



Summary Report
Technical Assessment
of the Maya Mountains Massif

April, 2008



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Summary Report Technical Assessment of the Maya Mountains Massif

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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:

Core Planning Team

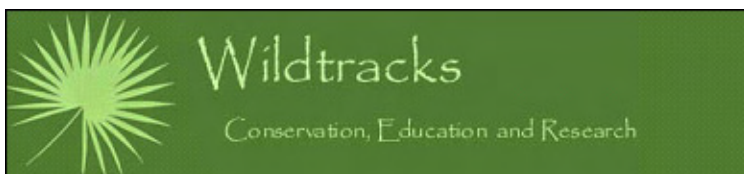
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... those community, public and private sector individuals who contributed towards the outputs of this Technical Assessment.

...Nellie Catzim and Jaime Awe as co-consultants

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

A full list of participants is included in Annex 1



Summary Report: Technical Assessment of the Maya Mountains Massif – Prepared by:
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Summary – Technical Assessment 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. A Technical Assessment of the Biodiversity and Cultural Heritage of the Maya Mountains Massif System (Report Two)
3. A Technical Assessment of the Threats and Opportunities of the Maya Mountains Massif System (Report Three)
4. Socio-Economic Analysis of the Maya Mountains Massif System (Report Four)
5. Management Capacities within the Maya Mountains Massif System (Report Five)

The **Summary – Technical Assessment of the Maya Mountains Massif** report provides the national and regional context for the Technical Assessment project, and summarises the four individual outputs of the technical assessment, as listed above.

It provides a summary of the analysis of the biodiversity and cultural values of the Maya Mountains Massif, and the outputs of the viability assessment – the results of the TNC Conservation Action Planning process. The threats and impacts on the system are also summarised, following assessment using the RAPPAM and TNC CAP processes.

A summary of the socio-economic context of the Maya Mountains Massif system is also included, with an assessment of present and potential options for financial and natural resource sustainability, both at community level, and at system level.

The report also summarises the RAPPAM¹ assessment of management capacities of the individual protected areas within the system is presented, as well as a system-level overview of strengths, weaknesses, and management gaps, with recommendations for system-level strengthening of management.

The report concludes with a series of recommendation for strengthening system-level management through a number of management strategies - zonation, the development of a system-level management structure and system-level management programmes. A series of critical management objectives and strategic actions are also presented, as an output of the Conservation Action Planning process.

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

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1. Introduction

1.1 Defining the Project

As part of Belize's National Protected Area System Plan, the Forest Department (FD) has identified the need to simplify the existing protected area system by consolidating adjacent protected areas into single, multi-zoned management units, creating a smaller number of sites that are individually more important (NPAPSP, 2005). One of the three areas highlighted for this strategy is the Maya Mountains Massif, approximately 1,260,800 acres (510,330 hectares) of national lands under protection. This project, the Technical Assessment of the Maya Mountains Massif, provides an initial step forward in this process, towards increasing management effectiveness through implementation of system-level management for the Maya Mountains Massif, building on the strengths of the current site-level management organizations and promoting collaboration, cost-sharing and providing support for those management organizations identified as benefitting from strengthening.

As well as providing recommendations for improving management effectiveness of this area, a key component of the project has been the development of synergies between national and bi-national initiatives, and collaborations between project partners, with results being shared among the various planning processes - the **Maya Mountain Marine Corridor** (Toledo Institute for Development and Environment (TIDE)), the **Chiquibul National Park Management Plan** (Friends for Conservation and Development (FCD)), the **Golden Stream Watershed Project** (Ya'axche Conservation Trust (YCT)), and the **Synthesis of Freshwater Research and Conservation Activities in the Watersheds of Belize** (The Nature Conservancy(TNC)).

Throughout the planning process there has also been recognition of the importance of a strong bi-national process that is legitimate for both Belize and Guatemala, with two final products - one for each country, and an overlap of participants from each of the national Core Planning Teams in the parallel workshops in Belize and Guatemala, to ensure there is close collaboration between both planning processes.

Identification of the Core Planning Team and Key Stakeholders

The Core Planning Team, for the Technical Assessment of the Maya Mountains project (the team responsible for designing, implementing and monitoring the technical assessment), was identified and confirmed during the first meeting of key stakeholders, held on the 23rd March, and includes representatives from the key Government management bodies (the Forest Department and Institute of Archaeology) as well as Friends for Conservation and Development, (the co-management agency active in developing collaborative strategies for increasing management effectiveness within the Chiquibul and Bladen areas of the Maya Mountains Massif), Belize Audubon Society and Wildtracks (the consultants leading the process). Consejo Nacional de Areas Protegidas (CONAP-Petén) was also represented on the Core Planning Team, and guidance was provided throughout the conservation action planning process by The Nature

Maya Mountains Massif

Managers

Forest Department
Institute of Archaeology

Co-management Agencies

Belize Audubon Society
Friends for Conservation and Development
Bladen Management Consortium
Itzamna Society

Long Term Forest License Holders

Pine Lumber Company
Thomas Gomez and Sons
The Wood Depot
New River Enterprises

Core Planning Team

Consultants:

Wildtracks: Paul and Zoe Walker

Forest Department:

Wilber Sabido
Hannah St. Luce

Institute of Archaeology

George Thompson
Brian Woodye

Friends for Conservation and Development

Rafael Manzanero

Belize Audubon Society

Ivis Chan
Allen Genus / Dominique Lizama

CONAP

Sergio Guzman
Raquel Siguenza (Consultant)

The Nature Conservancy:

Natalie Rosado (Belize)
Rudy Herrera (Guatemala)
Estuardo Secaira (CAP Coach)

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Conservancy, with the presence of both TNC-Belize and TNC-Guatemala, as well as additional assistance from Estuardo Secaira, as the TNC-CAP coach.

Further assistance was also provided by TNC through the participation of Rebecca Esselman and Juan Carlos Villagran in a number of the workshops, and through the participation of Maria Elena Molina as facilitator for the cultural elements during the identification and assessment of threats.

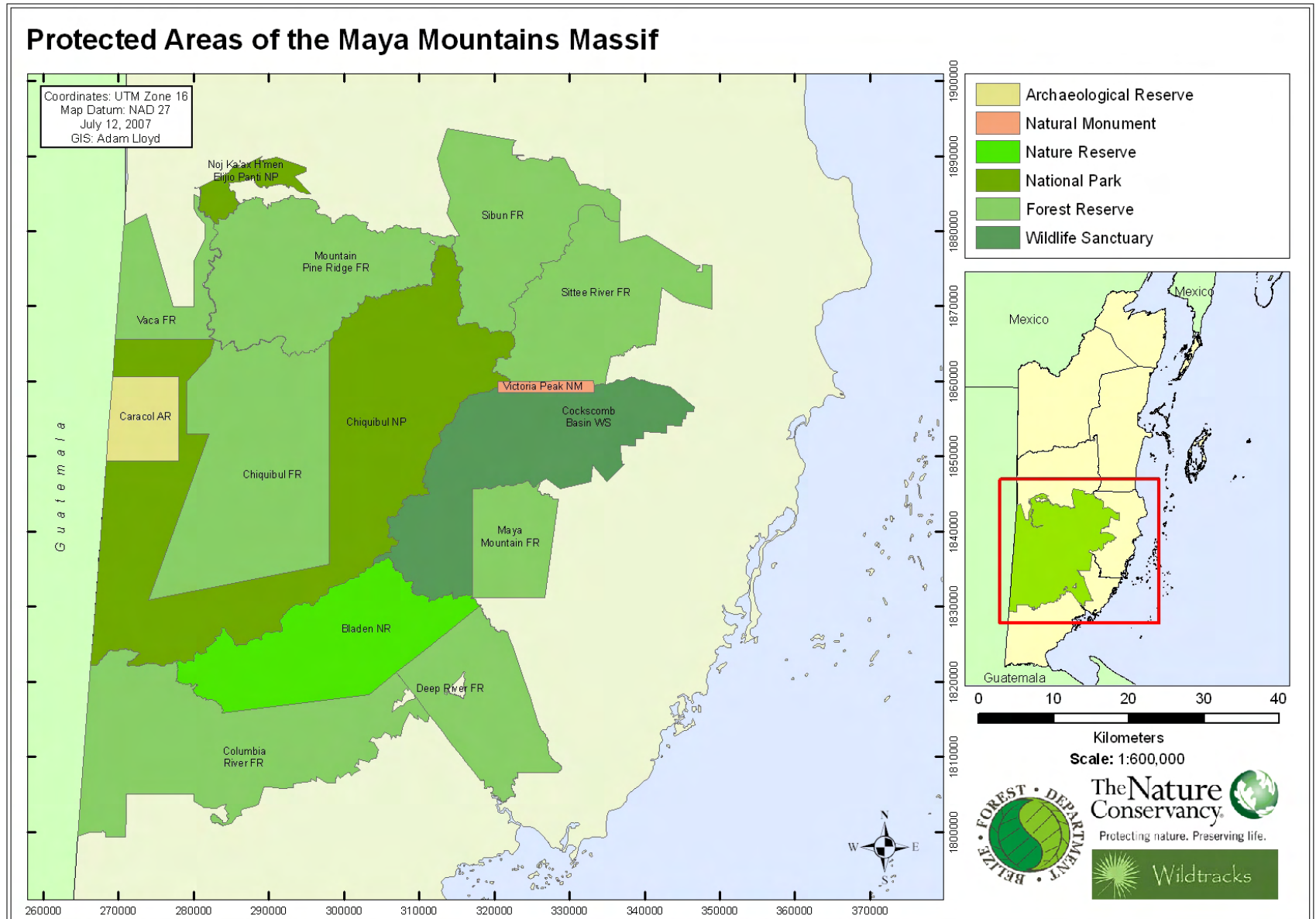
Also identified were technical experts, and perhaps most importantly, key stakeholders - individuals, groups, and institutions who have a vested interest in the natural resources of the project area and/or who will potentially be affected by project activities within the Maya Mountains Massif, and have something to gain or lose if conditions change - whose participation in workshops throughout the conservation action planning process has been considered critical to the success of the project (Annex One).

Project Scope

The Maya Mountains Massif, covering an estimated 1,260,800 acres (approximately 510,330 hectares) (FD, 2007), stretches from Vaca Forest Reserve at its most northerly extent to Columbia River Forest Reserve in the south, and encompasses a total of fourteen protected areas, as defined by the National Protected Areas Act, administered by the Forest Department, and as defined by the Ancient Monuments and Antiquities Act, administered by the Institute of Archaeology (Table 1; Map 1).

NAME	STATUS	IUCN CAT	ACRES
Sibun	Forest Reserve	VI	96564.45
Vaca	Forest Reserve	VI	34886.89
Chiquibul	Forest Reserve	VI	147823.10
Maya Mountain	Forest Reserve	VI	38259.77
Sittee River	Forest Reserve	VI	92316.59
Columbia River	Forest Reserve	VI	148302.97
Deep River	Forest Reserve	VI	67304.82
Mountain Pine Ridge	Forest Reserve	VI	106,352.70
Cockscomb Basin	Wildlife Sanctuary	IV	122,260.14
Victoria Peak	Natural Monument	III	4,840.56
Noj Kaax Me'en Eligio Panti	National Park	II	12,657.30
Chiquibul	National Park	II	264,003.25
Caracol	Archaeological Reserve	II	25,549.46
Bladen	Nature Reserve	Ia	99,673.80
APPROXIMATE AREA (ACRES)			1,260,800

Table 1: Protected Areas of the Maya Mountains Massif project area



Map 1: Protected Areas of the Maya Mountains Massif

Bi-national Perspectives

As part of a bi-national initiative, the overall focus of the project also extends into the contiguous Chiquibul / Montañas Mayas of Guatemala, through a parallel planning process being conducted by the Consejo Nacional de Areas Protegidas (CONAP), as part of the updating of the Complejo III (Chiquibul / Montana Mayas) Masterplan (Map 2).

To ensure close collaboration between the two projects of the bi-national initiative, site visits were arranged to protected areas on both sides of the border, to increase awareness of the state of biodiversity protection and the scale of threats and impacts in both countries. This certainly increased awareness in the Belize contingent of the limited protection afforded by the 'Biosphere Reserve' designation, the scale of deforestation taking place along the Guatemala side of the Belize-Guatemala border, and of the problems faced by Guatemalan border communities, with low employment opportunities and limited land availability. Discussions with CONAP-Petén staff, community members (including those who are currently farming within the Chiquibul National Park, on the Belize side of the border), and xateros provided an increased understanding of the complexities of the situation on the border, and an improved bi-national perspective.

For the Guatemala contingent, the site visits to the Chiquibul area of the Maya Mountains Massif increased awareness of the intact nature of the MMM and the scale of impacts from Guatemalan xatero and agricultural incursions, and the national concern within Belize regarding the need for enforcement within the framework of the current confidence building measures between the two countries.

A final meeting at bi-national level was held towards the end of the project to ensure calibration at bi-national level, and provided a forum for discussion of national and bi-national initiatives and strategies to address the issue of Guatemalan xatero and agricultural incursions.

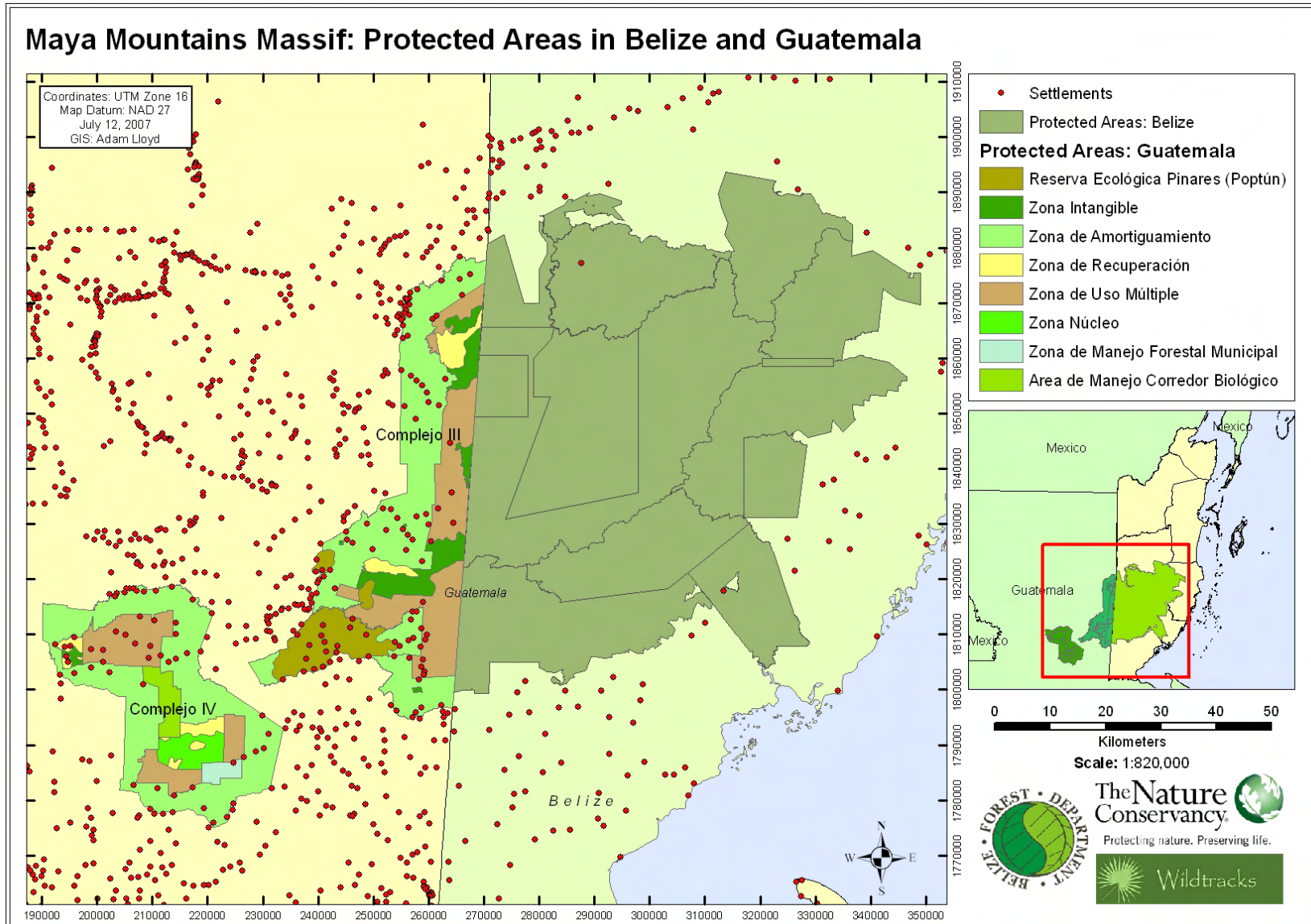


Guatemala Site Visit, 2007

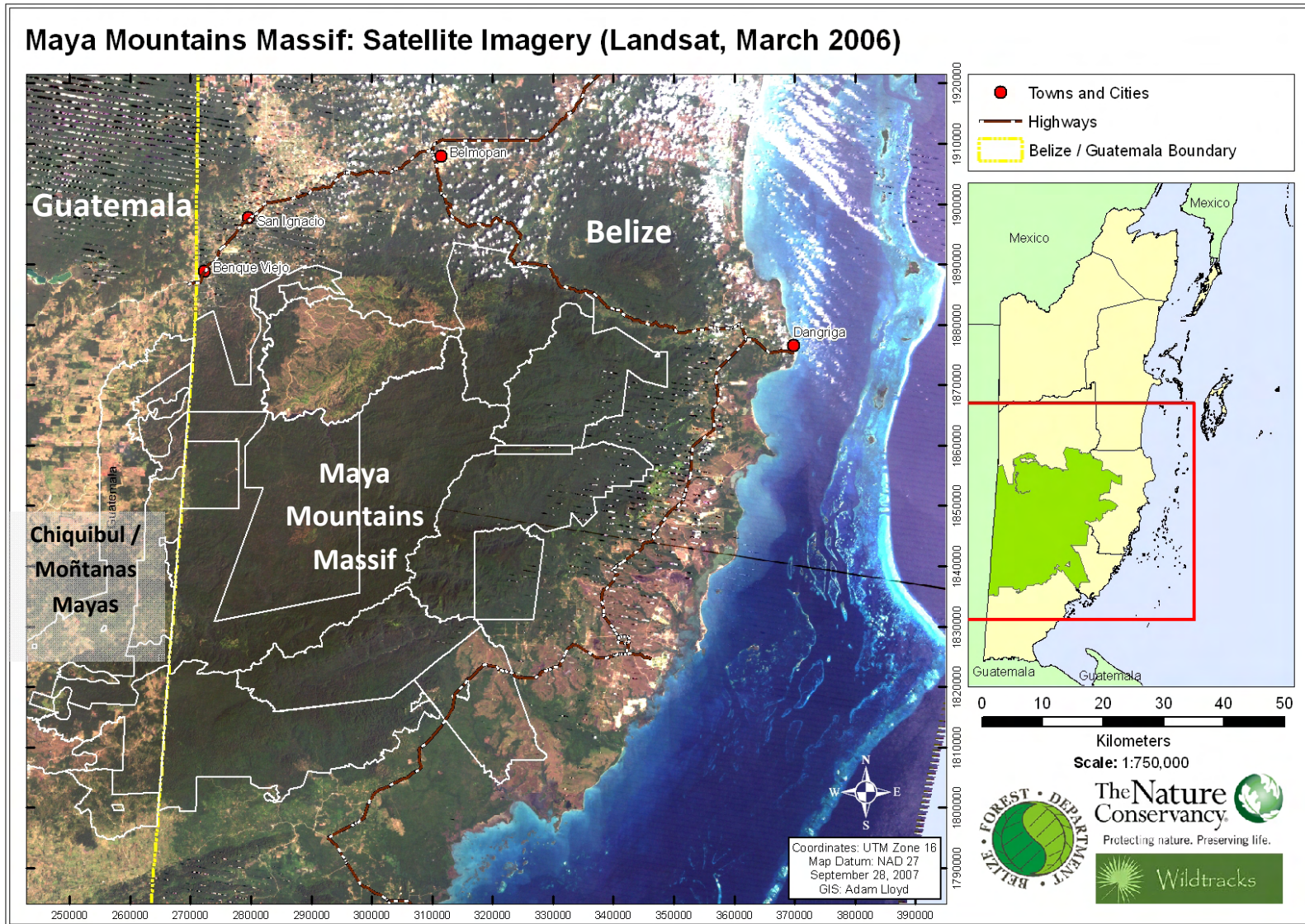
Above: Deforestation in the El Carrizal area, within the Multiple Use Zone. This Multiple Use Zone extends along much of the border.

Middle: Monte de los Olivos, one of the primary xate harvesting communities adjacent to the border, dependent on Belize xate.

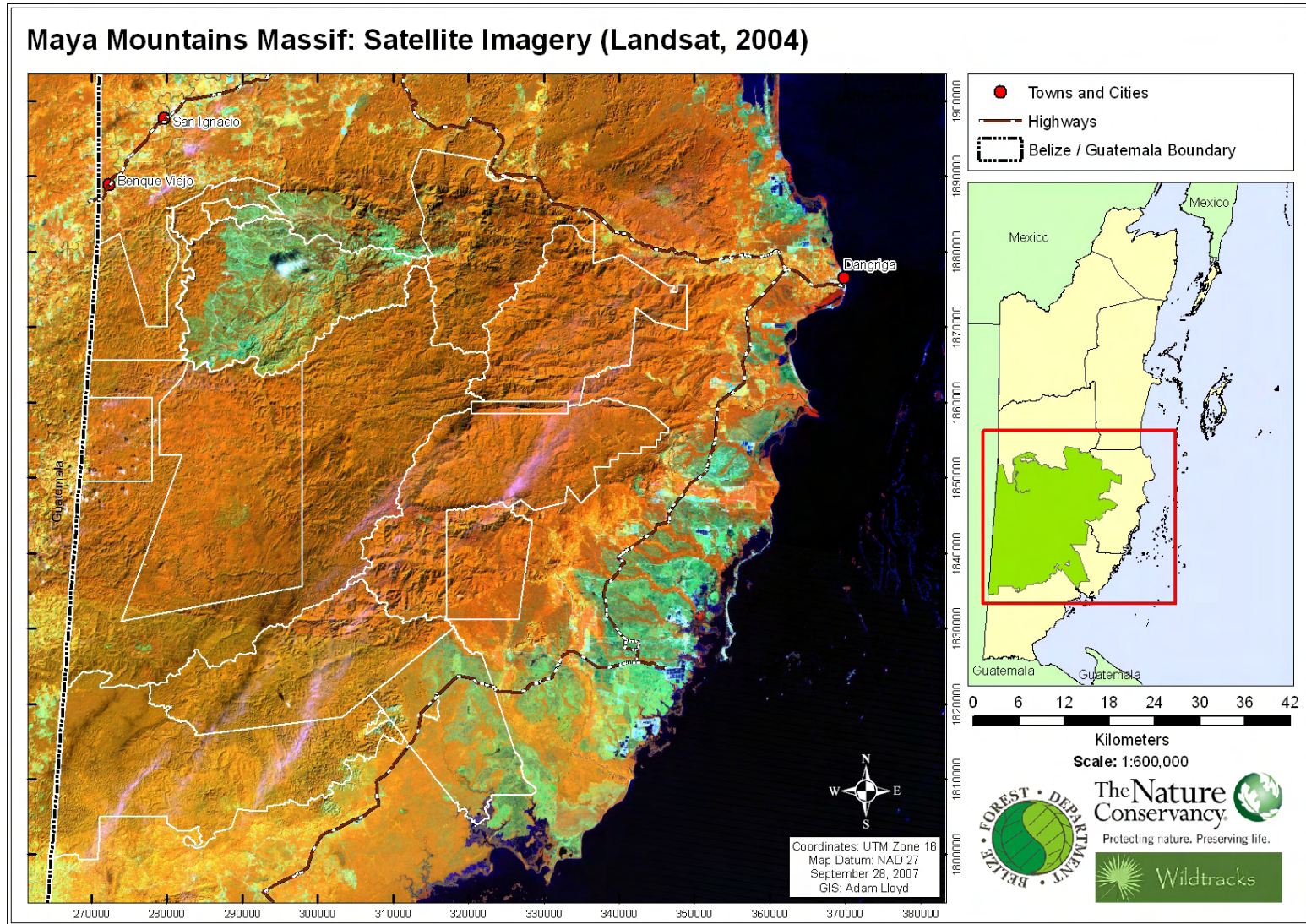
Below: Consultations with local farmers in the El Carrizal Area of Guatemala, who are currently farming within the Chiquibul National Park



Map 2. Complejo III of the Chiquibul / Montañas Mayas of Peten, Guatemala, and the Maya Mountains Massif of Belize, showing community distribution



Map 3: The Maya Mountains Massif and Adjacent Chiquibul / Montañas Mayas Biosphere Reserve



Map 4: The Maya Mountains Massif

Establishing a Collective Vision

Establishing a collective vision for the Maya Mountains Massif as a collaborative initiative with the participation of the key stakeholders was considered one of the first steps, and perhaps one of the most important of the consultative process. This was achieved during the first CAP workshop for the Conservation Action Planning process (**CAP1**), held on the 19th June, 2007, and focused on participation by a broad range of stakeholders for the development of the long term **Vision** for the effective conservation of the natural and cultural values of the Maya Mountains Massif in perpetuity. A similar process was also implemented in Poptun, Guatemala, to start the conservation planning process for the Complejo III of the Chiquibul / Montañas Mayas.



CAP 1: Developing a Vision for the Maya Mountains Massif (Belize)

Belize Vision Statement

The Maya Mountains Massif of Belize and Guatemala is internationally recognized for its exceptional natural and cultural values. This vast, contiguous forest and complex of watersheds, contributes to national development, regional cooperation and international conservation. The Massif is managed as an exemplary model of integrated management that maintains ecological integrity and preserves cultural heritage for future generations.

Guatemala Vision Statement

La Reserva de Biosfera Montañas Mayas-Chiquibul y los Refugios de Vida Silvestre Machaquila y Xutilha, ubicados en el Sureste de Petén, por sus características geomorfológicas contienen una gran diversidad biológica de flora y fauna que conjuntamente con el Macizo de Montañas Mayas de Belice integran un bloque de bosque continuo que contribuye a mitigar el cambio climático y protege zonas de recarga hídrica de alta importancia socioeconómica transfronteriza y sitios arqueológicos mayas y cultura viva, los cuales son manejados en forma sostenible y participativa para la protección, conservación y generación de bienes y servicios en beneficio de la población local y regional, y las futuras generaciones.

Project Assumptions

A number of assumptions have been made in the definition of the scope of the project:

- The project scope does not include the marine and estuarine elements of the Deep River Forest Reserve, as it is felt that these have been adequately covered by the Golden Stream Watershed Project under Ya'axche Conservation Trust (YCT) and the Maya Mountain Marine Corridor under Toledo Institute for Development and the Environment (TIDE).
- It is recognised that whilst there is some information available on both the biodiversity and cultural targets, there are also significant gaps, and the assessments and recommendations are based on the best scientific information available
- It is recognised that perceptions on biodiversity viability varies between Guatemala and Belize, and that there is a need to integrate the results of the two initiatives.
- Whilst the Guatemalan Conservation Action Planning process concentrated on both Complejo III (the Chiquibul / Montañas Mayas Biosphere Reserve) and Complejo IV (the Machaquila Xutliha Wildlife Refuge), only Complejo III is considered relevant for the purposes of the Belize Conservation Action Planning process, as there is currently no natural forest connectivity between the Maya Mountains Massif/Complejo III block, and Complejo IV.
- All figures, indicators and maps are based on the protected area system as of October, 2007, and this is considered the baseline for future monitoring and planning.

**Technical Assessment of the
Biodiversity and Cultural Heritage
of the Maya Mountains Massif**

Summary

2. Technical Assessment of the Biodiversity and Cultural Heritage of the Maya Mountains Massif

2.1 Biodiversity Value of the Maya Mountains Massif

Introduction

- Mesoamerica has been recognised under several recent ecoregional planning initiatives as one of the richest biodiversity areas on this planet, with seventeen percent of all known terrestrial species. It is also recognized as part of the second largest contiguous area of tropical rainforest in the Americas, after the Amazon (CEPF, 2004).
- Belize 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.
- The past low human population density and the network of intact, natural ecosystems within the protected areas system has resulted in Belize providing an important service in the maintenance of regional biodiversity.
- Several key assessments highlight the critical importance of the Maya Mountains as one of three national priority areas important in maintaining high levels of biodiversity.
- The functioning ecosystems and intact natural vegetation have 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, is highlighted for its importance for marine conservation in Mesoamerica, and for its the importance of the environmental services – the watershed and carbon sequestration functions, the hydrological processes all add to the importance of these protected areas.
- Increased population pressures and higher levels of poverty are increasing human impacts on the natural resources from both Belize and Guatemala, reducing the viability of the biodiversity of the Maya Mountains Massif.

Biodiversity Characteristics

Ecoregions

Three Ecoregions (Table3) are present within the Maya Mountains Massif - two (**Petén-Veracruz Moist Forest and Belizean Pine Forest**) are rated as **Critical/Endangered**, and are included within the scope of this assessment. The third, **Belizean Coast Mangroves**, is covered under the parallel Maya Mountain Marine Corridor CAP initiative (Meerman and Salas, in prep.).

Biome	Ecoregion	Status
<i>Tropical and Subtropical Moist Broadleaf Forest</i>	<i>Petén-Veracruz Moist Forest</i>	<i>Critical/ Endangered</i>
<i>Tropical and Subtropical Moist Coniferous Forest</i>	<i>Belizean Pine Forest</i>	<i>Critical/ Endangered</i>
<i>Mangrove</i>	<i>Belizean Coast Mangrove</i>	<i>Vulnerable</i>

Table 3: Ecoregion Classification for the Maya Mountains Massif area (Olson et. al., 2001),

Peten-Veracruz Moist Forest

- This large block of tropical forest – a matrix of moist tropical forest, bajo, wetlands and riparian habitats, stretches through Belize, Guatemala and southern Mexico.
- The rate of deforestation increases in the region (1.3% per year regionally (it is suggested that the national rate may be much higher, at 2.3% (C. Young, 2007)), with fragmentation of the remaining broadleaf forest blocks, resulting in not only the loss of key predators, but also secondary local extinctions and changes in species composition
- In the south eastern Maya Mountains Massif, particularly the Columbia River Forest Reserve, impacts from Hurricane Iris (2001) and subsequent fire damage and timber salvage operations have significantly altered forest structure.
- Elsewhere in the MMM, recent human impacts of forestry and mining have been overshadowed by the widespread illegal xate harvesting and associated hunting impacts from Guatemala.
- In the adjacent Complejo III of the Montañas Maya / Chiquibul Biosphere Reserve in Petén there has been large-scale clearance, particularly for cattle farming, even within the strictest protected area category, the Zona Núcleo.



Landscape of the Petén, following removal of the Petén-Veracruz Moist Forest

Belizean Pine Forest

- The Belizean pine forests of the Mountain Pine Ridge and the coastal plains represent one of the few examples of pre-montane pine forest in the Neotropics, and are considered to have a global status of 'critical/endangered' (WWF, 2001). The vegetation is characterized by the presence of the predominant tree species *Pinus caribaea*, with patches of *Pinus oocarpa* in some upper elevation areas. A number of endemic species are restricted to these Pine Forest areas.
- Fires are an important process in the maintenance of the pine forest, however, the increasing frequency of fires is resulting in a degradation of much of the ecosystem to grass savanna.
- In 2000 - 2002, the extensive standing crop of mature pine trees was also decimated by a severe infestation of Southern Pine Bark Beetle, radically changing the forest structure. The pine stands are slowly recovering, with natural regeneration, coupled with extensive forest restoration work, speeding up the restoration of the aesthetic appeal of the Pine Forest, as well as the reestablishment of future timber stocks.



Belizean Pine Forest

Ecosystems

- Current ecosystem mapping of the vegetation in the Maya Mountains Massif indicates a complex mosaic of 44 tropical broadleaf, pine forest and aquatic ecosystems under the UNESCO system of classification
- There are also a further 3 agricultural systems (representing the agricultural incursion areas), and 2 categories of Caribbean Mangrove forest, mapped within Deep River Forest Reserve, not covered within this overview (this ecosystem type is covered by the parallel Maya Mountain Marine Corridor projects).
- Nationally, thirteen of these ecosystems are found only within the Maya Mountains Massif, a further 11 have over 80% of their total national extent within the Massif, and eighteen are considered as under-represented within the national protected areas system.

Species of International Concern

- The Maya Mountains Massif is regionally important in its role of maintaining viable populations of at least 30 species of international concern (rated as Critically Endangered, Endangered or Vulnerable under the IUCN, 2007).
- Two of these are considered Critically Endangered – Morelet’s Treefrog (*Agalychnis moreletii*) and *Zamia prasina*, a cycad species, both found primarily in mid to upper elevations.
- Eight species are listed as Endangered, including the black howler monkey (*Alouatta pigra*)
- Three amphibian species of the Maya Mountains Massif are rated as Endangered (*Craugastor sabrinus*, *Bromeliohyala bromeliacia* and *Eleutherodactylus sandersoni*). A further three species of amphibian are classified as ‘Vulnerable’ (IUCN, 2007). These species are considered a increasing risk of Chytrid infection in the upper elevation areas (Global Amphibian Assessment, 2004)
- Land use change is also affecting species such the Endangered Baird’s tapir (*Tapirus bairdii*), though the Maya Mountains Massif still remains a stronghold for this species. Inundation of riparian systems favoured by this species as a result of dam construction has also been highlighted as a pressure on this species.
- Also of concern is the yellow-headed parrot (*Amazona oratrix*), considered ‘Endangered’ (IUCN, 2007), and restricted in Belize to pine savannas, and the Belizean sub-species **scarlet macaw** (*Ara macao*), thought to number fewer than 200 individuals (Matola, 2002)..

Critically Endangered Species of the Maya Mountains Massif IUCN Redlist, 2007	
Morelet’s Treefrog	<i>Agalychnis moreletii</i>
Cycad	<i>Zamia prasina</i>
Endangered Species of the Maya Mountains Massif	
Black Howler Monkey	<i>Alouatta pigra</i>
Yellow-headed Parrot	<i>Amazona oratrix</i>
Treefrog	<i>Bromeliohyala bromeliacia</i>
Treefrog	<i>Craugastor sabrinus</i>
Sanderson’s Treefrog	<i>Eleutherodactylus sandersoni</i>
Baird’s Tapir	<i>Tapirus bairdii</i>
	<i>Trichilia breviflora</i>
Fiddlewood, Yax-Nik	<i>Vitex gaumeri</i>
Zanthoxylum species	<i>Zanthoxylum procerum</i>

Endemic Species

- **Plants:** Of the forty one species of plant endemics recorded to date in Belize ((Missouri Botanical Gardens, 2007), fifteen (37%) are recorded from the Maya Mountains Massif. Many of these are recorded only from the highly restricted Belizean Pine Ecoregion and its fire-adapted savanna ecosystems (Balick, 2000; WWF, 2001).
- **Fish:** Two endemic freshwater fish species have been recorded in Belize - *Poecilia teresae*, (largely confined to the fast flowing streams of the Maya Mountains) and (Fishbase, 2007; Greenfield and Thomerson, 1997), and the cave chulin, or catfish, *Rhamdia typhla* (recorded only from Las Cuevas cave, in the Chiquibul Forest Reserve) and (Greenfield et. al., 1982)..

Belize Endemic Species found in the Maya Mountains Massif

Plants

- *Anemia bartletti*
- *Axonopus ciliatifolius*
- *Telanthophora bartletti*
- *Calyptanthus bartletti*
- *Dalechampia schippii*
- *Galactia anomala*
- *Koanophyllon sorensenii*
- *Mimosa pinetorum*
- *Neurolaena schippii*
- *Oxandra proctorii*
- *Pisonea proctorii*
- *Schippia concolor*
- *Scutellaria lundellii*
- *Syngonanthus bartlettii*
- *Zinowiewi pallid*

Vertebrates

- *Poecilia teresae*
- *Rhamdia typhla*
- *Rana juliani*

- **Amphibians:** *Rana juliani* is currently considered to be Belize's only endemic frog, and whilst restricted to the Maya Mountain Massif, it is considered common in the fast flowing streams, and probably occurs throughout much of the Chiquibul Forest Reserve (Lee, 1996). Ongoing work in the upper elevation areas of the Maya Mountains Massif suggest, however, that there may be more endemic amphibian species still to be identified.

Critical Ecosystem and Landscape Functions

- The Maya Mountains Massif performs a number of critical ecosystem and landscape functions at both national and regional level.
- As one of the largest remaining contiguous blocks of forest in Central America, it is recognized for its role in maintenance of the matrix of tropical broadleaf forests that are characteristic of northern Mesoamerica, but are currently greatly diminished in comparison with the historic range.
- Until recently, the area was considered to be maintaining the full range of natural processes and disturbance regimes, and to be functioning within the range of acceptability, with minimal human intervention
- Recent pressures, particularly from Guatemala, are, however, having significant impacts on the biodiversity, and require immediate intervention if the long term degradation of the natural and cultural resources is to be avoided, and the critical ecosystem functions of the Maya Mountains Massif are to be maintained.
- The major current impact on the Maya Mountains Massif has been identified as the illegal, widespread and unsustainable harvesting of *Chaemadorea ernesti-augusti* (xate), with associated hunting pressure, which has reportedly drastically reduced populations of many game species within the forest, including species not generally hunted within Belize, such as Baird's tapir, scarlet macaw and spider monkeys.

Critical Ecosystem Functions of the Maya Mountains Massif

Direct Products

- Food
- Medicines
- Building materials
- Craft Materials
- Commercial Timber
- Xate

Ecosystem Services

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

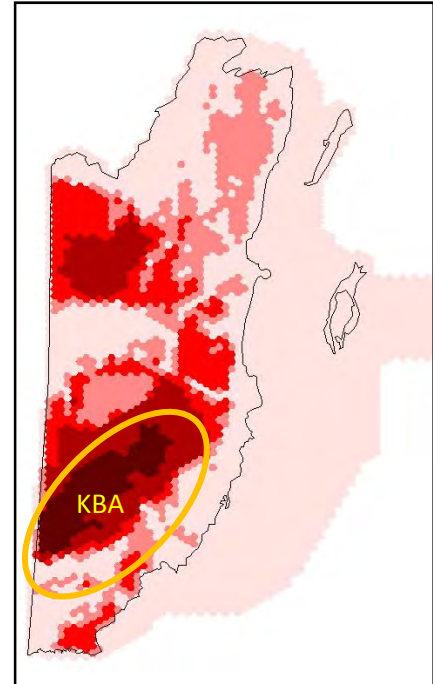
Inspirational and Cultural Attributes

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

Assessing Biodiversity Importance

Key Biodiversity Areas

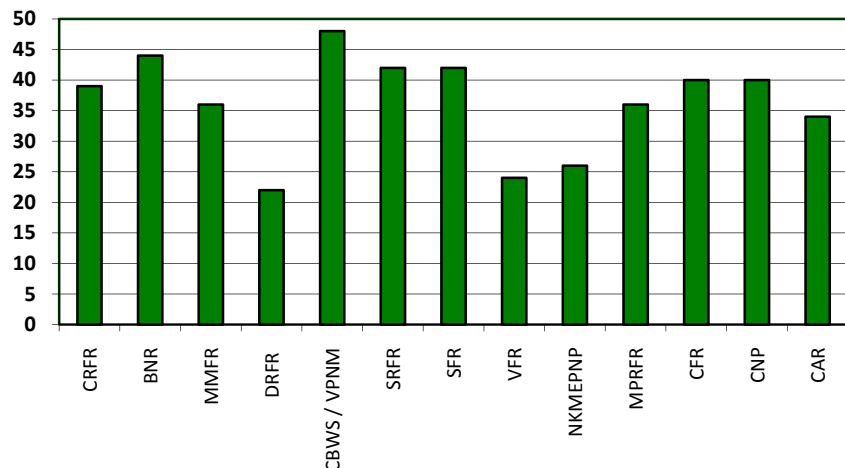
- The Key Biodiversity Areas analysis (Meerman, draft) used the Marxan Analytical Tool to determine biodiversity importance for Belize, based largely upon endangered and/or endemic species, and those considered to be of national concern.
- The Maya Mountains Massif is consistently highlighted in national and regional planning projects as a primary key conservation area. In the Key Biodiversity Areas assessment, the darker the red, the greater the importance of the area with respect to the conservation of threatened species (Map 5).
- The analysis is largely based on threatened species-presence data, and does not include overall species richness or ecosystem condition or functionality - additional factors taken into consideration in the current Technical Assessment, and in developing management zoning recommendations for the Maya Mountains Massif



Map 5: Draft Belize KBA map
(Adapted from Meerman, 2007)

RAPPAM Assessment of Biodiversity Importance

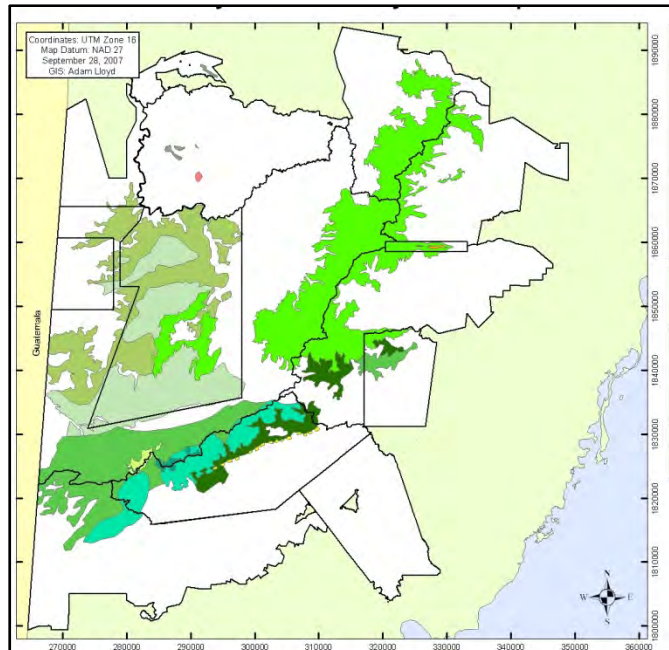
- The biodiversity component of the Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) process highlighted the value of each of the individual protected areas.
- The initial results of this analysis (Graph 1) highlight the important landscape functions played by the protected areas of the Maya Mountains, particularly those that lie against the Maya Divide. Cockscomb Wildlife Sanctuary, Bladen Nature Reserve, Sittee River Forest Reserve and Sibun Forest Reserve rate as the highest value areas of threatened species protection, species richness, endemism, watershed functionality and maintenance of natural resources and disturbance regimes, with the Chiquibul Forest Reserve / National Park and Columbia River Forest Reserve also being highly rated.



Graph 1: Relative Biodiversity Importance of the Protected Areas of the Maya Mountains Massif (RAPPAM assessment, 2007)

Redundancy in Biodiversity Protection

- There is very little species-level biodiversity data available for the Maya Mountains Massif, the majority of biological assessments and research being site-focussed, with little scope for system-wide comparison.
- With the exception of a few broad-ranging key species, distributional data is generalized and predictive, rather than based on reliable, ground-truthed data, and cannot yet be relied upon for conservation planning uses – at least not at the species level. Significantly more system-wide, multi-taxa, focussed site assessments will need to be conducted before the distribution of more than a handful of non-ubiquitous species can be reliably predicted across the Massif.
- Ongoing research (Brewer, S. pers. com; Goodwin, Z. pers. com; Walker, P. pers. obs.), is demonstrating multi-taxa discoveries of new species of plants and vertebrates, and far higher species richness in some areas of the Maya Mountains Massif than would be predicted with current techniques and available data – demonstrating that there are significant risks to effective overall biodiversity conservation in looking for redundancy in species or system protection at this time, with the current information available.
- The species diversity of the Maya Mountains may be significantly higher than has been presumed to date, so cautionary principles dictate that whilst there may now be a political need to look for possible redundancy within the Maya Mountains Massif, actions should be deferred until appropriate ground-based comparative field assessments have been implemented.
- Connectivity also needs to be considered in the question of redundancy, as the Massif is not considered large enough to maintain viable populations of large predators if it is isolated from currently contiguous forests.
- Recognizing that the best available data at the moment is not sufficient or accurate enough to be used to determine redundancy at species-level, redundancy can currently only be considered at the ecosystem level. A total of 13 Belize's ecosystems occur only in the Maya Mountains Massif, each with a very limited range, which dictates that there is no redundancy in their protection in the system, and that therefore none of the 13 protected areas within their combined footprint can be considered redundant in their entirety (Map 6).
- Recognizing that the core area of the Massif cannot be considered redundant in either species level or ecosystem level protection, particularly with its importance in watershed protection for both Belize and Guatemala, the question of redundancy must therefore be focussed along the periphery of the system.
- The maintenance of forest cover along the border with Guatemala is recognized as a



preferred policy to help buffer the biodiversity of the core of the Maya Mountains Massif from illegal incursions and extraction - the western boundary of the Maya Mountains Massif is therefore not included in the assessment of potential redundancy in species and/or ecosystem protection.

- There is recognition of the need to maintain connectivity with the remaining forest tracts of Complejo III – without connectivity, the Guatemalan forests are now too small to retain maintain viable biodiversity in isolation.
- Examination of ecosystems in the remaining peripheral area of the Massif, and using the NPAP Gap Analysis indicates that two ecosystems might be considered to potentially have some redundancy in level of protection.
 - **Tropical evergreen seasonal broad-leaved lowland hill forest on steep karstic terrain** exceeds the national target level of protection by 11%. This ecosystem occurs within 6 of the protected areas of the Massif, and is the predominant ecosystem of the Vaca Forest Reserve and Eljio Panti National Park. However, also to be considered is that karst landscapes are highlighted as in need of increased conservation strategies on the regional and global scale.
 - **Tropical evergreen broad-leaved lowland forest on poor or sandy soils** has a level of protection 3% above the target level. This ecosystem occurs within much of the Deep River Forest Reserve and the south-eastern portion of Maya Mountain Forest Reserve. It should however be noted the overall 3% redundancy was reduced to about 1.5% by the recent de-reservation of part of the Maya Mountain Forest Reserve.
- Cautionary principles relating to current mapping data dictate that possible re-alignment actions, based on redundancy, should be deferred until there is appropriate ground-based comparative field assessments (and a parallel assessment of the socio-economic context of these areas. The only other (small) area that might be considered to have any redundancy is the south-eastern corner of Maya Mountain Forest Reserve.

2.2 Archaeological and Cultural Values of the Maya Mountains Massif

Introduction

- The Maya Mountains Massif represents one of the most poorly studied archaeological regions of Belize, 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.
- The greater Maya Mountains contain 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.

Archaeological Characteristics

- Archaeologically, Belize is located within the eastern Maya lowlands and is part of the Maya sub-area of Mesoamerica. Human prehistory within the Maya Lowland sub-area (and by extension Belize) is generally divided into three major time-frames
 - **Pre-ceramic period (10,000 – 1200 B.C.)**
 - **Prehistoric Maya occupation (1200 BC to AD 1500)**
 - **Historic period (1500 -1900 A.D.)**
- Four geo-cultural sub-regions have been identified within the Maya Mountains Massif:
 - **Mountain Pine Ridge Sub-region** The agriculturally nonproductive nature of the region has been held responsible for the lack of archaeological sites in this sub-region. However it has been suggested that the region was a source of granite and slate, exploited by the Maya for the manufacturing of manos, metates and non-utilitarian objects.
 - **Chiquibul Sub-region:** The richer soils of the Chiquibul area promoted the development of communities, agricultural terracing, and the establishment of Caracol, the major ceremonial center in the Chiquibul area.
 - **Vaca Sub-region:** The many caves of the Vaca sub-region, situated in the northern boundaries of the Plateau, are considered to have been important to the Maya culture, and some now important tourism destinations.
 - **Southern Sub-region:** The southern Belize sub-region encompasses the Sibun and Sitté River Forest Reserves, Cockscomb Basin Wildlife Sanctuary, the Maya Mountain, Deep River and Columbia River Forest Reserves, and the Bladen Nature Reserve. More than 200 sites have been identified and mapped in southern Belize, with economic activities of these centers believed to be focused on resource exploitation and exchange, resulting in the rise of many regional centers along the foothills of the Maya Mountain.

2.3 Biodiversity Viability Assessment

Introduction

The Viability Assessment conducted under the Conservation Action Planning process has assisted the project team in building an informed structure to guide conservation and research in the Maya Mountains Massif. It has been developed based on established principles of ecology and conservation science, and uses the best available information on the target's biology and ecology in an explicit, objective, and consistent manner, with extensive input from technical and field experts both nationally and internationally.

Selecting Conservation Targets

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

These targets were required to meet the following criteria, where possible (adapted from TNC, 2007):

- **Targets should represent the biodiversity and cultural heritage of the site.**
- **Targets reflect ecoregion or other existing conservation goals.**
- **Targets are viable or at least feasibly restorable.**
- **Targets are highly threatened.**

Six biodiversity targets were selected for the Maya Mountains Massif, and can be divided into three subgroups:

- **Ecosystem Level:**
 - *Broadleaf Forest*
 - *Pine Forest and Savanna*
 - *Aquatic and Riparian Ecosystems*
- **Species Assemblages:**
 - *Upper Elevation Amphibians*
 - *Forest Products*
- **Keystone / Umbrella / Flagship Species:**
 - *Jaguar*

Three cultural targets were chosen to represent the cultural values of the Maya Mountains Massif:

- *Archaeological Sites*
- *Aesthetic Landscapes*
- *Subterranean Systems*

Focal Conservation Targets for the Maya Mountains Massif

Biodiversity Targets

- Broadleaf Forest
- Pine Forest and Savanna
- Aquatic and Riparian Ecosystem
- Upper Elevation Amphibians
- Forest Products
- Jaguar

Cultural Targets

- Archaeological Sites
- Aesthetic Landscapes
- Subterranean Systems

Conservation targets associated with the estuarine and coastal ecosystems of Deep River Forest Reserve have not been included within this assessment, as these are considered to be adequately covered within the parallel Maya Mountain Marine Corridor project. It is assumed that conservation of these focal targets will ensure the conservation of all native biodiversity within the functional landscape of the Maya Mountains Massif. The Conservation Targets and nested targets are described within the **Technical Assessment of the Biodiversity and Cultural Heritage of the Maya Mountains Massif (Report Two)**.

Assessing Biodiversity Viability

The first stage of the viability assessment is the identification of **key ecological attributes** (KEAs) for each of the conservation targets. The key ecological attribute is defined as:

“an aspect of a target's biology or ecology that if present, defines a healthy target and if missing or altered, would lead to the outright loss or extreme degradation of that target over time”.

TNC, 2007

For the purposes of this project, and in line with the TNC Conservation Action Planning approach, the Key Ecological Attributes have been grouped into three classes:

- **Size** - a measure of the area or abundance of the conservation target's occurrence.
- **Condition** - a measure of the biological composition, structure and biotic interactions that characterize the occurrence.
- **Landscape context** - an assessment of the target's environment including ecological processes and regimes that maintain the target occurrence such as flooding, fire regimes and other natural disturbances, and connectivity. allowing access to habitats and resources or the ability to respond to environmental change through dispersal or migration.

Whilst the **Key Ecological Attribute** defines the critical requirements for a conservation target, **indicators** have been used to provide a means of measuring the status of the Key Ecological Attributes for each conservation target. An effort has been made throughout the viability assessment to use indicators that are measurable, precise, consistent, sensitive and technically and financially feasible. A viability rating is developed for each indicator, based on the following scale:

- **Very Good** – The Indicator is considered to have an ecologically desirable status, requiring little or no intervention for maintenance.
- **Good** – The indicator lies within the acceptable range of variation, though some intervention is required for maintenance.
- **Fair** – The indicator lies outside the acceptable range of variation, and human intervention is required if the viability of the target is to be maintained
- **Poor** – Restoration of the conservation target is increasingly difficult, and impacts may result in extirpation from the conservation area

The current status and project goals for each indicator were developed during the workshop, with subsequent consultations with protected area managers, co-managers, and technical and field staff to refine the assessment and increase the accuracy of each of the indicator ratings. Specific technical working group meetings were called to focus on particular conservation targets, with Forest Department and the Institute of Archaeology, and a series of target meetings were held to address identified gaps in information. The viability for each conservation target of the Maya Mountains Massif is summarised below (Table 4), and the background analysis contained in Report Two.

Summary of Biodiversity Target Viability for the Maya Mountains Massif				
Conservation Targets	Landscape Context	Condition	Size	Viability Rank
	Grade	Grade	Grade	
Broadleaf Forest	Very Good	Good	Very Good	Very Good
Pine Forest and Savanna	Fair	Fair	Good	Fair
Aquatic and Riparian Systems	Fair	Very Good	Very Good	Good
Upper Elevation Amphibians	Good	Good	Good	Good
Forest Products	Very Good	Fair	Fair	Good
Jaguar	Very Good	Good	Good	Good

Table 4: Summary of Biodiversity Target Viability for the Maya Mountains Massif

2.4 Cultural Viability Assessment

Introduction

The Viability Assessment for the cultural targets has been developed based on integrity and the best available information on the target's conceptual meaning, physical condition, and sacredness, in an explicit, objective, and consistent manner, with extensive input from technical and field experts.

Identification of Conservation Targets

Three Conservation Targets were selected:

- **Archaeological**
- **Aesthetic Landscapes**
- **Subterranean Systems**

Assessing Cultural Viability

The first stage of the viability assessment is the identification of **key attributes** for each of the conservation targets, including:

- Historical, aesthetic, scientific and technical attributes
- Social, spiritual-religious, educational attributes, based on identity
- Economic, touristic and productive attributes
- Landscape and scenic attributes

For the purposes of this project, and in line with the TNC Conservation Action Planning approach, the key characteristics have been grouped into three classes - **Conceptual Content**, **Physical Condition** and **Context**.

Assessment of these three **key characteristics** for each conservation target allows a characterization of a target's cultural integrity within an area, providing a basis on which to analyse the effects of deterioration, and allowing corresponding strategies to be developed:

- **Conceptual Content** – the extent to which a target reflects socio-cultural values of a historical period from which it dates, its authenticity, age, information, messages and meanings it transmits.
- **Physical Condition** - a comparison between a targets original and its current state, based on:
 - How intact or deteriorated it is compared to its original extent
 - How altered it is on a spatial level by changes – justified and non-justified, attachments, stratification etc.
 - How degraded its materials and shapes are
- **Context** – based on the natural and social surroundings including key natural and/or social factors that contribute or impinge upon the conservation or degradation of selected cultural targets

Guidelines to assigning hierarchical values to cultural integrity have been developed (TNC, 2003):

Conceptual Context:

- **Very Good** – Fully expresses in a complete fashion all the historical characteristics of the period which it represents
- **Good** – Expresses almost in its totality the historical characteristics of the period which it represents
- **Fair** – Expresses some of the historical characteristics of the period which it represents
- **Poor** – Expresses a few of the historical characteristics of the period which it represents

Physical Condition:

- **Very Good** – Expresses that it has a complete representation of all of its components and that its spatial, material, structural, morphological characteristics are in good shape
- **Good** – Expresses that its representation is 75% complete, and that has few alterations in its spatial, material, structural, and morphological characteristics
- **Fair** – Its representation is incomplete, with only 50% of many parts intact, and with many modifications in its spatial, material, structural, and morphological characteristics
- **Poor** – With incomplete representation of almost all its parts (only 25% intact) and with significant modifications to its spatial, material, structural, and morphological characteristics

Context:

Natural Context

- **Very Good** – Almost all natural factors favour conservation of selected cultural target
- **Good** – Most natural factors favour conservation of cultural target
- **Fair** – Many existing natural factors promote the deterioration of cultural target
- **Poor** – The majority of natural factors promote the deterioration of cultural target

Cultural Context

- **Very Good** – Almost all social factors favour conservation of cultural target selected
- **Good** – Most social factors favour conservation of cultural target selected
- **Fair** – Many social factors promote a deterioration of cultural target
- **Poor** – The majority of social factors promote a deterioration of cultural target

The viability for each conservation target of the Maya Mountains Massif is summarised below (Table 5), and the background analysis contained in Report Two.

:

Conservation Targets	Conceptual Content	Physical Condition	Natural Context	Viability Rank
	Rating	Rating	Rating	
Archaeological Sites	Good	Fair	Good	Good
Aesthetic Landscapes	Very Good	Very Good	Good	Very Good
Subterranean Systems	Good	Very Good	Good	Good

Table 5: Summary of Cultural Target Viability for the Maya Mountains Massif

2.5 Combined Biodiversity and Cultural Target Viability Assessment

The results of the two processes can then be combined to determine the overall viability of both biodiversity and cultural targets. For this assessment, the viability of the Maya Mountains Massif system is assessed as **GOOD** (Table 6)

Summary of Overall Conservation Target Viability for the Maya Mountains Massif				
Conservation Targets	Landscape Context	Condition	Size	Viability Rank
	Grade	Grade	Grade	
Broadleaf Forest	Very Good	Good	Very Good	Very Good
Pine Forest and Savanna	Fair	Fair	Good	Fair
Aquatic and Riparian Systems	Fair	Very Good	Very Good	Good
Upper Elevation Amphibians	Good	Good	Good	Good
Forest Products	Very Good	Fair	Fair	Good
Jaguar	Very Good	Good	Good	Good
Archaeological Sites	Good	Fair	Good	Good
Aesthetic Landscapes	Very Good	Very Good	Good	Very Good
Subterranean Systems	Good	Very Good	Good	Good
Biodiversity Health Rank for the Maya Mountains Massif				Good

Table 6: Summary of Overall Conservation Target Viability for the Maya Mountains Massif

**Technical Assessment of
Threats and Opportunities of the Maya Mountains Massif**

3. Technical Assessment of Threats and Opportunities of the Maya Mountains Massif

Introduction

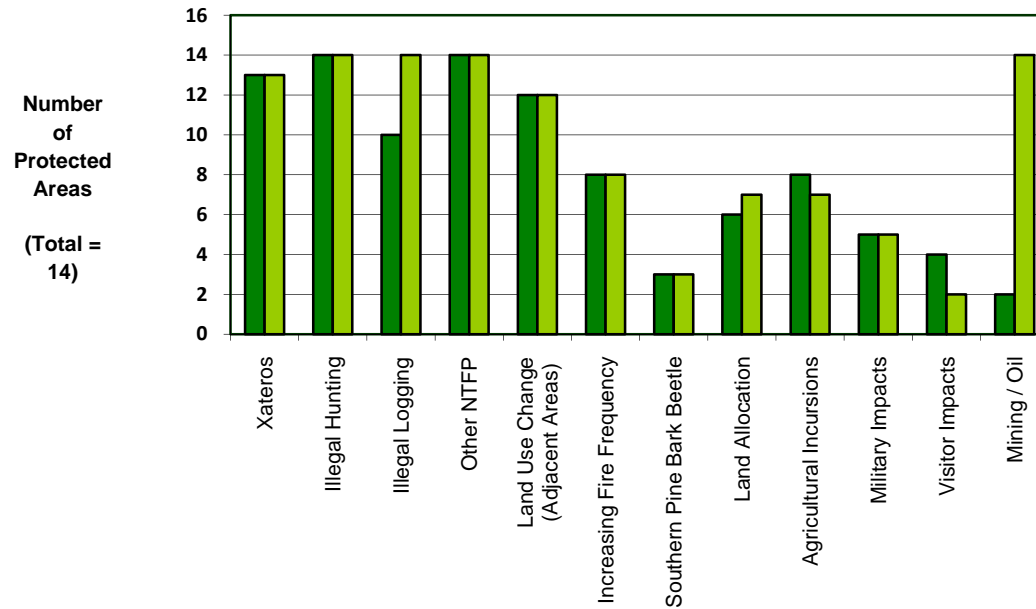
The assessment of critical threats took part in three phases – first as part of the **Rapid Assessment and Prioritization of Protected Areas Management (RAPPAM)** (WWF, 2003), which then fed into the landscape-scale assessment of threats to the Maya Mountains Massif as a system, using the **TNC Conservation Action Planning process**. The third was an assessment of the **General and Specific Threats to Cultural Targets**.

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

The RAPPAM methodology 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
-
- 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 7 and 8; 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,**
 - **Unsustainable / illegal Xate harvesting,**
 - **Harvesting of Non-Timber Products (excluding xate),**
 - **Unsustainable / illegal Logging**
 - **Mining / Oil Exploration**

The full results of the RAPPAM analysis are presented in Report Three.



Graph 2: RAPPAM Scope of Pressures and Threats across the protected areas of the Maya Mountains Massif System

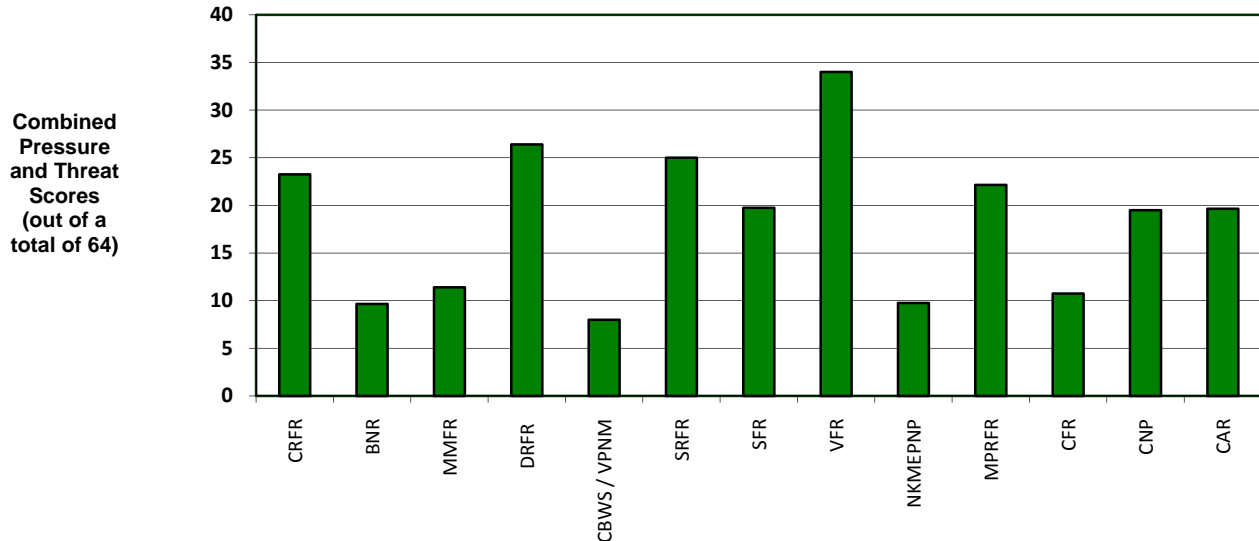
Identified Impacts on Protected Areas of the Maya Mountains Massif (RAPPAM)

- 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 associated impacts – hunting, looting, harvesting of other forest products)
- 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

Summary Report - Technical Assessment of the Maya Mountains Massif



Graph 3: Combined, Averaged 'Degree of Pressure and Threat' Averaged Scores per Protected Area within the Maya Mountains Massif systems

When assessed per protected area for combined pressure and threat scores, those protected areas with the greatest combined threat and pressure scores (combined scores of 25 or over) are identified as:

- Vaca Forest Reserve
- Deep River Forest Reserve
- Sittee River Forest Reserve

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.

The protected areas with the lowest combined threat and pressure scores (combined scores of 10 or under) are:

- **Cockscomb Basin Wildlife Sanctuary / Victoria Peak Natural Monument**
- **Bladen Nature Reserve**
- **Elijio Panti National Park**

Table 8: RAPPAM Results - 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 8: RAPPAM Results - Summary of Critical Impacts / 2		
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

3.2 CAP Assessment of Critical Threats

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 6).

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 9).

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

Definitions for Stress and Source of Stress

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).

TNC, 2007

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 identified and assessed threats, allowing prioritization of conservation actions and resources towards 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, these 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**

The complete CAP threat assessment results are summarized in this document (Table 9) and presented in full in Report Three.

Summary Report - Technical Assessment of the Maya Mountains Massif

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

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 9: CAP2 Output - Summary of CAP Threat Assessment

Critical Threats to Biodiversity

Forest 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 incursions first reported in 1987.
- In the past two years (2007/2008) 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).
- 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.
- The long term border dispute between Guatemala and Belize, and weak governance and law enforcement in the southern Peten area, also exacerbate the situation.
- Surveillance and enforcement have been consistently improving, 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 is considered to be very high. However, the level of activity should decrease as the area is more effectively monitored, and enforcement activities are actively implemented.



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

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.

Unsustainable Harvesting of Xate by Illegal Guatemalan Xateros

Illegal harvesting of xate leaves (*Chamaedorea ernesti-augustii*) 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, with xateros being considered to be active throughout the Chiquibul area (National Park and Forest Reserve), where xate is present, (N. Uck, CNP)

- 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 levelled off, with between 1,000 and 1,500 xateros operating in the area since then.
- 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.
- 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).

Subsistence Hunting by Illegal Guatemalan Xateros

Hunting in the Chiquibul forest is primarily linked to xatero activity, with 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), with populations of white-lipped peccary (*Tayassu pecari*) 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

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



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.).

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, along with Little Quartz Ridge, 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 10; 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.

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

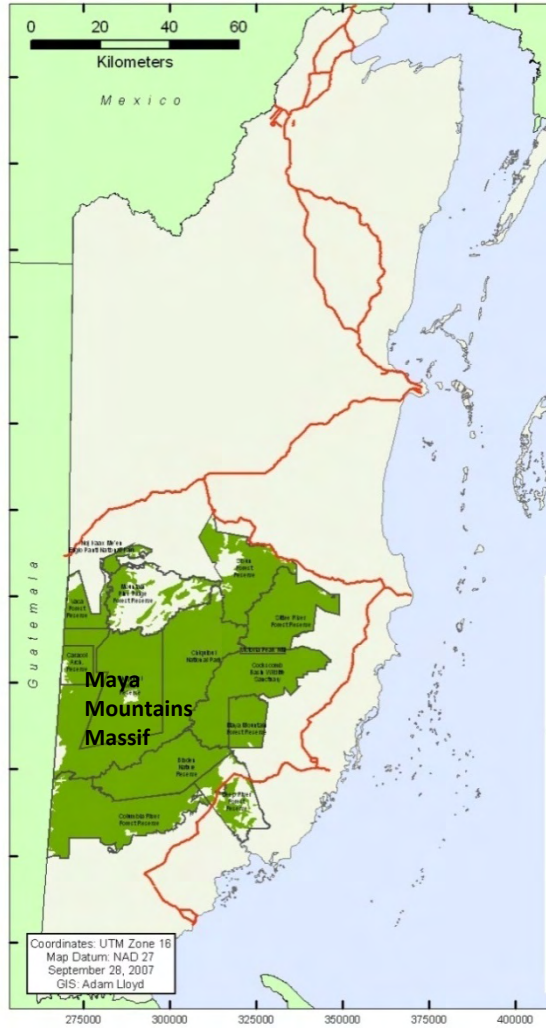
- Gold prospecting in the Ceibo Chico area of the Chiquibul National Park has been an ongoing activity since the late 1980s, and continues under Boiton Minerals/Erin Ventures Inc. (under Ceiba Resources Ltd.). Whilst currently the level of impacts area low, there are concerns that the level of impact 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.

- 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.

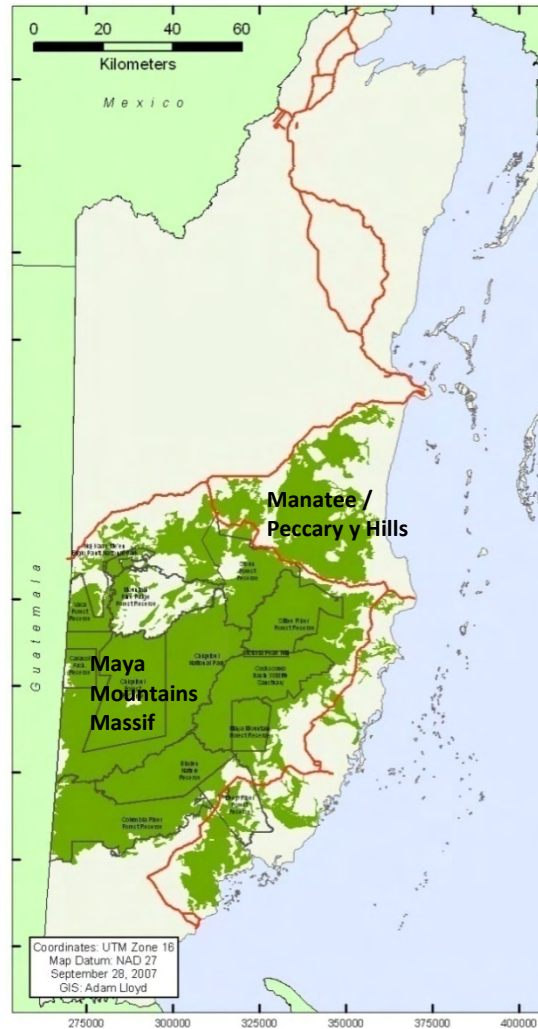
Fragmentation of Broadleaf Forest Connectivity

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 such as jaguar, which are considered to require large expanses of unfragmented forest for long term biodiversity viability.

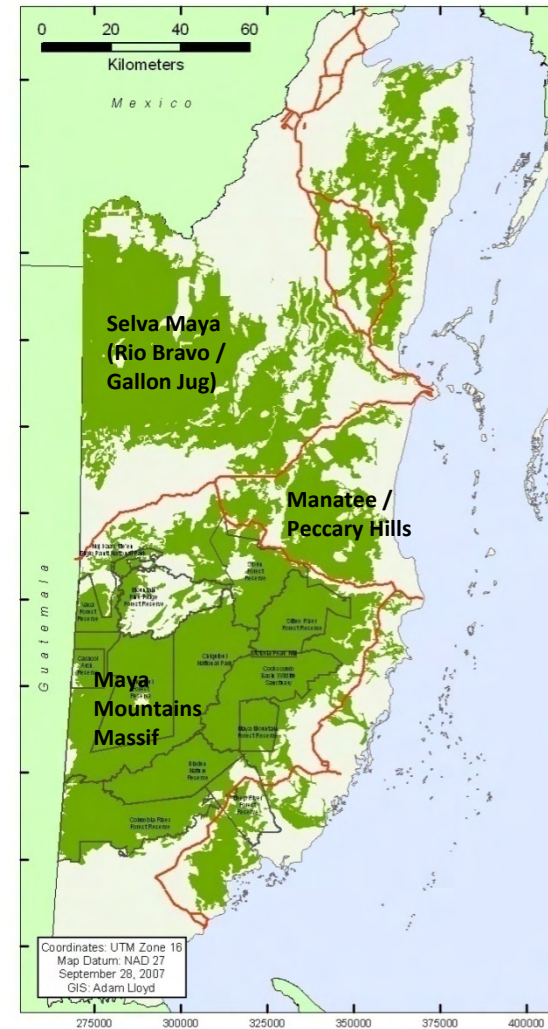
- The Maya Mountains Massif alone is not considered large enough to support a viable jaguar population, the key predator, in the long term, with the identification of the critical importance of connectivity between the Maya Mountains Massif and the Rio Bravo/Gallon Jug / Selva Maya as of major importance in maintaining this key species.
- Two priority areas have been identified as important for the maintenance of broadleaf forest connectivity:
 1. **Sibun Forest Reserve and the Manatee/RunawayCreek/Peccary Hills area**
 2. **The Manatee/RunawayCreek/Peccary Hills area and the Selva Maya area**



Contiguous Broadleaf Forest of the MMM



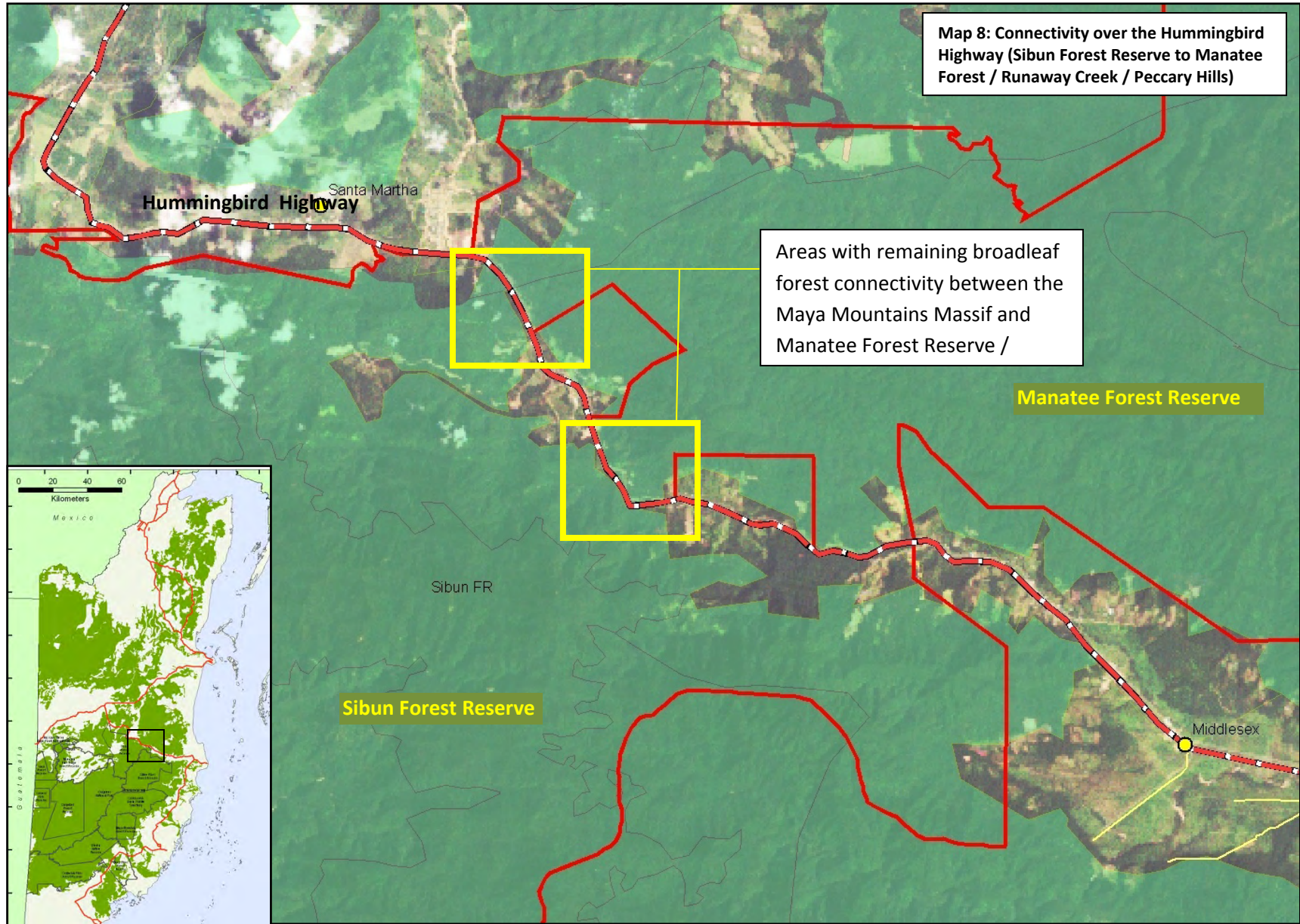
Contiguous Broadleaf Forest allowing for connectivity across <50m non-broadleaf forest gaps

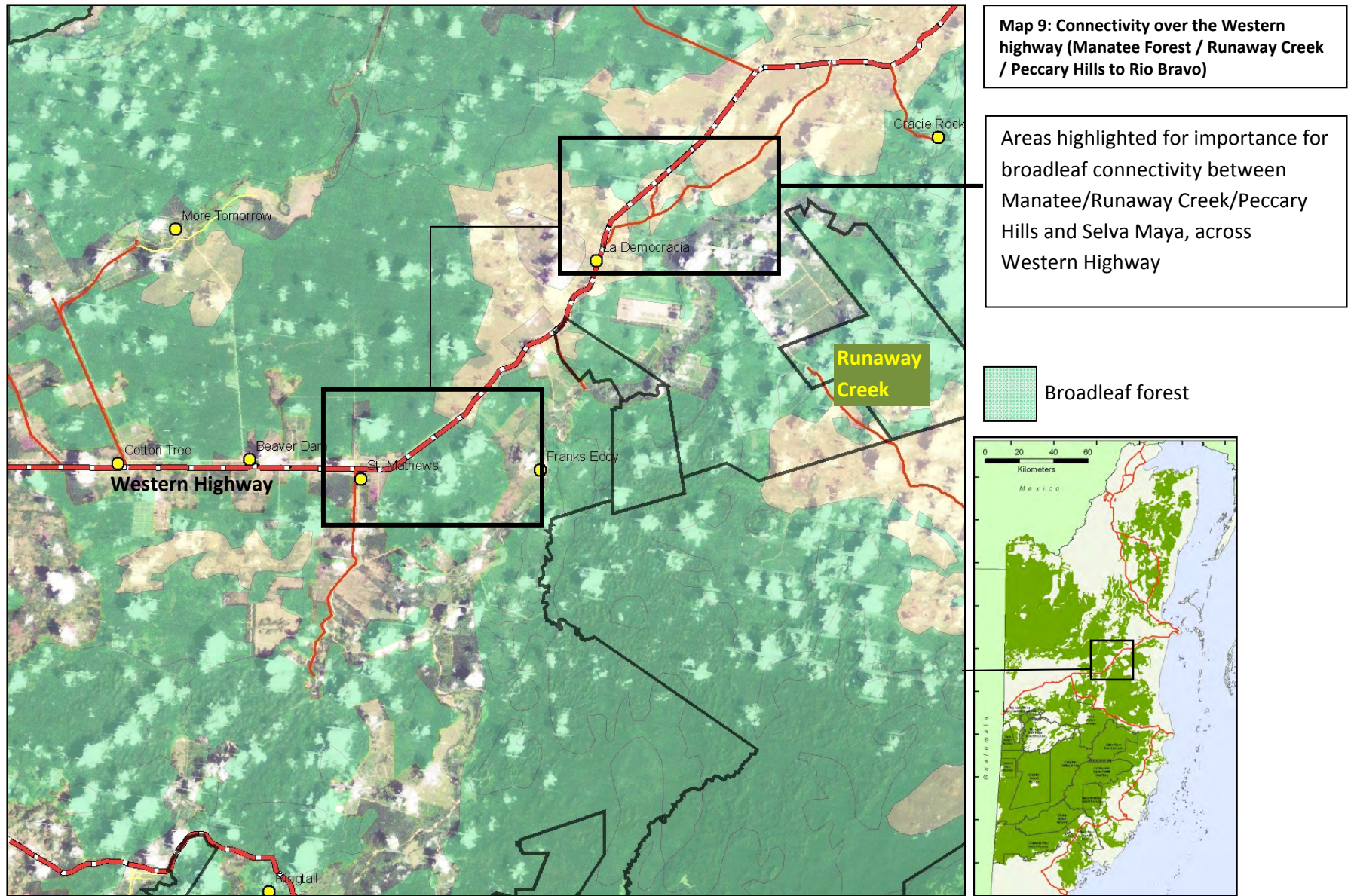


Contiguous Broadleaf Forest allowing for connectivity across <100m non-broadleaf forest gaps

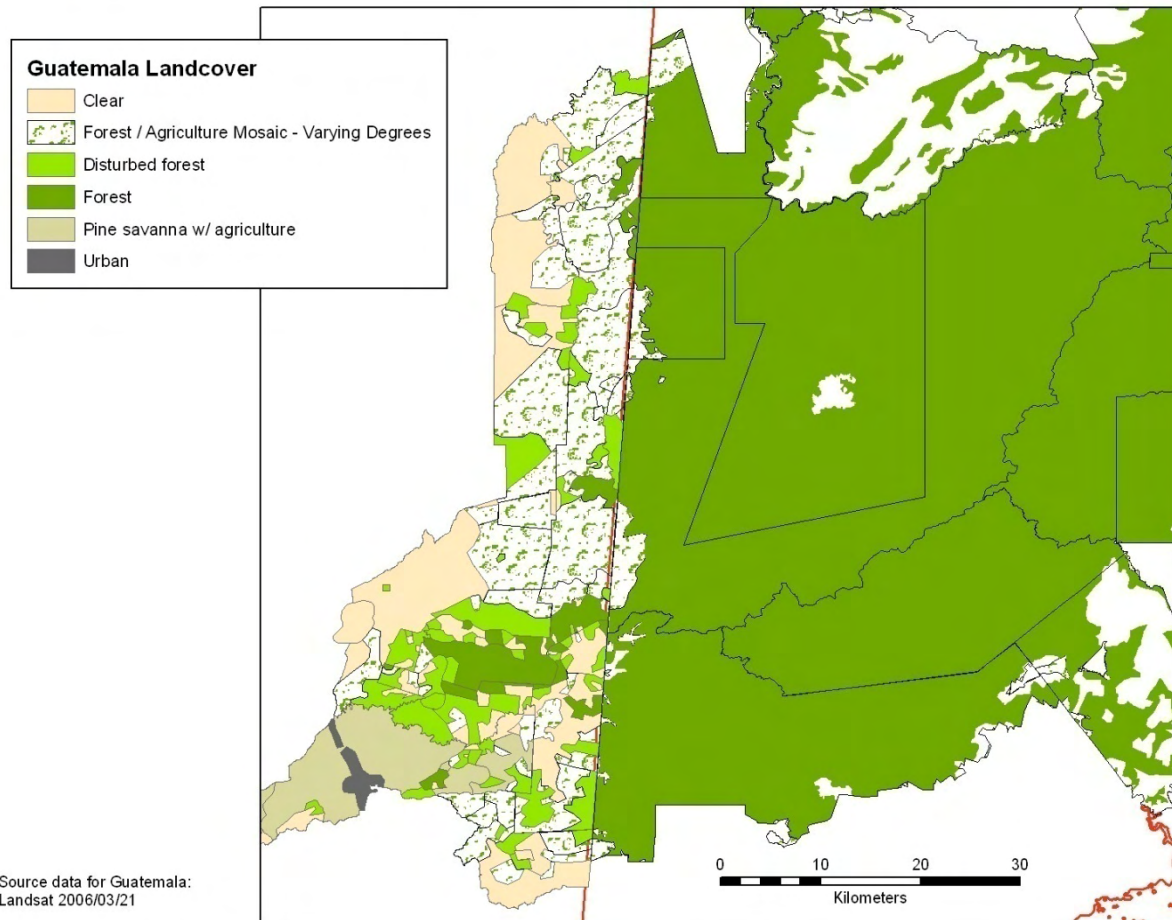
Map 7: Connectivity indicators for the Maya Mountains Massif

A. Lloyd, Based on: Meerman (2004). Belize Ecosystem Map





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.



Map 10: Contiguity with broadleaf forest in 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).

General 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** 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.
- 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.
- 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 the sites in Belize.
- **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.

Specific Threats to Cultural Heritage

Identified site specific threats to preservation of cultural integrity include:

- **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, for export to Guatemala.
- **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.
- 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.

Strategic Responses to Threats

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 Elijio Panti National Park is also a prospective co-management partner.

3.3 Situation Analysis

Introduction

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 assisted in the development of 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 generated 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 assists in building 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.

The full Situation Analysis output is presented in the Technical Assessment of the Threats and Opportunities of the Maya Mountains Massif



Situation Analysis for the Maya Mountains Massif
Above: Derric Chan of Friends for Conservation and Development
Right: Situation Analysis for the Broadleaf Forest conservation target of the Maya Mountains Massif

**Report on Socio-Economic Analysis
For the Maya Mountains Massif**

4. Socio-Economic Assessment of the Maya Mountains Massif

4.1 Introduction

Socio-economics typically analyzes the social impacts of economic activity that may affect patterns of consumption, the distribution of incomes and wealth, the way in which people behave (both in terms of purchase decisions and the way in which they choose to spend their time), and the overall quality of life. This analysis looks specifically at the economic activities and community uses of the Maya Mountains Massif and makes strategic recommendations based on existing and potential economic activities within the project scope, in Belize.

Buffer communities highlighted for their importance through the RAPPAM process were targeted for this analysis (Table 11).

Community	District	Population ¹
Cristo Rey	Cayo	691
San Antonio	Cayo	1402
Seven Miles/Progresso	Cayo	472
St. Margaret	Stann Creek	669
Middlesex	Stann Creek	302
Pomona	Stann Creek	1101
Maya Center	Stann Creek	293
Maya Mopan	Stann Creek	427
Bladen	Toledo	-
Golden Stream	Toledo	317
Medina Bank	Toledo	93
Tambran ²	Toledo	-
Trio	Toledo	383
San Antonio	Toledo	1158
San Pedro Colombia	Toledo	1459

¹ Belize's Mid-year census (2006).

² Tambran is considered a satellite of Golden Stream and is included in the figures for Golden Stream

Table 11: Key Stakeholder Communities of the Maya Mountains Massif

Level of Dependence on Natural Resources

The study revealed that the Communities' level of dependence on the natural resources varied by geographical location. The level of dependence was low in the Cayo and Stann Creek Valley area, medium or moderate in the Southern Stann Creek region, whilst the communities in the Toledo District (the southern-most portion of the MMM) are significantly dependent on the natural resources.

Although the level of dependence on the resources varied, there were cross cutting similarities in the actual resources that they used. All communities indicated that they depend to some extent on the Maya Mountain Massif for:

Food

- Hunting by communities is primarily for the two species of peccary, deer and gibbon, with communities in the Stann Creek and Toledo Districts also highlighting fresh water fish species and fresh water lobster as important natural food resources.

Building materials

- Communities in the Cayo District seldom use materials from the forest for building their homes, most homes being either concrete or purchased lumber
- In the Stann Creek and Toledo Districts, bush sticks are used more frequently for construction, bay leaves or cohune leaves for roofing, hard woods for siding and vines for tying.
- The communities in Southern Stann Creek and Toledo depend heavily on natural material harvested from the adjacent forests.

Medicinal purposes

- All communities indicated that they still depend on medicinal plants for basic illnesses such as headache, cough, cold or fever.
- In the Cayo District however, most individuals grow these plants in their backyards or they go to the resident bush doctor who grows them
- In the Stann Creek and Toledo District community members also depend heavily on medicinal plants, but unlike the communities in Cayo, they still go to the forest to extract these plants when needed.

This varying degree of dependence is consistent with the level of poverty in the respective regions. The specific factors influencing quality of life in these regions are identified as employment rate, access to formal health care, literacy rate, access to educational opportunities, and cultural values and traditions.

Employment rate

- The higher the employment rate, the lower the level of dependence. The stakeholder communities in Cayo (in particular San Antonio) have a very high employment rate in the tourism industry and in agriculture, with a corresponding low rate of dependence.
- Communities in Stann Creek District also show high levels of employment mainly in the citrus industry (primarily in Stann Creek Valley), banana, aquaculture, and tourism industries. However, low income in the seasonal agricultural workers sector in southern Stann Creek is known to have resulted in hunting by these workers in Cockscomb Basin Wildlife Sanctuary, Sittee River, Sibun and Maya Mountain Forest Reserves and Bladen Nature Reserve to provide a protein supplement to the diet

- Unlike the other two districts, the employment rate in Toledo is extremely low, with most rural families depend heavily on subsistence farming.

Access to formal Health Care

- In all cases, health care is available in the nearest town. Some communities have a health clinic but a recent staff shortage has resulted in the removal of doctors and health care providers from the clinics.

Literacy rate and Access to educational opportunities

- Literacy rate is much lower in the Toledo district as compared to the Stann Creek and Cayo district with the Cayo district having the highest literacy rate.
- The literacy rate was linked directly to the accessibility of educational institutions in terms of both transportation and cost. Most communities have a primary school but students have to travel to the nearest town to access secondary level education. Where access to secondary education is easy, community members have a high rate of secondary education, as is the case in Cayo District This was also true of the Stann Creek Valley area, with the exception of St. Margaret village.
- In the Southern Stann Creek area and the Toledo district, it was reported that the transportation cost and the cost of schooling were prohibitive for most families, preventing access to educational opportunities.

Cultural Values and Traditions

- One other identified crucial factor in dependency on natural resources is the traditional way of life in most of the Mayan communities of the South, with the need for natural resources and agricultural land for subsistence farming. As the population continues to grow within all of these communities so does the threat to the future sustainability of the Maya Mountain Massif, with an increased demand for land.

Community Perceptions

Participation and socio-economic benefits are inextricably linked, and identified is a need for rethinking theoretical assumptions made by Protected Areas managers and co-managers regarding stakeholder and community participation in conservation-oriented projects and programs.

- The prevailing assumption is that stakeholders and local communities will “buy into” the objectives of conservation and sustainable use of the natural resources, and respect the boundaries of the protected areas if the following elements are available to them:
 - information on the benefits of having the protected area (biodiversity, aesthetics, recreation and environmental goods and services),
 - education, training and capacity building (usually through workshops) to assist in the development of skills for alternate income generating activities
 - mechanisms for participation in co-management
- while some local communities appreciate in principle that protected areas can bring long-term benefits, in practice, they are more concerned with meeting the everyday needs of their families and communities.

- stakeholders and local communities want to see tangible socio-economic results from workshops, or direct access to capital, markets or equipment that can assist them in transforming skills into direct monetary income
- in Toledo, stakeholders and local communities do not perceive themselves as a threat to the protected areas, but rather the encroaching Guatemalans, large-scale loggers and large-scale agricultural producers and politicians as creating the most devastating impacts on the natural resources,
- stakeholders participation on advisory and decision-making mechanisms is not a determinant of their support for the protected area; it is a space for them to negotiate concrete socio-economic benefits.
- The level and quality of participation in these mechanisms and the extent to which the participants truly represent their communities depends on whether or not they have concrete benefits to report to their constituents. Otherwise, these representatives increasingly view participation as a “waste of time”, and will attend only if they are provided stipends, transportation, meals and in some cases, accommodations (Catzim A., 2007).

4.2 Unsustainable Activities

The Socio-economic Assessment shows that there are currently several unsustainable activities occurring within the Maya Mountains Massif - both legal and illegal. These include:

- Unsustainable and illegal extraction of non-timber products (e.g. xate)
- Illegal Hunting
- Illegal Fishing
- Unsustainable and illegal Logging
- Agricultural Incursions
- Archaeological Looting

While these activities can be considered as the primary unsustainable activities within the Maya Mountain Massif they are not the only ones. For example, military training and mining of minerals are both occurring within the Maya Mountains Massif, particularly in the Chiquibul Forest. However there is not enough information to indicate at this point whether or not they are sustainable – either environmentally or economically, highlighting the need for further analysis of these particular activities, and the associated road infrastructure, leading to potential habitat fragmentation, and increased accessibility for illegal hunting and other unsustainable activities.

Illegal Extraction (non-timber products)

- Xate is the most highlighted non-timber product currently being extracted from the Maya Mountains Massif and is a major source of income for Guatemalan communities; resulting in illegal entry of xateros to the Belizean side of the border to harvest this product.
- Three Belizean entities hold permits under the Forest Department to legally harvest Xate. While this has created some level of employment in the local communities on the Belize side of the border, it is not considered significant.

- Illegal harvesting was of major concern to sustainability, with significant numbers of leaves being harvested, as well as additional harvesting of seeds and seedlings for resale to the xate plantations (both in Guatemala and Belize)
- The xate stocks are currently declining faster than they are able to regenerate, making this extraction unsustainable.
- Bay leaves, cohune leaves, copal, pimenta seeds and medicinal plants were also identified as products being extracted.

Illegal Hunting and Fishing

- Hunting is an age-old tradition in most communities in Belize, and is most predominant in the Toledo District, where it is also a necessity for supplementing the household diet, given the low levels of income. In both the Stann Creek and Toledo districts, meat from hunting was highlighted as a major food source.
- There is a significant market for game meat in Belize, with a large percentage of Belize's population, both rural and urban considering eating game meat it as part of their cultural heritage.
- Reports indicate that the recent increase in the cost of basic food items has resulted in a marked increase in hunting activity. Reports also indicate that hunting in Stann Creek and Toledo is not only for subsistence, but also for commercial purposes
- As a result of this activity, there has been a marked decline in the number of sightings of these species by hunters, which raises concerns for the survival of these game species, and the predatory species that rely on a healthy prey base.
- Whilst much of this hunting activity takes place on national lands outside protected areas, all Maya Mountains Massif protected area co-managers report hunting incursions at some level. (Bol, FCD, pers. com.)
- Fishing is reported to be taking place in the Stann Creek and Toledo districts, with incursions into the middle reach river stretches of all protected areas. Whilst traditional fishing methods of hook, cast net and spear fishing have been considered to some extent sustainable, the current use of seine nets across the water courses is thought to have reduced the majority of river systems within Belize below the ranges of natural variation.

Illegal Logging

- Reports of Belize logging incursions within the protected areas of the Maya Mountains Massif are of small numbers of trees in peripheral areas, particularly in Stann Creek and Toledo Districts.

Agricultural Incursions

- All of the communities indicated that they depend to some extent on agricultural activities either for subsistence or commercial purposes. The continual requirement for new land, with existing forest cover and intact fertility, is causing conflict between farming communities and protected areas, with agricultural incursions occurring in Columbia River Forest Reserve, and Sibun and Sittee River Forest Reserves on the east facing slopes of the Maya Divide from communities in Toledo and Stann Creek, or

in the western Chiquibul Forest, where similar land issue problems drive the Guatemalans into Belize territory to clear illegal farmlands.

Archaeological Looting

- Looting results in a decrease in the cultural value and tourism potential of the archaeological resources, and also impacts negatively on the marketability of the various cultural sites of the Maya Mountains Massif for tourism

4.3 Sustainable Activities

There are a number of environmentally and financially sustainable activities that are currently taking place in the Maya Mountains Massif, including:

- Tourism related Activities and Services
- Managed Logging
- Agro-forestry
- Employment in Protected Areas
- Local Craft production

Tourism related Activities and Services

Tourism plays a vital role in Belize's economy. It is undoubtedly one of the major contributors to the country's economic development and as such is promoted and supported by government and other major stakeholders including but not limited to protected areas management organizations and communities.

- Protected areas management organizations often engage in tourism-related activities as a financial sustainability mechanism, as tourism is considered to be compatible with conservation.
- In most if not all instances, the percentage of any given protected area used for tourism activities is so small that the impact on the ecological function of the area is minimal and within acceptable limits.
- Communities view tourism solely as an income generating activity, and most are not concerned about the conservation related objectives, but are aware that the tourism industry and by extension their income, is dependent on the existence of the natural resources. This has resulted in increased awareness of conservation efforts and to some extent the appreciation for protected areas. While this is not the case across the entire protected areas system it is relevant to the Maya Mountains Massif.
- Tourism provides communities with the most visible financial benefits, tied to an understanding of the importance of conservation. As tourism becomes more important as a means of income, so does the awareness level of the importance of sustainable use of the natural resources, as seen in the tour operators and larger resorts.
- In the northern region of the Massif, communities benefit directly from tourism-related employment opportunities, particularly in high-end resorts/lodges.

- In Maya Center, over 90% of the community benefits from the Cockscomb Basin Wildlife Sanctuary through an arrangement between the Maya Center Women's Group and the management agency.
- Tourism's sustainability is still dependent on the continued awareness and understanding of the direct linkages between tourism (income generation) and the sustainable use of the natural resources.

Managed Logging

In the past, short-term logging licenses have been issued resulting in unsustainable harvesting, with extraction of as much timber as possible within the area given during the life of the license, regardless of future sustainability. However, there has been a recent shift to long-term forest licenses, issued for 20 or 40 years, with a focus on sustainability and responsible forest management.

- Concessionaires consider the investment to be very costly but believe that the long term forest license concessions will be worth the investment, though they also consider that it is too early to tell what returns will result from the level of investment

Agro-forestry: Cacao

Agro-forestry activities such as organic cacao production are favored as sustainable community initiatives because of their low impact level, whilst providing relatively significant financial returns. In the case of organic cacao, the market is secure with demand exceeding current production levels, making this a very viable and sustainable activity.

Employment in Protected Areas

Protected areas also provide job opportunities for buffer communities, though both full time and part time employment. A rapid assessment of the protected areas of the Maya Mountain Massif reveals that, with the exception of Forest Reserves and Caracol Archaeological Reserve, 100% of field staff is hired from the buffer communities.

- Where there is significant tourism activity, as at Cockscomb, opportunities for employment increase, with trail and facility maintenance activities requiring a larger workforce. The opportunities, however, vary among protected areas, as their designation dictates allowable activities within the specific areas

Local Craft Production

Craft production is primarily in the southern region of the Maya Mountain Massif, generally on an individual basis and, with the exception of Maya Center, with no organized means of sale or distribution of the craft products.

- Whilst currently at a cottage industry level, with organization and the development of a distribution system this activity has the possibility to develop into a more profitable and sustainable activity.

- Critical to success would be an in-depth market analysis to ensure financial viability

All these activities are considered sustainably viable, and compatible with conservation efforts - particularly if they are continuously monitored and their impacts evaluated over time. Tourism, the preferred sustainability mechanism of protected area co-management organizations,

4.4 Potentially Viable Activities toward Sustainability

Payment for Environmental Services

- Payment for Environmental Services is a relatively new concept that has taken shape over the past ten years, and is a potentially viable activity for the country as a whole. However, because of the expanse of the MMM, it would be a possibility worth exploring with relevant government officials.
- In the case of Costa Rica, the government created new legislation that allowed for them to serve as an intermediary in the sale of forest services such as carbon sequestration and watershed protection to both domestic and international buyers. It also established a fund using the sales of these services and a fuel tax in order to pay individuals for their services. The Costa Rican programme covers several types of actions including reforestation, sustainable management of forests, forest preservation and forest regeneration, and is a means of encouraging private landholders to keep their land forested.
- The details of any PES system in Belize would need to be carefully examined and proper financial analysis completed before taking up such an initiative. However, the market does exist for the sale of these services so it should be seriously considered as a viable option. It will require significant political support as legislative changes will more than likely be necessary.
- The PES system in Belize should logically focus on the primary users of the natural resource; for example, bottling companies (drinking water), and hydro-electric companies, who would be asked to pay a predetermined fee into a fund for system-level management (possibly managed by PACT) that could be used, as in the Costa Rica case, to finance a fiscal incentive program for private protected areas considered important to achieving the long-term objectives of the Maya Mountains Massif – for example, through provision of connectivity of the Maya Mountain Massif to the Rio Bravo / Selva Maya block. A funding mechanism such as this also has the potential to assist management and co-management agencies in daily administration of the protected areas, particularly in areas of funds for human resources.
- There should be a mechanism to ensure that this fee is in some way tax deductible for the private companies, ensuring that it is not passed on to the end users of the value added product. For this reason, any proposed PES will require
 - in-depth financial analysis
 - stakeholder buy-in
 - legislative changes
 - extensive political support.

Carbon sequestration

- Carbon Sequestration or the sale/trading of Carbon Credits, like payment for environmental services, is a relatively new concept. The financial market for carbon trading is very young but

emerging into a very profitable option for developing countries like Belize, especially with the recent outputs from the Bali climate change conference. Either incorporated into a scheme such as payment for environmental services or on its own, carbon sequestration initiatives would be a potentially viable option for the Maya Mountains Massif.

- To date, there are three legally binding carbon trading arrangements and one major voluntary market with legal implications. Under the Kyoto Protocol, there are two main trading devices. The first, the Clean Development Mechanism (CDM), allows Kyoto countries to offset their emissions by investing in clean technologies in developing countries or purchasing the resultant Certificates of Emission Reduction (CERs) from such projects. The second, called Joint Implementation (JI), allows industrialized countries to do essentially the same thing, only in other industrialized countries.

The other government-backed trading program, the European Emission Trading Scheme (EU ETS), was adopted by the European Council in 2003. In 2006, 1.1 billion CERs (each worth one metric ton of CO₂) were channeled through the EU ETS at a value of \$24.3 billion.

The last carbon trading pact is the voluntary scheme implemented in the U.S. through the Chicago Climate Exchange (CCX).

- As long as companies are trying to reduce their emission-- voluntarily or not -- there will be significant profit potential for companies (or countries) that aid in reducing those emissions. And with companies now being called upon to disclose their carbon footprint and climate risk, it looks as though carbon reduction industry can only forge vibrantly ahead.

Given that Belize is a developing nation it would not be able to trade carbon credits under all three mechanisms established as a result of the Kyoto protocol. It would however fall under the Clean Development Mechanism which is a market based mechanism for cooperation between industrialized countries and developing countries. The two major goals of the CDM are:

- 1) To reduce green house gas emissions (by assisting Industrialized countries to comply with the emission limitations and reduction commitments outlined in the Kyoto protocol)
- 2) To assist developing countries that host projects (that on a voluntary basis contribute to global emission reductions) to achieve sustainable development.

Belize's forest is relatively young; therefore, studies will need to be conducted to determine the level of biomass and the allowable tons per acre that could be traded. The CDM also supports initiatives in the transport and energy sectors in addition to afforestation and reforestation projects. At the time of report preparation the market price on the European Climate Exchange Market was €23.30/ton.

The Caribbean Center for Combating Climate Change and the government of Belize would be the most obvious partners in developing any carbon sequestration initiative, and such an initiative would be most effective at the system or national level. The potential beneficiaries would be the government of Belize, protected areas management organizations, communities and buyers of the carbon credits.

Reforestation initiatives

- As in the case of Carbon Sequestration, reforestation initiatives could be a part of a much larger payment for environmental services scheme or it could be developed independently, in areas where there have been agricultural incursions, or in areas identified as essential for forest

connectivity. Although it can be viewed as a long term investment, there is a pilot project in Costa Rica that has developed a business model to address the long wait before seeing any financial benefits, that would be applicable to Belize.

- It would be a potentially viable option for communities to consider reforesting their lands if the financial returns are greater than the benefits they are currently receiving from subsistence agriculture, especially if it is feasible to tie this into carbon sequestration credits. Reforestation would entail research into the best commercially viable native species and the exploration of markets both domestically and internationally. This is currently being investigated in the boundary areas of Columbia River Forest Reserve through the Forest Department, in partnership with local communities, and may provide a replicable model that could be used in other areas of boundary conflict such as Vaca Forest Reserve and the south east of the Maya Mountain Forest Reserve.

Palmetto Seed Harvesting

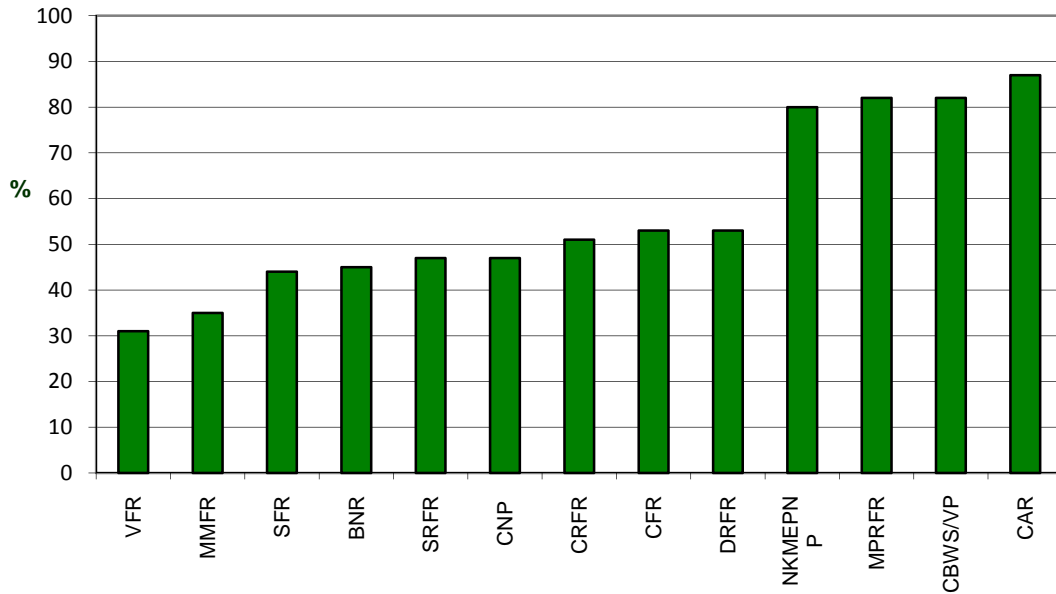
- Local communities in the southern coastal plain have been benefitting in the past from opportunities presented by the international market for palmetto, or 'popta' seeds (*Acoelera phe wrightii*), with contracts to supply harvested seeds from wild-growing palms on the coastal savanna – most particularly relevant to Deep River.
- Whilst there is no local market for palmetto seeds, there is a large international market, primarily in Canada, the USA and Europe. Currently Belize has one exporter who is averaging 200 tonnes of seeds annually. However, the demand is greater than the current supply, so there is room for expansion. Because the seeds are exported in the raw state (only dried and packaged) there is no large capital intensive investment, and production cost is minimal. With market prices at \$2.80/dry lb this is a potentially very sustainable activity.
- The best option would be to partner with a private investor who would absorb all the legal and financial requirements, with the communities benefitting through employment. Since the collection of the palmetto seeds is compatible with conservation efforts if managed and monitored, and would potentially generate a direct source of income for communities it is worth exploring further.
- One of the conservation benefits of community-level harvesting of palmetto seeds has been seen in the greater awareness of the need to prevent the frequent fires that impact the savanna

Managed Xate extraction

- There is undoubtedly a huge market for xate, both in the USA and Europe. This is a viable option if enforcement agencies are able to develop stringent criteria for harvesting and are able to monitor the harvesting cycle. The most feasible way that communities can benefit from this activity is through job creation, under the xate concessions. Currently, three xate concessions are being implemented within the Maya Mountains Massif, but all of these are heavily impacted by the illegal harvesting by Guatemalan xateros, preventing attempts at developing rotational harvesting and regeneration cycles. This leads to questions of sustainability in the current xate industry.
- To develop a sustainable industry in Belize would require a much more detailed inventory of xate abundance, distribution and densities than is currently available, particularly areas where there is estimated to be a significant supply. There would also need to be the effective removal of the illegal xate harvesting, both the small scale harvesting by community members in Belize, and the much larger scale incursions from Guatemala.

- Another potentially viable option is the establishment of xate plantations on existing forested farm lands (particularly in the southern region). There is currently a pilot project under way in the Peten region, and initiatives under YCT to investigate xate as a potential alternative income source at community level, with future potential for establishing xate plantations in existing forests as opposed to cleared lands. A financial feasibility study for this initiative would be required.

4.5 Site Level Assessment



Graph 4: Socio-Economic Importance of the Protected Areas of the Maya Mountains Massif

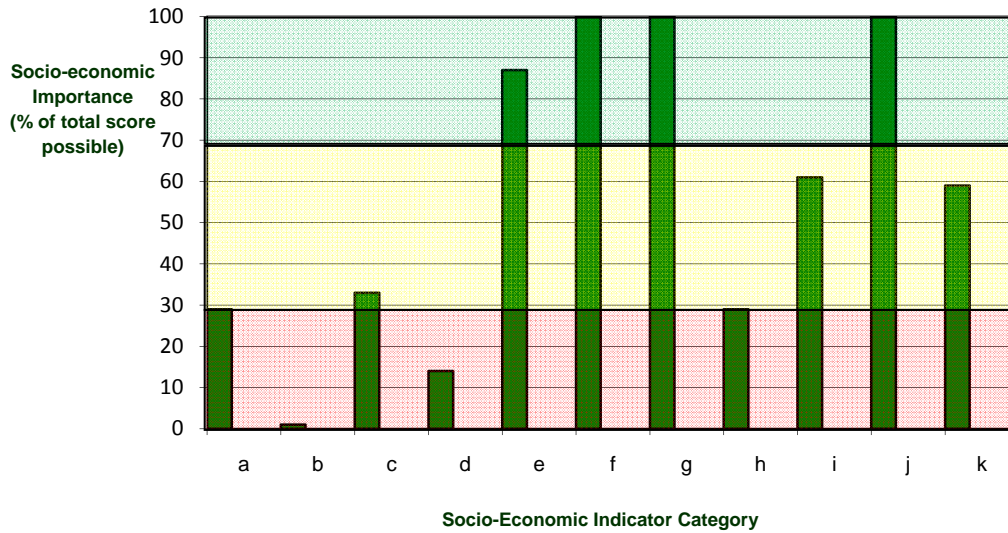
The three protected areas that are assessed of greatest socio-economic benefit to local communities under the RAPPAM criteria are those most actively promoting tourism - it would appear that this industry directly impacts more households financially in adjacent communities than logging concessions, with wider spreading financial benefits within stakeholder communities.

Highest Socio-Economic Benefit	/55	%
Caracol Archaeological Reserve	48	87
Cockscomb Basin Wildlife Sanctuary	45	82
Mountain Pine Ridge Forest Reserve	45	82

The two protected areas assessed as providing least benefit to local communities are Vaca and Maya Mountain Forest Reserves, currently lacking on-site management or activity, even through long term forest licenses. Both these protected areas have recently suffered from agricultural incursions and de-reservations and have heavy hunting pressure.

Lowest Socio-Economic Benefit	/55	%
Vaca Forest Reserve	17	31
Maya Mountain Forest Reserve	19	35

System Level Assessment



Graph 5: Socio-Economic Indicator Scores over the Maya Mountains Massif System

- a) The PA is an important source of employment for local communities
- b) Local communities depend upon the PA resources for their subsistence
- c) The PA provides community development opportunities through sustainable resource use
- d) The PA has religious or spiritual significance
- e) The PA has unusual features of aesthetic importance
- f) The PA contains plant species of high social, cultural or economic importance
- g) The PA contains animal species of high social, cultural or economic importance
- h) The PA has a high recreational value
- i) The PA has a high potential recreational value
- j) The PA contributes significant ecosystem services and benefits to communities
- k) The PA has a high educational and/or scientific value

At the system level, whilst no Belizean communities are considered to be dependent on natural resources within the protected areas of the Maya Mountains Massif, the protected areas themselves are considered to contain significant valuable resources – plants and animals of economic and cultural value, such as xate and other non-timber resources, timber resource, game species, and medicinal plants, and all have significant ecosystem services, such as providing protection to the headwaters of the majority of the watersheds of Belize (Graph 5).

The majority of the protected areas also have features considered to be of high aesthetic importance, the Maya Mountains Massif encompassing the highest peaks in the country, and a landscape of mountains, waterfalls, caves and karst scenery. Also included within the landscape are a number of historical and cultural sites, the most important considered to be Caracol, the Natural Arch and the Chiquibul cave system.

4.6 Recommendations for Strengthening Socio-Economic Importance of the Maya Mountains Massif System

A series of recommendations have been developed based on these results for strengthening importance of the Maya Mountains Massif to the stakeholder communities (Table 12).

Table 12: Recommendations for Strengthening Socio-Economic Importance of the Maya Mountains Massif System	
Socio-Economic Indicator	Assessment Results
Local Community Employment	<p>This indicator area is particularly weak, with an average score for local employment is 1.36 (27%) out of a possible 5. Only three protected areas rate '5' for local community employment Cockscomb, Caracol and Mountain Pine Ridge - primarily through tourism. Neither of the south or south-eastern protected areas (Columbia River Forest Reserve and Bladen Nature Reserve) are considered important for local community employment at the time of the RAPPAM survey (despite those employed by the timber harvesting in Columbia River) – communities that highlight the need to see economic benefits from the protected areas.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> ▪ Implement agro-forestry concept currently being reviewed by the Forest Department for Columbia River Forest Reserve ▪ Develop increased-value craft activities in buffer communities, with a fee structure for sustainably harvested raw materials within permitted extractive zones ▪ Develop and implement a system-level tourism policy to more effectively realize the tourism potential, and thereby increase tourism-related employment
Community dependence on the natural resources	<p>No community adjacent to the Maya Mountains Massif is considered to be dependent on the natural resources, as most still have adjacent village lands. Many, though, rely on the watershed protection and clean water that the Maya Mountains provides. This environmental service is not clearly recognised by local community members.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> ▪ Increase awareness of environmental services in communities buffering the Maya Mountains Massif, especially in the area of watershed protection ▪ Increase awareness among policy makers of the importance of environmental services to communities buffering the Maya Mountains Massif, especially in the area of watershed protection ▪ Investigate potential reforestation projects on exhausted community lands adjacent to PAs – to increase availability of natural resources outside the protected areas
Availability of community development opportunities through sustainable resource use	<p>Four protected areas (Cockscomb, Caracol, Eljio Panti and Mountains Pine Ridge) are rated as having associated community development opportunities through sustainable resource use – generally through tourism. Belize Audubon Society and Itzamna Society have also both been assisting with community alternative livelihood projects with varying success. All other protected areas score '0' – though it should be remembered that a number have no adjacent communities in Belize.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> ▪ Increase 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

Table 12: Recommendations for Strengthening Socio-Economic Importance of the Maya Mountains Massif System / 2	
Socio-Economic Indicator	Assessment Results
Spiritual and cultural significance of the protected area	<p>Itzamna Society is the only co-management partner that considers the protected area - Elijio Panti National Park – to be of significant spiritual and cultural significance. Caracol also rates as of cultural value, but is not considered to be of spiritual significance, and some spiritual ties to the land are considered to exist in the Columbia River Forest Reserve, with calls for a ‘Maya Homeland’ from indigenous people in the Toledo communities.</p> <p>The low score across the system reflects to some extent the lack of knowledge of cultural values, with many archaeological and important cave sites throughout much of the Maya Mountains Massif, but generally not a focus of protected area management (eg. the Maya sites of Cockscomb and Bladen).</p> <p>Recommendations:</p> <ul style="list-style-type: none"> ▪ Increased liaison between protected area managers / co-managers and the Institute of Archaeology to increase prioritisation of cultural resources within the Maya Mountains Massif system ▪ Training for protected area staff in recognition, reporting and monitoring of archaeological sites and artefacts
Aesthetic significance of the protected area	<p>Only two protected areas rate poorly for aesthetic significance – Vaca and Maya Mountain Forest Reserve, though this probably reflects more the lack of management interest and visitation in these two areas than a lack of aesthetic properties.</p>
Presence of plants of social, economic and cultural importance	<p>The protected areas of the Maya Mountains Massif are, without exception, considered to protect species of social, economic and cultural importance, including game species, medicinal plants, xate, and timber resources, the last having been heavily exploited in the past, and still considered of economic importance to Belize.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> ▪ Improved monitoring and management of the xate concessions ▪ Complete implementation of move from short-term logging licenses to long –term forest license concessions, for sustainability of forest resources ▪ Continued protection of sufficient area to ensure viability of key species (eg. jaguar of social, economic and cultural importance)
Presence of animals of social, economic and cultural importance	
Current recreational value of the protected area (based on use)	<p>Four protected areas (Cockscomb, Caracol, Elijio Panti and Mountain Pine Ridge are considered to have significant current recreational value.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> ▪ 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 ▪ Develop and implement a system-level tourism policy to more effectively realize the tourism potential of the Maya Mountains Massif, and thereby increase tourism-related employment

Table 12: Recommendations for Strengthening Socio-Economic Importance of the Maya Mountains Massif System / 3	
Socio-Economic Indicator	Assessment Results
Potential perceived recreational value of the protected area	<p>Only three protected area co-managers see no perceived recreational values for their protected area – Bladen, by its designation as a Nature Reserve, is a non-recreational area. The other two – Maya Mountain and Vaca Forest Reserves, though this probably reflects more the lack of management interest and visitation in these two areas than a lack of recreational values.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> ▪ 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 ▪ Develop and implement a system-level tourism policy to more effectively realize the tourism potential, and thereby increase tourism-related employment
Ecosystem services provided by the protected area to local communities	<p>All protected areas within the system are recognized by the protected area managers and co-managers as providing important environmental services, but this value is not always apparent to – or recognized by - the buffer communities of policy makers.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> ▪ Increase awareness of environmental services in communities buffering the Maya Mountains Massif, especially in the area of watershed protection ▪ Increase awareness among policy makers of the importance of environmental services to communities buffering the Maya Mountains Massif, especially in the area of watershed protection
Educational and scientific value of the protected area	<p>Six protected areas (Cockscomb, Chiquibul Forest Reserve and National Park, Bladen, Elijo Panti and Mountain Pine Ridge) are recognised for being significant for their educational and scientific value, whilst a further three are considered as having a value in this indicator area. Two protected areas are not considered to have any educational or scientific value – Maya Mountain and Vaca Forest Reserves</p> <p>Recommendations:</p> <ul style="list-style-type: none"> • Develop and implement a system-level education policy to more effectively use the resources of the Massif for education • Develop and implement a system-level approach to research and monitoring, with prioritization of identified needs

4.7 Strategic Recommendations

The analysis of ongoing and potential economic activities and community uses of the Maya Mountain Massif resulted in the following strategic recommendations which can be categorized as general, specific, or targeted.

General Recommendations

Recommendations towards increasing management effectiveness of the Maya Mountains Massif in relation to the socio-economic context have been categorized as short, medium or long term:

Recommendation	Short term	Medium term	Long term
Establish responsibility for implementation of recommendations			
Develop Communications Strategy			
Think beyond local markets and small projects			
Increase education opportunities			
Improve health care			
Implement effective zoning			
Partnering / collaboration with Private Sector			
Enhancing visitor experience			
Concessions in Protected Areas			
Private enterprise development			

- **Establish responsibility for implementation of recommendations**

One of the first steps is to establish responsibility for the implementation of the recommendations to ensure that once recommendations are reviewed and accepted, implementation is effective. Therefore, it is crucial to establish or assign specific responsibilities among the Government agencies and their co-management partners.

- **Develop a communications strategy**

A Communications Strategy should be developed to create awareness of the importance of the Maya Mountain Massif among Private Sector and Policy Makers, focusing not only on the ecological importance of the area but also highlighting its financial contribution to various sectors within the economy. It should address private sector concerns (as it relates to investment costs), and be presented in business terms

While the tourism industry is already realizing the importance of responsible tourism there are other industries that can benefit greatly from improved techniques that are more compatible with sustainable resource use, and generate more profits.

- **Think beyond local markets and small projects**

While small projects have some impact on the socio-economic status of communities, the impacts have often been limited. Donor agencies or projects tend to favor group initiatives as opposed to individuals, but experience has shown that group projects that work best generally involve individual production, whilst group activities are limited to training and marketing.

Instead of focusing on small projects, it is recommended to start exploring opportunities that focus on external or new markets and, if necessary, possibly establish linkages at a regional level to achieve competitiveness.

- **Increase Education Opportunities**

Limited education, and its direct link to poverty, is demonstrated as one of the key factors that leads to natural resource dependence. Organizations such as YCT and TIDE have gone beyond the basic environmental education program and have developed scholarship programs for their stakeholder communities. These programs have been very successful and have opened the way for communication with the community, as they see the program as a direct benefit of the protected area. This not only provides educational opportunities for the community but it also builds a cadre of environmental educators. If the education/scholarship program is managed effectively, it can also become a source of human capital for protected areas management organizations.

- **Improve Health Care**

Like education, health care is an important socio-economic factor when looking at stakeholder communities. Although it appears to be outside the scope of conservation efforts, it is actually an important area to address in order to have communities participate in conservation. This strategy would require collaboration and possibly pooling of resources among the relevant government agencies (Ministry of Health) and the protected areas management entities to address the lack of health care in most of the communities.

- **Implement effective Zonation**

There is a need for zonation of certain areas in order to allow communities to access raw materials required for the establishment of sustainable activities – for example, allowing limited and managed extraction of raw materials such as pimento or popta seeds.

Specific/Targeted Recommendations

- **Partner/Collaborate with Private Sector**

There are many opportunities for GoB, NGOs and CBOs to partner and collaborate with private sector in the protection of natural resources. For too long, conservation organizations have viewed private sector as a threat instead of an opportunity. While this view has been changing in recent years, Belize still has a long way to go in proactively forging these partnerships. In the Maya Mountain Massif it is evident that the best approach to effective landscape management is an inclusive and equitable integrated management scheme. Therefore, the following were identified as the best areas for collaboration with private sector in the MMM. These include enhancing visitor experience, private enterprise development, and concessions in Protected Areas.

- **Enhancing Visitor Experience**

Reports indicate that the Cayo District benefits significantly from tourism and continues to promote tourism as one its major income earner. This can be attributed to the proximity of major towns and high end lodges to the many scenic areas within that region of the Maya Mountain Massif. While other regions of the Massif can also benefit from tourism, the high end lodges provide a unique opportunity for protected areas management organizations in the Cayo District.

Tourism is all about selling an experience. Therefore, the management organizations of protected areas have an opportunity to capitalize on their knowledge and create a service to lodges that would allow them to sell and market unique packages that enhance visitor experience. One option is to offer special interactive presentations on the unique features of the protected areas and possibly some history of the area including an opportunity for the guests to take away more than just pictures but a connection with the area that they visit. It also provides an opportunity for the management organization to invite these visitors to contribute to the protection of "Nature's Best Kept Secret". The end result would be a unique and enhanced experience for visitors thereby improving the lodges' marketability and at the same time creating an opportunity for management organizations to tap into non-traditional funding source. High end lodges are the most feasible partners for this type of venture; however, there are other opportunities for management organizations to partner with other resort owners, hoteliers and tour operators to enhance visitor experience.

Caracol Archaeological Reserve is one of the most visited sites in Belize and is considered one of the more sustainable protected areas within the Maya Mountain Massif. The success of Caracol can be attributed to several key factors which include among others a significant level of capital investment in infrastructure (site level), accessibility and marketing. Of the three key factors aforementioned, two related to visitor experience. The significant investment in infrastructure and accessibility is by no means a singular effort of the Institute of Archaeology but rather a joint effort among several agencies. This has proven successful and the same approach needs to be considered in improving infrastructure and accessibility in the other protected areas within the Massif. This can be achieved through a concerted effort at the ministerial level (Ministry of Natural Resources, Ministry of Finance, Ministry of Works, etc.) or it can be achieved through private sector investments; namely concessions.

Marketing also plays a pivotal role in visitation statistics and can be considered in the case of Caracol as a multidimensional approach with government and private sector both taking on an important role in marketing of the site; government through the Belize Tourism Board and the Institute of Archaeology and private sector through the many, resorts, travel agencies and tour operators. Therefore, the same approach is recommended for other protected areas within the wider Massif.

- **Concessions in Protected Areas**

Even though concessions in protected areas most often go hand in hand with tourism, their very nature warrants a separate discussion. Protected areas co-management organizations in Belize view tourism as a viable source of income and support tourism related activities and services because of its compatibility with conservation efforts.

In most cases management organizations channel their limited resources into several program areas. These may include anything from biodiversity conservation, research, education, advocacy, and community outreach and, of course, tourism. Of all the program areas mentioned, however, tourism is considered the most viable income generator and as such is pursued with high expectations. In reality, tourism-related activities must be well planned and executed for it to generate significant income. Like any other industry, it requires certain expertise and skill level to deliver a satisfactory product, and willingness to invest.

The capacity level, or what can be referred to as the “core competency,” of most protected areas management organizations is in the areas of conducting biodiversity conservation through monitoring, environmental education, and community outreach. Tourism is not the strength of these organizations and it is essential that this is realized. While it is a valuable source of income, it is not necessarily the most effective or efficient use of the organization’s limited human and financial resources. For this reason, the relevant authorities should consider the possibility of granting tourism concessions within protected areas. This opens the door for private sector collaboration in areas where the expertise and in most cases the capital investment exists.

Hotel concessions could be considered within a number of existing tourism areas – Cockscomb Basin Wildlife Reserve being a prime example. Currently, daily visitation to the protected area is high from adjacent tourism establishments such as Kanantik Resort, with limited financial returns to the protected area. It has been recognized that Cockscomb management’s forte does not lie in tourism hospitality, and that it would benefit from the presence of a mid to high-end hotel in or adjacent to the current Headquarters site, run as a tourism concession, to provide this facility within the Wildlife Sanctuary, providing greater financial benefit to the protected area. There are concerns, however, as to how the weak legal security of protected areas, with the constant threat of dereservation, will affect the attraction of investment, as concession holders would be seeking long-term security for their investments.

Tourism concessions for larger areas could be considered in areas currently highlighted as critical management gaps, such as Sittee River and Sibun Forest Reserves, where terrain is generally not suitable for logging concessions, but where the importance for biodiversity conservation and/or watershed protection is considered high. These could encompass management of a larger footprint, with similar conditions for management planning as exists for current co-management agencies, providing a potential management presence and interest within these Forest Reserves, and financial returns to the management authority through concession fees and profit-sharing.

The details of how concessions in protected areas should work in Belize will require some research and significant participation by all relevant managing authorities. The concession licenses themselves however should be seen as a tool to ensure that the resources are not over-exploited, that the impact is minimal, and that the benefits derived from the concession are equitable among the relevant stakeholders. Issues such as duration of concession licenses should reflect the level of investment by the concession holders with clauses that explicitly outline the terms and conditions for arbitration and/or termination.

The challenge will lie in the enforcement of the concession licenses and the procedure for awarding the concessions. There are risks associated with concessions, but they can be mitigated with thorough analysis of the awarding process and well thought out, comprehensive concession contracts.

- **Private Enterprise Development**

Results of the socio-economic survey indicate that the poverty level and the dependence on the natural resources in the South Stann Creek and Toledo District is much higher than that of the Stann Creek Valley area and the Cayo District which means that strategy development for the South Stann Creek and Toledo District should be geared toward alleviating pressure on the natural resource by creating alternatives to unsustainable resource extraction.

The southern regions would benefit most from the production of cacao, the harvesting of popta seeds and the manufacturing of handicrafts in collaboration with private sector. In the case of cacao, the Toledo Grower’s Association serves as the intermediary between the producers (cacao farmers) and the purchasers of cacao. This has proven very effective. In light of this, it is

recommended that a similar mechanism be established to promote the harvesting of popta seed and the production of handicrafts.

It is recommended that a private investor or private group/company establish the operational and administrative structure needed to supply the international market with popta seed. Individuals within the communities interested in becoming harvesters would then become suppliers to the private investor. Harvesting of this, or any other natural resource, would require baseline studies and the development of sustainable extraction plans, and ongoing monitoring and enforcement, but the necessary investment would be absorbed by the private investor. This would stimulate both development of an emerging industry, and create an indirect employment opportunity for communities and economic returns for PA management through fee structures and payment for extracted resources.

The same can be said of handicraft production. Opportunities exist for private investors to establish the administrative structure and quality control and distribution system for the handicrafts produced by individuals in the communities. The approach however must be holistic to be truly successful and effective. This means approaching private sector and government agencies such as BELTRADe (under the current Fiscal Incentives Act) to ensure that the Government of Belize provides the necessary fiscal incentives, and private sector provides the necessary capital investment. The challenge lies in identifying individuals or companies willing to take the risk of working with communities, and willing to make the long term investments.

At the end of the day, however, one of the key points highlighted in the southern regions is the desire of community members to have a steady income through employment. This can only be achieved through attraction of further development to the southern coastal plain, whether based on tourism, agro-industries or other business initiatives.

- **Other Economic Opportunities**

It is recommended that the viability of engaging in a payment for environmental services or carbon sequestration scheme is explored in detail. These are potential economic opportunities for the Massif that would be most effective as a system or national level initiative. . A system-wide negotiated carbon sequestration scheme for the Maya Mountains Massif has the potential to provide very adequate financing for all needed system-wide management improvements into the long-term.

**Technical Assessment of the
Management Capacity
within the Maya Mountains Massif**

Summary

5. Management Capacities within the Maya Mountains Massif

5.1 Introduction

Background

Protected areas are one of the most important conservation tools available to Belize's efforts towards the goals laid out under the Convention on Biological Diversity. However unless these protected areas are managed effectively, they will not fulfill their objectives of biodiversity conservation, environmental management and the protection of cultural heritage.

The Maya Mountains Massif, consisting of fourteen protected areas within Belize, is biodiversity-rich, and encompassing thirty-seven globally threatened species (four species considered 'Critically Endangered', thirteen classified as 'Endangered' (IUCN, 2008), and twenty classified as 'Vulnerable'². Eighteen endemic species have been identified to date in the rich matrix of ecosystems. Despite its protected status, the Maya Mountain Massif is subjected to a number of threats throughout its range, including illegal and unsustainable harvesting of xate, illegal hunting and fishing, farming incursions and increased fire impacts. There is recognition of the need for more effective system-level management of the area, greater participation from stakeholder communities in management decisions, and greater trans-boundary collaboration with the management stakeholders of the contiguous Chiquibul / Montañas Mayas of the Southern Petén area of Guatemala (NPAPSP, 2005).

The present management capacities of the protected area management bodies have been assessed using the Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) methodology (WWF, 2003). The findings from the RAPPAM process, collated from meetings and interviews conducted between April and June, 2007, are summarized within this report, which also highlights gaps in management in the Maya Mountains Massif, and strategy recommendations for increased coordination between management units, with the objective of strengthening the overall national and regional integration of the Maya Mountains Massif into an amalgamated protected areas system, with management focused on system-wide goals and objectives.

Scope and Coverage of Assessment

The Maya Mountains Massif area covers an estimated 1,260,800 acres of Belize (approximately 510,330 hectares), stretching from Vaca Forest Reserve at its most northerly extent to Columbia River Forest Reserve in the south, and is composed of a total of fourteen protected areas (FD, 2007). It is highlighted as a priority area under the Maya Forests Ecoregional Plan (TNC, 2006), and, together with Complejo III (Reserva de Biosfera Montañas Mayas-Chiquibul), of the Guatemala protected areas system, which forms part of the Chiquibul / Montañas Mayas, one of the largest remaining areas of contiguous forest in Mesoamerica.

² These estimates for number of threatened species per IUCN category include three aquatic / marine species present within the estuarine and lower river ecosystems of Deep River, covered under the Maya Mountains Marine Corridor Conservation Action Plan

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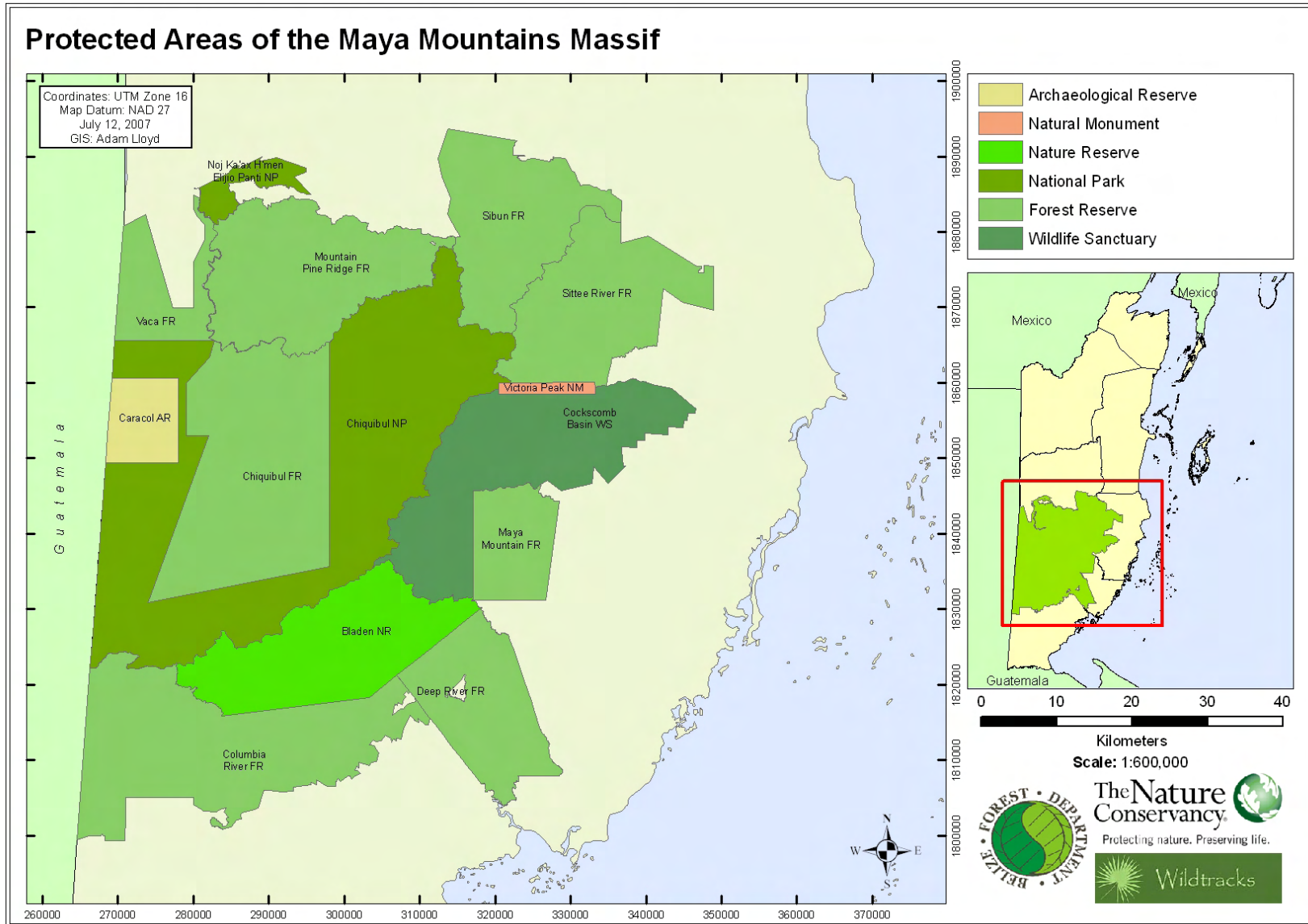
The fourteen protected areas within the Maya Mountains Massif vary in size and status, ranging from Victoria Peak Natural Monument (the smallest of the protected areas, designated for its national importance as the highest peak in Belize) to Chiquibul National Park, important for both its biodiversity and watershed protection roles (Map 11; Table 13).

NAME	STATUS	IUCN CAT	ACRES
Sibun*	Forest Reserve	VI	96564.45
Vaca	Forest Reserve	VI	34886.89
Chiquibul	Forest Reserve	VI	147823.10
Maya Mountain	Forest Reserve	VI	38259.77
Sittee River**	Forest Reserve	VI	92316.59
Columbia River	Forest Reserve	VI	148302.97
Deep River	Forest Reserve	VI	67304.82
Mountain Pine Ridge	Forest Reserve	VI	106,352.70
Cockscomb Basin*	Wildlife Sanctuary	IV	122,260.14
Victoria Peak	Natural Monument	III	4,840.56
Noj Kaax Me'en Eligio Panti	National Park	II	12,657.30
Chiquibul	National Park	II	264,003.25
Caracol	Archaeological Reserve	II	25,549.46
Bladen	Nature Reserve	Ia	99,673.80
APPROXIMATE AREA (ACRES)			1,260,800

* Boundaries currently being redefined

** Includes Davis Falls

Table 13: Protected Areas of the Maya Mountains Massif



Map 11: Protected Areas of the Maya Mountains Massif

The National Protected Areas System of Belize

Belize’s National Protected Areas System is managed under the recently approved National Protected Areas Policy and System Plan (NPAPSP, 2005), which provides a framework of general principles within which this assessment has been developed. Two different Government Ministries currently have mandates for the creation of national protected areas within the Maya Mountains Massif - the Forest Department of the Ministry of Natural Resources and the Environment, (responsible for the administration of the Forest Act and the National Parks System Act), and the Ministry of Youth, Sports and Culture (responsible for the creation of Archaeological Reserves under the Ancient Monuments and Antiquities Act, and managed by the Institute of Archaeology).

Current Protected Area Status

All but one of the protected areas of the Maya Mountains Massif are established under the Forest Department through the National Parks System Act, and fall within five distinct categories, each with restrictions strictly defined by law. 42% of the Maya Mountains Massif is designated for the conservation of biodiversity and cultural resources. This includes three of the protected area categories (National Park, National Monument and Wildlife Sanctuary), providing full protection to the natural resources, with use concentrating on tourism, research and education.

Status	Extractive Use	Tourism	Research	Education
Forest Department				
Nature Reserve	No	No	Yes	Yes
National Park	No	Yes	Yes	Yes
National Monument	No	Yes	Yes	Yes
Wildlife Sanctuary	No	Yes	Yes	Yes
Forest Reserve	Yes	Yes	Yes	Yes
Institute of Archaeology				
Archaeological Reserve	No	Yes	Yes	Yes

Table 14: Permitted activities per designated status of protected areas of the Maya Mountains Massif

Protected Area Management Organizations

Management responsibility for the protected areas of the Maya Mountains Massif is divided between two Ministries - the Ministry of Natural Resources and the Environment and the Ministry of Culture. All but 2% of the Maya Mountains Massif is under the mandate of the former, through the Forest Department, which shares this responsibility with a number of co-management agencies and long-term forest license concession holders (Table 15):

Belize Audubon Society: One of the most established conservation organizations within Belize, currently with a ten-year co-management agreement covering Cockscomb Basin Wildlife Sanctuary and Victoria Peak Natural Monument, as well as a seat on the Executive Board of the Bladen Management Consortium.

Bladen Management Consortium: The co-management partner for Bladen Nature Reserve, the BMC Board consists of a consortium of agencies – Forest Department, Belize Audubon Society, Belize Foundation for Environmental Education, Ya’axche Conservation Trust, Toledo Institute for Development and Environment and the international organization Flora and Fauna International.

Friends for Conservation and Development: The co-management partner for Chiquibul National Park, and working in close collaboration with other management bodies within the Chiquibul area, and within the Maya Mountains Massif as a whole, towards integrated management of the Maya Mountains Massif.

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Itzamna Society: Has the co-management agreement for the Noj Ka'ax H'Men Elijio Panti National Park.

Friends of the Valley: Recognised as potential co-manager, Friends of the Valley, a local community-based organization, has an informal management agreement for Davis Falls and Swim Pools, two prospective National Parks potentially to be excised from Sittée River Forest Reserve and developed for their recreational properties and biodiversity protection.

Of the eight **Forest Reserves**, six are being managed under long term (20 - 40 year) logging concessions, and similar agreements are being discussed for two of the remaining extractive reserves. One (Sibun Forest Reserve) is currently being managed under a short-term (10 year) agreement. Vaca Forest Reserve is currently under a logging moratorium following past heavy, unsustainable and illegal extraction.

Protected Area	Current Co-management Agencies	Agreement Type	Date Agreement first signed
a) Biodiversity and Cultural Conservation			
Cockscomb Basin Wildlife Sanctuary	Belize Audubon Society	<ul style="list-style-type: none"> ▪ Co-Management Agreement 	1986 (most recently renewed in 2004)
Victoria Peak Natural Monument			
Bladen Nature Reserve	Bladen Management Consortium	<ul style="list-style-type: none"> ▪ Co-Management Agreement 	August 1996 (most recently renewed in 2007)
Noj Kaax Me'en Elijio Panti National Park	Itzamna Society	<ul style="list-style-type: none"> ▪ Co-Management Agreement 	June, 2001
Chiquibul National Park	Friends for Conservation and Development	<ul style="list-style-type: none"> ▪ Co-Management Agreement 	June, 2007
b) Extractive Use			
Chiquibul Forest Reserve	Bull Ridge Company	<ul style="list-style-type: none"> ▪ Long Term Logging License (40 yrs) 	October 2006
Columbia River Forest Reserve	Atlantic Industries (in limbo)	<ul style="list-style-type: none"> ▪ Long Term Logging License (20 yrs) 	1997
	2 proposed		-
Deep River Forest Reserve	Thomas Gomez and Sons	<ul style="list-style-type: none"> ▪ Long Term Logging License (40 yrs) 	September 2005
	The Wood Depot	<ul style="list-style-type: none"> ▪ Long Term Logging License (40 yrs) 	2003
Maya Mountain Forest Reserve	1 proposed Long Term Forest License	<ul style="list-style-type: none"> ▪ None 	In process
Mountain Pine Ridge Forest Reserve	Pine Lumber Company	<ul style="list-style-type: none"> ▪ Long Term Logging License (40 yrs) 	2002
	1 proposed	<ul style="list-style-type: none"> ▪ Long Term Logging License 	In process
Sibun Forest Reserve	Noel Codd	<ul style="list-style-type: none"> ▪ 10 year Logging License 	2007
Sittée River Forest Reserve	New River Enterprises	<ul style="list-style-type: none"> ▪ Long Term Logging License (40 yrs) 	2006
Vaca Forest Reserve	Proposed 9 year recovery	<ul style="list-style-type: none"> ▪ None 	-

Table 15: Co-management agencies within the Maya Mountains Massif

A site-specific co-management agreement has been signed between the Institute of Archaeology and Friends for Conservation and Development for the Chiquibul cave system, and similar proposed co-management agreements are under discussion between the IoA and Forest Department for the cave

systems of Mountain Pine Ridge, and with Itzamna Society for the co-management of Offering Cave, within Elijio Panti National Park.

5.2 Rapid Assessment and Prioritization of Protected Areas Management

Following the identification of the scope of the assessment by the Forest Department, and of the protected areas to be included within the Maya Mountains Massif system, an assessment of the current **management capacities** has been conducted, looking both at local level effectiveness, and of abilities to address trans-boundary areas and issues.

The protocol used for this assessment is the **Rapid Assessment and Prioritization of Protected Areas Management Methodology (RAPPAM)** (WWF, 2003), developed under the WWF's Forests for Life programme to provide a tool for the rapid assessment of management effectiveness within a particular country or region, towards enhancing the viability of protected area networks worldwide.

The RAPPAM methodology is designed to give broad-level comparisons across a protected area system, providing guidance for protected area management within the broad context of the system being assessed, and leading to identification of areas where greater integration and / or collaborative efforts will improve management effectiveness over the system.

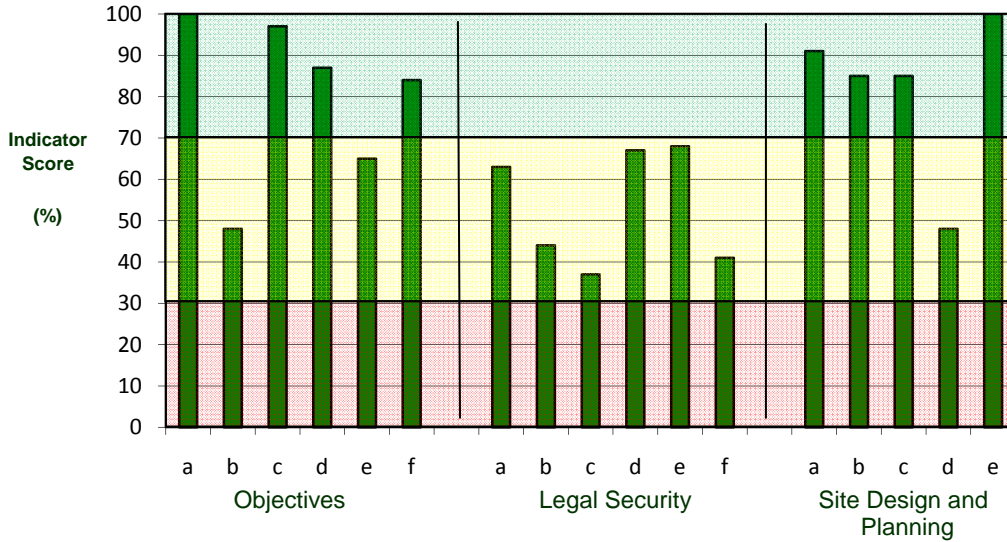
An initial workshop was held with protected area managers on 11th April, 2007 to introduce the RAPPAM tool, and calibrate the questionnaire to ensure that there was consensus on the meanings of both the questions and the possible choices. This was followed by a series of on-site interviews with protected area staff – both the managers and the field staff – conducted between April and June, 2007 for completion of the questionnaire. Additional consultation was also conducted with FD staff, and key stakeholders in communities identified as potentially impacting the natural resources of the adjacent protected areas.

Assessment of management effective and management capacity under RAPPAM uses three categories – Planning, Inputs and Management – under which each protected areas is assessed. The full assessment is presented in the **Technical Assessment of the Management Capacities within the Maya Mountains Massif** (Report 5). The results are summarised below:

5.3 Assessment of Planning

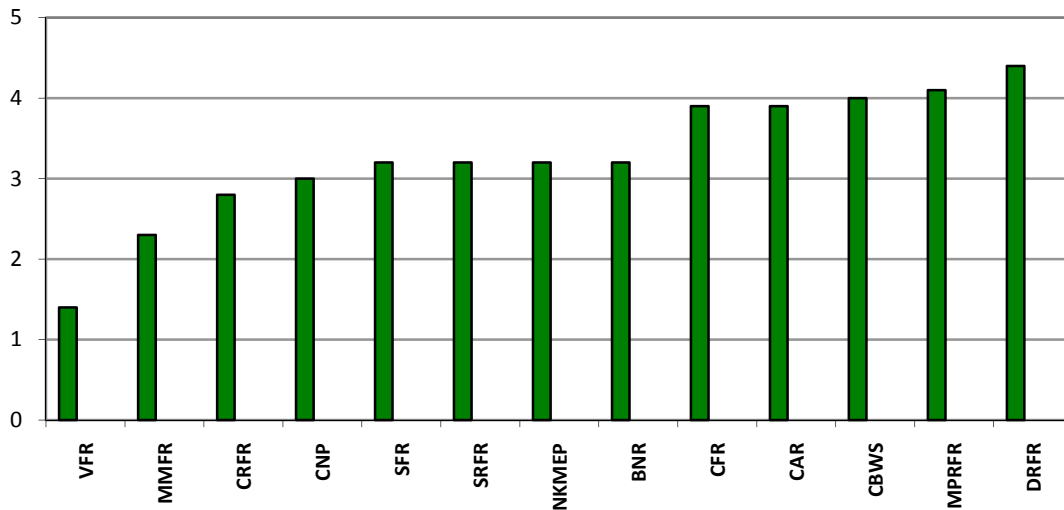
Assessment of **Planning** under the RAPPAM process focuses on three categories:

- Objectives
- Legal Security
- Site Design and Planning



*The Indicator Score is the total scores summed across all protected areas within the system, represented as a percentage of the possible highest total score (75)

Graph 6: Planning Indicator Scores over the Maya Mountains Massif System



Graph 7: Average Planning Indicator Scores per Protected Area

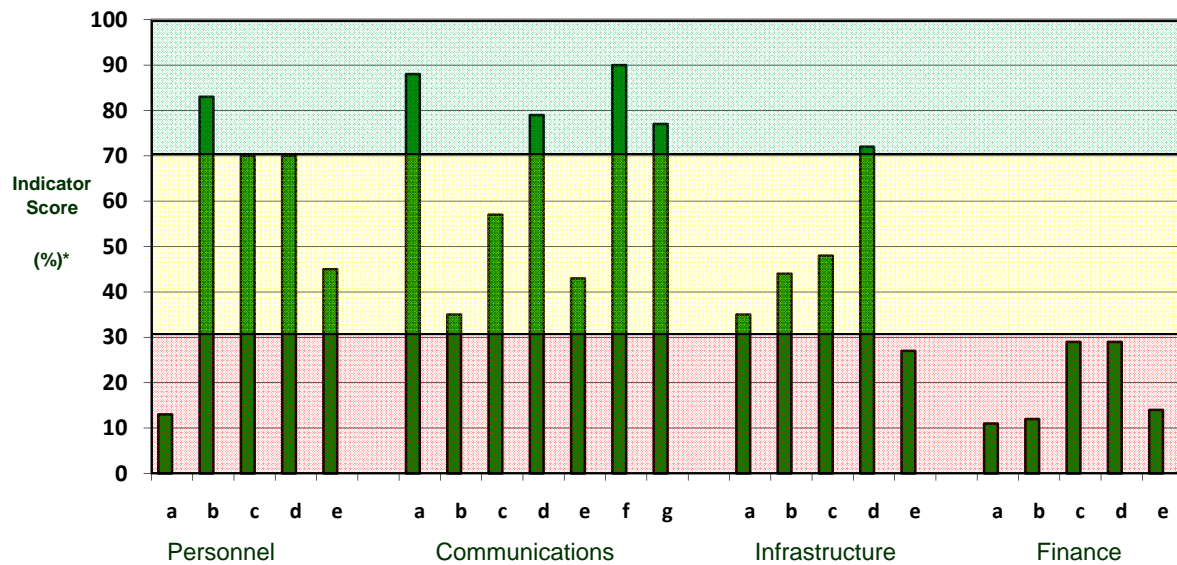
Planning Indicator Summary:

1. The strongest areas of **Planning** at site level across the system are the focus of objectives on biodiversity conservation and the contiguity of the system.
2. The weakest areas of **Planning** at site level across the system are those associated with legal security, and the limited number of protected areas with current management plans.
3. The five protected areas with the highest **Planning** indicator scores are Deep River Forest Reserve, Mountain Pine Ridge Forest Reserve, Cockscomb Basin Wildlife Sanctuary, Caracol Archaeological Reserve and Chiquibul Forest Reserve.
4. Those Forest Reserves with highest **Planning** indicator scores are those managed under private sector long term forest licenses
5. The protected areas with the lowest **Planning** indicators scores are Vaca and Maya Mountain Forest Reserves, both lacking in on-site management

5.4 Assessment of Inputs

Assessment of **Inputs** under the RAPPAM process focuses on four categories:

- **Personnel**
- **Communications**
- **Infrastructure**
- **Finance**

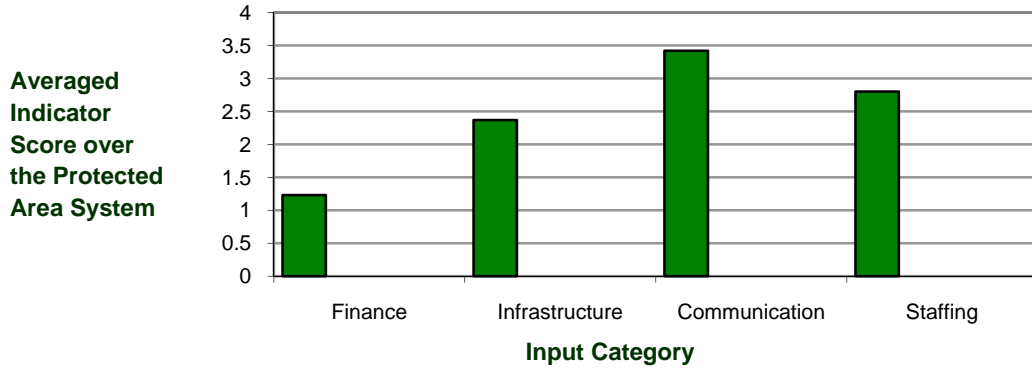


*as a percentage of the possible highest total score (75)

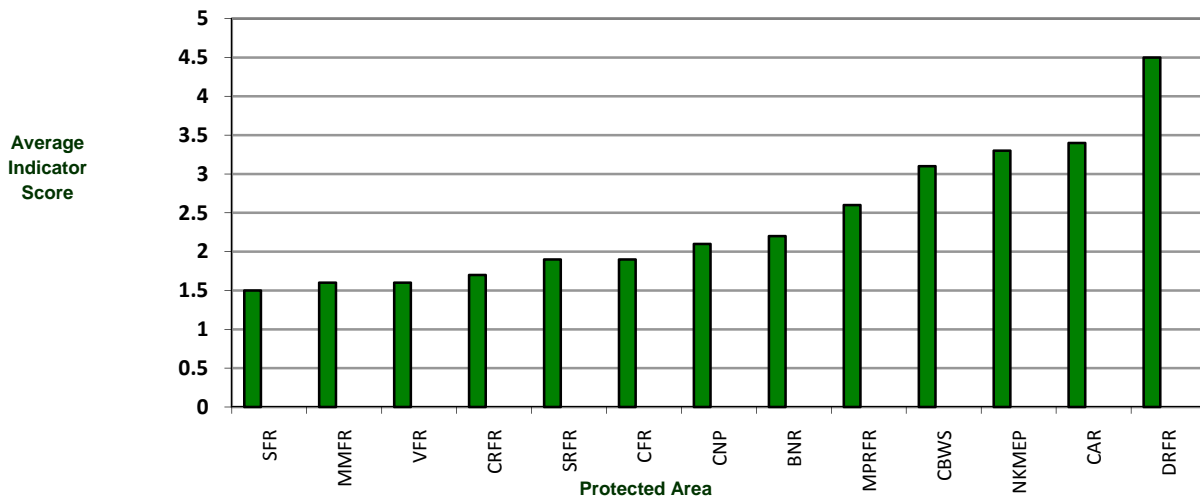
Graph 8: Input Indicator Scores over the Maya Mountains Massif System

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Overall, **Finance** is the weakest of the Input areas, with **Infrastructure** also scoring below 2.5 (50%). **Staffing**, whilst rated higher than Finance and Infrastructure, is still considered to require strengthening. **Communication and Information** rates highest of the four areas, though this is based on the good communication, liaison and collaboration that exists at the majority of levels of management within the system. The Information aspect of this indicator category would benefit from further strengthening.



Graph 9: Input Indicator Scores per Input Category



Graph 10: Input Indicator Scores per Protected Area

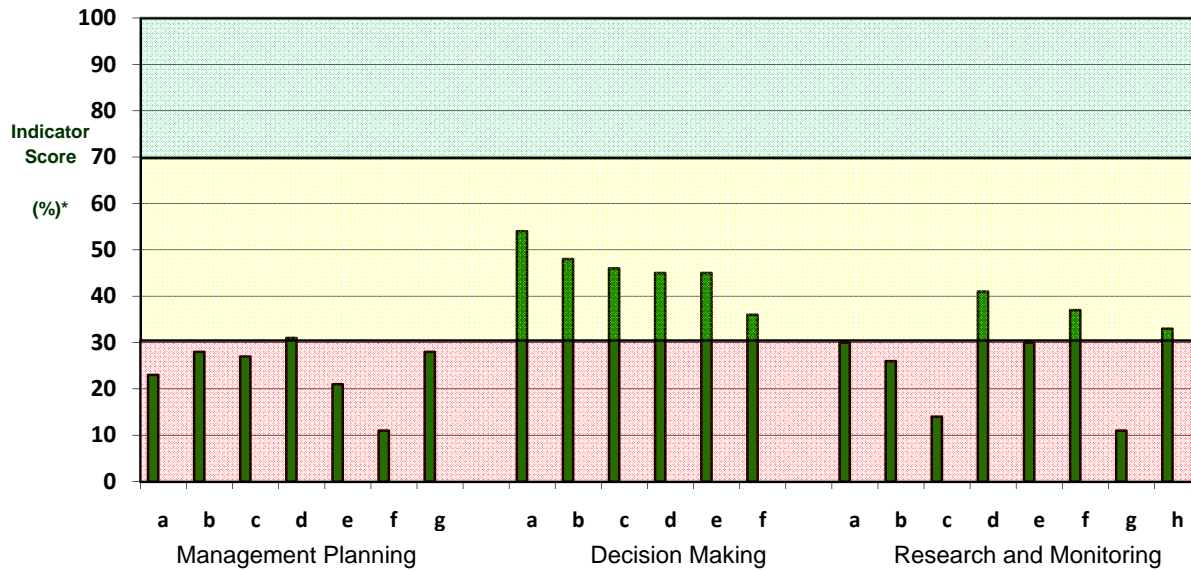
Input Indicator Score Summary:

1. The strongest areas of **Inputs** at site level across the system reflect the increasing communication and collaboration between protected area co-managers and the Forest Department.
2. The weakest areas of **Inputs** at site level across the system are adequate staffing and finance, followed by infrastructure. There is also inadequate information on biodiversity, cultural resources and the social context available for effective management
3. The five protected areas with the highest **Input** indicator scores are Deep River Forest Reserve, Caracol Archaeological Reserve, Eljio Panti National Park, Cockscomb Basin Wildlife Sanctuary, and Mountain Pine Ridge Forest Reserve,.
4. Those Forest Reserves with highest **Input** indicator scores are those managed under private sector long term forest licenses, with investments being made into long term management
5. The protected areas with the lowest **Input** indicators scores are Sibun Forest, Maya Mountain and Vaca Forest Reserves, all three lacking in on-site management

5.5 Assessment of Management Processes

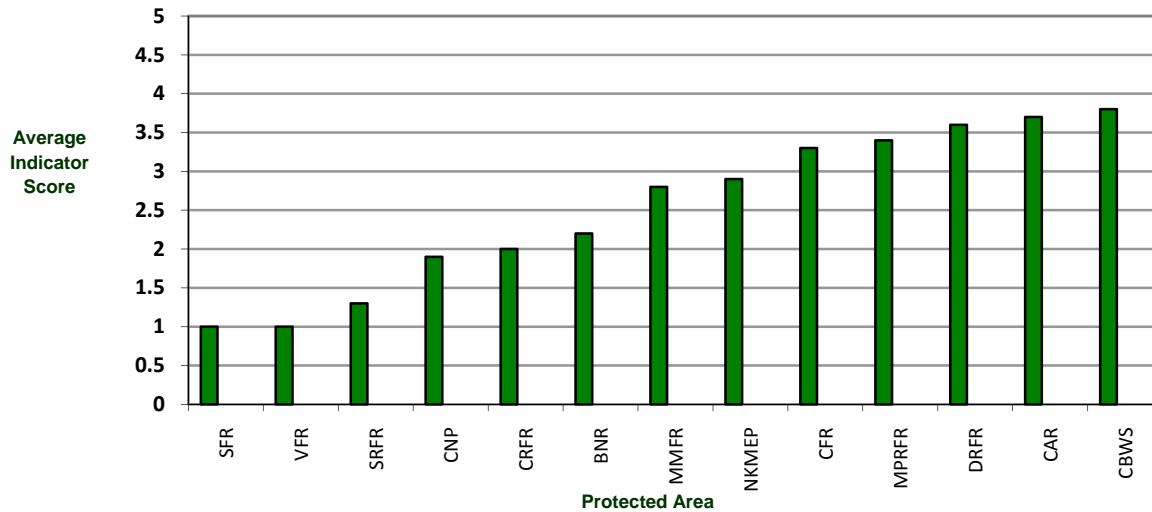
Assessment of **Management Processes** under the RAPPAM protocol focuses on three categories:

- **Management Planning**
- **Management Decision Making**
- **Research and Monitoring**



*The Indicator Score is the total scores summed across all protected areas within the system, represented as a percentage of the possible highest total score (75)

Graph 11: Management Process Indicator Scores over the Maya Mountains Massif

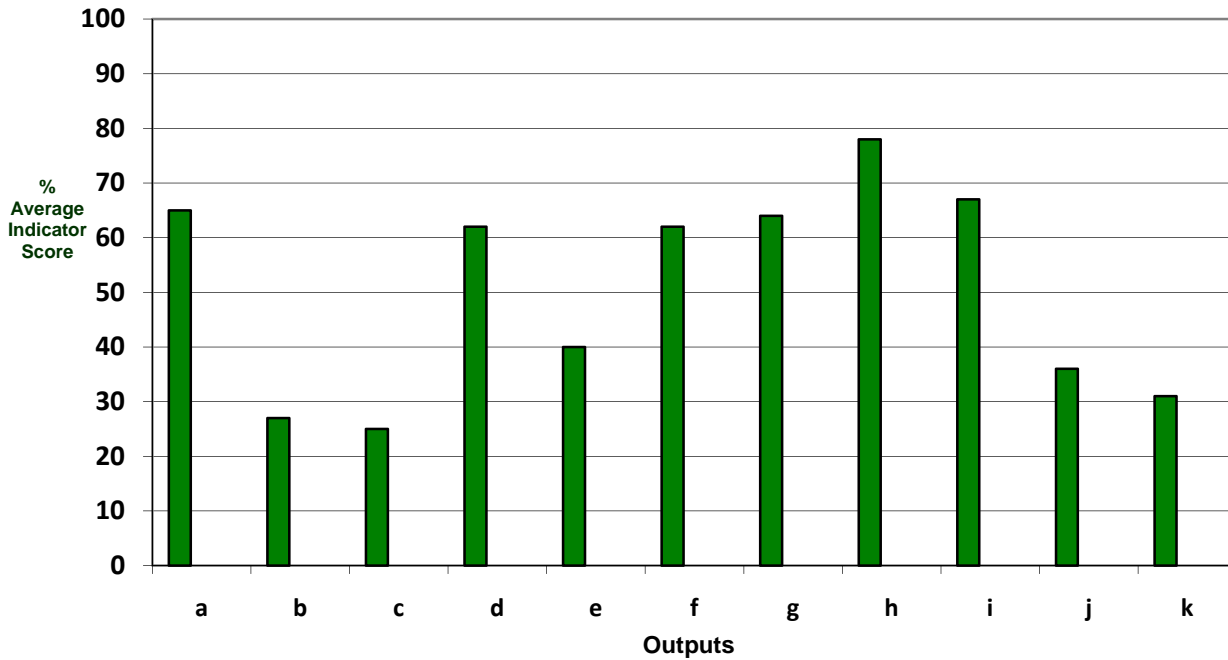


Graph 12: Management Processes Indicator Scores per Protected Area

Management Processes Indicator Score Summary:

1. The strongest areas of **Management Processes** at site level across the system are the areas of decision making, though these indicators all score under 60%, and most score under 50%.
2. The weakest areas of **Management Processes** at site level across the system are the lack of site level financial and / or business planning, and the limited collaborative cost-effective efforts in areas other than surveillance and enforcement. Baseline information is also identified as a critical weakness at both site and system-level planning.
3. The five protected areas with the highest **Management Processes** indicator scores are Cockscomb Basin Wildlife Sanctuary, Caracol Archaeological Reserve, Deep River Forest Reserve, Mountain Pine Ridge Forest Reserve and Chiquibul Forest Reserve
4. Those Forest Reserves with highest **Management Processes** indicator scores are those managed under private sector long term forest licenses – it should be borne in mind that the majority of their management is focused on effective management of the timber resources, not necessarily of the watershed characteristics, or the biodiversity and cultural resources generally.
5. The protected areas with the lowest **Management Processes** indicators scores are Sibun, Sittee and Vaca Forest Reserves, all three lacking in on-site management

5.6 Outputs at System-level



Graph 13: Output Indicator Scores per Protected Area

Indicators that Score > 50%

Threat prevention, detection and enforcement: Many of the protected area managers consider that surveillance and enforcement is consistent with the threats and pressures, PA objectives and annual work plans (where these exist). However this does not reflect the situation on the ground - the protected areas, whilst implementing surveillance activities as outlined in their workplans, are on the whole not able to effectively lower or prevent threats within much of the system. Several concentrate on a small, focal area, where tourism activities occur, yet have limited resources to extend to the rest of the management area.

Collaborative efforts are currently being implemented in the Maya Mountains West to increase effectiveness of surveillance and enforcement, with active participation from other sectors – Belize Defence Force, Immigration and the Police Department. The Maya Mountains East have not yet achieved this level of collaboration, though some sharing of human resources between protected areas is taking place, to increase the effectiveness of patrols.

Indicator Categories: Outputs

In the last two years, the following outputs have been consistent with the threats and pressures, PA objectives, and annual workplan:

- a Threat prevention, detection and enforcement
- b Site restoration and mitigation efforts
- c Wildlife or habitat management
- d Community outreach and education efforts
- e Visitor and tourist management

- f Critical Infrastructure development
- g Management planning and inventorying

However, the scale of incursions from Guatemala will require greater input than protected area managers and co-managers can achieve with their current enforcement capacity, even with these collaborative partnerships.

Recommendations:

- Increase collaboration towards threat prevention, detection and enforcement in the Maya Mountains East, based on the Maya Mountains West model
- Establishment of a trained patrol team to be deployed at system-level in surveillance and enforcement hotspots

Community outreach and education efforts: The majority of co-managers have community outreach and education programmes, though these are limited to some extent by the budget and focus of funding agencies. The Forest Department, as managers of the Forest Reserves, and the private sector long-term forest license partners, recognize the importance of community engagement and increasing awareness of the value of the protected areas, especially in terms of environmental services, but have not yet taken adequate steps to implement effective outreach and education programmes.

Recommendations:

- Increase collaboration towards more effective community outreach, developing synergies and reducing repetition in areas of stakeholder overlap
- Investment by long-term forest license holders in collaborative community outreach and education efforts by protected area co-managers working in this area with stakeholder communities, to achieve effective results for mutual and system-level benefit

Critical Infrastructure Development: The majority of protected areas consider that critical infrastructure is present, though could be improved. In reality this is a generous rating for this indicator, critical infrastructure being assessed relative to that of other protected areas – rather than relative to that in more effectively managed reserves elsewhere in the region.

Recommendations:

- Increase protected area staff and managers' awareness of the mechanisms and infrastructure of effectively managed PAs in the region to help raise the bar of standards and identify infrastructural gaps to be prioritized for strengthening.
- Develop system-level goals for minimum standards for infrastructure for effective site-level management.

Management planning and inventorying: The averaged score for this indicator obscures the discrepancies across the system – protected areas either have current management plans and associated inventories, or they do not. Those with current management plans score quite highly, those without do not.

Recommendations:

- Move towards all protected areas within the Massif having up to date site management plans, with associated resource inventorying

- Ensure that these site-level management plans reflect system-level zonation and programmatic priorities and responsibilities

Staff monitoring, supervision and evaluation: Management effectiveness in this area was generally thought to be good – in fact it was the highest scored indicator in this grouping. Most PA staff felt that they have adequate supervision and evaluation.

Recommendations:

- Increase system-level collaboration between protected area managers to help give structure to those scoring more poorly in these aspects of staff management.

Staff training and development: In the majority of protected areas, most staff felt that they had been given adequate training to effectively carry out their work. There is however scope for improvement, with the relatively high score partly reflecting lack of exposure to, and knowledge of, specific areas where increased training can pay significant dividends.

Recommendation:

- Provide system-level training opportunities for PA staff, particularly in the areas of surveillance and enforcement, monitoring, tourism management and hospitality skills, record-keeping and reporting

Score 31 – 50%

Visitor and tourist management: Few protected areas of the Maya Mountains Massif have active tourism, or active tourism management. There is scope for significant improvement in visitor management in even the most effectively managed protected areas in the Massif. It is generally recognized that most PA staff lack the capacity and/or training, infrastructure and management support for effective visitor management.

Recommendations:

- Provide system-level support training and guidelines for basic visitor management.
- Investigate feasibility and conduct a cost/benefit analysis for allocating tourism concessions, following system-level guidelines and standards, and providing profit-sharing returns to the PA managers or authority.

Research and monitoring outputs: Protected area staff and managers rated their effectiveness in this area as being in need of significant strengthening. Whilst some management bodies have attempted to implement some biodiversity monitoring, there has generally been insufficient or haphazard training, with a lack of clearly identified objectives. Lack of use of any resulting data has been a deterrent to PA staff to continue data collection.

Recommendations:

- Identify system-level priorities for research and monitoring, and the protocols to be used
- Develop a system-level framework for training PA staff in these protocols
- Develop a system-level framework for the implementation, coordination and supervision of research & monitoring activities by PA managers and staff

- Develop a system-level framework for the collation, analysis and interpretation of data collected by PA managers, and for the dissemination of outputs in a meaningful format

Financial sustainability: All protected area staff and managers rated their effectiveness in this area as being in need of significant strengthening. It is broadly recognized that most protected area managers lack business and financial planning skills, without which financial sustainability remains unattainable.

Recommendations:

- Increase training opportunities for PA managers to strengthen business and financial planning skills
- Increase collaboration between protected area managers to facilitate skills transfer in the area of financial planning
- Investigate strengthening PA financial sustainability through collaborative partnerships with the private sector – e.g. through profit-sharing tourism concessions.
- Investigate system-level funding mechanisms (eg. Payment for Environmental Services and Carbon Sequestration)

Score ≤ 30%

Site Restoration and Mitigation Efforts: Few of the protected areas are considered to require any site restoration or mitigation efforts – those that do are protected areas with significant areas of pine forest and savanna, where a combination of Southern Pine Bark Beetle and fire have resulted in degradation, with reduced pine density. Mountain Pine Ridge, which has been badly impacted by both these factors in the last few years, now has large scale replanting efforts underway to restore the system. In other pine ecosystem areas, the Forest Department is encouraging the development of long term forest licenses with private sector, as seen in the two 40 year concessions for Deep River Forest Reserve, promoting investment in reforestation. A similar strategy is being used for Columbia River Forest Reserve, where hurricane damage has been followed by extensive salvage extraction, and on-site resource management will assist natural regeneration

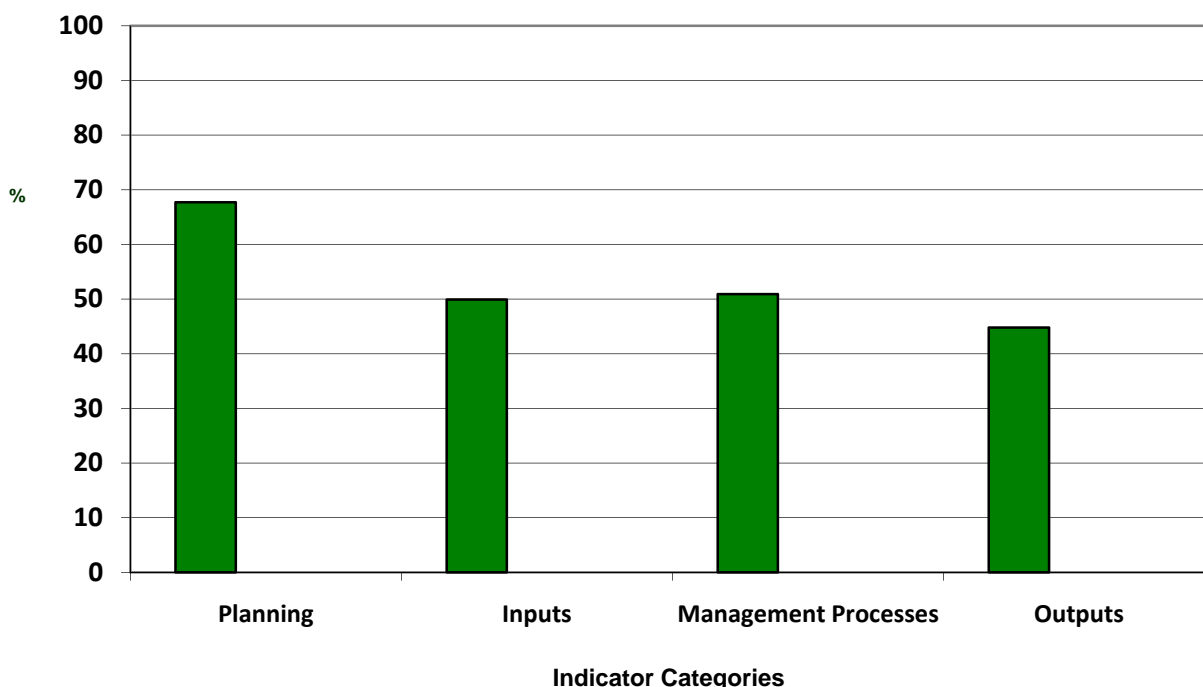
Wildlife or habitat management: As with the above indicator, there are few instances in the protected areas of the Maya Mountains Massif where active wildlife or habitat management is required – over and above the surveillance and enforcement activities that are assessed separately. The low scores for this indicator are therefore a reflection of this general lack of need rather than lack of capacity.

5.7 Summary of Management Effectiveness Results

The data was analyzed at both system and site level, to form an overview of management effectiveness in the protected areas of the Maya Mountains Massif System, and to provide system-level recommendations for strengthening management.

When results from all the protected areas are averaged per indicator, they identify the areas of relative strengths and weaknesses of management across the system (Graph 14). Only two of the Indicator Categories score over 50% - **Planning** and **Management Processes**, and neither of these scores more than 70%, suggesting that on average, Planning and management processes are not present across the System, but are present in those protected areas with a strong management presence, and a management plan in place.

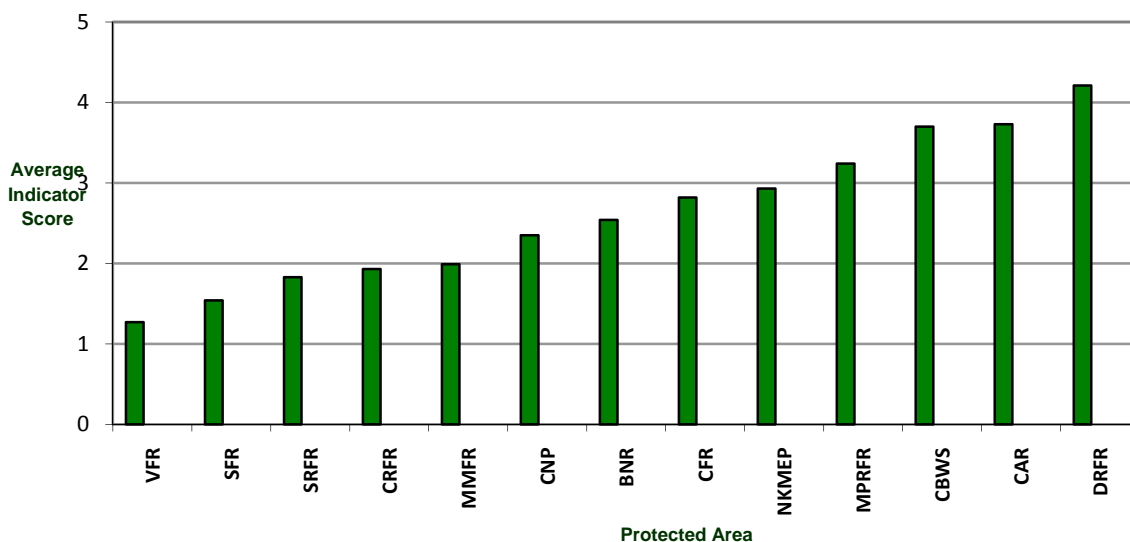
Input and **Outputs** both score below 50%, suggesting that significant strengthening is required in these areas – limited funding and personnel being linked to low management effectiveness.



Graph 14: Averaged Management Effectiveness Scores per Indicator Area

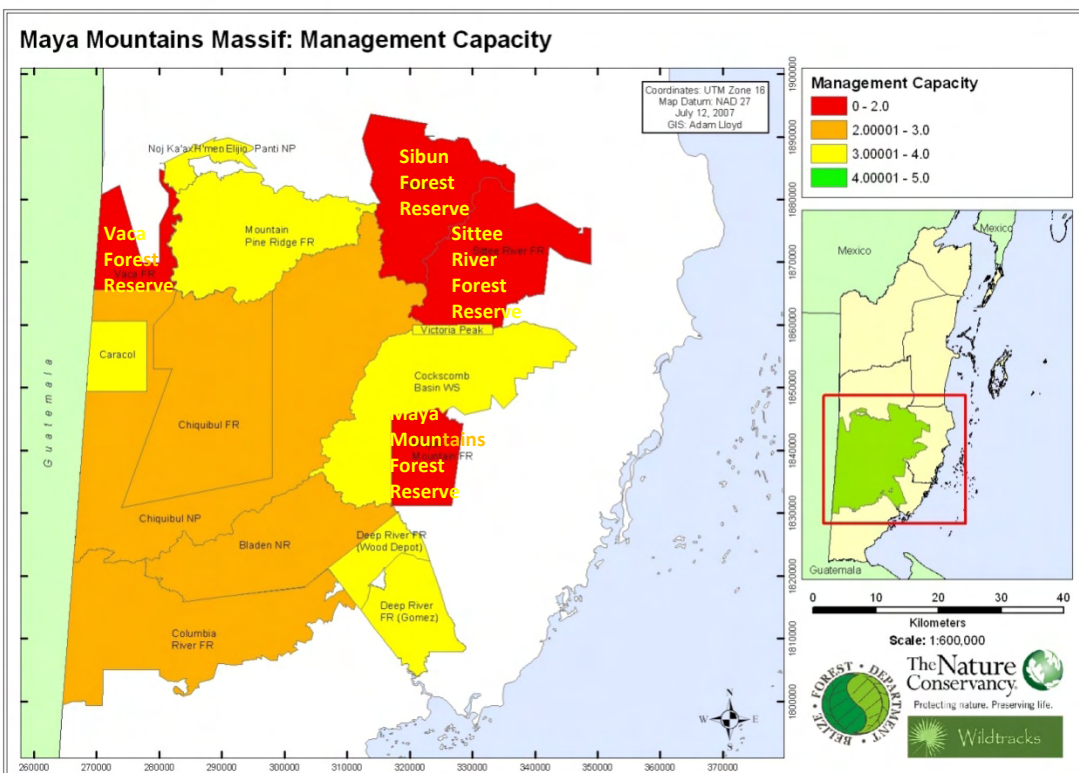
Each protected area was also assessed in terms of total management effectiveness, using an average of the scores for the Indicator areas (Graph 14). This highlights those protected areas that are considered to have relatively strong management:

Deep River Forest Reserve	under a long-term forest license
Caracol Archaeological Reserve	managed under the Institute of Archaeology, with significant visitation
Cockscomb Basin Wildlife Sanctuary	managed under the Belize Audubon Society, with significant visitation and strong education component
Mountain Pine Ridge Forest Reserve	strong forestry base, with long term forest license, and significant visitation



Graph 15: Summary of Management Effectiveness Indicator Scores per Protected Area

The RAPPAM results also provide a clear identification of the significant management gaps within the Maya Mountains Massif, highlighting four protected areas - Vaca, Sibun, Sittee River and Maya Mountain Forest Reserves as in critical need of strengthening management presence and management activities (Map 12). These four are all extractive reserves, but with topography that provides a distinct physical barrier to their use for timber extraction. All are also under pressure for dereservation, with agricultural and hunting incursions occurring on an ongoing and unrestricted basis.



Management Strategy Recommendations

For the Maya Mountains Massif

6.0 Management Strategies for the Maya Mountains Massif

6.1 CAP Strategy Development: Objectives and Actions

Introduction

With information available from the previous CAP workshops on the target viability and critical threats, and the development of situation analyses for the different biodiversity conservation targets, a general stakeholder meeting was held to develop objectives and strategies to successfully implement effective conservation management of the protected areas of the Maya Mountains Massif.

Objectives, defined as “Specific statements detailing the desired accomplishments or outcomes of a particular set of activities within a project” (TNC, 2007), have been developed towards fulfilment of the Vision for the Maya Mountains Massif, and primarily focus on the abatement of critical threats and identified specific conservation requirements. These objectives were developed using the following criteria...that they be:

- **Specific** – to ensure that all stakeholders involved in the project have the same understanding of what the terms mean.
- **Measurable** - to allow progress to be measured.
- **Achievable** - realistic given the current conditions, 10-year time period, resources allocated, etc.
-
- **Relevant** – impact oriented and represent the necessary changes in key ecological attributes, critical threat factors, or project resources to achieve the project goal.
- **Time-Limited** - clear about when the objective will be achieved.

Using this as a framework, thirteen objectives were developed during the workshop, and then further modified and improved during the Core Planning Meeting on the 11th October, 2007. A fourteenth objective was developed during a specific workshop for cultural targets, held at the Institute of Archaeology, and added to reflect the cultural targets (Table 8).

Strategic Actions were also developed to provide a framework for achieving each objective (Report 5), and a first assessment of prioritisation was conducted.

Objectives for Effective Conservation Management of the Maya Mountains Massif

- Objective 1:** By the year 2012, the illegal xatero incursions and associated activities have been reduced by 85%
- Objective 2:** By the year 2012, all agricultural incursions within the protected areas of the MMM are vacated and regenerating into forest and there are no new ones reported
- Objective 3:** By 2012, connectivity between the Maya Mountains Massif and Rio Bravo will have been secured, through the Manatee Forest Reserve, and across the Western Highway
- Objective 4:** By 2012, conservation of all freshwater communities within the MMM is maintained for 90% of watersheds to support viable populations of migratory species, through appropriate zoning, and longitudinal connectivity to the coast
- Objective 5:** By 2012, the incidence and size of fires is reduced by 50% within the Upland Pine Savannas and 25% for the Coastal Plain Pine Savannas, and by 2017, the incidence of fires is reduced by 75% within the two systems.
- Objective 6:** By the year 2012, at least 65% of the Maya Mountains Massif is considered as an effective reservoir for the protection of game species through the use of zonation and implementation of legislation
- Objective 7:** By 2015, all hydropower developments in the MMM have minimized their ecological impacts on freshwater biodiversity, by meeting or exceeding international environmental standards
- Objective 8:** By the year 2012, all xate extraction in the Maya Mountains Massif is sustainable and regulated through the establishment of an effective xate industry in Belize through partnerships between private sector, government, NGOs and communities
- Objective 9:** By the year 2017, reduce chemical pollution is reduced within the Maya Mountains Massif to meet international water quality standards
- Objective 10:** By the year 2012, 50% of the deforested areas of the Upland Pine Savannas have been replanted where regeneration alone will not be sufficient to restore the forest; the remaining 50% of the area is replanted by 2017 in the production zones.
- Objective 11:** By 2012, all pine bark beetle spots within Upland Pine Savannas and the Coastal Plain Pine Savannas are controlled, with no patch development.
- Objective 12:** Flow recommendations are implemented to mimic key attributes of natural flow, sediment and energy regimes by 2010 for the 3 dams on the Macal River.
- Objective 13:** By the year 2012, 95% of riparian buffer ecosystems are maintained unimpacted within the MMM.
- Objective 14:** By the year 2017, 25% of the known cultural sites of the MMM are conserved through greater knowledge of sites, more effective management, and greater collaboration with other conservation partners

Table 16: Objectives for the Maya Mountains Massif

6.2 Developing System-Level Direction to the Management of the Maya Mountains Massif

The National Protected Areas Policy and System Plan recommendations include the simplification of the existing protected area system by consolidating adjacent protected areas into single, multi-zoned management units – to create a smaller number of sites that are individually more important. In identifying the Maya Mountains Massif as a group of protected areas where such consolidation would reinforce national prominence in protected area system management at a regional scale, the NPAPSP seeks to rationalize management, reduce duplication of management effort, facilitate most appropriate use of the land within the protected area(s) through zoning, and increase management and financial effectiveness.

Boundary modifications, including the dissolution of boundaries between protected areas within the Massif, was considered to be the preferred route towards the creation of system-level effective management of the MMM - with Forest Reserves, for example ceasing to exist as separate entities, with their extractive areas becoming extractive zones, their protection areas being re-assigned to other zones with appropriate management regimes. The Plan recognizes that this is a radical approach, and states that it is seen as a long-term end-product of implementation of the system plan.

The amalgamation of the management of the 14 protected areas within the Maya Mountains Massif into a single protected area, managed by a government-based National Parks agency would be the optimal option in terms of financial effectiveness. However to plan in that direction would be contrary to the government policy to increase public participation in, and economic benefits from, the management of protected areas, as recognized within the NPAPSP:

“Participatory mechanisms which are vital to optimizing socio-economic benefits, such as collaborative management agreements and landscape-level management plans, shall be encouraged to build the cultural and ecological integrity of the protected areas”

(NPAP, 2005. Policy Statement 17).

Furthermore, it is recognized that very significant investments have been made by co-management partners and other stakeholders towards the improved management of individual protected areas and towards increased collaboration with stakeholder communities - and that these financial, human and technical investments form the foundations for the establishment of effective system-level management of the Maya Mountains Massif.

Supporting justification for the dissolution of protected area boundaries *within* the MMM include reduced duplication of effort and expenditure on management, although it is questionable whether this would be achieved by, for example merging Sibun Forest Reserve and Sittie River Forest Reserve into one larger unit, when neither has a management presence on the ground, and both represent different watersheds. It should also be noted that significant efforts were put into the review and revision of many of Belize's terrestrial protected area boundaries in the 1990's, with current boundaries *between* PAs within the Maya Mountains Massif largely reflecting watersheds, potential land use (dictated partly by topography), or management regime – and as such broadly reflect the logistical constraints within which the biological, hydrological and cultural resources are managed.

The challenge is therefore how to reconcile these apparent contradictions, in order to establish an effective system-level management of the Maya Mountains Massif, building on the existing partnerships, experience and investments.

Three options have been identified for establishing effective system-level management:

1. **Maintain Status Quo** – maintain the current approach of site-level management, with increased collaboration between co-management bodies
2. **Amalgamation of the protected areas into a single management unit**, dissolution of boundaries between the individual protected areas, with the implementation of management of the overall area as a single protected area zoned for the various resource uses, under a Government National Parks agency
3. **Establishment of effective, system-level management** of the Maya Mountains Massif through the implementation of amalgamated, system-level management programmes across a zoned landscape - superimposed on top of the existing PA boundaries and co-management partnerships.

For the Maya Mountains Massif, Option 3 is the recommended option, given the current context and conditions.

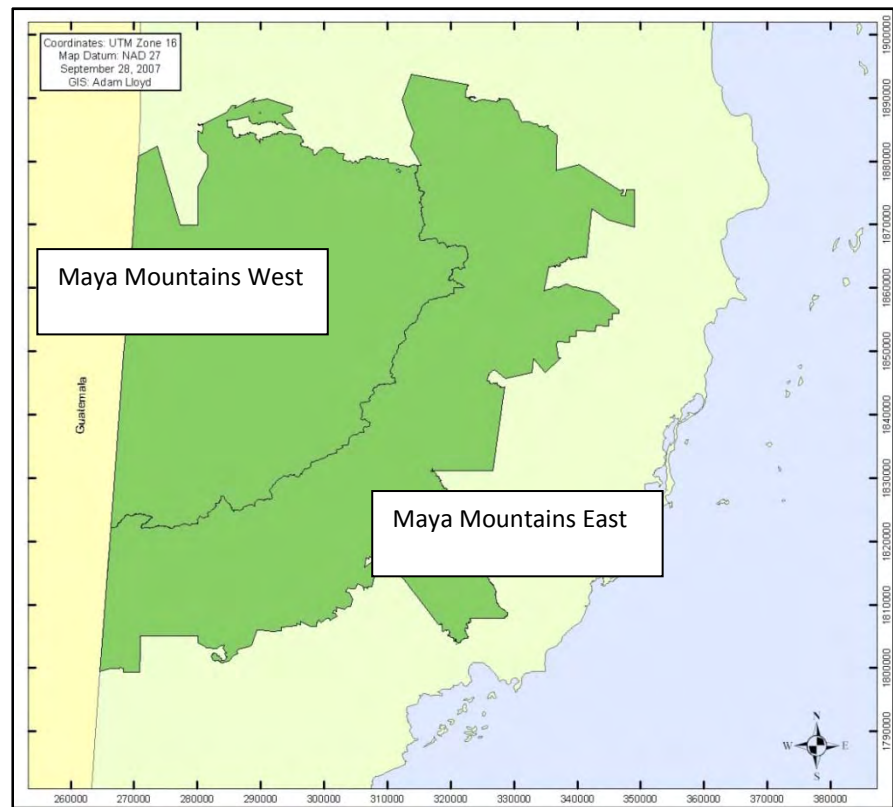
Recommendation 1: The formation of the Maya Mountains Massif Directorate – a system-level coordinating body comprised of collaborating managers, co-managers and other key stakeholders, with technical input from an advisory body

Central coordination of system-level programmatic areas is seen as the logical and most efficient route towards establishing effective integrated management of the Maya Mountains Massif as a whole, with amalgamation of the oversight and direction of the system-level management of the Maya Mountains Massif system into a single coordinating body – the Maya Mountains Massif Management Directorate (or similar).

- The Directorate should be led by the Forest Department, in collaboration with the Institute of Archaeology, and should include cross-sectoral representation (co-managers, Department of Geology and Petroleum, surveillance and enforcement agencies, tourism stakeholders) to strengthen integrated management of the natural and cultural resources and environmental services of the Massif.
- Current site-level management and co-management structures would be retained, with ongoing individual protected area programmes and activities, as developed within the site-level management plans.

Logistical constraints and differences in management priorities and different stakeholders suggests that there should be two sub-Directorate management committees, or steering committees – **Maya Mountains East** and **Maya Mountains West** (Map 13; Figure 1).

These two **steering committees** will be responsible for overseeing implementation of the system-level strategic actions under the different programmatic areas.



Map 13: Maya Mountains West and Maya Mountains East management areas within the Maya Mountains Massif System

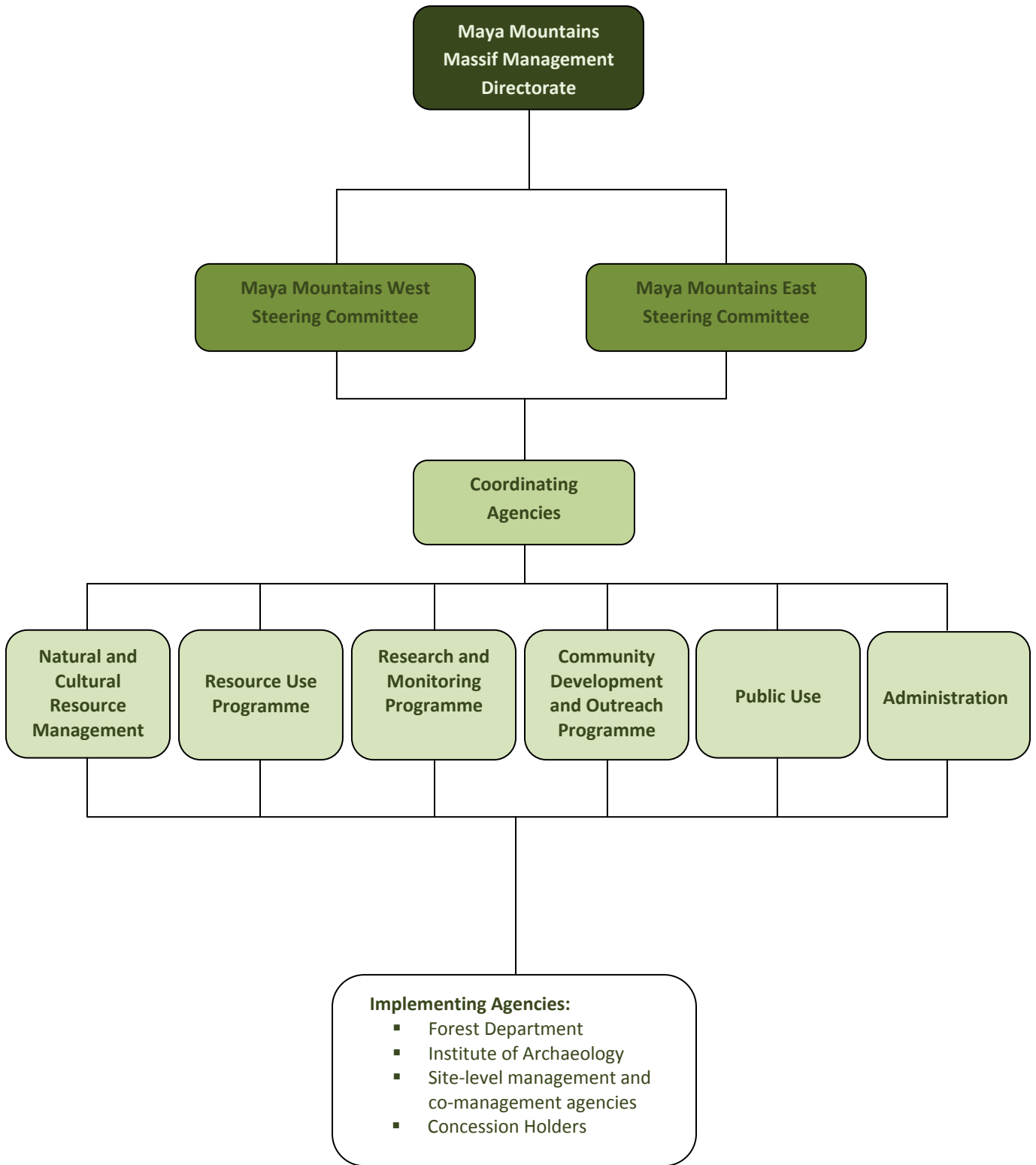


Figure 1: Recommended Management Structure of the Maya Mountains Massif System for System-Level Policies and Strategic Actions

System-level management should be guided through a series of Management Programmes, providing a framework for coordination of implementation of specific system-level activities:

- | System-level Programmes | |
|-------------------------|--|
| ▪ | Natural and Cultural Resource Management Programme |
| ▪ | Resource Use Programme |
| ▪ | Scientific Research and Monitoring Programme |
| ▪ | Community Development and Outreach Programme |
| ▪ | Public Use Programme |
| ▪ | Administration Programme |
| ▪ | Infrastructure and Maintenance Programme |

It is recommended that for each programme area, a lead agency should be selected to take on the role of active coordination of implementation, in collaboration with site-level managers. The coordinating agency is tasked with working with the co-management organizations, long-term forest license holders and other stakeholders to ensure implementation at site level (Figure 2).

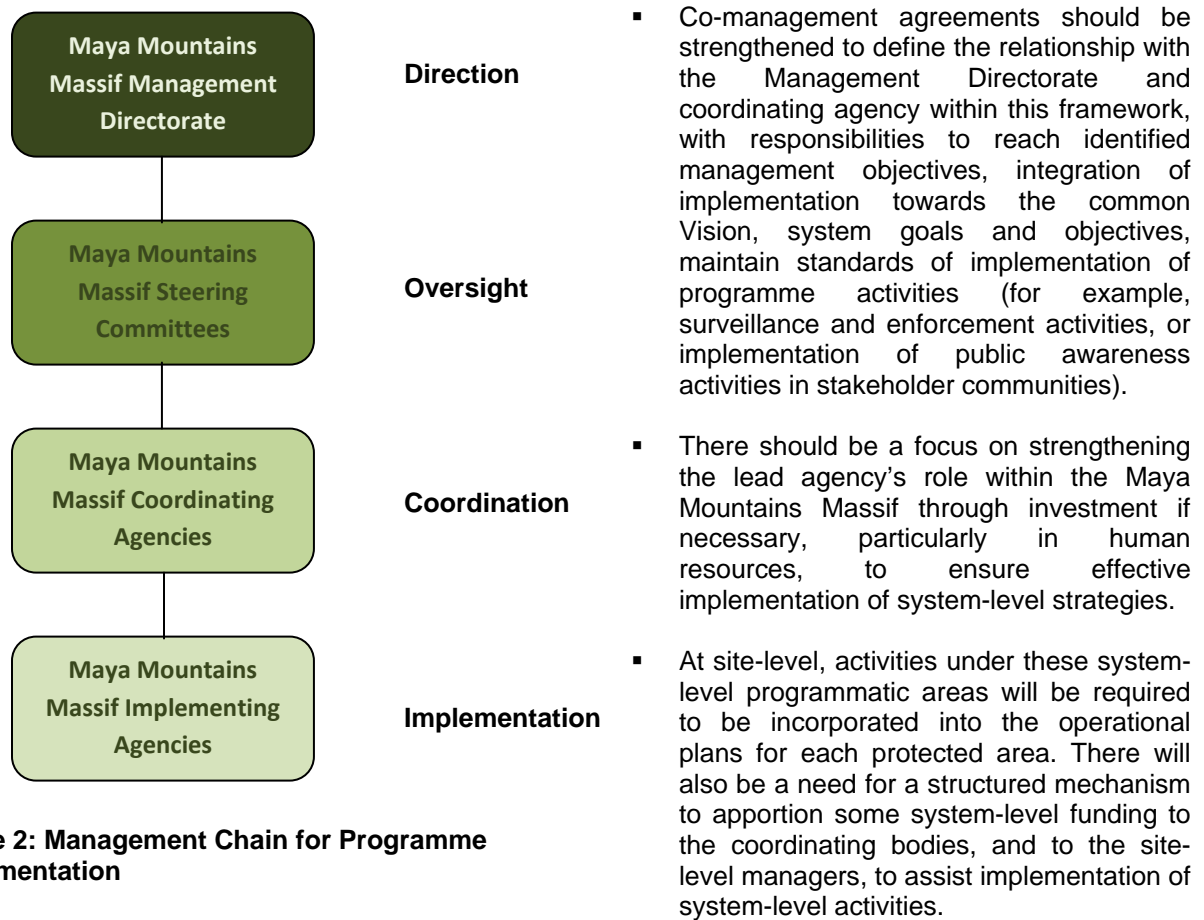


Figure 2: Management Chain for Programme Implementation

6.3 Management Strategies: Amalgamation of Management Programmes versus Management Units

There is logic to the majority of the existing protected area boundaries within the Maya Mountains Massif, reflecting topography, watersheds, etc., as well as the practicalities and logistics of management. Significant resources have already been spent on realignments to rationalize and facilitate management, and there is a need to build on these investments

Some of the weakest aspects of the National Protected Area System identified under the 2006 management effectiveness assessment (Walker et. al. 2006) are:

- Surveillance & enforcement
- Public support / awareness
- Long-term financing mechanisms

There is the critical need to develop clear, measurable strategies for effective system-level management of the Maya Mountains Massif as a single unit, that address these weaknesses, through the establishment of system-level direction and oversight. This will be most effectively achieved through amalgamation / central coordination of management themes (programmes), to strengthen and rationalize existing management structures, investments, capacities etc. Site amalgamation of the protected areas themselves would not achieve these outcomes.

Recommendation 2: To retain current protected area boundaries, but develop and implement system-level management programmes for the Maya Mountains Massif system, under the management of the Maya Mountains Massif Directorate

- System-level planning and implementation of programmes will address system-level needs, opportunities and challenges, and reduce significant overlaps between protected area management activities, with increased effectiveness and cost benefits, particularly in the following areas:
 - surveillance and enforcement
 - public awareness, support and appreciation
 - community participation
 - long-term financing mechanisms
 - monitoring (of both biodiversity and management)
 - system-representation regionally & internationally

Each of the Management Programmes (Table 16) will build on the strengths of the existing system, co-management bodies, investments, capacities and infrastructure, fill identified gaps in upper management, develop stronger synergies between co-managers, and integrate site-level management within the management of the entire Massif. As such it will maintain and strengthen current partnerships, reduce duplication of effort, and provide a far stronger case for regional and international funding for long-term sustainability of management.

At site-level, activities under these system-level programmatic areas will be required to be incorporated into the operational plans for each protected area. There will also be a need for a structured mechanism to apportion some of the system-level funding to the coordinating bodies, and to the site-level managers, to assist implementation of system-level activities.

Table 17: System-Level Management Programmes						
Strategy: Establish an MMM coordinating body to ensure coordinated actions in system-level programmes						
Enhance management capacity and management effectiveness through provision of support to protected area managers across the system, and through programmatic area	Natural and Cultural Resource Management Programme	Resource Use Management Programme	Research and Monitoring Programme	Community Development and Outreach	Public Use (Tourism and Recreation)	Administration
	Coordination of system-level surveillance and enforcement and of enforcement unit	Coordination of licenses / monitoring for sustainable timber extraction	Coordination of system-level scientific research	Coordination of system-level environmental education	Coordination of system-level visitor safety and protection policies	General coordination and administration, including accounting policies
	Coordination of system-level zoning and boundaries	Coordination of licenses / monitoring for sustainable xate extraction	Coordination of activities to fill identified system-level knowledge gaps	Coordination of system-level public outreach and information	Coordination of system-level visitor education and interpretation	Coordination of system-level planning
	Coordination of habitat restoration (pine)	Coordination of licenses / monitoring for sustainable extraction of other non-timber forest products	Coordination of system-level monitoring for conservation action planning indicators	Coordination of system-level alternative livelihood initiatives	Coordination of system-level best practices policies	System-level financial sustainability mechanisms (PES, carbon sequestration etc.)
	Coordination of system-level fire management	Coordination of licenses / monitoring for extraction of non-sustainable resources (eg. Minerals)	Coordination of system-level scientific data management	Coordination of system-level community capacity building initiatives		Coordination of system-level collaborative initiatives
	Coordination of system-level cultural resource management	Coordination of licenses / monitoring of other resource use (eg. Water)				Capacity building of partner organizations
						Infrastructure and maintenance

6.4 Management Strategies: Programme Implementation

It is recommended that a coordinating agency be targeted for each management programme, to work with the site level management agencies to ensure coordinated implementation of system-level programme activities. Potential coordinating agencies are suggested for the different programmatic areas, based on capacity, experience and strengths shown in collaborative initiatives (Table 18).

Natural and Cultural Resource Management Programme	Forest Department Institute of Archaeology
Resource Use Management Programme	Forest Department Geology and Petroleum
Scientific Research and Monitoring	Research-focused organization – optimally, the proposed UB Research and Monitoring Institute
Community Development and Outreach	Friends for Conservation and Development
Public Use	Institute of Archaeology
Administration	Forest Department
Infrastructure and Maintenance	Forest Department

Table 18: Recommended Coordinating Agencies

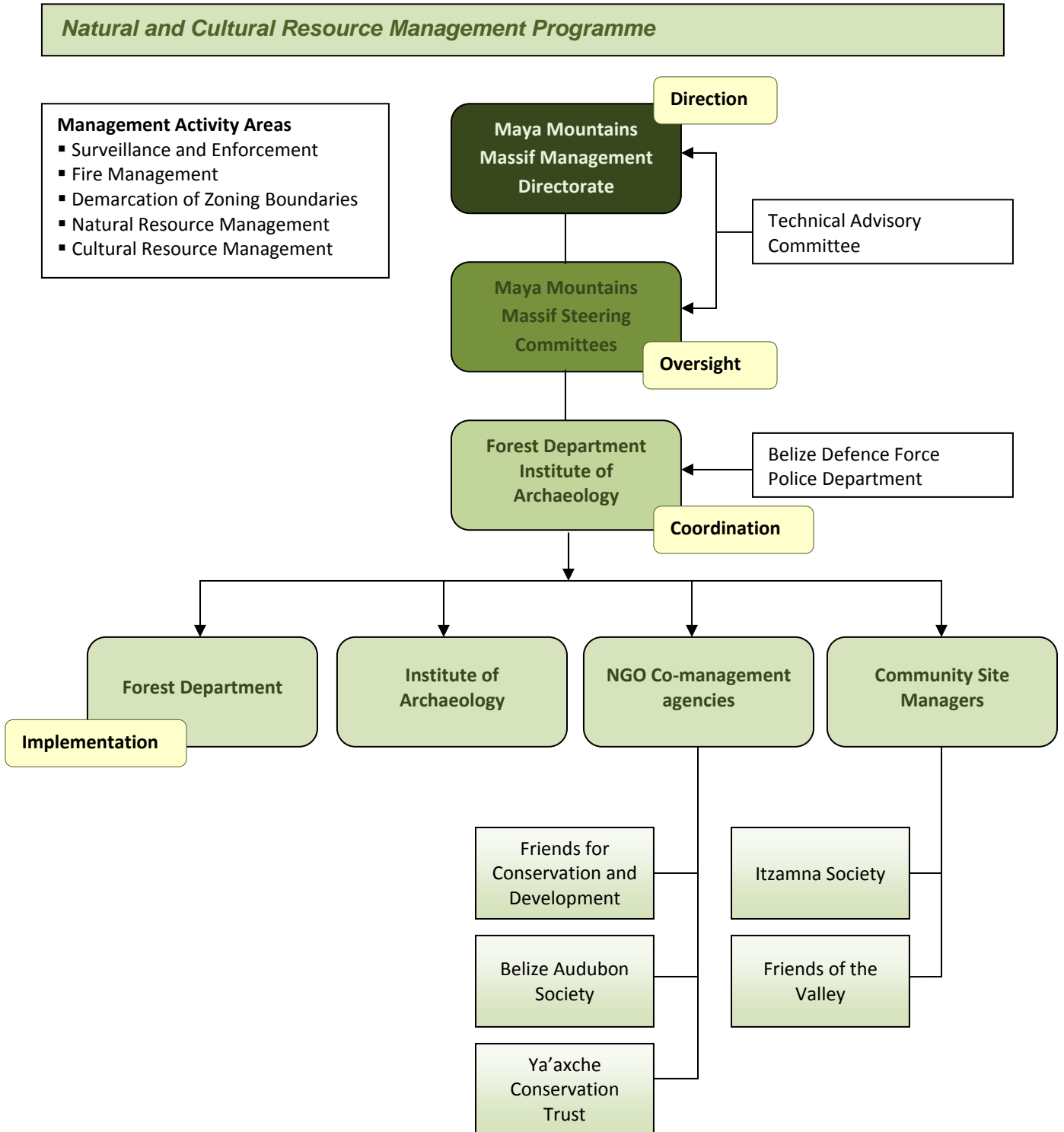


Figure 3: Recommended Management Structure for Natural and Cultural Resource Management

Natural and Cultural Resource Management Programme - System-level Recommendations			
Priority			
<ul style="list-style-type: none"> Develop and implement system-level framework and goals for Natural and Cultural Resource Management 			
Programme Area	Threats	Conservation Targets	Recommendations
Surveillance and Enforcement	Threats <ul style="list-style-type: none"> Illegal xate harvesting Illegal hunting Illegal fishing Illegal logging Looting Agricultural incursions 	Biodiversity Targets <ul style="list-style-type: none"> Broadleaf Forest Pine Forest and Savanna Aquatic and Riparian Ecosystem Forest Products Jaguar Cultural Targets <ul style="list-style-type: none"> Archaeological Sites Aesthetic Landscapes Subterranean Systems 	<ul style="list-style-type: none"> 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) Strengthen multi-agency, binational patrols along the Adjacency Zone through increased resources, with the participation and collaboration of BDF, Police, FD, Immigration, IoA, FCD, Guat. Army, CONAP Build on current multi-agency collaboration within the Maya Mountains Massif for surveillance and enforcement activities Ensure oversight of surveillance and enforcement patrols within the Maya Mountains Massif through inclusion of at least one protected area officer or co-management representative Involve mining, timber concessionaires, tour operators and other stakeholders in monitoring and surveillance in MMM, by providing logistical assistance, overnight facilities, transportation and information to patrolling crews. Establish system-level surveillance and enforcement task force for deployment to critical hotspots for illegal activity within the MMM Maintain a permanent presence on the southern edge of the Chiquibul National Park in the Rio Blanco area Establish 5km Buffer Area on Guatemala border System-level surveillance and enforcement activities, with particular focus on protection of Core Preservation Zone and Buffer Area Strengthen enforcement of implementation of hunting regulations through collaborative partnerships, capacity building, resource allocation and increased presence in the field System-level collaboration towards greater conviction rate for offenders Investigate scope for development of community-managed buffer areas adjacent to protected areas for community sustainable use of natural resources

Natural and Cultural Resource Management Programme - System-level Recommendations			
Programme Area	Threats	Conservation Targets	Recommendations
Natural Resource Management	<p>Threats</p> <ul style="list-style-type: none"> Fragmentation 	<p>Biodiversity Targets</p> <ul style="list-style-type: none"> Broadleaf Forest Forest Products Jaguar 	<ul style="list-style-type: none"> Ensure continued protection of sufficient broadleaf forest area to maintain viability of key species (eg. Jaguar) of social, economic and cultural importance Define, assess and prioritise potential corridor options Investigate and implement conservation easements for corridor formation - legislation and engaging private landowners Encourage collaboration with and between Private Protected Areas located within identified corridors Promote best practices land use by private owners within the corridor Investigate land purchase opportunities for securing connectivity Establish and enforce Core Preservation Zone for game species within the overall zonation system of the Maya Mountains Massif
	<p>Threats</p> <ul style="list-style-type: none"> Agricultural Incursions 	<p>Biodiversity Targets</p> <ul style="list-style-type: none"> Broadleaf Forest Pine Forest and Savanna Aquatic and Riparian Ecosystem Forest Products Jaguar <p>Cultural Targets</p> <ul style="list-style-type: none"> Archaeological Sites Aesthetic Landscapes 	<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 provide a management presence and sustainability mechanism 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 production in the Vaca Forest Reserve
	<p>Threats</p> <ul style="list-style-type: none"> Environmental pollution 	<p>Biodiversity Targets</p> <ul style="list-style-type: none"> Upper Elevation Amphibians Aquatic and Riparian Ecosystems 	<ul style="list-style-type: none"> Identify major environmental pollutants and establish a baseline in upper elevation areas, and exiting river systems, for future monitoring Encourage adoption of best management practices in major polluting agro-industries, and the population in general, through increasing awareness, regulations and international technical and financial support Implement on-going monitoring of identified pollutants

Natural and Cultural Resource Management Programme - System-level Recommendations			
Programme Area	Threats	Conservation Targets	Recommendations
Natural Resource Management	Threats <ul style="list-style-type: none"> ▪ Illegal Hunting 	Biodiversity Targets <ul style="list-style-type: none"> ▪ Broadleaf Forest ▪ Jaguar 	<ul style="list-style-type: none"> ▪ 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 ▪ Establish and enforce core protection areas for game species within the overall zonation system of the Maya Mountains Massif ▪ Support the development and implementation of ex-situ game farming in partnership with local hunting communities to replace the need for wild game meat ▪ 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 ▪ Effectively regulate commercial trade in game meat, through certification of wild game meat traders and restaurants
	Threats <ul style="list-style-type: none"> ▪ Dams 	Biodiversity Targets <ul style="list-style-type: none"> ▪ Aquatic and Riparian Ecosystem 	<ul style="list-style-type: none"> ▪ Work with DoE and BECOL to review international environmental standards, and determine suitability of standards for hydropower development in the MMM ▪ Work with DoE to mandate compliance with international environmental standards by current and future hydropower developments ▪ Complete assessment to determine base conditions for flow, sediment and energy regimes of Macal River, relative to natural regimes, determine attributes that are critical to target viability, and make recommendations for implementation of flow, sediment and energy regimes, if different from existing dam management

Natural and Cultural Resource Management Programme - System-level Recommendations			
Programme Area	Conservation Target	Threats	Recommendations
Natural Resource Management	Threats <ul style="list-style-type: none"> ▪ Fire 	Biodiversity Targets <ul style="list-style-type: none"> ▪ Pine Forest and Savanna 	<ul style="list-style-type: none"> ▪ Establish a National Forest Health Working Group to coordinate the implementation of the National Forest Health Strategy ▪ Socialize, approve and implement the draft National Forest Health Strategy ▪ Prepare and implement a Fire Management Plan in partnership for the MMM with all key stakeholders, to be implemented through the establishment of a co-ordinating National Forest Fire Management Working Group ▪ Increase 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 ▪ 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 communities to replace the need for wild game meat, and thereby reduce instance of hunting fires
	Threats <ul style="list-style-type: none"> ▪ Military activities 	Biodiversity Targets <ul style="list-style-type: none"> ▪ Broadleaf Forest ▪ Pine Forest and Savanna ▪ Jaguar 	<ul style="list-style-type: none"> ▪ Liaise with BATSUB re. removing Core Preservation Zone from the BATSUB military training area ▪ Increase collaboration with BATSUB towards road maintenance and fire management activities ▪ Increase liaison with BATSUB towards reducing noise pollution in areas identified as key to wildlife and/or tourism

Natural and Cultural Resource Management Programme - System-level Recommendations			
Programme Area	Threats	Conservation Targets	Recommendations
Natural Resource Management	Threats <ul style="list-style-type: none"> ▪ Southern Pine Bark Beetle 	Biodiversity Target <ul style="list-style-type: none"> ▪ Pine Forest and Savanna 	<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
Cultural Resource Management	Threats <ul style="list-style-type: none"> ▪ Looting ▪ Vandalism 	Cultural Targets <ul style="list-style-type: none"> ▪ Archaeological Sites ▪ Aesthetic Landscapes ▪ Subterranean Systems 	<ul style="list-style-type: none"> ▪ Increased liaison between protected area managers / co-managers and the Institute of Archaeology to increase prioritization of protection of cultural resources within the Maya Mountains Massif system ▪ Increased liaison and collaboration between IoA in Belize and IDEAH in Guatemala in tackling knowledge gaps, looting and trafficking of artefacts ▪ Develop a comprehensive list of sites, with mapping and assessment of all sites within the MMM ▪ Increase the number of multi-year archaeological research projects in MMM ▪ Development of more archaeological sites for tourism purposes, with effective management plans in place ▪ Training for protected area staff in recognition, reporting, mapping, information gathering and monitoring of archaeological sites and artifacts within the Maya Mountains Massif ▪ Increase management presence at archaeological sites through collaboration with other conservation organizations of the MMM, and participate in binational patrols

Natural and Cultural Resource Management Programme - System-level Recommendations			
Programme Area	Threats	Conservation Targets	Recommendations
Cultural Resource Management	Threats <ul style="list-style-type: none"> ▪ Looting ▪ Vandalism 	Cultural Targets <ul style="list-style-type: none"> ▪ Archaeological Sites ▪ Aesthetic Landscapes ▪ Subterranean Systems 	<ul style="list-style-type: none"> ▪ 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
Policy	Threats <ul style="list-style-type: none"> ▪ Dereservation ▪ Fire ▪ Illegal hunting ▪ Environmental pollution 	Biodiversity Targets <ul style="list-style-type: none"> ▪ Broadleaf Forest ▪ Pine Forest and Savanna ▪ Aquatic and Riparian Ecosystem ▪ Upper Elevation Amphibians ▪ Forest Products ▪ Jaguar Cultural Targets <ul style="list-style-type: none"> ▪ Archaeological Sites ▪ Aesthetic Landscapes ▪ Subterranean Systems 	<ul style="list-style-type: none"> ▪ Lobby for the National Protected Areas Act to support and strengthen the National Protected Areas System Plan, to prevent the by-passing of the due process associated with dereservation of areas in the MMM ▪ Amend and strengthen the Forests Act to incorporate Forest Fire Regulations with realistic penalties and implement with effective enforcement ▪ Support the preparation and institutionalization of a National Forest Fire Management Policy for Belize ▪ Increase effective control of hunting through revision and active implementation of existing hunting legislation ▪ Amend current policies and regulations for strengthening regulation of pollutants

Resource Use Programme

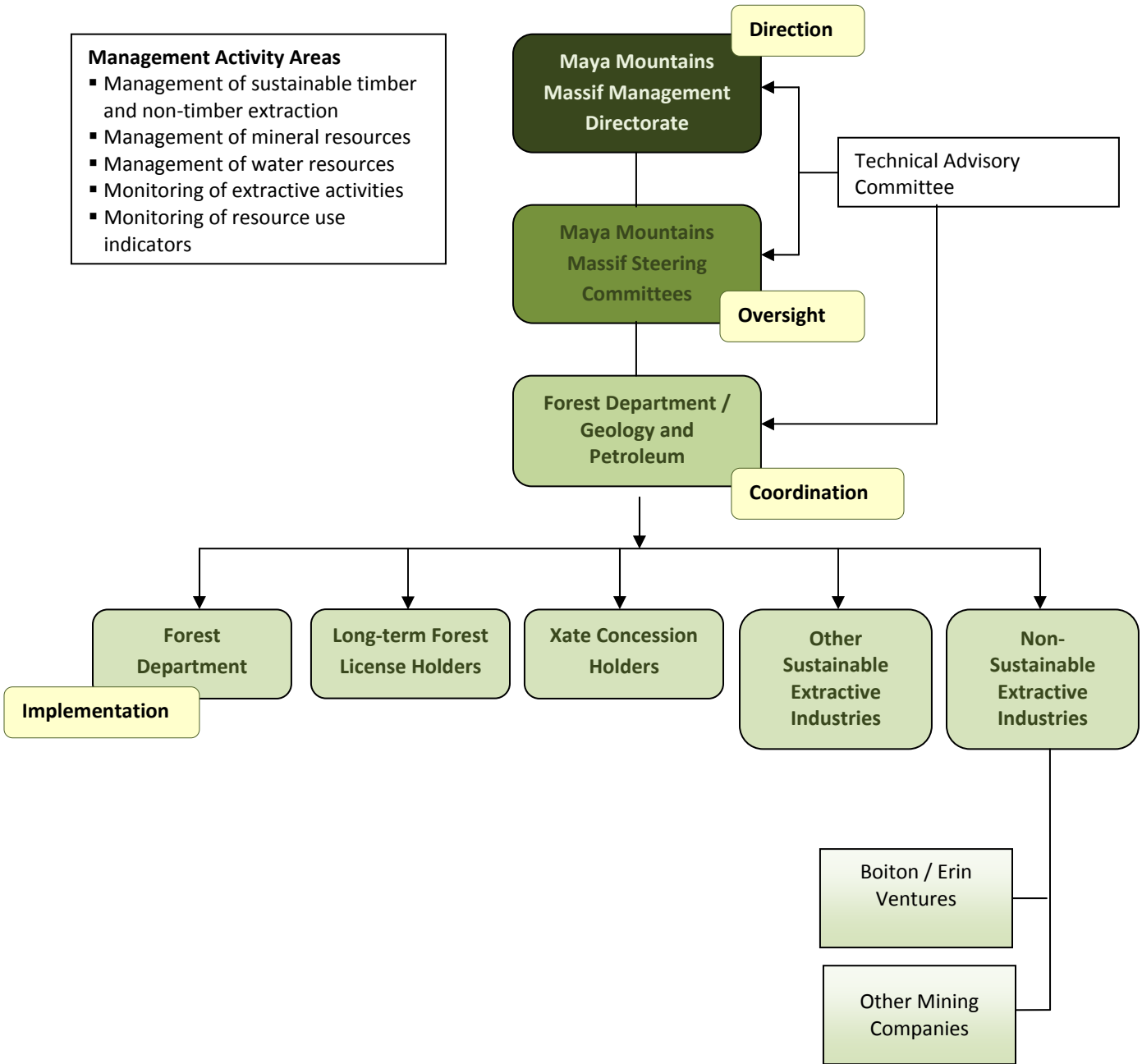
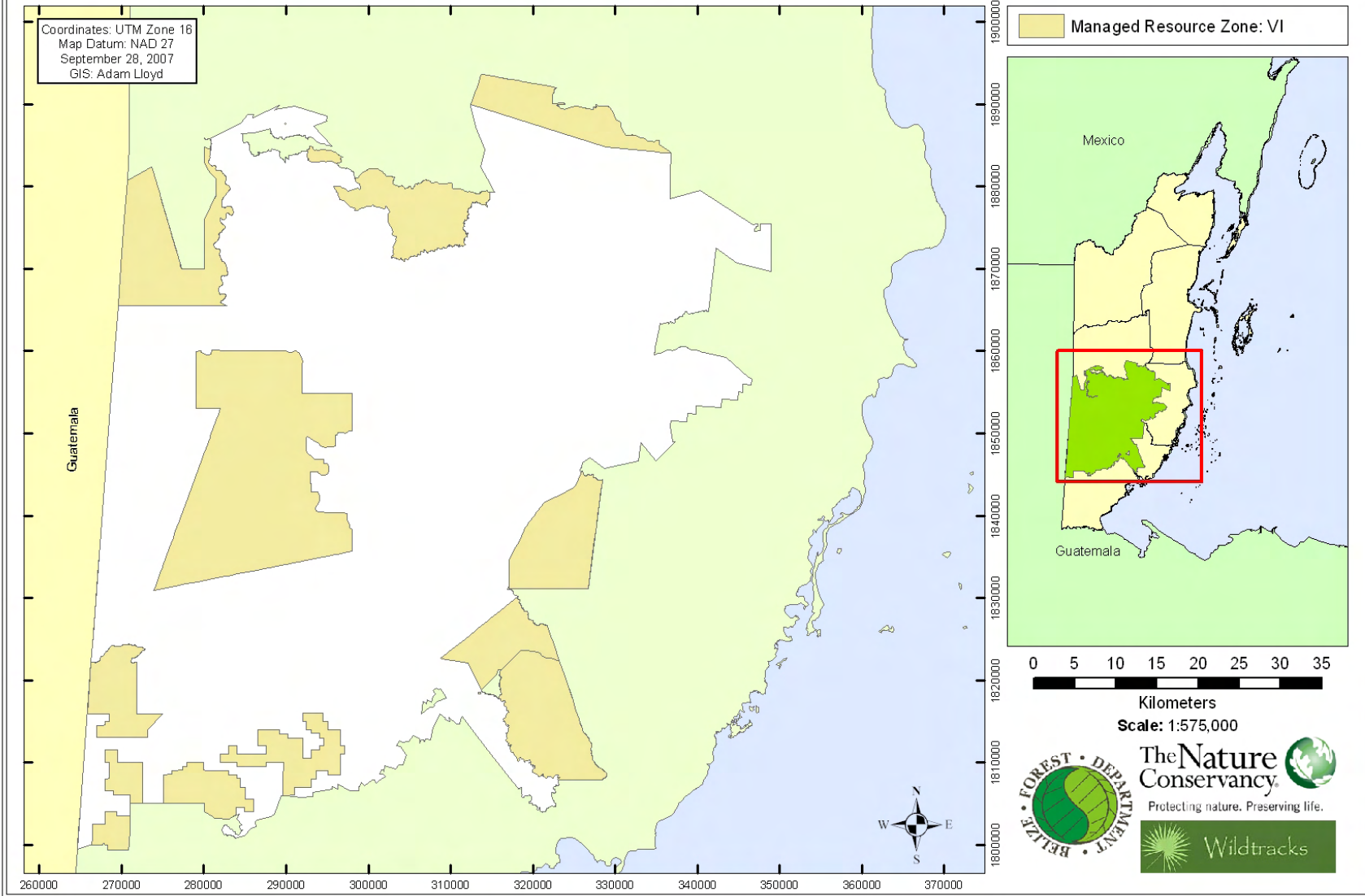


Figure 4: Recommended Management Structure for Resource Use Programme

Resource Use Programme - System-level Recommendations			
Priority			
<ul style="list-style-type: none"> Develop and implement system-level framework and goals for Resource Management 			
Programme Area	Threats	Conservation Targets	Recommendations
Sustainable harvesting of timber		Biodiversity Targets <ul style="list-style-type: none"> Broadleaf Forest Pine Forest and Savanna Aquatic and Riparian Ecosystem Forest Products Jaguar Cultural Targets <ul style="list-style-type: none"> Archaeological Sites Aesthetic Landscapes 	<ul style="list-style-type: none"> Complete 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, restoration management, and integrates protected area management plan components for biodiversity and cultural protection Strengthen monitoring of timber operations and adherence to license agreements Strengthen surveillance and enforcement Monitor timber being milled and marketed, particularly in Stann Creek and Toledo Districts Implement a national licensing system for all sawmills
Sustainable harvesting of Xate	Threats <ul style="list-style-type: none"> Unsustainable harvesting of xate Illegal harvesting of xate 	Biodiversity Targets <ul style="list-style-type: none"> Forest Products 	<ul style="list-style-type: none"> 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 Encourage development of an 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, among crop plantations (like cacao), and nurseries in Guatemala and Belize, in order to have a more controlled and sustainable source of xate. Hold concession holders liable for infractions by their harvesting crews

Resource Use Programme - System-level Recommendations			
Programme Area	Threats	Conservation Targets	Recommendations
Sustainable harvesting of Xate	Threats <ul style="list-style-type: none"> ▪ Unsustainable harvesting of xate ▪ Illegal harvesting of xate 	Biodiversity Targets <ul style="list-style-type: none"> ▪ Forest Products 	<ul style="list-style-type: none"> ▪ Strengthen surveillance and enforcement ▪ Develop a financing mechanism whereby concession holders cover the cost of monitoring by FD
Sustainable harvesting of other Non-Timber Forest Products	Threats <ul style="list-style-type: none"> ▪ Unsustainable and illegal harvesting of non-timber forest products (excluding xate) 	Biodiversity Targets <ul style="list-style-type: none"> ▪ Forest Products 	<ul style="list-style-type: none"> ▪ 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 ▪ Investigate other potentially commercially viable non-timber forest product alternatives ▪ Develop a financing mechanism whereby concession holders cover the cost of monitoring by FD
Mineral Extraction	Threats <ul style="list-style-type: none"> ▪ Forest clearance ▪ Increased accessibility ▪ Potential for pollution of aquatic systems 	Biodiversity Targets <ul style="list-style-type: none"> ▪ Broadleaf Forest ▪ Pine Forest and Savanna ▪ Aquatic and Riparian Ecosystem Cultural Targets <ul style="list-style-type: none"> ▪ Archaeological Sites ▪ Aesthetic Landscapes 	<ul style="list-style-type: none"> ▪ Increased liaison and collaboration between Geology and Petroleum and Forest Departments, with development of an agreement or protocol for granting licenses within the Maya Mountains Massif ▪ No mineral exploration or extraction within Ia(i) or Ia(ii) ▪ Place a moratorium on further mining licenses (exploration or extraction) within Zone Ia(iii), until biodiversity and geological surveys have been conducted to assess biodiversity and mineral value of the MMM to ensure that decisions are 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)), once moratorium is lifted ▪ 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

Maya Mountains Massif: Zoning: Managed Resource Zone



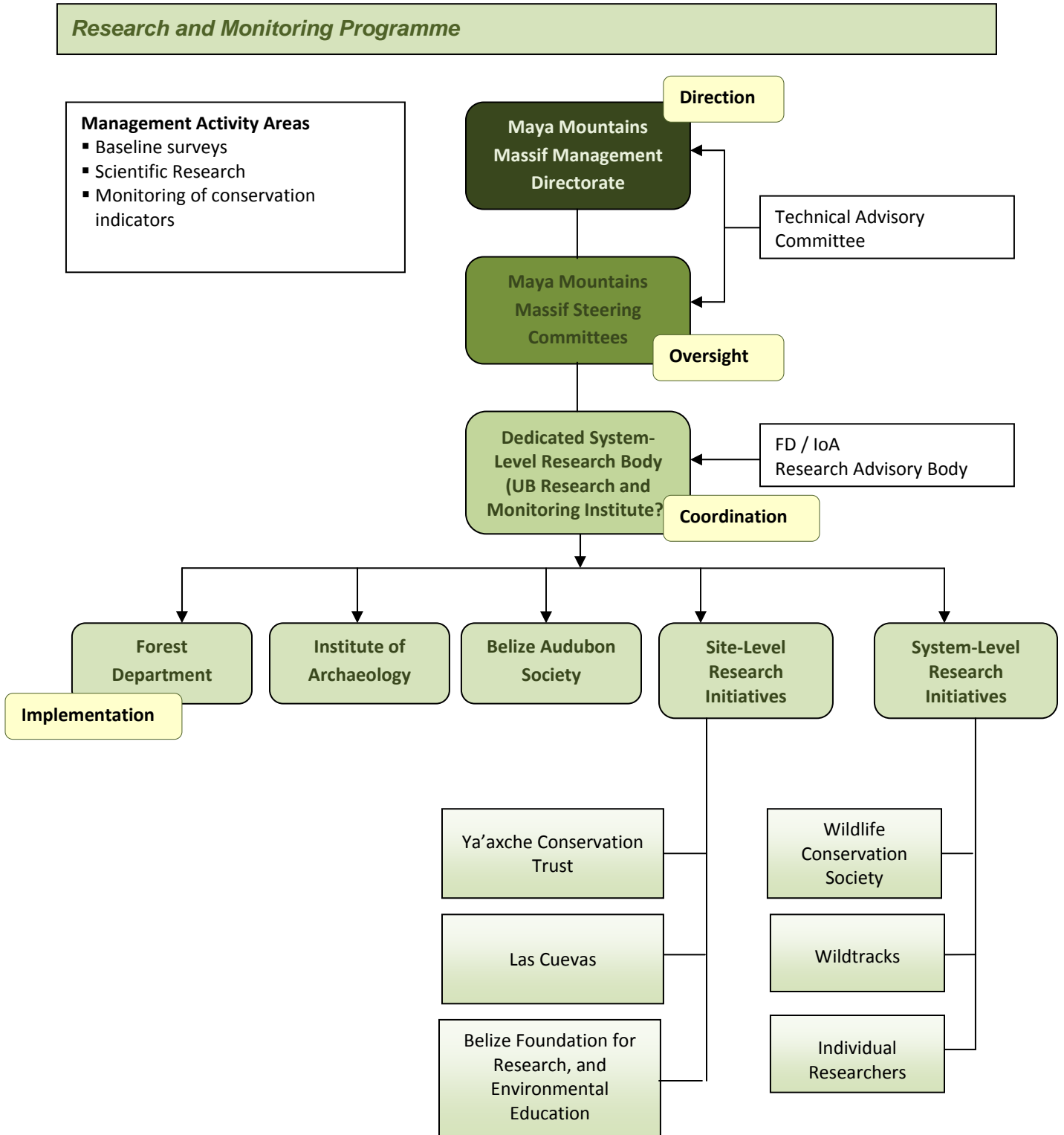


Figure 5: Recommended Management Structure for Research and Monitoring Programme

Research and Monitoring Programme			
Priority			
<ul style="list-style-type: none"> Develop and implement system-level framework and goals for Research and Monitoring Programme 			
Programme Area	Threats	Conservation Targets	Recommendations
<p>Research and Monitoring Identify and prioritize system-level management needs re. applied research and monitoring</p>		<p>Biodiversity Targets</p> <ul style="list-style-type: none"> Broadleaf Forest Pine Forest + Savanna Aquatic and Riparian Upper Elevation Amphibians Forest Products Jaguar <p>Cultural Targets</p> <ul style="list-style-type: none"> Archaeological Sites Aesthetic Landscapes Subterranean Systems 	<ul style="list-style-type: none"> Baseline data on species distributions, abundances, population trends and natural range of variation Baseline data on edaphic parameters determining biodiversity distribution patterns across the Massif Pressures and threats impacting populations Baseline data re. possible sustainable use of resources Watershed integrity and water quality Map and assess archaeological sites across the Massif and build a system-level database Prioritize and increase number of archaeological sites with ongoing and long-term research programmes
<p>Implement additional system-level research & monitoring related needs identified in the CAP process</p>		<p>Biodiversity Targets</p> <ul style="list-style-type: none"> Broadleaf Forest Pine Forest and Savanna Aquatic and Riparian Ecosystem Upper Elevation Amphibians Forest Products Jaguar <p>Cultural Targets</p> <ul style="list-style-type: none"> Archaeological Sites Aesthetic Landscapes Subterranean Systems 	<ul style="list-style-type: none"> 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 Assess biodiversity importance and health of the freshwater systems of the MMM to inform biodiversity conservation, zoning and management Initiate and implement ongoing monitoring of flow, sediment and energy regime parameters and key species Collect baseline data to establish benchmarks for defining viable game species populations, and implement monitoring Conduct studies on the ecology of the Pine Bark Beetle Identify and implement internationally accepted assessment and monitoring protocols for amphibian populations to determine deviations from baseline conditions Monitor agrochemical deposition by orographic rainfall in upper elevation areas Monitor agrochemical presence in creeks and rivers leaving the Maya Mountains Massif

Community Development and Outreach Programme

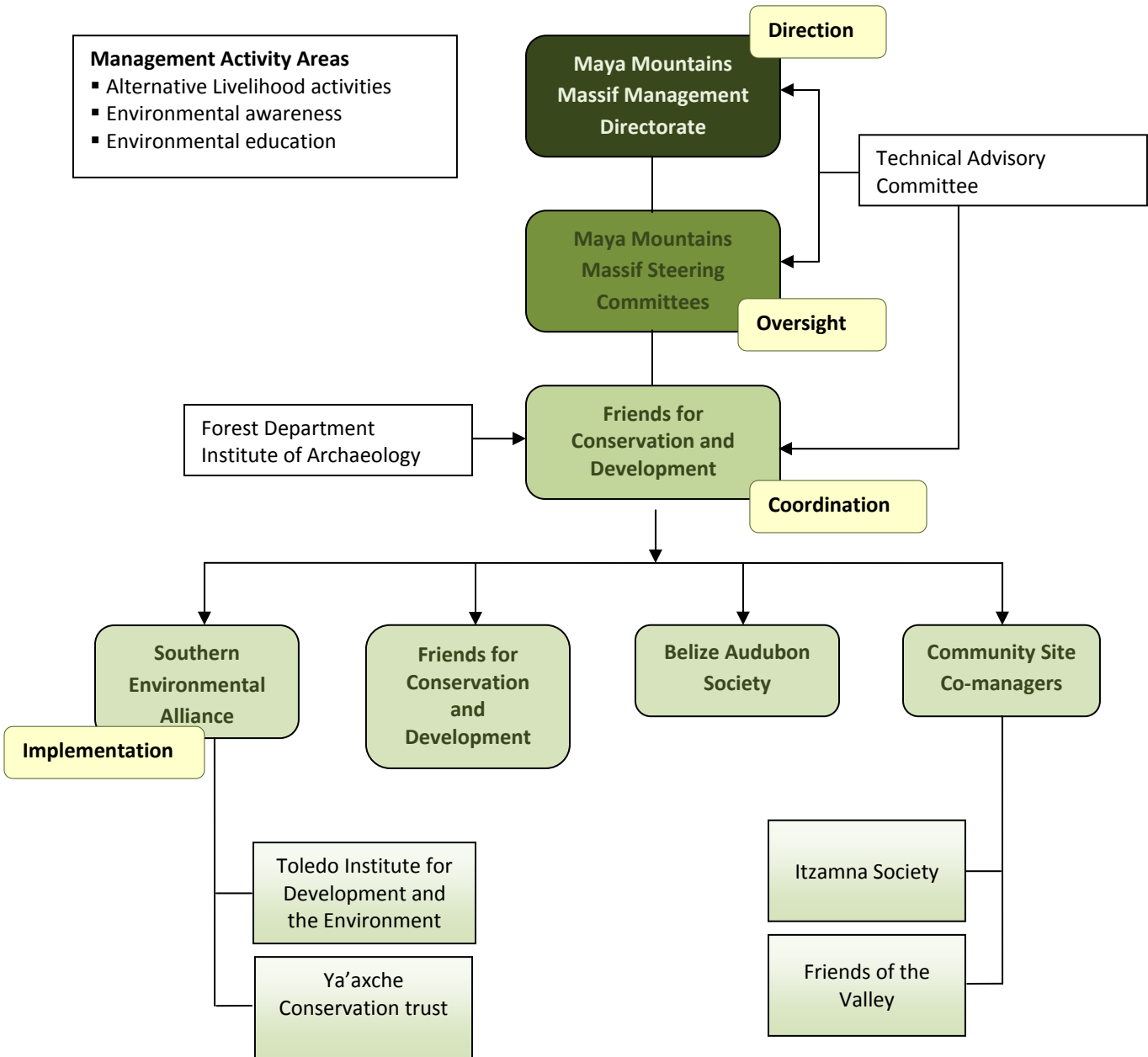
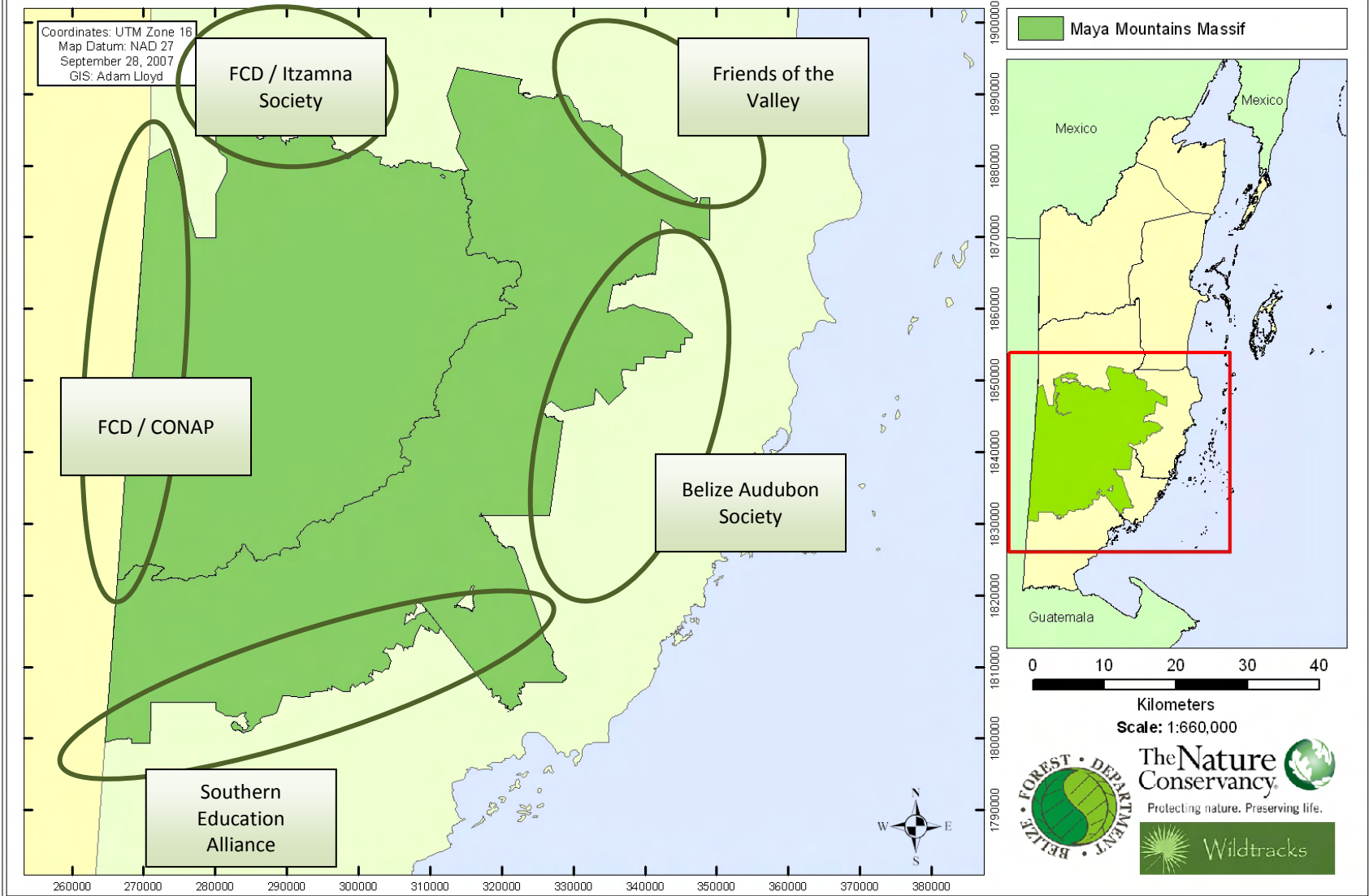


Figure 6: Recommended Management Structure for Community Development and Outreach Programme

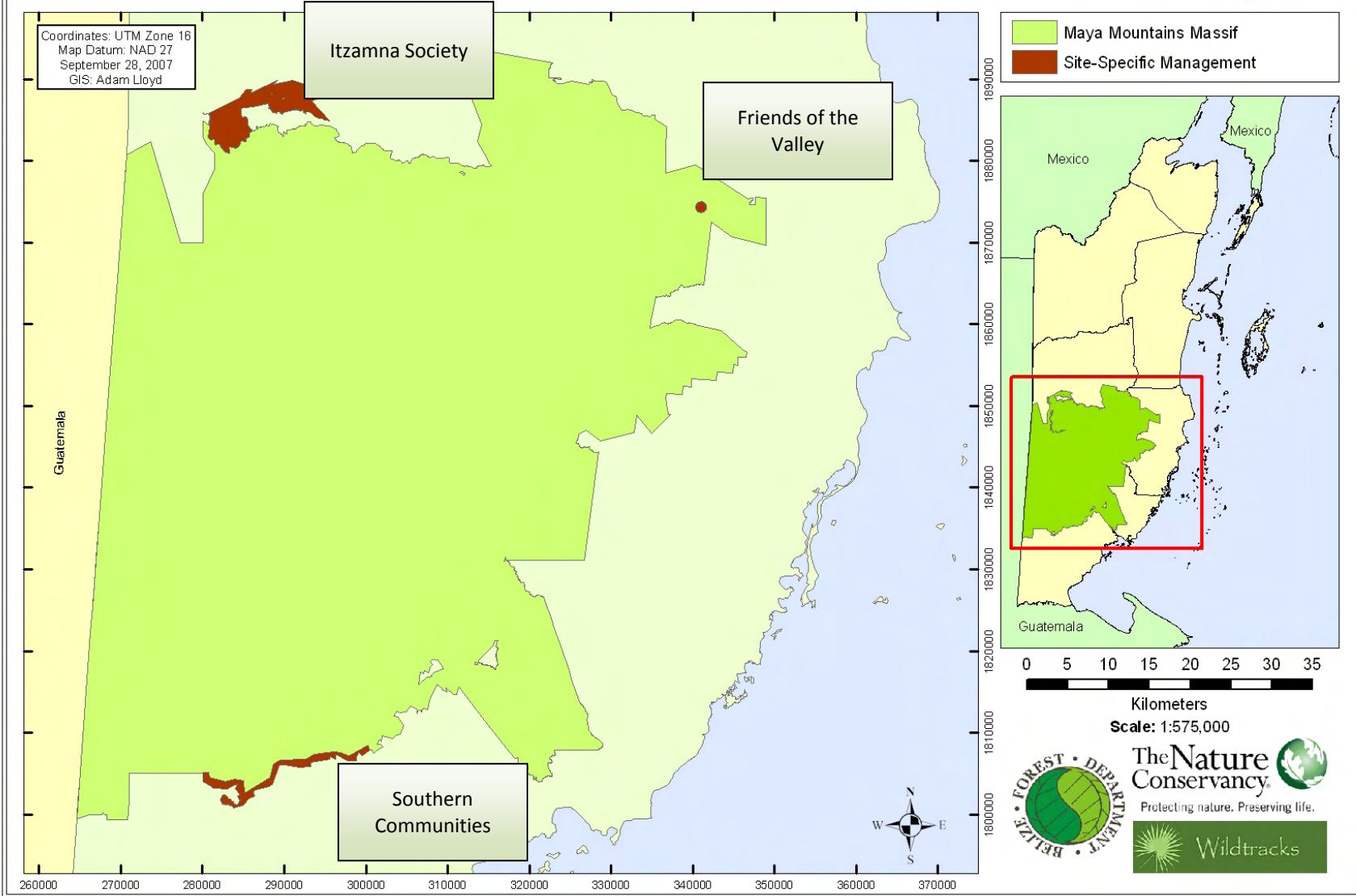
Maya Mountains Massif: Community Outreach Spheres



Community Development and Outreach Programme			
Priority			
<ul style="list-style-type: none"> ▪ Develop and implement system-level framework and goals for Community Development and Outreach Programme 			
Programme Area	Threats	Conservation Targets	Recommendations
Stakeholder awareness of natural and cultural resources, and environmental services			<ul style="list-style-type: none"> ▪ Increase public awareness of environmental services in stakeholder communities through system-level public awareness programme ▪ Increase awareness among policy makers of the importance of environmental services to communities buffering the Maya Mountains Massif, especially in the area of watershed protection ▪ Increase awareness of the archaeological and cultural heritage of the Maya Mountains Massif through education programmes ▪ Increase awareness of protected area and wildlife protection regulations in local communities ▪ Increase awareness in BDF of protected area and wildlife regulations, environmental services, and environmental best practices for patrols
Community Development Opportunities			<ul style="list-style-type: none"> ▪ 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 ▪ Promote sustainable income-generating activities, such as honey, cacao and xate production, for farmers in the areas adjacent to MMM, especially near the Vaca, Maya Mountains, and Columbia River Forest Reserves ▪ Support initiatives to increase employment opportunities and opportunities for community development through regulated and monitored sustainable resource use, particularly in those communities that have the highest impact on the natural resources ▪ Support the development and implementation of game farming in partnership with local hunting communities to replace the need for wild game meat

Community Development and Outreach Programme			
Programme Area	Threats	Conservation Targets	Recommendations
Community Employment Opportunities			<ul style="list-style-type: none"> ▪ Implement agro-forestry concept currently being reviewed by the Forest Department for Columbia River Forest Reserve ▪ Develop increased-value craft activities in buffer communities, with a fee structure for sustainably harvested raw materials within permitted extractive zones ▪ Develop and implement a system-level tourism policy to more effectively realize the tourism potential, and thereby increase tourism-related employment
Access to Natural Resources			<ul style="list-style-type: none"> ▪ Investigate potential reforestation projects on exhausted community lands adjacent to PAs – to increase availability of natural resources outside the protected areas
Community Development Opportunities – Guatemala			<ul style="list-style-type: none"> ▪ Support CONAP in its strategies to increase alternative livelihood opportunities for Guatemalans that have the highest impact on the natural resources of the Maya Mountains Massif (Belize)

Maya Mountains Massif: Site-Specific Management



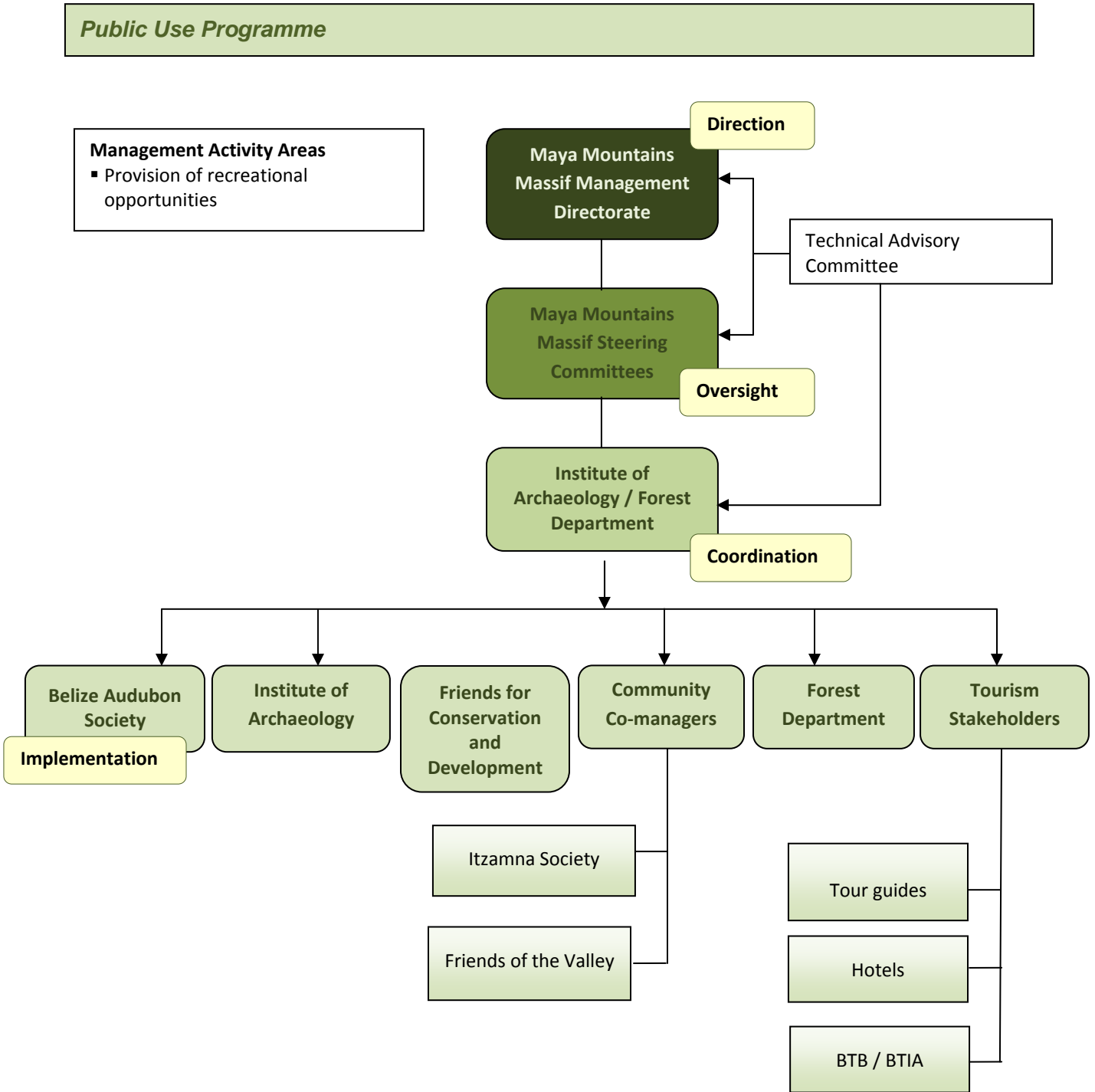
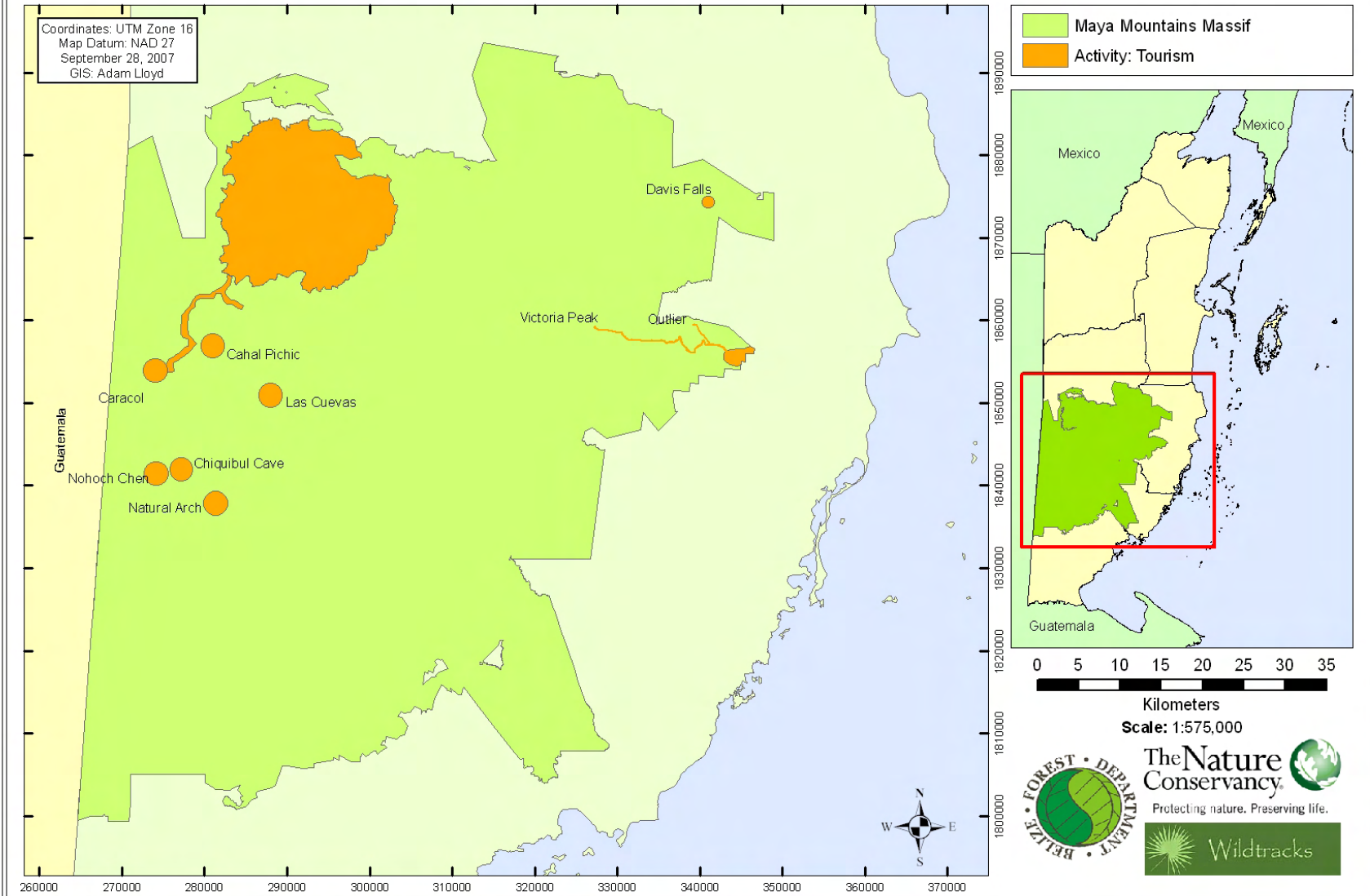


Figure 7: Recommended Management Structure for Community Development and Outreach Programme

Public Use Programme			
Priority			
▪ Develop and implement system-level framework and goals for Public Use Programme			
Tourism Management			<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 recognized by the FD and site level co-management partners as having an 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
Development of tourism sites			<ul style="list-style-type: none"> ▪ Develop and implement a system-level tourism policy to more effectively realize the tourism potential of the Maya Mountains Massif, and thereby increase tourism-related employment ▪ Development of more archaeological sites for tourism purposes, with effective management plans in place, by 2017
Development of community managed tourism sites			<ul style="list-style-type: none"> ▪ 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

Maya Mountains Massif: Tourism



Administration Programme

- Management Activity Areas**
- Financial Management
 - Financial sustainability
 - Human resources management
 - Infrastructure management
 - Equipment and equipment maintenance

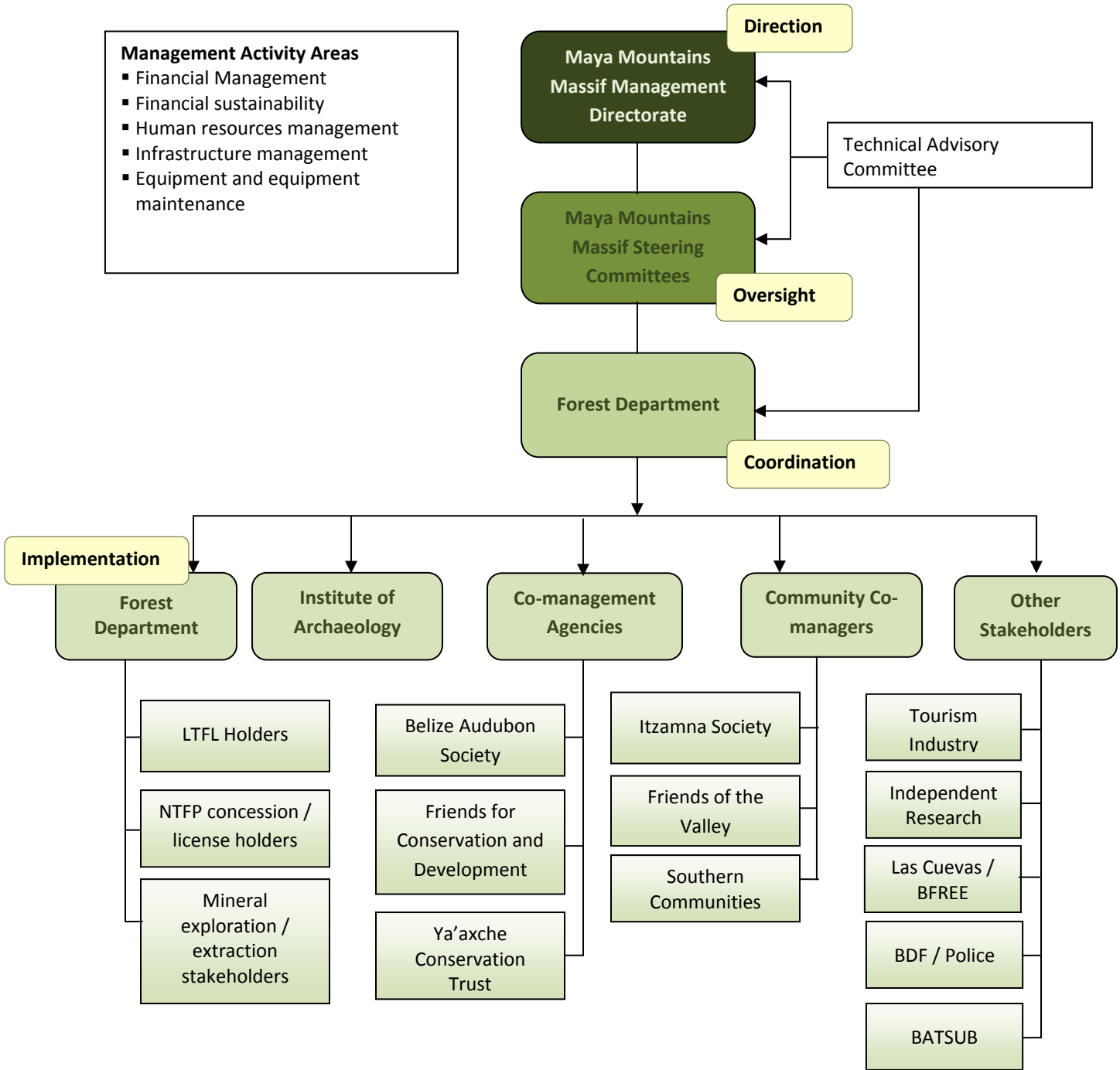


Figure 8: Management Structure for Administrative Programme

Administration Programme			
Priority			
<ul style="list-style-type: none"> ▪ Develop and implement system-level framework and goals for Administration Programme 			
Financial sustainability mechanisms			<ul style="list-style-type: none"> ▪ Development of more archaeological sites for tourism purposes, with effective management plans in place ▪ Investigate alternative financial sustainability mechanisms
Communication and Collaboration			<ul style="list-style-type: none"> ▪ Strengthen the coordination and collaboration among departments of the Ministry of Natural Resources, relevant conservation NGO's, national and local politicians towards the protection of the MMM ▪ 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)
Infrastructure and Maintenance			

6.5 Management Strategies: Best Use of Resources – land, biodiversity and minerals

In addition to the mandated role of conserving the rich biodiversity of the Maya Mountains Massif, the protected areas of the Massif also provide critical ecosystem services to the national well-being and economy of Belize.

- **Watershed Functionality:** With its often very steep terrain and thin soils, very significant portions of the Maya Mountains Massif are best suited to watershed protection and flood control – as recognized in their designated roles. Whilst these ecosystem functions have served Belize well to date, they are becoming increasingly threatened by rapid population growth and the associated demand for agricultural lands.
- Watershed protection and flood control functionality is central to the lack of widespread fatalities and infrastructure damage from increasingly frequent strong tropical storm events – it is no accident that the Belizean population escaped so lightly from the impacts of Hurricanes Mitch, Keith, Iris and Dean.
- **Biodiversity-important Lowland Forests:** The steeper lands with poor soils are generally unsuitable for agriculture, with agricultural incursions and subsequent de-reservations, have largely taken place on the alluvial soils of valleys around the perimeter of the Maya Mountains Massif – removing significant areas of some of the most species-rich and productive forests from the system, with potentially significant impacts on the long-term viability of many species of conservation and cultural concern.
- There is an over-arching need to develop significant long-term funding mechanisms to maintain and manage the integrity of the Maya Mountains Massif for the conservation of biodiversity, for the sustainable extraction of timber and non-timber forest products, for watershed protection and flood control, and the numerous other environmental services it provides.
- As global market moving towards provision of financial support to maintain forest cover, recognizing this to be the most cost effective means of slowing global warming and at the same time conserving biodiversity, it is important that Belize should not undersell these resources, and that as funds are negotiated and secured, they be used either as an endowment fund or through some other long-term guarantee mechanism.
- The sale of carbon credits (which is likely to be facilitated and strengthened through the current international consensus towards the Bali Roadmap for 2012), the receipt of funds from payments for environmental services, tourism concessions, could all play a significant role in strengthening and financing current best-use management of the Maya Mountains Massif.
- There is also a need for an integrated approach to management, with adequate cost/benefit analyses in decision-making regarding activities likely to negatively impact biodiversity / cultural heritage conservation, or the environmental services provided by the Maya Mountains Massif. It is also logical that a payment system be developed with payments from any such activities (eg a royalty on gross income from all extractive uses) going back into management – these should be factored in as a cost from the beginning of any and all potentially negatively impacting activities, otherwise cost/benefit analyses are incomplete and the protected areas effectively subsidize potentially incompatible activities.

6.6 Management Strategies: Amalgamation of Management Units – System-Level Management Zones

The following table outlines the recommended system-level management zones for the Maya Mountains Massif System, taking into consideration:

- **topography,**
- **watershed protection and functionality**
- **biodiversity and cultural values,**
- **current and best land use,**
- **stakeholder footprint**
- **mineral values**
- **threat distribution**
- **accessibility**

Three zoning categories have been developed:

Core Preservation Zone Ia

Strict Core Preservation Zone (i)

Restricted use area for core biodiversity and cultural resource protection, with critical management activities (including prioritized surveillance and enforcement) and research.

Core Preservation Zone (ii)

Restricted use area open to researchers. Some areas may be opened for controlled, low impact, guided, tourism, where site-level management permits

Core Preservation Zone (iii)

Restricted use area open to management activities, researchers, with enhanced surveillance and enforcement activities.

Covers area along the Maya Mountain Divide with high biodiversity value (identified as part of Belize's primary Key Biodiversity Area), where mineral deposits are expected – Insufficient data is currently available for designation of management activities.

Some areas may be opened for controlled, low impact, guided, tourism, where site-level management permits

General Protection Zone (II)

General Protection Zone

General biodiversity and cultural resource protection, with visitor access for tourism, education and research. Provides a buffer for the Core Preservation Zone

Sustainable Resource Extraction Zone (VI)

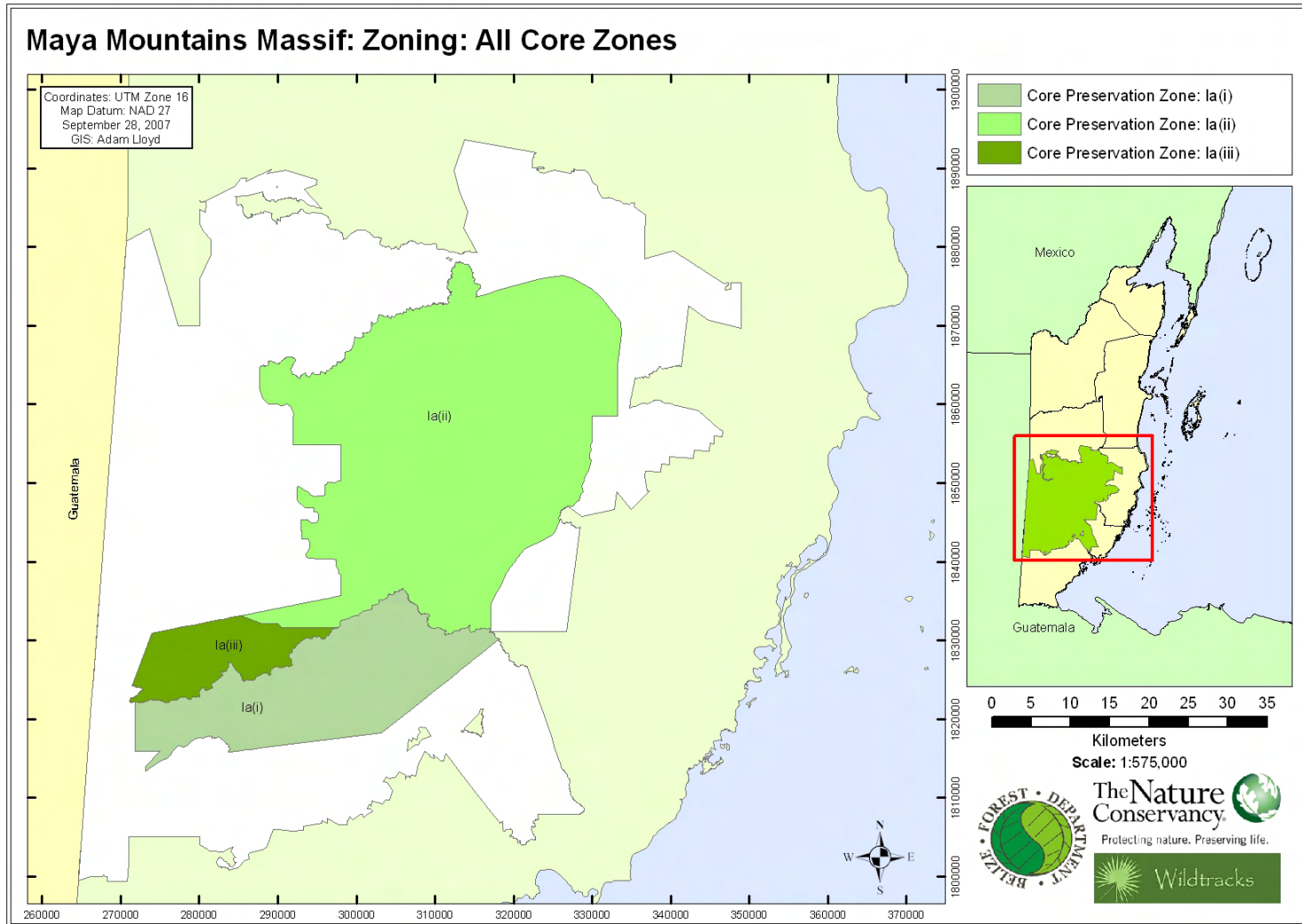
General biodiversity protection area designated for sustainable extraction of timber and non-timber resources.

Summary Report - Technical Assessment of the Maya Mountains Massif

Management Zones for the Maya Mountains Massif		
Zone	Objective	Regulations/Guidelines
IUCN Category 1a		
<p>1a(i)</p> <p>Strict Core Preservation Zone (i)</p> <p>Restricted use area for core biodiversity and cultural resource protection, with critical management activities (including prioritized surveillance and enforcement) and research.</p>	<ul style="list-style-type: none"> ▪ To preserve habitats, ecosystems and species in a pristine state, with minimal human impact ▪ To maintain ecological, biological and hydrological processes and functionality ▪ To maintain genetic resources in a dynamic and evolutionary state ▪ To maintain landscape features and protect areas of particularly fragile habitat or those with threatened or rare species, or features of cultural importance ▪ To allow surveillance and enforcement, and carefully planned research and environmental monitoring activities 	<ul style="list-style-type: none"> ▪ No entry, except by management, surveillance and enforcement personnel, permitted researchers ▪ Minimal impact research under special permission from Forest Department, Institute of Archaeology (dependent on research target) and site-level protected area co-managers ▪ No collecting of flora, fauna or inorganic material other than by approved researchers (as defined within the Research Policy document) with the permission of Forest Department, in consultation with site-level protected area co-managers ▪ Effective, prioritized surveillance and enforcement program
<p>1a(ii)</p> <p>Strict Core Preservation Zone (ii)</p> <p>Restricted use area open to researchers</p> <p>Some areas may be opened for controlled, low impact, guided, tourism, where site-level management permits</p>	<ul style="list-style-type: none"> ▪ To preserve habitats, ecosystems and species in a pristine state, with minimal human impact ▪ To maintain ecological, biological and hydrological processes and functionality ▪ To maintain genetic resources in a dynamic and evolutionary state ▪ To maintain landscape features and protect areas of particularly fragile habitat and/or those with threatened or rare species, or features of cultural importance ▪ To allow surveillance and enforcement, and carefully planned research and environmental monitoring activities ▪ To allow controlled, low impact, guided, tourism, where site-level management permits 	<ul style="list-style-type: none"> ▪ No entry, except by management, surveillance and enforcement personnel, permitted researchers ▪ Minimal impact research under special permission from Forest Department, Institute of Archaeology (dependent on research target) and site-level protected area co-managers ▪ No collecting of flora, fauna or inorganic material other than by approved researchers (as defined within the Research Policy document) with the permission of Forest Department, in consultation with site-level protected area co-managers ▪ Controlled low-impact, guided tourism, where site-level management zones permit ▪ Effective, prioritized surveillance and enforcement program

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Management Zones for the Maya Mountains Massif		
Zone	Objective	Regulations/Guidelines
IUCN Category 1a		
<p>1a (iii)</p> <p>Core Preservation Zone (iii)</p> <p>Restricted use area open to management activities, researchers, with enhanced surveillance and enforcement activities.</p> <p>Covers area along the Maya Mountain Divide with high biodiversity value (identified as part of Belize's primary Key Biodiversity Area), where mineral deposits are expected – Insufficient data is currently available for designation of management activities.</p> <p>Some areas may be opened for controlled, low impact, guided, tourism, where site-level management permits</p>	<ul style="list-style-type: none"> ▪ Maintain ecological, biological and hydrological functionality. ▪ Moratorium on new activities pending mineral and biodiversity surveys to inform management planning. ▪ To maintain landscape features and protect areas of particularly fragile habitat and/or those with threatened or rare species, or features of cultural importance ▪ To allow surveillance and enforcement, and carefully planned research and environmental monitoring activities ▪ To allow controlled, low impact, guided, tourism, where site-level management permits ▪ Increase knowledge of mineral and biodiversity resources for effective planning for integrated management of this prior to lifting moratorium ▪ To reduce and prevent impacts from current and any future exploratory and/or extractive mining activities through careful, informed, integrated planning and execution of approved activities 	<ul style="list-style-type: none"> ▪ No entry, except by management, surveillance and enforcement personnel, permitted researchers and current mining concession holder* ▪ Minimal impact research under special permission from Forest Department, Institute of Archaeology (dependent on research target) and site-level protected area co-manager ▪ No collecting of flora, fauna or inorganic material other than by approved researchers (as defined within the Research Policy document) with the permission of Forest Department, in consultation with site-level protected area co-manager ▪ Controlled low-impact, guided tourism, where site-level management zones permit ▪ Implementation of a moratorium on further mineral explorative / extractive activities until sufficient information is available for effective planning ▪ All mining operations (exploratory and extractive), to have EIA, with strict ECP guidelines, and monitoring by FD, FCD and Geology and Petroleum, funded by concession holder ▪ Where exploratory and /or extractive mining activities are approved, best practices for "minimum impact" are implemented, geared towards limiting footprint, damage, destruction or disturbance of natural habitat and cultural resources ▪ Close liaison and collaboration with Department of Geology and Petroleum, towards integrated management. <p>*Moratorium on future concessions is recommended until there is sufficient knowledge for effective evaluation and planning</p>

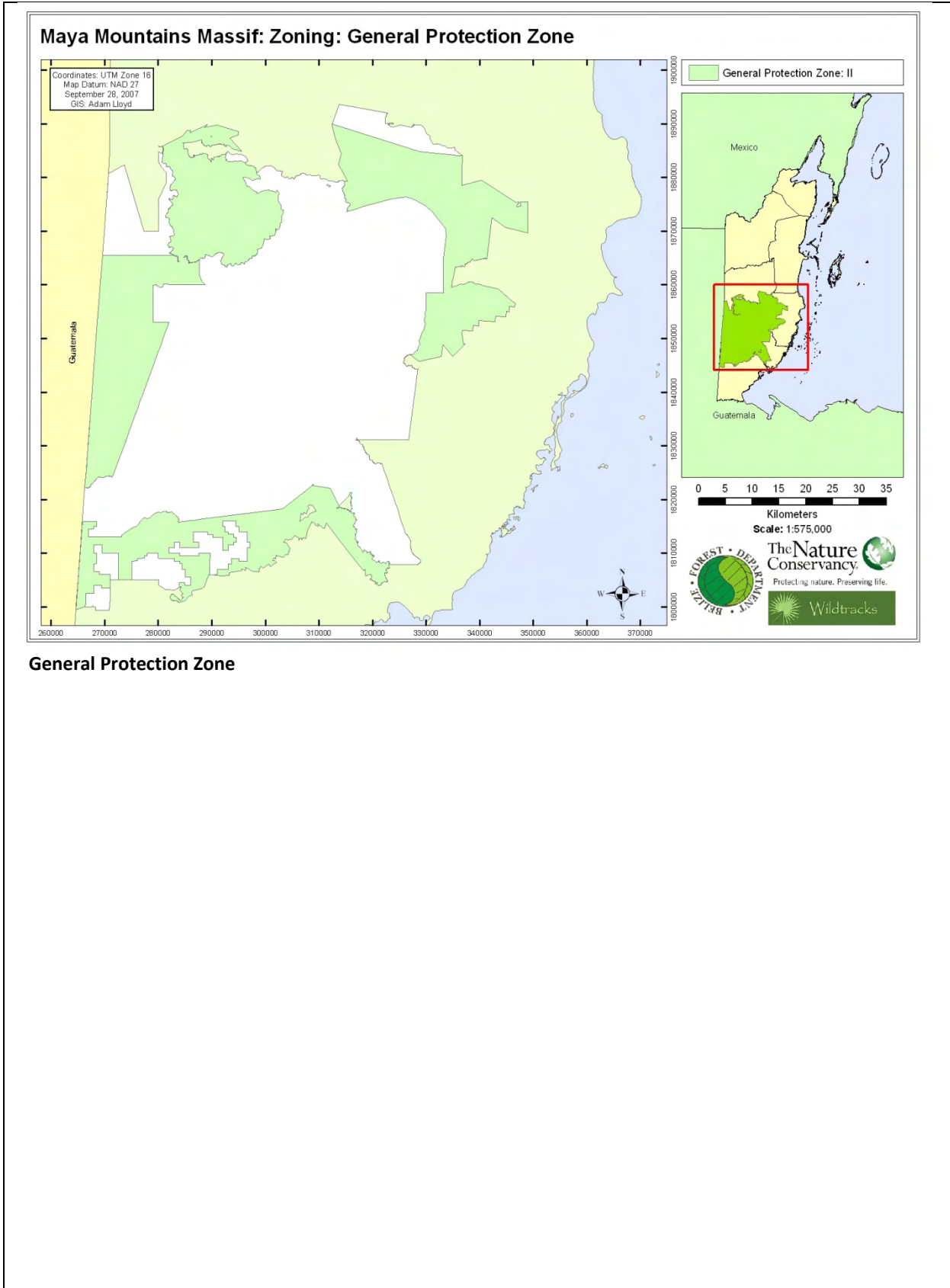


Core Preservation Zones (i), (ii) and (iii)

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Management Zones for the Maya Mountains Massif		
Zone	Objective	Regulations/Guidelines
IUCN Category II		
<p>II</p> <p>General Protection Zone</p> <p>General biodiversity and cultural resource protection, with visitor access for tourism, education and research</p> <p>Provides a buffer for the Core Preservation Zone</p>	<ul style="list-style-type: none"> ▪ To maintain biodiversity resources and watershed functionality with minimal human impact, under management of the Forest Department and site-level protected area co-managers ▪ To maintain cultural resources with minimal human impact, under management of the Institute of Archaeology, in collaboration and site-level protected area co-managers and, where relevant, Forest Department ▪ To allow access for scientific research, education and low-medium impact tourism ▪ To ensure effective surveillance and enforcement 	<ul style="list-style-type: none"> ▪ Minimal impact research under special permission from Forest Department, Institute of Archaeology (dependent on research target) and site-level protected area co-managers ▪ No collecting of flora, fauna or inorganic material other than by approved researchers (as defined within the Research Policy document) with the permission of Forest Department, in consultation with site-level protected area co-managers ▪ Low to medium impact tourism, where site-level management zones permit ▪ All mining operations (exploratory and extractive), to have EIA, with strict ECP guidelines, and monitoring by FD, FCD and Geology and Petroleum, funded by concession holder ▪ Where exploratory and /or extractive mining activities are approved, best practices for “minimum impact” are implemented, geared towards limiting footprint, damage, destruction or disturbance of natural habitat and cultural resources ▪ Close liaison and collaboration with Department of Geology and Petroleum, towards integrated management. ▪ Effective Surveillance and enforcement

Summary Report - Technical Assessment of the Maya Mountains Massif



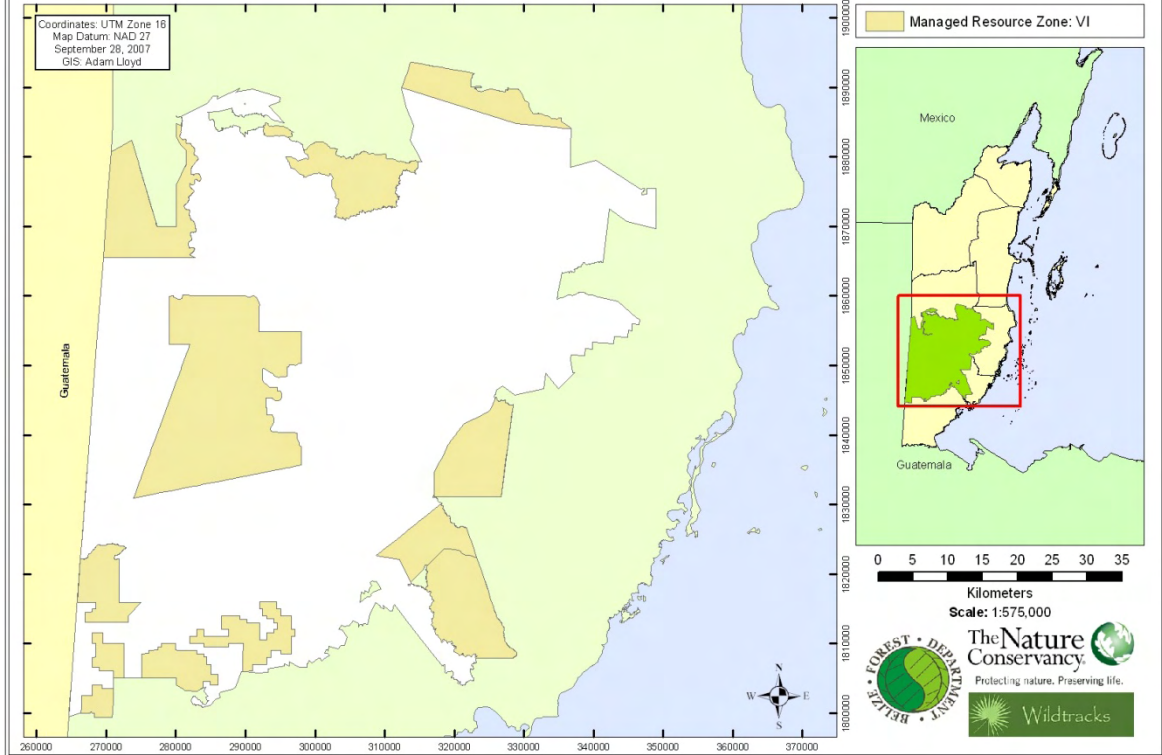
General Protection Zone

Summary Report - Technical Assessment of the Maya Mountains Massif

Management Zones for the Maya Mountains Massif		
Zone	Objective	Regulations/Guidelines
IUCN Category VI		
<p>VI</p> <p><i>Sustainable Resource Extraction Zone</i></p> <p>General biodiversity protection area designated for sustainable extraction of timber and non-timber resources.</p>	<ul style="list-style-type: none"> ▪ To maintain biodiversity resources and watershed functionality with low human impact, under management of the Forest Department and site-level co-managers ▪ To maintain cultural resources with low human impact, under management of the Institute of Archaeology, in collaboration and site-level protected area co-managers and, where relevant, Forest Department ▪ To allow permitted, sustainable extractive use of natural resource, with effective licenses and monitoring in place ▪ To allow access for scientific research, education and low-medium impact tourism ▪ To ensure effective surveillance and enforcement 	<ul style="list-style-type: none"> ▪ Minimal impact research under special permission from Forest Department, Institute of Archaeology (dependent on research target) and site-level protected area co-managers ▪ No collecting of flora, fauna or inorganic material other than by approved researchers (as defined within the Research Policy document) with the permission of Forest Department, in consultation with site-level protected area co-managers ▪ Low to medium impact tourism, where site-level management zones permit ▪ All mining operations (exploratory and extractive), to have EIA, with strict ECP guidelines, and monitoring by FD, FCD and Geology and Petroleum, funded by concession holder ▪ Where exploratory and /or extractive mining activities are approved, best practices for “minimum impact” are implemented, geared towards limiting footprint, damage, destruction or disturbance of natural habitat and cultural resources ▪ Close liaison and collaboration with Department of Geology and Petroleum, towards integrated management. ▪ Effective surveillance and enforcement

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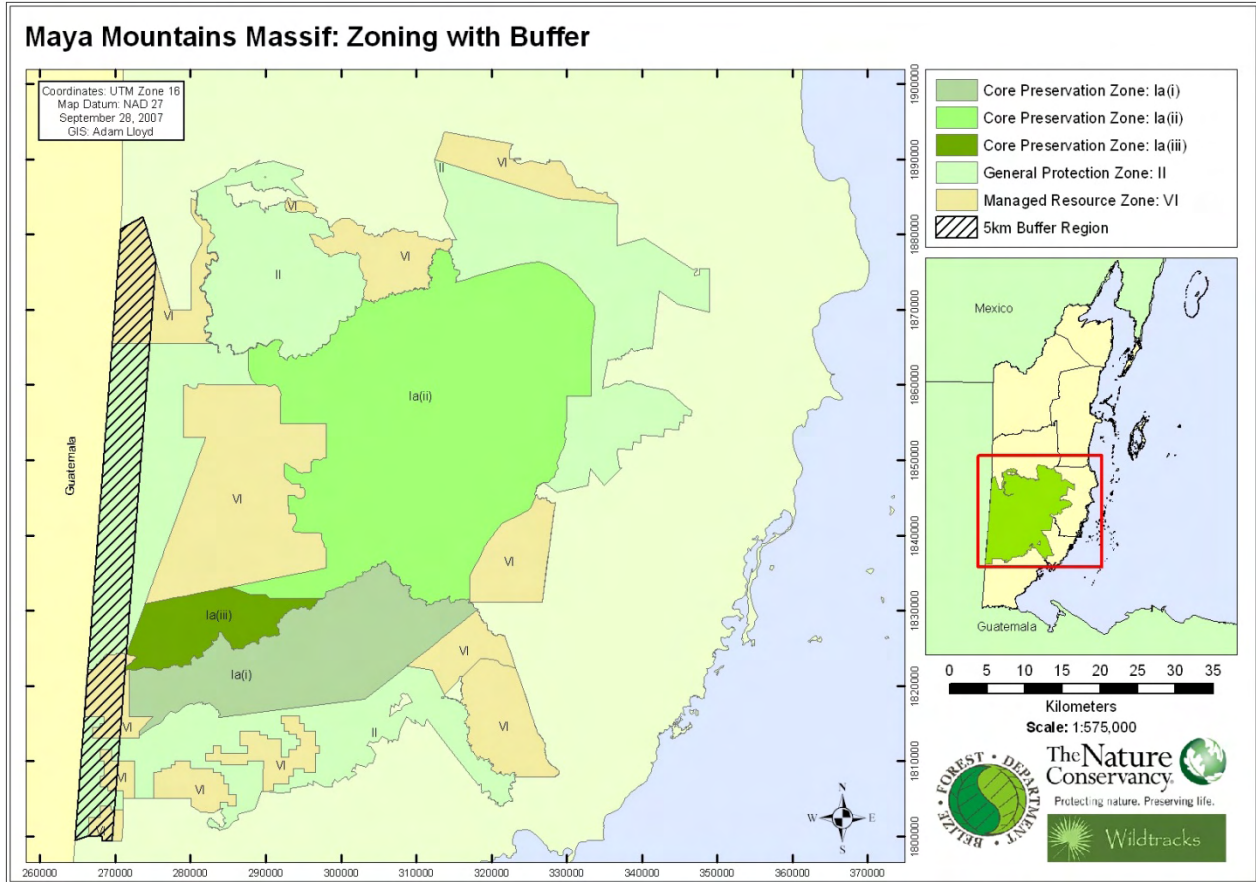
Maya Mountains Massif: Zoning: Sustainable Resource Extraction Zone



Sustainable Resource Extraction Zone

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Buffer Area	Objective	Regulations/Guidelines
<p>Whilst not a permanent zone, it is recommended that the 5km strip adjacent to the border be considered a Buffer Zone, with particular attention to surveillance and enforcement activities</p>	<ul style="list-style-type: none"> ▪ To maintain biodiversity and cultural resources, and watershed functionality with minimal human impact ▪ To prioritize surveillance and enforcement activities ▪ To allow for those activities designated under the management zones 	<ul style="list-style-type: none"> ▪ Surveillance and enforcement against illegal resource extraction



5km Buffer Area

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Annex One

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Annex One

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Xate concession holders	Mark Leslie	
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We have tried to ensure that all participants have been listed here, but apologize to anyone who has been inadvertently left out.

Annex Two

Objectives and Strategic Actions for the Maya Mountains Massif

Objective 1

By the year 2012, the illegal xatero incursions and associated activities have been reduced by 85%

Strategic action 1: 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

Comment: Low confidence in estimate of cost. Dependent on field verification

Strategic action 2: Involve mining, timber concessionaires, tour operators and other stakeholders in monitoring and surveillance in MMM, by providing logistical assistance, overnight facilities, transportation and information to patrolling crews.

Strategic action 3: 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

Strategic action 4: 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 action 5: Investigate the possibility for inclusion of fish-tail xate (*Chamaedorea ernesti-agustii*) in Appendix II of CITES, through dialogue between FD, CONAP, and agencies in Mexico, by collecting the available information, identifying information gaps and making the case.

Strategic action 6: 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

Strategic action 7: 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)

Objective 2

By the year 2012, all agricultural incursions within the protected areas of the MMM are vacated and regenerating into forest and there are no new ones reported

Strategic action: Dialogue with appropriate institutions in Guatemala, in order to facilitate the provision of alternative agricultural land in Guatemala for farmers that currently cultivate illegally in Belizean territory

Strategic action: Lobby for the National Protected Areas Act to support and strengthen the National Protected Areas System Plan, to prevent the by-passing of the due process associated with dereservation of areas in the MMM

Strategic action: 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

Strategic action: Strengthen the coordination and collaboration among departments of the Ministry of Natural Resources, relevant conservation NGO's, national and local politicians towards the protection of the MMM

Strategic action: 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)

Strategic action: Promote sustainable income-generating activities, such as honey, cacao and xate production, for farmers in the areas adjacent to MMM, especially near the Vaca, Maya Mountains, Columbia River, Sibun and Sittee River Forest Reserves

Objective 3

By the year 2012, connectivity between the Maya Mountains Massif and Rio Bravo, through the Manatee Forest Reserve, and across the Western Highway, will have been secured

Strategic action: Define, assess and prioritise potential corridor options

Strategic action: Investigate and implement conservation easements for corridor formation - legislation and engaging private landowners

Strategic action: Encourage collaboration with and between Private Protected Areas located within the corridor

Strategic action: Promote best practices land use by private owners within the corridor

Strategic action: Investigate land purchase opportunities for securing connectivity

Objective 4

By the year 2012, conservation of all freshwater communities within the MMM through appropriate zoning, and longitudinal connectivity to the coast is maintained for 90% of watersheds to support viable populations of migratory species.

Strategic action: Assess biodiversity importance and health of the freshwater systems of the MMM to inform biodiversity conservation, zoning and management

Strategic action: Identify and designate core protection areas for freshwater biodiversity conservation within the MMM

Objective 5:

By the year 2012, reduce the incidence and size of fires by 50% within the Upland Pine Savannas and 25% for the Coastal Plain Pine Savannas, and by 2017, reduce the incidence of fires by 75% within the two systems.

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

Strategic action: Prepare and implement a Fire Management Plan in partnership for the MMM with all key stakeholders, to be implemented through the establishment of a co-ordinating National Forest Fire Management Working Group

Strategic action: Support the preparation and institutionalization of a National Forest Fire Management Policy for Belize

Strategic action: 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

Strategic action: 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

Strategic action: 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)??

Strategic action: 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

Strategic action: Support the development and implementation of game farming in partnership with local hunting communities to replace the need for wild game meat

Objective 6

By the year 2012, at least 65% of the Maya Mountains Massif is considered as an effective reservoir for the protection of game species through the use of zonation and implementation of legislation (See a map and discuss)

Strategic action: Increase effective control of hunting through revision and active implementation of existing hunting legislation

Strategic action: Collect baseline data to establish benchmarks for defining viable game species populations, and implement monitoring

Strategic action: Establish and enforce core protection areas for game species within the overall zonation system of the Maya Mountains Massif

Strategic action: 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

Strategic action: Effectively regulate commercial trade in game meat, through certification of wild game meat traders and restaurants

Strategic action: 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

Objective 7

By the year 2015, all hydropower developments in the MMM have minimized their ecological impacts on freshwater biodiversity, by meeting or exceeding ISO 14001 (or similar appropriate standards)

Strategic action: Work with DoE and BECOL to review ISO 14001, and determine suitability of standards for hydropower development in the MMM

Strategic action: Work with DoE to mandate compliance with ISO 14001 standards or similar by current and future hydropower developments

Objective 8

By the year 2012, all xate extraction in the Maya Mountains Massif is sustainable and regulated through the establishment of an effective xate industry in Belize through partnerships between private sector, government, NGOs and communities

Strategic action: Put in place effective, regulated xate industry with a commitment from concession holders towards adherence to regulations for sustainability

Strategic action: 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

Comment: Low confidence in estimate of cost. Dependent on field verification

Strategic action: 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

Strategic action: Promote the inclusion of fish-tail xate (*Chamaedorea ernesti-agustii*) in Appendix II of CITES, spearheaded by FD and CONAP(?), by collecting the available information, identifying information gaps and making the case.

Strategic action: 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 action: Involve mining, timber concessionaires, tour operators and other stakeholders in monitoring and surveillance in MMM, by providing logistical assistance, overnight facilities, transportation and information to patrolling crews.

Strategic action: 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

Objective 9

By the year 2017, reduce chemical pollution within the Maya Mountains Massif by 25% from the 2010 baseline levels

Strategic action: 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

Strategic action: Identify and implement of internationally accepted assessment and monitoring protocols to determine deviations from baseline conditions

Strategic action: Amend current policies and regulations for strengthening regulation of pollutants

Strategic action: Encourage adoption of best management practices in major polluters, and the population in general, through increasing awareness, regulations and international technical and financial support

Objective 10

By the year 2012, 50% of the deforested areas of the Upland Pine Savannas have been replanted where regeneration alone will not be sufficient to restore the forest; the remaining 50% of the area is replanted by 2017 in the production zones.

Strategic action: Formulate and implement a Forest Restoration Plan for the Upland Pine Savannas to identify areas needing active restoration, management regimes and timeframes for replanting

Strategic action: Establish long term forest licenses with private investors for pine savanna areas that need to be restored

Strategic action: Strengthen the capacity of the Forest Department to effectively regulate the implementation of the Forest Restoration Plan, through increased human and financial resources

Strategic action: 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

Objective 11

By the year 2012, all pine bark beetle spots within Upland Pine Savannas and the Coastal Plain Pine Savannas are controlled, with no patch development.

Strategic action: Socialize, approve and implement the draft National Forest Health Strategy

Strategic action: Establish a National Forest Health Working Group to coordinate the implementation of the National Forest Health Strategy

Strategic action: Conduct studies on the ecology of the Pine Bark Beetle

Strategic action: 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

Strategic action: 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

Strategic action: 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

Strategic action: 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)??

Objective 12

By 2012, implement flow recommendations to mimic key attributes of natural flow, sediment and energy regimes by 2010 for the 3 dams on the Macal River.

Strategic action: Complete assessment to determine base conditions for flow, sediment and energy regimes of Macal River, relative to natural regimes, determine attributes that are critical to target viability, and make recommendations

Strategic action: Implement flow, sediment and energy regime recommendations if different than existing dam management

Strategic action: Initiate and implement ongoing monitoring of flow, sediment and energy regime parameters and key species

Objective 13

By the year 2012, 95% of riparian buffer ecosystems are maintained unimpacted within the MMM.

Strategic action: Revise and strengthen current legislation to include increased penalties, and promote more effective monitoring and enforcement

Strategic action: Promote long term forest licenses and monitor and enforce riparian buffer protection regulations

Objective 14

By the year 2017, conserve 25% of the known cultural sites of the MMM through greater knowledge of sites, more effective management, and greater collaboration with other conservation partners

Strategic action: Develop a comprehensive list, with mapping and assessment of all sites within the MMM by 2017

Strategic action: Increase the number of multi-year archaeological research projects in MMM by 2012

Strategic action: Development of more archaeological sites for tourism purposes, with effective management plans in place, by 2017

Strategic action: Increase management presence at archaeological sites by 2012, through collaboration with other conservation organizations of the MMM, and participate in binational patrols

Strategic action: Training of other conservation partners in mapping and information gathering for archaeological sites within the M

