Conservation Area Plan

Peccary Hills Area

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Site Name: Peccary Hills Area

Ecoregions: Petén-Veracruz Moist Forest
Belizean Pine Forest
Belizean Coastal Mangrove

Country /District: Mesoamerica - Belize / Belize District

Acreage: 18,600 acres (8,000 acres Hwatchy Property)
(10,600 acres national land)

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Executive Summary

Conservation Goals and Vision

The Peccary Hills area is an amazing matrix of ecosystems, with a rich wildlife and cultural heritage, lying close to Belize City (the main urban centre of Belize). Yet it has managed to escape the pressures of increasing human footprint, and been undisturbed by development….until now.

The overarching goal for conservation in the Peccary Hills Area is to ensure the long-term viability of all native species, natural communities, and ecological systems, and to sustain the landscape configurations and ecological processes critical to ensuring their long-term survival. This conservation plan identifies fauna, flora ecosystems and cultural heritage that represent the most urgent conservation priorities for the management body, and the strategies that should be put into place to ensure effective management over the 5 year implementation period.

There is a shared vision for the conservation of the Peccary Hills area - to preserve the rich biodiversity, cultural and physical resources of the area in perpetuity, with management sustained by environmentally sensitive tourism that provides broadscale employment and careers for the residents of Gracie Rock Village. This was summed up by the Gracie Rock community planning team during conservation planning as:

"Protection for the Peccary Hills area, with income generation for the Gracie Rock community through tourism, bridging the gap between development and sustainability"

This vision is shared by David Gegg, the Managing Director of Maya World Adventures – who appreciated the conservation importance of the area, and recognized its tourism potential. The resultant partnership between Maya World Adventures and the Gracie Rock Community, working towards their shared vision for the conservation of the Peccary Hills area, is very much in tune with the goals of the Government of Belize in terms of developing appropriate economic use of protected areas and ensuring an equitable spread of benefits amongst stakeholder communities.

In 1994, the Gracie Rock subdivision, 8000 acres of the focal area, was purchased by Hwatchy International, with plans for large-scale subdivision and the construction of a housing development. A bridge was constructed over the Sibun River at Gracie Rock to access the property, and a series of roads were created in the first phase of the development.

The development stalled in the late 1990's, providing a window of opportunity to secure the conservation of this unique wilderness area. To provide a short term means to prevent any further impacts from occurring, an option to purchase the 8,000 acre property was negotiated by Maya World Adventures, to provide time to seek funds to purchase the property for conservation before development and sale of house lots starts,

and whilst conservation is still an option. This agreement gives temporary access to the land and management rights to Maya World Adventures, but expires in mid-2006.

Time, however, is rapidly running out, and whilst funds are available for sustaining the area in the long term, through already established tourism activities, unless funds can be located for the initial purchase, the land, its wildlife and rich archaeological history may well be lost to housing development.

I. Introduction

1.1 Background and Objectives

Through a partnership resulting from a shares vision, Maya World Adventures and the Gracie Rock community are working towards the conservation of the Peccary Hills Area through the sustainability mechanism of managed tourism, to provide an improved quality of life for the local communities. This is based on the following goals

1. Establish the Peccary Hills Area as a conservation area, placing it trust for the Belizean people, with a long term management agreement in place

2. Ensure the equitable spread of benefits and opportunities in the stakeholder communities through employment and the promotion of economic activities compatible with the conservation goals, and high level of participation from local stakeholders

3. Ensure the continued maintenance of key environmental processes to promote healthy, functioning terrestrial and aquatic ecosystems.

4. Protect all species in the variety of habitats in which they naturally occur, particularly those recognized as globally and nationally threatened

5. Protect the cultural resources of the Peccary Hills area

6. Ensure sustainability of the conservation area through the planned management of tourism

It is proposed that the 8,000acre Hwatchy property and adjacent 10,600 acres be acquired and placed in conservation trust for the people of Belize, through legal agreement with the Government of Belize. The trust agreement will mandate the conservation management of the lands to a legally registered body under the direction of Maya World Adventures, with formal representation from a Local Advisory Committee of Gracie Rock community, and define the scope of tourism operations within the area. As with other protected areas, a conservation management plan will be required, which will develop the strategies of the various management programmes, set the 'limits of acceptable change'.

The purpose of this plan is to define the ecosystems and species on which conservation strategies should be concentrated to achieve the conservation goals, and to assess the threats that face them. It also identifies the strategies and actions that can be implemented to reduce those threats, and allows the prioritization of the actions, allowing focus of resources on strategies that can make the most positive impact. It also provides a means for measuring success.

1.2 Site Description

The Peccary Hills conservation planning area encompasses both private and national land, in two contiguous properties, lying within the Manatee Special Development Area. The first and foremost is 8,000 acres, privately owned by Hwatchy International Ltd. The second, of 10,600 acres, is national land and lies to the east, providing connectivity to Northern Lagoon (Annex 6: Map 2).

The Peccary Hills and adjacent savanna are situated between N 1918000 and W 348000 (UTM) in Belize District, the most developed of the six districts of Belize, yet is almost pristine in nature. The focal area, a combination of national and private lands, lie 30 km south west of Belize City, on the western shore of Northern Lagoon, stretching northwest to the Sibun River (Annex 6: Map 1). To the south lies Manatee Forest Reserve, and to the west is the Runaway Creek Nature Preserve. The Peccary Hills area covers approximately 18,600 acres of tropical broadleaf forest and short grass savanna, freshwater creeks and mangroves. It has very distinctive physical features – with tower karst limestone rising out of the flat coastal plain, forming steep sided hills, with cliffs, limestone arches, and impressive cave structures.

The area protects the drainage area of Freshwater Creek, part of the Northern Lagoon watershed (Annex 6: Map 3), providing connectivity from the karst hill slopes and swamp forest, into Northern Lagoon. The Freshwater Creek area is highlighted as being a key water system for the in-situ conservation of the Central American River Turtle (*Dermatemys mawii*).

The ecosystems within the two contiguous tracts of land are a matrix of broadleaf forest, short grass and pine savannah, freshwater creeks, swamp forest, and mangrove, sheltering a representative array of Belize's mammals, including jaguar, puma, paca, Baird's tapir, white tailed deer, red brocket deer, Yucatan black howler monkey and the Central American spider monkey.

The adjacent Northern Lagoon is part of a complex network of coastal lagoons and creeks that are highlighted for the presence of the critically endangered goliath grouper, and for their importance for the West Indian manatee (Auil, pers. comm.), a species that also ventures at times up both Freshwater Creek and the Sibun River.

A third area, 'Property A', is private property of 1,000 acres, providing connectivity between the Hwatchy property and Runaway Creek private reserve. Whilst not yet included within the conservation plan, it is taken into consideration due to its value for connectivity.

The primary stakeholder community is Gracie Rock, with a population estimated at approximately 170, consisting of households scattered along both sides of the Sibun River. Other communities that also impact the area include Freetown Sibun to the north, La Democracia to the west, and Gales Point to the south. Belize City, with a population estimated at 59,400. (CSO, 2004), lies 30km to the northeast, but at present has minimal impact Table 1.

Peccary Hills – Stakeholder Communities		
Community	**Influence or impact on Peccary Hills Area**	
Gracie Rock	+	Approx. population: 170. Primary occupation – employed by Maya World Adventure in tourism. Hunting and fishing reduced
La Democracia	-	At the junction between the Western Highway and the Coastal Road. Adjacent citrus plantation employs approx. 200 seasonal migrant workers – considered the primary source of hunting and fishing pressure
Freetown Sibun	-	To the north of Gracie Rock, on the Sibun River. One commercial hicatee hunter. Previous hicatee breeding project.
Gales Point	-	Approx. population: 500. Hunt paca and white-tailed deer on the savanna as far north as Tum Tum Creek
Belize City	-	Population: 59,400. Sport hunting and fishing sometimes at weekends in Freshwater Creek area. Increased boat activity possibly a problem for manatee

Table 1: Stakeholder Communities of Peccary Hills

Traditionally, the Peccary Hills area has been used for subsistence hunting and fishing, with some local quarrying of sand from the short grass savanna areas by the community of Gracie Rock, which is spread out along the river.

Significant social change has occurred in the community over the last twenty years, with a many of the younger generation moving away from the traditional subsistence lifestyle in favour of a less taxing existence in Belize City. Some of those who remained took up work at the nearby quarry, and became less reliant upon the surrounding natural resources. More recently still, with the downsizing of the quarry workforce, the community of Gracie Rock had suffered a significant economic downturn, from its already low-income level.

Maya World Adventures has based its tourism operations in Gracie Rock, relying on the near-pristine nature of the tropical forest, the rich wildlife, protection of the ceremonial sites within the many caves, and to the undisturbed waters of Freshwater Creek. These are also qualities valued by the community members, leading to a collaborative partnership between members of Gracie Rock and Maya World Adventures, seeking a means to ensure the long-term protection of the area, putting in place the necessary infrastructure for sustainability, and developing and implementing conservation goals and actions that contribute to the long-term national goals for biodiversity protection.

This tourism development has brought about a significant re-invigoration within the community. The local skills and knowledge of the natural resources that had been unable to sustain the community are at last both needed and rewarded – providing a significant portion of the households with a regular and reliable income. At the same time, new skills are being developed that further enhance prospects for continued improvements to standards of living within the community.

In so doing, the tourism use of the Gracie Rock property has dramatically reduced remaining anthropogenic pressures on the natural resources. The project is very much in line with the Government of Belize's desire to see local communities benefit from protected areas – and may become a model of how to build financial sustainability and community support into protected area management.

II. Conservation Targets

Introduction

As a first step in the conservation planning process, six conservation targets were chosen, at a coarse enough scale to encompass the diverse guilds and individual species of conservation concern. Two of these targets are broad ecosystem categories, two are species assemblages, and two are individual species.

- Tropical broadleaf forest
- Short grass savanna
- Native fish species (Cichlids)
- Game Species
- Central American River Turtle
- Central American Spider Monkey

Also selected was a seventh target, cultural heritage, to capture the important archaeological elements of the site:

- Cultural Heritage

This was considered separately in the site analysis.

Ecosystems, plants and animals of conservation concern were nested under the broader conservation elements listed above, on the understanding that strategies designed on the broader scale would be effective on those species nested within.

2.1 Tropical broadleaf forest

The tropical forest of the Peccary Hills area is part of the Petén-Veracruz Moist Forest ecoregion - a large block of tropical forest that stretches through Belize, Guatemala and southern Mexico, the northern limit being approximately 22°N, towards the northern extent of Veracruz State in Mexico, with the southern extent reaching approximately 15°N, just north of the southern border of Guatemala.

This ecoregion is classed as ‘Critical/ Endangered’ as the rate of deforestation increases (World Wildlife Fund, 2001). Throughout Central America, this results in not only the loss of key predators, but also secondary local extinctions and changes in species composition when these key species are removed. For all these reasons, tropical moist forests such as that of the Peccary Hills area typically require large protected areas to maintain viable populations and sustain ecological processes, with buffering from edge effects, and provision for linkage through natural habitat corridors.

In the Peccary Hills Area, these forests are represented by a matrix of ten ecosystems - a combination of moist tropical forest, bajo, wetlands and riparian habitats – covering 72% of the project area. Species-richness is high (though the number of endemic species is low) with a high proportion of tightly linked ecological interactions such as symbiosis. Many tree, vertebrate and invertebrate species occur at relatively low densities, resulting in large areas being needed for the support of viable populations, particularly of the larger predators, increasing the importance of forest connectivity.

Photograph 1:
Tropical broadleaf Forest

The forest ecosystems within this broad category are characterized primarily by topography, hydrology and soils – the vegetation of the karst limestone landscape, with its steep-sided hills and alluvial valleys, the swamp forests of the low-lying inundation areas. Within the Peccary Hills area, undisturbed areas of tropical broadleaf forest have a very high canopy, with emergents reaching 30m in height – some of the tallest forest in Belize. Species richness is high, with these intact forest tracts harbouring an evidently healthy population of both Central American spider monkeys and Yucatan howler monkeys. Past selective logging activities have concentrated on mahogany and Mexican cedar – such that the numerous hardwoods have been left, and are present in good densities, and of massive stature.

The high swamp forest is highlighted as one of four priority ecosystems considered under-represented in the national protected areas system, as it does not meet the 10% minimum level of protection advocated by IUCN (Meerman, 2005). If the approximately 4,650 acre tract of this ecosystem within the Peccary Hills area are placed under formal conservation management, this would represent a 17% increase in the area of this system currently under protection, and would increase the level of protection over the minimum 10% advocated by IUCN.

Nested Conservation Elements

This category covers the mosaic of broadleaf forest ecosystems of the Peccary Hills area. Several IUCN red-listed and CITES listed species are restricted to the broadleaf forest area – the 'endangered' Yucatan black howler (*Alouatta pigra*), the 'vulnerable' sub-species of Central American spider monkey (*Ateles geoffroyi yucatanensis*), the CITES Appendix I-listed ocelot (*Leopardus pardalis*), margay (*Leopardus wiedii*) and jaguarundi (*Herpailurus yaguarundi*).

The 'near threatened' jaguar (*Panthera onca*), puma (*Puma concolor*), great curassow (*Crax rubra*) and the nationally ''vulnerable' crested guan (*Penelope purpurascens*) are also found in this habitat, as are a number of species presently considered non-threatened, such as collared peccary (*Tayassu tajacu*).

Two freshwater turtles (*Claudius angustatus* and *Kinosternon acutum*), both considered 'lower risk', were recorded from the swamp forest, and two endemic plant species have been recorded from the karst area – *Zamia sp. nov.* and *Louteridium chartaceum* – the latter is only known from the Peccary Hills themselves.

This target also represents the karst areas – the limestone cliffs and caves that are themselves an important geological conservation focus, and the cultural value they represent, as ceremonial sites for the ancient Maya. The recognition of the importance of karst landscapes as a conservation target by the IUCN World Commission on Protected Areas in 1997, and the increasing need for their protection, has led to an evaluation of karstic scenery and its protection throughout Central America (Kueny and Day, 2002). The Mesoamerican region contains a significant proportion of the global karstic limestone, stretching from the Yucatan Peninsula to Panama, with 18% under some form of protection.

Belize is highlighted as the country with the largest area of karst under protection (68% of the total karst landscape of the country falls within protected areas), however this is fast being eroded as the karst areas come under increasing pressure from dereservation of forest reserves, whittling away at the protected areas, and to some extent from quarrying for limestone hardcore,

See Annex 2: Conservation Elements and Nested Targets

Conservation Target: Broadleaf Forest		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Good**	There are some small areas of forest clearance from past development and fire, but generally the extent of the broadleaf forest has not otherwise been anthropogenically reduced. Historical records demonstrate that the local topography has provided variable protection from natural and anthropogenic impacts, enhancing the resilience of the system to perturbations.
Condition	**Good**	Whilst much of the broadleaf forest could be classed as having very good condition, some areas are impacted by land clearance for agriculture, and from past selective logging, and by the Hwatchy property development, but the basic integrity of this ecosystem has remained intact
Landscape Context	**Good**	Broadleaf forest is represented throughout much of Belize, though direct connectivity for the Peccary Hills is dependent on a small band of riverine forest on the Sibun, where it crosses the Coastal Road.

2.2 Short Grass Savanna

The short grass savanna ecosystem of the Peccary Hills Area is part of the Belizean Pine Forest ecoregion, highlighted as one of the few regional fragments of lowland pine forests (World Wildlife Fund, 2001). In the region, this ecosystem shows a gradient from fully developed pine forest through short grass savanna and pine, to short grass savanna (without pine) dependant on soil type and frequency of fires. Under the WWF categories, it is given the conservation status critical / endangered, being severely threatened by increasing frequency and intensity of fire, following past logging pressures.

Photograph 2:
Belizean pine forest, showing effects of increasing frequency of fire

The 'short-grass savanna with needle-leaved trees' within the Peccary Hills area is a matrix of three ecosystems:

- Short-grass savanna with needle-leaved trees
- Short-grass savanna with shrubs
- Eleocharis marsh

Covering 27% of the planning area, this ecosystem shows a gradient from short grass savanna and pine, to short grass savanna (without pine) dependant on soil type and frequency of fires, and covers an area of approximately 5,100 acres in the east of the property.

Of the short grass savanna with pines, a little under half the area of this ecosystem targeted nationally for conservation management is met by the current protected areas of Belize (Meerman, 2005), and the addition of the Peccary Hills area would add approximately 1,400 acres (over 3%) to the nationally protected tracts, if formally protected.

Frequent anthropogenic fires have eradicated pine from areas where they occurred as recently as 20 years previously – leaving a 'short-grass savanna with shrubs', a 3,700 acre complex mosaic of species assemblages, each reflecting micro-topography, soil hydrology, soil acidity & nutrient availability, fire regime and seed source. Much of the short-grass savanna is open grassland, with stands of *Acoelorraphe wrightii,* or *Eleocharis sp*. in low-lying areas. Raised, forested hummocks occur across portions of the savanna, with a species assemblage best characterized under 'tropical evergreen seasonal broadleaf lowland forest over calcareous soils: Yucatan variant'.

Restoration of the *Pinus caribaea* population and range should be a priority, bringing with it the likely restoration of nesting and feeding habitat for the endangered yellow-headed parrot.

Nested Conservation Elements

Species that frequent this ecosystem group include two mammal species of international concern (IUCN, 2004): one endangered species (Baird's tapir (*T. bairdii*)), and one species classed as near threatened (puma (*Puma concolor*). White-tailed deer (*Odocoileus virginianus*) and collared peccary (*Tayassu tajacu*) are also represented by this conservation target. It is also important habitat for pine savanna specialist birds such as the endangered yellow headed parrot (*Amazona oratrix*) and jabiru (*Jabiru mycteria*), the aplomado falcon (*Falco femoralis*), and the azure-crowned hummingbird (rated G3 under the Global Conservation Status rankings, Natureserve, 2005). Also nested within this conservation element is the nationally endangered passionflower *Passiflora urbaniana* (Meerman, 2005).

Yellow-headed parrot **-** Belize is the last stronghold of *Amazona oratrix*, listed as Endangered (IUCN, 2004), and Globally Endangered by Birdlife. It has encountered massive declines - globally, numbers dropped an estimated 90% to 7,000 in the late 70's, with a further estimated 68% decline in the last 10 years (Birdlife, 2000), and is further threatened by the increasing frequency of savanna fires, which burn nesting trees and remove foraging habitat. At present numbers are considered low enough to threaten viability, and it is recognized that the species will not be able to recover without human intervention.

Jabiru Stork - The Jabiru (*Jabiru mycteria*) is nationally protected from hunting under the Wildlife Protection Act. With a low regional population estimated to be between 250 and 400 individuals, numbers are thought to be increasing, particularly with the creation of additional foraging areas such as shrimp farms and rice fields. The opening up of these new foraging areas, however, is causing friction. Recent studies have shown that the Central American population is thought to be isolated from that of South America, leading to questions of population viability (Figueroa, 2005).

See Annex 2: Conservation Elements and Nested Targets

Conservation Target: Short grass Savannah		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Good**	5,100 acres of short grass savanna will be protected by the protection of the Peccary Hills area – potentially large enough to remain a viable ecosystem
Condition	**Fair**	Impacted by increasingly frequent anthropogenic fires. Past logging has removed many of the larger pine trees. Pine savanna would be classed as poor, shrub savanna would be classed as good – in combination, fair
Landscape Context	**Good**	Whilst much of the pine savannah country-wide is negatively impacted by increased frequency of fire, the ecosystem generally is intact, with good connectivity.

2.3 Native fish species (Cichlids)

The cichlid species are targeted food species (especially 'tuba' (*C. synspilum*), resulting in declining stocks within the otherwise unimpacted Freshwater Creek system. These have therefore been chosen as a key conservation species assemblage target, with mitigating measures that will also protect the entire aquatic freshwater ecosystem.

Freshwater Creek has been important traditionally for the abundant fish stocks. Fish populations, however, have demonstrated a serious decline over recent years through over-fishing. This pressure was particularly severe during the road construction associated with the first phase of the Hwatchy property development, when seine nets were used during the dry season within the creek system, resulting in a population crash of the species favoured for the table (Gracie Rock community members, pers. com.). Cichlids recorded in Freshwater Creek targeted by fishermen include the bay snook (*Petenia splendida*), mus mus (*Cichlasoma friedrichsthali*), the Mayan Cichlid (*C. uropthalmus*), the redhead cichlid or 'tuba' (*C. synspilum*) and the blue-eyed cichlid (*C. spilurum*).

Local reports suggest that a small number of tilapia may also exist in the headwaters of the system - it is possible that the invasion of the system by *Tilapia* may place further pressure on the fish stocks in the future as it spreads, with competition for nesting and food resources.

Nested Conservation Elements

The freshwater ecosystem, represented in the conservation planning by the native cichlid species, provides shelter for a number of threatened species. The West Indian manatee (*Trichechus manatus*), listed as 'vulnerable' (IUCN, 2004) is known to enter the creek, as does the critically endangered goliath grouper (*Epinephelus itajara*).

Also represented is the Belizean Coastal Mangrove ecoregion, which runs along the coast of Belize, as far south as the Bahia de Annatique in Guatemala. Within the Peccary Hills area, mangroves are located on the lower reaches of Freshwater Creek, and on the western shore of Northern Lagoon. It is the waters of these areas that are important for West Indian manatees, as feeding and nesting grounds for herons and egrets, and as a refuge area for juvenile fish species. The mangroves also play an important role in buffering the land from wave action, with clearance leading to extensive coastal erosion. This ecoregion is considered 'vulnerable' (WWF Ecoregions Programme (WWF, 2001) with increasing threat of clearance for coastal development throughout its range.

One of the most viable populations of the endangered Central American River Turtle (*Dermatemys mawii*) left in Belize is within this system (and is targeted as a separate conservation element in its own right). The Neotropical river otter (*Lutra longicaudis*), a species of 'lower risk' is present in the area, as is the water opossum (*Chironectes*

minimus), according to local reports. Two freshwater turtles (*Staurotypus triporcatus* and *Trachemys scripta*), both considered 'lower risk', exist in the Freshwater Creek system.

See Annex 2: Conservation Elements and Nested Targets

Conservation Target: Native Fish Populations (Cichlids)		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Fair**	Fish populations are reported to have declined very significantly in the last ten years through unsustainable fishing pressure. Active conservation management is required to reverse this trend
Condition	**Good**	Current fish populations show signs of impacts – reduced size, changing species composition, abundance etc. but are still considered viable with appropriate conservation actions in place.
Landscape Context	**Fair**	The freshwater habitat is considered very healthy, with little impact. However the limited connectivity for salt intolerant species, isolated from replenishment, may result in species decline if no conservation intervention takes place to remove the negative anthropogenic impacts on size and condition

2.4 Game Species

The game species populations of the Peccary Hills appears to be very healthy, as compared with the majority of locations in Belize (including protected areas), where hunting / poaching is having significant impacts upon the populations. The relatively high population densities that are reported, and as deduced from qualitative observations of tracks, etc. during this survey are indicative of low hunting pressure from stakeholder communities. Hunting does still occur at a level greatly reduced from past levels, and it is a conservation goal of the management to continue working collaboratively with stakeholder communities to stop all hunting within the project area and thereby enable game species populations to return to unimpacted levels. Identification of game species as a conservation target is largely to further prioritize the enforcement of no-hunting regulations, and facilitate the measurement of success of the associated conservation actions.

The exception to the healthy status of the game species populations is the white-lipped peccary, which was reportedly extirpated from the area by the 1970's, and which has not subsequently re-colonized. As a wide-ranging species that plays an important role in plant dispersal and energy flow, requiring large areas of contiguous forest largely free from sustained hunting pressure, its absence from the Peccary Hills area is a conservation concern. Future management planning should explore the feasibility of re-introduction.

Nested Conservation Elements

Game Species	
Great curassow	*Crax rubra*
Crested guan	*Penelope purpurascens*
Paca	*Agouti paca*
Nine-banded armadillo	*Dasypus novemcinctus*
Collared peccary	*Tayassu tajacu*
White-tailed deer	*Odocoileus virginianus*
Red brocket deer	*Mazama americana*
Baird's Tapir	*Tapirus bairdii*

See Annex 2: Conservation Elements and Nested Targets

Conservation Target: Game Species		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Very Good**	The game species populations within the Peccary Hills Area are considered very good, though there is currently some hunting pressure (possibly at a sustainable level). White-lipped peccary, however, were extirpated from the area in the 1970's, reputedly from a combination of natural and anthropogenic impacts. The presence of key predators demonstrates presence of adequate prey density.
Condition	**Very Good**	Local reports suggest that the condition of the game species populations can be considered Very Good, with populations recovering and extending outwards into adjacent farmlands.
Landscape Context	**Good**	The forest habitats of the game species are mostly in Very Good condition, though the savanna habitats are degraded from the impacts of anthropogenic fires. To date connectivity remains, with contiguous habitats for these species.

2.5 Central American River Turtle

The Central American River Turtle or 'Hicatee' (*Dermatemys mawii*) has been selected because of specific threats to the viability of not only the population at local level, within the project area, but also at national and regional level. Extirpated from much of its range in Mexico and Guatemala as a result of hunting pressure, this species is also in decline in Belize, and is considered likely to be elevated to the status of Critically Endangered in the near future. It would appear that the Gracie Rock / Freshwater Creek area may be one of the last strongholds for this species. Whilst local reports indicate that large specimens are less frequent than previously (indicating unsustainable hunting pressure), the population still has good recruitment.

Photograph 3:
Central American River Turtle

The stakeholder communities of Gracie Rock and Freetown Sibun are already largely sensitized as to the conservation importance of the hicatee, and are likely to be co-operative with conservation actions aimed towards the securing of the long-term presence of this species within the freshwater ecosystems. A species recovery plan is urgently needed, which will need to address the critical conservation requirements of the species, and at the same time focus the cultural importance of the species (as a food item) towards sustainability.

Conservation Target: Central American River Turtle		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Good**	The population of this species in this locality is thought to be the largest encountered country-wide, though the species has declined in abundance in recent years.
Condition	**Good**	The population is reproductive, with juveniles reportedly easily observed. However, reduced abundance of large adults indicates that unsustainable harvesting pressure is having an impact on the population structure of this species, in this locality.
Landscape Context	**Poor**	The freshwater habitat is considered very healthy, with little anthropogenic alteration. Regionally, this species is in precipitous decline and in real danger of extinction within the next two decades if urgent conservation actions are not implemented.

2.6 Central American Spider Monkey

The Peccary Hills area broadleaf forests provide shelter to the two species of primates present in Belize. It has perhaps the only coastal plain population of the Central American Spider Monkey (*Ateles geoffroyi yucatanensis*), a regional sub-species considered 'vulnerable' (IUCN, 2004).

The Central American spider monkey is known to be particularly shy and reclusive in Belize, and its presence is considered to be an indicator of relatively undisturbed forest. *Atleles geoffroyi* is particularly vulnerable to human disturbance in Belize, requiring a large area of relatively undisturbed forest in order for viable populations to occur. Much of the population is restricted to the least disturbed hill slopes of the Maya Mountains, or
to the Gallon Jug forest node in the northwest of Belize. It is also established within the karst hills of the Peccary Hills area, spreading into northern Manatee Forest Reserve and Runaway Creek (private reserve).

Photograph 4: Central American spider monkey (*Ateles geoffroyi*)

With increasing habitat fragmentation and loss, the Belizean subspecies (*A. g. yucatanensis*) has recently been upgraded to Vulnerable, as the population is projected to decline by 35% over the next 30 years in the region, primarily due to deforestation and fragmentation of habitat (IUCN, 2004).

It is also representative of other arboreal species – for example, the Yucatan Black Howler Monkey (*Alouatta pigra*), kinkajou (*Potos flavus*) and Mexican porcupine (*Coendou mexicana*).

Conservation Target: Central American Spider Monkey		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Good**	Small groups, with an estimated total of 45 adults within the area. It is believed that the population is still recovering from past impacts.
Condition	**Good**	Young present, signifying a reproductively active population. Rated as good, not very good, as studies in other areas indicate that group size should perhaps be larger (Reid, 1997)
Landscape Context	**Good**	The broadleaf forest is more or less structurally intact, and at present, there is direct connectivity along the Sibun River at present, though diminishing through land use change. In the national context, this species is rated as 'vulnerable', and is thought to be declining.

2.7 Cultural Heritage

The Maya settlements in the Sibun River valley in the Terminal Classic era have left their mark, with the discovery of ceremonial pottery vessels left as offerings within the caves of the karst area. These caves held great cultural significance for the Maya, being thought to represent the entrance to the underworld, where the gods resided. Offerings in the form of food, water and incense to carry messages to the gods, were left within the caves in ceremonial vessels

One such cave – Arch Cave – was investigated by the Xibun Archaeology Research Project. This cave, deemed "the most amazing thing I have ever seen!" by archaeological caver P. Paterson (Leonard, 2003), shows signs of modification by the Maya, as well as housing fifteen complete pottery vessels, ranging from 'ollas', (globular vessels with rounded walls and a narrow neck, possibly holding offerings of water or food), to bowls (shorter vessels with no neck restriction, often with a pedestal base, some thought to possibly be used to burn incense). Altars surrounded by pots, mostly intact, emphasize the importance of this cave as a sacred site, strengthened by the presence of jaguar teeth – an offering to the gods (Photograph 1).

Photograph 5:
Ceremonial vessels, Arch Cave

Other caves, too, have been found to contain similar examples of Maya pottery. Perhaps the most astounding fact about this area is that, in view of its location, so close to Belize City, and to the Gracie Rock access road, the vessels have not been looted (as has occurred with many other caves in the karst areas of Belize). This appears to be due entirely to the respect the Gracie Rock community members have for the offerings and their significance, and a desire to keep their presence relatively secret within Belize.

A small Maya settlement (given the name Freshwater Creek) was recorded from within the Peccary Hills area, east of Arch Cave (McAnany and Thomas, 2003).

2.8 Overall Viability Summary

Using the viability assessment approach of the TNC 5-S System, six conservation targets were evaluated. The resultant viability assessment indicates that the overall health of the species and biological systems of the Peccary Hills is good – a situation that is more positive than in a high proportion of Belize's existing protected areas. The one conservation target with a lower overall viability is the Central American River Turtle – but the both the population size and condition of this species are good within the project area: it is its critical status elsewhere in its range that is of real concern.

The assessment demonstrates that the biodiversity of the Peccary Hills has a viable future, and will benefit from formal conservation management. Whilst the Peccary Hills were identified as a gap within the current protected areas system (NPAPSP, 2005), the current biodiversity assessment demonstrates the health of the ecosystems and populations of the Peccary Hills – and confirms the need for their formal protection within the national system of protected areas.

Table 2: Viability Ranking for Selected Conservation Targets (based on TNC 5-S System)

Conservation Target	Size	Condition	Landscape Context	Overall Viability Rank
Short grass savannah	Good (3.5)	Fair (2.5)	Good (3.5)	**Good (3.17)**
Broadleaf Forest	Good (3.5)	Good (3.5)	Good (3.5)	**Good (3.50)**
Game Species	Good (3.5)	Very Good (4)	Good (3.5)	**Good (3.67)**
Native Fish Species (Cichlidae)	Fair (2.5)	Good (3.5)	Good (3.5)	**Good (3.17)**
Central American River Turtle	Good (3.5)	Good (3.5)	Poor (1.0)	**Fair (2.67)**
Central American Spider Monkey	Good (3.5)	Good (3.5)	Fair (2.5)	**Good (3.17)**
Overall Viability Rating of Peccary Hills				**Good (3.23)**

Very Good: Viability criteria at or above desired future status
Good: Viability at or above minimum threshold for biological integrity
Fair: Viability criteria at or above a minimum restorable level
Poor: Viability criteria below minimum restorable status (probably unrecoverable)

Following an assessment of the six conservation targets, an overall viability rank of **Good** can be established for the Peccary Hills area, under the TNC 5-S System (Table 2), indicating that the health of this area is generally escaped significant anthropogenic impacts to date.

2.9 Viability Goals

For each conservation target a recommended goal has been set, with relevant indicators that can be monitored over time to assess whether that goal has been met (Table 3).

Table 3: Viability Goals

Conservation Target	Current Rating	Goal	Justification and Indicator
Short grass Savannah	**Good**	**Good**	***Goal:* Good.** To improve the condition of the short grass savannah primarily by reducing anthropogenic fire impacts and restoration of pine ecosystem
			Potential Monitoring Indicators: Number and extent of fires per year; % of savanna not exposed to fire more frequently than every five years; % area showing regeneration of pine
Broadleaf forest	**Good**	**Very Good**	***Goal:* Very Good.** To maintain the broadleaf forest in its current condition or better; to allow previously impacted areas to continue regeneration free from the risk of anthropogenic fire
			Potential Monitoring Indicators: % of mature forest with no anthropogenic impacts to forest structure; % of previously impacted forest demonstrating undisturbed succession;
Native Fish Species	**Good**	**Very Good**	***Goal:* Very Good.** To increase the size and condition of the local native fish population to Very Good.
			Potential Monitoring Indicators: Population density and size distribution of fish populations
Central American River Turtle	**Fair**	**Good**	***Goal:* Good.** Improve the status of *Dermatemys mawii* within the Peccary Hills area, by improving size and condition of local population to Very Good
			Potential Monitoring Indicators: Population density and size distribution of *D. mawii* within the Peccary Hills area;
Game Species	**Good**	**Very Good**	***Goal:* Very Good.** To increase the size of the local game species populations through cessation of all hunting
			Potential Monitoring Indicators: Population density of game species (through camera trapping)
Central American Spider Monkey	**Good**	**Very Good**	***Goal:* Very Good.** To ensure continued viability of the Central American Spider Monkey population by increasing population size and condition
			Potential Monitoring Indicators: Population size of Central American Spider Monkey

Using the assessments of the viability of the conservation targets, and of the threats impacting them, the conservation targets can be prioritized in terms of the urgency of conservation actions to address the threats.

These have been placed within three bands: high priority, medium priority and lower priority (Table 4). Whilst recognizing that all six conservation targets merit strategies and actions to ensure their continued viability, the prioritization should help in the determination of allocation of management funds.

Table 4: Priority Areas of Action for the Peccary Hills area

Priority	Rank	Conservation Target	Primary Threat
High Priority	1	Central American River Turtle	Hunting of CA river turtles
	2	Central American Spider Monkey	Property Development
Medium Priority	3	Broadleaf Forest	Property Development
	4	Short grass savanna	Fire
Lower Priority	5	Game Species	Hunting of Game Species
	6	Native fish species	Fishing

III. Conservation Threats

Nine primary threats have been identified for inclusion in the threat analysis, each of which is analyzed in Annex 5. Following a planning workshop held in Gracie Rock, it was decided to combine three of these threats - hunting, hunting for Central American River Turtle, and fishing – for the purposes of the following overview. The more detailed analysis of severity and scope can be found in Annex 5:

Stress	Hunting / Fishing	Logging	Property Development	Fire	Removal of Connectivity	Tourism Impacts	Looting
Tropical broadleaf Forest	-	Low	Very High	Low	Low	Low	-
Short-grass Savanna	-	-	High	Very High	-	Low	-
Game Species	Low	-	Very High	Low	Medium	Low	-
Native Fish Species	High	-	High	-	-	-	-
Central American River Turtle	Medium	-	Very High	-	-	Low	-
Central American Spider Monkey	-	Low	Very High	-	Low	Low	-
Archaeological Sites	-	-	Very High	-	-	Low	Very High

Table 5: Stress ratings for Conservation Targets of Peccary Hills (using TNC 5-S Framework).

See Annex 5: Threat Assessment

Analysis of the impacts of the source of the threat under the TNC 5-S Framework is based on a combination of 'contribution' and 'irreversibility'.

Source	Hunting / Fishing	Logging	Property Development	Fire	Removal of Connectivity	Tourism Impacts	Looting
Tropical broadleaf Forest	-	Low	Very High	Low	Low	Low	-
Short-grass Savanna	High	-	Very High	Very High		Low	-
Game Species	Low	-	Very High	Low	Medium	Low	-
Native Fish Species	High	-	Low	-	-	-	-
Central American River Turtle	High	-	High	-	-	Low	-
Central American Spider Monkey	-	Low	Very High	-	High	Low	-
Archaeological Sites	-	-	Very High	-	-	Low	Very High

Table 6: Source ratings for Conservation Targets of Peccary Hills (using TNC 5-S Framework)

See Annex 5: Threat Assessment

Overall Threat Rank for the Peccary Hills Area

Conservation Target	Overall Threat Rank
Tropical broadleaf Forest	Very High
Short-grass Savanna	Very High
Game Species	Very High
Native Fish Species	High
Central American River Turtle	High
Central American Spider Monkey	Very High
Archaeological Sites	Very High
Overall threat rank	Very High

Table 7: Threat Ranks for Peccary Hills Area

The threat assessment indicates the threats (present and potential) to the conservation targets are potentially very severe, potentially even catastrophic. The over-arching threat is that posed by the Hwatchy property development, which would effectively remove almost all biodiversity value of the project area. Fire, fishing, and hunting of hicatee are the next most pressing threats. Tourism threats are assessed as being low – on the basis of coming from the current tourism management, which has demonstrated considerable environmental sensitivity. Operation of tourism activities under a different management policy or body would in all likelihood impact the threat assessment.

IV. Goals and Strategies

Using the results from the analysis of the target viability and threats, conservation strategies are developed that focus on threat abatement (reduction), towards the achievement of the project goals and objectives.

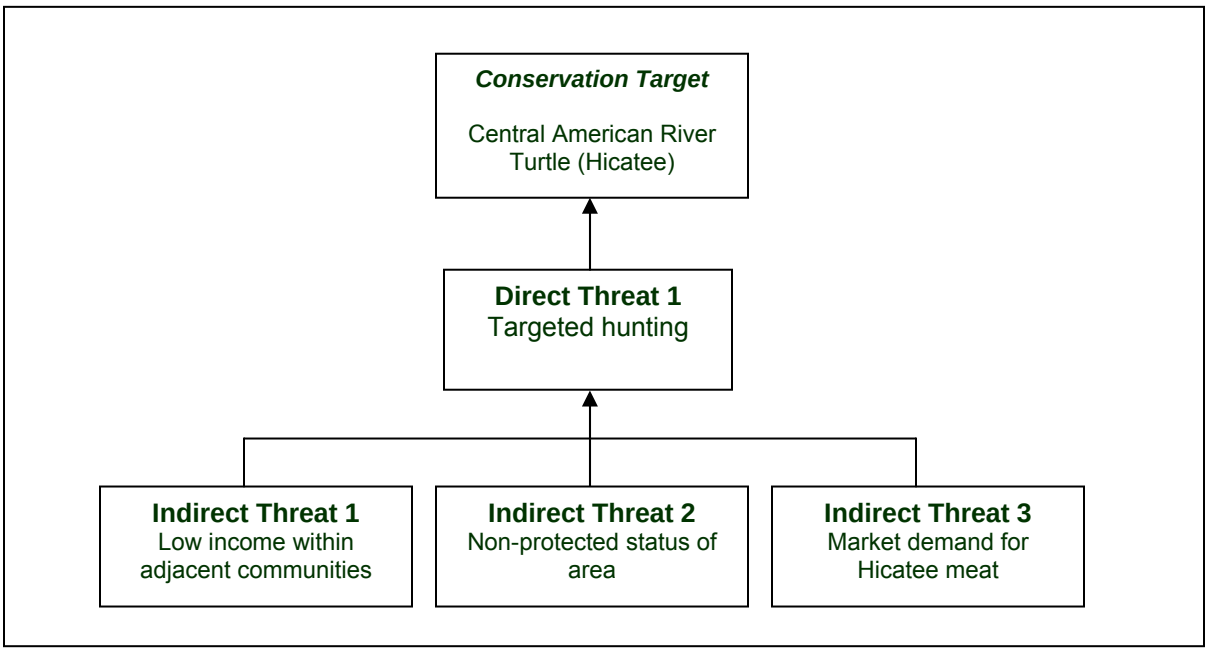
Overall Conservation Goals

1. Ensure the continued maintenance of the matrix of forest communities
2. Promote the regeneration of the pine forest system on the coastal plain
3. Ensure the continued maintenance of hydrologic processes to promote and maintain healthy, functioning aquatic ecosystems.
4. Protect viable populations of all species in the variety of habitats in which they naturally occur.

An objective is developed for each of the conservation targets, with a number of associated actions.

1. Central American River Turtle

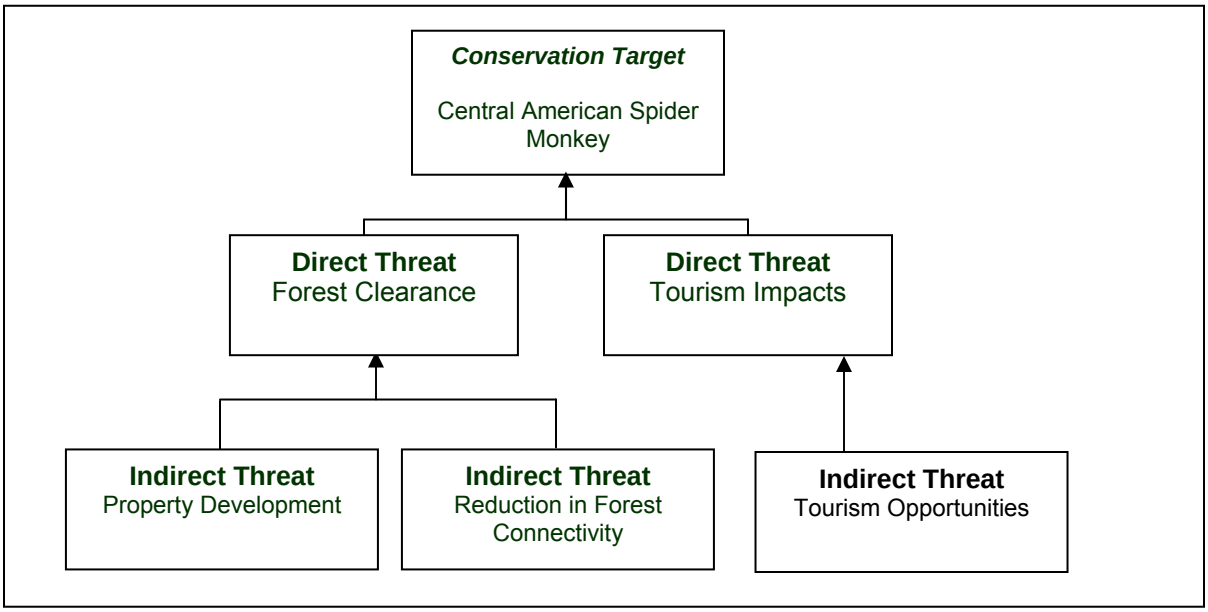
Objective: Improve size and condition of local Central American River Turtle population to 'very good' by 2010



Central American River Turtle: Threats and Strategies		
Threat	**Direct / Indirect**	**Strategy and Actions**
Hunting of hicatee within the protected area	Direct	**Strategy 1:** Prevent hunting of hicatee within the project area by direct and indirect means **Actions:** Develop enforcement plan; Prioritize enforcement of no hunting of hicatee; Increase patrolling within critical areas by Freshwater Creek; Demarcate boundaries and access points;
		Strategy 2: Increase awareness of the status of the Central American River Turtle **Actions:** Raise local awareness of endangered status of Central American River Turtle and importance of Freshwater Creek in conservation of this species; raise awareness of the goals and regulations towards protection of hicatee; increase knowledge of the distribution and abundance of the Central American River Turtle within the Freshwater Creek and Sibun areas; Ensure hicatee meat is boycotted by Maya World Adventures and associated companies
Non protected Status of Area	Indirect	**Strategy 1:** Establish Peccary Hills Area as a conservation area **Actions:** Seek funding (soft loan / grant) for purchase 8,000 acre Hwatchy Property; Develop agreement with Ministry of Natural Resources re. 10,600 acres national lands; Investigate feasibility of purchase of 1,000 acre Property A; Place land in trust for Belizean people through memorandum with Government of Belize. Develop conservation management plan for area; Develop Hicatee Recovery Plan for this location, in collaboration with relevant experts
Low income within adjacent communities	Indirect	**Strategy 1:** Facilitate complementary programmes and activities to assist local communities to develop improved, sustainable income **Actions:** Ensure local communities benefit from employment opportunities; Ensure that local communities have access to economic opportunities associated with the protected area; Develop alternative livelihoods associated with tourism, through training and provision of market opportunities; Ensure this is tied into a 'no-hunting' message

2. Central American Spider Monkey

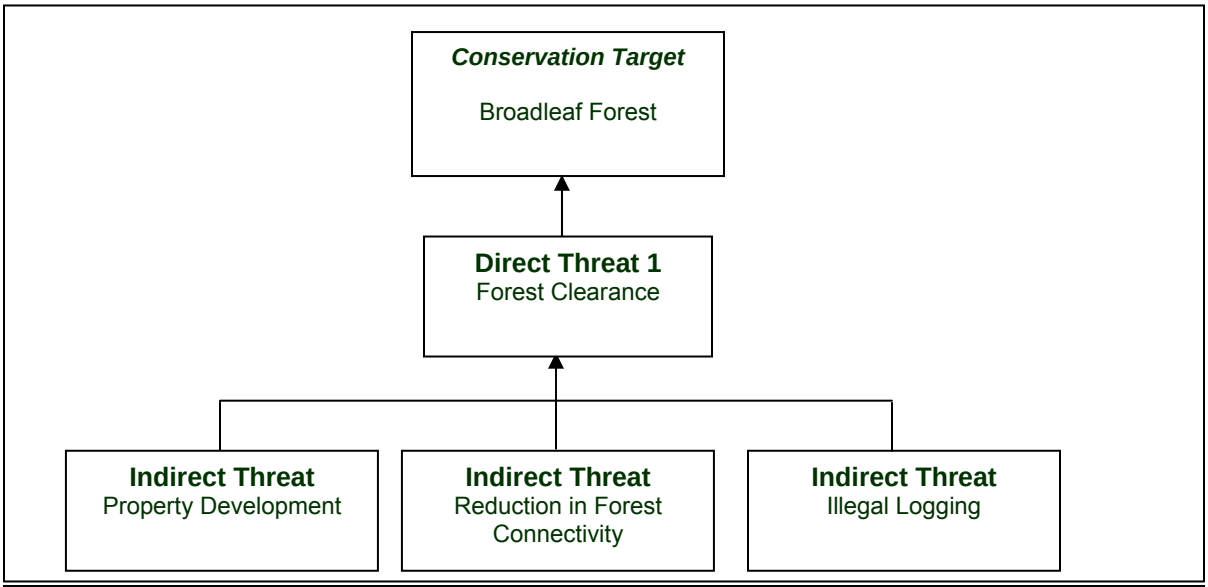
Objective: Maintain the population size and distribution of the Central American Spider Monkey in the Peccary Hills Area in its present state of better



Central American Spider Monkey: Threats and Strategies		
Threat	**Direct / Indirect**	**Strategy and Actions**
Forest Clearance	Direct	**Strategy 1:** Ensure that forest clearance is minimized **Actions:** Ensure control of activities through resolving ownership status of Peccary Hills area through purchase and agreements; Ensure any forest clearance that takes place is in accordance with conservation management planning and zonation; Ensure any forest clearance takes into account the distribution and use of the forest by Central American Spider Monkeys, and their need for forest connectivity
Tourism Impacts	Indirect	**Strategy 1:** Ensure tourism impacts on Central American Spider Monkeys are minimized **Actions:** Ensure any tourism activities takes into account the distribution and use of the forest by Central American Spider Monkeys, and minimize noise impact in these areas;
Property Development	Indirect	**Strategy 1:** Establish Peccary Hills Area as a conservation area **Actions:** Seek funding (soft loan / grant) for purchase 8,000 acre Hwatchy Property; Develop agreement with Ministry of Natural Resources re. 10,600 acres national lands; Investigate feasibility of purchase of 1,000 acre Property A; Place land in trust for Belizean people through memorandum with Government of Belize. Develop conservation management plan for area
Reduction of Forest Connectivity	Indirect	**Strategy 1:** Promote maintenance of forest connectivity **Actions:** Ensure any forest clearance takes into account the distribution and use of the forest by Central American Spider Monkeys, and their need for forest connectivity; Liaise with adjacent land owners, especially along the Sibun River, to encourage maintenance of connectivity of 66' riparian vegetation buffer; Maintain forest connectivity within the Peccary Hills Areas; Collaboration with DoE to encourage developers to maintain 66' riparian vegetation buffer

3. Tropical Broadleaf Forest

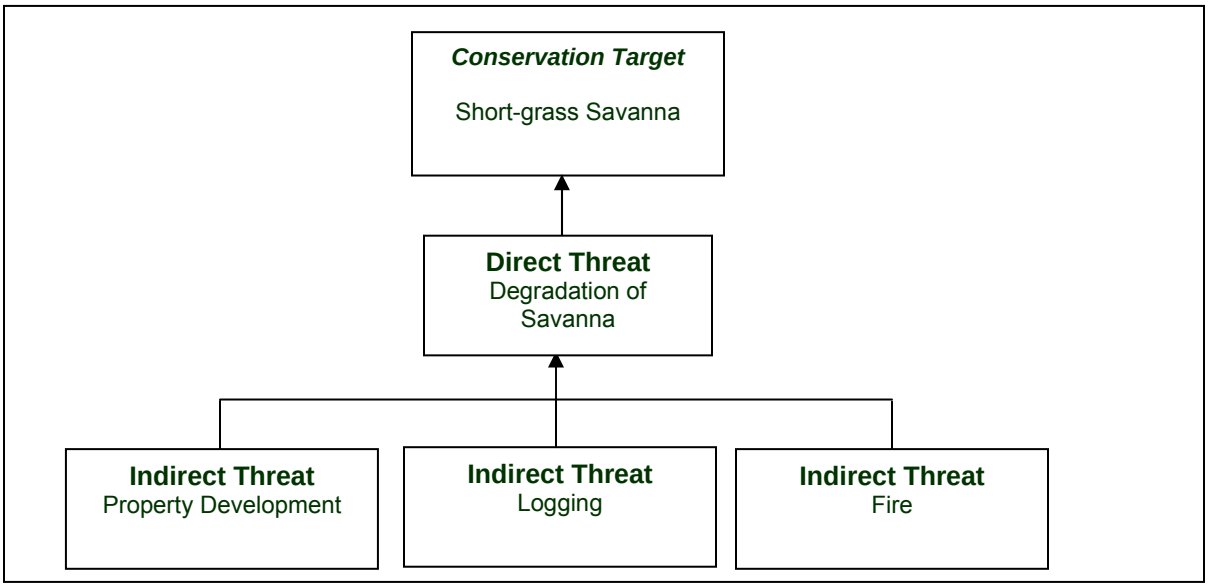
Objective: Maintain the integrity of the mature broadleaf forest areas and facilitate the regeneration of previously disturbed areas



Tropical Broadleaf Forest: Threats and Strategies		
Threat	**Direct / Indirect**	**Strategy and Actions**
Forest Clearance	Direct	**Strategy 1:** Ensure that forest clearance is minimized **Actions:** Ensure control of activities through resolving ownership status of Peccary Hills area through purchase and agreements; Ensure any forest clearance that takes place is in accordance with conservation management planning and zonation;
Property Development	Indirect	**Strategy 1:** Establish Peccary Hills Area as a conservation area **Actions:** Seek funding (soft loan / grant) for purchase 8,000 acre Hwatchy Property; Develop agreement with Ministry of Natural Resources re. 10,600 acres national lands; Investigate feasibility of purchase of 1,000 acre Property A; Place land in trust for Belizean people through memorandum with Government of Belize. Develop and implement conservation management plan for area
Reduction of Forest Connectivity	Indirect	**Strategy 1:** Promote maintenance of forest connectivity **Actions:** Ensure any forest clearance takes into account the distribution and use of the forest by Central American Spider Monkeys, and their need for forest connectivity; Liaise with adjacent land owner, especially along the Sibun River, to encourage maintenance of connectivity of 66' riparian vegetation buffer; Maintain forest connectivity within the Peccary Hills Areas; Collaboration with DoE to encourage developers to maintain 66' riparian vegetation buffer
Illegal Logging	Indirect	**Strategy 1:** Prioritize patrolling to prevent logging incursions **Actions:** Patrol to ensure that no logging incursions take place; Demarcate boundaries of conservation area clearly; Identify critical entry areas for priority patrolling; Develop planning for clear enforcement actions within conservation management plan; Liaise with Forest Department on enforcement

4. Short-grass Savanna

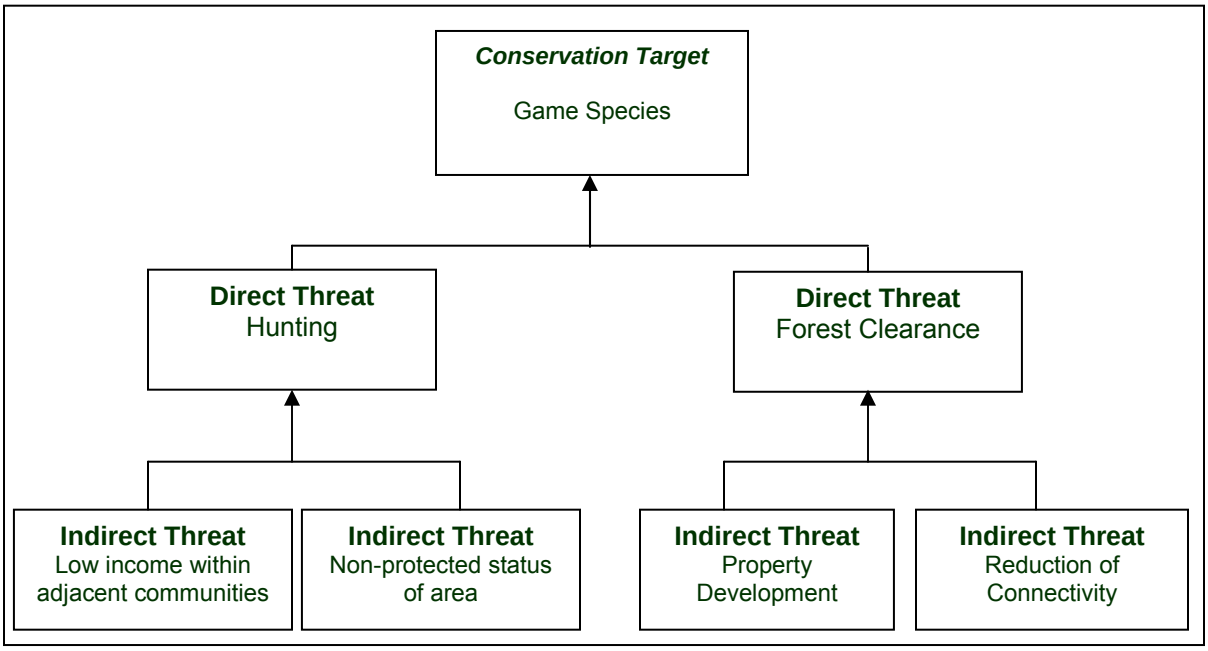
Objective: Restoration of the pine component of the short-grass savanna and associated plant community assemblages by 2010



Short-grass Savanna: Threats and Strategies		
Threat	**Direct / Indirect**	**Strategy and Actions**
Degradation of short-grass savanna	Direct	**Strategy 1:** Implement strategies towards the restoration of the short-grass savanna **Actions:** Ensure control of activities through resolving ownership status of Peccary Hills area through purchase and agreements; Ensure any activities that take place in the short-grass savanna area is in accordance with conservation management planning and zonation; Develop and implement a fire management programme; develop and implement a savanna restoration programme
Property Development	Indirect	**Strategy 1:** Establish Peccary Hills Area as a conservation area **Actions:** Seek funding (soft loan / grant) for purchase 8,000 acre Hwatchy Property; Develop agreement with Ministry of Natural Resources re. 10,600 acres national lands; Investigate feasibility of purchase of 1,000 acre Property A; Place land in trust for Belizean people through memorandum with Government of Belize. Develop and implement conservation management plan for area
Logging	Indirect	**Strategy 1:** Collaborate with GoB to ensure that logging concessions are not granted for this area **Actions:** Collaborate with GoB to ensure that logging concessions are not granted for this area; Patrol to ensure that no logging incursions take place; Demarcate boundaries of conservation area clearly; Identify critical entry areas for priority patrolling; Develop clear enforcement actions within conservation management plan; Liaise with Forest Department on enforcement
Fire	Indirect	**Strategy 1:** Develop Fire Management Programme for the short-grass savanna **Actions:** Develop and implement a fire management programme; Train employees and community participants in fire management; raise awareness of the problems of unmanaged fires; Increased vigilance against hunters in dry season

5. Game Species

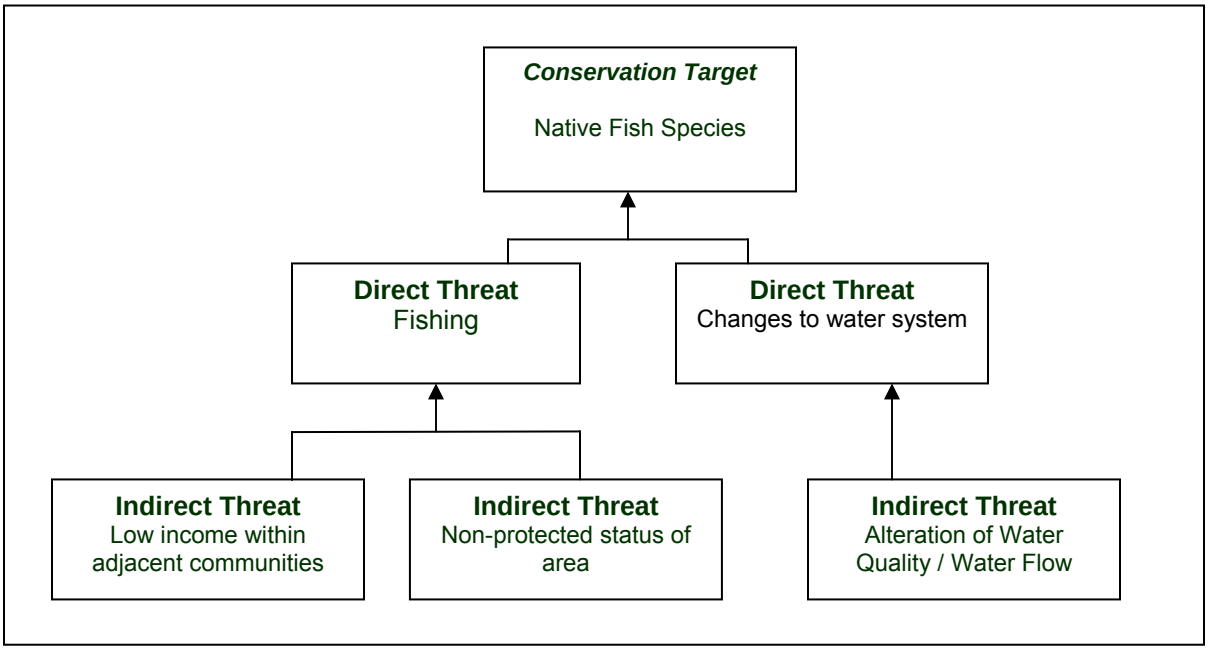
Objectives: Improve the population size and condition of game species to 'very good' by 2010



Game Species: Threats and Strategies		
Threat	**Direct / Indirect**	**Strategy and Actions**
Hunting within the project area	Direct	**Strategy 1:** Reduce hunting within the project area by direct and indirect means **Actions:** Develop enforcement plan; Prioritize enforcement of no hunting regulation; Increase patrolling within critical areas and at critical times; Demarcate boundaries and access points; **Strategy 2:** Increase awareness of the benefits of conserving game species **Actions:** Raise local awareness of conservation; raise awareness of the goals and regulations towards protection of game species; Ensure wild game meat is boycotted by Maya World Adventures and associated companies
Forest Clearance	Direct	**Strategy 1:** Establish Peccary Hills Area as a conservation area **Actions:** Seek funding (soft loan / grant) for purchase 8,000 acre Hwatchy Property; Develop agreement with Ministry of Natural Resources re. 10,600 acres national lands; Investigate feasibility of purchase of 1,000 acre Property A; Place land in trust for Belizean people through memorandum with Government of Belize. Develop and implement conservation management plan for area
Low income within adjacent communities	Indirect	**Strategy 1:** Facilitate complementary programmes and activities to assist local communities to develop improved, sustainable income **Actions:** Ensure local communities benefit from employment opportunities; Ensure that local communities have access to economic opportunities associated with the protected area; Develop alternative livelihoods associated with tourism, through training and provision of market opportunities; Ensure this is tied into a 'no-hunting' message

6. Native Fish Species (Cichlids)

Objectives: Improve the population size and condition of the Native Fish Species by 2010



Native Fish Species: Threats and Strategies		
Threat	**Direct / Indirect**	**Strategy and Actions**
Fishing within the project area	Direct	**Strategy 1:** Reduce fishing within the project area by direct and indirect means **Actions:** Develop enforcement plan; Prioritize enforcement of no fishing regulation; Increase patrolling within critical areas and at critical times; Demarcate boundaries and access points; Raise local awareness of conservation; raise awareness of the goals and regulations towards protection of fish species;
Changes to water system	Direct	**Strategy 1:** Ensure that good water quality and flow are maintained in Freshwater Creek and associated wetland systems **Actions:** Ensure that all tourism activities minimize impacts on water quality and water flow; Ensure riparian vegetation is protected; Ensure all measures are taken to prevent pollutants entering the water; Provide protection for mangrove habitat and associated wildlife; Ensure any infrastructure development does not impact water flow or water quality;
Low income within adjacent communities	Indirect	**Strategy 1:** Facilitate complementary programmes and activities to assist local communities to develop improved, sustainable income **Actions:** Ensure local communities benefit from employment opportunities; Ensure that local communities have access to economic opportunities associated with the protected area; Develop alternative livelihoods associated with tourism, through training and provision of market opportunities; Ensure this is tied into a 'no-fishing' message

Native Fish Species: Threats and Strategies (continued)		
Threat	**Direct / Indirect**	**Strategy and Actions**
Non-protected area status	Indirect	**Strategy 1:** Establish Peccary Hills Area as a conservation area **Actions:** Seek funding (soft loan / grant) for purchase 8,000 acre Hwatchy Property; Develop agreement with Ministry of Natural Resources re. 10,600 acres national lands; Place land in trust for Belizean people through memorandum with Government of Belize. Develop and implement conservation management plan for area

Strategy Leverage

It is possible to look at the impact each strategy may have over all the conservation targets, to analyze the leverage of each activity (Table 8), in terms of the number of targets they impact.

Strategies	Short grass savanna	Tropical broadleaf forest	Game Species	Native fish species	Central American River Turtle	Central American Spider Monkey	Total
Prioritize patrolling – reduce hunting, fishing and logging							
Establish Peccary Hills as a Conservation Area							
Increase awareness of importance of conservation							
Facilitate complementary programmes and activities to assist local communities to developed improved sustainable income							
Ensure that forest clearance is minimized							
Promote maintenance of forest connectivity							
Ensure tourism Impacts are minimized							
Implement strategies towards rehabilitation of short-grass savanna							
Collaborate with GoB to prevent logging concession for area							
Increase Awareness of status of Central American River Turtle							
Ensure maintenance of good water quality and flow							
Develop fire management programme							

Key		
	Low	**Impacts 1 – 2 targets**
	Medium	**Impacts 3 – 4 targets**
	High	**Impacts 5 – 6 targets**

Table 8: Strategy Leverage

Of the twelve strategies, two are highlighted as being of the greatest impact. These are:

- **Establish Peccary Hills as a Conservation Area**
- **Prioritize patrolling – reduce hunting, fishing and logging**

Prioritized and implemented, these will have the greatest positive affect on the Peccary Hills Area.

Five strategies have a medium level impact – positively affecting between three and four targets, whilst the last five strategies are more specific, affecting one or two targets.

V. Measures of Success

Table 9: Measures of Success – Objectives and Goals

	Target	Trend Data	Activity	Indicator
Short-grass Savanna				
Objective: Restoration of the pine component of the short-grass savanna and associated plant community assemblages by 2010				
Goal: To improve the condition of the short grass savannah primarily by reducing anthropogenic fire impacts and restoration of pine ecosystem	Reduce anthropogenic fires on savanna to once every three years	Number of fires per year and % savanna burnt	Log fire activity on the savanna and map extent	% of savanna not exposed to fire more frequently than every five years;
	Increase the % area showing regeneration of pine	% area of savanna with pine with pine seedlings	Map areas showing pine regeneration through presence of seedlings	% savanna showing regeneration of pine
Tropical broadleaf Forest				
Objective: Maintain the integrity of the mature broadleaf forest areas and facilitate the regeneration of previously disturbed area				
Goal: To maintain the broadleaf forest in its current condition or better	Ensure that 100% of the unimpacted broadleaf forest remains in its present state	Number of impacts on the broadleaf forest (fires, logging, clearance), and % area affected	Monitor any impacts on the broadleaf forest – number and area	% of mature forest with no anthropogenic impacts to forest structure
Goal: To allow previously impacted areas to continue regeneration free from the risk of anthropogenic fires	Ensure that previously impacted forest regenerates in all areas outside the footprint of current tourism development	Number of impacts on the regenerating area, and % of previously impacted forest affected	Monitor any impacts on the disturbed broadleaf forest – number and area	% of previously impacted forest demonstrating undisturbed succession;

Game Species				
Objective: Improve the size and condition of the Game Species population to 'very Good' by 2010				
Goal: To increase the size of the local game species population through cessation of hunting	Reduce hunting activity within the project	Number of hunters (or signs of hunters) encountered within area	Log number of encounters with hunters (or signs of hunters) within the area	Number of hunters encountered (or signs of hunters) annually within the area
	Increase game species densities	Frequency of trap incidents	Monitor game species presence in key locations using camera traps	Population density of game species (through camera trapping)
Native Fish Species				
Objective: Improve the size and condition of the native fish species community by 2010	Reduce fishing activity within the project	Number of fishermen (or signs of fishermen) encountered within area	Log number of encounters with fishermen (or signs of fishermen) within the area	Number of fishermen encountered (or signs of fishermen) annually within the area
Goal: To increase the size and condition of the native fish species population to 'very good' by 2010	Increase the number and size of the target cichlid fish species	Density, and size of target species in monitoring locations	Monitor density of indicator species at set monitoring points every quarter	Population density of target indicator cichlid species (*Petenia splendida, Cichlasoma friedrichsthali and C. synspilum*)
Central American River Turtle (*Dermatemys mawii*)				
Objective: Improve size and condition of the Central American River Turtle population to 'very good' by 2010				
Goal: Improve the status of *Dermatemys mawii* within the Peccary Hills area, by improving size and condition of local population to Very Good	To enable the population density and size distribution for this species to return to non-impacted levels	Changing population density and size structure of the population	Annual assessment of population density, and of size-class distribution.	Increased population density, and greater representation of larger size classes within the population within the Peccary Hills area.
Central American Spider Monkey				
Objective: Maintain the size and distribution of the Central American Spider Monkey population in the Peccary Hills in its present state or better				
Goal: To ensure continued viability of the Central American Spider Monkey population by increasing population size and condition	To enable the population density and group size for this species to return to non-impacted levels	Changing population density and group size	Annual assessment of overall population and group size distribution within the focal area	Population density and group size structure Central American Spider Monkey within the project area.

VI. Project Capacity

The Peccary Hills and adjacent savanna system is currently under the management of Maya World Adventure, under agreements with the owner of the 8,000acre Hwatchy property, and the Government of Belize (re. the national lands in which the savanna system is located). In the interests of community support and the dissemination of benefits, residents of Gracie Rock are an integral component of the management team established by Maya World Adventure. Initial focus has been on the establishment of a significant tourism use of the area, maximizing upon the locality and the rich natural and cultural resources. Management focus is now being focused upon the need to secure the future of these resources – both for their conservation and to sustain the ongoing tourism development. This critical path is effectively an inversion of that of most of Belize's protected areas – financial sustainability has been established prior to the formal protection of the area. The benefits of this approach are numerous, the two most important being the early establishment of both wide-scale community support (rare in Belize), and financially sustainable management.

The management team currently has a corporate structure, with an experienced project director, an on-site management team and workforce recruited from Gracie Rock. The mutually beneficial, and somewhat philanthropic, relationship between Maya World Adventure and Gracie Rock is scheduled to be formalized under the proposals for the long-term management structure – with the residents of Gracie Rock having a structured involvement in all levels of management through an advisory committee. The maintenance of an overall corporate structure is the recommended option – the benefits of business professionalism merged with stakeholder involvement are manifested in the accomplishments made to date. In terms of ability to generate economic benefits for stakeholder communities from conservation areas, this management structure could well become a model for use elsewhere in Belize – and is very much in line with government goals.

Project Capacity

An evaluation of the organizational capacity of those interested – the Gracie Rock community and Maya World Adventure - in taking on the management of the Peccary Hills area is based on six criteria:

1. **Staff Leadership**
2. **Multidisciplinary Team**
3. **Institutional Leadership**
4. **Funding**
5. **Social / Legal Framework**
6. **Community and constituency Support**

1. Staff Leadership

Definition: The presence of a talented staff member with lead responsibility for conserving the area. If multiple staff leaders are involved, they must also have a shared vision of success and successful collaboration mechanisms in place.

Staff Leadership		
Rating	**Description**	
Very High	A staff leader has (1) clearly assigned responsibility, authority, and accountability for conserving the area, (2) experience in implementing conservation strategies, and (3) sufficient time to focus on developing and implementing conservation strategies at the area. If multiple staff leaders are involved, they have a shared vision of success and successful collaboration mechanisms in place	
High	A staff leader has any two, but not all three elements of focused staff responsibility (responsibility, experience, time). If multiple staff leaders are involved, there may be some difficulties in collaboration.	
Medium	A staff leader has no more than one of the three elements of focused staff responsibility (responsibility, experience, time). If multiple staff leaders are involved, they have conflicting visions of success and no collaboration mechanisms	
Low	No staff member(s) with designated job responsibility for site conservation.	

High: At present, there is a clearly designated leadership role, filled by Nick Bougas of Maya World Adventures, who has the vision necessary to ensure that the Peccary Hills Area can achieve its aim as a contributor to the National Protected Areas System. Within the Gracie Rock community, this leadership role is recognized, respected and supported.

The rating of 'High', as opposed to 'Very High' reflects the present focus on tourism – though implementation of basic conservation strategies to date have been through the tourism aspect, so the tourism and conservation management cannot be considered as mutually exclusive. The current management trend is towards a rating of Very High

2. Multidisciplinary Team

Definition: Project receives support from an experienced, multidisciplinary team to develop and implement key conservation strategies - located on site, within the lead institution(s) or provided by partner organizations.

Multidisciplinary Team		
Rating	**Description**	
Very High	The project receives sufficient experienced support from a project team in all functions needed for successful conservation strategy implementation.	
High	The project receives support from a project team – but regular assistance is not available in a few important programmatic areas needed for successful conservation strategy implementation.	
Medium	The project receives support from a project team – but regular assistance is not available in many important programmatic areas needed for successful conservation strategy implementation.	
Low	The project receives insufficient assistance in most programmatic areas.	

High: The project has an experienced team able to provide the administrative and logistical support required for the long-term success of Peccary Hills as a conservation area, but lacks experience in conservation management. However, the management body acknowledges this gap in current capacity, and the hiring of appropriate skills is included within the Maya World Adventures business plan, along with training for the development of these skills within the organization. Development of formal collaborative support mechanisms with others in the conservation arena will help maintain this rating.

The rating of 'Medium' has been allocated to reflect the willingness of the project managers to invest in technical assistance when it has been needed to date – for development of a biodiversity assessment of the area, and for conservation planning. It is anticipated that this will continue into the future, when a more detailed 5-year management plan will be required.

3. Institutional Leadership

Definition: A private conservation organization (NGO), government agency, other private sector institution or some combination of institutions is providing leadership for developing and implementing conservation strategies at the project area. If multiple institutions are involved they must have a shared vision of success and successful collaboration mechanisms in place.

High: Maya World Adventures is in a clear leadership position, and has developed a successful and collaborative relationship with the Gracie Rock community, with a shared vision for the Peccary Hills area. Whilst there is a need formalize this arrangement, the de facto management partnership is ranked as High in institutional leadership. Gracie Rock would like to see the formation of a registered community

advisory group to represent their interests in the conservation of the area. Formalization of this structure, concurrent with the building of conservation management capacity will increase the rating to Very High.

Institutional Leadership		
Rating	**Description**	
Very High	There is clear leadership provided by one or a combination of institutions that (1) have established clear responsibility and (2) developed adequate capacity to implement conservation strategies. If multiple institutions are involved they have a shared vision of success and successful collaboration mechanisms in place.	
High	Institutional leadership is being provided but assignment of responsibility or adequate capacity is not at a sufficient level. If multiple institutions are involved, there may be some difficulties in collaboration.	
Medium	Institutional leadership is failing to provide adequate capacity to implement conservation strategies even though responsibility for project area is has been accepted by one our more institutions. If multiple institutions are involved, there are serious difficulties in collaboration.	
Low	No institution has clear responsibility or adequate capacity to implement conservation strategies	

4. Funding

Definition: Existence of sufficient operational funding to support the staff and operating costs, as well as program funding to implement and sustain key strategies. Funding may come from both private and public sectors and be available through a variety of mechanisms and sources, such as appropriation of public funds, contributions by donors, endowment and other sources.

Funding		
Rating	**Description**	
Very High	Funding to implement key conservation strategies and for core operations has been secured, pledged, or is highly probable for at least two years, and the project has developed likely sources of long-term funding to sustain core costs and key conservation strategies for the next 5 years	
High	Funding to develop and launch key conservation strategies and for core operations has been secured, pledged, or is highly probable for at least two years, and the project has undertaken the necessary financial planning and achieved partial success in developing sources of long-term funding to sustain core costs and key conservation strategies for the next 5 years.	
Medium	Funding has been secured or pledged for core operations for at least one year and some planning underway to develop diversified sources of long-term support for operations and conservation strategies.	
Low	Funding has not been secured or pledged for core operations for one-year and no planning or implementation of long-term funding sources.	

High: Funding to implement the key conservation strategies is available for at least the next two years, sustained by the already successful tourism activities – this is a known quantity. Logistical and administrative support are established and in place.

However, funding is being sought for the prime objective, the purchase of the Peccary Hills Area.

5. Social / Legal Framework

Definition: Existence of an appropriate framework of protection tools and policy instruments that can be deployed to secure enduring conservation results at the project area. The potential legal protection tools include many types of ownerships and forms, such as parks, privately owned conservation areas, community reserves, conservation easements or public designations. The potential policy instruments also include many types, such as development ordinances, legal permits, seasonal restrictions or no-take fisheries zones. This factor seeks to assess whether the potential legal framework for conservation at the project area exists, not whether it has been fully deployed or fulfilled.

Social / Legal Framework		
Rating	**Description**	
Very High	An appropriate framework of protection tools and policy instruments exists, and is either being deployed, or has the potential to be deployed at the project area	
High	Most key elements of a legal framework exist, but one key protection tool or policy instrument needs to be authorized or substantially amended.	
Medium	Medium: Some elements of a legal framework exist, but two or more key protection tools or policy instruments need to be authorized or substantially amended.	
Low	Few or no elements of a legal framework for conservation exist.	

High: Belize will soon have an appropriate policy framework (currently being developed) into which the project area can fit. There is support at Government level for the inclusion of the 10,600 acres Government land (though this still requires final authorization), and the wish to proceed with the purchase of the Hwatchy Property (and Property A, at this or a later stage), to then place the project area in trust for the Belizean people (as has been done with the Programme for Belize lands), with a long-term management agreement.

6. Community and constituency Support

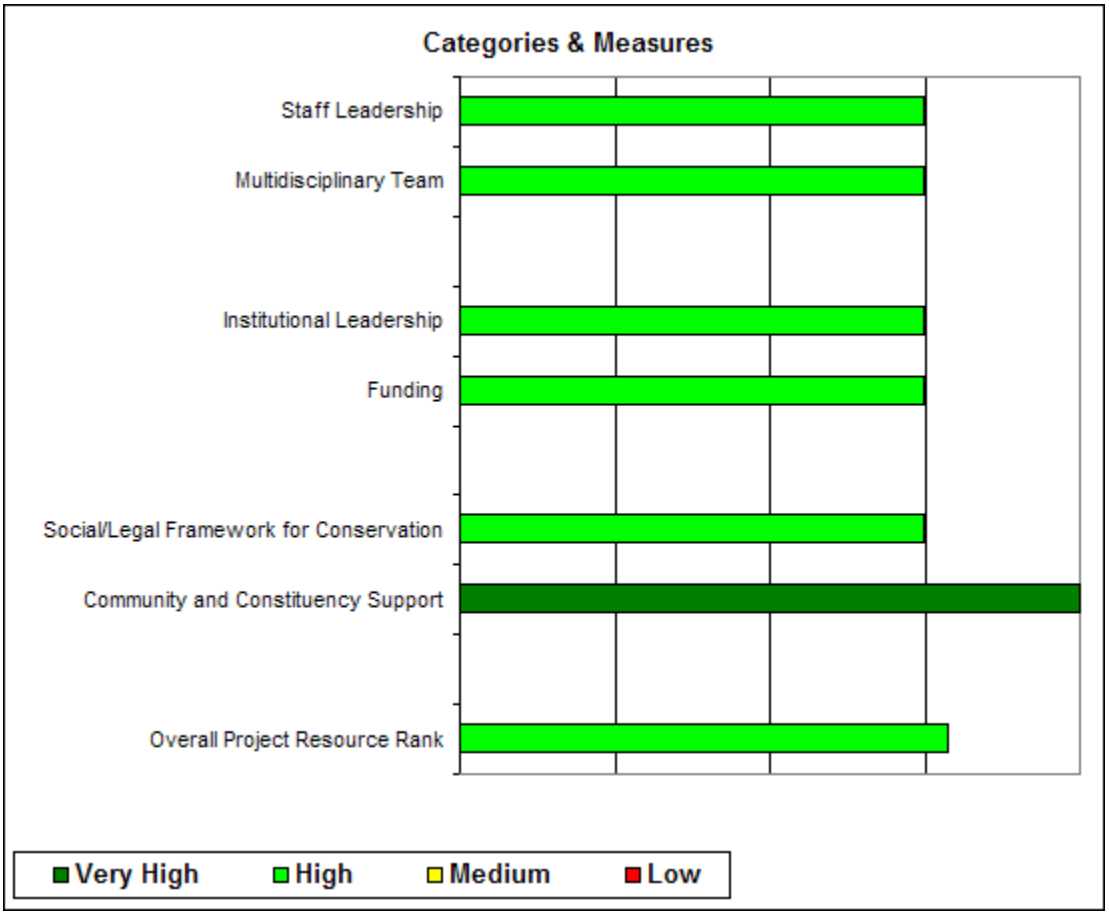
Definition: The project team effectively engages and gains the support of key constituencies, including those in the local community.

Very High: The project has the support of the stakeholder community, who are effectively engaged in social programmes and through direct employment. In the future there will also be further community involvement in the project through the formation of an advisory committee, to assist with conservation management. There

is support from the Ministry of Natural Resources, with negotiations towards the inclusion of the 10,600 acres of national land in the conservation planning area.

Community and Constituency Support		
Rating	**Description**	
Very High	The project team and their program are favorably received and supported by key constituencies, including those in the local community. There are no major obstacles to key strategy implementation due to community resistance.	
High	The project team and their program are largely favorably received and supported by key stakeholders, but there is some difficulty in strategy implementation due to community resistance.	
Medium	The project team and their program have mixed support in the community and there is some significant community opposition to strategy implementation.	
Low	The project team and their program have very little support in the community and there is significant community opposition preventing most key strategy implementation.	

Categories & Measures	**Score**
People	
Staff Leadership	High
Multidisciplinary Team	HIgh
People Average	**High**
Internal Resources	
Institutional Leadership	High
Funding	High
Internal Resources Average	**High**
External Resources	
Social/Legal Framework for Conservation	High
Community and Constituency Support	Very High
External Resources Average	**Very High**
Overall Project Resource Rank	**High**
TNC Resource Analysis	



Graph 1: Analysis of Capacity, using TNC analysis framework

The outcome of the assessment suggests that the capacity of the organization is high, with a good leadership (though more focused currently on the tourism project). The support in terms of organizational skills, logistics, and administration is very high, but the management team lacks conservation management expertise – this, however, is an area that can be supplemented through support and assistance in critical strategy development areas, the development of a detailed conservation management plan, and the formation of partnerships with conservation organizations in-country.

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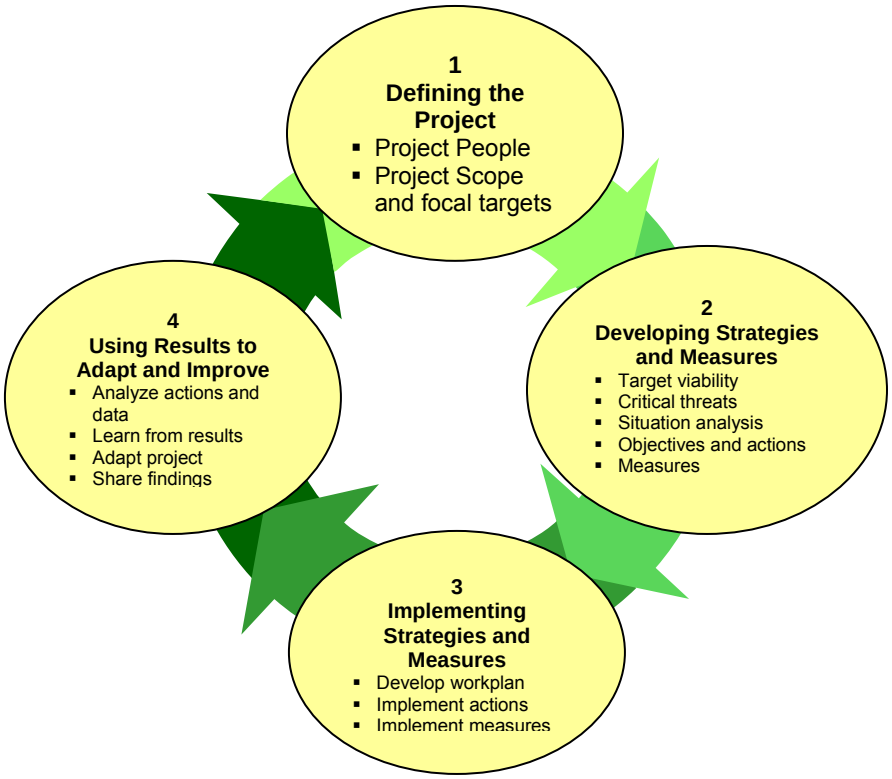
Annexes

Annex I. Conservation Planning

This 5-year conservation area plan for the Peccary Hills Area is based on the Nature Conservancy site conservation planning process and the Wildlife Conservation Society Living Landscapes Programme, which have been used to develop site-specific conservation strategies. It sets priorities and develops strategies for successful management of the resources that are then implemented during the course of the plan, to ensure the viability of the targeted ecosystems and species.

Following the Nature Conservancy's conservation planning model ensures that planning for the Peccary Hills Area, as a conservation area, is targeted at the long-term survival of all life and ecological communities represented within the target area – not just those that are threatened, as this approach usually consolidates species and ecosystems into major groupings that represent all the biodiversity within the area.

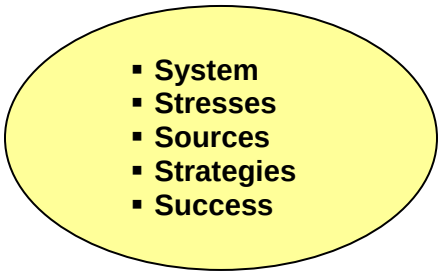
Success of implementation is essential to the planning cycle, and will need to be monitored to allow feedback into the adaptive planning cycle.



The Nature Conservancy Planning (CAP) Process

This conservation plan involves the first two steps of the TNC Conservation Area Planning process. It defines the project scope, and works towards developing strategies and measures, based on biodiversity viability and an analysis of the critical threats.

The TNC 5-S Framework has a structured, five step process, focused on the following areas:



The Nature Conservancy 5-S Framework

- **Systems - Identifying Conservation Priorities:** Species and ecosystems are selected as conservation elements – focusing conservation planning efforts within the Peccary Hills Area. These targets are chosen as representative of the biodiversity of the area and the main threats impacting biodiversity. A biodiversity assessment provides background data on the Peccary Hills Area and the conservation elements chosen, and feeds into the conservation planning.

- **Stresses:** A threat analysis determines how the conservation elements are impacted by anthropogenic interactions. This assessment has been supplemented by the Wildlife Conservation Society Landscape Planning threat assessment system, to give a broader view of the stresses to the systems.

- **Sources:** An assessment of the causes of impacts to the systems identifies and ranks the sources of the stresses, and why these interactions are taking place

- **Strategies:** The development of ways to mitigating threats and enhance biodiversity

- **Success:** A means of assessing the effectiveness in reducing the threats and improving the viability of the biodiversity in the Peccary Hills Area, through monitoring progress towards established goals

This analysis is done within the political framework of Belize and the socio-economic context of the immediate stakeholder communities.

Annex 2: Data Development

A biodiversity assessment was completed in 2005 to enable the development of a well informed conservation plan. This is now supplemented by an assessment of viability and threats (using TNC and WCS programmes), included within this plan. Data for these two reports was derived from a number of sources. Fieldwork and community input from the Gracie Rock community provided much of the baseline biodiversity data, with information on bird populations from the adjacent Runaway Creek private reserve, where there has been active long-term monitoring of resident and migratory birds. This field data was supplemented by previous work in the area towards the development of the Manatee Special Development Area (…..), and for an environmental impact assessment for the Hwatchy property development (Meerman, 1996). Land ownership details were provided by Mr. David Gegg, director of the lead management organization, Maya World Adventures. Protected area information for an analysis of connectivity was assisted by the Forest Department, who provided the newly revised statutory instrument for Manatee Forest Reserve.

Species: All twenty-four species listed by IUCN as globally threatened that are present within the Peccary Hills Area were considered as targets or nested targets (1 critically endangered, 5 endangered, 6 vulnerable and 12 lower risk / near threatened; IUCN, 2004). Also considered were those species that have been highlighted as of national concern (including endemics and/or species in serious decline and/or where there are concerns for long-term viability), and G1-G3 species highlighted by Natureserve, defined as of concern by their global conservation status (Natureserve, 2005). The two species chosen as specific conservation targets are the Central American river turtle (*Dermatemys mawii*) and the yellow-headed parrot (*Amazona oratrix*) – both species that are currently facing rapidly declining numbers, with urgent need for specific conservation actions.

Species Assemblages: Where species have similar requirements, they have been grouped – native cichlid species, for example, is a grouping of several fish species that are indicative of the health of the Freshwater Creek system. This species assemblage is heavily pressured by over fishing, the primary stress on the system, and actions to mitigate this threat and ensure the maintenance of the freshwater environment for these species will benefit the freshwater system as a whole.

Conservation Element: Native Fish Species (Cichlids)	
Petenia splendida	Bay Snook
Cichlasoma synspilum	Redhead cichlid, Tuba
Cichlasoma friedrichsthali	Yellowjacket cichlid, Mus mus
Cichlasoma uropthalmus	Mayan cichlid
Cichlasoma spilurum	Blue-eyed cichlid

Game species is a similar example – a grouping of prey species (both birds and mammals) targeted by hunters, that span more than one ecosystem.

Conservation Element: Game Species	
Crax rubra	Great curassow
Penelope purpurascens	Crested guan
Agouti paca	Paca
Dasypus novemcinctus	Nine-banded armadillo
Tayassu tajacu	Collared peccary
Odocoileus virginianus	White-tailed deer
Mazama americana	Red brocket deer
Tapirus bairdii	Baird's Tapir

Ecosystems: Preliminary information on the ecosystems was interpreted from the Belize Ecosystem Map (Meerman and Sabido, 2001, revised 2004), using ArcView. This was then supplemented by ground truthing and fieldwork, giving greater accuracy at a higher resolution, applicable to future management strategies. An updated ecosystem was created for the Peccary Hills Area from the information gathered (Annex 6: Map 4).

Ecosystems of the Peccary Hills Area	
UNESCO classification	
Broad Ecosystems	**Ecosystem Categories**
Tropical Broadleaf Forest	Tropical evergreen seasonal broadleaf lowland forest over rolling calcareous hills
	Tropical evergreen seasonal broadleaf lowland forest over steep calcareous hills
	Tropical evergreen seasonal broadleaf lowland forest over calcareous soils; Yucatan variant
	Tropical evergreen seasonal broadleaf lowland forest over calcium-rich alluvium
	Tropical evergreen seasonal broadleaf lowland forest over poor or sandy soils
	Tropical evergreen seasonal broadleaf alluvial forest
	Tropical evergreen seasonal broadleaf lowland swamp forest: high variant
	Tropical evergreen seasonal broadleaf lowland swamp forest: low variant
	Tropical evergreen broadleaf scrub forest on calcareous crags
	Broad-leaved lowland shrubland: Miconia variant
	Deciduous lowland riparian shrubland of the plains
	Fire-induced lowland fern thicket
Short-grass Savanna	Short-grass savanna with needle-leaved trees
	Short-grass savanna with shrubs
	Eleocharis marsh
Freshwater Wetlands	Tropical lowland tall herbaceous swamp
	Tropical floating leaf communities of freshwater lakes
	Tropical underwater communities of freshwater lakes
	Rooted underwater communities of flowing water
	River
	Riverine mangrove forest
Agriculture	Shifting cultivation including unimproved pasture
	Woody perennial crops
***Classification follows Meerman and Sabido, 2001 (revised 2004)**	

Annex 3: Biodiversity Health

Introduction

Identifying elements of conservation concern is a preliminary step in planning for conservation action. The next step is to identify the effect of any threats on the viability of conservation elements and the biodiversity health of the area as a whole. Threats are conditions or activities that negatively affect conservation elements, either directly or indirectly. Viability is the likelihood that an element will persist long-term. Biodiversity health is an aggregation of the viability of all the conservation elements, the likelihood that the conservation area will remain an ecologically functioning landscape over time. Threats and biodiversity health are examined within a 5-year time frame, using current conditions and projected trends. A re-assessment should take place half way through the implementation process, again projecting 5 years into the future.

Biodiversity Viability Assessment

Table 3: TNC Viability Criteria	
Size	A measure of the target's area or abundance, based on the minimum requirement needed to ensure survival after natural disturbance
Condition	An integrated measure of community composition, structure and biotic interactions (eg. structure, population components etc.)
Landscape Context	An integrated measure of two factors – key elemental processes that sustain the species or ecosystem, and connectivity

The status of the eight identified conservation targets is assessed using the TNC target viability ranking, based on size, condition and landscape context (Table 3). Within each of these three viability criteria, the conservation targets are rated using the following scale (Table 4):

Table 4: TNC Viability Ratings	
Very Good:	Functioning at an ecologically desirable status, and requires little human intervention
Good:	Functioning within its range of acceptable variation; may require some human intervention
Fair:	Lies outside its range of acceptable variation and requires human intervention. If unchecked, the target will be seriously degraded
Poor:	If allowed to remain in the present status, restoration or preventing local extinction will be impossible

Annex 4: Conservation Elements and Nested Targets

Conservation Target: Tropical Broadleaf Forest

Conservation Elements and Nested Targets					
Tropical Broadleaf Forest Ecoregion: Petén-Veracruz Moist Forest (WWF: CR/EN)		**IUCN**	**CITES**	**GCS**	**National Status**
Ecosystems					
Tropical evergreen seasonal broadleaf lowland forest over rolling calcareous hills					
Tropical evergreen seasonal broadleaf lowland forest over steep calcareous hills					
Tropical evergreen seasonal broadleaf lowland forest over calcareous soils; Yucatan varient					
Tropical evergreen seasonal broadleaf lowland forest over calcium-rich alluvium					
Tropical evergreen seasonal broadleaf lowland forest over poor or sandy soils					
Tropical evergreen seasonal broadleaf alluvial forest					
Tropical evergreen seasonal broadleaf lowland swamp forest: high variant					*
Tropical evergreen seasonal broadleaf lowland swamp forest: low variant					
Tropical evergreen broadleaf scrub forest on calcareous crags					
Broad-leaved lowland shrubland: Miconia variant					
Deciduous lowland riparian shrubland of the plains					
Fire-induced lowland fern thicket					
Species					
Black-throated Shrike Tanager	*Lanio aurantius*			G3/4	
Blue Seedeater	*Amaurospiza concolor*			G3	
Central American Spider Monkey	*Ateles geoffroyi*			G3	
Jaguar	*Panthera onca*	NT		G3	
Rose-throated Tanager	*Piranga roseogularis*			G3	
Rufous breasted Spinetail	*Synallaxis erythrothorax*			G3	
Spot-breasted Wren	*Thryothorus maculipectus*			G3	
Stub-tailed Spadebill	*Platyrinchus cancrominus*			G3	
Tawny-winged Woodcreeper	*Dendrocincla anabatina*			G3	
White-bellied Wren	*Uropsila leucogaster*			G3	
White-collared Manakin	*Manacus candei*			G3	
Yellow-winged Tanager	*Thraupis abbas*			G3	
Yucatan Black Howler Monkey	*Alouatta pigra*			G3	
Yucatan Woodpecker	*Melanerpes pygmaeus*			G3	
*Highlighted as one of four national ecosystems with less than 10% protected, under the Gap Analysis, National Protected Areas Policy and System Plan. (Meerman, 2005)					

Conservation Target: Short-grass Savanna

Conservation Elements and Nested Targets		IUCN	CITES	GCS	National Status
Short Grass Savanna **Ecoregion: Belizean Pine Forest (WWF: CR/EN)**					
Ecosystems					
Short-grass savanna with needle-leaved trees					
Short-grass savanna with shrubs					
Eleocharis marsh					
Species					
Yellow-headed Parrot	*Amazona oratrix*	**EN**		**G2**	
Jabiru	*Jabiru mycteria*		**I**		
Yucatan Bobwhite	*Colinus nigrogularis*			**G3**	
Ruddy Crake	*Laterallus ruber*			**G3/4**	
Baird's Tapir	*Tapirus bairdii*	**VU**	**I**	**G3**	
Azure-crowned Hummingbird	*Amazilia cyanocephala*			**G3**	

Conservation Target: Native Fish Species (Cichlids)

Conservation Elements and Nested Targets					
Native Fish Species (Cichlids) **Ecoregion: Belize Coastal Mangrove**		**IUCN**	**CITES**	**GCS**	**National Status**
Ecosystems					
Tropical lowland tall herbaceous swamp					
Tropical floating leaf communities of freshwater lakes					
Tropical underwater communities of freshwater lakes					
Rooted underwater communities of flowing water					
River					
Riverine mangrove forest					
Species					
Agami Heron	*Agamia agami*				**VU**
Black Catbird	*Melanoptila glabrirostris*	**NT**		G3	NT
Black-crowned Night-Heron	*Nyctanassa nycticorax*				**VU**
Brown Pelican	*Pelecanus occidentalis*				**VU**
Central American River Turtle	*Dermatemys mawii*	**EN**			**EN**
Common Slider	*Trachemys scripta*	**LR/ NT**			**LC**
Goliath Grouper	*Epinephelus itajara*	**CR**			
Great Blue Heron	*Ardea herodius*				**VU**
Magnificent Frigatebird	*Fregata magnificens*				**VU**
Mangrove Swallow	*Tachycineta albilinea*			G3	
Mangrove Vireo	*Vireo pallens*			G3	
Mexican Giant Musk Turtle	*Staurotypus triporcatus*	**LR/ NT**			**NT**
Morelet's Crocodile	*Crocodylus moreletii*	**LR/ NT**	**I**		**CD**
Muscovy Duck	*Cairina moschata*				**VU**
Neotropical River Otter	*Lutra longicaudis*				**DD**
Snowy Egret	*Egretta thula*				**VU**
Tricolored Heron	*Egretta tricolor*				**VU**
Water Opossum	*Chironectes minimus*	**LR/ NT**			
West Indian Manatee	*Trichechus manatus*				**VU**
White Ibis	*Eudocimus*				**VU**
Yellow-crowned Night Heron	*Nyctanassa violacea*				**VU**

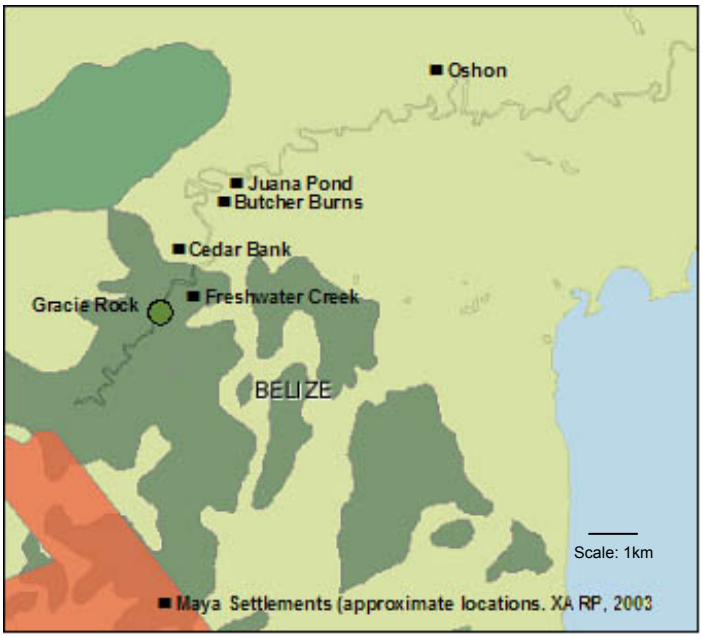
Conservation Target: Game Species

Species		IUCN	CITES	GCS	National Status
Crested Guan	*Penelope purpurascens*				VU
Great Curassow	*Crax rubra*	LR / NT			VU
Jaguar	*Panthera onca*	LR / NT	I	G3	NT
Jaguarundi	*Herpailurus yaguarondi*		I		LC
King Vulture	*Sarcoramphus papa*				VU
Margay	*Leopardus wiedii*		I		VU
Ocelot	*Leopardus pardalis*		I		VU
Puma	*Puma concolor*	LR / NT			NT
Collared Peccary	*Tayassu tajacu*				
Paca	*Agouti paca*				
Nine-banded Armadillo	*Dasypus novemcinctus*				
White-tailed Deer	*Odocoileus americana*				

Conservation Target: Central American Howler Monkey

Species		IUCN	CITES	GCS	National Status
Yucatan Howler Monkey	*Alouatta pigra*	EN	I	G3	VU
Kinkajou	*Potos flavus*				
Mexican Porcupine	*Panthera onca*				

Conservation Target: Cultural Heritage



Identified Maya Settlements in the Gracie Rock area
Map adapted from BERDS

Annex 5: Threat Assessment

Stress	Hunting		Fishing		Logging		Property Development		Tourism		Fire		Removal of connectivity	
Short grass savanna	-	-	-	-	-	-	V. High	High	Low	Low	V. High	V. High	-	-
	-		-		-		High		Low		V. High		-	
Tropical broadleaf forest	-	-	-	-	Low	Low	V. High	V. High	Low	Low	High	Low	Low	Low
	-		-		Low		V. High		Low		Low		Medium	
Game Species	Low	Low	-	-	-	-	V. High	V. High	Low	Low	Medium	Low	Medium	Medium
	Low		-		-		V. High		Low		Low		Medium	
Native cichlid species	-	-	High	High	-	-	High	High	-	-	-	-	-	-
	-		V. High		-		High		-		-		-	
Central American River Turtle	Medium	Medium	-	-	-	-	High	High	Low	Low	-	-	-	-
	Medium		-		-		V. High		Low		-		-	
Central American Spider Monkey	-	-	-	-	Low	Low	V. High	V. High	Low	Low	-	-	Low	Low
	-		-		Low		V. High		Low		-		Low	
	Severity	Overall												
	Scope													

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 stress is likely to destroy or eliminate the conservation target over some portion of the target's occurrence at the site.

High: The stress is likely to seriously degrade the conservation target over some portion of the target's occurrence at the site.

Medium: The stress is likely to moderately degrade the conservation target over some portion of the target's occurrence at the site.

Low: The stress 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 stress is likely to be very widespread or pervasive in its scope, and affect the conservation target throughout the target's occurrences at the site.

High: The stress is likely to be widespread in its scope, and affect the conservation target at many of its locations at the site.

Medium: The stress 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 stress 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.

Source	Hunting		Fishing		Logging		Property Development		Tourism		Fire		Removal of connectivity	
Short grass savanna	-	-	-	-	-	-	V. High	V. High	Low	Low	V. High	V. High	-	-
			-		-		V. High		Low		High		-	
Tropical broadleaf forest	-	-	-	-	Low	Low	V. High	V. High	Low	Low	Low	Low	Low	Low
	-		-		Low		V. High		Low		Medium		Medium	
Game Species	Low	Low	-	-	-	-	V. High	V. High	Low	Low	Low-	Low	Low	Medium
	Low		-		-		V. High		Low		Low-		Medium	
Native cichlid species	-	-	V. High	High	-	-	Low	Low	-	-	-	-	-	-
	-		Medium		-		Low		-		-		-	
Central American River Turtle	V. High	High	-	-	-	-	High	High	Low	Low	-	-	-	-
	Medium		-		-		High		Low		-		-	
Central American Spider Monkey	-	-	-	-	Low	Low	V. High	V. High	Low	Low	-	-	Medium	High
	-		-		Low		V. High		Low		-		V. High	
	Contribution	Overall												
	Irreversibility													

Contribution: 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: reversibility of the stress caused by the Source of Stress.

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

Assessing the threats to biodiversity is a three-part process:

a) Identifying historical, active and potential threats
b) Assessing the threat scope and severity
c) Rating threat severity, urgency, relative area, recovery and potential

This analysis, combined with that of the viability assessment, produces the information required for prioritization of conservation actions and resources. The TNC threat assessment can be used to produce an overall threat rank, based on an analysis of the stresses facing the conservation elements and the sources of those threats. A stress is a process or event with direct negative consequences for the conservation element (such as the alteration of stream flow). The source of the stress is the action or entity that produces the stress (eg. the damming of the stream). These are identified and rated individually for each conservation element, and then combined to produce an overall threat score.

Information is gathered on the following criteria for each of the conservation targets, for incorporation into the more detailed threat analysis, based on the WCS Living Landscapes threat analysis:

☐ **Threat Status:** Whether the threat is:
- **Historical**
- **Present / Active**
- **Potential**

☐ **Target:** The conservation target(s) affected by the threat.

☐ **Source of Threat:** The direct and indirect sources of the threat.

☐ **Area:** The percentage of the conservation target area the threat affects, using the following WCS rankings – each ranking is associated with a score that is then incorporated into the analysis

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

☐ **Severity:** The severity of the threat – how intense or great the impact is – is rated using the following scoring system:

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

☐ **Urgency:** The likelihood of the threat occurring over the next five years is ranked on a scale of:

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

☐ **Recovery Time:** The length of time it will take the target to recover following major disturbance, ranked on a scale of:

Recovery Ranking		(adapted from WCS)
Criteria	**Score**	
Recovery	**3**	100+ years or never
	2	11-100 years
	1	1-10 years
	0	Immediate

☐ **Probability of the Threat Occurring:** The probability of the threat occurring during the timeframe of the management plan, ranked on a scale of:

Probability Ranking		(adapted from WCS)
Criteria	**Score**	
Probability	**1.00**	0.76-1.0
	0.75	0.51-0.75
	0.50	0.26-0.50
	0.25	≤0.25

☐ **Management Actions:** Specific management actions that can be used to reduce or eliminate the threat.

Nine primary threats have been identified for inclusion in the threat analysis, each of which is analysed below:

Threat 1: Logging		
Illegal removal of trees from the Tropical Broadleaf Forest within the Peccary Hills area		
Status	Active	
Target	Tropical Broadleaf Forest	
Source	***Direct:*** Cutting of selected trees by illegal loggers – mostly mahogany and cedar ***Indirect*:** Financial opportunities from logging; limited active patrolling and lack of signs	
Area	**1**	Very small area impacted – specific trees
Severity	**1**	Has a measurable effect on density and distribution within affected area
Urgency	**3**	Current threat. Illegal logging occurred last year, and loggers tried to enter property this year
Recovery Time	**2**	Most targeted trees would be replaced within this ecosystem within 50 to 100 years from existing seed trees
Probability of Threat Occurring	**1.00**	Without increased patrolling, illegal loggers will enter the property again in dry season at some point in the next five years
Management Actions	Increased vigilance against logging incursions, particularly from the Coastal Road; Guarded gate on access route from Gracie Rock	

Threat 2: Hunting		
Hunting of game species		
Status	Active	
Target	Game species (particularly paca, collared peccary, great curassow)	
Source	***Direct:*** Local communities ***Indirect*:** Protein supplement for diet; low income communities; market for game meat	
Area	**2**	Localized impact for specific species
Severity	**1**	Game populations currently increasing
Urgency	**3**	Hunting occurs at present
Recovery Time	**1**	With the exception of the white-lipped peccary, the abundance of game species is such that recovery to full population densities will be fast
Probability of Threat Occurring	**1.00**	Hunting is still occuring, though greatly reduced from past levels
Management Actions	Demarcation of boundaries following status change of property; signs; night patrols; enforcement of no hunting;	

Threat 3: Hunting Central American River Turtles		
Hunting of this endangered species is threatening its overall viability both locally, and globally		
Status	Active	
Target	Central American River Turtle	
Source	***Direct:*** Hunting of Central American River Turtle opportunistically by all communities. One commercial hunter in Freetown Sibun ***Indirect*:** Market demand, low income	
Area	**4**	The whole population is under threat, but the majority of hunting activity appears to come from Freetown Sibun
Severity	**3**	Local reports suggest that the population has declined, but young are still seen frequently each year in Freshwater Creek, and adults in the Sibun
Urgency	**3**	Hunting is ongoing, particularly from Freetown Sibun. Popular as a food item during Easter celebrations, when people from Belize City come to Gracie Rock .
Recovery Time	**2**	To recover sufficiently for there to be a healthy, unimpacted population, with natural size class representation, will take over ten years,
Probability of Threat Occurring	**1.00**	The threat is ongoing
Management Actions	Greater awareness of status of *Dermatemys mawii*; prioritization of enforcement of laws regulating hunting of *D. mawii*; increased knowledge of status of *D. mawii* population in Freshwater Creek and Sibun, distribution etc.; enforcement of seine net regulations in creeks; increased patrols before Easter; public awareness to sensitize communities regarding the critical nature of the hicatee populations within this locality	

Threat 4: Fishing		
Native fish populations decreasing from over-fishing		
Status	Active	
Target	Native fish species (cichlidae – *Petenia splendida, Cichlasoma friedrichsthali, Cichlasoma uropthalmus*)	
Source	***Direct:*** Fishermen from all local communities ***Indirect*:** Traditional activity; Low income families requirement to supplement diet	
Area	**4**	Native cichlids are taken preferentially by net and line in the Freshwater Creek, and with line, and sometimes seine nets across creeks in the nursery areas.
Severity	**2**	Fish stocks are currently reduced, and size of individuals caught is decreasing
Urgency	**3**	Fishing is continuing
Recovery Time	**1**	The fish population should recover within 10 years if fishing is stopped
Probability of Threat Occurring	**1.00**	Fishing will occur within the next year
Management Actions	Awareness of private protected area status within local communities; Enforcement of no fishing; Monitoring of fish stocks	

Threat 5: Fire		
Increasing frequency of anthropogenic fire within the savanna area of Peccary Hills		
Status	Active	
Target	Short-grass savannah, (including yellow-headed parrot and jabiru nesting sites)	
Source	***Direct:*** Fires started primarily by hunters ***Indirect*****:** Financial opportunities from hunting; lack of awareness / respect of legislation concerning burning of savannah; lack of awareness of the severe degredation caused by repeated fire; lack of prioritization of fire fighting by management	
Area	**4**	Fire spreads through the whole savanna in most years
Severity	**3**	The savannah ecosystem is changing, with local eradication of pine in some areas; nesting savanna birds species such as yellow-headed parrots and jabiru are impacted, but basic components of ecosystems still largely intact.
Urgency	**3**	Current threat. If not tackled, the ecosystem will degrade still further
Recovery Time	**2**	Recovery of the pine element of the savannah will take over ten years, if fire impacts are managed to allow regeneration
Probability of Threat Occurring	**1.00**	The threat is occurring increasingly frequently, and will occur at least once during the 5 year management period, if not more frequently
Management Actions	Developing and implementing a fire management programme, increased vigilance against hunters in the savanna dry season, fire awareness and fire management training for local communities	

Threat 6: Looting		
Removal of Maya artifacts from the karst caves		
Status	Historical; Potential	
Target	Mayan artifacts	
Source	***Direct:*** ***Indirect*****:** Low income; High value – monetary gain	
Area	**4**	Limited number of caves with artifacts – all are vulnerable
Severity	**3**	Once artifacts are looted, they can't be replaced
Urgency	**2**	The threat is increasing as more people become aware of the location of the caves
Recovery Time	**3**	Once artifacts are looted, they can't be replaced
Probability of Threat Occurring	**0.75**	The threat is increasing as more people become aware of the location of the caves
Management Actions	Greater protection of the caves; gated guarded entrance to property, frequent patrols; possibly gated entrance to primary caves	

Threat 7: Reduction of Connectivity		
Development adjacent to the Sibun River may remove connectivity of tropical broadleaf forest – important for maintenance of gene flow for most species, particularly spider monkeys and (to a lesser extent) howler monkeys		
Status	Potential	
Target	Central American Spider Monkey (*Ateles geoffroyi*)	
Source	***Direct:*** Deforestation of adjacent properties ***Indirect*:** Development pressure; high land values, particularly with water frontage	
Area	**4**	All riparian zone connectivity is at risk, despite protective legislation
Severity	**2**	Potentially significant impacts by reducing gene flow
Urgency	**1**	Loss of connectivity is generally a gradual process in Belize, but large scale loss is a possibility
Recovery Time	**2**	Broadleaf forest regeneration could re-establish connectivity within 15 and 20 years
Probability of Threat Occurring	**0.50**	A pragmatic estimate
Management Actions	Raise awareness in Gracie Rock; liaison with adjacent landowners; collaboration with DoE to enforce existing legislation in planning processes	

Threat 8: Property Development		
Status	Potential	
Target	Tropical Broadleaf Forest	
Source	***Direct:*** Land use change to housing development ***Indirect*:** Wish of owner to recoup investment and generate significant profits	
Area	**3**	The Hwatchy Development plan calls for the sub-division of the whole 8,000 acre privately owned property into 1,000 agricultural plots, 3 villages, a commercial sub-division, and an eco-lodge. Included within this footprint is the steep karstic hills, the tall swamp forest to the south, and the seasonally inundated savanna.
Severity	**3**	The development would result in the near total loss of biodiversity of the property, including endemic and endangered species
Urgency	**3**	The purchase agreement expires in mid-2006 – it can be anticipated that failure to purchase will result in the re-initiation of the development
Recovery Time	**3**	Recovery from such severe and extensive impacts could not take place, ie. the damage would be irreparable
Probability of Threat Occurring	**0.75**	Strong likelihood, if the current purchase attempt is not successful
Management Actions	Conservation purchase of the Hwatchy property; protection of the 10,600 acres of Government land; Legal action to press for a revision of the development plan and a more thorough EIA with specific zoning recommendations and mitigating actions	

Threat 9: Tourism Impacts		
Increased tourism presence		
Status	Active	
Target	Tropical Broadleaf Forest; Savanna	
Source	***Direct:*** Tourism impacts – noise, disturbance ***Indirect*:** Need for sustainability through available tourism market	
Area	**1**	Footprint of tourism impact is extremely limited
Severity	**1**	Management actions limit tourism impacts – mostly noise.
Urgency	**3**	Tourism is occurring, and has some impact
Recovery Time	**1**	Area and severity of impacts are so small that recovery would be extremely fast
Probability of Threat Occurring	**1.00**	Tourism is occurring now, and will continue as the funding mechanism to sustain conservation of the natural resources
Management Actions	Development of a tourism management policy and plan; Tight management of tourism using the process of 'limits of acceptable change'; Liaison with Institute of Archaeology for best practices guidelines in archaeological cave sites;	

c) Rate Threat Severity, Urgency, Relative Area, Recovery and Probability

These threat components are then assessed using the WCS threats criteria and ranking system, This data is entered into Table 1, where those threats that have the most impact on the conservation area are identified using the equation:

Total threat score = (Urgency + Recovery) x Severity x Area x Probability

…then being ranked, with the highest threat being awarded the highest threat score

Table 1: Analysis of threats impacting Peccary Hills **(based on WCS Living Landscapes Programme)**

Threat	Severity Score	Urgency Score	Area Score	Recovery score	Probability Score	Total Threat Score	Rank*
Logging	1	3	1	2	1.00	5	**2**
Hunting – Game Species	1	3	2	1	1.00	8	**3**
Hunting – *Dermatemys mawii*	3	3	4	2	1.00	60	**8**
Fishing	2	3	4	1	1.00	32	**5**
Fire	3	3	4	2	1.00	60	**8**
Looting	3	2	4	3	0.75	45	**6**
Removal of Connectivity	2	1	4	2	0.50	12	**4**
Property Development	3	3	4	3	0.75	54	**7**
Tourism Impacts	1	3	1	1	1.00	4	**1**

Threat Assessment Ranks **(adapted from WCS Living Landscapes Programme)**

Severity	Rank	Urgency	Rank
None or positive	0	Won't happen in > 10 years	0
Measurable effect on density or distribution	1	Could happen between 3 – 10 years	1
Substantial effect but local eradication unlikely	2	Could (or will) happen within 1 – 3 years	2
Local eradication a possibility	3	Threat is occurring now, and needs action	3
Proportion of Local Area Affected	**Rank**	**Recovery Time**	**Rank**
0	0	Immediate	0
1-10%	1	1-10 years	1
11-25%	2	11-100 years	2
26-50%	3	100+ years or never	3
>50%	4		
Probability of threat occurring			
≤ 0.25	0.25		
0.26 – 0.50	0.50	***Lowest threat score rank = 1**	
0.51 – 0.75	0.75		
0.76 – 1.00	1.00		

Prioritising Conservation Targets

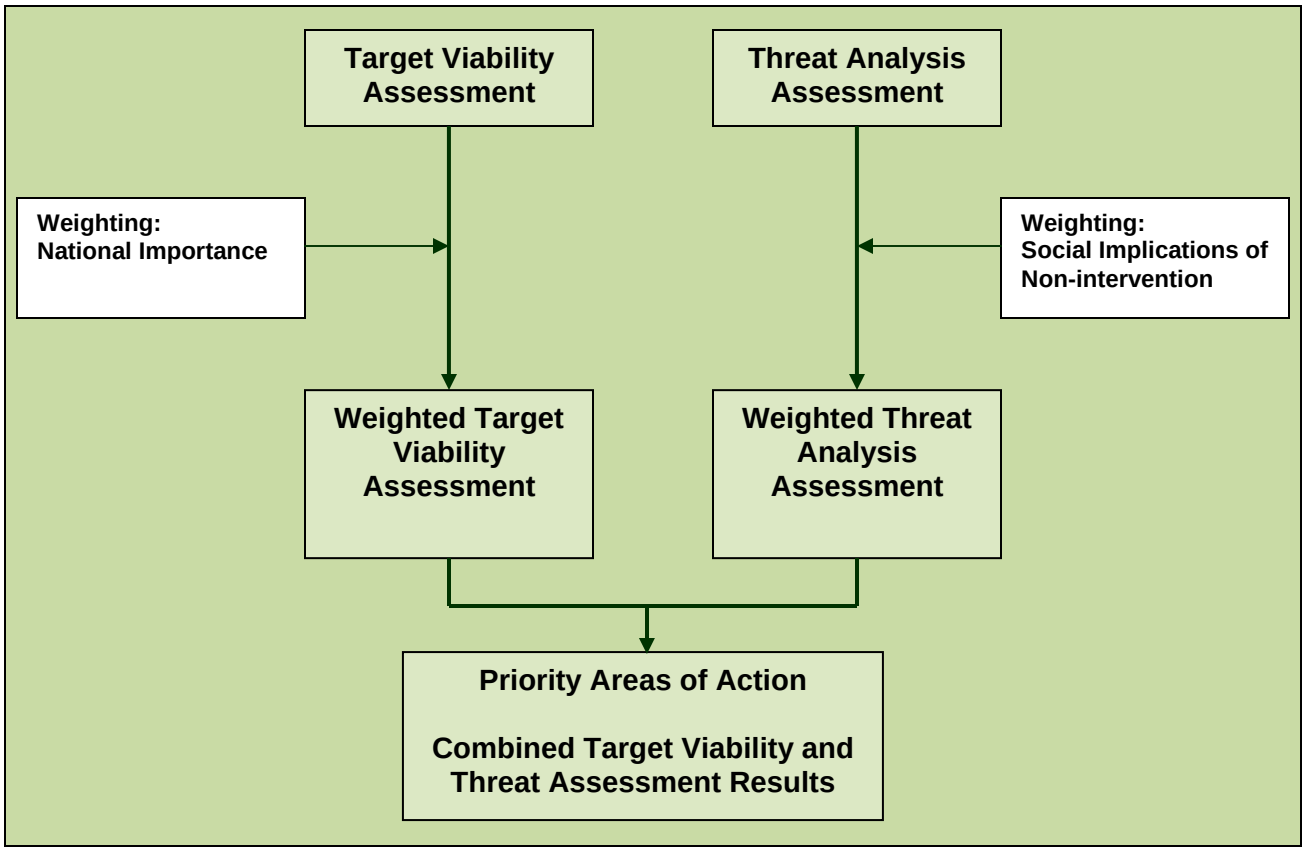
Using the combined TNC 5-S conservation target viability ranking and the WCS threat analysis, it is possible to establish the priority of conservation actions for the conservation targets highlighted for Peccary Hills Area. The appeal of this modified TNC 5-S and WCS Living Landscape approaches is that:

- it reduces the level of subjectivity associated with the traditional threat analysis approach
- it is useable by a broader cross section of technicians and managers
- it has greater relevance to the social and management capacity issues associated with Belize's protected areas than either the TNC or WCS approaches alone, and uses the strongest components of these two systems

However, to be relevant on a national level as well as local level, the combined analysis must also adequately address two further factors:

- the national importance of a particular target
- the social implications of prioritization and implementation of conservation actions

To ensure that these two factors are taken into account, it is first necessary to add a weighting factor to the target viability assessment and threat analysis respectively.



a) Incorporating Target Viability (TNC):

The numerical score assigned through the TNC target viability assessment in Table 1, is then multiplied by a weighting that reflects the relative national importance, or priority, of the particular conservation target (Table 2):

Table 2: Numeric ranking of TNC target viability			
Conservation Target	**TNC Target Viability (See Table…)**	**Overall Viability**	**National Priority Weighting****
Central American River Turtle	Poor	2.67	3
Game Species	Good	3.67	2
Native Fish Species (Cichlidae)	Good	3.17	1
Short grass Savannah	Good	3.17	2
Broadleaf Forest	Good	3.50	3*
* This gets a high national priority rating due to the presence of tall swamp forest through a significant portion of the broadleaf forest area, highlighted under the NPAPSP			

**National Priority Rating	Justification	Weighting
Lowest Priority	Assigned to a conservation target whose presence within the protected area is of almost negligible national importance, for example one that has a very low viability rating within the PA, but which is well represented elsewhere with a higher viability – the native fish species are assigned this weighting.	**1**
Medium Priority	A target whose presence in the protected area is important, but which is well represented elsewhere in the protected areas system.	**2**
Highest Priority	A conservation target whose presence within the protected area is considered of highest national importance, such as an ecosystem or species which is not represented elsewhere in the Country, or which is especially rare – Central American river turtle is a good example.	**3**

b) Incorporating Threat Analysis (WCS)

The ranked WCS threat scores for the primary threats affecting the selected conservation targets are multiplied by a weighting factor that reflects the predicted ramification of lack of implementation of conservation action to address the threat – will the threat be increased as a direct result of lack of conservation action? The aim of this weighting is to distinguish between two types of threats (Table 3).

Table 3: Weighting for ramification of inaction	Weighting
Threats which may increase, but not as a direct and deliberate response to lack of specific management actions to address the threat	1
Threats that will increase, as a direct and deliberate response to lack of specific management actions to address the threat	2

In most, if not all, instances this reflects social / anthropogenic threats pertaining to enforcement of protected area regulations. For example, for many protected areas in Belize, not addressing the threats associated with hunting, fishing, logging and looting incursions, is likely to encourage perpetrators responsible for these threats to increase their activities beyond current levels - possibly very considerably – and encourage others to do the same. The WCS rank is then multiplied by the non-

intervention implication weighting to give a weighted threat analysis score (Table 4).

Table 4: Adding the non-intervention weighting

Primary Threat	Ranked Primary Threats	Non-intervention Implication Weighting	Weighted Threat Analysis Score
Logging	**2**	2	4
Hunting – Game Species	**3**	2	6
Hunting – *Dermatemys mawii*	**7**	2	14
Fishing	**4**	2	8
Fire	**7**	1	7
Looting	**5**	2	10
Removal of Connectivity	**12**	1	12
Property Development	**6**	1	6
Tourism Impacts	**1**	1	1

Identifying Priorities

The TNC viability and the national priority weighting can then be combined with the weighted ranked WCS threat analysis score using the following equation to allow prioritization ranking:

P = (1/V) x N x T

Where: P = Prioritization Score
V = Viability Score
N = National Priority Weighting
T = Weighted ranked WCS Threat Score

A conservation target with a high viability rating will have a lower priority for conservation action, whilst a conservation target facing a high threat will have a higher priority for conservation action. These scores are then ranked in descending order to reflect priority for conservation actions (Table 5).

Table 5: Prioritising Conservation Targets

Conservation Target	Primary Threat	Viability Score (V)	National Priority Weighting (N)	Weighted WCS Threat Score (T)	Prioritisation Score	Ranked Priority
Central American River Turtle	Hunting of CA River Turtle	2.67	3	14	15.73	1
Game Species	Hunting	3.67	2	6	3.27	5
Native Fish Species (Cichlidae)	Fishing	3.17	1	8	2.52	6
Short grass Savannah	Fire	3.17	2	7	4.42	4
Broadleaf Forest	Property Dev	3.50	3	6	5.14	3
Central American Spider Monkey	Property dev	3.17	3	6	5.68	2

This is a relatively simple system, which gives prioritisation rankings in broad general agreement with those developed through the more traditional holistic approach to threat analysis.

Through this analysis, the following prioritization was developed for the Peccary Hills area

Table 6: Priority Areas of Action for the Peccary Hills area

Priority	Rank	Conservation Target	Primary Threat
High Priority	1	Central American River Turtle	Hunting of CA river turtles
	2	Central American Spider Monkey	Property Development
Medium Priority	3	Broadleaf Forest	Property Development
	4	Short grass savanna	Fire
Lower Priority	5	Game Species	Hunting of Game Species
	6	Native fish species	Fishing