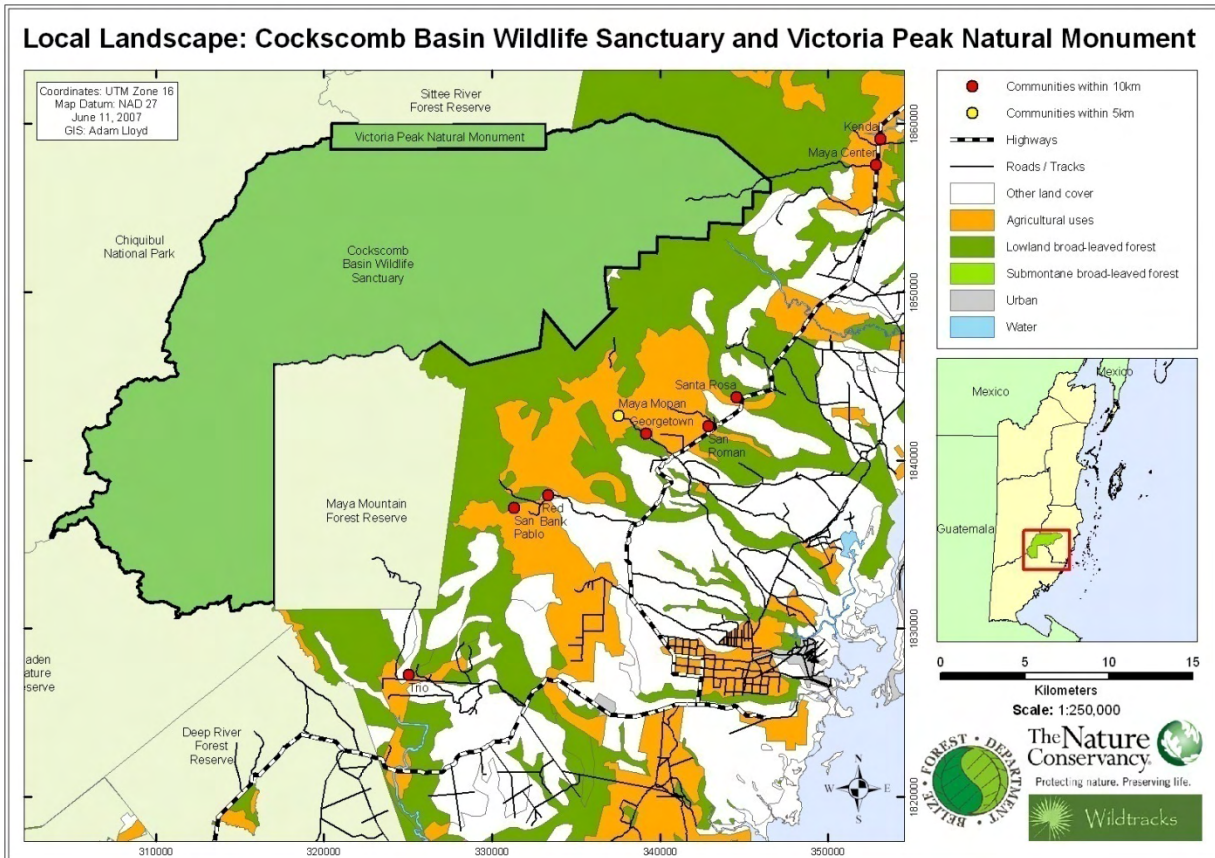


Figure 2: US Capital License Area (Adapted from Meerman, 2006)

Adjacent Land Use Change

Whilst land clearance is generally outside the protected areas, it has an impact on the state of the biodiversity within the boundaries, removing the buffer of forest that currently exists, and increasing access for illegal activities. This is occurring along the south / southeast facing boundaries of Cockscomb Basin Wildlife Sanctuary, for example, from Maya Mopan and Maya Centre area, all the way southwards to Trio, where political influence has resulted in dereservation of a portion of the adjacent Maya Mountain Forest Reserve for agriculture. With the limited resources available, logging and other activities in these buffer areas cannot closely monitored, with the high probability that there will be some incursions into the Cockscomb Basin Wildlife Sanctuary, particularly in the more remote southern extension.



Map 2: Land clearance for Agriculture, adjacent to Cockscomb Basin Wildlife Sanctuary

Fragmentation of Broadleaf Forest Connectivity

Whilst the broadleaf forest ecosystems of the Massif are believed to be generally sufficient in scope to fulfill minimum dynamic area requirements for long-term viability, and therefore for most species in the area, in isolation, it is considered too small to maintain long-term viability for some landscape-scale species – including the jaguar. Both the Conservation Action Planning workshops and technical meetings during the Conservation Action Planning process highlighted the importance of broadleaf forest connectivity, particularly for the larger, wide-ranging species indicative of the trophic integrity and health of the tropical forest ecosystem, that require large expanses of unfragmented forest for long term biodiversity viability.

Broadleaf forest connectivity from the Maya Mountains Massif outwards was investigated, both into the southern coastal plain and northwards into the Manatee / Peccary Hills node, and on from there into the Rio Bravo /Gallon Jug area of the Selva Maya. As this is a binational project, and as biodiversity doesn't recognize borders, broadleaf forest connectivity was also examined with the Guatemalan Complex III: Reserva De Biosfera Montañas Mayas/Chiquibul, to the west of the Maya Mountains Massif. Connectivity westwards through Complejo III in Guatemala, then northwards towards the Selva Maya has effectively been lost, through large scale forest clearance for cattle.

The Massif also plays a critical core protection area role within the Mesoamerica Biological Corridor and Wildlife Conservation Society's Corridor Initiative, and is now considered the only remaining viable linkage between the Selva Maya forests to the north and the Sierra de Las Minas Biosphere Reserve in southern Guatemala. With the rapid expansion of human footprint in Cayo District north of the Massif, potentially viable biodiversity connectivity remains only to the north-east, through the Manatee Forest Reserve and the Runaway Creek and Peccary Hills private protected areas and the recently designated Peccary Hills National Park.

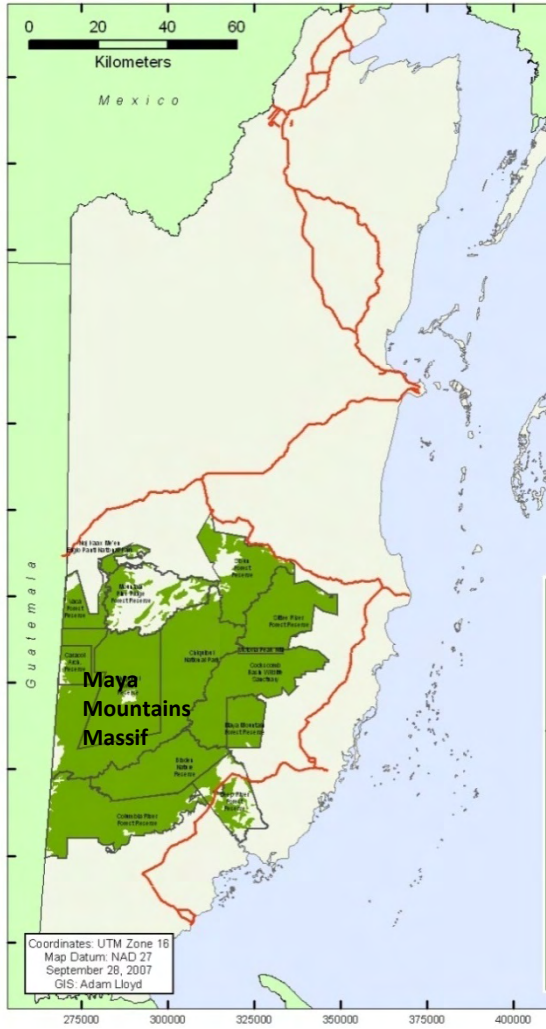
Priority Connectivity Recommendations

Securing the immediate and ongoing viability of this connectivity will entail:

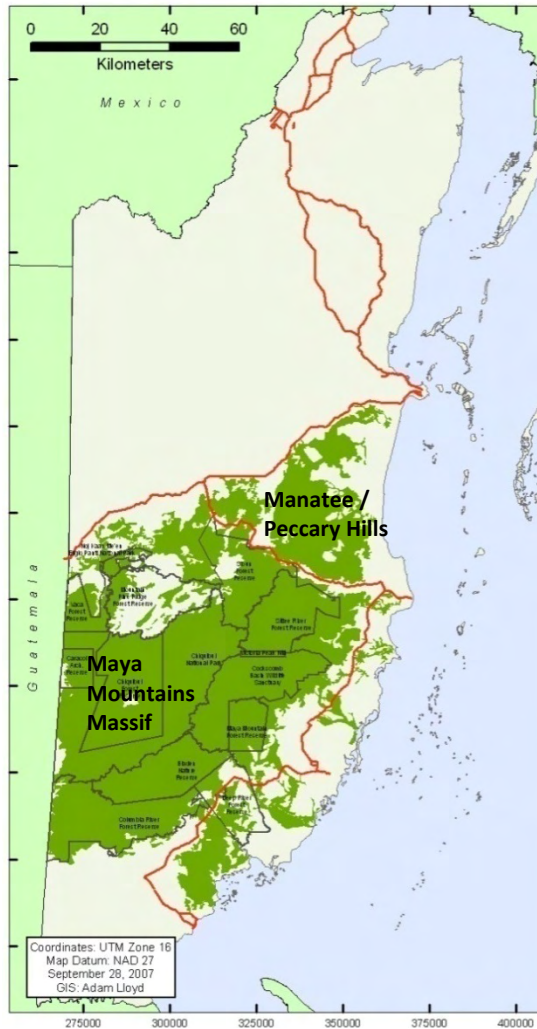
- Maintaining connectivity between the Sibun Forest Reserve and the Manatee Forest Reserve
- Establishing connectivity between the Manatee Forest Reserve and the Runaway Creek / Peccary Hills area
- Strengthening the security of the Peccary Hills as a protected area
- Establishing corridor-compatible management between Runaway Creek/Peccary Hills and the Community Baboon Sanctuary, and from there to Rio Bravo

The two bottlenecks in this linkage identified as critical for the maintenance of broadleaf forest connectivity:

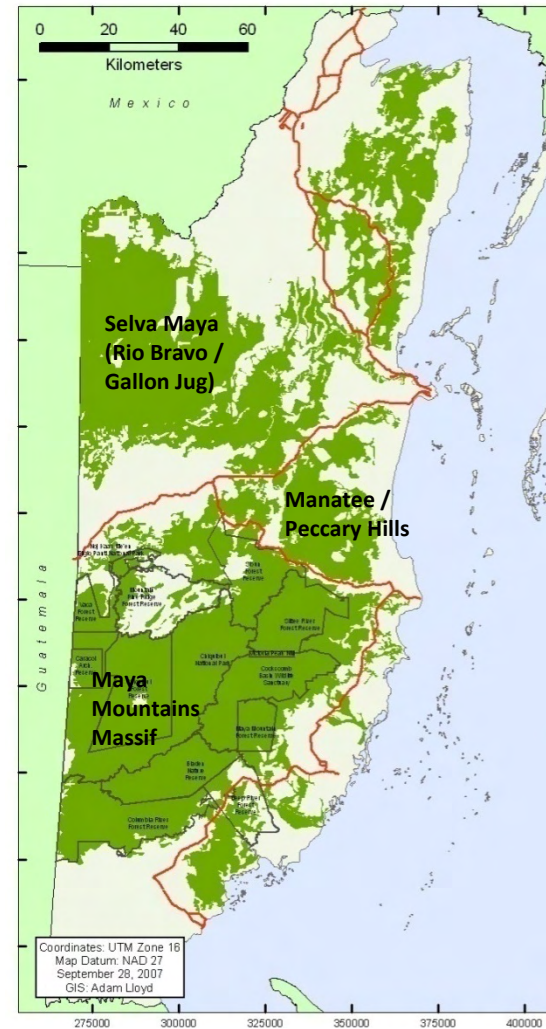
- 1. Sibun Forest Reserve and the Manatee Forest Connectivity across the Hummingbird Highway**
- 2. The Runaway Creek/Peccary Hills connectivity northwards over the Western Highway towards Rio Bravo**



Contiguous Broadleaf Forest of the MMM

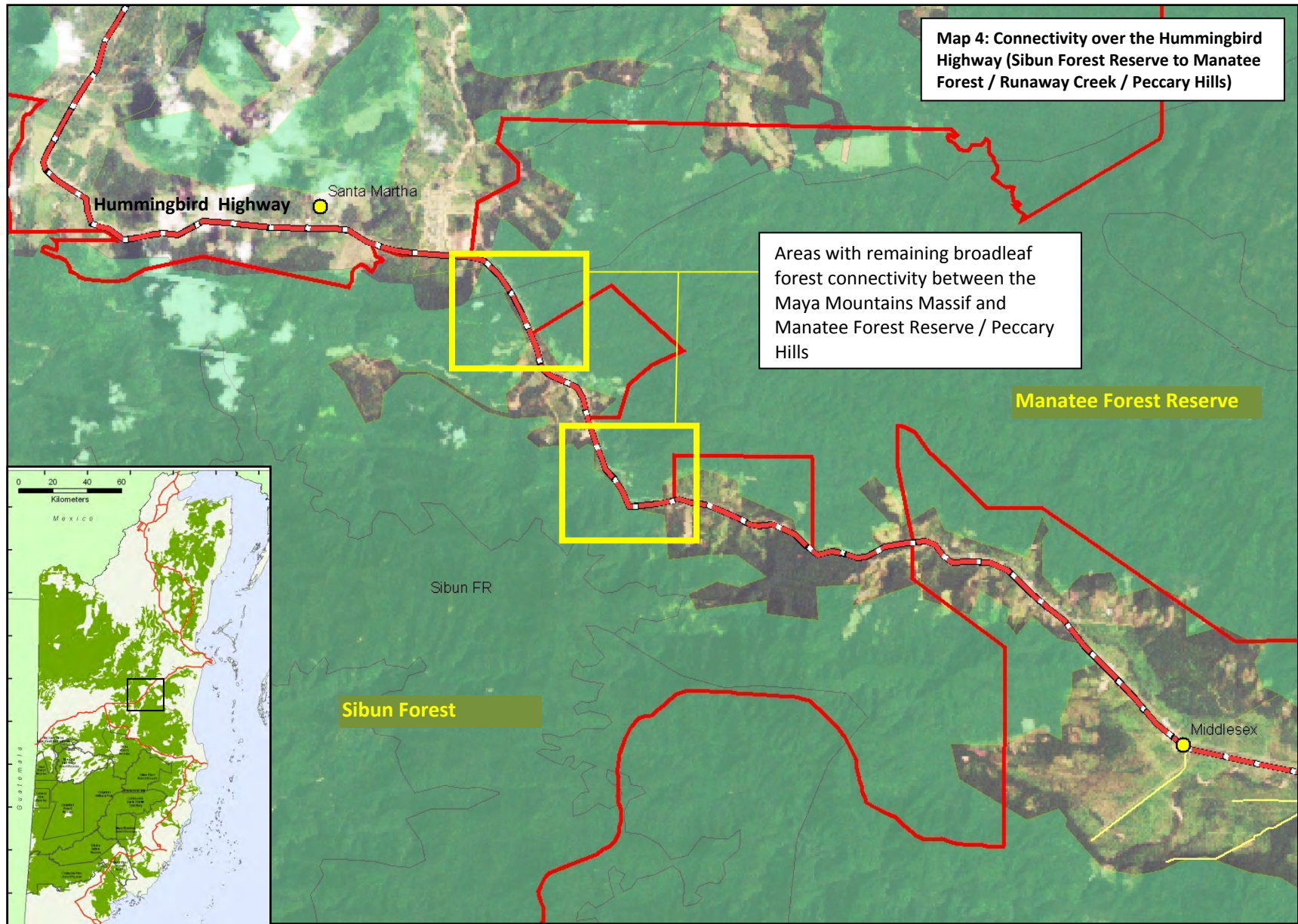


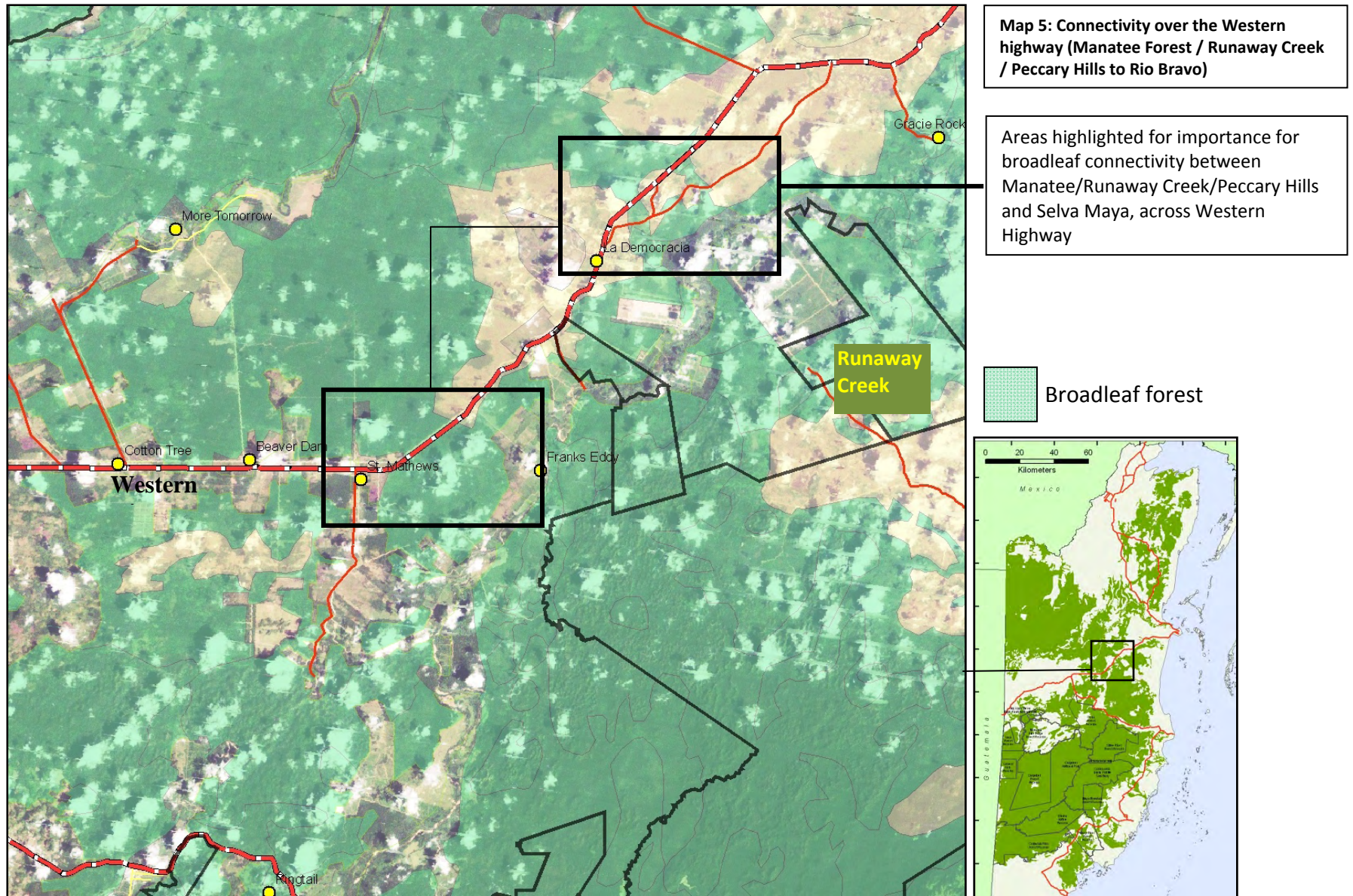
Contiguous Broadleaf Forest allowing for connectivity across <50m non-broadleaf forest gaps

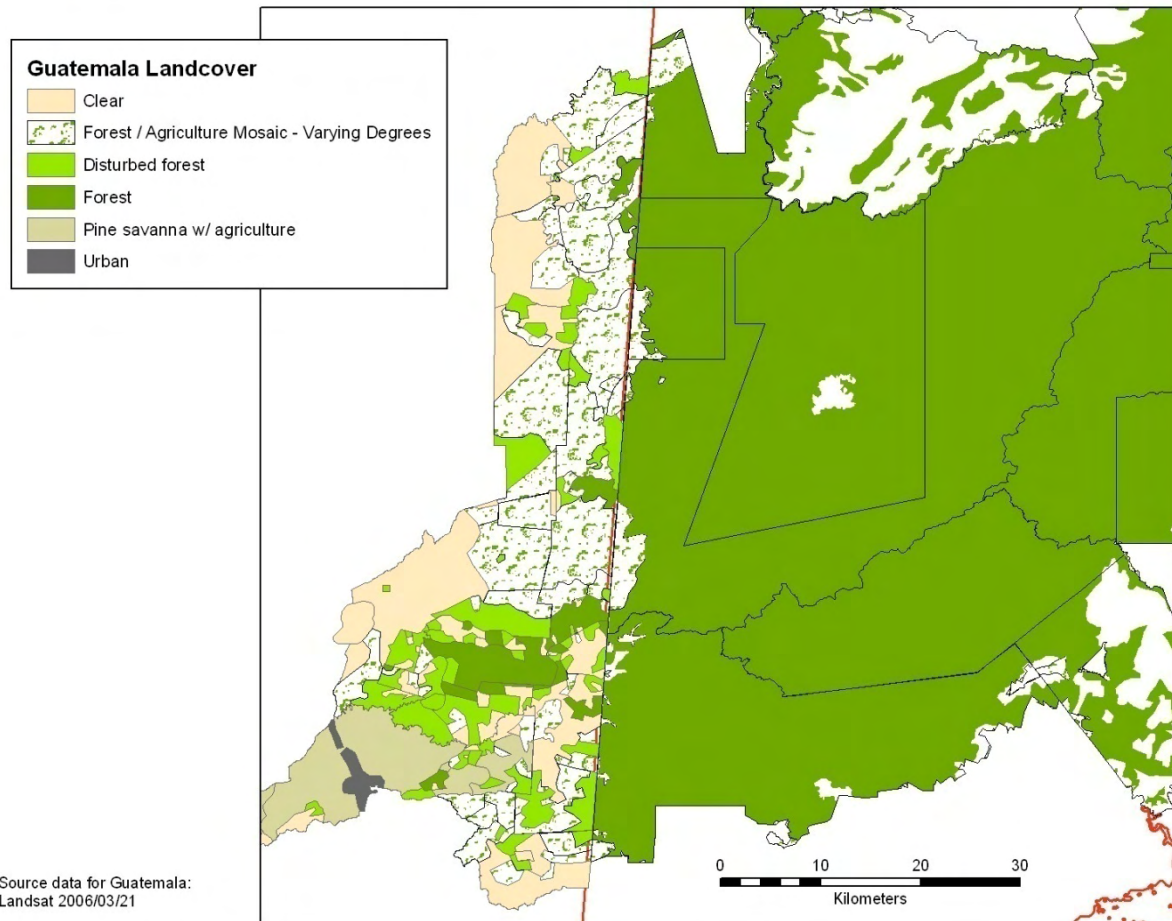


Contiguous Broadleaf Forest allowing for connectivity across <100m non-broadleaf forest gaps

Map 3: Connectivity indicators for the Maya Mountains Massif
A. Lloyd, Based on: Meerman (2004). Belize Ecosystem Map







Map 6: Contiguity with broadleaf forest in Complejo III, Guatemala

When including contiguous forest in Guatemala, the total broadleaf forest cover is increased by approximately a further 32,550 hectares (80,433 acres) to approximately 479,317 hectares (1,184,418 acres). This includes both the "Disturbed forest" and "Forest" categories shown in Map 10. Disturbed forest is still predominantly forest, with some small burned areas and/or clearings (typically less than 100m across, and surrounded by forest with canopy).

3.0 The ‘Rapid Assessment and Prioritization of Protected Area Management’ (RAPPAM) Process

3.1 Introduction

The RAPPAM methodology is designed to give broad-level comparisons across a protected area system. Whilst it has not been developed for site-specific protected area adaptive management purposes, it does provide guidance for protected area management within the broad context of the system being assessed, leading to identification of areas where greater integration and / or collaborative efforts will improve management effectiveness over the system. It provides information that facilitates:

- Identification of management strengths and weaknesses of individual protected area management
- Analysis of the scope, severity, prevalence and distribution of the identified threats and pressures facing the protected area management within the Maya Mountain Massif system
- Identification of areas of high ecological and social importance and vulnerability
- Indication of the urgency and conservation priority of critical threats for individual protected areas within the Maya Mountain Massif system
- Assistance in the development and prioritization of appropriate policy interventions and recommendations for the improvement of protected area management effectiveness

An initial workshop was held with protected area managers on 11th April, 2007 to introduce the RAPPAM tool, and calibrate the questionnaire to ensure that there was consensus on the meanings of both the questions and the possible choices.

Identified Impacts on Protected Areas of the Maya Mountains Massif (RAPPAM)

- Unsustainable and/or illegal hunting (from Belizean communities - excluding xatero activity)
- Unsustainable and illegal xate harvesting (including associated impacts – hunting, looting, harvesting of other forest products)
- Unsustainable and/or illegal harvest of Non-timber Forest Products (including pimento seeds, bayleaf, and parrot nestlings)
- Unsustainable and/or illegal logging (including timber salvage operations)
- Pests / Disease (Southern Pine Bark Beetle)
- Increasing fire frequency
- Land allocation / dereservation
- Land use change in adjacent areas
- Agricultural incursions
- Impacts of military training exercises
- Visitor and tourism impacts
- Mining / oil exploration and extraction impacts

Other Noted Impacts

- Dam construction
- Pollution

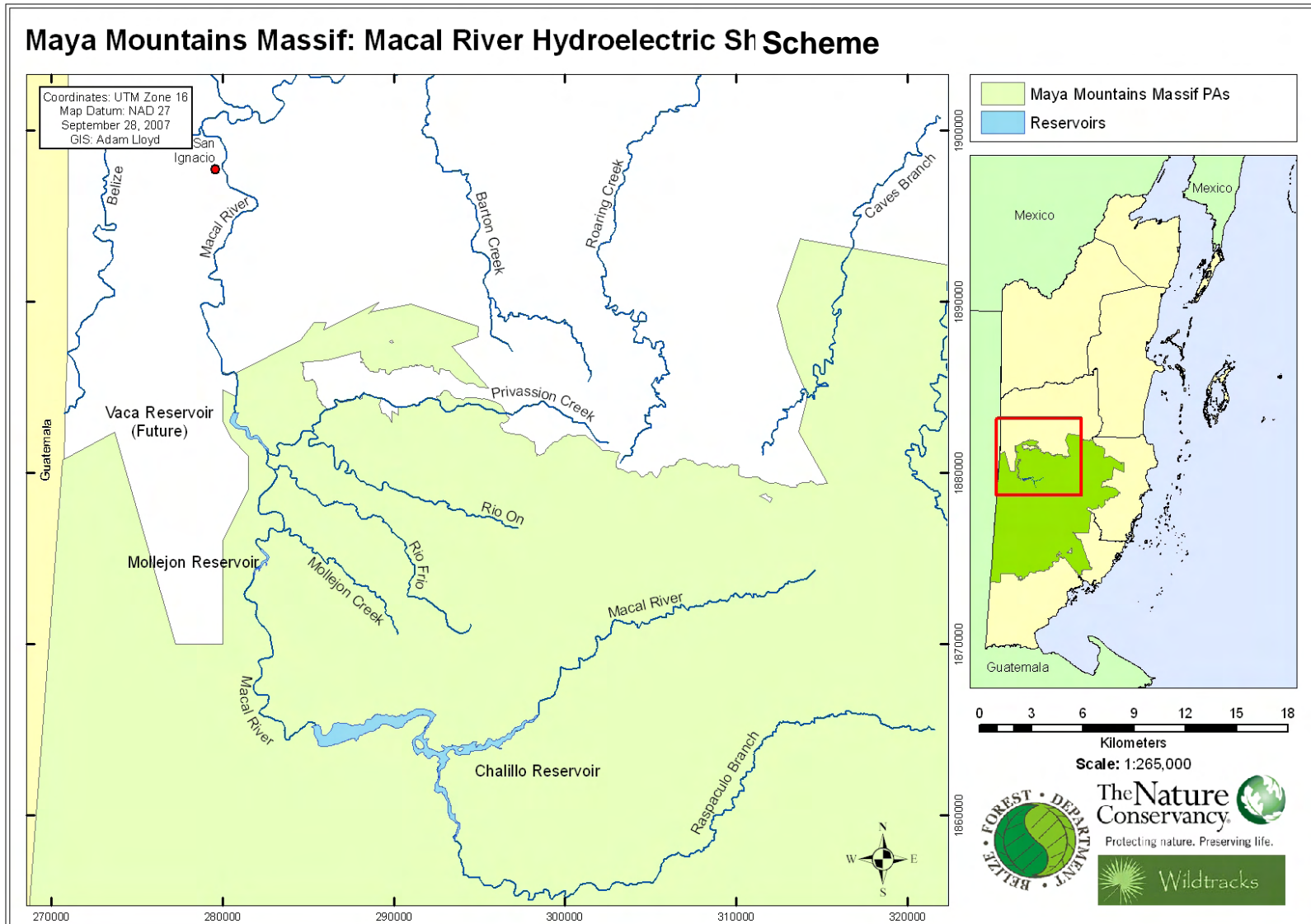
3.2 Critical threats Identified under the RAPPAM Process

The RAPPAM process identified fourteen threats considered critical to at least one of the fourteen protected areas of the Maya Mountains Massif. Each was assessed as a ‘**pressure**’ (past impact on the system), and ‘**threat**’ (the future potential impact) (Table 5; Graphs 2 and 3.). Results of pressure and threat occurrence across the system show that five major impacts are considered to be relevant to all the protected areas: **Illegal hunting, Illegal Hunting, Unsustainable / illegal Xate harvesting, Harvesting of Non-Timber Products (excluding xate), Unsustainable / illegal Logging and Mining / Oil Exploration.**

Only one of these, **Mining / Oil Exploration**, is seen as a potentially rapidly increasing threat across the system when compared with past pressures, with the increasing interest in oil exploration and gold/mineral extraction, and the legislative loophole that allows the Department of Geology and Petroleum to issue mining exploration licenses within protected areas.

Illegal Logging, whilst not an active threat in all protected areas, is considered to be likely to increase, as access becomes easier in the border areas of, for example, Cockscomb Basin Wildlife Sanctuary and Bladen Nature Reserve. However the establishment of long-term forest licenses in the extractive reserves should assist in the control of unsustainable logging activities, and in surveillance against illegal logging incursions within the protected areas, so whilst the scope of this impact is expected to increase, the severity is expected to decrease.

A number of impacts are limited to specific examples, a small number of protected areas, or by ecosystem specificity – for example, the construction of **dams** and resultant inundation of dam reservoir areas (Chalillo and Mollejon being the only two examples currently within the Maya Mountains Massif, with construction starting on a third, upstream from the Vaca Falls) (Map 3), and with the presence of the Hydromaya facility lying approximately 775m south of the southern boundary of Columbia River Forest Reserve, outside of the MMM.



Map 7: Dam Inundation Areas within the Maya Mountains Massif

The impacts of the **Southern Pine Bark Beetle**, which are restricted to protected areas with pine forest; **Visitor Impacts** are currently restricted to Caracol, Mountain Pine Ridge, Cockscomb Basin and Victoria Peak - those protected areas with significant visitation within the system); and **Military Impacts** are restricted primarily to those protected areas included within, or adjacent to, military training areas (Mountain Pine Ridge, Chiquibul and Vaca) or areas of military patrol activity (along the adjacency zone of the Belize / Guatemala border). There are also impacts that have not been voiced within this assessment, but were mentioned during the Conservation Action Planning threat assessment process that followed – the potential environmental pollution of aquatic systems by mining effluent, and of upper elevation areas following pesticide deposition through orographic rainfall being two such concerns. Also of concern is opportunistic looting of archaeological sites throughout the Maya Mountains Massif system, whether by local hunters or xateros.

In general, there has been little resolution of past pressures, and most of the impacts are expected to continue over the next five years, unless effective implementation of adequate mitigation measures takes place to ensure that the level of impact decreases.

Results of pressure and threat occurrence across the system show that five major threats are considered to be relevant to all the protected areas (Figure 1):

- **Hunting**
- **Logging**
- **Harvesting of Non-Timber Products**
- **Mining / Oil Exploration**
- **Xate**

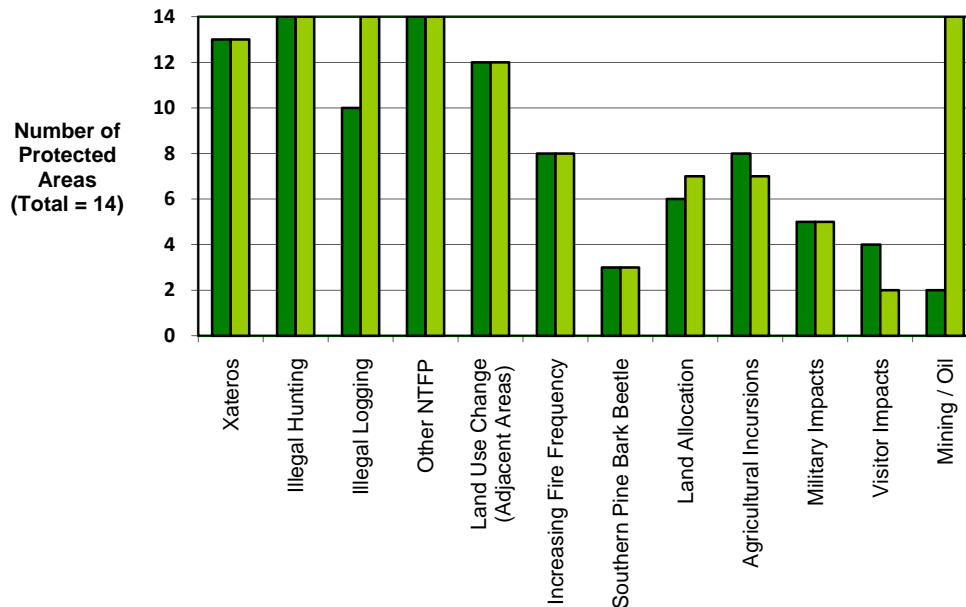


Figure 1: RAPPAM Scope of Pressures and Threats across the protected areas of the Maya Mountains Massif System

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In general, there has been little resolution of past pressures, and most of the impacts are expected to continue over the next five years, unless effective implementation of adequate mitigation measures takes place to ensure that the level of impact decreases.

Table 1: Summary of Critical Impacts		
Pressure/Threat	Impacts on Biodiversity	Causes
Unsustainable and / or Illegal Hunting and Fishing	<ul style="list-style-type: none"> ▪ Reduced viability of game species populations, and associated impacts on trophic structure of area ▪ Deliberate setting of fires in grassland areas adjacent to and in the PAs with pine savanna to attract white-tailed deer, causing increased fire impacts – biodiversity loss, impaired condition ▪ Likely long-term perturbation of forest structure & dynamics because of xatero hunting impacts on seed dispersers ▪ Likely long-term perturbation of aquatic ecosystems because of reduced populations of larger fish species 	<ul style="list-style-type: none"> ▪ Low income in communities adjacent to PA, and reliance on game meat and fish to supplement diet ▪ Limited capacity of PA staff to effectively monitor and enforce within PA (limited staff / finance) ▪ Increased access from land clearance in boundary areas, for subsistence, recreational and commercial hunters ▪ High cost of red meat ▪ Preference for game meat
Unsustainable and / or Illegal Xate Harvesting	<ul style="list-style-type: none"> ▪ Reduced viability of xate (<i>Chaemadorea ernestii-augustii</i>) ▪ Associated impacts on wildlife – intensifies, indiscriminate hunting, harvesting of parrots for pet trade, clearing of vegetation for camp areas, harvesting of pacaya and other plant food sources ▪ Likely long-term perturbation of forest structure & dynamics because of xatero hunting impacts on seed dispersers 	<ul style="list-style-type: none"> ▪ Low income in communities in Guatemala communities adjacent to Chiquibul National Park ▪ Good market price of xate in Guatemala and internationally ▪ Limited ability to effectively monitor and enforce within PA (number of rangers / finance) ▪ Weak governance and law enforcement in border areas with southern Peten, Guatemala
Unsustainable and / or Illegal Harvesting of Non-Timber Forest Products (excluding xate)	<ul style="list-style-type: none"> ▪ Reduced viability of heavily harvested species such as thatching palms, orchids, palmetto (seeds and stems) and other seeds ▪ Heavy pressure on already reduced yellow-headed (and other) parrot populations 	<ul style="list-style-type: none"> ▪ High demand for house construction materials by local communities ▪ Market for palmetto, palm and cycad seeds ▪ Market for parrot nestlings, especially yellow-headed parrot
Unsustainable and Illegal Logging	<ul style="list-style-type: none"> ▪ Changes in species composition with selective removal of species such as cedar, mahogany etc. ▪ Fragmentation of forest structure through construction of logging roads and tracks ▪ Increased access for hunting and other illegal activities ▪ Hunting by logging crews ▪ Over-harvesting of seed and fruit trees in areas of hurricane damage ▪ Increased risk of erosion in riparian belt 	<ul style="list-style-type: none"> ▪ High demand for timber and timber products, both within Belize and for export ▪ Increasing value of timber ▪ Use of cut logs for house and livestock fence construction ▪ Weak enforcement of logging policies
Mining / Oil Exploration	<ul style="list-style-type: none"> ▪ Removal of riparian vegetation and adjacent broadleaf forest in mining concession area ▪ Fragmentation of broadleaf forest due to construction of access road, with increased potential for edge effects ▪ Increased accessibility for hunting and other illegal activities 	<ul style="list-style-type: none"> ▪ High market value of gold and other mineral resources ▪ Over-riding ability of Dept. of Geology and Petroleum to issue exploration and mining licenses within Pas ▪ Lack of integrated management
Agricultural Incursions	<ul style="list-style-type: none"> ▪ Removal of broadleaf forest cover ▪ Associated impacts on wildlife – indiscriminate hunting, harvesting of parrots for pet trade, harvesting of pacaya and other plant food sources ▪ Fire impacts associated with forest clearance for agriculture ▪ Leaching of soils with removal of forest canopy ▪ Increased erosion on steeper slopes 	<ul style="list-style-type: none"> ▪ Limited land availability for agriculture in Guatemala, for communities adjacent to Belize border ▪ Limited capacity of PA staff to effectively monitor and enforce within PA (limited staff / finance) ▪ Increased access in boundary areas with Guatemala ▪ Weak governance and law enforcement in border areas with southern Peten, Guatemala

Table 5: RAPPAM Results - Summary of Critical Impacts (continued)		
Pressure/Threat	Impacts on Biodiversity	Causes
Land Use Change in Adjacent Areas	<ul style="list-style-type: none"> ▪ Removal of buffer area vegetation ▪ Increased accessibility for hunting, fishing, looting ▪ Increased potential for edge effects along boundaries following clearance of forest for agricultural land ▪ Increased fire hazard along boundary areas ▪ Increased potential for agricultural incursion and/or illegal logging 	<ul style="list-style-type: none"> ▪ Increased requirement for agricultural land in the coastal plain areas ▪ Political use of land allocation process ▪ Increased land values
Increasing Fire Frequency	<ul style="list-style-type: none"> ▪ Impacts on already reduced yellow-headed parrot populations, with reduced nestling survival and reduced numbers of suitable nesting trees ▪ Fire frequency is increasing – there are now fires almost every year, degrading the pine savanna forest towards open grassland with decreased species diversity. ▪ Potential to affect viability of broadleaf forest in ecosystem boundary areas ▪ Associated impacts on aquatic system, following rain ▪ Long recovery time 	<ul style="list-style-type: none"> ▪ Low income in communities encourages hunting for the table, with associated burning of pine ridge and savanna to attract white-tailed deer ▪ Deliberate setting of fires in savanna areas adjacent to and in the PAs with pine savanna to attract white-tailed deer, causing increased fire impacts ▪ Changing attitude towards natural resources in local communities, with less respect for environment ▪ Lack of awareness in younger generations of need for fire control ▪ Lack of awareness of long term impacts of fire, in local communities ▪ Lack of awareness of environmental benefits of tropical forest, its vulnerability and need for conservation ▪ Limited capacity of PA staff to effectively monitor and enforce within PA (limited staff / finance)
Land Allocation / Dereservation	<ul style="list-style-type: none"> ▪ Allocation of land within the protected area for farming, resulting in forest clearance and size reduction of protected area 	<ul style="list-style-type: none"> ▪ Advance of agricultural frontier, with encroachment on protected areas ▪ Political motivation ▪ Lack of liaison and cooperation between Government Departments ▪ Lack of clear boundaries, and lack of awareness of locations of protected areas in local communities ▪ Lack of respect for environmental benefits of protected areas
Pests / Diseases	<ul style="list-style-type: none"> ▪ Impacts of Southern Pine Bark Beetle on pine forests ▪ Potential for Chytrid infection in upper elevation amphibians 	<ul style="list-style-type: none"> ▪ Limited staff / funds for monitoring and pine area management pre-Southern Pine Bark Beetle ▪ Lack of knowledge on upper elevation amphibians in Belize and potential impacts, but considered high risk ▪ Orographic deposition of agro-chemicals in upper elevation areas
Visitor Impacts	<ul style="list-style-type: none"> ▪ Increased visitor numbers, with related impacts of soil compaction on trails, increased garbage, expanding and unofficial campsites, pressure on fragile ecosystems, increased fire risk ▪ Vandalism (including graffiti) of archaeological structures and caves ▪ Unregulated research activities (eg. involving collection and experimentation on critically endangered amphibian species) ▪ Unregulated education field project activities and impacts 	<ul style="list-style-type: none"> ▪ Lack of enforcement of 'no litter' regulations by guides ▪ Lack of adequate incentives / fines ▪ Limited capacity of PA staff to effectively monitor and enforce visitor regulations (number of staff / finance) ▪ Limited capacity of protected area co-managers / research stations to oversee research relating to sensitive species
Military Impacts	<ul style="list-style-type: none"> ▪ Increased human presence in broadleaf forest areas ▪ Increased noise impacts associated with training activities - explosions, live-firing and helicopters, for example, with disturbance of wildlife ▪ Increased fire risks ▪ Low level hunting impacts by Belize Defense Force patrols and British Forces local trackers 	<ul style="list-style-type: none"> ▪ Designated military training areas for British Forces, under agreement with Belize Government ▪ Limited opportunities for live-firing training elsewhere ▪ Lack of awareness of protected area legislation and regulations among military personnel, and / or lack of respect, and / or lack of enforcement

3.4 Impacts per Protected Area

When assessing the impacts per protected area, only one protected area, **Vaca Forest Reserve**, stands out as having a combined average pressure and threat score of over 30 (out of a total possible of 64). A further four (**Columbia River Forest Reserve**, **Deep River Forest Reserve** (both Gomez and Wood Depot Concession management areas), **Sittee River Forest Reserve** and **Mountain Pine Ridge Forest Reserve**) have scores between 20 and 30 (Figure 4; Table 6). Three of the five protected areas with the highest pressure / threat scores are characterized by pine forest / savanna vegetation, devastated by Southern Pine Bark Beetle in 2001, and currently being impacted by increasingly frequent fires. The combination of these two impacts highlight these protected areas as being the most at risk (Figure 2).

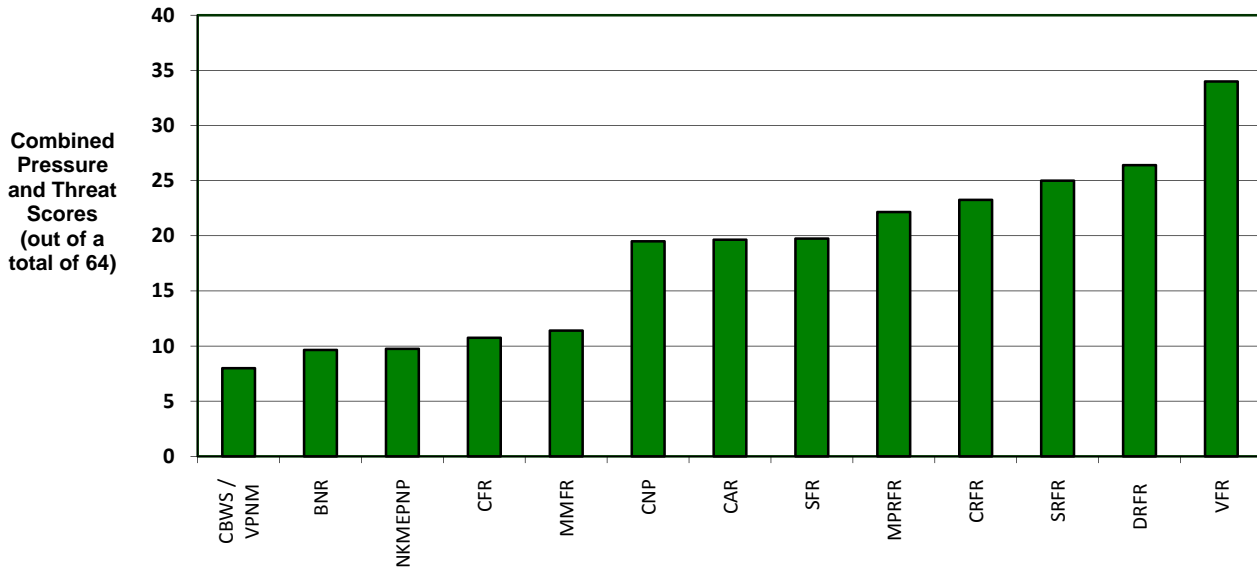


Figure 2: Combined, Averaged ‘Degree of Pressure and Threat’ Averaged Scores per Protected Area within the Maya Mountains Massif systems

Major Pressures (over the last 5 years)	Major Threats (in the next 5 years)	Observations
Vaca Forest Reserve		
<ul style="list-style-type: none"> ▪ Land Allocation ▪ Agricultural Incursions ▪ Xateros ▪ Local illegal hunting 	<ul style="list-style-type: none"> ▪ Land Allocation ▪ Agricultural Incursions ▪ Xateros ▪ Local illegal hunting 	Following construction of access road to the Mollejon Dam, the easier access through the Forest Reserve gave rise to a high degree of agricultural incursions, accompanied by illegal hunting activity. This has been further exacerbated by political allocation of lands within the FR. The proximity to the border, the limited management presence, and the presence of xate, has also led to the biodiversity of the area being heavily impacted by xateros.
Deep River Forest Reserve		
<ul style="list-style-type: none"> ▪ Increasing Frequency of Fire ▪ Southern Pine Bark Beetle ▪ Local illegal hunting ▪ Illegal harvesting of non-timber forest products ▪ Xateros 	<ul style="list-style-type: none"> ▪ Increasing Frequency of Fire ▪ Xateros ▪ Local illegal hunting ▪ Unsustainable and / or illegal harvesting of non-timber forest products ▪ Southern Pine Bark Beetle 	The coastal pine savanna, impacted by Southern Pine Bark Beetle in the 2001 outbreak, is currently being heavily impacted by the increasing frequency of fire, altering the composition of the ecosystem, preventing regeneration of pine, and removing nesting trees of the yellow-headed parrot. Lowland fires in these areas are generally associated with hunting activity, targeting white-tailed deer on the pine savanna during dry season. With a band of broadleaf forest to the north and west, there have also been reports of xatero activity, with the associated heavy and indiscriminate hunting pressures. There is also unsustainable harvesting of non-timber forest products such as palmetto seeds and sticks, thatch leaves and medicinal plants. Low levels of Southern Pine Bark Beetle activity are also reported as being a potential threat to the timber resources, and are consequently being closely monitored.
Sittee River Forest Reserve		
<ul style="list-style-type: none"> ▪ Land Allocation ▪ Xateros ▪ Agricultural Incursions ▪ Local illegal hunting 	<ul style="list-style-type: none"> ▪ Agricultural Incursions ▪ Land Allocation ▪ Xateros ▪ Local illegal hunting 	The lack of on-site management presence within this Forest Reserve has given rise to a high degree of agricultural incursions, accompanied by illegal hunting activity. There have also been reports of xatero activity, with the associated hunting pressures. The PA is being further eroded by political allocation of lands.
Columbia River Forest Reserve		
<ul style="list-style-type: none"> ▪ Xateros ▪ Unsustainable and / or illegal logging ▪ Increased frequency of fire ▪ Agricultural incursions 	<ul style="list-style-type: none"> ▪ Agricultural incursions ▪ Increased frequency of fire ▪ Xateros ▪ Unsustainable and / or illegal logging 	CRFR was heavily impacted by Hurricane Iris in 2001, with large areas of forest destruction. More recently, logging salvage operations have opened up the area, with tracks penetrating into the logging concession areas, increasing accessibility. The short term outlook of these companies and the limited number of FD staff for monitoring has led to unsustainable practices, with the removal of remaining seed and fruiting trees. The large dry timber load resulting from hurricane damage has been a major fire risk, and in some boundary areas, milpa fires have extended into the protected area itself. Agricultural incursions have become an increasing problem, especially in the San Pedro Columbia area, and illegal Guatemala settlement has been a consistent problem – particularly Santa Rosa, which was finally relocated in April, 2008. Xateros have also been active within the protected area over the last five years, but to a lesser extent than the more northerly Chiquibul area, as xate is generally less abundant in CRFR. Extensive logging incursions, again from Guatemala, are of particular impact on the plateau north-west of Little Quartz Ridge.
Mountain Pine Ridge Forest Reserve		
<ul style="list-style-type: none"> ▪ Increasing frequency of fire ▪ Southern Pine Bark Beetle ▪ Xateros ▪ Military Impacts 	<ul style="list-style-type: none"> ▪ Xateros ▪ Increasing frequency of fire ▪ Military Impacts ▪ Southern Pine Bark Beetle 	Following the heavy impact by the Southern Pine Bark Beetle infestation in 2001, resulting in the death of pine trees over a large portion of the area, the large fuel load has made the MPRFR particularly vulnerable to fire, both from lightning strikes, and more frequently, associated with military training activities. Xateros have been active in areas where the pine ridge is broken by broadleaf forest, harvesting xate for sale in Guatemala.

Table 2: Summary of major pressures and threats on the five most heavily impacted protected areas (RAPPAM Assessment, 2007)

An analysis of the pressures and threats affecting the five most heavily impacted protected areas shows that xatero activity has the highest scope, affecting all five of the protected areas (Figure 5). Xatero activities encompass not only xate harvesting, but also indiscriminate hunting to sustain the xateros whilst they are harvesting. Illegal hunting by local Belizean communities is also prevalent throughout the protected area system, but at a much lower level of impact than that of the xateros, being limited to a small number of community-based hunters and affecting a much more selective game species base.

The protected area that clearly shows the least impacts is the combined Cockscomb Basin Wildlife Sanctuary / Victoria Peak Natural Monument – a reflection of both the degree of management presence and of its geographical position. Also showing low combined average pressure and threat scores are Bladen Nature Reserve and Noj Kaaj H'Meen Elijio Panti National Park². All three of these protected areas are being actively managed under co-management agreements between the Forest Department and conservation organizations.

The majority of protected areas show a clear pattern of pressures, either remaining constant or increasing as they continue as threats over the next five years (Figure 4). The one protected area that shows a reverse trend – Mountain Pine Ridge - reflects past pressures of Southern Pine Bark Beetle on the pine forest, an impact that is now considered to be under control through improved management.

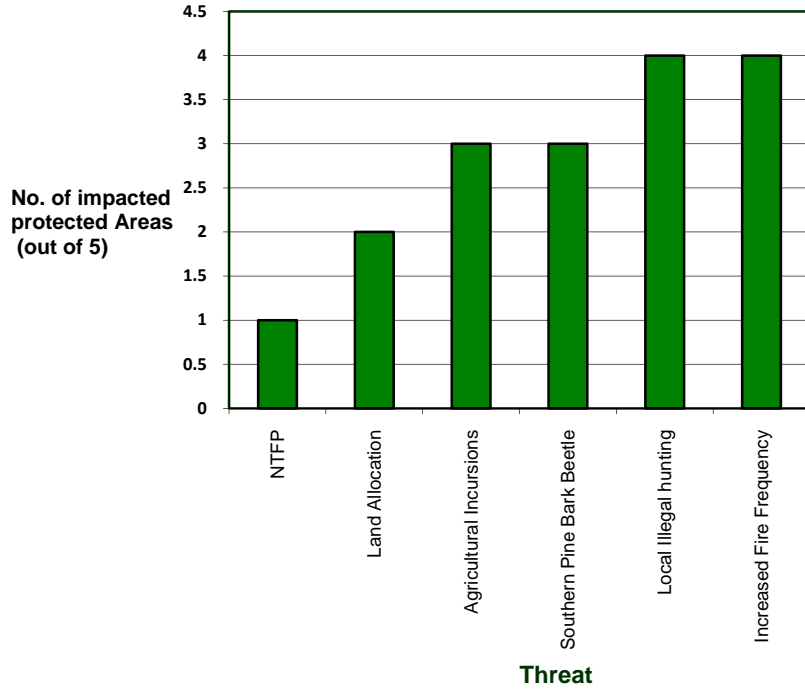


Figure 3: Major Pressures / Threats on the five most impacted protected areas of the Maya Mountains Massif system (RAPPAM Assessment, 2007)

² Subsequent to this assessment, additional data gathered from the management planning process for Elijio Panti suggests that the threat score for the National Park may be higher than indicated here

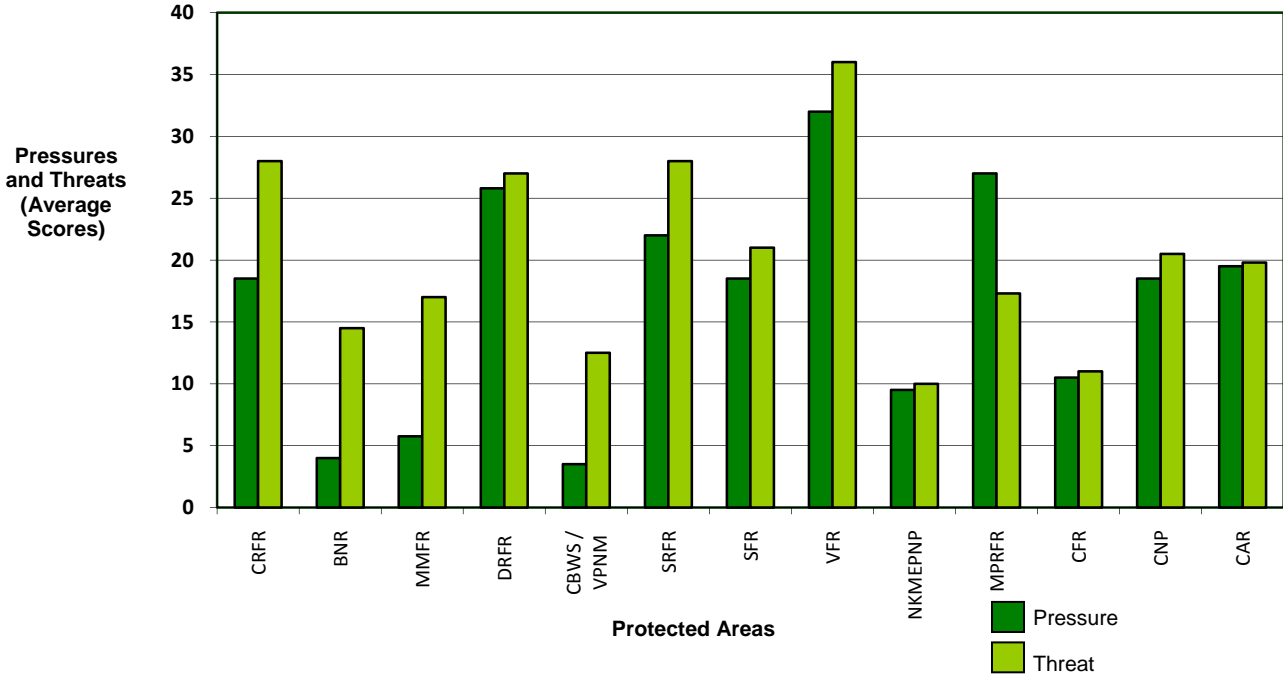


Figure 4: Comparison of ‘Degree of Pressure and Threat’ Averaged Scores per Protected Area within the Maya Mountains Massif systems (RAPPAM Assessment, 2007)

When the results are analyzed per protected area category (Figure 5), Forest Reserves show the greatest levels of both threats and pressures, with pressures considered to be increasing over the next five year period. Caracol, the single Archaeological Reserve, also shows high pressure and threat scores, primarily due to its location adjacent to the border with Guatemala, and the impacts from xateros, illegal logging and agricultural incursions from Guatemala.

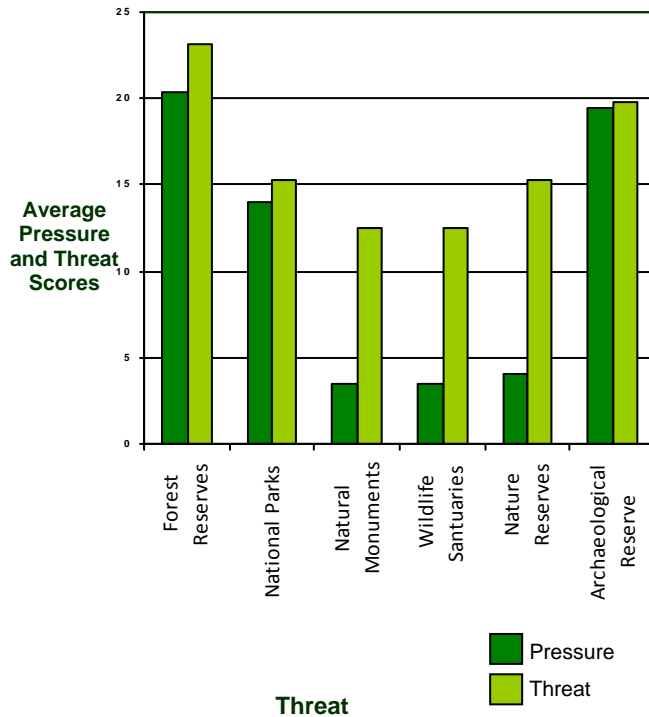


Figure 5: Major Pressures / Threats per Protected Area Category

Summary of Pressures and Threats (RAPPAM Assessment, 2007)

In summary:

1. The five **pressures** with the highest scope are illegal hunting, unsustainable and / or illegal harvesting of non timber products (excluding xate), unsustainable and / or illegal harvesting of xate, land use change in adjacent areas and unsustainable and / or illegal logging.
2. The five **threats** with the widest scope are illegal hunting, unsustainable and / or illegal harvesting of non timber products (excluding xate), unsustainable and / or illegal logging, land use change in adjacent areas, mining / oil exploration, and unsustainable and / or illegal harvesting of xate.
3. The five protected areas with the greatest **pressures** are Vaca Forest Reserve, Mountain Pine Ridge Forest Reserve, Deep River Forest Reserve, Sittee River Forest Reserve and Caracol Archaeological Reserve
4. The five protected areas with the greatest **threats** are Vaca Forest Reserve, Sittee Forest Reserve, Columbia River Forest Reserve, Deep River Forest Reserve and Sibun Forest Reserve.
5. The protected areas with the least overall **pressures and threats** are Cockscomb Basin Wildlife Sanctuary and Victoria Peak Natural Monument, with combined co-management under Belize Audubon Society.

The results of the RAPPAM assessment of pressures and threats give an overall idea of the impacts and scale-of-impacts being faced throughout the system. Whilst generally these results are considered to accurately reflect the current status of threats within the Maya Mountains Massif system, there is recognition that there is a loss of accurate representation of the very high level of impact of xatero activity on the biodiversity of Chiquibul Forest Reserve, as other threats to this protected area are low.

4.0 Specific Threats to Cultural Targets

During the last decade the Institute of Archaeology has identified several factors that threaten the stability, integrity and preservation of Belize's tangible cultural patrimony within the greater Maya Mountains Massif. Several of these threats can be classified as general threats because they affect all properties, but in addition to these is also a small group of site-specific threats.

Wide scale threats affecting all archaeological sites:

- **Looting,**
- **Forces of nature**
- **Human development**

Looting is the single greatest concern for sites in every sub-region of the Maya Mountains Massif, primarily fueled by the law of supply and demand for exotic antiquities by wealthy collectors. With the lure of fast, significant financial returns, archaeological sites will continue to be targeted by local "huaqueros". In Vaca and the Chiquibul, the majority of the looting is conducted by xateros, active in the area illegally harvesting xate palm leaves, but also opportunistically looting structures when they encounter them. In other sub-regions of Belize, (e.g. Toledo), both native and non-native Belizeans loot sites as a means to acquire hard cash. Today there is not a single region in Belize that is not affected by this situation.

The greatest **forces of nature** affecting the sites are hurricanes, rainfall, and seismic events. Hurricanes are particularly problematic at sites where the vegetation has been cleared for purposes of site development and conservation. Increased rainfall during tropical storms leads to erosion and the destabilization of monumental architecture. Problems associated with these types of situation particularly affect sites on the east facing slopes of the Maya Mountains Massif, and were experienced at both Lubaantun and Nim Li Punit during and following Hurricane Iris.

Heavy downpours also erode the soils around prehistoric buildings and acid rain can contribute to the dissolution of the limestone building blocks used by the northern Belize Maya. Although not as prevalent as tropical storms, and despite the distant location of most faults, seismic events, particularly earthquakes, have affected several of our sites in Belize. Some of these effects have been recorded at Caracol, Nim Li Punit and Lubaantun.

Human development is of particular concern in areas near large population bases, and therefore less of a threat within the Maya Mountains Massif itself. However, incursions into the foothills, with the desire for new farm land, logging concessions, and access to these resources results with the construction of new roads, the mining for construction materials, and general habitat destruction.

In other cases, damming of rivers (e.g. Chalillo and Vaca) for the production of hydroelectric power leads to the inundation and destruction of large numbers of sites and their cultural data. In Vaca, the most recent threat is the development of feeder roads being constructed into areas of newly dereserved lands. In the Chiquibul, there are concerns that the gold mining operations of the Ceibo Chico area have the potential to destroy evidence of prehistoric farming settlements along the river.

Site-Specific Threats

Identified site specific threats to preservation of cultural integrity include:

- **Extraction of metals for sale to Guatemalan smelters**
- **Tourism**

Metal extraction particularly threatens Historic Period remains in the Chiquibul and Vaca sub-regions, with the removal of remnants of rail and locomotive components from the area around Vaca Falls and

Punta Rieles by metal extractors, and transported by Guatemalan trucks through Arenal. Dismantling and destruction has also occurred of some of the machinery left behind by the Menguel Company at the end of the 1920's in the Caracol Archaeological Reserve.

Insufficient communication between Government Departments, whilst considered a general threat to natural and cultural resources throughout Belize, has also been highlighted in the specific threat in the above example, with a written permit being issued by the then officer in charge of the Forest station at Douglas D'Silva for the removal of the machinery.

Tourism is of particular threat to surface sites with high levels of visitation, and at present levels is not considered a major concern with the sites open to the public in the Maya Mountains Massif. Caracol has the highest level of tourism, with approximately 12,700 visitors recorded in 2006 - but even so, the visitor numbers are still far lower than other sites such as Xunantunich and Altun Ha. Tourism is nevertheless a long-term concern, particularly in cases where fragile architecture or monuments are partly accessible to visitors. In an effort to address this concern, the Institute of Archaeology generally creates specific tourist pathways through the sites, and has been investing heavily in the production of fiber glass replicas of fragile stucco monuments.

Tourism is also of particular concern in cave sites. Once visitors enter the caves it is very difficult to monitor their activities in these subterranean sites, with heavy reliance on the professionalism of tour guides to assist in the protection of these sites.

4.1 Strategic Responses to Threats to Cultural Resources

The Institute of Archaeology has expended much effort to implement several of the following strategies to address identified threats within the Maya Mountains Massif:

- Improve presence at archaeological sites by increasing the number of research projects
- Support of and participation in military patrols
- Establishment of co-management agreements with conservation partners
- Educational programs.

The establishment of archaeological projects in remote areas has provided not only important new information on relatively unknown regions of the country, but have also served to introduce presence in remote areas, deterring/discouraging looting activities at sites under investigation. In view of this the Institute of Archaeology has actively tried to encourage new research projects in almost every sub-region of the Massif, with work at Caracol, new research at Las Cuevas, the Raspacula branch, and possibly in the Chiquibul Cave system this coming year. In 2008 a survey of cave sites is being conducted in southwestern Toledo.

Co-management agreements are being signed with co-management partners for a number of sites – Chiquibul Cave System, for example, is now being managed under agreement with Friends for Conservation and Development, and Elijo Panti National Park is also a prospective co-management partner.

5.0 Situation Analysis

Conservation Action Planning: Situation Analysis

Introductions

The information derived from the RAPPAM outputs and the first two CAP workshops on the viability of the conservation targets and the direct impacts to biodiversity and cultural target viability was further developed during the first day of the CAP3 workshop, developing a situation analysis, with inputs from a wide range of stakeholders, each with a different perspective on the Maya Mountains Massif.

The Situation Analysis workshop generates a description of the participants understanding of impacts on the conservation targets and the stresses on the Maya Mountains Massif system as a whole, both in terms of the biological issues and the human context. The participatory process also builds a picture of the contributing factors - the indirect threats, key actors, and opportunities for successful action - that are integral in the development of objectives and strategies as an output of the conservation planning process, and provides a basis on which to develop a monitoring framework.



Participants:

Situation Analysis
9th October, 2007

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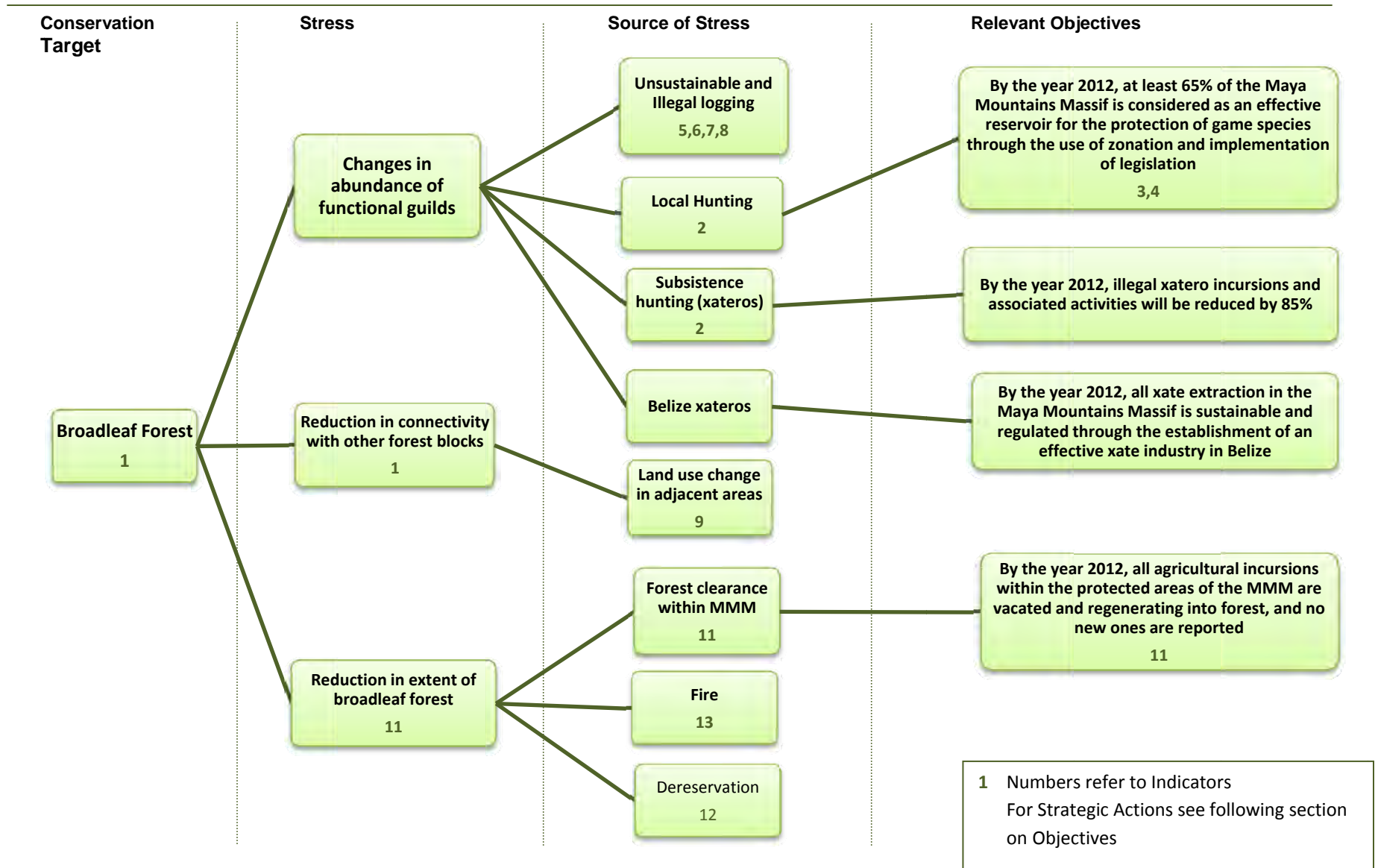
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Zoe Walker (Wildtracks)
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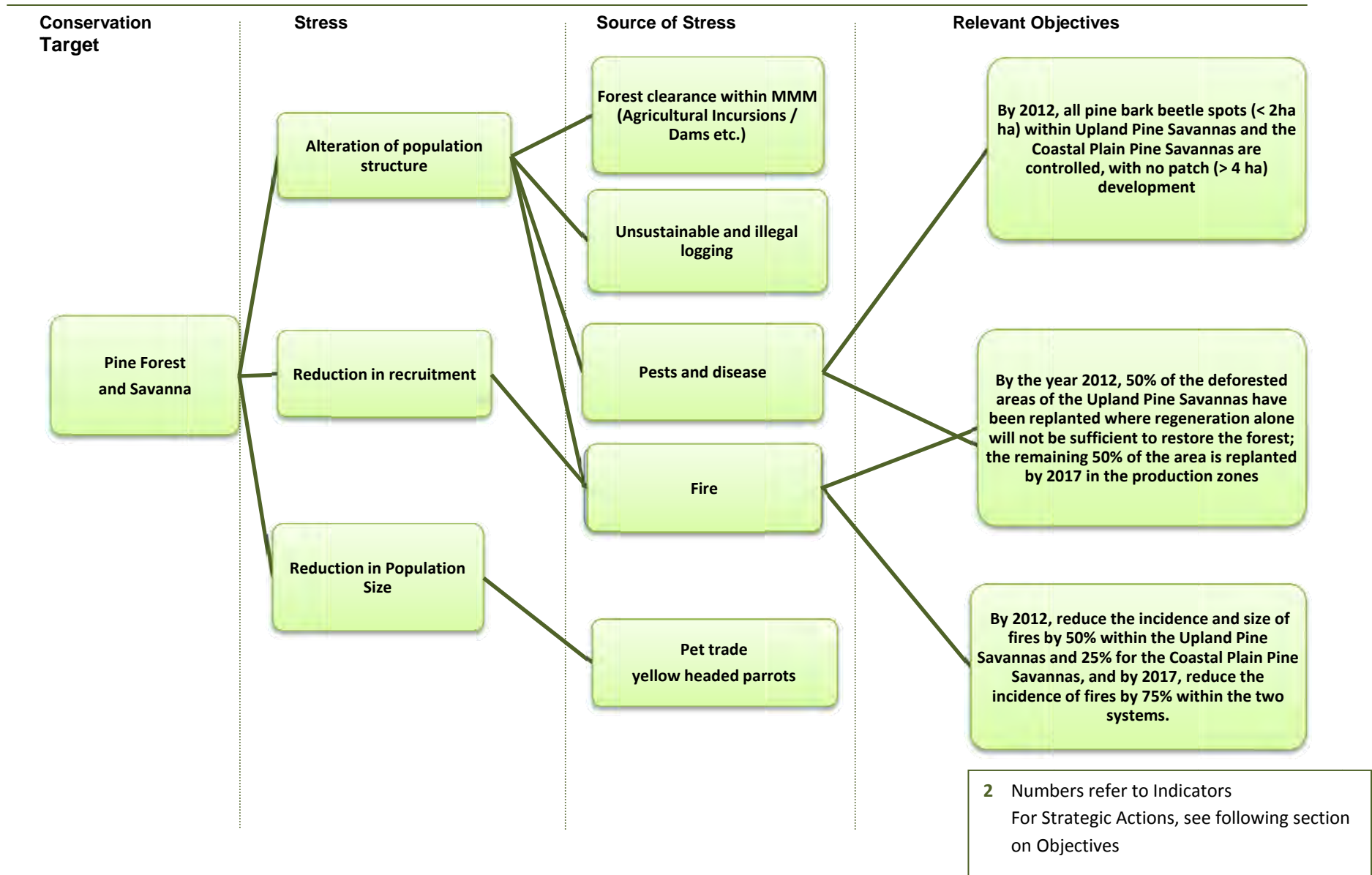
Situation Analysis: Broadleaf Forest



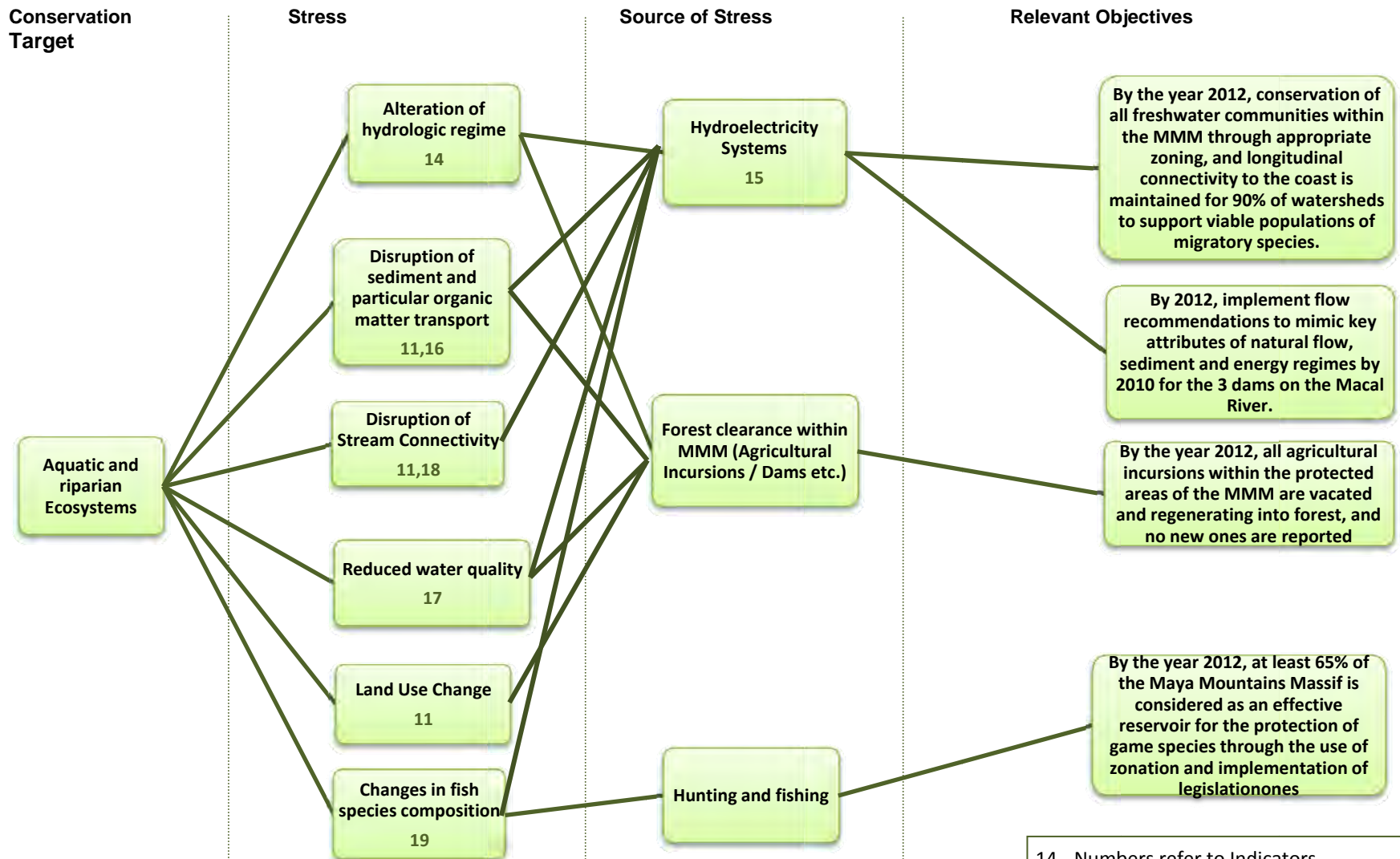
Monitoring Framework: Broadleaf forest Indicators					
ID	Indicator	Methods, Location	Responsible Body	Priority (High, Medium or low)	Cost (High, Medium or low)
1	Total area of contiguous broadleaf forest	(Baseline from CAP1) LANDSAT 5 (via Chetumal?), ASTER for increased resolution and reliability. Acquire scenes at beginning of dry season – Feb/March. Ground control points collected regularly to use in interpretation. Overflights for specific areas.	(UB?) PA managers FD Monitoring body?		Low
2	Hunting pressure . . . (to be decided)	Standardised patrol reports including standardised georeferenced recording of: gunshots, shotgun cartridges, camps, kill sites. Bi-annual summary reports sent to central body.	PA managers FD		Low
3	Number of bi-national patrols per year	Bi-national patrol reports	FD FCD IoA		Low
4	A monitoring programme has been designed and is being implemented	Baseline. Patrol reports. Indicator species – cracids, peccary?	PA managers Researchers FD Monitoring body?		High for establishment; low for operation
5	Number of recorded incidences of illegal logging activity	Standardised biannual submission of patrol reports. No. of stumps? Stump diameters?	PA managers FD Monitoring body?		
6	Number of long term forest licenses considered to be sustainable	Baseline report. Evaluation process. Trade felling reports.	Independent reviewer		Medium
7	No. of LTFL management plans considered to be sustainable	Critical review of management plans.	Independent reviewer		Low
8	No. of LTFL companies certified under FSC	FSC listing	External reviewer Percival Cho?		Low
9	Percentage of border with contiguous forest cover	(See 1 – RS data collection)	(See 1)		(See 1)
10	Number of critical corridors assessed as functional	(See 1 – RS data collection) Ground surveys	(See 1)		(See 1)

Monitoring Framework: Broadleaf forest Indicators (continued)					
ID	Indicator	Methods, Location	Responsible Body	Priority (High, Medium or low)	Cost (High, Medium or low)
11	Percentage of land cover not under natural vegetation	Baseline – current situation (Oct 2007), excluding pending dereservations. (See 1 – RS data collection) Ground surveys	(See 1)		(See 1)
12	Acreage of MMM dereserved relative to present boundaries (Oct 2007)	Gazetted dereservations.	FD LIC? PA managers		Low?
13	Acreage of broadleaf forest burned per year	Annual. SERVIR. Ground truthing. Patrol reports. (See 1 – RS data collection)	PA managers Monitoring body?		Low

Situation Analysis: Pine Forest and Savanna



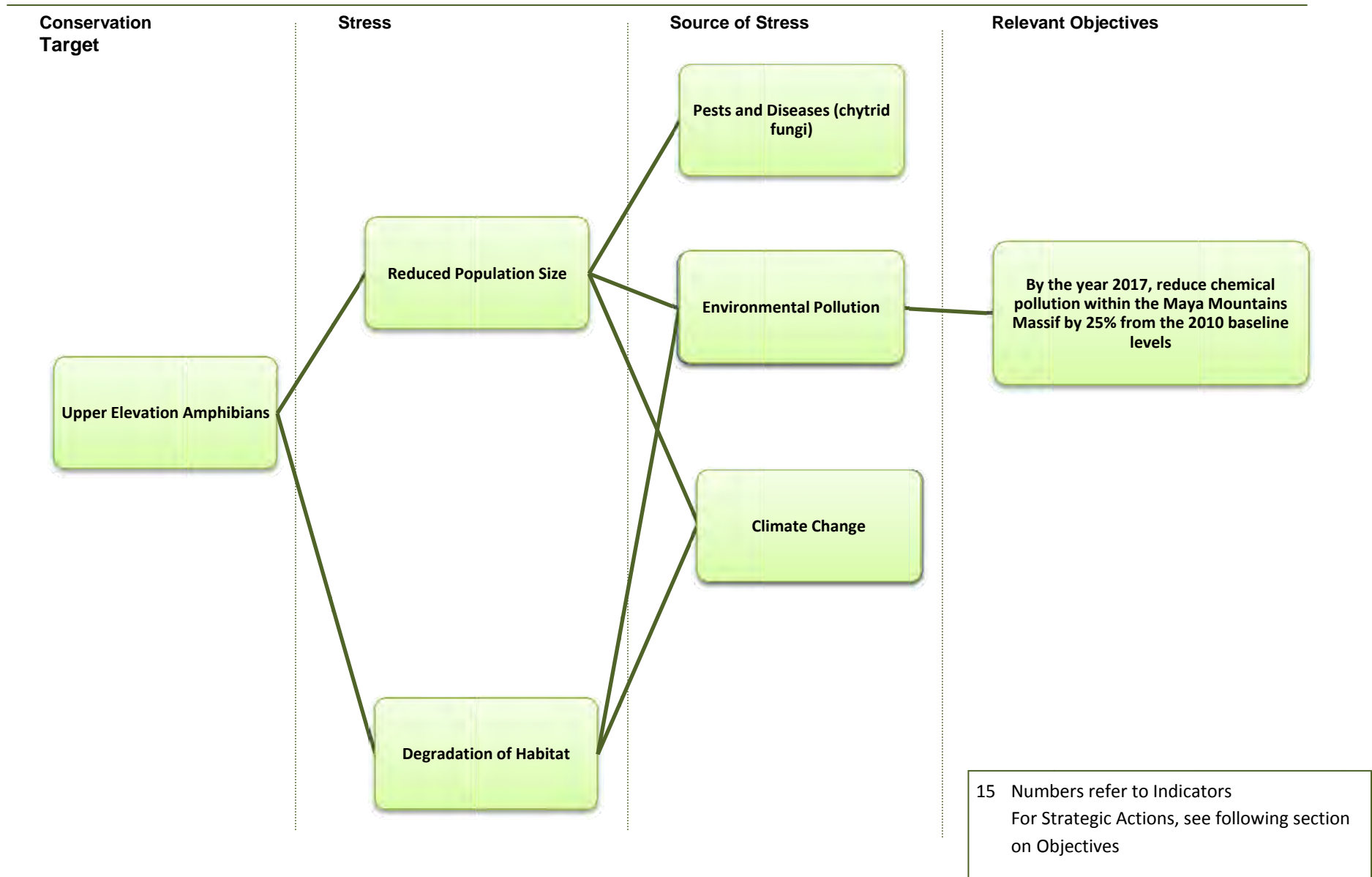
Situation Analysis: Aquatic and Riparian Ecosystems



14 Numbers refer to Indicators
For Strategic Actions, see following section on Objectives

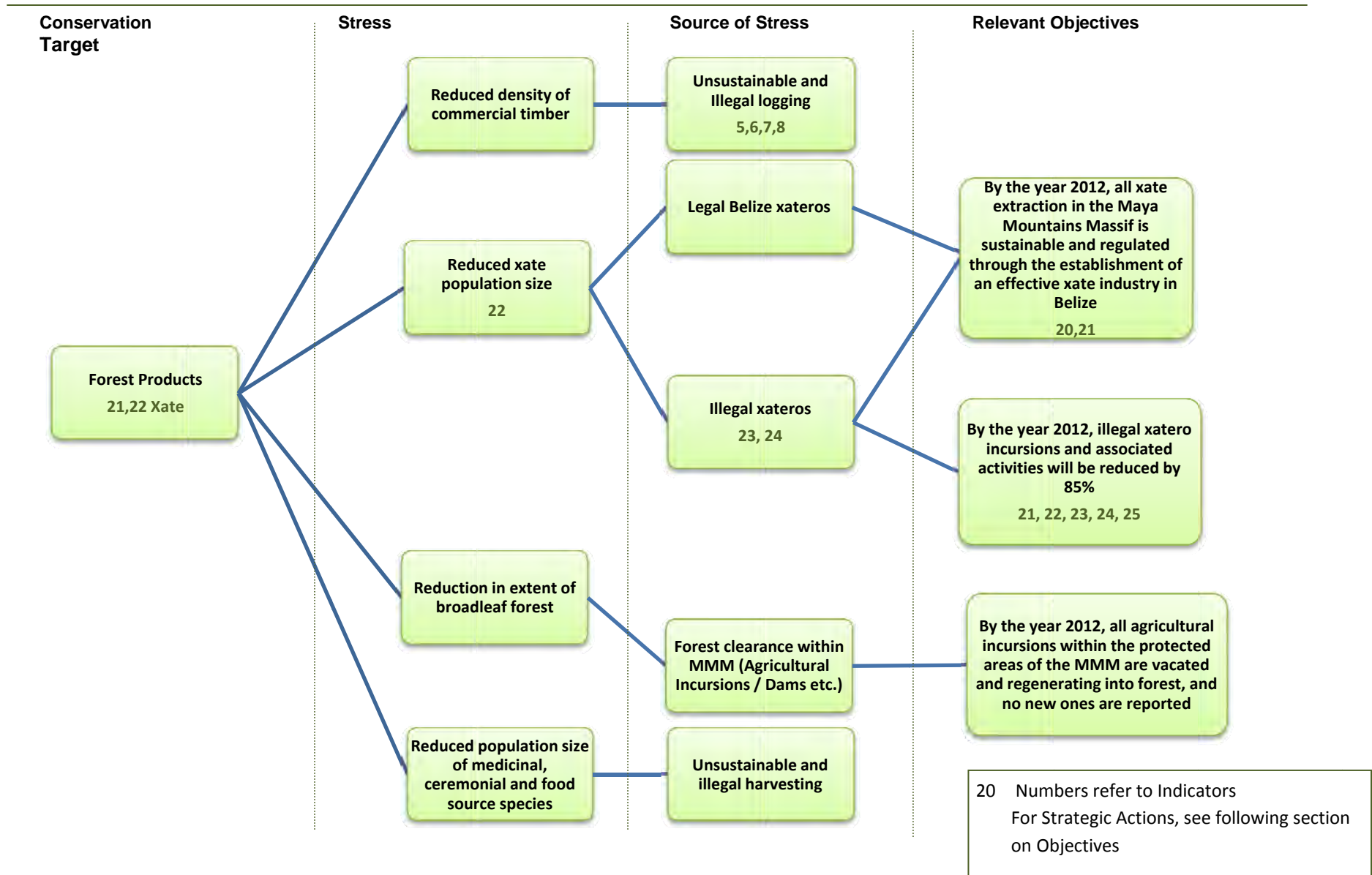
Monitoring Framework: Aquatic and riparian ecosystems					
ID	Indicator	Methods, Location	Responsible Body	Priority (High, Medium or low)	Cost (High, Medium or low)
14	Alteration of hydrologic regime	Hydromet station data (downstream of MMM reserves) – historical and current. Mean low and peak flows in dry season and wet season. High flow events – magnitude and duration, timing.	Hydromet		Low
15	Hectares of watersheds impacted upstream of dams	(See 1) Dam management company	Dam management company Monitoring body?		Low
16	Measurement of suspended sediment load upstream and downstream (of dams?)	Measure total suspended solids (Bowen lab, BWS?)	Dam management company?		Low
17	Measurement of standard water quality parameters relative to national baseline and landscape context	Dissolved oxygen, temperature, pH, conductivity, hardness, nutrient analysis, bio-indicators, mercury	Dam management company DOE Ministry of Health?		Low?
18	Presence/absence of atyid and macrobrachium shrimps and mullets	Presence/absence – field surveys. (Training of PA staff)	PA staff Monitoring team (UB / Galen / etc. ??)		Low
19	Fishing pressure	Standardised patrol reports including standardised georeferenced recording of: fishing camps, fish bones, barbecue sites, fish nets/lines/traps. Biannual reports sent to central body.	PA managers ... ?		Low

Situation Analysis: Upper Elevation Amphibians



15 Numbers refer to Indicators
 For Strategic Actions, see following section on Objectives

Situation Analysis: Forest Products



20 Numbers refer to Indicators
 For Strategic Actions, see following section on Objectives

Monitoring Framework: Forest products (including xate)					
ID	Indicator	Methods, Location	Responsible Body	Priority (High, Medium or low)	Cost (High, Medium or low)
20	Amount and quality of xate exported per year	FD records; royalty records (FD); records from concession holders	FD		Low?
21	Average number of xate leaves per plant	Field surveys: 1) within concession areas; 2) other areas of the MMM	FD PA managers		Medium (with 22)
22	Average number of xate plants per hectare	Field surveys: 1) within concession areas; 2) other areas of the MMM	FD PA managers		Medium (with 21)
23	Number of active trails (used by Guatemalan xateros?)	Patrol reports Bi-national patrol reports?			Low
24	Presence/absence of illegal xateros within MMM PAs	Patrol reports	PA managers FD BDF Concession holders		Low
25	Amount of non-farmed xate exported from the Poptun area	Records from CONAP	CONAP		Low
26	Elevation of <i>Chamaedorea ernesti-agustii</i> to CITES Appendix II status	CITES lists	FD		Low
27	Presence/absence of effective xate industry association	?? (Measures of effectiveness?)	FD		?

6.0 Strategic Recommendations

Strategic Recommendations		
Pressure/Threat	Causes	Recommendations
<p>Unsustainable and / or Illegal Hunting and Fishing</p>	<ul style="list-style-type: none"> ▪ Low income in communities adjacent to PA, and reliance on game meat and fish to supplement diet ▪ Limited capacity of PA staff to effectively monitor and enforce within PA (limited staff / finance) ▪ Increased access from land clearance in boundary areas, for subsistence, recreational and commercial hunters ▪ High cost of red meat ▪ Preference for game meat 	<ul style="list-style-type: none"> ▪ Support initiatives to increase employment opportunities and opportunities for community development through sustainable resource use, particularly in those communities that have the highest impact on the natural resources (the stakeholder communities in Toledo) ▪ Investigate options for community site agreements for tourism sites (eg. Friends of the Valley / Davis Falls and Swim Pools), giving access and tourism management to site-specific areas, without the requirement for excision from established protected areas, category change, or full-scale co-management agreements ▪ Increased awareness of protected area and wildlife protection regulations within local communities ▪ Increase awareness of environmental services and the benefits of the Maya mountains Massif ▪ Support the development and implementation of game farming in partnership with local hunting communities to replace the need for wild game meat ▪ Build on current multi-agency collaboration for surveillance and enforcement activities ▪ Investigate scope for development of community managed buffer areas adjacent to protected areas for community sustainable use of natural resources ▪ Establish and enforce core protection areas for game species within the overall zonation system of the Maya Mountains Massif ▪ Establish system-level surveillance and enforcement task force for deployment to critical hotspots for illegal activity within the Maya Mountains Massif ▪ Strengthen multi-agency, binational patrols along the Adjacency Zone through increased resources, presence and collaboration among BDF, Police, FD, Immigration, IoA, FCD, Guat. Army, CONAP ▪ Strengthen enforcement of implementation of hunting regulations through collaborative partnerships, capacity building, resource allocation and increased presence in the field, especially for the white-lipped peccary ▪ System-level collaboration towards greater conviction rate for offenders

Strategic Recommendations		
Pressure/Threat	Causes	Recommendations
<p>Unsustainable and / or Illegal Xate Harvesting</p>	<ul style="list-style-type: none"> ▪ Low income in communities in Guatemala adjacent to Chiquibul National Park ▪ Good market price of xate in Guatemala and internationally ▪ Limited ability to effectively monitor and enforce within PA (number of rangers / finance) ▪ Weak governance and law enforcement in border areas with southern Peten, Guatemala 	<ul style="list-style-type: none"> ▪ Support CONAP in its strategies to increase opportunities for community development through sustainable resource use, in those communities in Guatemala that have the highest impact on the natural resources of the Maya Mountains Massif (Belize) ▪ Build on current multi-agency collaboration for surveillance and enforcement activities ▪ System-level collaboration towards greater conviction rate for offenders ▪ Hold concession holders liable for infractions by their harvesting crews ▪ Ensure sustainable management of xate concessions in Belize by calculating and monitoring the production potential of each concessional area, in order to control the purchasing of illegally harvested xate ▪ Put in place effective, regulated xate industry with a commitment from concession holders towards adherence to regulations for sustainability ▪ Promote certification of sustainably managed xate concessions and plantations in Guatemala and Belize, through coordination with Rainforest Alliance and other relevant organizations, and by creating awareness of ecological consequences of the xate trade ▪ Promote the establishment of xate plantations in forested areas, crop plantations (like cacao), and nurseries in Guatemala and Belize, in order to have a more controlled and sustainable source of xate.

Strategic Recommendations		
Pressure/Threat	Causes	Recommendations
<p>Unsustainable and /or Illegal Harvesting of Non-Timber Forest Products (excluding xate)</p>	<ul style="list-style-type: none"> ▪ High demand for house construction materials by local communities ▪ Market for palmetto, palm and cycad seeds ▪ Market for parrot nestlings (especially yellow-headed parrot) and other wildlife 	<ul style="list-style-type: none"> ▪ Complete implementation of move from short-term logging licenses to long-term forest license concessions, for sustainability of forest resources ▪ Establish long term forest licenses with private investors for pine savanna areas that need to be restored ▪ Formulate and implement long-term sustained yield forest management plans for each LTFL concession area that takes into consideration fire, pine bark beetle and restoration management ▪ Strengthen multi-agency, binational patrols along the Adjacency Zone through increased resources, presence and collaboration among BDF, Police, FD, Immigration, IoA, FCD, Guat. Army, CONAP ▪ Establish and enforce core protection areas for game species within the overall zonation system of the Maya Mountains Massif ▪ Strengthen enforcement of implementation of hunting regulations through collaborative partnerships, capacity building, resource allocation and increased presence in the field, ▪ Investigate scope for development of community managed buffer areas adjacent to protected areas for community sustainable use of natural resources ▪ Investigate financial feasibility of sustainable community harvesting of palmetto ('popta') seeds in southern Belize, with identification of private sector investment for development of quality control and marketing, and development of licensing and monitoring framework ▪ Investigate financial feasibility of allspice and vanilla as sustainable non-timber forest products, with identification of private sector investment for development of quality control and marketing, and development of licensing and monitoring framework
<p>Unsustainable and Illegal Logging</p>	<ul style="list-style-type: none"> ▪ High demand for timber and timber products, both within Belize and for export ▪ Increasing value of timber ▪ Use of cut logs for house and livestock fence construction ▪ Weak enforcement of logging policies 	<ul style="list-style-type: none"> ▪ Investigate scope for development of community managed buffer areas adjacent to protected areas for community sustainable use of natural resources ▪ Monitoring of timber being milled and marketed, particularly in Stann Creek and Toledo Districts

Strategic Recommendations		
Pressure/Threat	Causes	Recommendations
Looting	<ul style="list-style-type: none"> ▪ Low income in local communities ▪ High demand for archaeological artefacts, with high value ▪ Limited knowledge of locations of sites ▪ Limited effectiveness of surveillance and enforcement for archaeological sites ▪ High presence of illegal Guatemalan xateros within Maya Mountains Massif, with opportunistic looting of structures encountered ▪ Destruction of archaeological structures during dam and road construction 	<ul style="list-style-type: none"> ▪ Establish system-level surveillance and enforcement task force for deployment to critical hotspots for illegal activity within the Maya Mountains Massif ▪ Strengthen multi-agency, binational patrols along the Adjacency Zone through increased resources, presence and collaboration among BDF, Police, FD, Immigration, IoA, FCD, Guat. Army, CONAP ▪ Increased liaison and collaboration between protected area managers / co-managers and the Institute of Archaeology to increase prioritisation of cultural resources within the Maya Mountains Massif system ▪ Establishment of co-management agreements for critical sites ▪ Increase research presence by attracting more research projects within the Maya Mountains Massif ▪ Increased liaison and collaboration between IoA in Belize and IDEAH in Guatemala in tackling knowledge gaps, looting and trafficking of artefacts ▪ Training for protected area staff in recognition, reporting and monitoring of archaeological sites and artifacts ▪ Ensure all dam and road construction within the Maya Mountains Massif minimizes impacts on archaeological structures (and include this within ECP requirements for any tourism concession, mining license etc.) ▪ Ensure aesthetic landscapes are categorized as sensitive landscapes under EIA schedules, requiring a full EIA to be conducted for any development within these areas ▪ Increase awareness of the archaeological and cultural heritage of the Maya Mountains Massif through education programmes

Strategic Recommendations		
Pressure/Threat	Causes	Recommendations
Mining / Oil Exploration	<ul style="list-style-type: none"> ▪ High market value of gold and other mineral resources ▪ Over-riding ability of Dept. of Geology and Petroleum to issue exploration and mining licenses within Pas ▪ Lack of integrated management 	<ul style="list-style-type: none"> ▪ Increased liaison and collaboration between Geology and Petroleum and Forest Department, with development for an agreement or protocol for granting licenses within the Maya Mountains Massif ▪ Place a moratorium on any further mining licenses (exploration or extraction), particularly within Zone Ia(iii), until a geological survey has been conducted to assess mineral value of the Maya Mountains Massif, to ensure that any decision making process is informed ▪ Ensure a full and adequate EIA is required under EIA schedules for any mining exploration or extraction activity within the Maya Mountains Massif, to be approved by both Geology and Petroleum and Forest Departments, with particular attention paid to any concessions that may be located within the Core Preservation Zone (Ia(iii)) ▪ Ensure there is effective monitoring of any mining license concession within the Maya Mountains Massif, with costs to be covered by the license holder as a stipulation within the ECP
Agricultural Incursions	<ul style="list-style-type: none"> ▪ Limited land availability for agriculture in Guatemala, for communities adjacent to Belize border ▪ Limited capacity of PA staff to effectively monitor and enforce within PA (limited staff / finance) ▪ Increased access in boundary areas with Guatemala ▪ Weak governance and law enforcement in border areas with southern Peten, Guatemala 	<ul style="list-style-type: none"> ▪ Increased awareness of protected area and wildlife protection regulations within local communities ▪ Build on current multi-agency collaboration for surveillance and enforcement activities ▪ Investigate scope for development of community managed buffer areas adjacent to protected areas for community sustainable use of natural resources ▪ Establish system-level surveillance and enforcement task force for deployment to critical hotspots for illegal activity within the Maya Mountains Massif ▪ Strengthen multi-agency, binational patrols along the Adjacency Zone through increased resources, presence and collaboration among BDF, Police, FD, Immigration, IoA, FCD, Guat. Army, CONAP ▪ Increased awareness of protected area regulations within local communities and agricultural sector ▪ Increase awareness of environmental services and the benefits of the Maya Mountains Massif ▪

Strategic Recommendations		
Pressure/Threat	Causes	Recommendations
Land Use Change in Adjacent Areas	<ul style="list-style-type: none"> ▪ Increased requirement for agricultural land in the coastal plain areas ▪ Political use of land allocation process ▪ Increased land values 	<ul style="list-style-type: none"> ▪ Increased liaison with the Department of Agriculture and Fisheries, and the Citrus Growers Association to halt the advance of citrus farms into Sibun and Sittee River Forest Reserves ▪ Investigate potential for tourism concessions within the Sibun and Sittee River Forest Reserves to give a management presence ▪ Investigate scope for development of community managed buffer areas adjacent to protected areas for community sustainable use of natural resources, particularly on southern coastal plain / foothills ▪ Investigate feasibility of community management initiatives – eg. In the Taungya Zone of Columbia River Forest Reserve, and possibly honey producers in the Vaca Forest Reserve
Increasing Fire Frequency	<ul style="list-style-type: none"> ▪ Low income in communities encourages hunting for the table, with associated burning of pine ridge and savanna to attract white-tailed deer ▪ Deliberate setting of fires in savanna areas adjacent to and in the PAs with pine savanna to attract white-tailed deer, causing increased fire impacts ▪ Changing attitude towards natural resources in local communities, with less respect for environment ▪ Lack of awareness in younger generations of need for fire control ▪ Lack of awareness of long term impacts of fire, in local communities ▪ Lack of awareness of environmental benefits of tropical forest, its vulnerability and need for conservation ▪ Limited capacity of PA staff to effectively monitor and enforce within PA (limited staff / finance) 	<ul style="list-style-type: none"> ▪ Increased liaison and collaboration between protected area managers/co-managers/LTFL for joint response to fires ▪ Increase vigilance within the Pine Savannas to reduce the incidence of fires associated with illegal hunting activities, through strengthening private sector and NGO strategic alliances supporting FD ▪ Develop and implement a wildfire suppression strategy for each LTFL area (Note: frequent wildfires stress trees and make them susceptible to pine bark beetle attacks) ▪ Develop and implement a multi-lingual and appropriate Public Awareness and Communications Strategy addressing the negative impacts of fires associated with hunting and milpa clearance ▪ Support the development and implementation of game farming in partnership with local hunting communities to replace the need for wild game meat, as a means of reducing savanna fires associated with hunting

Strategic Recommendations		
Pressure/Threat	Causes	Recommendations
Land Allocation / Dereservation	<ul style="list-style-type: none"> ▪ Advance of agricultural frontier, with encroachment on protected areas ▪ Political motivation ▪ Lack of liaison and cooperation between Government Departments ▪ Lack of clear boundaries, and lack of awareness of locations of protected areas in local communities ▪ Lack of respect for environmental benefits of protected areas 	<ul style="list-style-type: none"> ▪ Strengthen multi-agency, binational patrols along the Adjacency Zone through increased resources, presence and collaboration among BDF, Police, FD, Immigration, IoA, FCD, Guat. Army, CONAP ▪ Strengthen the implementation of the binational institutional action plan between Forest Department and CONAP (binational monitoring and surveillance, information exchange, environmental education, community development in the MMM, fundraising) ▪ Investigate potential for tourism concessions within the Sibun and Sittee River Forest Reserves to give a management presence ▪ Investigate feasibility of community management initiatives – eg. honey producers in the Vaca Forest Reserve, to provide surveillance presence ▪ Ensure boundary clearance in identified critical areas
Visitor Impacts	<ul style="list-style-type: none"> ▪ Lack of enforcement of ‘no litter’ regulations by guides ▪ Lack of adequate incentives / fines ▪ Limited capacity of PA staff to effectively monitor and enforce visitor regulations (number of staff / finance) ▪ Limited capacity of protected area co-managers / research stations to oversee research relating to sensitive species 	<ul style="list-style-type: none"> ▪ Development of visitor regulations and guidelines for Core Preservation Zone: Visitors accessing this area have to be accompanied by guides recognised by the FD, as having as adequate level of training, adopt ‘leave no trace’ principles, and are equipped with adequate safety equipment ▪ Build capacity of protected area staff for tourism management ▪ Ensure effective protocols are in place in the vetting of research proposals, particularly within the Core Preservation Zone ▪ Adequate monitoring of fieldwork where threatened or sensitive species are targeted

Strategic Recommendations		
Pressure/Threat	Causes	Recommendations
Pests / Diseases	<ul style="list-style-type: none"> ▪ Limited staff / funds for monitoring and pine area management pre-Southern Pine Bark Beetle ▪ Lack of knowledge on upper elevation amphibians in Belize and potential impacts, but considered high risk ▪ Orographic deposition of agro-chemicals in upper elevation areas 	<ul style="list-style-type: none"> ▪ Develop and implement a Public Awareness Program that informs owners of private pine lands, concession holders and co-management agencies of the consequences of pine bark beetle infestations and the monitoring and control measures they should implement ▪ Formulate and implement a Forest Restoration Plan for the Upland Pine Savannas to identify areas needing active restoration, management regimes and timeframes for replanting ▪ Strengthen the capacity of the Forest Department to effectively regulate the implementation of the Forest Restoration Plan, through increased human and financial resources ▪ Strengthen the management and regulatory capacity of FD and establish a team to monitor and manage fires and pine bark beetle outbreaks, and form strategic alliances with key agencies that could provide assistance with aerial monitoring ▪ Increase knowledge of distribution and status of upper elevation amphibians ▪ Identify major environmental pollutants by June 2008 and establish a baseline through collaborative research initiatives among protected area managers, in collaboration with NGOs private sector, DoE, FD and other GoB agencies ▪ Monitor agrochemical deposition by orographic rainfall in upper elevation areas ▪ Monitor agrochemical presence in creeks and rivers leaving the Maya Mountains Massif ▪ Encourage adoption of best management practices in major polluters, and the population in general, through increasing awareness, regulations and international technical and financial support
Military Impacts	<ul style="list-style-type: none"> ▪ Designated military training areas for British Forces, under agreement with Belize Government ▪ Limited opportunities for live-firing training elsewhere ▪ Lack of awareness of protected area legislation and regulations among military personnel, and / or lack of respect, and / or lack of enforcement 	<ul style="list-style-type: none"> ▪ Increase awareness in BDF of protected area and wildlife regulations, environmental services, and environmental best practices for patrols ▪ Ensure BDF patrols within the Maya Mountains Massif include at least one protected area officer or co-management representative ▪ Liaise with Batsub re. removing Core Preservation Zone from the Batsub military training area

Annexes

Annex One: Calibrated RAPPAM Assessment Form
Annex Two: RAPPAM Results per impact
Annex Three: CAP Threat Assessment
Annex Four: CAP Situation Analysis results and indicators

Annex One: RAPPAM Pressure and Threat Assessment Format

WWF

**RAPID ASSESSMENT AND PRIORITIZATION OF PROTECTED
AREA MANAGEMENT (RAPPAM) METHODOLOGY**

CALIBRATED RAPID ASSESSMENT QUESTIONNAIRE

Background Information

1. BACKGROUND INFORMATION

- a) Name of protected area:
- b) Date established:
- c) Size of protected area:
- d) Name of respondent:
- e) Date survey completed:
- f) Annual budget:
- g) Specific management goals and objectives:

- h) Critical protected area activities:

2. PRESSURES AND THREATS

Pressures: Past forces or activities that have negatively impacted the biodiversity
Threats: Potential forces or activities that will negatively impact the biodiversity

Pressure:

Has **Has not been a pressure in the last 5 years**

In the past 5 years this activity has:	Extent	Impact	Permanence
<input type="checkbox"/> Increased sharply <input type="checkbox"/> Increased slightly <input type="checkbox"/> Remained constant <input type="checkbox"/> Decreased slightly <input type="checkbox"/> Decreased sharply	<input type="checkbox"/> Throughout (> 50%) <input type="checkbox"/> Widespread (25-50%) <input type="checkbox"/> Scattered (5-25%) <input type="checkbox"/> Localized (< 5%)	<input type="checkbox"/> Severe (target eliminated) <input type="checkbox"/> High (target seriously degraded) <input type="checkbox"/> Moderate (moderately degraded) <input type="checkbox"/> Mild (slight impact)	<input type="checkbox"/> Permanent (> 100 years) <input type="checkbox"/> Long term (20-100 years) <input type="checkbox"/> Medium term (5-20 years) <input type="checkbox"/> Short term (< 5 years)

Threat:

Will **Will not be a pressure in the next 5 years**

The probability of the threat occurring is:	Extent	Impact	Permanence
<input type="checkbox"/> Very High <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/> Very Low	<input type="checkbox"/> Throughout (> 50%) <input type="checkbox"/> Widespread (25-50%) <input type="checkbox"/> Scattered (5-25%) <input type="checkbox"/> Localized (< 5%)	<input type="checkbox"/> Severe (target eliminated) <input type="checkbox"/> High (target seriously degraded) <input type="checkbox"/> Moderate (moderately degraded) <input type="checkbox"/> Mild (slight impact)	<input type="checkbox"/> Permanent (> 100 years) <input type="checkbox"/> Long term (20-100 years) <input type="checkbox"/> Medium term (5-20 years) <input type="checkbox"/> Short term (< 5 years)

Pressure:

Has **Has not been a pressure in the last 5 years**

In the past 5 years this activity has:	Extent	Impact	Permanence
<input type="checkbox"/> Increased sharply <input type="checkbox"/> Increased slightly <input type="checkbox"/> Remained constant <input type="checkbox"/> Decreased slightly <input type="checkbox"/> Decreased sharply	<input type="checkbox"/> Throughout (> 50%) <input type="checkbox"/> Widespread (25-50%) <input type="checkbox"/> Scattered (5-25%) <input type="checkbox"/> Localized (< 5%)	<input type="checkbox"/> Severe (target eliminated) <input type="checkbox"/> High (target seriously degraded) <input type="checkbox"/> Moderate (moderately degraded) <input type="checkbox"/> Mild (slight impact)	<input type="checkbox"/> Permanent (> 100 years) <input type="checkbox"/> Long term (20-100 years) <input type="checkbox"/> Medium term (5-20 years) <input type="checkbox"/> Short term (< 5 years)

Threat:

Will **Will not be a pressure in the next 5 years**

The probability of the threat occurring is:	Extent	Impact	Permanence
<input type="checkbox"/> Very High <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/> Very Low	<input type="checkbox"/> Throughout (> 50%) <input type="checkbox"/> Widespread (25-50%) <input type="checkbox"/> Scattered (5-25%) <input type="checkbox"/> Localized (< 5%)	<input type="checkbox"/> Severe (target eliminated) <input type="checkbox"/> High (target seriously degraded) <input type="checkbox"/> Moderate (moderately degraded) <input type="checkbox"/> Mild (slight impact)	<input type="checkbox"/> Permanent (> 100 years) <input type="checkbox"/> Long term (20-100 years) <input type="checkbox"/> Medium term (5-20 years) <input type="checkbox"/> Short term (< 5 years)

Annex Two

Rapid Assessment and Prioritisation of Protected Areas Management

Summary of Threats

Xate Harvesting (and associated impacts – hunting (including scarlet macaws), NTFP etc.)

Xate Harvesting	Status	Extent	Impact	Permanence
Columbia River				
Pressure	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Bladen				
Pressure	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Maya Mountain				
Pressure	Scattered (5 - 25%)	Mild	Short Term (< 5 years)	2
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Deep River (Gomez)				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Wood Depot)				
Pressure	Throughout (>50%)	Moderate	Medium Term (5 - 20 years)	16
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Cockscomb				
Pressure	Localized (< 5%)	Mild	Short Term (> 5 years)	1
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Sittee River				
Pressure	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Sibun				
Pressure	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Vaca				
Pressure	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Elijio Panti				
Pressure	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Mountain Pine Ridge				
Pressure	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Xate Harvesting	Status	Extent	Impact	Permanence
Chiquibul Forest Reserve				
Pressure	Throughout (> 50%)	High	Long Term (20 - 100 years)	36
Threat	Throughout (> 50%)	High	Long Term (20 - 100 years)	36
Chiquibul National Park				
Pressure	Throughout (> 50%)	High	Long Term (20 - 100 years)	36
Threat	Throughout (> 50%)	High	Long Term (20 - 100 years)	36
Caracol				
Pressure	Throughout (> 50%)	High	Long Term (20 - 100 years)	36
Threat	Throughout (> 50%)	High	Long Term (20 - 100 years)	36

Hunting (local communities – excluding xateros)

Hunting	Extent	Impact	Permanence	
Columbia River				
Pressure	Widespread (25 – 50%)	Moderate	Medium Term (5 - 20 years)	12
Threat	Throughout (>50%)	High	Medium Term (5 – 20 years)	24
Bladen				
Pressure	Scattered (5 - 25%)	Moderate	Short Term (< 5 years)	4
Threat	Throughout (>50%)	High	Medium Term (5 – 20 years)	24
Maya Mountain				
Pressure	Scattered (5-25%)	Mild	Short Term (< 5 years)	12
Threat	Scattered (5-25%)	Moderate	Long Term (20 – 100 years)	24
Deep River (Gomez)				
Pressure	Throughout (>50%)	High	Medium Term (5 - 20 years)	24
Threat	Throughout (>50%)	High	Medium Term (5 - 20 years)	24
Deep River (Wood Depot)				
Pressure	Throughout (>50%)	High	Medium Term (5 - 20 years)	24
Threat	Throughout (>50%)	High	Medium Term (5 - 20 years)	24
Cockscomb				
Pressure	Scattered (5-25%)	Moderate	Short Term (< 5 years)	4
Threat	Widespread (25 – 50%)	Moderate	Medium Term (5 – 20 years)	12
Sittee River				
Pressure	Throughout (>50%)	Moderate	Medium Term (5 - 20 years)	16
Threat	Throughout (>50%)	High	Medium Term (5 – 20 years)	24
Sibun				
Pressure	Throughout (>50%)	Moderate	Medium Term (5 - 20 years)	16
Threat	Throughout (>50%)	High	Medium Term (5 – 20 years)	24
Vaca				
Pressure	Throughout (>50%)	High	Medium Term (5 - 20 years)	24
Threat	Throughout (>50%)	High	Medium Term (5 – 20 years)	24
Elijio Panti				
Pressure	Scattered (5 - 25%)	Moderate	Short Term (< 5 years)	4
Threat	Widespread (25 – 50%)	Moderate	Short Term (< 5 years)	6

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Hunting	Extent	Impact	Permanence	Score
Mountain Pine Ridge				
Pressure	Localized (< 5%)	Moderate	Short Term (< 5 years)	2
Threat	Scattered (5 - 25%)	Moderate	Short Term (< 5 years)	4
Chiquibul Forest Reserve				
Pressure	Scattered (5 - 25%)	Mild	Short Term (< 5 years)	2
Threat	Scattered (5 - 25%)	Mild	Short Term (< 5 years)	2
Chiquibul National Park				
Pressure	Scattered (5 - 25%)	Mild	Short Term (< 5 years)	2
Threat	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Caracol				
Pressure	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (< 5%)	Mild	Short Term (< 5 years)	1

Unsustainable and illegal logging (including salvage timber licenses)

Logging	Extent	Impact	Permanence	
Columbia River				
Pressure	Widespread (25 – 50%)	High	Long Term (20 – 100 years)	18
Threat	Scattered (5 - 20%)	Moderate	Long Term (20 – 100 years)	24
Bladen				
Pressure	-	-	-	-
Threat	-	-	-	-
Maya Mountain				
Pressure	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Threat	Widespread (25 – 50%)	Moderate	Medium Term (5 - 20 years)	12
Deep River (Gomez)				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Wood Depot)				
Pressure	-	-	-	-
Threat	-	-	-	-
Cockscomb				
Pressure	-	-	-	-
Threat	-	-	-	-
Sittee River				
Pressure	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Sibun				
Pressure	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Vaca				
Pressure	-	-	-	-
Threat	-	-	-	-
Elijio Panti				
Pressure	-	-	-	-
Threat	-	-	-	-
Mountain Pine Ridge				
Pressure	Localized (<5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (<5%)	Mild	Short Term (< 5 years)	1
Chiquibul Forest Reserve				
Pressure	-	-	-	-
Threat	-	-	-	-

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Logging	Extent	Impact	Permanence	Score
Chiquibul National Park				
Pressure	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Caracol				
Pressure	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (< 5%)	Mild	Short Term (< 5 years)	1

Other NonTimber Forest Products (excluding xatero activity)

NTFP	Extent	Impact	Permanence	
Columbia River				
Pressure	-	-	-	-
Threat	-	-	-	-
Bladen				
Pressure	-	-	-	-
Threat	-	-	-	-
Maya Mountain				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Gomez)				
Pressure	Throughout (> 50%)	Moderate	Short Term (< 5 years)	8
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Deep River (Wood Depot)				
Pressure	Throughout (> 50%)	Moderate	Short Term (< 5 years)	8
Threat	Throughout (> 50%)	High	Medium Term (5 - 20 years)	24
Cockscomb				
Pressure	-	-	-	-
Threat	-	-	-	-
Sittee River				
Pressure	-	-	-	-
Threat	-	-	-	-
Sibun				
Pressure	-	-	-	-
Threat	-	-	-	-
Vaca				
Pressure	-	-	-	-
Threat	-	-	-	-
Elijio Panti				
Pressure	-	-	-	-
Threat	-	-	-	-
Mountain Pine Ridge				
Pressure	-	-	-	-
Threat	-	-	-	-
Chiquibul Forest Reserve				
Pressure	-	-	-	-
Threat	-	-	-	-
Chiquibul National Park				
Pressure	-	-	-	-
Threat	-	-	-	-
Caracol				
Pressure	-	-	-	-
Threat	-	-	-	-

Land Use Change in Adjacent Area

Adjacent Land Use Change	Extent	Impact	Permanence	
Columbia River				
Pressure	Scattered (5 - 25%)	Mild	Medium Term (5 – 20 years)	4
Threat	Widespread (25 – 50%)	Moderate	Medium Term (5 – 20 years)	12
Bladen				
Pressure	Localized (< 5%)	Mild	Medium Term (5 – 20 years)	2
Threat	Localized (< 5%)	Moderate	Medium Term (5 – 20 years)	4
Maya Mountain				
Pressure	Scattered (5 - 25%)	Moderate	Medium Term (5 – 20 years)	8
Threat	Scattered (5 - 25%)	Moderate	Medium Term (5 – 20 years)	8
Deep River (Gomez)				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Wood Depot)				
Pressure	-	-	-	-
Threat	-	-	-	-
Cockscomb				
Pressure	Scattered (5 - 25%)	Moderate	Medium Term (5 – 20 years)	8
Threat	Widespread (25-50%)	Moderate	Medium Term (5 – 20 years)	12
Sittee River				
Pressure	Localized (< 5%)	Mild	Medium Term (5 – 20 years)	2
Threat	Localized (< 5%)	Moderate	Medium Term (5 – 20 years)	4
Sibun				
Pressure	Localized (< 5%)	Mild	Medium Term (5 – 20 years)	2
Threat	Localized (< 5%)	Moderate	Medium Term (5 – 20 years)	4
Vaca				
Pressure	Localized (< 5%)	Mild	Medium Term (5 – 20 years)	2
Threat	Widespread (25 – 50%)	Moderate	Medium Term (5 – 20 years)	12
Elijio Panti				
Pressure	-	-	-	-
Threat	-	-	-	-
Mountain Pine Ridge				
Pressure	-	-	-	-
Threat	-	-	-	-
Chiquibul Forest Reserve				
Pressure	-	-	-	-
Threat	-	-	-	-

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Adjacent Land Use Change	Extent	Impact	Permanence	
Chiquibul National Park				
Pressure	-	-	-	-
Threat	-	-	-	-
Caracol				
Pressure	-	-	-	-
Threat	-	-	-	-

Increasing Frequency of Fire

Fire	Extent	Impact	Permanence	
Columbia River				
Pressure	Localized (<5%)	Severe	Permanent (>100 years)	16
Threat	Scattered (5 – 25%)	Severe	Permanent (>100 years)	32
Bladen				
Pressure	Localized (<5%)	High	Long Term (20 – 100 years)	9
Threat	Localized (<5%)	High	Long Term (20 – 100 years)	9
Maya Mountain				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Gomez)				
Pressure	Throughout (>50%)	High	Long Term (20 – 100 years)	36
Threat	Throughout (>50%)	High	Long Term (20 – 100 years)	36
Deep River (Wood Depot)				
Pressure	Throughout (>50%)	High	Long Term (20 – 100 years)	36
Threat	Throughout (>50%)	High	Long Term (20 – 100 years)	36
Cockscomb				
Pressure	-	-	-	-
Threat	-	-	-	-
Sittee River				
Pressure	-	-	-	-
Threat	-	-	-	-
Sibun				
Pressure	-	-	-	-
Threat	-	-	-	-
Vaca				
Pressure	-	-	-	-
Threat	-	-	-	-
Elijio Panti				
Pressure	Localized (< 5%)	High	Medium Term (5 - 20 years)	6
Threat	Localized (< 5%)	High	Medium Term (5 - 20 years)	6
Mountain Pine Ridge				
Pressure	Throughout (>50%)	High	Long Term (20 – 100 years)	36
Threat	Widespread (25 – 50%)	High	Long Term (20 – 100 years)	27
Chiquibul Forest Reserve				
Pressure	-	-	-	-
Threat	-	-	-	-

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Fire	Extent	Impact	Permanence	
Chiquibul National Park				
Pressure	-	-	-	-
Threat	-	-	-	-
Caracol				
Pressure	Localized (< 5%)	High	Long Term (20 – 100 years)	9
Threat	Localized (< 5%)	High	Long Term (20 – 100 years)	9

Southern Pine Bark Beetle

Southern Pine Bark Beetle	Extent	Impact	Permanence	
Columbia River				
Pressure	-	-	-	-
Threat	-	-	-	-
Bladen				
Pressure	-	-	-	-
Threat	-	-	-	-
Maya Mountain				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Gomez)				
Pressure	Widespread (25-50%)	High	Long Term (20 – 100 years)	27
Threat	Localized (< 5%)	High	Medium Term (5 - 20 years)	6
Deep River (Wood Depot)				
Pressure	Widespread (25-50%)	High	Long Term (20 – 100 years)	27
Threat	Localized (< 5%)	High	Medium Term (5 - 20 years)	6
Cockscomb				
Pressure	-	-	-	-
Threat	-	-	-	-
Sittee River				
Pressure	-	-	-	-
Threat	-	-	-	-
Sibun				
Pressure	-	-	-	-
Threat	-	-	-	-
Vaca				
Pressure	-	-	-	-
Threat	-	-	-	-
Elijio Panti				
Pressure	-	-	-	-
Threat	-	-	-	-
Mountain Pine Ridge				
Pressure	Throughout (>50%)	High	Long Term (20 – 100 years)	36
Threat	Localized (< 5%)	High	Medium Term (5 - 20 years)	6
Chiquibul Forest Reserve				
Pressure	-	-	-	-
Threat	-	-	-	-
Chiquibul National Park				
Pressure	-	-	-	-
Threat	-	-	-	-
Caracol				
Pressure	-	-	-	-
Threat	-	-	-	-

Unauthorized Land Allocation

Land Allocation	Extent	Impact	Permanence	
Columbia River				
Pressure	-	-	-	-
Threat	-	-	-	-
Bladen				
Pressure	-	-	-	-
Threat	-	-	-	-
Maya Mountain				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Gomez)				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Wood Depot)				
Pressure	-	-	-	-
Threat	-	-	-	-
Cockscomb				
Pressure	-	-	-	-
Threat	-	-	-	-
Sittee River				
Pressure	Scattered (5 - 25%)	Severe	Permanent (>100 years)	32
Threat	Scattered (5 - 25%)	Severe	Permanent (>100 years)	32
Sibun				
Pressure	-	-	-	-
Threat	-	-	-	-
Vaca				
Pressure	Widespread (25 - 50%)	Severe	Permanent (>100 years)	48
Threat	Widespread (25 - 50%)	Severe	Permanent (>100 years)	48
Elijio Panti				
Pressure	Scattered (5 - 25%)	Mild	Short term (< 5 years)	2
Threat	-	-	-	-
Mountain Pine Ridge				
Pressure	-	-	-	-
Threat	-	-	-	-
Chiquibul Forest Reserve				
Pressure	-	-	-	-
Threat	-	-	-	-
Chiquibul National Park				
Pressure	-	-	-	-
Threat	-	-	-	-
Caracol				
Pressure	-	-	-	-
Threat	-	-	-	-

Agricultural Incursions

Agricultural Incursions	Extent	Impact	Permanence	
Columbia River				
Pressure	Localized (<5%)	Severe	Permanent (> 100 years)	16
Threat	Scattered (5 - 25%)	Severe	Permanent (> 100 years)	32
Bladen				
Pressure	-	-	-	-
Threat	-	-	-	-
Maya Mountain				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Gomez)				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Wood Depot)				
Pressure	-	-	-	-
Threat	-	-	-	-
Cockscomb				
Pressure	-	-	-	-
Threat	-	-	-	-
Sittee River				
Pressure	Localized (<5%)	Severe	Permanent (>100 years)	16
Threat	Scattered (5-25%)	Severe	Permanent (>100 years)	32
Sibun				
Pressure	Scattered (5-25%)	Severe	Permanent (>100 years)	32
Threat	Scattered (5-25%)	Severe	Permanent (>100 years)	32
Vaca				
Pressure	Scattered (5-25%)	Severe	Permanent (>100 years)	32
Threat	Widespread (25 – 50%)	Severe	Permanent (>100 years)	48
Elijio Panti				
Pressure	Scattered (5 - 25%)	Mild	Short term (< 5 years)	2
Threat	-	-	-	-
Mountain Pine Ridge				
Pressure	-	-	-	-
Threat	-	-	-	-
Chiquibul Forest Reserve				
Pressure	-	-	-	-
Threat	-	-	-	-

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Agricultural Incursions	Extent	Impact	Permanence	
Chiquibul National Park				
Pressure	Scattered (5 - 25%)	Severe	Permanent (> 100 years)	32
Threat	Scattered (5 - 25%)	Severe	Permanent (> 100 years)	32
Caracol				
Pressure	Scattered (5 - 25%)	Severe	Permanent (> 100 years)	32
Threat	Scattered (5 - 25%)	Severe	Permanent (> 100 years)	32

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Military Impacts

Military Impacts	Extent	Impact	Permanence	
Columbia River				
Pressure	-	-	-	-
Threat	-	-	-	-
Bladen				
Pressure	-	-	-	-
Threat	-	-	-	-
Maya Mountain				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Gomez)				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Wood Depot)				
Pressure	-	-	-	-
Threat	-	-	-	-
Cockscomb				
Pressure	-	-	-	-
Threat	-	-	-	-
Sittee River				
Pressure	-	-	-	-
Threat	-	-	-	-
Sibun				
Pressure	-	-	-	-
Threat	-	-	-	-
Vaca				
Pressure	-	-	-	-
Threat	-	-	-	-
Elijio Panti				
Pressure	Scattered (5-25%)	Moderate	Short Term (< 5 years)	4
Threat	Scattered (5-25%)	Moderate	Short Term (< 5 years)	4
Mountain Pine Ridge				
Pressure	Widespread (25 - 50%)	Moderate	Medium Term (5 - 20 years)	12
Threat	Widespread (25 - 50%)	Moderate	Medium Term (5 - 20 years)	12
Chiquibul Forest Reserve				
Pressure	Localized (< 5%)	Moderate	Short Term (< 5 years)	2
Threat	Localized (< 5%)	Moderate	Short Term (< 5 years)	2
Chiquibul National Park				
Pressure	Localized (< 5%)	Moderate	Short Term (< 5 years)	2
Threat	Localized (< 5%)	Moderate	Short Term (< 5 years)	2

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Military Impacts	Extent	Impact	Permanence	
Caracol				
Pressure	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (< 5%)	Mild	Short Term (< 5 years)	1

Tourism Impacts

Tourism Impacts	Extent	Impact	Permanence	
Columbia River				
Pressure	-	-	-	-
Threat	-	-	-	-
Bladen				
Pressure	-	-	-	-
Threat	-	-	-	-
Maya Mountain				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Gomez)				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Wood Depot)				
Pressure	-	-	-	-
Threat	-	-	-	-
Cockscomb				
Pressure	Localized (<5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (<5%)	Moderate	Short Term (< 5 years)	2
Sittee River				
Pressure	-	-	-	-
Threat	-	-	-	-
Sibun				
Pressure	-	-	-	-
Threat	-	-	-	-
Vaca				
Pressure	-	-	-	-
Threat	-	-	-	-
Elijio Panti				
Pressure	-	-	-	-
Threat	-	-	-	-
Mountain Pine Ridge				
Pressure	Localized (<5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (<5%)	Mild	Short Term (< 5 years)	1
Chiquibul Forest Reserve				
Pressure	-	-	-	-
Threat	-	-	-	-
Chiquibul National Park				
Pressure	-	-	-	-
Threat	-	-	-	-
Caracol				
Pressure	Localized (< 5%)	Mild	Short Term (< 5 years)	1
Threat	Localized (< 5%)	Moderate	Short Term (< 5 years)	2

Mining / Oil

Tourism Impacts	Extent	Impact	Permanence	
Columbia River				
Pressure	-	-	-	-
Threat	-	-	-	-
Bladen				
Pressure	-	-	-	-
Threat	-	-	-	-
Maya Mountain				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Gomez)				
Pressure	-	-	-	-
Threat	-	-	-	-
Deep River (Wood Depot)				
Pressure	-	-	-	-
Threat	-	-	-	-
Cockscomb				
Pressure	-	-	-	-
Threat	-	-	-	-
Sittee River				
Pressure	-	-	-	-
Threat	-	-	-	-
Sibun				
Pressure	-	-	-	-
Threat	-	-	-	-
Vaca				
Pressure	-	-	-	-
Threat	-	-	-	-
Elijio Panti				
Pressure	-	-	-	-
Threat	-	-	-	-
Mountain Pine Ridge				
Pressure	-	-	-	-
Threat	-	-	-	-
Chiquibul Forest Reserve				
Pressure	Localized (< 5%)	Mild	Medium Term (5 - 20 years)	2
Threat	Localized (< 5%)	Moderate	Medium Term (5 - 20 years)	4
Chiquibul National Park				
Pressure	Localized (< 5%)	Moderate	Medium Term (5 - 20 years)	4
Threat	Localized (< 5%)	Severe	Long Term (20 – 100 years)	12
Caracol				
Pressure	-	-	-	-
Threat	-	-	-	-

Annex Three

CAP Threat Assessment for the Maya Mountains Massif

Stresses and Source of Stress: Broadleaf Forest

Stresses		Severity	Scope	Stress Rank
1	Changes in abundance of functional guilds	High	High	High
2	Reduction in extent of broadleaf forest	Very High	Low	Low
3	Reduction in connectivity with other forest blocks	Medium	High	Medium

Broadleaf Forest Threats - Sources of Stress	Changes in abundance of functional guilds	Reduction in extent of broadleaf forest	Reduction in connectivity with other forest blocks
Stresses Rank	1	2	3
	High	Low	Medium
1. Unsustainable and illegal logging			<i>Threat to Target: Low</i>
Contribution	-	-	<i>Low</i>
Irreversibility	-	-	<i>Low</i>
Threat Rank	-	-	Low
2. Local Hunting			<i>Threat to Target: Low</i>
Contribution	<i>Low</i>	-	-
Irreversibility	<i>Medium</i>	-	-
Threat Rank	Low	-	-
3. Subsistence hunting (xateros)			<i>Threat to Target: High</i>
Contribution	<i>Very High</i>	-	-
Irreversibility	<i>Medium</i>	-	-
Threat Rank	High	-	-
4. Land use change in adjacent areas			<i>Threat to Target: Medium</i>
Contribution	<i>Low</i>	-	<i>Very High</i>
Irreversibility	<i>High</i>	-	<i>High</i>
Threat Rank	Medium	-	Medium

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Broadleaf Forest Threats - Sources of Stress	Changes in abundance of functional guilds	Reduction in extent of broadleaf forest	Reduction in connectivity with other forest blocks
Stresses Rank	1	2	3
	High	Low	Medium
5. Forest Clearance within the Maya Mountains Massif (Agricultural incursions / Dams etc.)			Threat to Target: Low
Contribution	<i>Low</i>	<i>High</i>	-
Irreversibility	<i>Low</i>	<i>Medium</i>	-
Threat Rank	Low	Low	-
6. Fire			Threat to Target: Low
Contribution	-	<i>High</i>	-
Irreversibility	-	<i>Medium</i>	-
Threat Rank	-	Low	-

Stresses and Source of Stress: Pine Forest and Savanna

Stresses		Severity	Scope	Stress Rank
1	Alteration of population structure	High	High	High
2	Reduction in population size	Medium	Medium	Medium
3	Reduction in recruitment	Medium	Medium	Medium
4	Change in species composition	High	Medium	Medium

Pine Forest and Savanna Threats - Sources of Stress	Alteration of population structure	Reduction in population size	Reduction in recruitment	Change in species composition
Stresses Rank	1	2	3	4
	High	Medium	Medium	Medium
1. Forest Clearance within the Maya Mountains Massif (Agricultural incursions / Dams etc.)				Threat to Target: High
Contribution	High	Low	High	High
Irreversibility	High	High	High	High
Threat Rank	High	Low	Medium	Medium
2. Pests and Disease – Southern Pine Bark Beetle				Threat to Target: High
Contribution	Very High	High	Medium	High
Irreversibility	Very High	High	Medium	High
Threat Rank	High	Medium	Low	Medium
3. Unsustainable and illegal logging				Threat to Target: Medium
Contribution	High	Medium	Low	Low
Irreversibility	Medium	Medium	Medium	Low
Threat Rank	High	Low	Low	Low
4. Pet trade (Yellow-headed parrot)				Threat to Target: Low
Contribution	Medium	Medium	Medium	Medium
Irreversibility	Low	Low	Low	Low
Threat Rank	Low	Low	Low	Low

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Pine Forests and Savannas Threats - Sources of Stress	Alteration of population structure	Reduction in population size	Reduction in recruitment	Change in species composition
Stresses Rank	1	2	3	
	High	Low	Medium	Medium
5. Fire				Threat to Target: High
Contribution	<i>Very High</i>	<i>Very High</i>	<i>Very High</i>	<i>Very High</i>
Irreversibility	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>
Threat Rank	High	Medium	Medium	Medium

Stresses and Source of Stress: Aquatic and Riparian Ecosystems

Stresses		Severity	Scope	Stress Rank
1	Alteration of hydrologic regime (flow regime)	High	Low	Low
2	Disruption of sediment and particular organic matter transport	Low	Low	Low
3	Water quality change	Medium	Low	Low
4	Disruption of stream connectivity	High	High	High
5	Disruption of landscape connectivity	Medium	Medium	Medium
6	Alteration of riparian forest	Very High	Low	Low
7	Increased sedimentation	Low	Medium	Low
8	Changes in species composition	High	High	High

Aquatic and Riparian Ecosystems Threats - Sources of Stress	Alteration of hydrologic regime (flow regime)	Disruption of sediment and particular organic matter transport	Water quality change	Disruption of stream connectivity	Disruption of landscape connectivity	Alteration of riparian forest	Increased sedimentation	Changes in species composition
Stresses Rank	1	2	3	4	5	6	7	8
	Low	Low	Low	High	Medium	Low	Low	High
1. Hydroelectricity Systems								Threat to Target: High
Contribution	Very High	Very High	Very High	High	High	Medium	High	-
Irreversibility	Very High	Very High	Very High	Very High	Very High	Very High	Very High	-
Threat Rank	Low	Low	Low	High	Medium	Low	Low	-
2. Forest Clearance within the Maya Mountains Massif (Agricultural incursions / Dams etc.)								Threat to Target: Medium
Contribution	Low	-	-	Low	-	Low	Low	-
Irreversibility	Medium	-	-	Medium	-	Medium	Medium	-
Threat Rank	Low	-	-	Low	-	Low	Low	-

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Aquatic and Riparian Ecosystems Threats - Sources of Stress	Alteration of hydrologic regime (flow regime)	Disruption of sediment and particulate organic matter transport	Water quality change	Disruption of stream connectivity	Disruption of landscape connectivity	Alteration of riparian forest	Increased sedimentation	Changes in species composition
Stresses Rank	1	2	3	4	5	6	7	8
	Low	Low	Low	High	Medium	Low	Low	High
3. Tourism Development								Threat to Target: Low
Contribution	Low	-	-	Low	-	Low	Low	-
Irreversibility	Medium	-	-	Medium	-	Low	Low	-
Threat Rank	Low	-	-	Low	-	Low	Low	-
4. Fire								Threat to Target: Medium
Contribution	-	-	-	Medium	-	-	Low	-
Irreversibility	-	-	-	Medium	-	-	Medium	-
Threat Rank	-	-	-	Medium	-	-	Low	-
5. Subsistence Hunting / Fishing (Xateros)								Threat to Target: High
Contribution	-	-	-	-	-	-	-	Medium
Irreversibility	-	-	-	-	-	-	-	Medium
Threat Rank	-	-	-	-	-	-	-	Medium
6. Local Hunting / Fishing								Threat to Target: Medium
Contribution	-	-	-	-	-	-	-	High
Irreversibility	-	-	-	-	-	-	-	Medium
Threat Rank	-	-	-	-	-	-	-	Medium

Stresses and Source of Stress: Upper Elevation Amphibians

Stresses		Severity	Scope	Stress Rank
1	Reduced population size	High	Very High	High
2	Habitat degradation	Medium	Very High	Medium

Upper Elevation Amphibians Threats - Sources of Stress	Reduced population size	Habitat degradation	
	1	2	
Stresses Rank	High	Low	
1. Pests and Diseases – Chytrid Fungi			Threat to Target: High
Contribution	High	-	
Irreversibility	High	-	
Threat Rank	High	-	
2. Changes in Weather Pattern			Threat to Target: High
Contribution	High	Very High	-
Irreversibility	Very High	Very High	-
Threat Rank	High	Medium	-
3. Environmental Pollution			Threat to Target: High
Contribution	High	Very High	-
Irreversibility	High	High	-
Threat Rank	High	Medium	-

Stresses and Source of Stress: Forest Products

Stresses		Severity	Scope	Stress Rank
1	Reduced xate population size	High	Very High	High
2	Altered xate population structure and recruitment	Very High	Very High	Very High
3	Reduced density of commercial timber	Medium	Medium	Medium
4	Reduced population size of medicinal, ceremonial and food source species	Low	Very High	Low
5	Reduction in extent of broadleaf forest	Very High	Low	Low

Forest Products Threats - Sources of Stress	Reduced xate population size	Altered xate population structure and recruitment	Reduced density of commercial timber	Reduced population size of medicinal, ceremonial and food source species	Reduction in extent of broadleaf forest
	1	2	3	4	5
Stresses Rank	High	Very High	Medium	Low	Low
1. Unsustainable Harvesting – illegal Guatemalan xateros					Threat to Target: Very High
Contribution	Very High	Very High	-	High	-
Irreversibility	High	High	-	Very High	-
Threat Rank	High	Very High	-	Low	-
2. Unsustainable Harvesting – illegal Belizean xateros					Threat to Target: Medium
Contribution	Low	Low	-	Low	-
Irreversibility	Medium	Medium	-	Medium	-
Threat Rank	Low	Medium	-	Low	-
3. Unsustainable Harvesting – Belizean concession holders					Threat to Target: High
Contribution	Medium	Medium	-	-	-
Irreversibility	Medium	Medium	-	-	-
Threat Rank	Medium	High	-	-	-

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Forest Products Threats - Sources of Stress	Reduced xate population size	Altered xate population structure and recruitment	Reduced density of commercial timber	Reduced population size of medicinal, ceremonial and food source species	Reduction in extent of broadleaf forest
Stresses Rank	1	2	3	4	5
	High	Very High	Medium	Low	Low
4. Forest Clearance within MMM (Agricultural Incursions, Dams etc.)					Threat to Target: Very High
Contribution	<i>Medium</i>	<i>Medium</i>	<i>Low</i>	<i>Low</i>	<i>Very High</i>
Irreversibility	<i>Very High</i>	<i>Very High</i>	<i>Very High</i>	<i>Very High</i>	<i>Very High</i>
Threat Rank	High	Very High	Low	Low	Low
5. Unsustainable and Illegal Logging					Threat to Target: Low
Contribution	-	-	<i>High</i>	-	-
Irreversibility	-	-	<i>Medium</i>	-	-
Threat Rank	-	-	Low	-	-

Stresses and Source of Stress: Jaguar

Stresses		Severity	Scope	Stress Rank
1	Direct human impact	Low	Low	Low
2	Decreasing abundance of food resources	Medium	High	Medium
3	Reduction in connectivity	Medium	Very High	Medium
4	Decreasing habitat area	Very High	Medium	Medium

Jaguar Threats - Sources of Stress	Direct human impact	Decreasing abundance of food resources	Reduction in connectivity	Decreasing habitat area
Stresses Rank	1 <i>Low</i>	2 <i>Medium</i>	3 <i>Medium</i>	4 <i>Medium</i>
1. Killing of jaguars in areas of human conflict				Threat to Target: Low
Contribution	<i>Low</i>	-	-	-
Irreversibility	<i>Medium</i>	-	-	-
Threat Rank	Low	-	-	-
2. Pet trade				Threat to Target: Low
Contribution	<i>Low</i>	-	-	-
Irreversibility	<i>Medium</i>	-	-	-
Threat Rank	Low	-	-	-
3. Subsistence Hunting (xateros)				Threat to Target: Medium
Contribution	<i>Medium</i>	<i>Very High</i>	-	-
Irreversibility	<i>High</i>	<i>High</i>	-	-
Threat Rank	Low	Medium	-	-
4. Local hunting				Threat to Target: Low
Contribution	<i>Low</i>	<i>Low</i>	-	-
Irreversibility	<i>Medium</i>	<i>Medium</i>	-	-
Threat Rank	Low	Low	-	-

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Jaguar Threats - Sources of Stress	Direct human impact	Decreasing abundance of food resources	Reduction in connectivity	Decreasing habitat area
Stresses Rank	1	2	3	4
	<i>Low</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>
5. Land Use Change in Adjacent Areas				Threat to Target: Medium
Contribution	<i>Low</i>	-	<i>Very High</i>	<i>Very High</i>
Irreversibility	<i>High</i>	-	<i>High</i>	<i>High</i>
Threat Rank	Low	-	Medium	Medium
6. Forest Clearance within the MMMM (Agricultural Incursions, Dams etc.)				Threat to Target: Medium
Contribution	<i>Medium</i>	<i>Medium</i>	<i>Low</i>	<i>Very High</i>
Irreversibility	<i>Very High</i>	<i>Very High</i>	<i>Very High</i>	<i>Very High</i>
Threat Rank	Low	Medium	Low	Medium

Stresses and Source of Stress: Archaeological Sites

Stresses		Severity	Scope	Stress Rank
1	Erosion and pulverization of archaeological structures	High	Medium	Medium

Archaeological Sites Threats - Sources of Stress	Erosion and pulverization of archaeological structures		
Stresses Rank	1		
	Medium		
1. Looting and Vandalism			Threat to Target: Medium
Contribution	Medium		
Irreversibility	Very High		
Threat Rank	Medium		
2. Uncontrolled Visitation			Threat to Target: Low
Contribution	Low		-
Irreversibility	High		-
Threat Rank	Low		-
3. Weathering			Threat to Target: Medium
Contribution	Very High		-
Irreversibility	High		-
Threat Rank	Medium		-
4. Hydroelectricity Systems			Threat to Target: Low
Contribution	Low		
Irreversibility	Very High		
Threat Rank	Low		
5. Roads / Infrastructure			Threat to Target: Low
Contribution	Low		
Irreversibility	High		
Threat Rank	Low		

Stresses and Source of Stress: Aesthetic Landscapes

Stresses		Severity	Scope	Stress Rank
1	Fragmentation/modification of the landscape	High	Medium	Medium

Aesthetic Landscapes Threats - Sources of Stress		Fragmentation/modification of the landscape		
Stresses Rank		1		
		Medium		
1. Uncontrolled Visitation			Threat to Target: Low	
Contribution		High		
Irreversibility		Medium		
Threat Rank		Low		
2. Forest Clearance within the MMM Agricultural Incursions, Dams etc.)			Threat to Target: Low	
Contribution		Medium		
Irreversibility		Medium		
Threat Rank		Low		
3. Land Use Change in Adjacent Areas			Threat to Target: Low	
Contribution		Medium		
Irreversibility		Medium		
Threat Rank		Low		
4. Mines and Minerals – exploration / extraction			Threat to Target: Medium	
Contribution		High		
Irreversibility		High		
Threat Rank		Medium		
5. Roads / Infrastructure			Threat to Target: Medium	
Contribution		Very high		
Irreversibility		Very High		
Threat Rank		Medium		

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Aesthetic Landscapes Threats - Sources of Stress	Fragmentation/modification of the landscape		
Stresses Rank	1		
	Medium		
6. Fire			Threat to Target: Low
Contribution	<i>Medium</i>		
Irreversibility	<i>High</i>		
Threat Rank	Low		

Stresses and Source of Stress: Subterranean Systems (Caves, Sinkholes Underground Rivers)

Stresses		Severity	Scope	Stress Rank
1	Diminishing populations of cave dwelling species (eg. bats)	Medium	Low	Low
2	water quality change	Low	Low	Low
3	Habitat destruction	Low	Low	Low
4	Loss of archaeological remains and drawings	High	Medium	Medium
5	Alteration of cave formation processes	Medium	Medium	Medium

Forest Products Threats - Sources of Stress	Diminishing populations of cave dwelling species (eg. bats)	water quality change	Habitat destruction	Loss of archaeological remains and drawings	Alteration of cave formation processes
Stresses Rank	1	2	3	4	5
	Low	Low	Low	Medium	Medium
1. Uncontrolled Visitation					Threat to Target: Medium
Contribution	Medium	Low	Low	High	Medium
Irreversibility	Medium	Low	Low	Very High	Very High
Threat Rank	Low	Low	Low	Medium	Medium
2. Fire					Threat to Target: Low
Contribution	Low	-	Low	-	-
Irreversibility	Medium	-	High	-	-
Threat Rank	Low	-	Low	-	-
3. Looting and Vandalism					Threat to Target: Medium
Contribution	-	-	High	Medium	-
Irreversibility	-	-	Very High	Very High	-
Threat Rank	-	-	Medium	Medium	-

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Table ...: Summary Results Threats Across Targets 1 - 15		Broadleaf Forest	Pine Forest and Savanna	Aquatic and Riparian Systems	Upper Elevation Amphibians	Forest Products	Jaguar	Archaeological Sites	Aesthetic Landscapes	Subterranean Sites	Overall Threat Rank
1	Forest clearance within MMM (Agricultural Incursions / Dams etc.)	Low	High	Medium	-	Very High	Medium	-	Low	-	High
2	Unsustainable harvesting - illegal Guatemalan xateros	-	-	-	-	Very High	-	-	-	-	High
3	Subsistence hunting (xateros)	High	-	High	-	-	Medium	-	-	-	High
4	Fire	Low	High	Medium	-	-	-	-	Low	Low	Medium
5	Hydroelectricity systems	-	-	High	-	-	-	Low	-	-	Medium
6	Changes in weather patterns (Climate change)	-	-	-	High	-	-	-	-	-	Medium
7	Environmental pollution	-	-	-	High	-	-	-	-	-	Medium
8	Pests and diseases - Southern Pine Bark Beetle	-	High	-	-	-	-	-	-	-	Medium
9	Pests and Diseases - Chytrid Fungus	-	-	-	High	-	-	-	-	-	Medium
10	Unsustainable harvesting - Belize xate concession holders	-	-	-	-	High	-	-	-	-	Medium
11	Land use change in adjacent areas (human settlements, farming, trails etc.)	Medium	-	-	-	-	Medium	-	Low	-	Medium
12	Looting and vandalism	-	-	-	-	-	-	Medium	-	Medium	Medium
13	Local hunting	Low	-	Medium	-	-	Low	-	-	-	Medium
14	Uncontrolled visitation	-	-	-	-	-	-	Low	Low	Medium	Low
15	Unsustainable and Illegal logging	Low	Medium	-	-	Low	-	-	-	-	Low
16	Roads / infrastructure	-	-	-	-	-	-	Low	Medium	-	Low
Threat Status for Targets and Project		Medium	High	High	High	Very High	Medium	Medium	Medium	Medium	High

Technical Assessment of the Maya Mountains Massif: Threats and Opportunities

Threats Across Targets 16 – 21 (continued)		Broadleaf Forest	Pine Forest and Savanna	Aquatic and Riparian Systems	Upper Elevation Amphibians	Forest Products	Jaguar	Archaeological Sites	Aesthetic Landscapes	Subterranean Sites	Overall Threat Rank
17	Mines and minerals - exploration/extraction	-	-	-	-	-	-	-	Medium	-	Low
18	Unsustainable harvesting - Belizean xateros	-	-	-	-	Medium	-	-	-	-	Low
19	Weathering	-	-	-	-	-	-	Medium	-	-	Low
20	Pet trade	-	Low	-	-	-	Low	-	-	-	Low
21	Killing of jaguars in areas of human conflict	-	-	-	-	-	Low	-	-	-	Low
21	Tourism development	-	-	Low	-	-	-	-	-	-	Low
Threat Status for Targets and Project		Medium	High	High	High	Very High	Medium	Medium	Medium	Medium	High