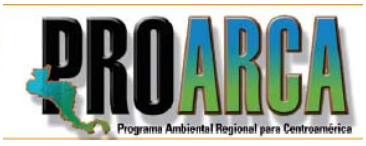
Bladen Nature Reserve

Management Plan

Volume II

FINAL DRAFT

PACT

BMC Comanagement Partners

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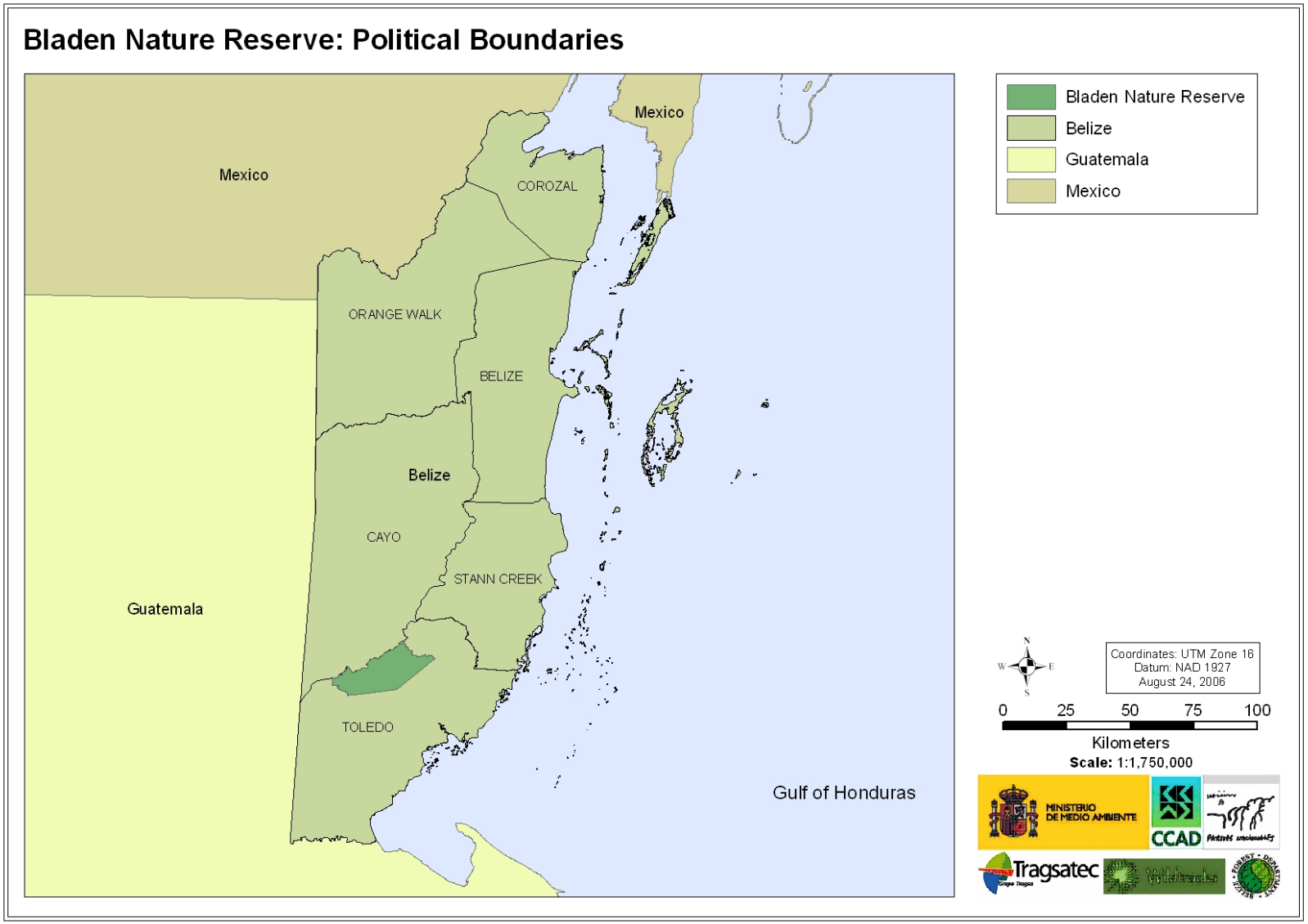
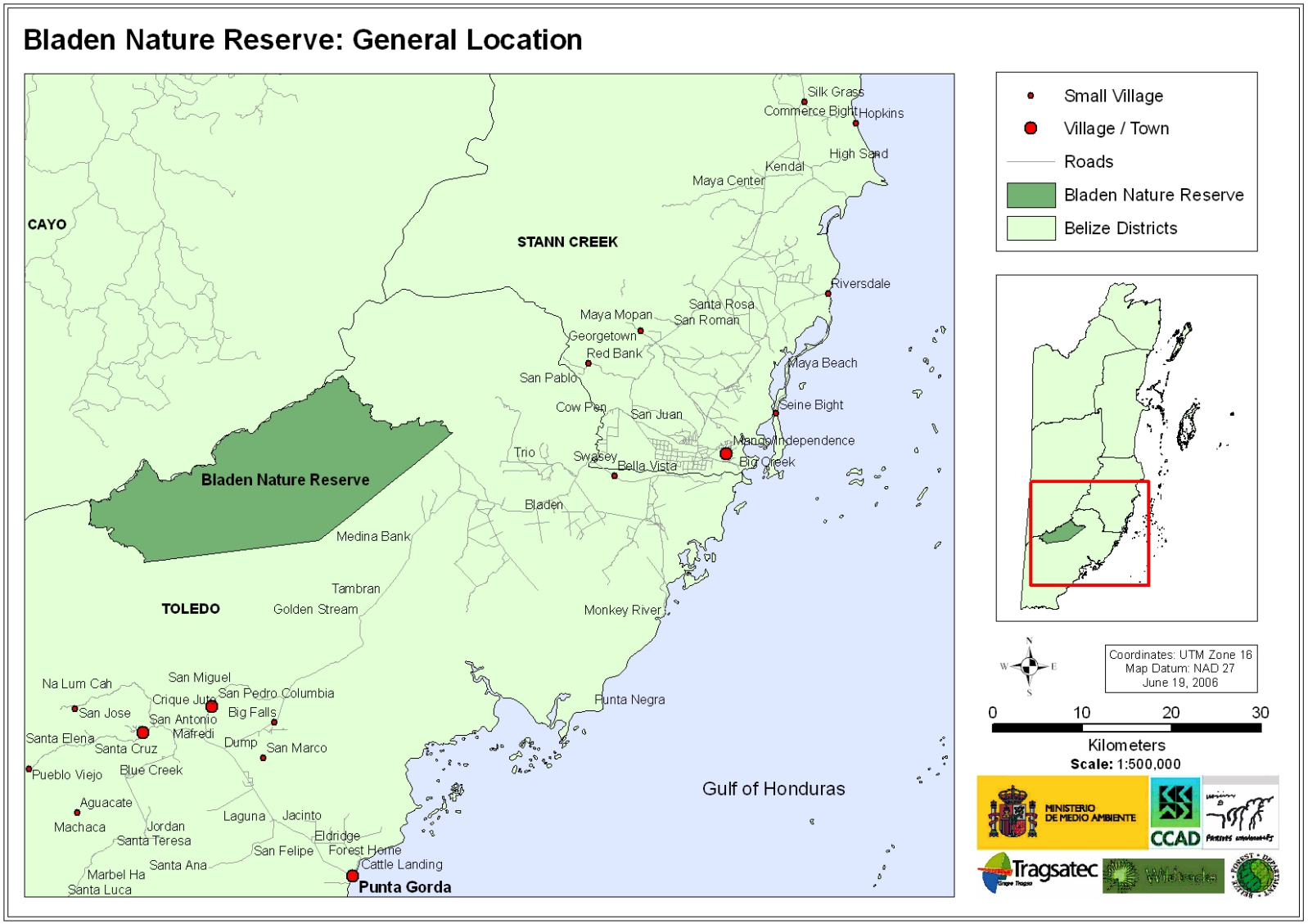


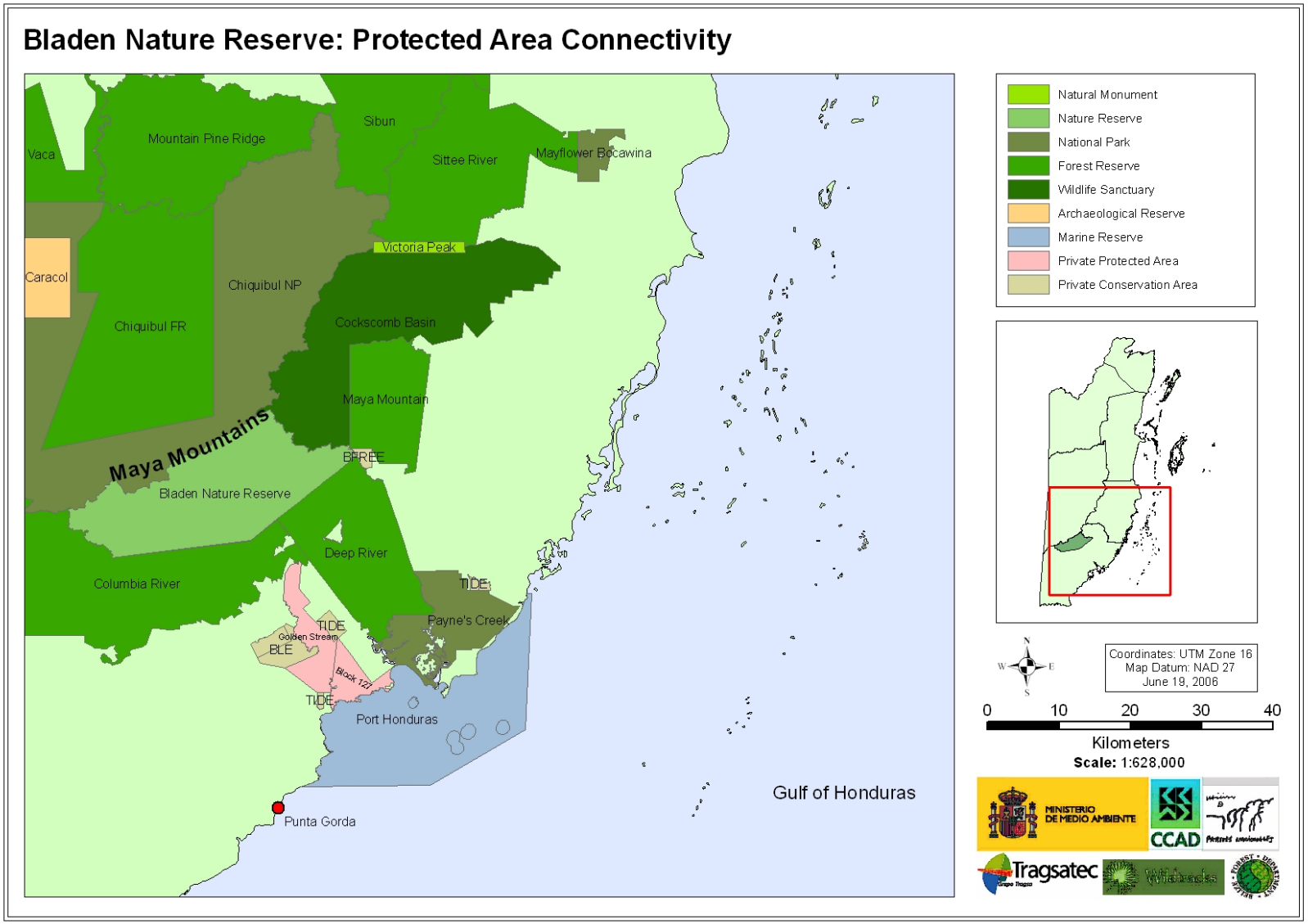
Map 1: Political Boundaries

Land Information Centre Spatial Layer (Made public through Paseo Pantera Consortium Univ. of Florida/USAID *Digital Geographic Database: Maya Forest Region: Mexico, Guatemala, Belize. Version 1, August 19110*), further modified by Jan Meerman. http://www.biodiversity.bz/; TNC Selva Maya project (http://www.selvamaya.org/)



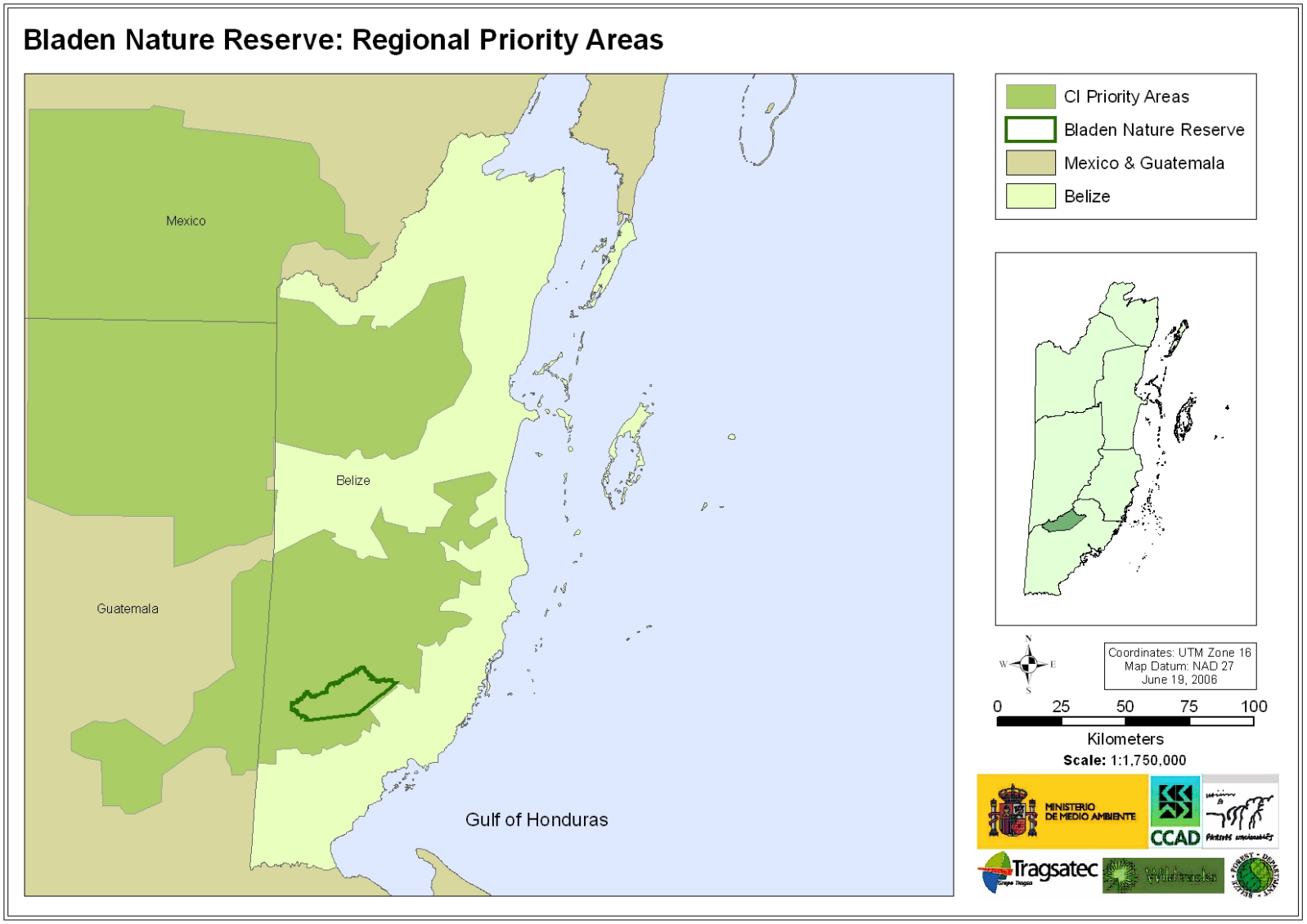
Map 2: General Location

Jan Meerman, BTFS. http://www.biodiversity.bz/, based on Int'l Travel Map of Belize (1:350,000), 2000 GOB Census, 2001 CSO
Abstract of Statistics

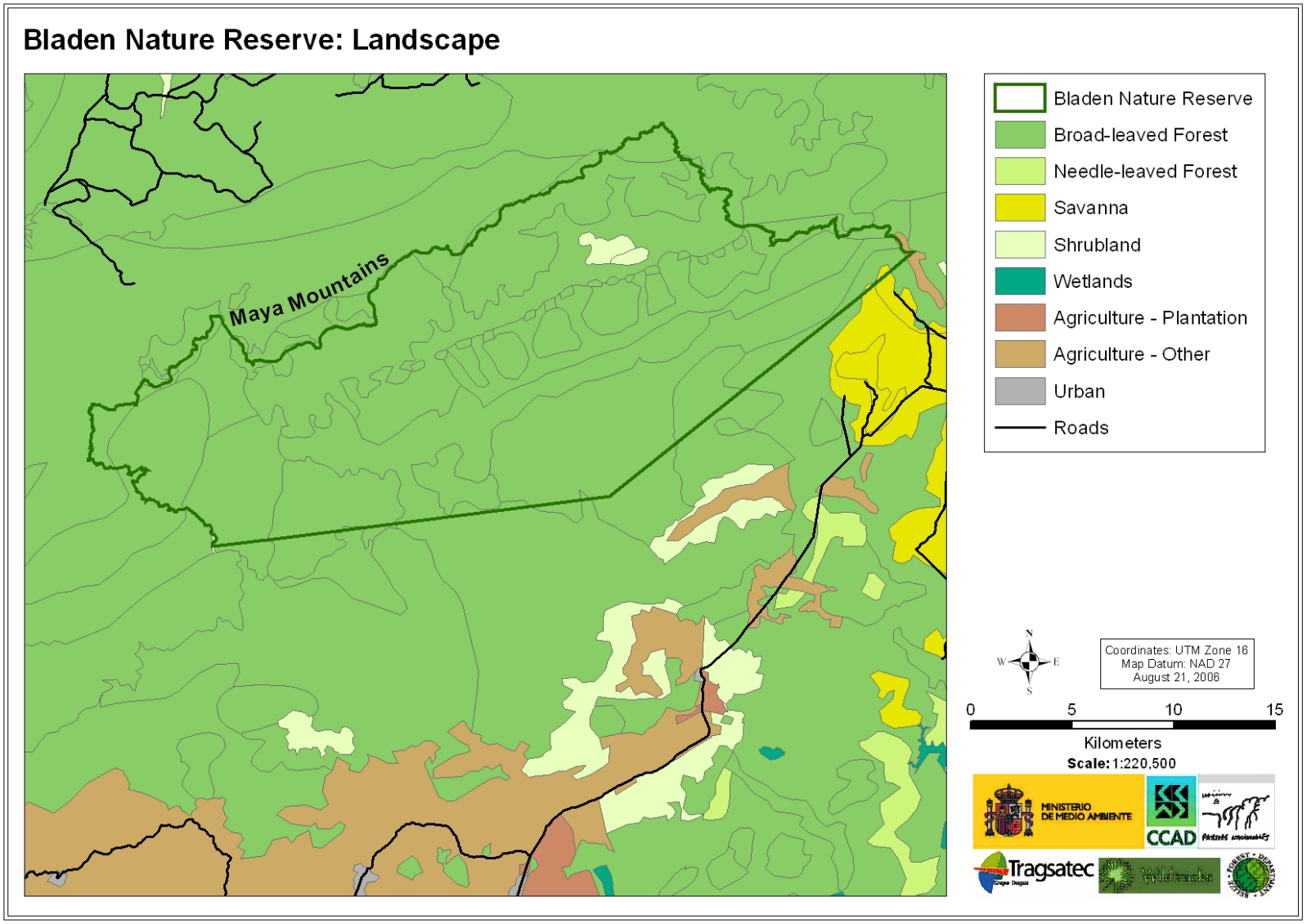


Map 3: Protected Area Connectivity.

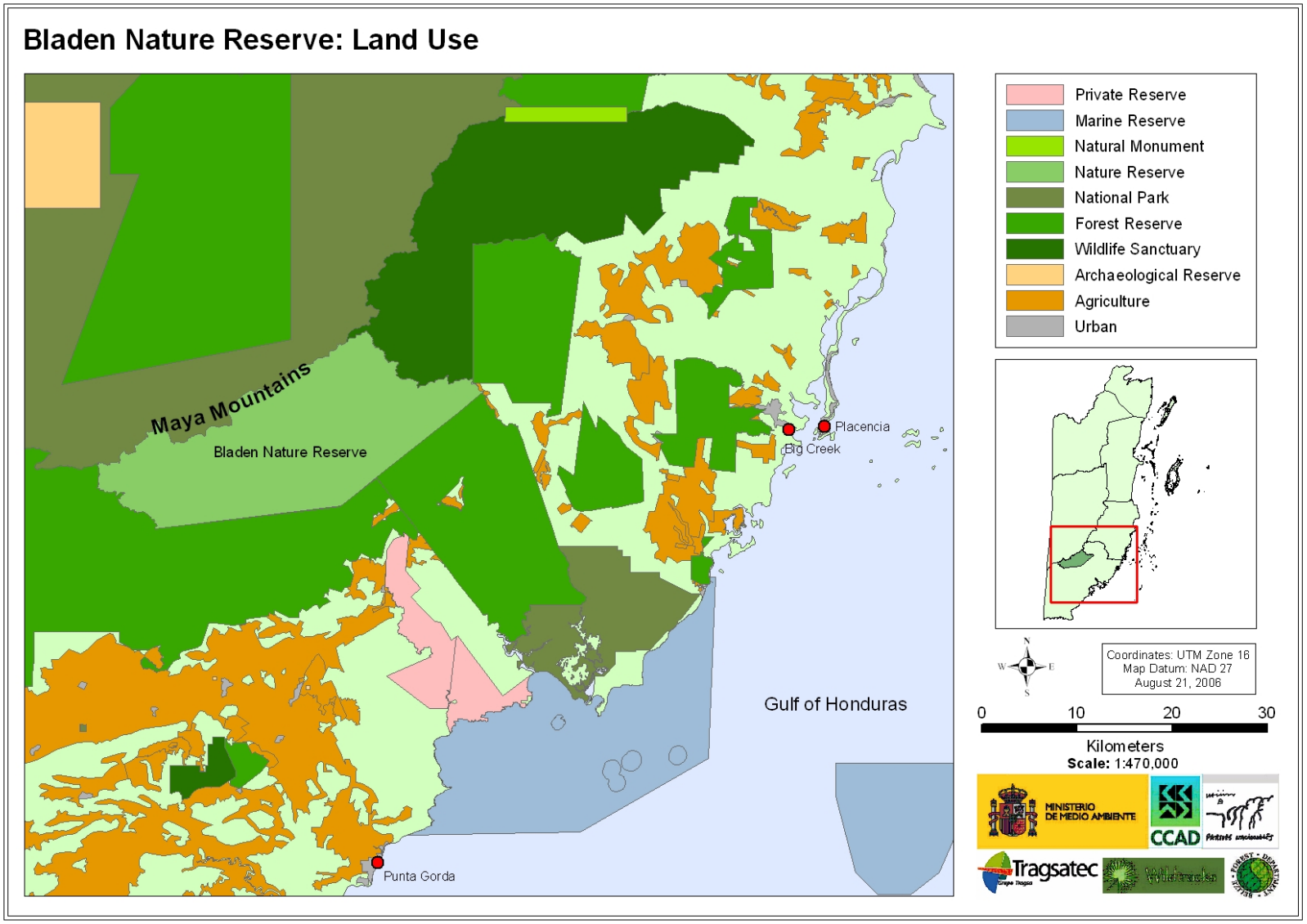
TNC Selva Maya project (http://www.selvamaya.org/)



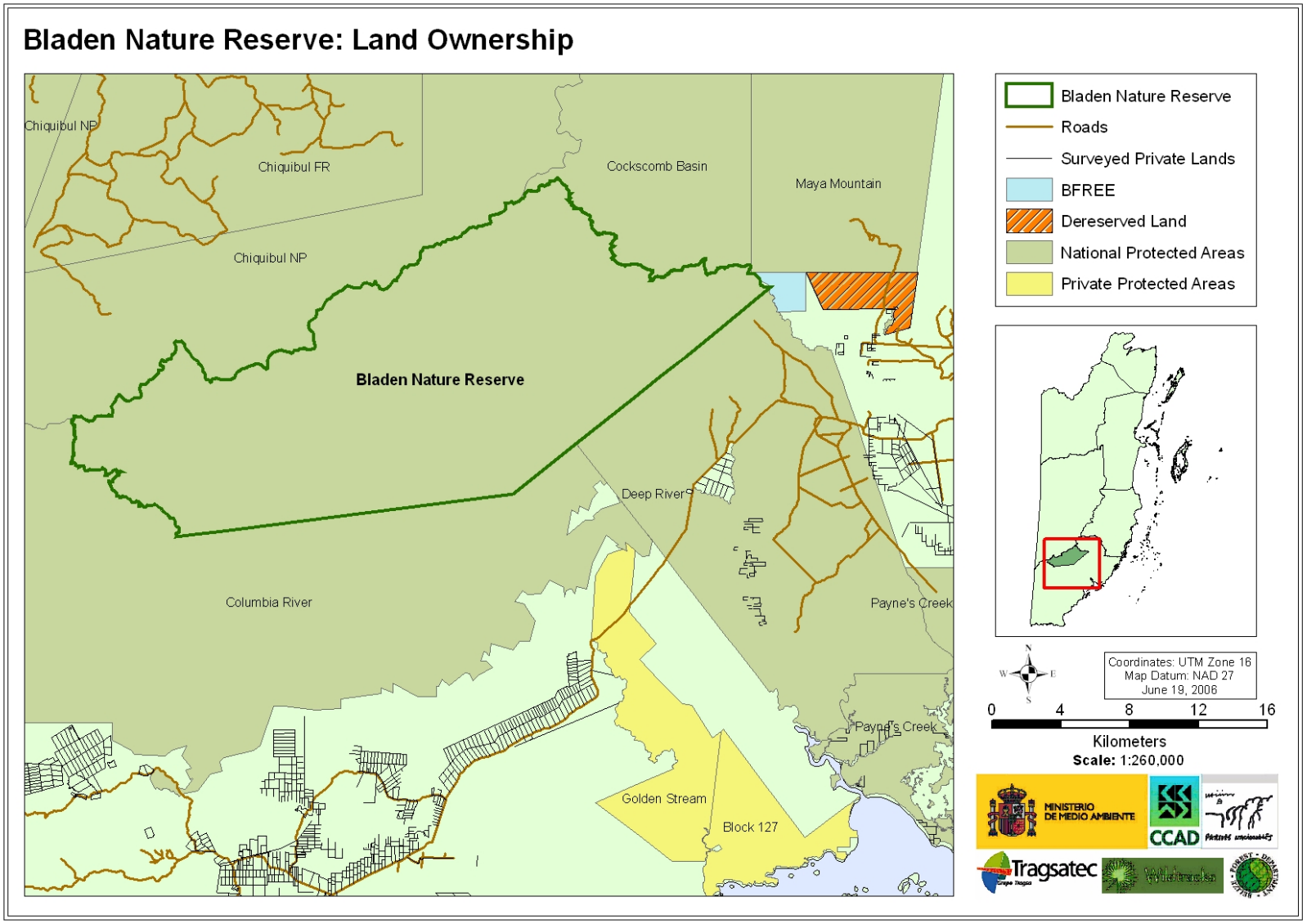
Map 4: Regional Priority Areas. See Annex 10 and 11 for metadata



Map 5: Landscape. See Annex 10 and 11 for metadata

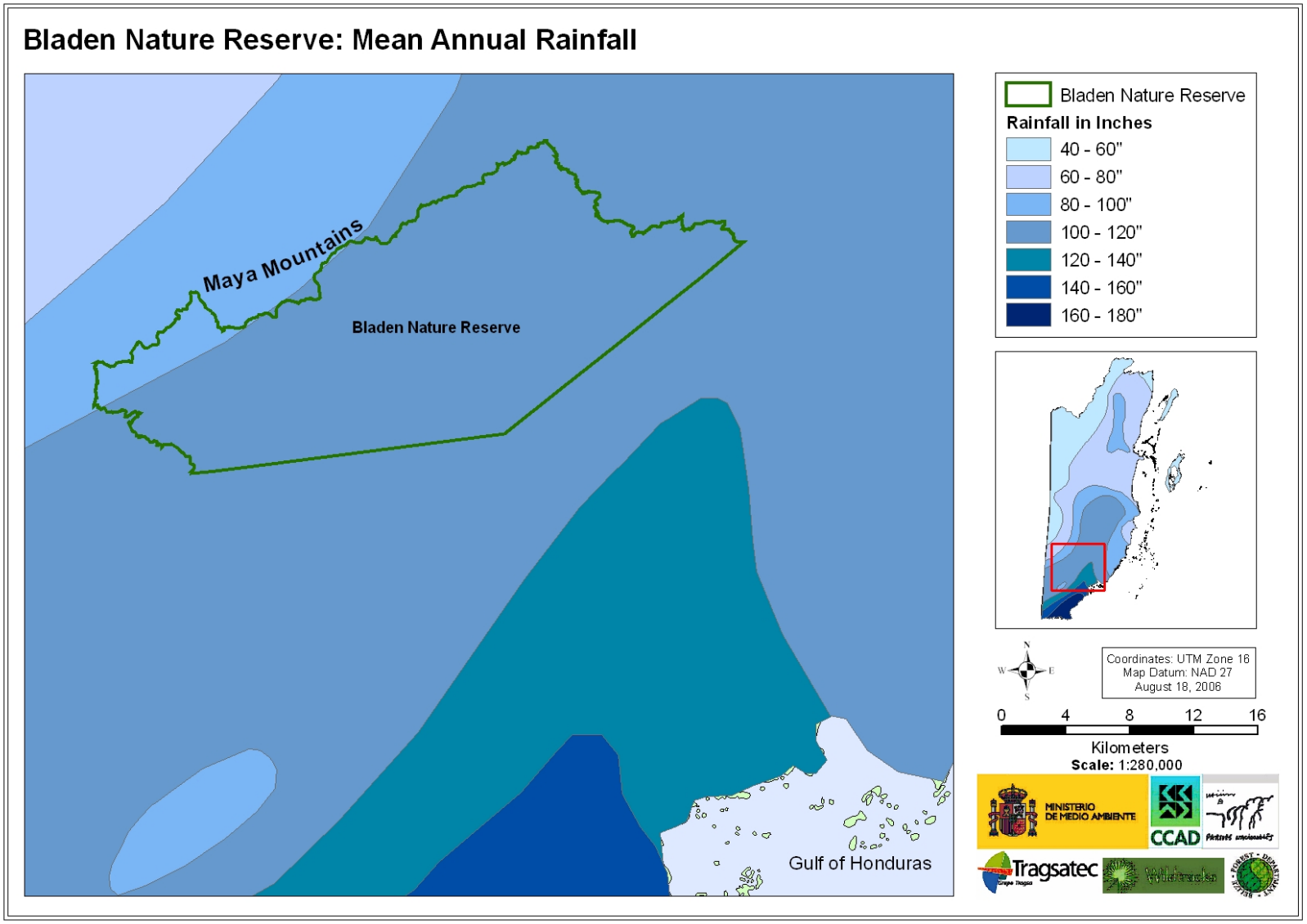


Map 6: Land Use. See Annex 10 and 11 for metadata



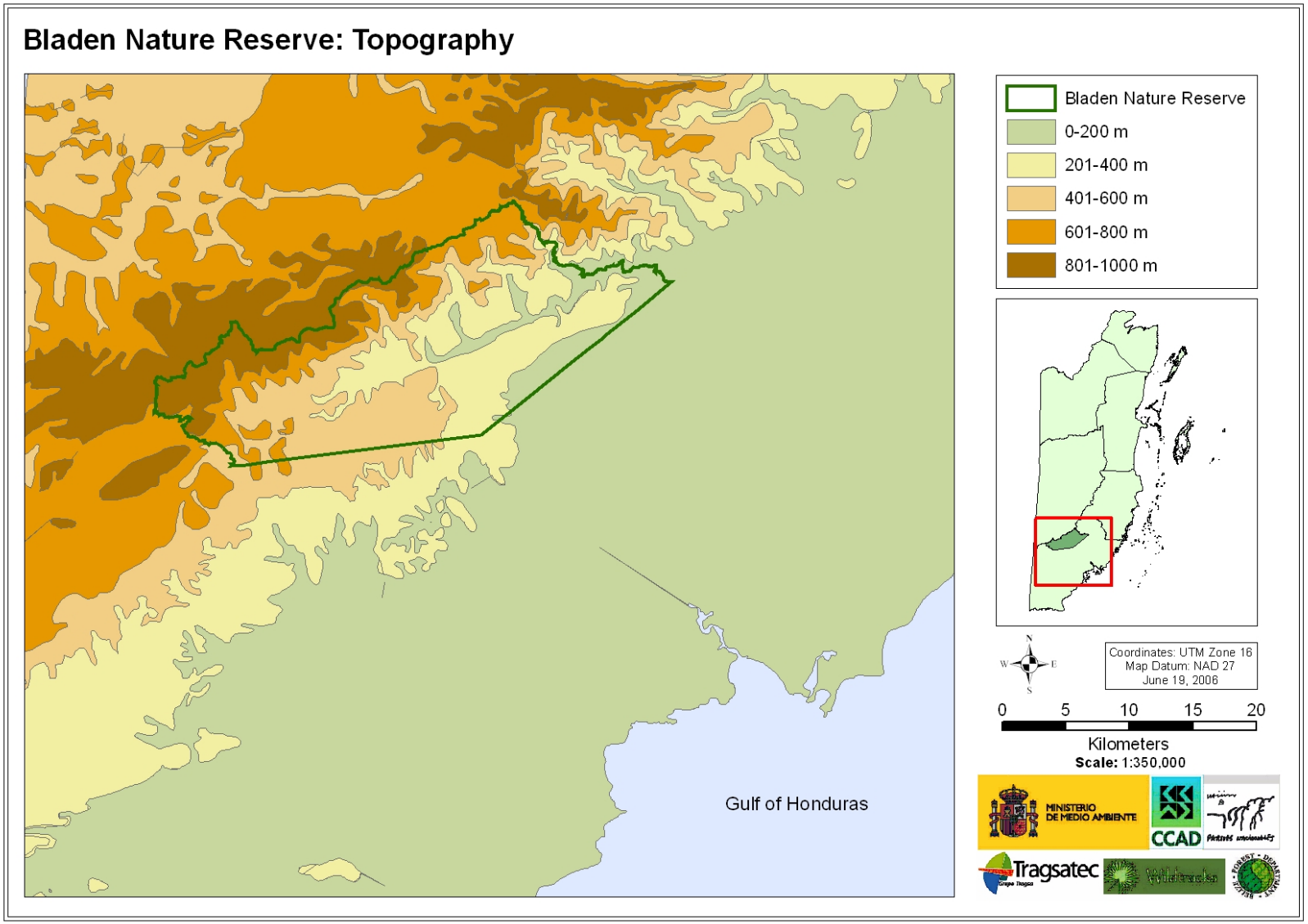
Map 7: Land Ownership.

Maya Mountain dereservation derived from georeferenced paper map supplied by BFREE showing dereserved area. Digitised by Adam Lloyd, Wildtracks, August 2006. Incomplete dataset of survey lines of properties in Belize - Fairweather, Chartered Surveyor, Belize, c/o Wildtracks



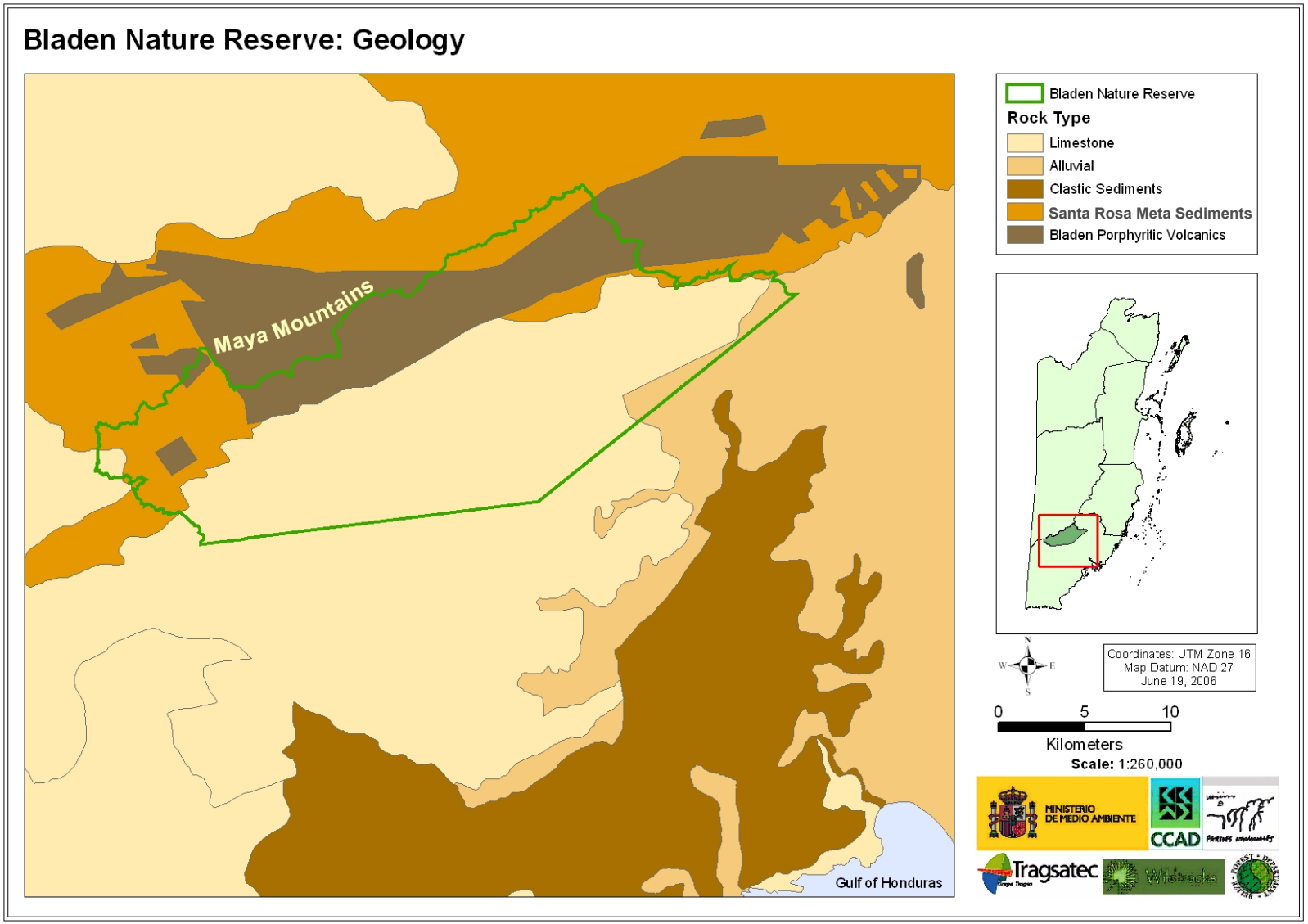
Map 8: Rainfall

Walker, S. H. 1973. Summary of climatic records for Belize. Land Res. Div. Surbiton, Surrey, England, Suppl. No. 3.Further modified by Jan Meerman. Digitised by Adam Lloyd, Wildtracks, 2006 from raster image downloaded from BERDS Map Explorer (http://www.biodiversity.bz).



Map 9: Topography

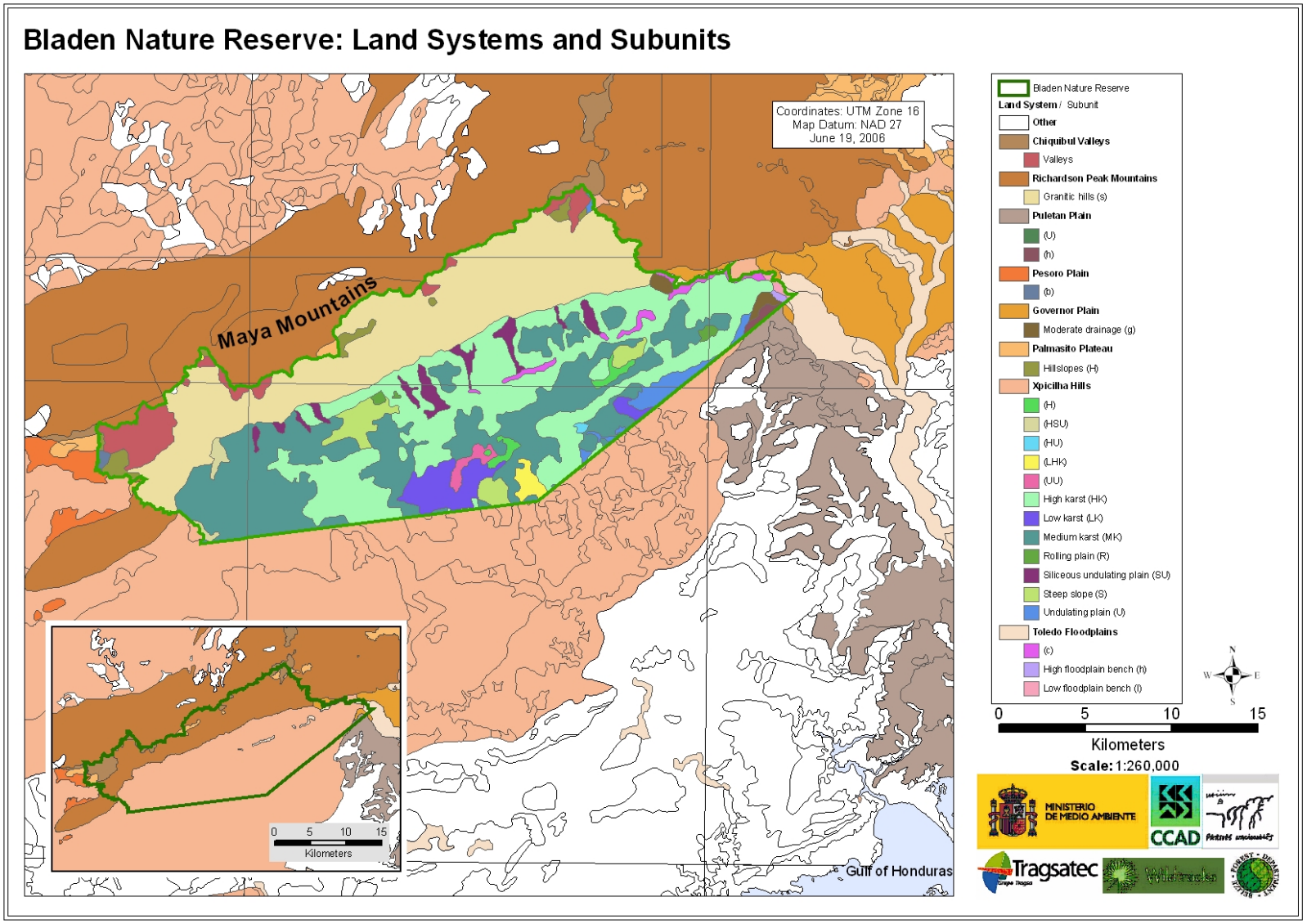
BTFS (Jan Meermal et al.), provided by Belize Audobon Society. Contours derived from digitised DOS maps.



Map 10: Geology

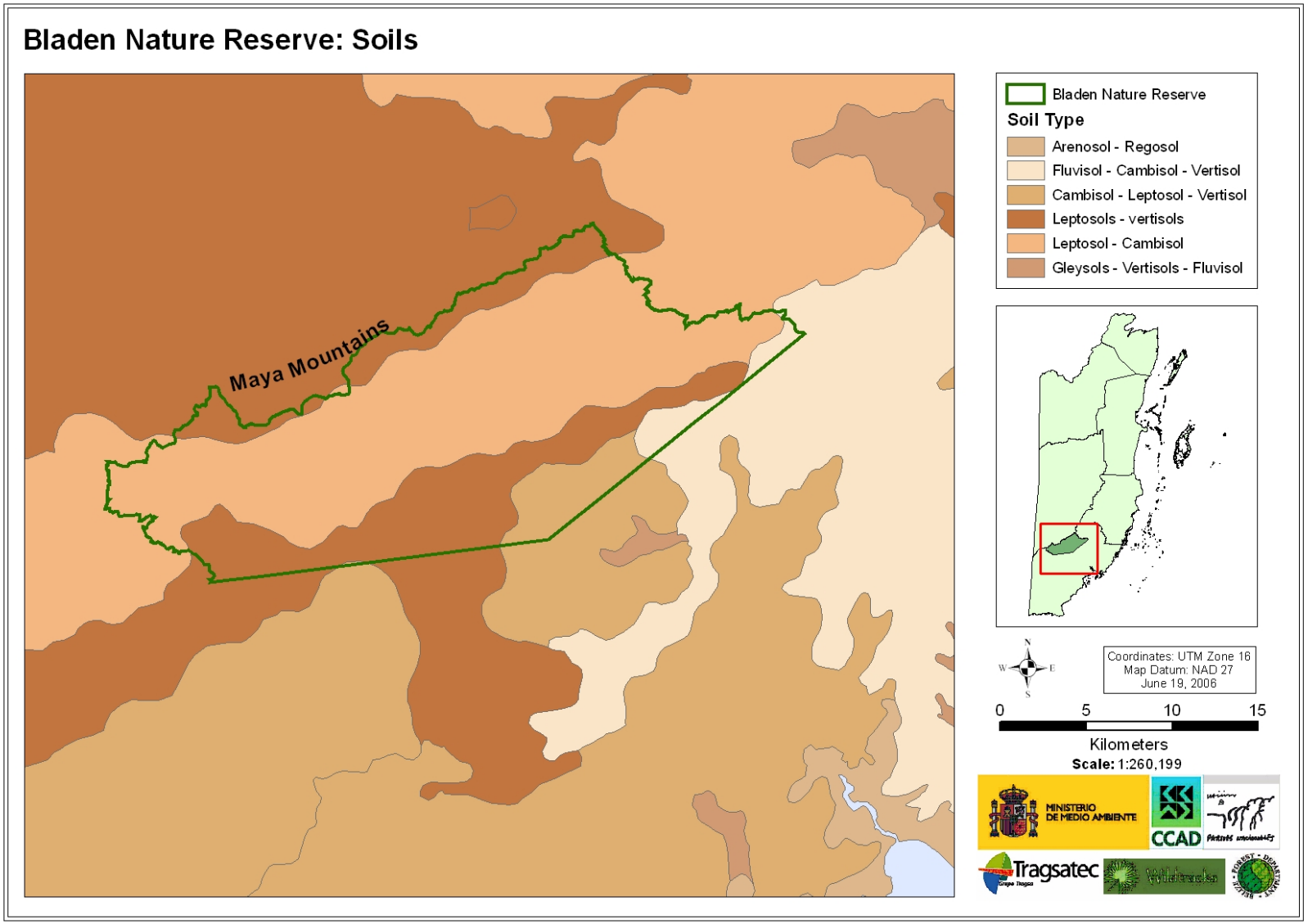
TNC Selva Maya project. (http://www.selvamaya.org); Shapefile generated specifically for Wildtracks, from georeferenced copy of printed "Geology Map of Belize", Jean H Cornec, 2003. (jcornec@aol.com)

Wildtracks, 2006



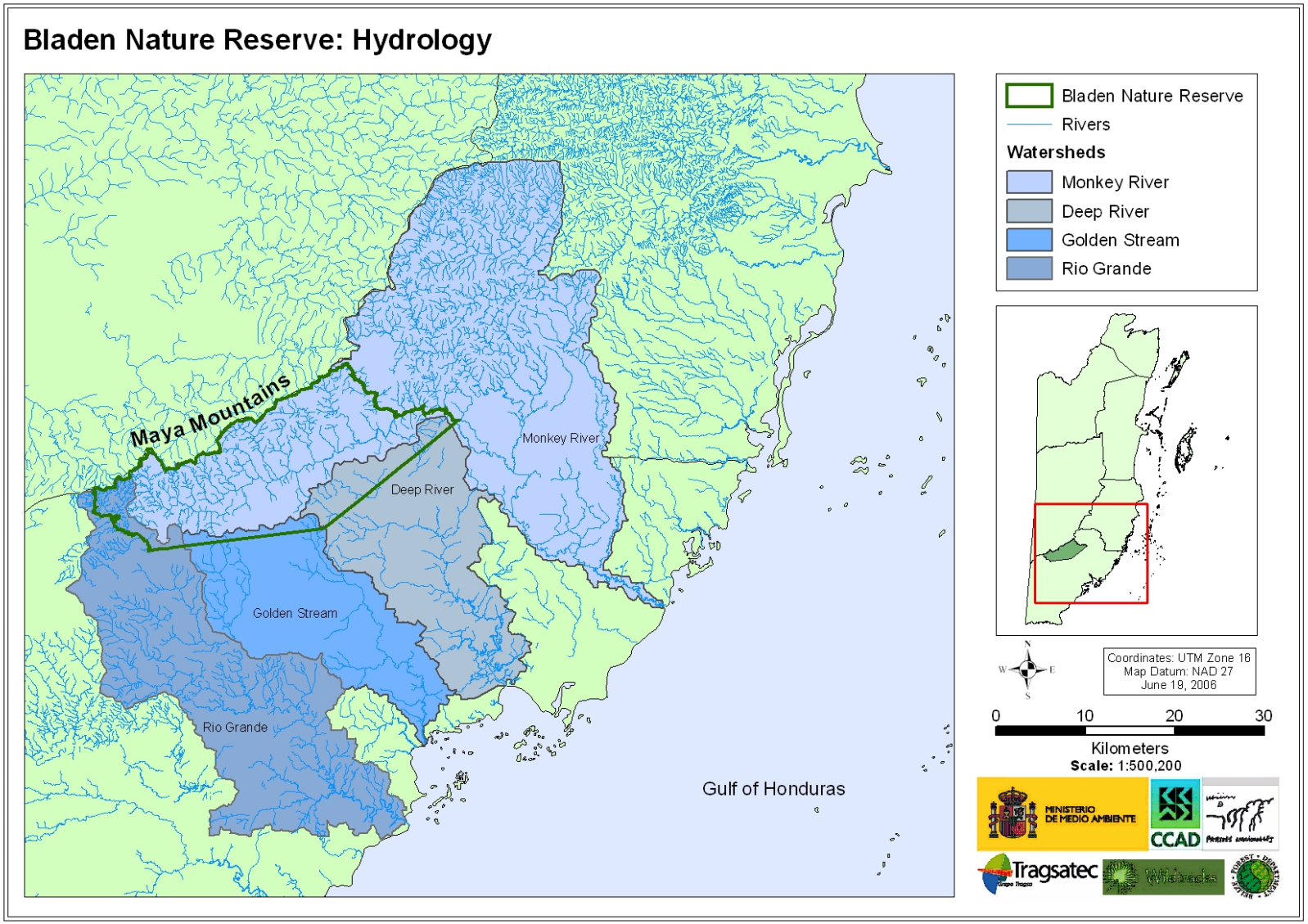
Map 11: Land Systems

Derived from NRI's *bz_land_sys_nri_2* by Adam Lloyd, Wildtracks, 2006; Natural Resource Institute. http://www.nri.org/



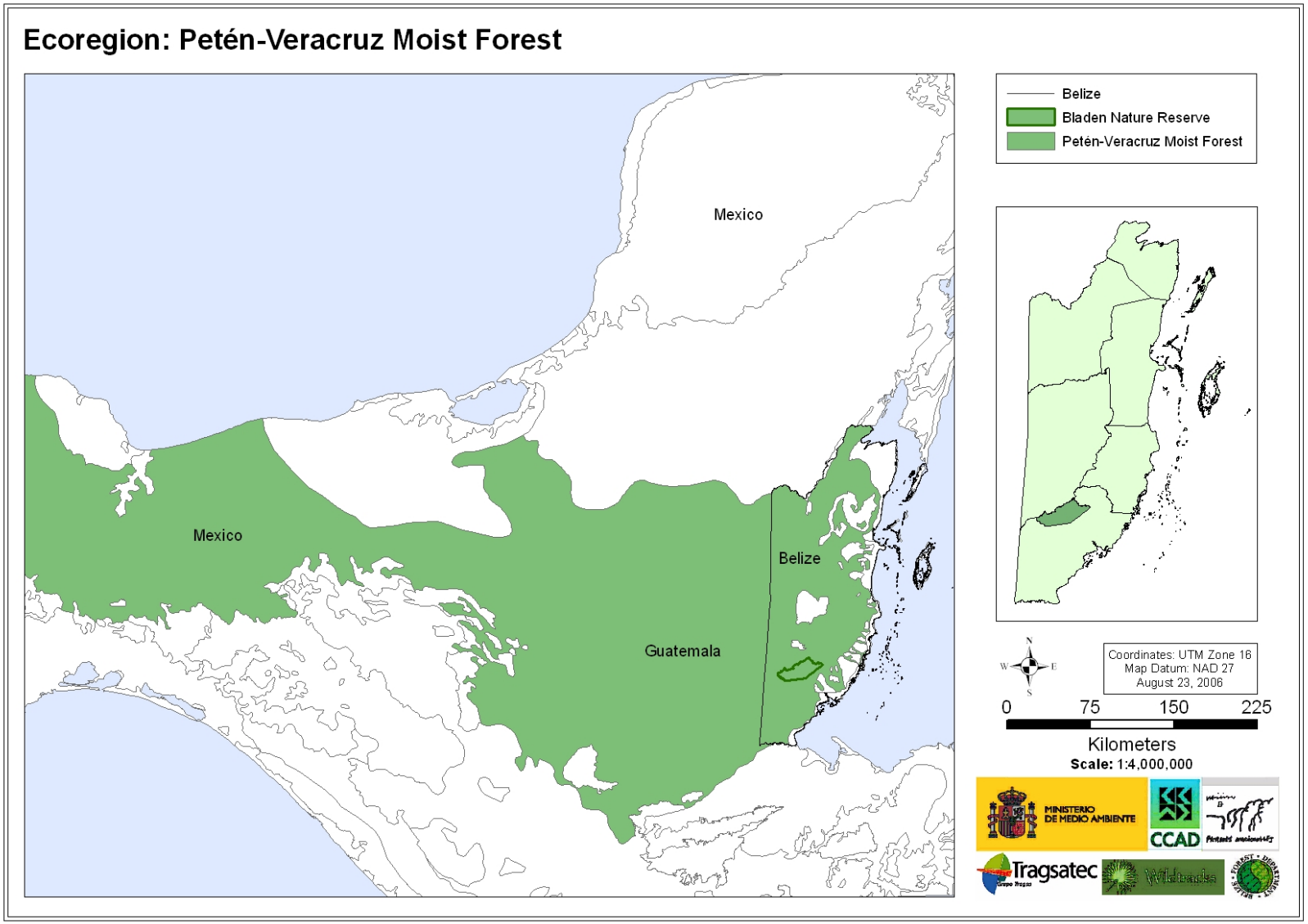
Map 12: Soils

Based on Wright, A. C, et al, 11109. Land in British Honduras. Colonial Res. Publ. No. 24. Note: Generated by PRONATURA for the TNC-led Selva Maya Project (draft form). Further modified to include information from *Baillie, et al. 1993. Revised Classification of the Soils of Belize. NRI Bulletin No. 59.*



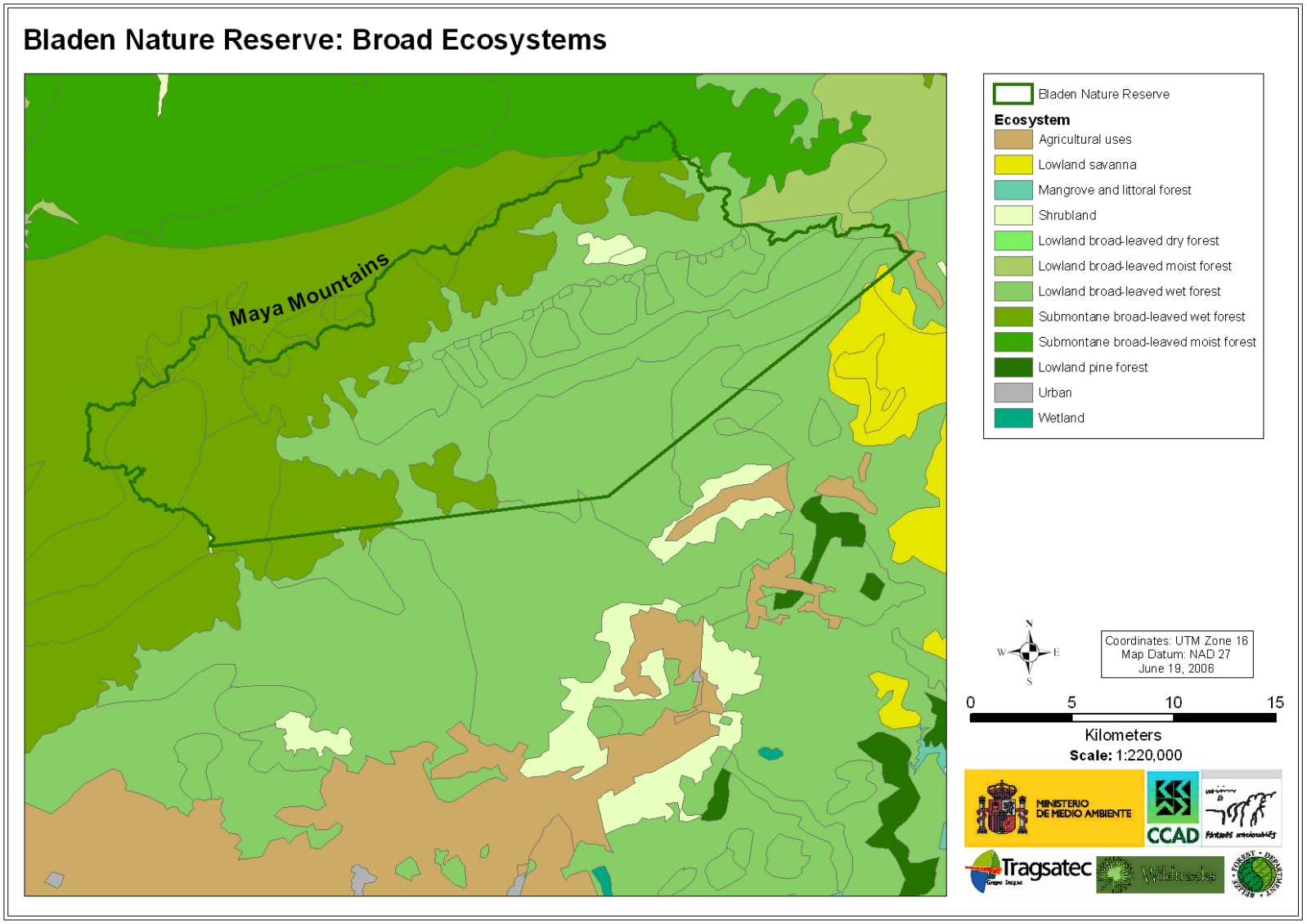
Map 13: Hydrology

Peter Esselman et al. Derived from digitisation of DOS 1:50,000 map sheets; Watersheds derived from watershed dataset provided by ICRAN / MAR, WRI, 2005. Derivation generated in 2006 by Adam Lloyd, Wildtracks.



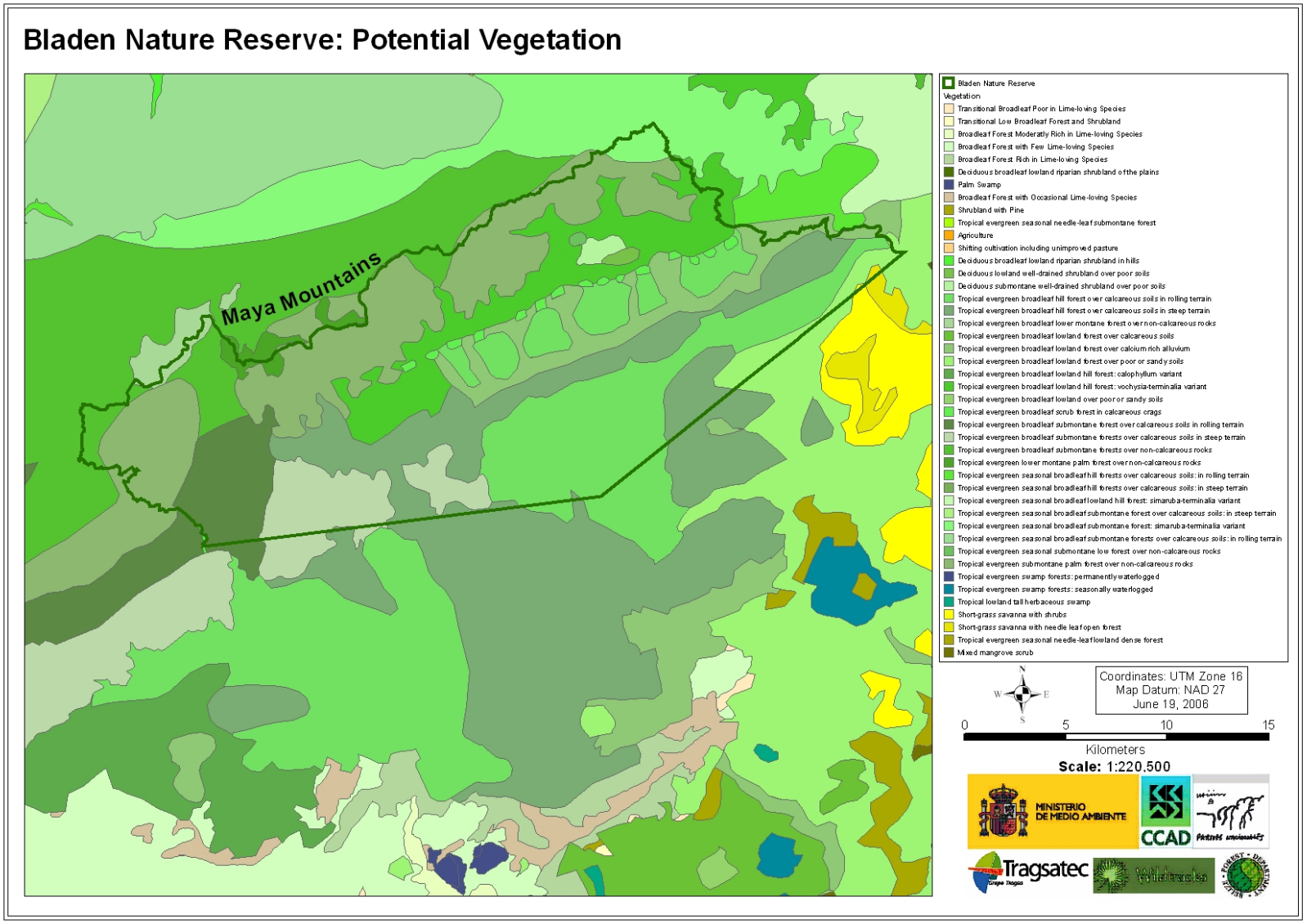
Map 14: Ecoregions

WWF Ecoregions dataset (Olson, D. M. and E. Dinerstein. The Global 200: Priority ecoregions for global conservation. (PDF file) Annals of the Missouri Botanical Garden 89:125-126). http://www.worldwildlife.org/ [clipped to Selva Maya region]



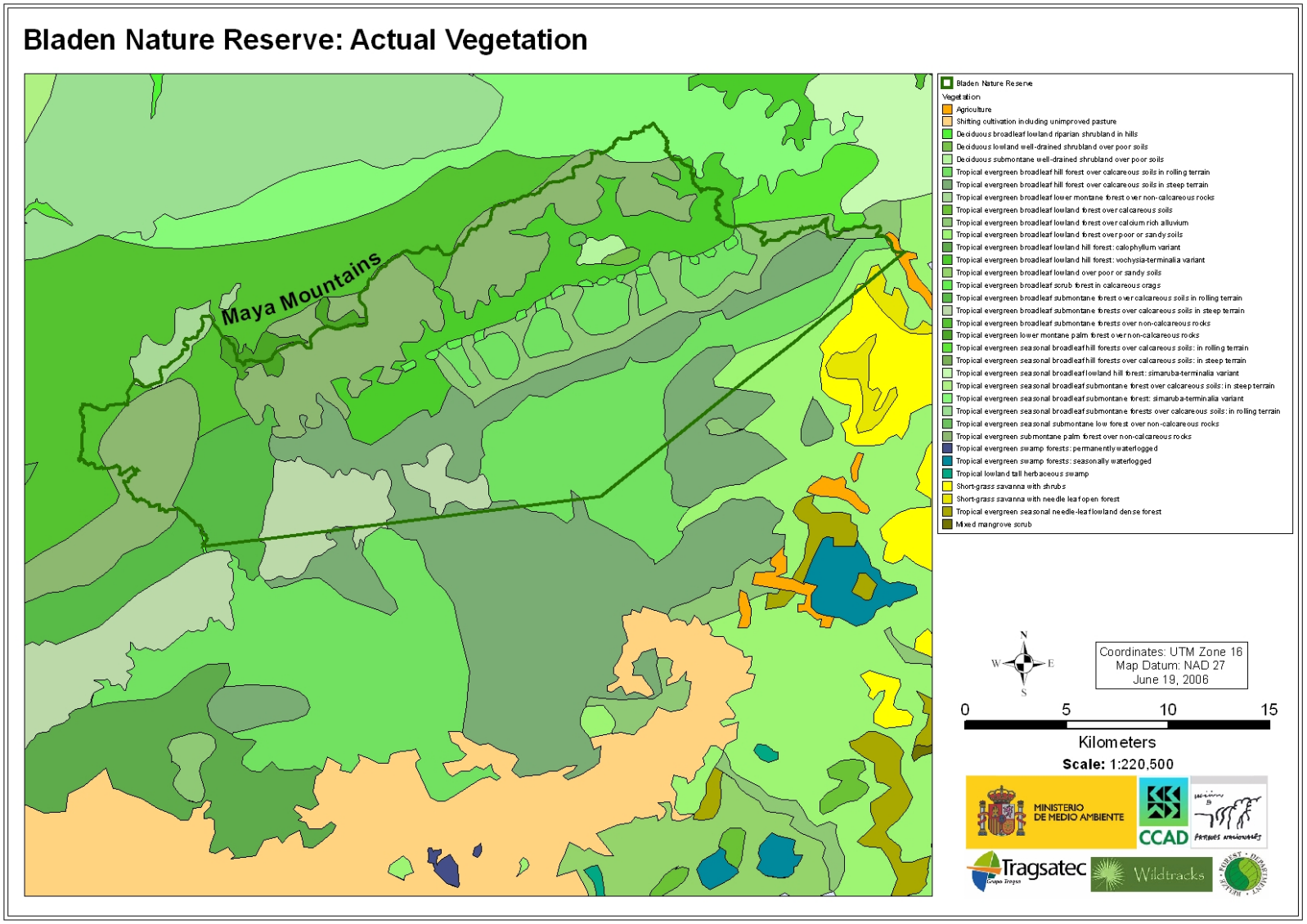
Map 15: Broad Ecosystems.

Meerman, J. C. and W. Sabido. 2001. Central America Ecosystems Map: Belize. CCAD/World Bank/Programme for Belize. Version 20060405. Major Revision by J. Meerman and posted 05 Apr 2006. http://www.biodiversity.bz/



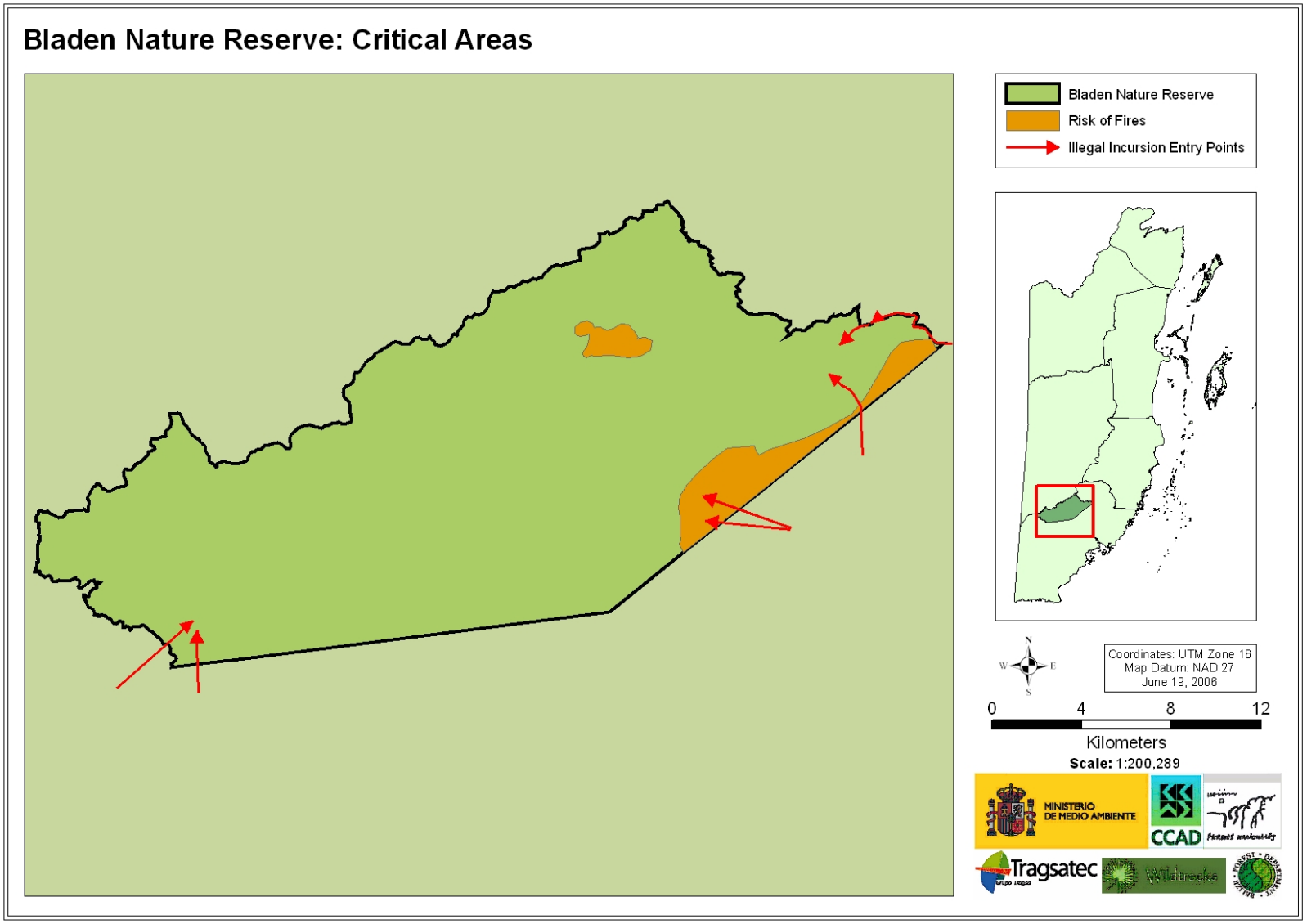
Map 16: Ecosystems – Potential Vegetation

Derived from *sist_ecol_pot,* TNC Selva Maya project (http://www.selvamaya.org/). Derivation by Adam Lloyd, Wildtracks, 2006.



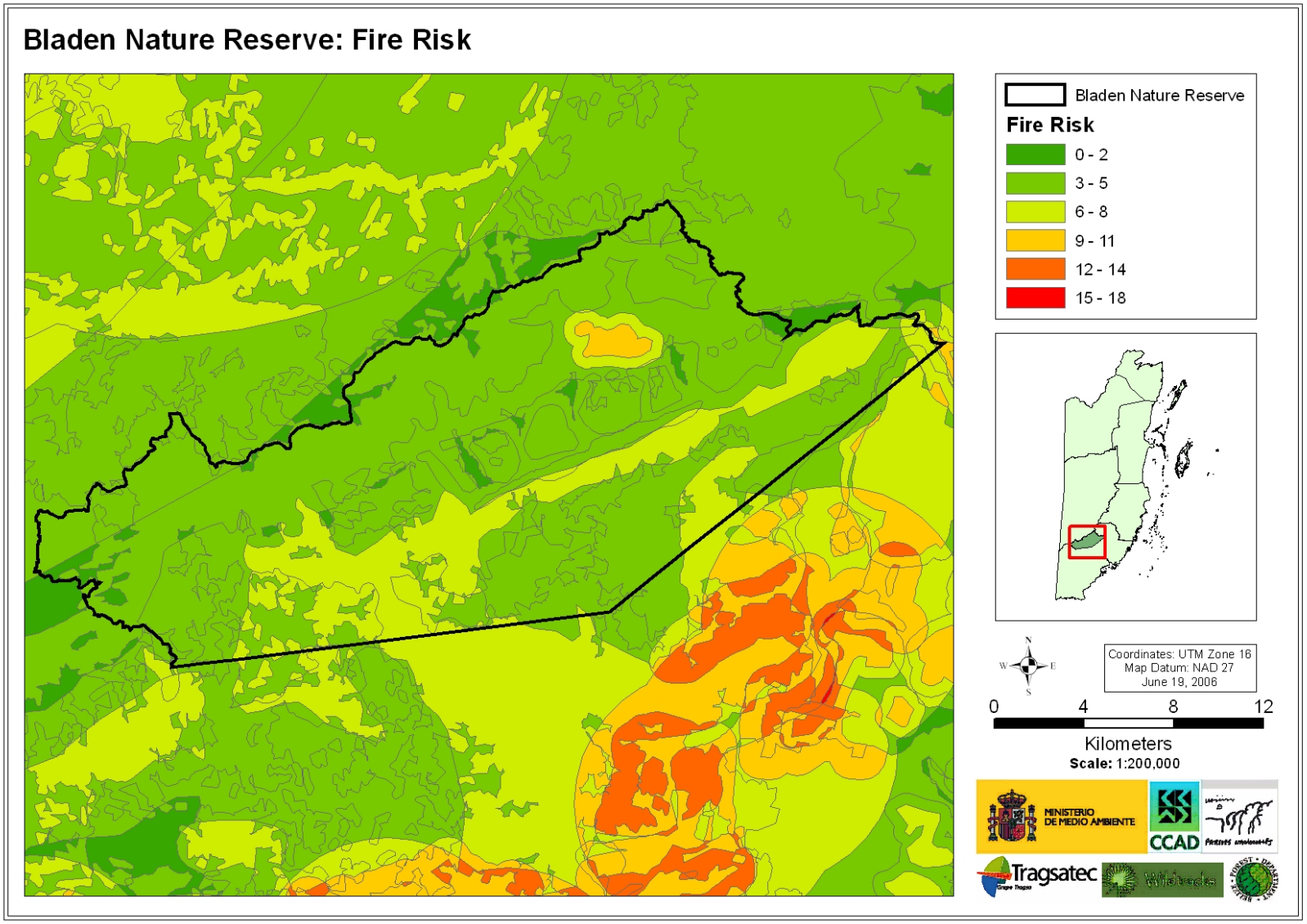
Map 17: Ecosystems – Actual Vegetation

Meerman, J. C. and W. Sabido. 2001. Central America Ecosystems Map: Belize. CCAD/World Bank/Programme for Belize. Version 20060405. Major Revision by J. Meerman and posted 05 Apr 2006. http://www.biodiversity.bz/; Bladen_Shrubland_Brewer Derived from *ecosys_bze_2004c* (Meerman), based on data supplied to Paul Walker, Wildtracks by Steven Brewer. Generated August 23, 2006.



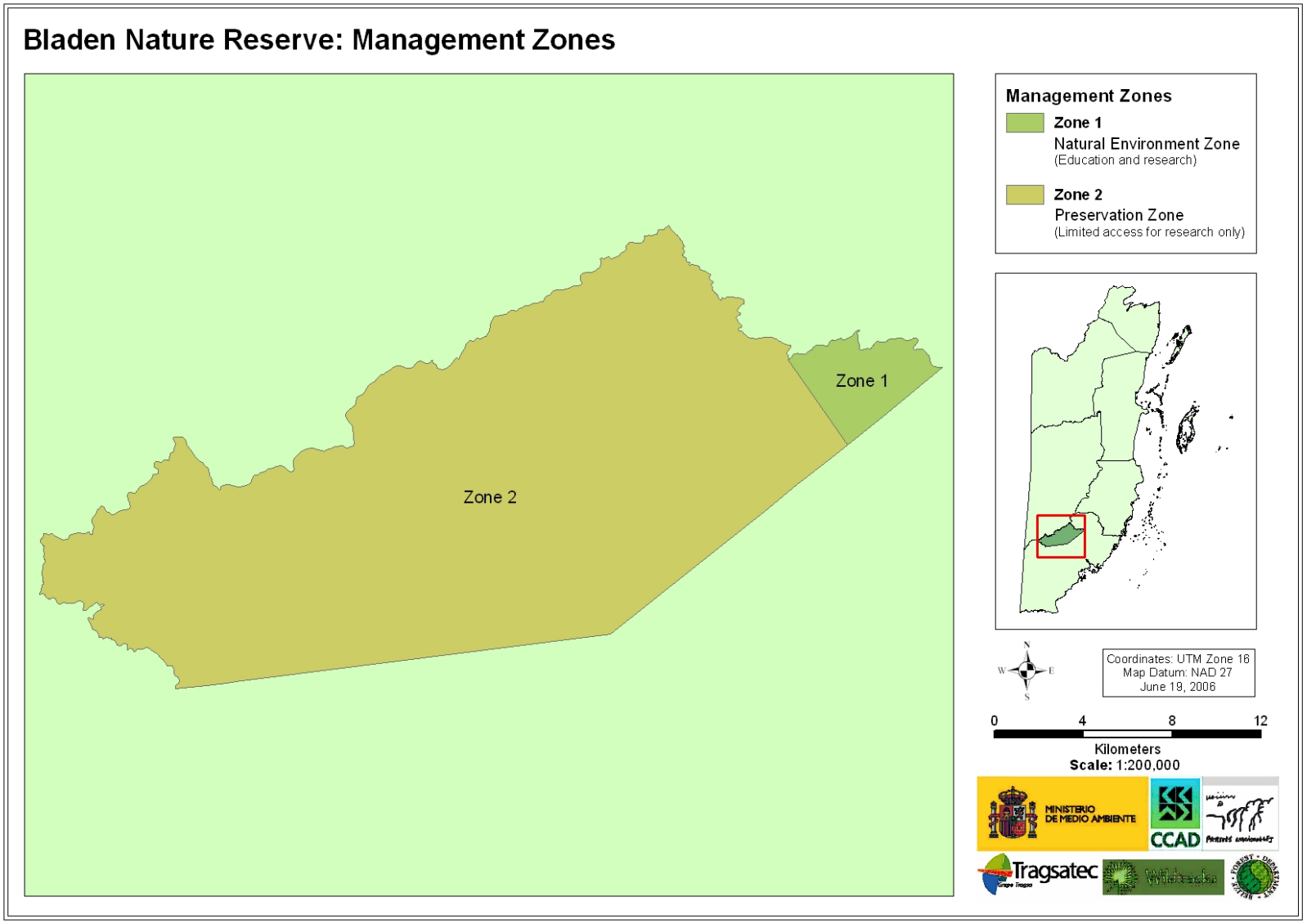
Map 18: Critical Areas.

Incursion Areas dataset based on information supplied by Paul Walker, Wildtracks. Aug 24, 2006. Fire Risk; Derived from *ecosys_bze_2004c (*Meerman*)*. Specific dataset generated for Paul Walker, Wildtracks. Dataset created on August 23, 2006.



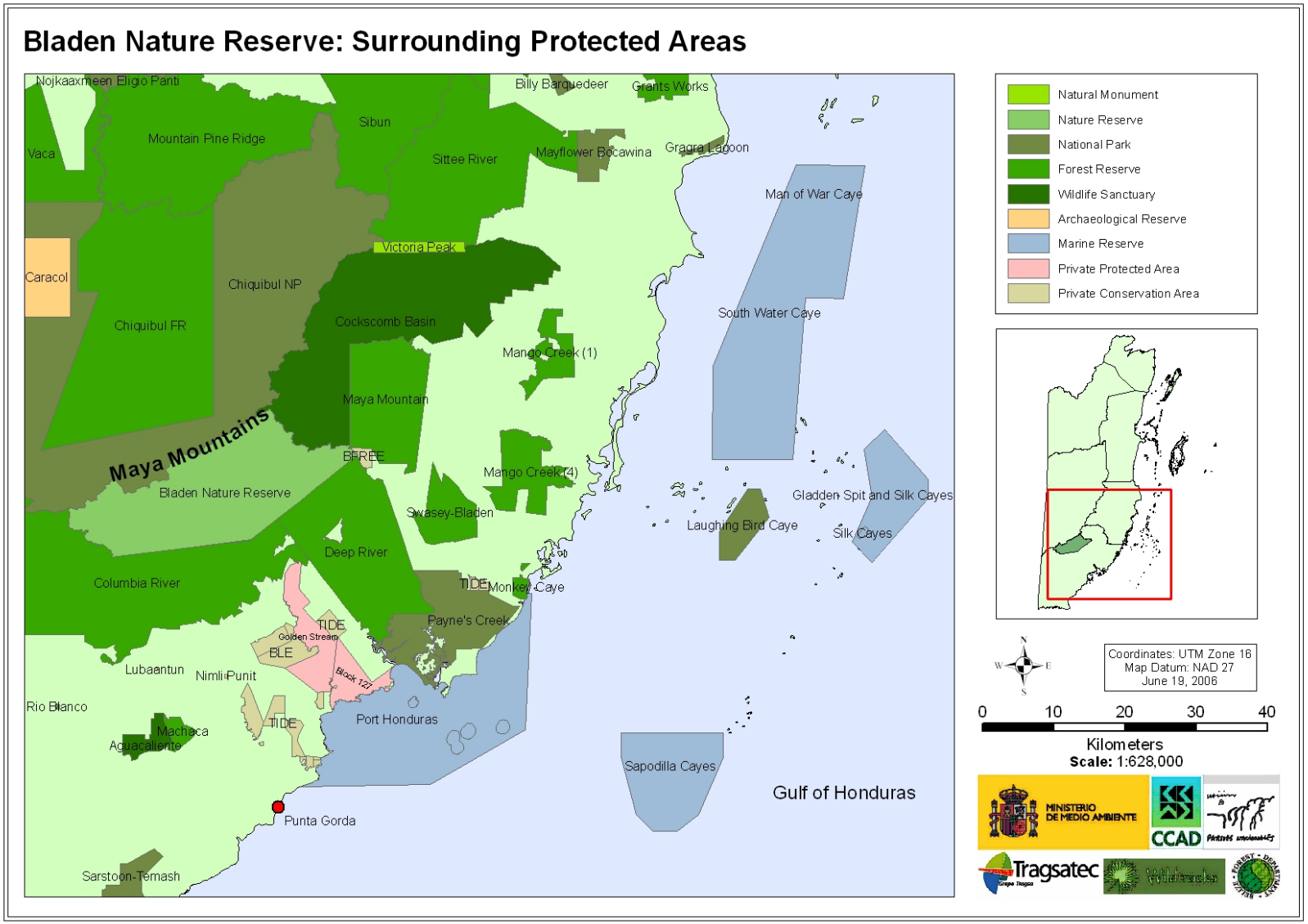
Map 19: Fire Risk

Jan Meerman, BTFS. Publisher: NPAPSP. http://www.biodiversity.bz/



Map 20: Management Areas

Georeferenced and digitised from data supplied by Zoe Walker, Wildtracks, from BMC



Map 21: Protected Areas adjacent to Bladen Nature Reserve

Georeferenced and digitised from data supplied by Zoe Walker, Wildtracks, from BMC

Annex 2: Ecosystems

Ecosystems of Bladen Nature Reserve (as mapped by Meerman & Sabido (2004)).

Tropical evergreen broad-leaved lowland hill forest on rolling karstic terrain	
Belize Ecosystems Legend Code:	1
Broad Ecosystem	Lowland broadleaved wet forest
Area mapped in Bladen Nature Reserve:	21,123.0 acres
Percentage of national coverage:	38.87%

This ecosystem was previously termed 'limestone hill forest', along with tropical evergreen broad-leaved lowland hill forest on steep karstic terrain, (Iremonger & Sayre, 1994). As its name implies, it occurs on less steep, rolling hills, and is mapped as occurring on the southern slopes of the ridge to the south of the Bladen Branch, and in a series of discrete tracts over rolling hills immediately to the north of the river, separated by relatively narrow tracts of alluvial forest following each of the river tributaries (Meerman & Sabido, 2004). Differences between these two ecosystems appear to be largely the result of steepness of the slopes, and the resultant differences in drainage. Generally the forest canopy is somewhat higher (trees up to 40m) on the rolling hills than on the steeper slopes. Based on topography, the 2004 mapping of this ecosystem is rather crude, and is likely to somewhat exaggerate its extent in the northeastern portion of the Reserve, where the karstic terrain is steep – rather than rolling. Similarly, topography dictates that relatively small tracts of steep karstic terrain forest will occur within the discrete tracts of rolling karstic terrain forest north of the river.

Iremonger and Sayre (1994) described this forest as having a canopy of 15-24m, on well-drained loamy soil. Predominant plants were reported to include *Calophyllum brasiliense, Sabal mauritiiformis, Pouteria durlandii, Trichilia minutiflora, Manilkara zapota, Cryosophila staurocantha* and *Astrocaryum mexicanum.*

The tract of this ecosystem represents a very significant portion (38.87%) of the total coverage of this system in Belize, as mapped by Meerman & Sabido (2004).

Tropical evergreen broad-leaved lowland hill forest on steep karstic terrain	
Belize Ecosystems Legend Code:	2
Broad Ecosystem	Lowland broadleaved wet forest
Area mapped in Bladen Nature Reserve:	15664.7acres
Percentage of national coverage:	16.85%

As noted for the lowland hill forest on rolling karstic terrain, this ecosystem is poorly defined from that on rolling karstic hills, having a generally similar species composition, but generally with a rather lower and more broken canopy. Its extent in Bladen is likely to be somewhat greater than that mapped by Iremonger & Brokaw (1995) & Meerman & Sabido (2004) – extending rather more in the eastern portion of the Reserve, and to the foot of the steep hills immediately to the south of the Bladen Branch.

Tropical evergreen broad-leaved lowland hill forest, Vochysia-Terminalia variant	
Belize Ecosystems Legend Code:	3
Broad Ecosystem	Lowland broadleaved wet forest
Area mapped in Bladen Nature Reserve:	11831.3acres
Percentage of national coverage:	57.75%

Growing on well-drained, non-calcareous soils over granitic rock, the tract of this forest represents the majority (over 57%) of the total extent of this system in Belize. It occurs on steep, rugged slopes (up to 500m elevation), between the margin of the granitic rock with the limestone, and the upper and generally less steep slopes to the north. It is characterized by species such as *Aspidosperma cruenta, Calophyllum brasiliense, Euterpe precatoria, Simarouba glauca, Terminalia amazonia, Vochysia hondurensis* and *Xylopia frutescens. Pinus caribaea* may become established in areas degraded by fire.

Tropical evergreen broad-leaved lowland forest on poor or sandy soils	
Belize Ecosystems Legend Code:	7
Broad Ecosystem	Lowland broadleaved wet forest
Area mapped in Bladen Nature Reserve:	2,009.7 acres
Percentage of national coverage:	1.22%

Mapped as occurring along the southeastern edge of Bladen Nature Reserve – the edge of the coastal plan running to the foothills of the ridgeline south of Bladen Branch (Meerman & Sabido, 2004). It had previously been mapped as being 'bottomland alluvial forest', over alluvial soils (Iremonger & Sayre, 1994); Meerman & Sabido's characterization is more credible for this location, reflecting the base soils. It is characterized by species such as *Acoelorraphe wrightii, Attalea cohune, Bactris mexicana, Calophyllum brasiliense, Dialium guianense, Ficus spp., Miconia spp., Pouteria sp., Simarouba glauca, Spondias sp., Terminalia amazonia, Vismia macrophylla* and *Xylopia frutescens.* With savanna fires occurring to the southeast of this tract, it is vulnerable to fire damage and degradation and associated establishment of *Byrsonima crassifolia* and *Pinus caribaea.*

Tropical evergreen broad-leaved submontane forest on rolling karstic hills	
Belize Ecosystems Legend Code:	8
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in Bladen Nature Reserve:	5,644.8 acres
Percentage of national coverage:	19.47%

Occurring on a rolling plateau in the SW of BNR, at elevations of 500-700m, on calcareous soils, this forest type is described as having an understory rich in Cyclanthaceae, *Chamaedorea spp*., *Peperomia spp*. and *Psychotria spp.* (Meerman & Sabido, 2001). One species of heliconia, *Heliconia librat,a* is reported as being restricted to this ecosystem (Meerman and Sabido, 2001).

Tropical evergreen broad-leaved submontane forest on steep karstic hills	
Belize Ecosystems Legend Code:	9
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in Bladen Nature Reserve:	6,349.7acres
Percentage of national coverage:	19.85%

Occurring to the east of the submontane forest on rolling karstic hills, this forest type occurs at similar elevations – but on significantly steeper karstic slopes. Access is particularly difficult, such that there is a dearth of information about the forest stature, structure or species composition. It is reported as having an understory rich in palm and ferns, and also to be habitat for the endemic *Zamia prasina* (Meerman & Sabido, 2001).

Tropical evergreen broad-leaved submontane forest	
Belize Ecosystems Legend Code:	10
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in Bladen Nature Reserve:	4,004.3acres
Percentage of national coverage:	6.22%

Contiguous with larger tracts to the north of Bladen, three tracts extend into northern BNR on the non-calcareous acidic soils over the granitic rock. Within Bladen it extends from elevations of 500-1,000m above sea level. Characteristic species include *Aspidosperma cruenta, Calophyllum brasiliense, Euterpe precatoria, Simarouba glauca, Terminalia amazonia, Vismia macrophylla, Vochysia hondurensis* and *Xylopia frutescens.*

Tropical evergreen broad-leaved submontane palm forest	
Belize Ecosystems Legend Code:	11
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in Bladen Nature Reserve:	22,306.9acres
Percentage of national coverage:	74.88%

Bladen Nature Reserve plays a critical role in protecting 75% of Belize's total coverage of this ecosystem, which occurrs in tracts on non-calcareous soils along the Main Divide of the Maya Mountains, forming the northern limit of the Reserve, and extending to the peaks of Little Quartz Ridge in the Columbia River Forest Reserve. *Colpothrinax cookii, Euterpe precatoria* and *Clusia spp.* are reported as being particularly common in this forest type (Meerman & Sabido, 2001). Other common species include *Calophyllum brasiliense, Chamaedorea spp., Cojoba arborea, Dendropanax arboreus, Ilex guianensis, Inga sp., Miconia spp., Quercus cortesii* and *Simarouba glauca*.

Tropical evergreen broad-leaved lower-montane forest	
Belize Ecosystems Legend Code:	12
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in Bladen Nature Reserve:	446.1acres
Percentage of national coverage:	20.86%

Occurring at elevations over 1,000m on granitic rocks, this ecosystem has an extremely limited distribution and extent in Belize – being found only in the vicinity of Doyle's Delight (in Chiquibul National Park), and extending into the northwestern tip of Bladen Nature Reserve. It is effectively the upper elevation extension (over 1,000m) of tropical evergreen broad-leaved submontane forest. Species recorded within this ecosystem include *Alchornea latifolia, Calophyllum brasiliense, Cojoba arborea, Cyrilla racemiflora, Dendropanax arboreus, Ilex guianensis, Magnolia yoroconte, Miconia sp., Myrica splendens, Quercus cortesii* and *Simarouba glauca.*

Tropical evergreen broad-leaved lower montane palm forest	
Belize Ecosystems Legend Code:	13
Broad Ecosystem	Submontane broadleaf wet forest
Area mapped in Bladen Nature Reserve:	556.3acres
Percentage of national coverage:	36.09%

This is another upper elevation forest type with an extremely limited distribution in Belize: being found only on the granitic hills on the boundary between Chiquibul National Park and Bladen Nature Reserve – to the east of the lower-montane forest. It is the upper elevation (over 1,000m) extension of tropical evergreen broad-leaved submontane palm forest (11), from which its biological distinction is questionable (Meerman & Sabido, 2001). Plant species recorded within this ecosystem are essentially those of the palm forest at slightly lower elevations.

Tropical evergreen broad-leaved alluvial forest on calcareous soils	
Belize Ecosystems Legend Code:	14
Broad Ecosystem	Lowland broadleaf wet forest
Area mapped in Bladen Nature Reserve:	6,985.6acres
Percentage of national coverage:	22.23%

The acreage listed for this ecosystem, calculated from the Belize Ecosystem Map (Meerman & Sabido, 2004), is in fact rather greater than the actual extent of the system. It is found along the banks of the Bladen Branch River, and its main tributaries, occurring in the lowlands (below 50m a.s.l), on the river banks, on the calcium-rich alluvial deposits, and bounded away from the river by the limestone hills – which extend significantly closer to the river than indicated in past mapping efforts (Iremonger & Brokaw, 1995; Meerman & Sabido, 2004). This riparian forest ecosystem is one of the preferred habitats for Howler Monkeys and Tapir. Common plants include *Acosmium panamense, Astrocaryum mexicanum, Bactris mexicana, Attalea cohune, Brosimum sp., Calyptrogyne ghiesbreghtiana Calophyllum brasiliense, Castilla elastica, Ceiba pentandra, Celtis schippii, Dendropanax arboreus, Desmoncus staurocanthos, Dialium guianense, Ficus spp., Inga affinis, Ochroma pyramidale, Pouteria spp., Protium schippii., Pterocarpus rohnii, Quararibea funebris, Sabal mauritiiformis, Schizolobium parahybum, Simira salvadorensis, Symphonia globulifera* and *Vochysia hondurensis.*

Tropical evergreen seasonal broad-leaved lowland hill forest, on rolling karstic terrain	
Belize Ecosystems Legend Code:	19
Broad Ecosystem	Lowland broadleaf moist forest
Area mapped in Bladen Nature Reserve:	14.2 acres
Percentage of national coverage:	0.02%
A tiny portion of this ecosystem projects across the Bladen Branch River into the eastern tip of BNR. It is a somewhat drier system than those more typical of Bladen, and is very susceptible to fire damage from adjacent farmlands. Common plants include *Acacia dolychostachya, Asdpidosperma cruenta, Attalea cohune, Brosimum alicastrum, Calophyllum brasiliense, Cedrela odorata, Cordia sp., Crysophila staurocantha, Cupania sp., Hirtella americana, Manilkara zapota, Sideroxylum sp., Sabal mauritiiformis, Spondias sp., Stemmadenia donnell-smithi, Trophis racemosa, Vitex gaumeri* and *Zanthoxylum sp.*	

Tropical evergreen seasonal broad-leaved submontane forest, Simarouba-Terminalia variant	
Belize Ecosystems Legend Code:	36
Broad Ecosystem	Submontane broadleaf moist forest
Area mapped in Bladen Nature Reserve:	942.7 acres
Percentage of national coverage:	0.85%
Extending into the extreme northeast of Bladen from Cockscomb Basin Wildlife Sanctuary and Chiquibul National Park to the north, this ecosystem occurs on granite hills between approximately 650m and 850m a.s.l. in Bladen. Common species for this system include *Attalea cohune, Astrocaryum mexicanum, Castilla elastica, Chrysophillum cainito, Dendropanax arboreus, Dialium guianense, Euterpe precatoria, Ficus spp., Protium schippii, Pourouma aspera, Schizolobium parahybum, Simarouba glauca, Swietenia macrophylla, Terminalia amazonia, Vismia macrophylla, Vochysia hondurensis, Xylopia frutescens* and *Zanthoxylum sp.*	

Tropical evergreen broad-leaved shrubland on steep karstic hills	
Belize Ecosystems Legend Code:	54
Broad Ecosystem	Lowland broadleaf wet forest
Area mapped in Bladen Nature Reserve:	829.4 acres
Percentage of national coverage:	100%
This ecosystem has only been identified in Bladen Nature Reserve. It is restricted to a series of steep limestone crags where the limestone portion of Bladen abuts the granitic rocks in the northern portion of the Reserve. It is found at altitudes between approximately 300m to 500m above sea level, with significant bare limestone outcrops. Mapping error (Iremonger & Brokaw, 1995; Meerman & Sabido, 2004) appears to have positioned the small patches of this ecosystem between 250m and 300m from the hills on which they are found. In stature, they are a low scrub forest with a canopy of 3-8m. The soil is described as being well-drained loam (Iremonger & Sayre, 1994). Woody plants identified in this habitat include *Amyris rhomboidea, Byrsonima bucidifolia, Clusia massoniana,* and *Guettarda sp..* Graminoids, *Gymnosiphon divaricatus,* along with epiphytic orchids, bromeliads and lichens are also reported as present (Iremonger & Sayre, 1994). *Glossostipula concinna* (Rubiaceae) was also recorded (Iremonger & Sayre, 1994), though this species is not included as being one of the vascular plants of Belize (Balick, et. al. 2000) – possibly in the absence of a voucher specimen?	

Deciduous broad-leaved lowland shrubland, well drained, over poor soils	
Belize Ecosystems Legend Code:	57
Broad Ecosystem	Lowland pine forest
Area mapped in Bladen Nature Reserve:	266.3 acres
Percentage of national coverage:	4.44%

Describedas a fire-induced scrubland with grasses (Meerman & Sabido, 2001), this ecosystem reportedly includes *Clusia sp., Curatella americana, Cyperus spp., Byrsonima crassifolia, Pinus caribaea, Quercus sp., Scleria sp*. and various orchids. In this locality, it can be expected that the fires that create and maintain this shrubland are natural – resulting from lightning strikes.

Deciduous mixed submontane shrubland over poor soils	
Belize Ecosystems Legend Code:	59
Broad Ecosystem	Submontane pine forest
Area mapped in Bladen Nature Reserve:	649.8 acres
Percentage of national coverage:	1.83%

Another fire-induced ecosystem (Meerman & Sabido, 2001), it is described as having a fairly open canopy up to 5-10m in height, on well-drained sandy loam or sandy clay loam over granitic rock (Iremonger & Sayre, 1994). Some predominant tree species were not identified, but those which were include *Clusia massoniana, Ilex guianensis, Myrcia leptoclada, Ormosia velutina, Pinus caribaea, Podocarpus guatemalensis, Quercus sapotifolia, Perdiaea belizensis* and *Roupala montana. Cyperus spp.* and *Dicranopteris flexuosa* are reported to dominate the herbaceous layer. Orchids include *Arpophyllum giganteum, Encyclia sp., Sobralia sp., Scaphyglottis behrii, S. prolifera* and *Vanilla sp.*

Deciduous broad-leaved lowland riparian shrubland in hills	
Belize Ecosystems Legend Code:	61
Broad Ecosystem	Shrubland
Area mapped in Bladen Nature Reserve:	11.0 acres
Percentage of national coverage:	0.16%

A small tract of this ecosystem was mapped, along the Central River, on the boundary between Bladen Nature Reserve and Columbia River Forest Reserve in the extreme SW corner of BNR (Meerman & Sabido, 2004). It is described as a community found along fast-flowing mountain streams, and typically having a mixture of vines, grasses and shrubs, with relatively sparse trees. Species typical of this ecosystem include *Ceiba pentandra, Schizolobium parahybum, Byttneria sp., Calathea sp., Canna indica, Castilla elastica, Cecropia obtusifolia, Cedrela odorata, Hamelia patens, Heliconia latispatha, Inga affinis, Ipomoea spp.* and *Maranta arundinaceae.*

Short-grass savanna with scattered needle-leaved trees	
Belize Ecosystems Legend Code:	62
Broad Ecosystem	Lowland savanna
Area mapped in Bladen Nature Reserve:	81.2 acres
Percentage of national coverage:	0.04%

A small tract of this ecosystem extends into the eastern tip of Bladen Nature Reserve, occurring on nutrient poor acidic soils, that are waterlooged in the wet season and parched in the dry season. Such open grass-dominated plains are typically dotted with specimens of *Pinus caribaea*, and shrubby patches including *Acoelorraphe wrightii, Brysonima crassifolia, Chrysobalanus icaco, Hirtella racemosa, Quercus oleoides, Passiflora urbaniana* and *Xylopia frutescens.* This ecosystem is extremely susceptible to anthropogenic fires, which if frequent (more frequent than every 5 years) displace this system towards a short-grass savanna with shrubs.

Short-grass savanna with shrubs	
Belize Ecosystems Legend Code:	63
Broad Ecosystem	Lowland savanna
Area mapped in Bladen Nature Reserve:	29.4 acres
Percentage of national coverage:	0.01%

Adjacent to the short-grass savanna with scattered needle-leaved trees, in the eastern tip of BNR, this ecosystem can be considered as being a degraded (fire-induced) example of that system. Whilst numerous fire-tolerant shrubs persist in the shrubby patches, *Pinus caribaea* cannot tolerate high frequency fire exposure, and becomes very uncommon / absent. *Miconia spp.* of these savannas readily resprout from underground, whilst *Brysonima crassifolia* typically loses only its new growth in fires and rapidly rebuds.

Agriculture	
Belize Ecosystems Legend Code:	79
Broad Ecosystem	Agricultural uses
Area mapped in Bladen Nature Reserve:	31.4 acres
Percentage of national coverage:	0.02%

A small tract of old farmland extends a short distance along the Bladen Branch River into BNR, from the BFREE lands. These abandoned farms are now regenerating into young secondary forests.

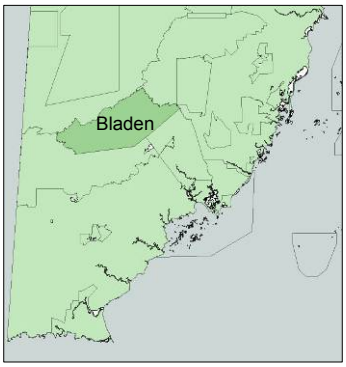
Annex 3: Species Reports

- Mammals
- Birds
- Reptiles and Amphibians

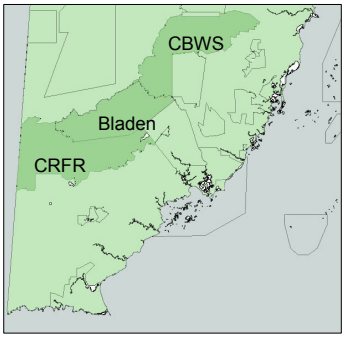
Mammals

With its forested slopes, riparian vegetation, valleys and rugged limestone landscapes, Bladen Nature Reserve is home to a wide variety of mammal species typical of tropical moist broadleaf forest. Of the 163 species of mammal recorded within Belize (Jacobs et. al. 1998) that could potentially be found in the protected area based on the assumption of similar ecosystems, 93 species are recorded as present within Bladen Nature Reserve itself.

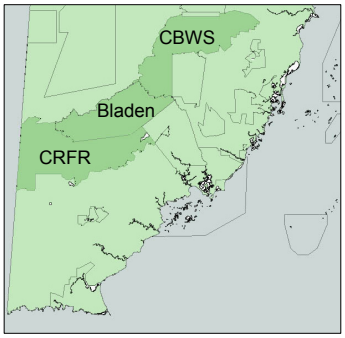
When the entire Maya Mountain block of east-slope protected areas of contiguous ecosystems is considered (Cockscomb Basin Wildlife Sanctuary, Bladen Nature Reserve and Columbia River Forest Reserve), the number of species that could be present increases to 110 species – 67% of the total number of mammal species recorded for Belize, partly as a result of specialized species surveys into groups such as the small rodents and bats (McCarthy 1987, McCarthy et. al. 1993, McCarthy and Blake 1987, Miller; 1999; Emmons 1993).



Species recorded only from Bladen Nature Reserve:
93 species are recorded within Bladen to date, of which seven are considered of global concern. Of these, two are 'endangered' under the IUCN redlist system (the Yucatan black howler monkey and Baird's tapir), and five are considered 'near threatened' (water opossum, Alston's mouse opossum, Thomas' sac-winged bat, puma and jaguar). Two further species are considered to be 'data deficient' with insufficient information to allow them to be categorised (red brocket deer and Neotropical river otter). Also present is the Central American spider monkey, listed as a sub-species considered to be of international concern (IUCN status: Vulnerable).



Species found in both Cockscomb Basin Wildlife Sanctuary and Columbia River Forest Reserve (and including those found in Bladen):
Of the 49 species projected to be within Bladen due to similarity and connectivity of ecosystems, and presence in both Cockscomb and Columbia River Forest Reserve, a further two species of international concern are listed – the Jamaican fruit-eating bat ('Lower risk') and the cacomistle ('Near threatened'), bringing the total list of species of international concern up to eleven (including the two species listed as 'data deficient').



Species found within the Maya Mountain Block (Bladen, Cockscomb, and / or Columbia River):
Of the 110 species recorded from the east of the Maya Mountain divide from the contiguous protected areas of Cockscomb Basin Wildlife Sanctuary southwards to include Bladen and Columbia River Forest reserve, a further three species are added to the list of threatened species for the area – the woolly opossum (considered 'vulnerable'), and three bat species listed as 'lower risk / near threatened' - Davis's round-eared bat, Van Gelder's bat, and Underwood's bonneted bat. Belize has a total of 21 threatened terrestrial mammal species (IUCN redlist) of which the Maya Mountain block provides protection for 15 (71%).

Bladen is therefore highlighted as a vital conservation area within the protected areas system, making a major contribution towards the maintenance of biodiversity in Belize. Its isolated nature and the lack of access have led to buffering it has with the presence of the other protected areas and the BFREE lands should enable it to continue its role in protecting both threatened and non-threatened species.

The Yucatan black howler (*Alouatta pigra*), one of two endangered species recorded from the area, is endemic to a small area of the Yucatan Peninsula, Belize and the Peten. This species was decimated by a yellow fever epidemic in 1956/1957 that swept through the *Alouatta* population throughout most of the country. Pockets of viable populations remained, including those in Columbia River Forest Reserve and Bladen Nature Reserve, whilst in other areas further north, such as Cockscomb Basin Wildlife Reserve, the epidemic was compounded by other impacts such as the effects of Hurricane Hattie in 1961, and by local hunting pressure, extirpating the local population by 1978 (Horwich et. al 1993). There was a notable lack of howler monkeys during both the 1987 and 1994 surveys, attributed to the yellow fever (Brokaw et. al, 1987) - however enquiries into the howler monkey populations in Bladen among traditional users of the area – chicleros and hunters – suggest that this species has been continuously present in the area, and this species is presently considered to have a healthy population (Marlin, pers. com.). This may be important for the replenishment of the coastal population following the population crash and social disorganization experienced after Hurricane Iris in 2001 (Pavelka, 2004). With increasing habitat fragmentation and loss throughout its range, *Alouatta pigra* has recently been upgraded to Endangered in the IUCN Redbook.

The second primate species, the Central American spider monkey (*Ateles geoffroyi*), appears to be more restricted to the forested hill slopes, overlapping less with the coastal areas of human impact. The Belize sub-species, *Ateles geoffroyi yucatanensis,* is listed as 'Vulnerable' (IUCN, 2005), reflecting the decreasing population in the region, primarily through habitat destruction. As a species that, in Belize requires large, intact forested areas with minimal human impact, *Ateles* is thought to be indicative of a healthy ecosystem. Further north in Cockscomb, it is only found towards the more remote hill slopes away from areas frequented by tourism activities.

Baird's Tapir *(Tapirus bairdii)*, is the largest herbivore present in Bladen, and tends to be associated particularly with riparian areas where it grazes on the herbaceous vegetation. Both the 1984 and the 1997 studies reported frequent sightings of tracks, suggesting that this species is widespread through the lowland areas of the Nature Reserve (Brokaw et. al.). Whilst listed as an 'Endangered' species internationally (IUCN, 2005), it is widespread in Belize, where it is seldom hunted (however, there have been recent reports of a tapir carcass killed adjacent to the protected area, with indications that it had been killed for the meat (Muschamp, pers. com, 2005), and there are reports that tapir

is considered a traditional delicacy by the Garifuna communities (community consultations). The main threat to this species in Belize is the increasing land use change, with the destruction of suitable habitat - the protection of significant tracts of unfragmented riparian vegetation and other suitable habitat is now considered a priority for its continued survival.

Eight species of Didelphidae have been recorded within Bladen Nature Reserve – including the woolly opossum (*Caluromys derbianus*) (IUCN status: vulnerable, 2004) and the 'near threatened' Alston's Mouse Opossum (*Micoureus alstoni*) (IUCN, 2004).

Two species of Edentata have been recorded for Bladen (the northern tamandua (*Tamandua mexicana*) and the nine-banded armadillo (*Dasypus novemcinctus*), neither of which is considered threatened. The northern tamandua is relatively common in broadleaf forest areas throughout Belize, and the nine-banded armadillo is a relatively abundant, favoured game species within Belize. The smaller silky anteater (*Cyclopes didactylus*) has been recorded from broadleaf forest in both Cockscomb Basin and the adjacent coastal plain and may therefore occur within the protected area, though is hard to detect because of its small size and secretive nature.

Twelve species of rodents have been identified to date from within Bladen Nature Reserve. A third species of squirrel, the variegated squirrel (*Sciurus variegatoides*), described locally as 'large and dark', or 'black' (Muschamp, pers. com.), has been recorded from Chiquibul and Columbia Forest areas (Matola, 1992; Rodgers et. al, 1991, Matola 1989), and therefore may also be present, though the range for this species is south of the Belize border (Reid, 1997).

The two larger rodent species – the agouti (*Dasyprocta puntata*) and paca (*Agouti paca*) - have both been recorded within Bladen. The larger paca (*A. paca*) is found more frequently along stream edges and on river banks, where it is sought as a preferred game species for local hunters (community consultations). The hispid pocket gopher (*Orthogeomys hispidus*) has been recorded in the adjacent Cockscomb Basin Wildlife Sanctuary and Columbia River Forest Reserve, and is therefore considered likely to occur in Bladen.

Thirty-six species of bat were recorded by a combination of surveys by McCarthy, in the late 1980's, and Miller in 1999 (Neobat, 2006).

Five species of non-Felidae carnivores were recorded from Bladen, and a sixth, the cacomistle (*Bassariscus sumichrasti*) has been recorded from Cockscomb and Columbia River Forest Reserve, so is likely to be present. Both of the two mustelids (tayra (*Eira Barbara*) and long-tailed weasel (*Mustela frenata*)) have been recorded within the protected area, as has the Neotropical river otter (*Lontra longicaudis*), this latter species being closely associated with the river system, where its presence indicates healthy fish stocks and little human disturbance. All five of the cat species found in Belize are reported to be present

within the Bladen area, suggesting that there is a good prey base to support these key predators (Marlin, pers. com.).

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

Both the white-tailed deer (*Odocoileus virginianus*) and the red brocket (*Mazama americana*) are found within Bladen - the larger of the two, *O. virginianus*, is favoured by hunters, and comes under intense pressure during dry season throughout Belize, when savannas are burnt to attract it to the fresh grass shoots that follow the fire. It prefers the savannah ecosystems, which are poorly represented within Bladen, but will also frequent the forested area. The smaller, more secretive *M. americana* is confined largely to the broadleaf forest areas, rarely venturing into the open areas.

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

Mammal Species of Bladen Nature Reserve					
Common Name	***Scientific Name***	**IUCN Global Status**	**IUCN Sub-species Status**	**CITES**	**National Status**
Didelphimorphia					
Didelphidae					
Common Opossum	*Didelphis marsupialis*				
Virginia Opossum	*Didelphis virginianus*				
Four-eyed Opossum	*Philander opossum*				
Central American Wooly Opossum	*Caluromys derbianus*				
Water Opossum	*Chironectes minimus*	NT			
Alston's Mouse Opossum	*Micoureus alstoni*	NT			
Mexican Mouse Opossum	*Marmosa mexicana*				
Robinson's Mouse Opossum	*Marmosa robinsoni*				
Xenartha					
Myrmecophagidae					
Northern Tamandua	*Tamandua mexicana*				
Dasypodidae					
Nine-banded Armadillo	*Dasypus novemcinctus*				
Chiroptera					
Emballonuridae					
Proboscis Bat	*Rhynchonycteris naso*				
Greater White-lined Bat	*Saccopteryx bilineata*				
Lesser White-lined Bat	*Saccopteryx leptura*				
Least Sac-winged bat	*Balantiopteryx io*	NT			VU
Lesser Dog-like Bat	*Peropteryx macrotis*				
Greater Dog-like Bat	*Peropteryx kappleri*				
Northern Ghost Bat	*Diclidurus albus*				
Noctilinoidae					
Greater Fishing Bat	*Noctillio leporinus*				
Mormoopidae					
Ghost-faced Bat	*Mormoops megalophylla*				
Common Mustached Bat	*Pteronotus parnelli*				
Lesser Mustached bat	*Pteronotus personatus*				
Davy's Naked-backed Bat	*Pteronotus davyi*				
Phyllostomidae					
Common Sword-nosed Bat	*Lonchorhina aurita*				
Brazilian Big-eared Bat	*Micronycteris microtis*				
Schmidt's Big-eared Bat	*Micronycteris schmidtorum*				
Niceforo's Bat	*Trinycteris nicefori*				
Davis Round-eared Bat	*Tonatia evotis*				
Cozumel Golden Bat	*Mimon cozumelae*				
Pale Spear-nosed Bat	*Phyllostomus discolor*				
Fringe-lipped Bat	*Trachops cirrhosus*				
Woolly False Vampire Bat	*Chrotopterus auritus*				
Great False Vampire Bat	*Vampyrum spectrum*				
Common Long-tongued Bat	*Glossophaga soricina*				
Underwood's Long-tongued Bat	*Hylonycteris underwoodi*				
Little Yellow-shouldered Bat	*Sturnira lillium*				
Short-tailed Fruit Bat	*Carollia soweli*				
Seba's Short-tailed Bat	*Carollia perspicillata*				

Common Name	*Scientific Name*	IUCN Global Status	IUCN Sub-species Status	CITES	National Status
Phyllostomidae (cont.)					
Wrinkle-faced Bat	*Centurio senex*				
Intermediate Fruit-eating bat	*Artibeius intermedius*				
Thomas' Fruit-eating Bat	*Artibeas watsoni*				
Jamaican fruit-eating Bat	*Artibeus jamaicensis*				
Great Fruit-eating Bat	*Artibeus lituratus*				
Toltec Fruit-eating Bat	*Artibeus toltecus*				
Pygmy Fruit-eating Bat	*Dermanura phaeotis*				
Common Tent-making Bat	*Uroderma bilobatum*				
Hairy Big-eyed Bat	*Chiroderma villosum*				
Little Yellow-eared Bat	*Vampyressa thyone*				
Desmodontidae					
Common Vampire Bat	*Desmodus rotundus*				
Natalidae					
Mexican Funnel-eared Bat	*Natalus stramineus*				
Vespertilinodae					
Hairy-legged Myotis	*Myotis keasyi*				
Argentine Brown Bat	*Eptesicus furinalis*				
Van Gelder's Bat	*Bauerus dubiaquercus*				
Central American Yellow Bat	*Rhogeessa tumida*				
Northern Yellow Bat	*Lasiurus intermdius*				
Southern Yellow Bat	*Lasiurus ega*				
Molossidae					
Underwood's Mastiff Bat	*Eumops underwoodi*				
Black mastiff bat	*Molossus rufus*				
Pallas' mastiff bat	*Molossus molossus*				
Primates					
Cebidae					
Yucatan Black Howler	*Alouatta pigra**	EN		I	VU
Central American Spider Monkey	*Ateles geoffroyi*			II	VU
			VU		
Rodentia					
Sciuridae					
Yucatan Squirrel	*Sciurus yucatanensis*				
Deppe's Squirrel	*Sciurus deppei*				
Agoutidae					
Central American Agouti	*Dasyprocta punctata*			III	
Paca	*Agouti paca*			III	
Heteromyidae					
Forest Spiny Pocket Mouse	*Heteromys desmarestianus*				
Muridae					
Rusty Rice Rat	*Oryzomys rostratus*				
Alfaro's Rice Rat	*Oryzomys alfaroi*				
Hispid Cotton Rat	*Sigmodon hispidus*				
Northern Climbing Rat	*Tylomys nudicaudus*				
Big-eared Climbing Rat	*Ototylomus phyllotis*				
Vesper Rat	*Nyctomis sumichrasti*				

Common Name	*Scientific Name*	IUCN Global Status	IUCN Sub-species Status	CITES	National Status
Rodentia cont.					
Erethizontidae					
Mexican Porcupine	*Coendou mexicanus*				
Lagomorpha					
Leporidae					
Forest Rabbit	*Sylvilagus brasiliensis*				
Carnivora					
Canidae					
Grey Fox	*Urocyon cinereoargenteus*				
Procyonidae					
Northern Racoon	*Procyon lotor*				
White-nosed Coati	*Nasua narica*			III	
Kinkajou	*Potos flavus*			III	
Mustelidae					
Tayra	*Eira Barbara*		VU	III	
Greater Grison	*Galictis vittata*				
Spotted Skunk	*Spilogale putorius*				
Striped Hog-nosed Skunk	*Conepatus semistriatus*				
Long-tailed Weasel	*Mustela frenata*				
Neotropical River Otter	*Lutra longicaudis*	DD		I	VU
Felidae					
Jaguarundi	*Herpailurus yaguarondi*[1]			I	
Ocelot	*Leopardsu pardalis*[1]			I	VU
Margay	*Leopardus wiedii*[1]			I	VU
Puma	*Puma concolor*	NT		I	NT
Jaguar	*Panthera onca*	NT		II	NT
Perissodactyla					
Tapiridae					
Baird's tapir	*Tapirus bairdii*	EN		I	VU
Artiodactyla					
Tayassuidae					
Collard Peccary	*Pecari tajacu*			II	
White-lipped Peccary	*Dicotyles pecari*			II	VU
Cervidae					
White-tailed Deer	*Odocoileus virginianus*				
Red brocket Deer	*Mazama americana*	DD			

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

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

Birds

Bladen Nature Reserve is considered to have a particularly rich and diverse avifauna. Whilst only 250 species have been recorded to date within the boundaries (based on surveys conducted within the protected area (Brokaw and Lloyd Evans, 1987; Iremonger and Sayer, 1994)), this is anticipated to climb to as many as 357 species, from knowledge of species recorded in adjacent protected areas of similar ecosystem types (Columbia River Forest Reserve (Conservation International, 1993; Meerman, 1997), Cockscomb Basin Wildlife Sanctuary (Walker and Walker, 2005) and Doyle's Delight (Teul, 2004)) – representing 62% of the total bird species currently recorded for Belize.

Figure 10: Characteristic Bird Species of the Bladen Nature Reserve Broadleaf Forest

Great Tinamou
Slaty-breasted Tinamou
Double-toothed Kite
White Hawk
Black-and-White Hawk-Eagle
Ornate Hawk-Eagle
Barred Forest-Falcon
Great Curassow
Spotted Wood-Quail
Short-billed Pigeon
Gray-chested Dove
Mealy Parrot
Spectacled Owl
Central American Pygmy-Owl
Violet Sabrewing
Collared Trogon
Slaty-tailed Trogon
Tody Motmot
White-whiskered Puffbird
Chestnut-colored Woodpecker
Scaly-throated Leaftosser
Black-faced Antthrush
Sepia-capped Flycatcher
Eye-ringed Flatbill
Ruddy-tailed Flycatcher
Sulphur-rumped Flycatcher
Rufous Mourner
Thrush-like Schiffornis
Rufous Piha
Lovely Cotinga
Red-capped Manakin
Tawny-crowned Greenlet
Green Shrike-Vireo
White-breasted Wood-Wren
Nightingale Wren
Golden-crowned Warbler
Black-throated Shrike-Tanager
Green Honeycreeper
Orange-billed Sparrow

Bladen Nature Reserve contains a wide variety of ecosystems, ranging from the fertile floodplain vegetation to the higher elevations of the Maya Mountains. This has resulted in the high species richness observed within the area. The majority of the species are lowland broadleaf forest generalists (Figure 10), found throughout much of Belize. The floodplain of Bladen Branch also attracts many of the riverine, forest edge and gallery forest species, such as the bare-throated tiger-heron (*Tigrisoma mexicanum*), the shy agami heron (*Agamia agami*) and muscovy duck (*Cairina moschata*),the white-necked Jacobin (*Florisuga mellivora)* and yellow-tailed oriole (*Icterus mesomelas*). Other species closely associated with water have also been recorded – the various kingfishers, spotted sandpiper (*Actitis macularia*) and the two species of waterthrush.

Figure 11: Higher Elevation Species of CBWS, CRFR and Doyle's Delight

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

Whilst the higher elevations within Bladen have not yet been studied, those of Columbia River Forest Reserve and Doyle's Delight (within Chiquibul Forest Reserve) have both been the focus of expeditions with experienced ornithologists recording the avifauna (Figure 11). These areas are contiguous with those of Bladen, and from the data at these two sites, there appears to be almost complete species overlap. With these areas being so remote and inaccessible, there has also been the addition of new species records for Belize, such as the scaly-throated foliage gleaner (*Anabacerthia variegaticeps*) (Doyle's Delight Expedition,1989), and tawny-throated leaftosser (Doyle's Delight Expedition,1993; Little Quartz Ridge, Jones, 1997).

Two neotropical migrants - Chuck-Will's-widow (*Caprimulgus carolinesis*) and the warbling vireo (*Vireo galvus*) - were also recorded for the first time, in Columbia River Forest Reserve in 1992 (Conservation International, 1993), and may be present in the higher altitude areas of Bladen Nature Reserve.

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

Bladen has two large resident game bird species, the great curassow (*Crax rubra*) and crested guan (*Penelope purpurascens*). Both these species, along with their more common relative, the plain chachalaca, are representatives of the Cracidae family – the most threatened of the Neotropical bird families. Cracids are important seed dispersers and are a major protein source for local communities. Within Belize, both the curassow and the guan are locally common, and outside of protected areas such as Bladen, they are legal game species for those with hunting permits. However, the increase in agricultural colonists and seasonal Central American workers adjacent to the Nature Reserve has led to increased illegal hunting within the protected area, resulting in reduced populations of both species, if not already, then in the future. This was noted by the 1992 and 1997 expeditions to Columbia River Forest Reserve directly south of Bladen, with reports that game species were unexpectedly scarce in even the upper elevations, suggesting increasing hunting pressure, with relatively easy access from Guatemala. Whether this is impacting Bladen itself is currently unknown, but the implications are that these areas, once considered pristine, should now be considered under threat. This pronounced negative response to hunting pressure makes these two species especially valuable as indicator species in areas where hunting still occurs.

Of particular note is the presence of a number of species in the protected area considered endangered or vulnerable, and in need of protection within Belize (Figure 12). These include one of the two large game species (the great curassow), and the keel-billed motmot (*Electron carinatum*). The 'near threatened' harpy eagle (*Harpia harpyia*) has also been recorded from Bladen (Marlin, pers. com., 2006), and the rare solitary eagle (*Harpyhaliaetus solitarius*) has been recorded from the adjacent Cockscomb Basin Wildlife Sanctuary and Doyle's Delight, with a high probability that its range includes Bladen. Other birds highlighted as being of concern include the second game species (*P.*

Figure 12: Bird Species of International Concern of the Maya Mountain Block

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

IUCN Red List, 2005

* Recorded in Bladen Nature Reserve

purpurascens), the ornate hawk-eagle (*Spizaetus ornatus*), and seasonally, the regionally endangered subspecies of the scarlet macaw (*Ara macao*) (Jones et. al. 2001).

The keel-billed motmot (*Electron carinatum*), a species of significant conservation concern, is listed as 'vulnerable' by IUCN (through BirdLife International). It is limited geographically to Central America, where it was found historically from southeastern Mexico to western Costa Rica. It is now considered very rare or absent within most of its historic range, with remaining populations concentrated in Belize and Nicaragua. It occurs in relatively low densities, even within optimal habitat, and requires large expanses of undisturbed habitat to ensure viable populations. In Belize it is associated with the higher elevations of the Maya Mountains, in areas of steep terrain intersected by streams. It is thought that there may be fewer than 10,000 individuals remaining in the wild, with some estimates placing this figure at closer to 2,500 (BirdLife International, 2000). The population is facing a continuing decline as its forest habitat is further fragmented and destroyed, and is reliant on connectivity of protected areas, such as those of the Maya Mountain Massif for its survival. These areas of Belize are thought by some to be the last stronghold of this species (Jones et. al. 2001).

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

Birds of Bladen Nature Reserve

Species		Status	Habitats	Bladen	BFREE	CBWS	CRFR	DD
Great Tinamou	*Tinamus major*	fP	BFM,BFL	x	x	x	x	
Little Tinamou	*Crypturellus soui*	fP	SC	x	x	x	x	
Slaty-breasted Tinamou	*Crypturellus boucardi*	fP	BFM,BFL	x	x	x	x	
Anhinga	*Anhinga anhinga*	fP	LA	x		x		
Bare-throated Tiger-Heron	*Tigrisoma mexicanum*	uP	WL,LA	x	x	x		
Great Blue Heron	*Ardea herodias*	oV	WL,LA	x	x	x		
Little Blue Heron	*Egretta caerula*	oV	WL,LA	x		x		
Green Heron	*Butorides virescens*	fV	LA	x		x		
Agami Heron	*Agamia agami*	uV	LA	x		x		
Yellow-crowned Night-Heron	*Nyctanassa violacea*	lP	LA	x		x		
Wood Stork	*Mycteria americana*	oV	LA	x		x		x
Black Vulture	*Coragyps atratus*	cP	SA,O	x		x		
Turkey Vulture	*Cathartes aura*	cP	SA,O	x		x	x	
King Vulture	*Sarcoramphus papa*	uP	BFM,BFL	x	x	x	x	x
Muscovy Duck	*Cairina moschata*	oV	LA	x	x	x		
Osprey	*Pandion haliaetus*	oV	LA,O	x		x		
Hook-billed Kite	*Chondrohierax uncinatus*	uP	BFM,BFL	x		x	x	
Swallow-tailed Kite	*Elanoides forficatus*	uS	BFM,BFL,O	x	x	x	x	x
Double-toothed Kite	*Harpagus bidentatus*	uP	BFM,BFL	x		x	x	
Plumbeous Kite	*Ictinia plumbea*	uS	BFM,BFL,O	x	x	x		
White Hawk	*Leucopternis albicollis*	uP	BFL,O	x		x	x	
Gray Hawk	*Asturina nitida*	fP	BFL,SC,O	x	x	x		
Common Black-Hawk	*Buteogallus anthracinus*	fP	SC	x	x	x		
Great Black-Hawk	*Buteogallus urubitinga*	uP	BFM,BFL,O	x		x	x	x
Roadside Hawk	*Buteo magnirostris*	fP	SC,SA,O	x	x	x		
Black Hawk-Eagle	*Spizaetus tyrannus*	uP	BFM,BFL,O	x		x	x	x
Ornate Hawk-Eagle	*Spizaetus ornatus*	rP	BFM,BFL,O	x		x	x	x
Barred Forest-Falcon	*Micrastur ruficollis*	uP	BFM,BFL	x		x	x	x
Collared Forest-Falcon	*Micrastur semitorquatus*	uP	BFM,BFL	x	x	x	x	x
Laughing Falcon	*Herpetotheres cachinnans*	fP	PW,SC,SA	x	x	x		
Bat Falcon	*Falco rufigularis*	uP	SC,O	x		x		x
Plain Chachalaca	*Ortalis vetula*	cP	BFL,BFM	x	x	x	x	x
Crested Guan	*Penelope purpurascens*	cP	BFM,BFL	x	x	x	x	x
Great Curassow	*Crax rubra*	uP	BFM,BFL	x	x	x	x	x
Singing Quail	*Dactylortyx thoracicus*	rP	BFM	x				

Status Legend

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

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

CBWS Cockscomb Basin Wildlife Sanctuary
CRFR Columbia River Forest Reserve
DD Doyle's Delight

Habitat Preferences within Bladen Legend (Adapted from Jones and Vallely, 2001)

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

Species		Status	Habitats	Bladen	BFREE	CBWS	CRFR	DD
Spotted Wood-Quail	*Odontophorus guttatus*	uP	BFM,BFL	x		x	x	x
Solitary Sandpiper	*Tringa solitaria*	oT	WL	x		x		
Spotted Sandpiper	*Actitis macularia*	fW	LA	x		x		
Short-billed Pigeon	*Columba nigrirostris*	cP	BFM,BFL	x	x	x	x	x
Ruddy Ground-Dove	*Columbina talpacoti*	cP	SC	x		x	x	
Blue Ground-Dove	*Claravis pretiosa*	cP	BFM,BFL	x	x	x	x	x
White-tipped Dove	*Leptotila verreauxi*	lP	BFM,BFL	x	x	x		
Ruddy Quail-Dove	*Geotrygon montana*	fP	BFM,BFL	x	x	x	x	x
Gray-fronted Dove	*Leptotila rufaxilla*	cP	BFM,BFL	x		x	x	
Gray-chested Dove	*Leptotila cassini*	cP	BFM,BFL	x	x	x	x	
Olive-throated Parakeet	*Aratinga nana*	cP	BFM,BFL	x	x	x	x	x
Scarlet Macaw	*Ara macao*	oV	BFL	x		x		
Brown-hooded Parrot	*Pionopsitta haematotis*	cP	BFM,BF	x	x	x	x	
White-crowned Parrot	*Pionus senilis*	cP	BFM,BFL	x	x	x	x	x
White-fronted Parrot	*Amazona albifrons*	rV	BFL,SA	x		x	x	
Red-lored Parrot	*Amazona autumnalis*	cP	BFL	x	x	x		x
Mealy Parrot	*Amazona farinosa*	cP	BFM,BFL	x	x	x	x	x
Squirrel Cuckoo	*Piaya cayana*	cP	BFM,BFL	x	x	x	x	
Groove-billed Ani	*Crotophaga sulcirostris*	cP	SC	x	x	x	x	
Vermiculated Screech-Owl	*Otus guatemalae*	uP	BFM,BFL	x		x	x	x
Crested Owl	*Lophostrix cristata*	rP	BFM,BFL	x		x	x	
Spectacled Owl	*Pulsatrix perspicillata*	uP	BFM,BFL	x		x	x	
Central American Pygmy-Owl	*Glaucidium griseiceps*	uP	BFM.BFL	x	x	x	x	
Mottled Owl	*Ciccaba virgata*	cP	BFM.BFL	x	x	x	x	x
Black-and-white Owl	*Ciccaba nigrolineata*	uP	BFL	x		x		
Common Nighthawk	*Chordeiles minor*	oT	SA,O	x	x	x	x	
Common Pauraque	*Nyctidromus albicollis*	cP	BFM,BFL	x	x	x	x	x
White-collared Swift	*Streptoprocne zonaris*	fP	O	x		x	x	x
Vaux's Swift	*Chaetura vauxi*	cP	O	x		x	x	x
Long-tailed Hermit	*Phaethornis superciliosus*	cP	BFM,BFL	x	x	x	x	x
Little Hermit	*Phaethornis longuemareus*	cP	BFM,BFL	x	x		x	
Scaly-breasted Hummingbird	*Phaeochroa cuvieri*	uP	BFM,BFL	x	x	x		
Wedge-tailed Sabrewing	*Campylopterus curvipennis*	cP	BFM,BFL	x	x	x	x	
Violet Sabrewing	*Campylopterus hemileucurus*	uP	BFM	x	x	x	x	x
White-necked Jacobin	*Florisuga mellivora*	fP	BFM.BFL,L	x	x	x	x	x
Green-breasted Mango	*Anthracothorax prevostii*	fP	AG	x	x	x		
Violet-crowned Woodnymph	*Thalurania colombica*	lP	BFM	x			x	

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Habitat Preferences within Bladen

Legend (Adapted from Jones and Vallely, 2001)

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

Species		Status	Habitats	Bladen	BFREE	CBWS	CRFR	DD
White-bellied Emerald	*Amazilia candida*	cP	BFM,BFL	x		x	x	x
Azure-crowned Hummingbird	*Amazilia cyanocephala*	lP	PW	x	x	x	x	x
Rufous-tailed Hummingbird	*Amazilia tzacatl*	cP	SC,SA	x	x	x	x	
Buff-bellied Hummingbird	*Amazilia yucatanensis*	?P	SC,SA	x		x		
Purple-crowned Fairy	*Heliothryx barroti*	uP	BFM, BFL	x	x		x	
Black-headed Trogon	*Trogon melanocephalus*	cP	BFL.BFM	x	x	x	x	
Violaceous Trogon	*Trogon violaceus*	cP	BFM,BFL	x	x	x	x	
Collared Trogon	*Trogon collaris*	fP	BFM,BFL	x		x	x	x
Slaty-tailed Trogon	*Trogon massena*	cP	BFM,BFL	x	x	x	x	
Ringed Kingfisher	*Ceryle torquata*	lP	LA	x	x	x		
Amazon Kingfisher	*Chloroceryle amazona*	lP	LA	x	x	x		
Green Kingfisher	*Chloroceryle americana*	cP	LA	x		x	x	
American Pygmy Kingfisher	*Chloroceryle aenea*	uP	LA	x		x		
Blue-crowned Motmot	*Momotus momota*	cP	BFM,BFL	x		x	x	x
Keel-billed Motmot	*Electron carinatum*	uP	BFM,BFL	x		x	x	x
White-necked Puffbird	*Notharchus macrorhynchos*	uP	SC	x	x	x	x	
White-whiskered Puffbird	*Malacoptila panamensis*	uP	BFM,BFL	x	x	x	x	
Rufous-tailed Jacamar	*Galbula ruficauda*	fP	BFM,BFL	x	x	x	x	
Emerald Toucanet	*Aulacorhynchus prasinus*	fP	BFM	x		x	x	
Collared Aracari	*Pteroglossus torquatus*	cP	BFM,BFL	x	x	x	x	
Keel-billed Toucan	*Ramphastos sulfuratus*	cP	BFM,BFL	x	x	x	x	
Black-cheeked Woodpecker	*Melanerpes pucherani*	cP	BFM,BFL	x	x	x	x	
Ladder-backed Woodpecker	*Picoides scalaris*	fP	PFL	x	x			
Smoky-brown Woodpecker	*Veniliornis fumigatus*	fP	BFM,BFL	x	x	x	x	x
Chestnut-colored Woodpecker	*Celeus castaneus*	uP	BFM,BFL	x	x	x	x	
Lineated Woodpecker	*Dryocopus lineatus*	cP	BFM,BFL	x	x	x	x	
Pale-billed Woodpecker	*Campephilus guatemalensis*	cP	BFM,BFL	x	x	x	x	x
Golden-fronted Woodpecker	*Melanerpes aurifrons*	cP	SC	x	x	x		
Rufous-breasted Spinetail	*Synallaxis erythrothorax*	fP	SC	x	x	x		
Buff-throated Foliage-gleaner	*Automolus ochrolaemus*	fP	BFM,BFL	x	x	x	x	x
Plain Xenops	*Xenops minutus*	cP	BFM,BFL	x	x	x	x	x
Scaly-throated Leaftosser	*Sclerurus guatemalensis*	uP	FM,BFL	x	x	x	x	x
Tawny-winged Woodcreeper	*Dendrocincla anabatina*	fP	BFM,BFL	x	x	x	x	x
Ruddy Woodcreeper	*Dendrocincla homochroa*	fP	BFM,BFL	x	x	x	x	
Olivaceous Woodcreeper	*Sittasomus griseicapillus*	fP	BFM,BFL	x	x	x	x	x
Wedge-billed Woodcreeper	*Glyphorynchus spirurus*	fP	BFM,BFL	x	x	x	x	
Northern Barred-Woodreeper	*Dendrocolaptes sanctithornae*	fP	BFM,BFL	x	x	x	x	

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Species		Status	Habitats	Bladen	BFREE	CBWS	CRFR	DD
Ivory-billed Woodcreeper	*Xiphorhynchus flavigaster*	cP	BFM,BFL	x	x	x	x	
Spotted Woodcreeper	*Xiphorhynchus flavigaster*	fP	BFM				x	x
Streak-headed Woodcreeper	*Lepidocolaptes souleyetii*	uP	BFM,BFL	x	x	x	x	x
Barred Antshrike	*Thamnophilus doliatus*	cP	SC	x	x	x	x	
Russet Antshrike	*Thamnistes anabatinus*	uP	BFM	x			x	
Plain Antvireo	*Dysithamnus mentalis*	fP	BFM,BFL	x	x	x	x	
Slaty Antwren	*Myrmotherula schisticolor*	fP	BFM	x			x	x
Dot-winged Antwren	*Microrhopias quixensis*	cP	BFL	x	x	x	x	
Dusky Antbird	*Cercomacra tyrannina*	cP	SC	x	x	x	x	x
Black-faced Antthursh	*Formicarius analis*	cP	BFM,BFL	x	x	x	x	x
Yellow-bellied Tyrannulet	*Ornithion semiflavum*	fP	BFM,BFL	x	x	x	x	
Northern Beardless Tyrannulet	*Camptostoma imberbe*	lP	PFL,SC	x				
Greenish Elaenia	*Myiopagis viridicta*	fP	BFM, BFL	x	x	x	x	
Yellow-bellied Elaenia	*Elaenia flavogaster*	cP	PW,SA	x	x	x	x	
Ochre-bellied Flycatcher	*Mionectes oleagineus*	cP	BFM,BFL	x	x	x	x	x
Sepia-capped Flycatcher	*Leptopogon amaurocephalus*	fP	BFM,BFL	x	x	x	x	
Paltry Tyrannulet	*Zimmerius vilissimus*	lP	BFL	x			x	
Northern Bentbill	*Oncostoma cinereigulare*	cP	BFM,BFL	x	x	x	x	x
Eye-ringed Flatbill	*Rhynchocyclus brevirostris*	uP	BFM,BFL	x	x		x	
Yellow-olive Flycatcher	*Tolmomyias sulphurescens*	cP	BFM,BFL	x	x	x	x	
Stub-tailed Spadebill	*Platyrinchus cancrominus*	cP	BFM,BFL	x	x	x	x	x
Royal Flycatcher	*Onychorhynchus coronatus*	uP	BFM,BFL	x	x	x	x	
Ruddy-tailed Flycatcher	*Terenotriccus erythrurus*	uP	BFM,BFL	x		x	x	
Sulphur-rumped Flycatcher	*Myiobius sulphureipygius*	cP	BFM,BFL	x	x	x	x	x
Olive-sided Flycatcher	*Contopus cooperi*	uT	BFM,BFL	x		x	x	
Tropical Pewee	*Contopus cinereus*	fP	BFM,BFL	x	x	x	x	x
Eastern Wood-Pewee	*Contopus virens*	vT	BFM,BFL	x	x	x	x	
Yellow-bellied Flycatcher	*Empidonax flaviventris*	fW	BFM,BFL	x		x	x	
Least Flycatcher	*Empidonax minimus*	fW	SC	x		x	x	
Black Phoebe	*Sayornis nigricans*	lP	LA	x		x		
Bright-rumped Attila	*Attila spadiceus*	cP	BFM,BFL	x	x	x	x	x
Rufous Mourner	*Rhytipterna holerythra*	uP	BFM,BFL	x	x	x	x	
Dusky-capped Flycatcher	*Myiarchus tuberculifer*	cP	BFM,BFL	x	x	x	x	
Great Crested Flycatcher	*Myiarchus crinitus*	fW	BFM,BFL	x	x	x	x	
Brown-crested Flycatcher	*Myiarchus tyrannulus*	cS	BFL,PW	x	x	x		
Great Kiskadee	*Pitangus sulphuratus*	cP	SC	x	x	x	x	

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Legend

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Species		Status	Habitats	Bladen	BFREE	CBWS	CRFR	DD
Boat-billed Flycatcher	*Megarynchus pitangua*	cP	BFM,BFL	x	x	x	x	x
Social Flycatcher	*Myiozetetes similis*	vP	SC	x	x	x	x	
Streaked Flycatcher	*Myiodynastes maculatus*	lS	BFM,BFL	x	x	x	x	
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*	cS	BFM,BFL	x	x	x	x	
Piratic Flycatcher	*Legatus leucophaius*	cS	BFL	x	x	x		
Tropical Kingbird	*Tyrannus melancholicus*	cP	PW,SA	x	x	x	x	
Eastern Kingbird	*Tyrannus tyrannus*	vT	BFL	x	x	x		
Thrush-like Schiffornis	*Schiffornis turdinus*	cP	BFM,BFL	x	x	x	x	x
Rufous Piha	*Lipaugus unirufus*	uP	BFM,BFL	x		x	x	x
Cinnamon Becard	*Pachyramphus cinnamomeus*	fP	BFM,BFL	x	x	x	x	
Gray-collared Becard	*Pachyramphus major*	rP	BFL	x	x			
Rose-throated Becard	*Pachyramphus aglaiae*	uP	BFL,PW	x	x	x	x	
Masked Tityra	*Tityra semifasciata*	cP	BFM,BFL	x	x	x	x	
Black-crowned Tityra	*Tityra inquisitor*	uP	BFL	x	x	x		
White-collared Manakin	*Manacus candei*	cP	BFL	x	x	x	x	x
Red-capped Manakin	*Pipra mentalis*	cP	BFM,BFL	x	x	x	x	x
White-eyed Vireo	*Vireo griseus*	cW	SC	x	x	x	x	
Yellow-throated Vireo	*Vireo flavifrons*	cW	BFM,BFL	x	x	x	x	
Philadelphia Vireo	*Vireo philadelphicus*	uT	BFL	x		x	x	
Red-eyed Vireo	*Vireo olivaceus*	cT	BFM,BFL	x	x	x	x	
Yellow-green Vireo	*Vireo flavoviridis*	cS	BFM, BFL	x	x	x	x	
Tawny-crowned Greenlet	*Hylophilus ochraceiceps*	cP	BFM,BFL	x	x	x	x	x
Lesser Greenlet	*Hylophilus decurtatus*	vP	BFM,BFL	x	x	x	x	
Green Shrike-Vireo	*Vireolanius pulchellus*	cP	BFM, BFL	x	x	x	x	x
Green Jay	*Cyanocorax yncas*	uP	BFL,PW	x		x	x	x
Brown Jay	*Cyanocorax morio*	cP	BFL,PW	x	x	x	x	
Gray-breasted Martin	*Progne chalybea*	cS	O	x		x	x	
Mangrove Swallow	*Tachycineta albilinea*	lP	LA	x		x	x	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	fP	BFM,BFL	x		x	x	x
Band-backed Wren	*Campylorhynchus zonatus*	lP	BFM,BFL	x		x	x	
Spot-breasted Wren	*Thryothorus maculipectus*	vP	BFM,BFL	x	x	x	x	x
White-breasted Wood-Wren	*Henicorhina leucosticta*	vP	BFM,BFL	x	x	x	x	x
Long-billed Gnatwren	*Ramphocaenus melanurus*	cP	BFM,BFL	x	x	x	x	
Tropical Gnatcatcher	*Polioptila plumbea*	fP	BFM,BFL	x	x	x	x	
Gray-cheeked Thrush	*Catharus minimus*	uT	BFM,BFL	x				
Swainson's Thrush	*Catharus ustulatus*	fT	BFM,BFL	x	x	x	x	x

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Wood Thrush	*Hylocichla mustelina*	cW	BFM,BFL	x	x	x	x	x
Clay-colored Robin	*Turdus grayi*	cP	BFL,SC	x	x	x	x	
Gray Catbird	*Dumetella carolinensis*	cW	BFM,BFL	x	x	x	x	x
Tennessee Warbler	*Vermivora peregrina*	fW	BFM,BFL	x	x	x	x	
Blue-winged Warbler	*Vermivora pinus*	uW	BFM,BFL	x		x	x	
Yellow Warbler	*Dendroica petechia*	cW	SC	x	x	x	x	
Chestnut-sided Warbler	*Dendroica pensylvanica*	cW	BFM,BFL	x	x	x	x	
Magnolia Warbler	*Dendroica magnolia*	cW	BFM,BFL	x	x	x	x	x
Golden-cheeked Warbler	*Dendroica chrysoparia*	?		x				
Black-throated Green Warbler	*Dendroica virens*	fW	PW,SC	x	x	x	x	x
Black-throated Blue Warbler	*Dendroica caerulescens*	x	SC	x				
Blackburnian Warbler	*Dendroica fusca*	fT	BFM,BFL	x		x		x
Yellow-throated Warbler	*Dendroica dominica*	cW	PFM,PFL	x	x	x	x	x
Black-and-white Warbler	*Mniotilta varia*	cW	BFM,BFL	x	x	x	x	x
American Redstart	*Setophaga ruticilla*	cW	BFM,BFL	x	x	x	x	x
Prothonotary Warbler	*Protonotaria citrea*	uT	BFL,LA	x	x	x	x	
Worm-eating Warbler	*Helmitheros vermivorus*	uW	BFM,BFL	x	x	x	x	x
Swainson's Warbler	*Limnothlypis swainsonii*	x	BFL	x		x		
Ovenbird	*Seiurus aurocapillus*	fW	BFM,BFL	x	x	x	x	x
Northern Waterthrush	*Seiurus noveboracensis*	cW	LA	x	x	x	x	x
Louisiana Waterthrush	*Seiurus motacilla*	uW	LA	x	x	x	x	x
Kentucky Warbler	*Oporornis formosus*	cW	BFM,BFL	x	x	x	x	
Common Yellowthroat	*Geothlypis trichas*	cW	SC	x	x	x	x	
Hooded Warbler	*Wilsonia citrina*	cW	BFM,BFL	x	x	x	x	x
Wilson's Warbler	*Wilsonia pusilla*	uW	BFM,BFL	x	x	x	x	x
Golden-crowned Warbler	*Basileuterus culicivorus*	cP	BFM,BFL	x		x	x	x
Rufous-capped Warbler	*Basileuterus rufifrons*	lP	PW	x		x		
Yellow-breasted Chat	*Icteria virens*	uW	SC	x	x	x	x	
Gray-headed Tanager	*Eucometis penicillata*	fP	BFM, BFL	x	x	x		
Black-throated Shrike-Tanager	*Lanio aurantius*	uP	BFM,BFL	x	x	x	x	
Red-crowned Ant-Tanager	*Habia rubica*	cP	BFM,BFL	x		x	x	x
Red-throated Ant-Tanager	*Habia fuscicauda*	vP	BFM,BFL	x	x	x	x	
Rose-throated Tanager	*Piranga roseogularis*	?	BFL	x				
Hepatic Tanager	*Piranga flava*	lP	PW	x		x		
Summer Tanager	*Piranga rubra*	cW	BFM,BFL	x	x	x	x	
Scarlet Tanager	*Piranga olivacea*	cT	BFM,BFL	x		x		
Crimson-collared Tanager	*Ramphocelus sanguinolentus*	fP	SC	x	x	x	x	

Status Legend

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

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

CBWS Cockscomb Basin Wildlife Sanctuary
CRFR Columbia River Forest Reserve
DD Doyle's Delight

Habitat Preferences within Bladen
Legend (Adapted from Jones and Vallely, 2001)

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

Species		Status	Habitats	Bladen	BFREE	CBWS	CRFR	DD
Scarlet-rumped Tanager	*Ramphocelus passerinii*	cP	SC	x	x	x	x	
Blue-gray Tanager	*Thraupis episcopus*	vP	BFL,PFL	x	x	x	x	
Yellow-winged Tanager	*Thraupis abbas*	cP	BFM,BFL	x	x	x	x	x
Scrub Euphonia	*Euphonia affinis*	uP	SC,SA	x		x		
Yellow-throated Euphonia	*Euphonia hirundinacea*	cP	BFM,BFL	x	x	x	x	x
Olive-backed Euphonia	*Euphonia gouldi*	cP	BFM,BFL	x	x	x	x	x
Golden-hooded Tanager	*Tangara larvata*	cP	BFL,PW	x	x	x	x	
Green Honeycreeper	*Chlorophanes spiza*	fP	BFM,BFL	x	x	x	x	x
Shining Honeycreeper	*Cyanerpes lucidus*	uP	BFM	x	x	x	x	x
Red-legged Honeycreeper	*Cyanerpes cyaneus*	cP	BFM,BFL	x	x	x	x	x
Variable Seedeater	*Sporophila americana*	vP	SC,SA	x	x	x		
White-collared Seedeater	*Sporophila torqueola*	vP	SC,SA	x	x	x	x	
Orange-billed Sparrow	*Arremon aurantiirostris*	cP	BFM,BFL	x	x	x	x	x
Green-backed Sparrow	*Arremonops chloronotus*	cP	BFL,SC	x	x	x	x	
Grayish Saltator	*Saltator coerulescens*	cP	SC	x	x	x	x	
Buff-throated Saltator	*Saltator maximus*	cP	BFL	x	x	x	x	
Black-headed Saltator	*Saltator atriceps*	cP	BFL	x	x	x	x	
Black-faced Grosbeak	*Caryothraustes poliogaster*	cP	BFM,BFL	x	x	x	x	x
Blue-black Grosbeak	*Cyanocompsa cyanoides*	cP	BFM,BFL	x	x	x	x	x
Blue Grosbeak	*Passerina caerulea*	cT	SC	x		x	x	
Indigo Bunting	*Passerina cyanea*	cT	SC	x	x	x	x	
Painted Bunting	*Passerina ciris*	oT	SC	x		x		
Melodious Blackbird	*Dives dives*	vP	SC	x	x	x		
Yellow-backed Oriole	*Icterus chrysater*	lP	PW	x	x	x		
Black-cowled Oriole	*Icterus prothemelas*	cP	BFL, PFL	x	x			
Hooded Oriole	*Icterus cucullatus*	?	SC	x	x			
Audubon's Oriole	*Icterus graduacauda*	?	?	x	x			
Yellow-tailed Oriole	*Icterus mesomelas*	uP	SC, LA	x	x	x		
Baltimore Oriole	*Icterus galbula*	cW	BFM, BFL	x	x	x	x	
Yellow-billed Cacique	*Amblycercus holosericeus*	cP	BFL,PW	x	x	x		
Chestnut-headed Oropendola	*Psarocolius wagleri*	lP	BFL	x		x	x	
Montezuma Oropendola	*Psarocolius montezuma*	cP	BFL	x	x	x	x	

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Herpetofauna

To date, a total of 92 species have been recorded to date in Bladen Nature Reserve: 24 amphibians, 1 crocodilian, 6 freshwater turtles, 21 lizards and 40 snakes. These include ubiquitous generalists (such as *Bufo valliceps* and *Dendropsophus microcephala*, along with species with ranges restricted to the mid-to upper elevations of the Maya Mountains within their range in Belize – species such as *Agalychnis moreletti, Rana juliani, Smilisca cyanosticta* and most of the *Eleutherodactylids*. Some of these species, eg *Bufo campbelli,* are believed to be largely restricted to largely intact mature forests such as found in parts of Bladen Nature Reserve, Cockscomb Basin Wildlife Sanctuary and other such areas that have not experienced logging activity or hurricane impacts in recent decades.

Of the 92 species recorded to date, the following are considered to be species of international concern (IUCN red-list):

Agalychnis moreletti	Morelet's Treefrog	CR
Eleutherodactylus sabrinus	Sabrinus Rainfrog	EN
Eleutherodactylus psephosypharus	Limestone Rainfrog	VU
Eleutherodactylus chac	Chac's Rainfrog	NT
Bufo campbelli	Campbell's Rainforest Toad	NT
Rana juliani (maculata)	Maya Mountain Frog	NT
Crocodylus moreletii	Morelet's Crocodile	LR
Claudius angustatus	Narrowbridge Musk Turtle	LR
Staurotypus triporcatus	Mexican Giant Musk Turtle	LR
Trachemys scripta	Slider	LR

Lying across the juncture between the southern lowlands and the southern uplands, Bladen Nature Reserve has perhaps the greatest elevational range of any protected area in Belize. Combined with the geological differences between the volcanic and granitic hills of the northern portion of the reserve, and the limestone hills of the southern portion, this has resulted in a diverse range of habitats for reptiles and amphibians. Along with Cockscomb Basin Wildlife Sanctuary to the north, Chiquibul National Park and Chiquibul Forest Reserve to the northwest and Columbia River Forest Reserve to the south and west, that Bladen Nature Reserve lies within the most herpetologically rich region of Belize. This Chiquibul / Montanas Mayas biodiversity hotspot is recognized within Conservation International's Critical Ecosystems Partnership Fund programme as being the area of Belize that is critical to the survival of the amphibian species of international conservation concern.

With the presumed log-normal distribution of species abundance (a few common species, many rare ones) in tropical forest herpetofaunal communities, developing a comprehensive herpetofaunal species list can take many years, even with periods of intense field surveys. Analysis of the known and predicted ranges of Belize's herpetofauna, and of their habitat requirements, it can be

estimated that the total number of species likely to occur within Bladen Nature Reserve is between 108 and 114 species (with a maximum possibly as high as 124).

Of the additional 30-41 species that are likely to occur in Bladen Nature Reserve, but which have not yet been recorded there, the following are considered to be species of international concern (IUCN red-list):

Eleutherodactylus sandersoni	Sanderson's Rainfrog	EN
Eleutherodactylus laticeps	Broadhead Rainfrog	NT
Smilisca cyanosticta	Blue-spotted Mexican Treefrog	NT
Bolitoglossa dofleini	Doflein's Salamander	NT

Whilst the conservation status of all known amphibian species was assessed under the Global Amphibian Assessment (Stuart, et. al., 2004), which indicated that a third of all amphibian species are threatened with extinction, reptiles have yet to receive similar attention – with only a very small percentage of species having yet been assessed. There can be little doubt that several of the reptile species found in Bladen Nature Reserve will be assessed as being of conservation concern once the exercise has been undertaken.

It is noteworthy that herpetological surveys in Bladen Nature Reserve have been limited in scope, having been focused mostly around those areas most easily accessible from the BFREE research station to the east, and along the Bladen River itself. The more remote forests in the upper elevations have received scant attention in terms of herpetofauna – the reptile life of this vegetation type remains almost completely unknown (Stafford & Meyer, 2000). Belize's amphibian fauna also remains poorly known, with new national records still occurring (Walker & Kaiser, 2006); it is highly likely that some of these additions to Belize's known herpetofauna will occur in the upper elevation forests of Bladen Nature Reserve, with the likelihood that some will be endemic to the southeastern Maya Mountains.

In summary, it can be stated that Bladen Nature Reserve lies within the area highlighted as critical to the long-term survival of Belize's amphibian species of conservation concern; that 20-30% of Bladen's herpetofauna has yet to be recorded, and that some of these will almost certainly be species not yet known to occur in Belize. The actual range of some of the upper elevation species may be very limited, and the level of conservation importance of this southeastern portion of the Maya Mountains will increase with increased knowledge of its herpetofauna.

Reptiles and Amphibians of Bladen Nature Reserve		
Species	**English Name**	**IUCN Status**
Bolitoglossa mexicana	Mexican Mushroomtongue Salamander	LC
Bolitoglossa rufescens	Northern Banana Salamander	LC
Rhinophrynus dorsalis	Burrowing Toad	LC
Craugastor chac	Chac's Rainfrog	NT
Craugastor psephosypharus	Limestone Rainfrog	VU
*Craugastor sabrinus**	Sabrinus Rainfrog	EN
Leptodactylus fragilis (labialis)	White-lipped Frog	LC
Leptodactylus melanonotus	Sabinal Frog	LC
Bufo campbelli	Campbell's Rainforest Toad	NT
Bufo marinus	Cane Toad	LC
Bufo valliceps	Gulf Coast Toad	LC
Agalychnis callidryas	Red-eyed Treefrog	LC
Agalychnis moreletti	Morelet's Treefrog	CR
Dendropsophus ebraccata	Hourglass Treefrog	LC
Dendropsophus microcephala	Yellow Treefrog	LC
Hyla picta	Painted Treefrog	LC
Scinax staufferi	Stauffer's reefrog	LC
Smilisca baudinii	Common Mexican Treefrog	LC
Tlalocohyla loquax	Mahogany Treefrog	LC
Hyalinobatrachium fleischmanni	Fleischmann'sGlass Frog	LC
Gastrophryne elegans	Elegant Narrowmouth Frog	LC
Rana berlandieri	Rio Grande Leopard Frog	LC
Rana juliani (maculata)	Maya Mountain Frog	NT
Rana vaillanti (palmipes)	Rainforest Frog	LC
Crocodylus moreletii	Morelet's Crocodile	LR
Claudius angustatus	Narrowbridge Musk Turtle	LR
Staurotypus triporcatus	Mexican Giant Musk Turtle	LR
Kinosternon leucostomum	White-lipped Mud Turtle	
Kinosternon scorpiodes	Scorpion Mud Turtle	
Rhinoclemmys areolata	Furrowed Turtle	
Trachemys scripta	Slider	LR
Coleonyx elegans	Yucatan Banded Gecko	
Sphaerodactylus glaucus	Dwarf Gecko	
Sphaerodactylus millepunctatus	Spotted Dwarf Gecko	
Thecadactylus rapicauda	Turnip Tail Gecko	
Basilicsus vittatus	Brown Basilisk	
Corytophanes cristatus	Smoothhead Helmeted Basilisk	
Corytophanes hernandezii	Hernandez's Helmeted Basilisk	
Laemanctus longipes	Eastern Casquehead Iguana	
Iguana iguana	Green Iguana	
Anolis biporcatus	Neotropical Green Anole	
Anolis capito	Bighead Anole	
Anolis lemurinus	Ghost Anole	
Anolis rodriguezii	Smooth Anole	

Reptiles and Amphibians of Bladen Nature Reserve		
Species	**English Name**	**IUCN Status**
Anolis sericeus	Silky Anole	
Anolis uniformis	Lesser Scaly Anole	
Eumeces sumichrasti	Sumichrast's Skink	
Mabuya unimarginata	Central American Mabuya	
Sphenomorphus cherriei	Brown Forest Skink	
Ameiva festiva	Middle American Ameiva	
Cnemidophorus angusticeps	Yucatan Whiptail	
Lepidophyma flavimaculatum	Yellow-spotted Night Lizard	
Boa constrictor	Boa Constrictor	
Amastridium veliferum	Rustyhead Snake	
Clelia clelia	Mussurana	
Coluber constrictor	Racer	
Coniophanes bipunctatus	Two-spotted Snake	
Coniophanes fissidens	White-lipped Spotbelly Snake	
Coniophanes imperialis	Black-striped Snake	
Dendrophidion nuchale	Black-naped Forest Racer	
Drymarchon corais	Indigo Snake	
Drymobius margaritiferus	Speckled Racer	
Elaphe flavirufa	Tropical Rat Snake	
Ficimia publia	Blotched Hook-nosed Snake	
Imantodes cenchoa	Blunthead Tree Snake	
Lampropeltis triangulum	Milk Snake	
Leptodeira frenata	Rain Forest Cat-eyed Snake	
Leptodeira septentrionalis	Northern Cat-eyed Snake	
Leptophis ahaetulla	Parrot Snake	
Leptophis mexicanus	Mexican Parrot Snake	
Ninia diademata	Ringneck Coffee Snake	
Ninia sebae	Redback Coffee Snake	
Oxybelis aeneus	Mexican Vine Snake	
Oxybelis fulgidus	Green Vine Snake	
Oxyrhopus petola	Calico False Coral Snake	
Pseustes poecilonotus	Puffing Snake	
Scaphiodontophis annulatus	Guatemalan Neckband Snake	
Senticolis triaspis	Peninsular Rat Snake	
Sibon nebulata	Cloudy Snail Sucker	
Sibon sartorii	Terrestrial Snail Sucker	
Spilotes pullatus	Tiger Tree Snake	
Thamnophis marcianus	Checkered Garter Snake	
Tretanorhinus nigroluteus	Orangebelly Swamp Snake	
Urotheca elapoides	False Coral Snake	
Xenodon rhabdocephalus	False Fer-De-Lance	
Micrurus diastema	Variable Coral Snake	
Micrurus hippocrepis	Maya Coral Snake	
Atropoides nummifer	Jumping Pitviper	
Bothriechis schlegelii	Eyelash Palm-Pitviper	

Reptiles and Amphibians of Bladen Nature Reserve		
Species	**English Name**	**IUCN Status**
Bothrops asper	Fer-de-Lance	
Crotalus durissus	Neotropical Rattlesnake	
Porthidium nasutum	Rainforest Hognose Pitviper	

Potential Reptiles and Amphibians of Bladen Nature Reserve			
Species	**English Name**	**IUCN Status**	**Potential**
Bolitoglossa dofleini	Doflein's Salamander	NT	X
Oedipina elongata	C. American Worm Salamander	LC	X
Eleutherodactylus laticeps	Broadhead Rainfrog	NT	X
Eleutherodactylus loki (rhodopis)	Polymorphic Robber Rainfrog	LC	X
Eleutherodactylus sandersoni	Sanderson's Rainfrog	EN	X
Hyla valancifer	Fringe-limbed Treefrog	CR	X
Phrynohyas venulosa	Veined Treefrog	LC	?
Smilisca cyanosticta	Blue-spotted Mexican Treefrog	NT	X
Hypopachus variolosus	Sheep Frog	LC	?
Dermatemys mawii	Central American River Turtle	EN	X
Kinosternon acutum	Tabasco Mud turtle	LR	?
Sceloporus variablis	Rosebelly Lizard		X
Anolis pentaprion	Lichen Anole		X
Anolis tropidonotus	Greater Scaly Anole		X
Eumeces schwartzei	Schwartze's Skink		?
Ameiva undulata	Rainbow Ameiva		X
Lepidophyma mayae	Maya Night Lizard		X
Celestus rozellae	Rozella's Lesser Galliwasp		X
Adelphicus quadrivirgatus	Middle American Earth Snake		X
Coniophanes schmidti	Schmidt's Black-striped Snake		X
Conophis lineatus	Road Guarder		?
Dendrophidion vinitor	Barred Forest Racer		X
Dryadophis melanolomus	Lizard Eater		X
Rhadinaea decorata	Adorned Graceful Brown Snake		X
Sibon dimidiata	Slender Snail Sucker		?
Sibon sanniola	Pygmy Snail Sucker		X
Stenorrhina degenhardtii	Degenhardt's Scorpion-eating Snake		X
Tantilla schistosa	Red Earth Centipede Snake		?
Tantillita canula	Yucatan Dwarf Short-tailed Snake		?
Tantillita lintoni	Linton's Dwarf Short-Tailed Snake		?
Thamnophis proximus	Western Ribbon Snake		X
Micrurus nigrocinctus	C. American Coral Snake		?
X represents species expected to occur in BNR, but not yet recorded there.			
? Represents additional species which could possibly occur in BNR.			

Fish

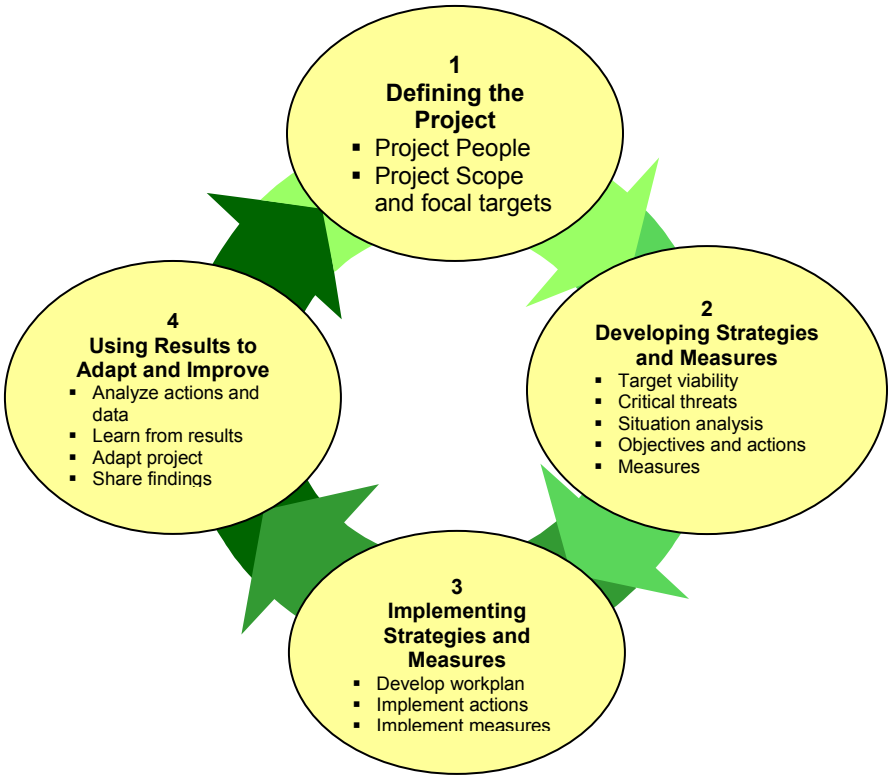
Fish of the Upper Monkey River Watershed	
Characidae	
Astyanax aeneus	Central Tetra, Bilum
Brycon guatemalensis	Machaca
Hyphessobrycon compressus	Mayan Tetra
Poecilidae	
Belonesox belizanus	Pike Killifish
Gambusia luma	Sleek Mosquitofish
Heterandria bimaculata	Twospot Livebearer
Poecilia mexicana	Shortfin Molly
Xiphophorus helleri	Green Swordtail
Synbrachindae	
Ophisternon aenigmaticum	Obscure Swamp Eel
Haemulida	
Pomadasys crocro	Burro Grunt
Cichlidae	
Petenia splendida	Bay Snook
Amphilophus robertsoni	False Firemouth Cichlid
Vieja maculicauda	Blackbelt Cichlid
Cichlasoma salvini	Yellowbelly Cichlid
Mugilidae	
Agonostomus monticola	Mountain Mullet
Joturus pichardi	Bobo Mullet
Eleotridae	
Gobiomorus dormitory	Bigmouth Sleeper
Gobidae	
Awaous banana	River Goby
	Esselman, 2001

Annex 4. Conservation Planning

This 5-year conservation area plan for the Bladen Nature Reserve 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 Bladen Nature Reserve, 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.

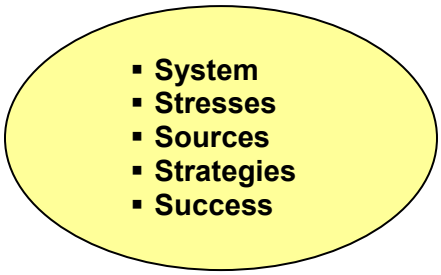
Success of implementation is essential to the planning cycle, and will need to be monitored to allow feedback into the adaptive planning cycle.



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 Bladen Nature Reserve. 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 Bladen Nature Reserve 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 Bladen Nature Reserve, 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 5: Conservation Elements and Nested Targets

As a first step in the conservation planning process, a workshop with BMC members and field staff, facilitated by the consultants, led to the selection of six conservation targets, at a coarse enough scale to encompass the diverse guilds and individual species of conservation concern. Three of these targets are broad ecosystem categories, two are species assemblages. Also considered is a sixth target, the cultural heritage of the protected area.

- Tropical broadleaf forest
- Lowland Pine Forest
- Aquatic and Riparian Ecosystems
- Game Species
- Upper Elevation Species
- Cultural Heritage

The status of the six conservation targets is assessed using the TNC target viability ranking, based on size, condition and landscape context (Table 1).

Table 1: 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

Within each of these three viability criteria, the conservation targets are rated using the following scale (Table 2):

Table 2: 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

Conservation Targets

1. Tropical Broadleaf Forest

The broad-leaved forests of Bladen Nature Reserve are some of the most pristine in Belize. Difficult access has limited the scale of past logging activities, and the presence of the karst hill slopes running from south west to north east has protected the forests from much of the hurricane damage seen elsewhere. This extensive tract of tropical broadleaf forest 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. Key prey populations, such as peccary, paca and curassow, are also under increasing hunting pressure, which has the potential to lead to changes in seed dispersal patterns, resulting in alteration of forest composition (Esselman, pers. com.). Tropical moist forest ecosystems such as that of Bladen 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.

The forest ecosystems within this broad category are defined primarily by topography, hydrology and soils – the forests of the volcanic soils and the vegetation of the karst landscape to the south-east of the protected area, with steep-sided hills and valleys. In Bladen, these forests are represented by a matrix of fourteen ecosystems (Meerman, 2004). Species richness is high with species of flora representative of both the Amazonian and Antillean regions.

Many tree, vertebrate and invertebrate species in tropical broadleaf forests such as those of Bladen occur at relatively low densities, resulting in large areas being needed for the support of viable populations, particularly of the larger predator and prey populations, increasing the importance of forest connectivity.

Recent threats include the improved access through Trio, increasing opportunities for illegal logging, and the potential for incursions by xateros.

Nested Conservation Elements

"Tropical evergreen broadleaved shrubland on steep karstic hills" is found only in Bladen Nature Reserve, and several other upland ecosystems such as the ***"tropical evergreen broad-leaved sub-montane palm forest"*** are restricted to ridges in Bladen and adjacent protected areas.

Several IUCN red-listed and CITES listed species are associated with the broadleaf forest. Bladen provides protection for the Critically Endangered *Agalychnis moreletii* – Morelet's treefrog, as well as three species of *Eleutherodactylus (E. sabrinus* (IUCN: Endangered)*, E. psephosypharus* (IUCN: Vulnerable) *and E. chac* (IUCN: Near threatened)), *Rana juliani,* the Maya Mountain frog (IUCN: Near threatened) and *Bufo cambelli,* Cambell's rainforest toad (IUCN: Near threatened) – all species with restricted ranges (covered under a separate conservation target – Upper Elevation Species). Two primates - *Alouatta pigra,* the Yucatan black howler (IUCN: Endangered), and *Ateles geoffroyi yucatanensis,* a sub-species of the Central American Spider Monkey considered 'vulnerable' (IUCN) have been recorded within Bladen, as have the five wild cat species - the 'near threatened' jaguar (*Panthera onca*) and puma (*Puma concolor*), and the smaller cats - the CITES listed ocelot (*Leopardus pardalis*), margay (*Leopardus wiedii*) and jaguarundi (*Herpailurus yaguarundi*).

Also within the broadleaf forest of the protected area are the *Crax rubra,* the great curassow (IUCN: Near Threatened) and the nationally 'vulnerable' crested guan (*Penelope purpurascens*), as are a number of species presently considered non-threatened, but highlighted as nationally threatened species, such as the white-lipped peccary (*Dicotyles pecari*).

This target also represents the karst areas – Bladen Nature Reserve, as part of the Little Quartz Ridge karst system (Miller, 1996), protects a complex system of ridges, limestone cliffs and caves that follow the southwest-northeast faulting (as does the Bladen Branch itself). The recognition of the importance of karst landscapes as a conservation target was highlighted by the IUCN World Commission on Protected Areas in 1997, as was the increasing need for their protection, which 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, particularly from dereservation of forest reserves, whittling away at the protected areas.

Conservation Target: Tropical Broadleaf Forest				
Tropical Broadleaf Forest **Ecoregion: Petén-Veracruz Moist Forest (WWF: CR/EN)**				**National Status**
Ecosystems				
Tropical evergreen broadleaved lowland hill forest over rolling karstic terrain				
Tropical evergreen broadleaved lowland hill forest over steep karstic terrain				
Tropical evergreen broadleaved lowland hill forest: Vochysia – Terminalia variant				
Tropical evergreen broadleaved lowland forest over poor or sandy soil				
Tropical evergreen broadleaved submontane forest over rolling karstic hills				
Tropical evergreen broadleaved submontane forest over steep karstic hills				
Tropical evergreen broadleaved submontane forest				
Tropical evergreen broadleaved submontane palm forest				*
Tropical evergreen broadleaved lower montane forest				
Tropical evergreen broadleaved lower montane palm forest				
Tropical evergreen broadleaved alluvial forest over calcareous soils				
Tropical evergreen seasonal broadleaved lowland hill forest over rolling karstic terrain				
Tropical evergreen seasonal broadleaved submontane forest: Simarouba – Terminalia variant				
Tropical evergreen broadleaved shrubland on steep karstic hills				*
Tropical evergreen broadleaved lowland hill forest over rolling karstic terrain				
Tropical evergreen broadleaved lowland hill forest over steep karstic terrain				
*** Over 70% of national area within Bladen**				
Species		**IUCN**	**CITES**	**National Status**
Morelet's Treefrog	*Agalychnis moreleti**	CR		
Yucatan Black Howler Monkey	*Alouatta pigra*	EN	I	
Baird's Tapir	*Tapirus bairdii*	EN	I	
Sabrina's Rainfrog	*Eleutherodactylus sabrinus**	EN		
Wooly Opossum	*Caluromys derbianus*	VU		
Keel-billed Motmot	*Electron carinatum**	VU		
Limestone Rainfrog	*Eleutherodactylus psephosypharus*	VU		
Water Opossum	*Chironectes minimus*	LR/nt		
Cacomistle	*Bassiriscus sumichrasti*	LR/nt		
Jaguar	*Panthera onca*	LR/nt	I	
Morelet's Crocodile	*Crocodylus moreleti*	LR/cd	I	
Great Curassow	*Crax rubra*	LR/nt		
Rainforest Toad	*Bufo cambelli*	LR/nt		
Chac Rainfrog	*Eleutherodactylus chac*	LR/nt		
Maya Mountain Rainfrog	*Rana juliana*	LR/nt		
White-lipped Peccary			I	
Collared Peccary			I	
Neotropical River Otter	*Lutra longicaudis*	DD	I	
Central American Spider Monkey	*Ateles geoffroyi yucatanensis*		I	VU

Conservation Target: Tropical Broadleaf Forest		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Very Good**	The Bladen Nature Reserve protects a viable, virtually pristine, matrix of vegetation types
Condition	**Very Good**	The integrity of this ecosystem has remained intact, with minimal past incursions for logging or land clearance. At present, there is no sign of incursion by xateros (their presence would dramatically reduce the current condition status).
Landscape Context	**Very Good**	With connectivity to broadleaf forest on three sides – Columbia River Forest Reserve to the southwest, Chiquibul Forest Reserve to the northwest and Cockscomb Basin Wildlife Sanctuary to the northeast, Bladen is part of a very large block of broadleaf forest.
Overall Rating: Very Good		

2 Game Species

This target includes terrestrial mammal and bird species that are actively hunted by local community members, and by seasonal workers from the agricultural communities such as Trio. Future pressure on this target may increase with the potential incursion of xateros, primarily from Guatemala, who subsist on game meat and fish whilst harvesting xate leaves. There may also be increased future pressure from the Trio area, with the construction of improved access to the Bladen River upstream.

According to local and written reports, Bladen has been subject to hunting pressure for many years – Dunham reports signs of extensive hunting pressure observed during the Maya Mountain Archaeological Project in 1993 / 1994 in all valleys surveyed except for Snake Creek. Local participants in the MMAP discuss hunting during the project to supplement diet, and the increase in knowledge of the area during the project would appear to have facilitated access for both hunters and looters. Hurricane Iris, in 2001, produced extensive areas of tree fall in the eastern foothills, blocking many of the access routes for hunters and relieving much of the illegal hunting pressure on the Reserve, though hunters have still accessed the area by following the course of the Bladen Branch itself. There is now a move among the local communities, however to reopen blocked trails, which will once more open the area up to increased hunting pressure.

Identification of game species as a conservation target is considered important within this management plan, to focus attention on the current limited enforcement of no-hunting regulations, and the increasing incursions into the area.

Nested Conservation Elements

The Game Species assemblage include bird and mammal species of both broadleaf forest and pine savanna – the nine-banded armadillo (*Dasypus novemcinctus*), paca (*Agouti paca*), white-tailed deer (*Odocoileus virginianus*), white-lipped peccary (*Dicotyles pecari*), great curassow (*Crax rubra*) and crested guan (*Penelope purpurascens*). The 'endangered' Baird's tapir (*Tapirus bairdii*) is also considered a game species in some

communities of the area, and active hunting of this species has been reported. Protection of game species will assist in the conservation of key predators in the area.

Strategies to protect game species will also add a degree of protection for archaeological sites, with strategies focused on preventing incursions, independent of the reasons behind these incursions.

Conservation Target: Game Species		**IUCN**	**CITES**	**GCS**	**National Status**
Crested Guan	*Penelope purpurascens*				**VU**
Great Curassow	*Crax rubra*	**LR / NT**			**VU**
Collared Peccary	*Tayassu tajacu*				
White-lipped Peccary					
Paca	*Agouti paca*				
Nine-banded Armadillo	*Dasypus novemcinctus*				
White-tailed Deer	*Odocoileus americana*				
Nested Elements					
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**

Conservation Target: Game Species		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Good**	The game species are known to be impacted in the lowland broadleaf forest by commercial hunters, but overall the populations are thought to have increased over the last five years, with hunting access blocked by tree fall after Hurricane Iris. More recently, the start of more effective patrolling may also have resulted in the continued recovery of the Game Species.
Condition	**Good**	Species composition and population structure will have been skewed to some extent by hunting pressure
Landscape Context	**Good**	Hunting activity is largely limited to the lowland broadleaf forest of the Bladen Branch and Richardson Creek floodplain, leaving much of the remaining forest unaffected. There is connectivity of tropical broadleaved forest on three sides to Colombia River Forest Reserve, Chiquibul Forest Reserve and Cockscomb Basin Wildlife Sanctuary, with evidence from camera trapping and tracks that many of these lowland game species will cross the Maya Divide, even if they don't actually reside in the uplands. Annual migration routes from the karstic hillslopes to the coastal plain in dry season have however become fragmented, with the construction of the Southern Highway and the increasing settlement in the area, resulting in increased pressure on some species, such as the white-lipped peccary.
Overall Rating: Good		

3. Aquatic and Riparian Ecosystems

Bladen Nature Reserve protects the pristine head waters of the Bladen Branch (a tributary of the Monkey River) and the associated Maya Mountain aquatic communities, also providing an essential resource for many non-aquatic species – whether through trophic interactions, or life-cycle requirements. Aquatic ecosystems energetically subsidize the terrestrial – whilst species richness is relatively low compared to terrestrial systems, the aquatic ecosystem is considered to be an energetically important part of the overall Broadleaf Forest Ecosystem, with species playing an important role in converting basal resources into biomass that is available for consumption by other aquatic and terrestrial organisms (Esselman, pers. com.). The Bladen also provides protection for the associated riparian vegetation and riparian-dependent species. The protected area is important in ensuring that clean water enters the coastal plain, where it is utilized by local communities and for agricultural production.

Nested Conservation Elements

Species associated with the upper Bladen watershed include the muscovy duck (*Cairina moschata*), game fish such as mountain mullet (*Agonostomus monticola*), bobo mullet (*Joturus pichardi*) and bay snook (*Petenia splendida*), and the smaller cichlids, livebearers and tetra. These support various vertebrate fish-eating species, including the Morelet's crocodile (*Crocodylus moreleti*) (IUCN: Lower risk /conservation dependent), the Neotropical river otter (*Lutra longicaudis*), and a number of species of freshwater turtles, kingfishers, herons and egrets. Several amphibian species are reliant on the water during part of their life cycle, and macroinvertebrates with aquatic larval stages provide an important resource for insectivorous birds and bats. Associated with the riverine vegetation are species such as Baird's tapir (*Tapirus bairdii*) (IUCN: Endangered) and the Yucatan howler monkey (*Alouatta pigra*) (IUCN: Endangered) and seasonally, migrant birds.

Illegal fishing is currently the major threat to aquatic communities. However, there is also a migratory component to the aquatic fauna (such as the Atyid shrimps (such as *Atya scabra*), important macroconsumers in headwater streams, that connect the mountains to the sea (Esselman, pers. com.)) which rely on connectivity with the coastal plain and the coastal waters. Whilst at present there are no physical barriers to movement of species up and down the rivers, increasing organic runoff from the banana farms downstream, diversion of water for irrigation and damming of the waterways may, in future, become a significant threat to the viability of these species.

Conservation Target: Aquatic and Riparian Ecosystems		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Good**	There are no barriers or other impediments to the water system within the protected area, but reports suggest there is relatively heavy fishing pressure in the lower reaches of the protected area, particularly in the vicinity of the Blue Pool.
Condition	**Good**	The upper watershed can be considered virtually pristine, with a natural species composition relatively unaffected by any anthropogenic activity. However in the lower reaches – the Blue Pool area in particular there are reports of use of poison for fishing both shrimp and fish – giving an overall condition considered as ***'good'*** rather than ***´very good.'***
Landscape Context	**Good**	The upper watershed of Bladen Branch is fully protected within Bladen, with key elemental processes in place, but as the river reaches the floodplain, anthropogenic factors such as pollution from banana and citrus farms, and sedimentation from clearance of the river banks is thought to be affecting species composition, and adversely affecting migratory species that move up and down stream, such as the Mountain Mullet.
Overall Rating: Good		

4. Upper Elevation Species

Bladen is surrounded by steep karst hills to the south, and volcanic mountains to the north, west and east. These higher-elevation areas (ranging from 500m to over 1,000m) protect a higher altitude forest, with the presence of a number of species not found in the valleys. Of particular importance are the upland amphibians, restricted to these higher elevations. These are highlighted for their globally declining populations, and because they are recognized as good indicators of airbourne and waterbourne issues in upland areas.

Nested Conservation Elements

Upper elevation species include a number of amphibians – *Agalychnis moreletii,* the Morelet's treefrog (IUCN: Critically Endangered), *Eleutherodactylus sabrinus,* Sabrina's rainfrog (IUCN: Endangered), *Eleutherodactylus psephosypharus,* the limestone rainfrog (IUCN: Vulnerable), *Eleutherodactylus chac*, Chac's rainfrog and *Rana juliani,* the Maya Mountain Frog (both IUCN: Near Threatened), and *Bufo campbelli* Campbell's Rainforest Toad (IUCN: Near Threatened). Higher elevation bird species recorded include *Electron carinatum,* the keel-billed motmot (IUCN: Vulnerable), and adjacent records for Doyle's Delight suggest that the scaly-throated foliage-gleaner (*Anabacerthia variegaticeps*) and the tawny-throated leaftosser (*Scelurus mexicana*) may also be present in Bladen.

Conservation Target: Upper Elevation Species		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Good**	The size of the higher elevation ecosystems is naturally defined, and it is presumed that species there are largely isolated from anthropogenic impacts. However, there is no information as to whether the upper elevation amphibian species are experiencing the global decline experienced elsewhere in the region.
Condition	**Good**	There has been very little work conducted in the higher elevation areas anywhere in Belize, so the condition has been categorised as ***'good'*** by default. There are no known anthropogenic stresses on the condition – though there is a question as to the potential impacts from predicted pesticide drift from the aerial spraying of the banana plantations in the coastal lowlands.
Landscape Context	**Very Good**	The higher elevation areas have good connectivity along the Maya Divide, and are defined by natural processes within protected areas.
Overall Rating: Good		

5. Lowland Pine Forest

The small area of lowland pine forest found at the edge of Bladen is part of the Belizean Pine Forest ecoregion, highlighted as one of the few regional fragments of lowland pine forests (World Wildlife Fund, 2001). This ecosystem shows a gradient from fully developed pine forest, as seen at Bladen, 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.

Logging and frequent anthropogenic fires have eradicated pine from adjacent areas where they occurred historically with the co-dominant oak, leaving a 'short-grass savanna with shrubs', making the remaining pine stand in Bladen Nature Reserve an important remnant of this ecosystem, despite its very limited extent, being one of the few protected lowland pine stands in Belize to remain in good condition.

Nested Conservation Elements

This covers short grass savannah through to pine forest. Species that frequent this ecosystem gradient include two mammal species of international concern - *Tapirus bairdii*, Baird's tapir (IUCN: Endangered), and *Puma concolor,* the puma (IUCN: Near threatened). White-tailed deer (*Odocoileus virginianus*) and collared peccary (*Tayassu tajacu*) are also represented by this conservation target, as are many other species that use this ecosystem either as prime habitat (nine-banded armadillo, for example) or as marginal or transitory habitat (jaguar and white-lipped peccary). Also potentially nested

within this conservation element is the nationally endangered passionflower *Passiflora urbaniana.* Palmetto (*Acoelorraphe wrightii*) is present in low densities within this ecosystem, and is coming under pressure from stem harvesting for structural materials, and seed harvesting for the relatively new medicinal market.

The lowland pine forest is also an important habitat for pine savanna specialist birds such as *Amazona oratrix,* the yellow headed parrot (IUCN: Endangered). Belize is the last stronghold of *Amazona oratrix*, listed as Endangered (IUCN, 2004; Birdlife International, 2004). 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.

Conservation Target: Lowland Pine Forest		
TNC Viability Criteria	**TNC Viability Rating**	**Justification**
Size	**Fair**	The area of pine savanna protected by the Nature Reserve is minimal (0.04% of the total pine forest in Belize), and is only 0.08% of Bladen Nature Reserve. It would not be viable if isolated from adjacent areas. Its extent within BNR may have been reduced by fire
Condition	**Good**	Whilst impacted by increasingly frequent anthropogenic fires started during milpa, hunting and logging activities, this lowland pine area is still in good condition in comparison with much of the coastal plain area.
Landscape Context	**Good**	Whilst much of the pine savanna country-wide is negatively impacted by increased frequency of fire, the ecosystem generally is relatively intact, with good connectivity, particularly in the coastal plain adjacent to (and including) the Bladen Nature Reserve area. Key processes – primarily fire – are present, but fire frequency has increased due to anthropogenic activities, to the point where it is negatively impacting the ecosystem
Overall Rating: Fair		

6. Cultural Heritage

For many years it was assumed that the steep and rugged terrain of Bladen would have been of little interest to the Ancient Maya, with difficult access and little cultivatable land. Exploration in the early 1900's by chicleros and mahogany extractors suggested however that the Maya had indeed settled the Bladen system, later confirmed by the Maya Mountain Archaeological Project (MMAP), which worked in the Bladen area for two successive years (1993 and 1994).

It would appear that the Bladen area was an important extraction area particularly for mineral resources. Whilst the density of settlement is considered low in comparison with the coastal plain, during the Late Terminal Classic (AD 700 – 900) virtually all inhabitable

land is considered to have been occupied, though Dunham estimates that there would have been no more than 10,000 people residing in the Bladen watershed at any one time during the Maya occupancy. The discovery of a Mixtec style vessel during the 1994 fieldwork indicates that the settlements had wide ranging contacts, even when much of the southern lowland populations were in decline (Dunham, 1994).

Three areas have been highlighted by the MMAP: Quebrada de Oro, Snake Creek and the Esperanza valley.

Two sites in the Quebrado de Oro area were discussed during early fieldwork in Bladen (Brokaw et. al. 1984). Both sites were located on the alluvial soils of the valley, one a minor settlement, the second a more structured site of plazas and structures, with outlying mounds. This second site lies on the steep bank of the Quebrada, which in 1984 was eroding inwards towards the site. Looting activity was observed at both sites. These sites were later revisited during the Maya Mountain Archaeological Project.

In 1994, further work by the MMAP located three unlooted sites of considerable complexity within the Snake Creek and Esperanza areas. Whilst the south-eastern lower valley of Snake Creek is steep sided and was uninhabited in Maya times, the good agricultural soils of the north-western upper valley was found to have supported a modest Late Terminal Classic community with well constructed house mounds in complex groupings, with two main plazas flanked by an extensive range of structures (Dunham, 1994). This site, named “Saach’olil” by the MMAP, is located on the creek bank, which is eroding its banks to gradually destroy the site.

During the same field season, Esperanza valley was discovered to have three sites, two of which are inside Bladen Nature Reserve, in its south western-most corner. “Chac Bolai,” situated on the valley floor of the Central River, is a moderately sized site found to consist of a large civic plaza, connected by a causeway to low temple mounds, with minor adjoining causeways. To the south lies “K’antulai,” located on the primary access route, straddling the mountain pass, and thought to have regulated the movement of people and goods into the Esperanza area during the Late Terminal Classic era. Unlike the majority of other sites, this fortress-like settlement, consisting of a long chain of structures (including a main, central plaza flanked by large structures), lies in an area of poor soils, distant from the nearest water supplies.

All three of these structures were unlooted in 1994 (Dunham, 1994), however, with the increasing knowledge of these sites, and the continued access by hunters to the area, it is unlikely that they are still intact. Anecdotal reports from as far as Gales point suggest major looting activity within the Bladen Nature Reserve within the last eight years, highlighting the urgent need for increased, more targeted and effective patrolling, and greater targeted monitoring of activity at the archaeological sites within the Reserve.

Overall Viability Summary

Five of the six conservation targets were evaluated using the TNC 5-S System, the resultant viability assessment indicating that the overall health of the species and biological systems of Bladen Nature Reserve is good – a situation that is more positive than in a high proportion of Belize’s existing protected areas, and reflects the near pristine nature of the majority of the protected area. Bladen has always been considered

an important part of the Maya Mountain block, and the current biodiversity assessment demonstrates the health of the ecosystems and populations of the area. The sixth – cultural heritage – was not evaluated for viability, as it is not a component of the biodiversity of the area.

Under this system, the viability of one of the conservation targets – Lowland Pine Forest, is rated as 'Fair'; three (Aquatic and Riparian Ecosystems, Upper Elevation Species Assemblages, and Game Species) are rated as 'Good', and the remaining two targets – have a 'Very Good' viability rating.

This gives an overall viability rank of **'Good'** for Bladen, under the TNC 5-S System. The 'good' rather than 'very good' rating particularly reflects the increasing frequency of anthropogenic fire in the lowland pine forest, and the hunting and fishing pressure that exists on the game and fish species.

Viability Ranking for Selected Conservation Targets (based on TNC 5-S System)				
Conservation Target	**Size**	**Condition**	**Landscape Context**	**Overall Viability Rank**
Broadleaf Forest	Very Good (4)	Very Good (4)	Very Good (4)	**Very Good (4)**
Game Species	Good (3.5)	Good (3.5))	Good (3.5)	**Good (3.50)**
Aquatic and Riparian Ecosystems	Good (3.5)	Good (3.5)	Good (3.5)	**Good (3.50)**
Upper Elevation Amphibian Species	Good (3.5)	Good (3.5)	Very Good (4)	**Good (3.67)**
Lowland Pine Forest	Fair (2.5)	Good (3.5)	Good (3.5)	**Fair (3.16)**
Overall Viability Rating of Bladen Nature Reserve				**Good (3.56)**

Very Good:	**>= 3.75**	Viability criteria at or above desired future status
Good:	**3.0 – 3.74**	Viability at or above minimum threshold for biological integrity
Fair:	**1.75 – 2.99**	Viability criteria at or above a minimum restorable level
Poor:	**<1.75**	Viability criteria below minimum restorable status (probably unrecoverable)

A recommended goal has been set for each conservation target, with relevant indicators that can be monitored over time to assess whether that goal has been met.

Viability Rating Goals			
Conservation Target	**Current Rating**	**Goal**	**Justification and Indicator**
Tropical Broadleaf forest	**Very Good**	**Very Good**	***Goal:* Very Good.** To maintain the broadleaf forest in its current condition or better, and ensure continued connectivity.
			Potential Monitoring Indicators: % of target impacted within Bladen – logging, land clearance for farms; natural disturbance, including fire originating from outside the protected area. Satellite and/or aerial photography; Mining permits and associated activities.
Game Species	**Good**	**Very Good**	***Goal:* Very Good.** To improve the current size and condition of the game species populations
			Potential Monitoring Indicators: Abundance and distribution of great curassow, white-lipped peccary; presence of key predators (jaguar/puma); Signs of hunting reported during patrols
Aquatic and Riparian Ecosystems	**Good**	**Very Good**	***Goal:* Very Good.** To improve the current condition of the natural aquatic ecosystems
			Potential Monitoring Indicators: Water quality, impacts on water flow and water quality, fish population; signs of fishing reported during patrols; migratory species (eg. *Atyid scabra* shrimps)
Upper Elevation Species	**Good**	**Very Good**	***Goal:* Very Good.** To improve the condition of viable populations of the higher elevation species
			Potential Monitoring Indicators: Size and condition of populations of highlighted upland species (particularly amphibians, birds and plants); presence of chytridomycosis in amphibian population; pesticide residues from pesticide drift
Lowland pine savanna	**Fair**	**Good**	***Goal:* Good.** To improve the conservation status of the lowland pine savanna primarily by reducing anthropogenic fire impacts
			Potential Monitoring Indicators: Number of fires per year and intensity, within pine savanna area, level of regeneration of pine
Cultural Heritage	**-**	**-**	***Goal:*** To ensure that all archaeological sites within Bladen Nature Reserve remain unimpacted by further looting in the future
			Potential Indicators: Number of incidences of looting within Bladen reported in patrol reports

Annex 6. Conservation Threat Assessment

Assessing the threats to the biodiversity of Bladen Nature Reserve is a two-part process:

a) Identifying historical, active and potential threats (Table 11)
b) Rating threat severity, urgency, relative area, recovery and potential

This analysis, when combined with the viability assessment, produces the information required for prioritizing conservation actions and use of limited resources.

Historical and present impacts to the protected area have been identified through consultations with many of the stakeholders – stakeholder community members, BMC members, hunters and wardens on the ground.

Threats and Conservation Targets	
Threats	**Conservation Targets**
Historical Threats	
Hurricanes	Entire protected area
Past logging	Lowland pine forest, Broadleaf Forest
Past Hunting	Game species
Past Fishing	Aquatic and riparian ecosystem
Past Looting	Archaeological sites
Active	
Hunting	Game species
Fishing	Aquatic and riparian ecosystem
Xate collection	Tropical broadleaf forest, Game species, Aquatic and riparian ecosystems
Fire	Lowland pine savanna
Looting	Archaeological sites
Potential	
Geological prospecting	Tropical broadleaf forest. Aquatic and riparian ecosystems
User Impacts (research / education)	Tropical broadleaf forest, Lowland pine forest, Central American spider monkey
Logging	Tropical broadleaf forest, Lowland pine forest
Agricultural Incursions	Tropical broadleaf forest
Palmetto seed harvesting	Lowland pine forest
Disruption of aquatic migratory routes	Aquatic and riparian ecosystems
Pesticide Drift / Chytridomycosis	Upper elevation species assemblages
Dereservation	Entire protected area

A broad-scale overview of past, present and potential impacts, stresses and threats was first conducted using an adaptation of The Nature Conservancy conservation area planning tool (in which threats are ranked individually (ie. not against each other) according to the **scope** (the proportionate size of the

geographic area affected) and **severity** (the level of damage) of the impact – Annex 3). This summary overview of information is then incorporated into a full threat analysis, based on the WCS Living Landscapes programme:

☐ **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 scores – each score 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 help reduce or eliminate the threat.

Twelve primary threats have been identified for inclusion in the threat analysis, each of which is analysed below. In the final development of priorities, which incorporates viability, as well as impacts, looting is evaluated separately.

Threat 1: Logging		
Illegal removal of trees from the Tropical Broadleaf Forest and / or Lowland Pine Forest within the Bladen Nature Reserve		
Status	Potential	
Target	Tropical Broadleaf Forest; Lowland Pine Forest	
Source	***Direct:*** Cutting of selected trees by illegal loggers ***Indirect*****:** Financial opportunities from logging; limited active patrolling and signs in the past	
Area	**1**	Very small area impacted – specific trees
Severity	**1**	Has a measurable effect on density and distribution within affected area
Urgency	**2**	With increased accessibility, it is possible that logging incursions may happen within the next 1 to 3 years
Recovery Time	**2**	Regeneration of selectively logged trees will take more than ten years
Probability of Threat Occurring	**0.50**	Without increased patrolling, there is a significant probability that illegal loggers will enter the property in dry season at some point in the next five years.
Management Actions	Close liaison with logging concession holders; increase awareness of boundaries in areas of potential conflict; increased vigilance against logging incursions, particularly in critical areas; continue close collaboration with Forest Department; increasing awareness in adjacent communities of role and location of Bladen Nature Reserve	

Threat 2: Hunting		
Hunting of game species		
Status	Active	
Target	Game species (particularly paca, collared peccary, great curassow and white-lipped peccary)	
Source	***Direct:*** Local community hunters, commercial hunters ***Indirect*:** Protein supplement for diet; low-income communities; market for game meat	
Area	**2**	Relatively localized impact along river for specific species, though percentage of preferred habitat being accessed by hunters appears to be high
Severity	**2**	Patrol reports and consultations with local hunters suggest there is substantial hunting pressure through much of the lower lands of Bladen, and new hunting trails are appearing in the area
Urgency	**3**	Hunting occurs at present
Recovery Time	**1**	It is considered that the reported abundance of game species is such that recovery to full population densities would be fast if hunting is prevented
Probability of Threat Occurring	**1.00**	The threat is occurring at the moment, and will increase with the increased opportunities for access through Trio, and clearance of hurricane tree-fall from other access trails
Management Actions	Demarcation of boundaries; signs; increased patrolling; enforcement of no hunting regulations; increasing awareness in adjacent communities of role and location of Bladen Nature Reserve; alternative livelihood options	

Threat 3: Fishing		
Fishing in the Bladen Branch, especially in the Blue Pool area		
Status	Active	
Target	Aquatic and Riparian Ecosystem (particularly fish species)	
Source	***Direct:*** Fishing by illegal hunters, primarily for subsistence on hunting trip ***Indirect*:** Presence of fishermen and hunters within Bladen	
Area	**2**	Occurs along the Bladen Branch and its tributaries
Severity	**1**	Thought not to be a major impact on local fish stocks
Urgency	**3**	Signs of recent fishing reported by most patrols
Recovery Time	**1**	The fish population should recover within 10 years if fishing is stopped
Probability of Threat Occurring	**1.00**	The threat is ongoing
Management Actions	Increased patrolling in critical areas (particularly Blue Pool area) and at critical times; enforcement of no fishing regulations; Demarcation of boundaries in critical areas; signs; increasing awareness in adjacent communities of role and location of Bladen Nature Reserve; investigation of alternative livelihood options	

Threat 4: Fire		
Increased frequency of fires in the Lowland Pine Savanna during dry season		
Status	Active	
Target	Lowland Pine Savanna and broadleaf forest on upper limestone slopes & ridges	
Source	***Direct:*** Fire ***Indirect*:** Anthropogenic causes – hunters, loggers, escaped milpa fires	
Area	**3**	Affects between 26% and 50% of the Lowland Pine Savanna within the protected area. Could potentially impact similar portions of upper slope broadleaf forest, particularly in the eastern area of the reserve
Severity	**2**	Causing extensive change to species composition in the savanna, but majority of species are still present. Can completely change species composition & structure on limestone slopes, potentially permanently
Urgency	**2**	Fire on the savanna is quite likely to occur within the next one to three years. There is a risk that such fires could reach broadleaf forest on limestone slopes in especially dry years
Recovery Time	**2**	Recovery of the pine element of the savannah will take over ten years, if fire impacts are managed to allow regeneration. It is thought that fire impacts to broadleaf forest on upper limestone slopes could last centuries, and possibly be irreversible
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. The probability of the threat of anthropogenic fires reaching the broadleaf forest on limestone slopes is far lower
Management Actions	Developing and implementing a fire management plan, increased vigilance against hunters in the savanna in dry season; fire awareness and fire management training for local communities, logging concession holders and logging crews operating in adjacent pine savanna areas	

Threat 5: Mining		
Reconnaissance and prospecting, with associated footprint of mining activity, access roads etc. and other associated activities. Potential of effects on water quality and flow		
Status	Potential	
Target	Tropical broadleaf forest; Aquatic and riparian ecosystems	
Source	***Direct:*** Clearance of vegetation for road construction and footprint of mine; potential hunting and fishing; noise disturbance of wildlife ***Indirect*:** Increased access for non-Bladen employees	
Area	**2**	Unlikely to impact more than 25%, because of variation in geology, but potential impacts include fragmentation by access roads, and greater ease of access for hunters
Severity	**2**	Substantial effect but local eradication unlikely
Urgency	**2**	Whilst a reconnaissance license has been issued for Bladen Nature Reserve (making this an urgent issue), prospecting has not started, and the license is about to expire
Recovery Time	**2**	With adequate investment in mitigation and restoration work, the system could recover within a few decades
Probability of Threat Occurring	**0.25**	Despite a license having been issued, no groundwork has taken place. With appropriate advocacy, it is hoped that another license will not be issued
Management Actions	Liaison with Geology and Petroleum Department, Forest Department, and prospecting companies; increase awareness of Geology and Petroleum Department, and at Ministerial level, of the role and location of Bladen Nature Reserve through formal presentation	

Threat 6: User Impacts		
Disturbance from increased use (education groups, student projects), primarily noise, affecting species distribution		
Status	Potential	
Target	Shy, reclusive vertebrate species	
Source	***Direct:*** Noise ***Indirect*****:** Increased visitation to area under education and research programmes	
Area	**1**	Only a small portion of the protected area will be open to controlled research and education visitation
Severity	**1**	Spider monkeys and a number of other mammalian ans avian species show a tendency to move away from disturbed areas in Belize, with changes in local distribution
Urgency	**2**	Low visitation (both legal and illegal) is occurring at present – this may increase as research and education opportunities increase
Recovery Time	**1**	Once disturbance is removed, recovery should be relatively fast, with wildlife moving back into the area. Some wildlife will also become accustomed to low levels of disturbance
Probability of Threat Occurring	**0.75**	The level of disturbance depends on success of marketing
Management Actions	User management through careful planning of trails; orientation talk on noise levels and researcher and student group behaviour on trails; development and implementation of limits of acceptable change programme	

Threat 7: Agricultural Incursions		
Land clearance for agriculture		
Status	Potential	
Target	Lowland Tropical Broadleaf Forest	
Source	***Direct:*** Clearance of land for agriculture ***Indirect*****:** Increasing population in adjacent area; expansion of farmland towards Bladen in the Trio area	
Area	**1**	Very localized, and would probably be discovered and stopped by wardens before any significant area had been cleared
Severity	**2**	Substantial impact through clear-felling, but as area is likely to be small, regeneration should be possible…therefore severity not as high as might be
Urgency	**2**	There is a possibility of this taking place if patrolling isn't effective, especially with the increased access through Trio area
Recovery Time	**2**	Recovery from total clearance will take more than ten years
Probability of Threat Occurring	**0.25**	Low probability, though this has increased through the increased access through Trio area
Management Actions	Increased patrolling in critical areas and at critical times; increased enforcement of regulations; Demarcation of boundaries in critical areas; signs; increasing awareness in adjacent communities of role and location of Bladen Nature Reserve; increased collaboration between Bladen and BFREE wardens; investigate the feasibility of designating a buffer zone at entrance to Bladen	

Threat 8: Xateros		
Incursions by Xatero cutters, with associated hunting and fishing impacts		
Status	**Active**	
Target	Tropical Broadleaf Forest; Game Species; Aquatic and Riparian Ecosystems	
Source	***Direct:*** Cutting of xate, hunting, fishing, looting ***Indirect*****:** Low income in Guatemalan xatero households; market for xate leaves; interest in xate harvesting in Red Bank	
Area	**4**	Xateros are known to harvest throughout viable range of xate in western Belize, and be self-sufficient through hunting and fishing whilst harvesting
Severity	**2**	Where xateros have been active in other areas of Belize, game species and xate populations have been significantly impacted
Urgency	**2**	The threat could occur in the next three years, as market demands force the xateros to move northeastwards, with incursions for xate through Columbia River Forest Reserve; and from the east, with increased interest in xate being expressed in Red Bank
Recovery Time	**1**	If the threat has been removed, and has been short-term, recovery of xate, game species and fish could take place within 10 years
Probability of Threat Occurring	**1.00**	Xatero activity has already been reported from Columbia River Forest Reserve, and with depletion of xate elsewhere, the interest expressed in Red Bank, and the resent granting of a xate extraction license for Stann Creek and Toledo; it is likely that xateros will attempt to enter the area over the time frame of this management plan, probably within the first year.
Management Actions	Increased patrolling in critical areas and at critical times; Demarcation of boundaries in critical areas; signs; increasing awareness of role and location of Bladen Nature Reserve in adjacent communities; close liaison with management of Chiquibul Forest Reserve and Forest Dept.; liaison with BDF for deep patrols; liaison with other xate transboundary initiatives; assessment, mapping and monitoring of xate presence within Bladen; investigate possibilities of alternative livelihoods involving xate; liaise with licensed xate collectors	

Threat 9: Seed harvesting		
Past and potential plant harvesting impacts include cacao seed stocks, palmetto and zamia seeds for export, and harvesting of tepejilote (*Chamaedorea tepejilote*) by hunters and looters		
Status	Active	
Target	Lowland Pine Forest	
Source	***Direct:*** Harvesting of palmetto seeds ***Indirect*****:** Market for seeds; low income in adjacent communities	
Area	**1**	Seed/plant harvesting takes place in a small area of the Nature Reserve
Severity	**1**	Low impact, especially with prevention in place through increased patrolling efficiency
Urgency	**3**	Palmetto seed harvesting is currently taking place
Recovery Time	**2**	Recovery should be fast, if harvesting methods are sustainable. However, there have been incidences of harvesters cutting whole palmetto plants to harvest seeds
Probability of Threat Occurring	**1.00**	Occurring at the moment
Management Actions	Increased patrolling in critical areas and at critical times; increased enforcement of regulations; demarcation of boundaries in critical areas; signs; increasing awareness of role and location of Bladen Nature Reserve in adjacent communities; training of palmetto harvesters in the need and methods for sustainable harvesting; investigation of alternative livelihood options; lobbying with local buyer for strict implementation of sustainable harvest methods	

Threat 10: Dereservation		
Present legislation allows for the dereservation of protected areas by the Minister of Natural Resources		
Status	Potential	
Target	Entire Protected Area or a portion of the protected area	
Source	***Direct:*** Removal of protected area status ***Indirect*:** Political pressure from adjacent communities for more land	
Area	**4**	Dereservation of even a portion of the area will have long term effects on all the area
Severity	**3**	Dereservation would probably result in removal of natural vegetation in the long term
Urgency	**1**	Unlikely to happen within the next 1 – 3 years
Recovery Time	**3**	Recovery is unlikely if dereservation takes place
Probability of Threat Occurring	**0.25**	Probability of dereservation within the next 5 years is unlikely
Management Actions	Increase awareness of role and value of Bladen Nature Reserve at local, national and international level; increase education and research activity within Bladen; strengthen links with Chiquibul management area; increase financial sustainability of Bladen; implement an effective fund-raising strategy; develop high profile research use	

Threat 11: Looting		
Removal of Maya artifacts from structures and caves		
Status	Historical, Active, and Potential	
Target	Archaeological sites	
Source	***Direct:*** Destruction of Maya structures and removal of artifacts ***Indirect*:** Low income in adjacent communities; High value – monetary gain	
Area	**4**	Finite number of structures with artifacts
Severity	**2**	Once structures are looted and artifacts removed, they can't be replaced
Urgency	**3**	The threat will increase as access becomes easier
Recovery Time	**3**	Once structures are looted and artifacts removed, they can't be replaced
Probability of Threat Occurring	**0.75**	The threat is increasing as access becomes easier through Trio. Conversely, there is now greater patrolling effort within the area
Management Actions	Close liaison and collaboration with Institute of Archaeology; increased patrolling effort, especially in critical areas; increasing awareness of role and location of Bladen Nature Reserve in adjacent communities; investigate possibilities of opening archaeological site(s) for research; advocate that Maya history be taught at primary and secondary level in Toledo	

Threat 12: Chytridomycosis		
Chytridomycosis is thought to be catalysed by a combination of interconnected effects, including pesticide deposition in upland areas through orographic precipiation		
Status	Active, Potential (Unknown)	
Target	Upper elevation Amphibian Species	
Source	***Direct:*** Precipitation of pesticides in upland rainfall ***Indirect*:** Aerial spraying of banana plantations on coastal plain	
Area	**4**	All the upland area is vulnerable
Severity	**3**	Regionally, a significant number of upland amphibian species have become extinct over the last five years due to this disease
Urgency	**3**	Based on occurrences elsewhere in the region, it is likely to be occurring now in BNR
Recovery Time	**3**	No recovery from extinctions
Probability of Threat Occurring	**0.5**	Unknown. Is known to be occurring in most other upland areas of the region, with species becoming extinct, but whether this is happening in Belize is unknown
Management Actions	Confirm species presence in upper elevations; confirm presence/absence of chytridomycota; identify chemicals used in up-wind agricultural areas; liaison with Pest Control Board, the Climate Change office and Belize Metereological Office; liaison with banana growers and other agricultural chemical users in the coastal plain area	

Rating Threat Severity, Urgency, Relative Area, Recovery and Probability

This data is entered into Table 7, where those threats that have the most impact on the conservation area are identified using the equation:

(Urgency + Recovery) x Severity x Area x Probability

Analysis of Threats Impacting Bladen					**(based on WCS Living Landscapes Programme)**		
Threat	**Area Score**	**Severity Score**	**Urgency Score**	**Recovery score**	**Probability Score**	**Total Threat Score**	**Rank***
Fire	4	2	2	2	1.00	32	**10**
Xate Harvesting	4	2	2	1	1.00	24	**9**
Hunting	2	2	3	1	1.00	16	**8**
Dereservation	4	3	1	3	0.25	12	**7**
Fishing	2	1	3	1	1.00	8	**6**
Mining	2	2	2	2	0.25	4	**5**
User Impact	1	1	2	1	0.75	2.25	**3**
Seed Harvesting	1	1	2	1	0.75	2.25	**3**
Logging	1	1	2	2	0.50	2	**1**
Agricultural Incursion	1	2	2	2	0.25	2	**1**
Non-ranked Threats							
Looting*	4	3	2	3	0.75	45	**12**
Chytridomycosis**	4	3	3	3	0.50	36	**11**

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		***Lowest threat score rank = 1**	
≤ 0.25	0.25		
0.26 – 0.50	0.50		
0.51 – 0.75	0.75		
0.76 – 1.00	1.00		

Table 7: Analysis of Threats Impacting Bladen

* Whilst looting is recognized as a threat, it is not included within the general threat analysis and prioritization process, as Maya sites and artifacts are finite, and therefore cannot be considered to have any form of viability. Cultural heritage and the associated threat of looting is therefore considered separately from the biodiversity, as a high priority in its own right.

** Chytridomycosis has been removed from the threat ranking as the level of threat (or even its presence) is currently unknown. This infection has caused numerous extinctions of upland amphibian species in Central America over the last 5 years, with virtually all precipitous declines and extinctions occurring at elevations 800m or more above sea level. It has long

been recognized that amphibian biology makes this taxa an especially sensitive indicator of environmental pollution. A convincing argument has been made that the fatal chytrid fungal infections are exacerbated by the impairment of amphibian immune systems by the orographic precipitation of organo-phosphate pesticides. Whilst there is a complete absence of data in Belize, there is little reason not to suspect that the declines and extinctions that are occurring elsewhere in the region are not occurring at similar elevations in Belize.

The aerial spraying of pesticides on banana crops in southern Belize is a potential source of organo-phosphates that are projected to be precipitated at upper elevations through orographic rainfall. Whilst a research project is currently being formulated to study this very situation, reliable data is unlikely to be available until late 2006 / 2007. In the meantime, data on the impacts and species extinctions observed elsewhere in Central America indicates that chytridomycosis in upper elevation amphibian species (including all of Belize's Near Threatened to Critically Endangered amphibians) could be the biggest single threat to biodiversity at the species level in BNR. This would automatically make conservation actions to tackle the situation the highest priority for the Natural Resources Management Programme for BNR. However, as there is currently a complete absence of national or site-level data, and the existence of the threat is based on extrapolation of occurrences elsewhere in similar situations throughout the region, it is not entered within the main threat analysis and prioritization process. It is however included within the section to demonstrate the potential severity of the situation, and the urgent need to undertake assessments within high-risk hotspots within BNR (and adjacent reserves with elevations over 800m).

2.5 Prioritizing Conservation Action

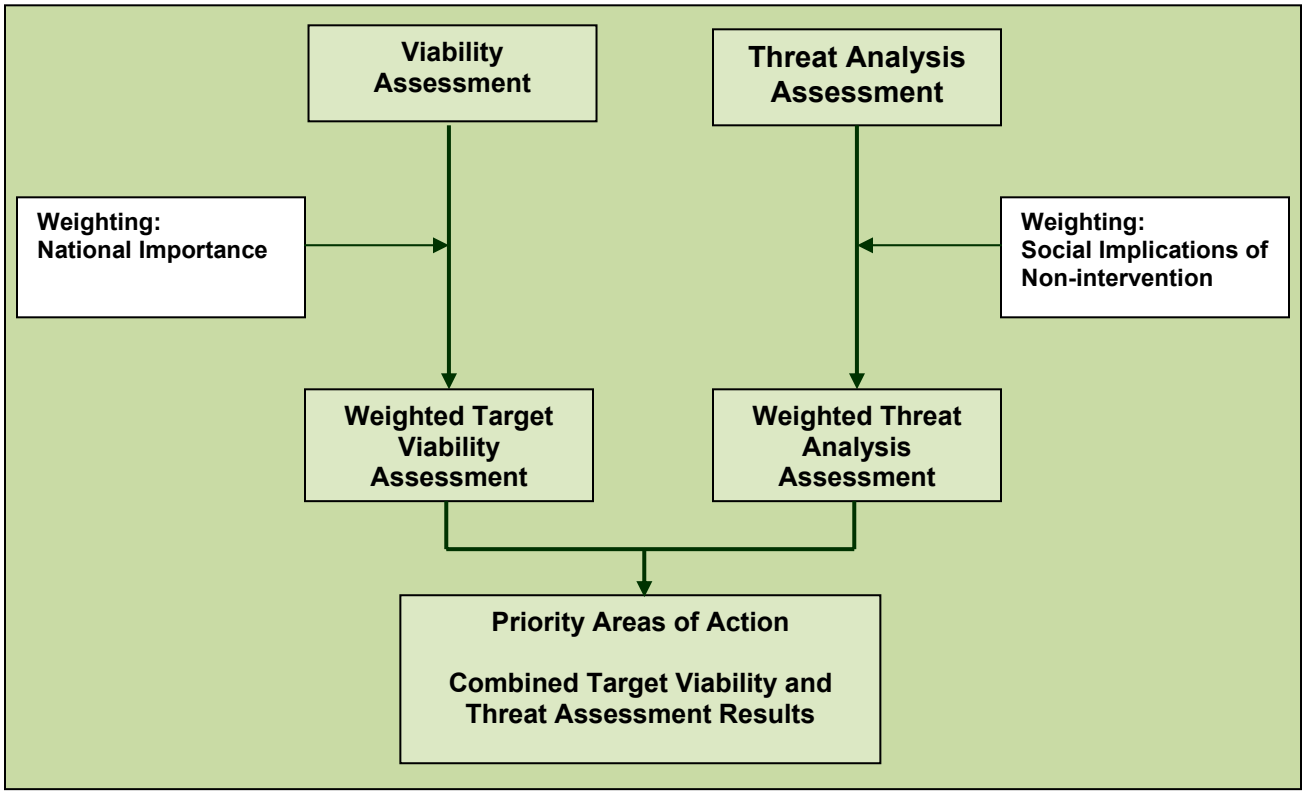
This management plan uses the a combination of the TNC 5-S conservation target viability ranking and the WCS threat analysis to establish the priority of conservation actions for the conservation targets highlighted for Bladen Nature Reserve. The appeal of this modified TNC 5-S and WCS Living Landscape approaches is that:

- it should reduce 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.

However, to be relevant on a national scale 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

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 (Box 1).



Box 1: Adding the National Context

2.5.1 Incorporating Target Viability (TNC):

A numerical score is first assigned to the TNC overall target viability, which is then multiplied by a weighting that reflects the relative national importance, or priority, of the particular conservation target (Table 8):

Numeric ranking of TNC target viability			
Conservation Target	**TNC Target Viability (See Table 5)**	**Overall Viability**	**National Priority Weighting****
Broadleaf Forest	**Very Good**	4	3*
Game Species	**Good**	3.50	2
Aquatic and Riparian Ecosystems	**Good**	3.50	2
Upper Elevation Amphibian Species	**Good**	3.67	3
Lowland Pine Forest	**Fair**	3.16	1
*** Designated 3 for near-pristine nature of forest, and upland elevation ecosystems**			

****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 – Elfin Woodland is a good example.	**3**

Table 8: Numeric ranking of TNC target viability

2.5.2 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 9).

Table 9: 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 10).

Adding the non-intervention weighting			
Primary Threat	**Ranked Primary Threats**	**Non-intervention Implication Weighting**	**Weighted Threat Analysis Score**
Xate Harvesting	**9**	2	18
Hunting	**8**	2	16
Fishing	**6**	2	12
Fire	**10**	1	10
Dereservation	**7**	1	7
Seed Harvesting	**3**	2	6
Mining	**5**	1	5
User Impact	**3**	1	3
Logging	**1**	2	2
Agricultural Incursion	**1**	2	2
Non-ranked Threats			
Looting	**12**	2	22
Chytridomycosis	**11**	1	11

Table 10: Adding the non-intervention weighting

2.5.3 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:

$$P = (1/V) \times N \times T$$

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.

Prioritization						
Conservation Target	**Primary Threat**	**Viability Score (V)**	**National Priority Weighting (N)**	**Weighted WCS Threat Score (T)**	**Prioritization Score**	**Ranked Priority**
Broadleaf Forest	Xate	4	3	18	13.5	1
Game Species	Hunting	3.5	2	16	9.14	2
Aquatic and Riparian Ecosystems	Fishing	3.50	1	12	3.43	3
Lowland Pine Forest	Fire	3.16	1	10	3.16	4
Non-ranked Targets						
Cultural Heritage	Looting	-	-	-	-	-
Upper Elevation Species	Chytridomycosis	3.67	3	11	8.99	-

Table 11: Prioritization

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

Through this analysis, the following prioritization order was developed for the Bladen Nature Reserve.

Priority Areas of Action for the Bladen Nature Reserve			
Priority	**Rank**	**Conservation Target**	**Primary Threat**
High Priority	1	Tropical Broadleaf Forest	Xateros
	2	Game Species	Hunting
Medium Priority	3	Aquatic and Riparian Ecosystems	Fishing
	4	Lowland Pine Forest	Fire
Un-ranked Conservation Targets		Cultural Heritage	Looting
		Upland Elevation Species	Chytridomycosis

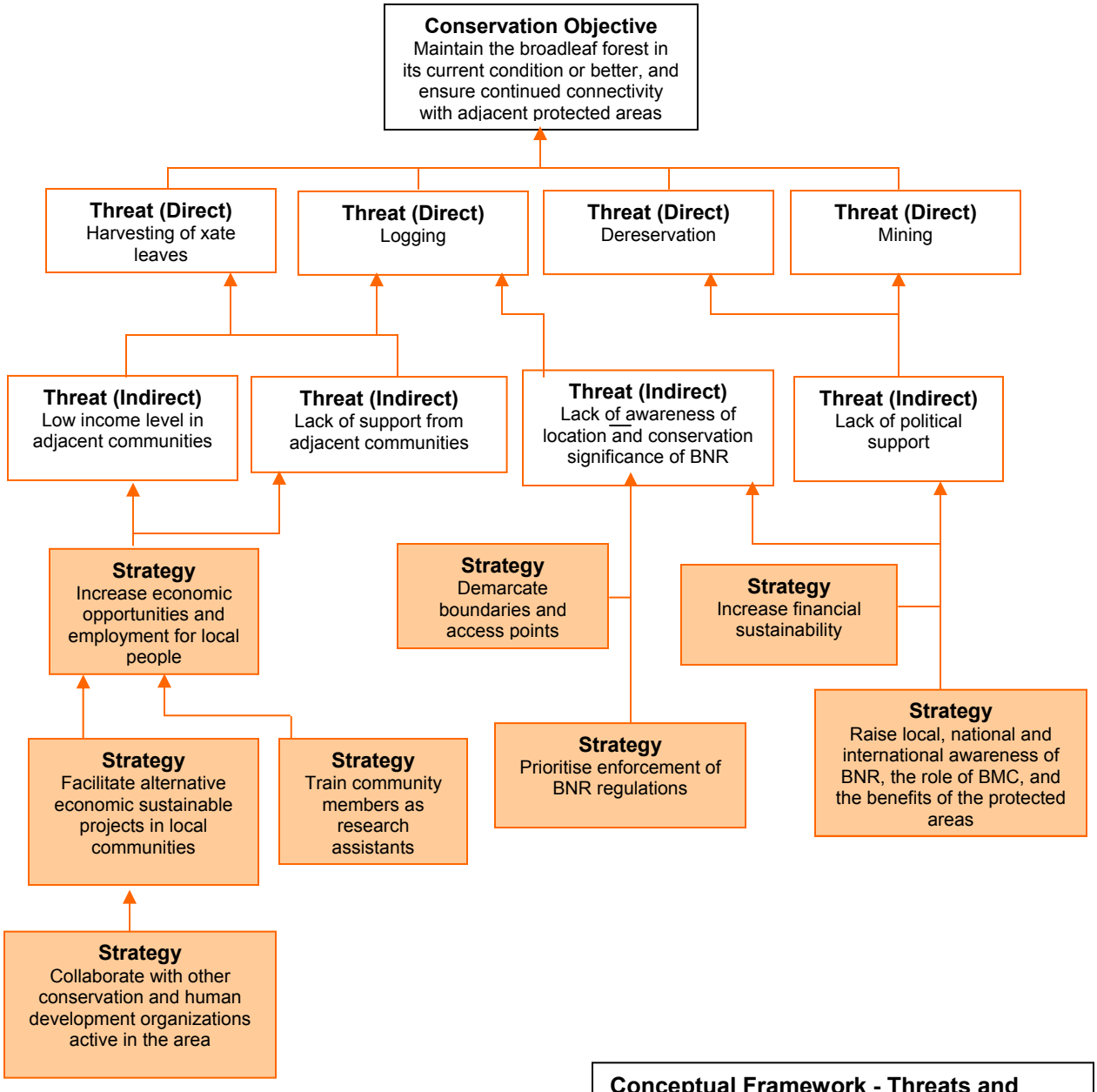
Table 12: Priority Areas of Action for the Bladen Nature Reserve

The two un-ranked conservation targets have not been included within the analysis for prioritization, but are important in terms of resource management. These are looting (not included within the threat analysis as Maya structures have no viability rating), and Upland Elevation Species (not included as there is insufficient national and / or local information on chytridomycosis, pesticide drift and other potential threats at this time).

Annex 7: Conservation Strategies

1. Tropical Broadleaf Forest

Objective: To maintain the broadleaf forest in its current condition or better, and ensure continued connectivity with adjacent protected areas.



Conceptual Framework - Threats and Strategies for Tropical Broadleaf Forest

Conservation Target: Tropical Broadleaf Forest		
Threat	**Direct / Indirect**	**Strategy and Actions**
Logging within Bladen Nature Reserve	Direct	**Strategy 1:** Reduce logging within the protected area by direct and indirect means **Actions:** Develop enforcement plan; Prioritize enforcement of no logging regulations; Increase patrolling within critical areas and at critical times; Demarcate boundaries and access points; Liaise with FD on enforcement issues; Liaise with logging concession holders and logging crews to raise awareness of boundary location of Bladen; Liaise with adjacent protected area management bodies re. illegal logging activities
		Strategy 2: Increase awareness of the environmental benefits of Bladen Nature Reserve **Actions:** Raise local awareness of conservation value; Raise awareness of the goals and regulations of the protected area towards protection of Bladen; collaborate with other conservation organizations working in the area to raise conservation awareness
Harvesting of xate leaves	Direct	**Strategy 1:** Ensure there are no incursions into Bladen by xateros (either Guatemalan or Belizean) **Actions:** Identify and map critical access areas for increased patrolling activity; Liaise with BDF and FD in joint patrolling of boundary areas; Keep informed of xatero activity in adjacent protected areas (primarily Columbia River Forest Reserve and Chiquibul National Park) and initiatives arising in the Red Bank area; Develop action plan for rapid implementation if xatero activity is reported within Bladen Nature Reserve
Mining	Direct	**Strategy 1:** Raise awareness in Geology and Petroleum Dept. of significance of Bladen in the protected areas system **Actions:** Close liaison with Dept. Geology and Petroleum re. issuing of prospecting and mining licenses within BNR; Annual presentation to Dept. targeted at increasing awareness of significance of Bladen; Increase national and international profile of Bladen; Lobby at ministerial level for continued protection of Bladen from mining impacts; Work with Geology and Petroleum Dept. to integrate TOR for environmental safeguards / actions into any license issued for BNR
		Strategy 2: Develop open communications and working relationship with companies that have been issued licenses for Bladen by Geology and Petroleum Dept. **Actions:** Development of long term mitigation plan to be enacted should mining permit be issued; Presentation to license holder targeted at increasing awareness of significance of Bladen; Increase national and international profile of Bladen
Dereservation	Direct	**Strategy 1:** Raise awareness in Government of significance of Bladen in the protected areas system **Actions:** Increase local awareness of environmental benefits of Bladen; Increase local support for BNR; Presentation to Minister of Natural Resources and other key officers, targeted at increasing awareness of significance of Bladen; Increase local, national and international profile of Bladen; Increase financial sustainability mechanisms for Bladen
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 direct employment opportunities associated with BNR /BMC; Ensure that local communities have access to economic opportunities associated with the protected area; Develop alternative livelihoods through training and facilitation of market opportunities; Ensure this is tied into a 'no-logging' message
Lack of awareness of location and conservation significance of BNR	Indirect	**Strategy 1:** Increase awareness of Bladen Nature Reserve and BMC **Actions:** Raise awareness of location and environmental benefits of BNR locally, nationally and internationally; Develop and implement awareness programme for local schools; Ensure boundaries are clearly demarcated in critical areas (eg. access routes); Work more closely and more effectively with local communities in the area, with workshops and other activities in local communities to increase awareness

2. Game Species

Objective: To improve the current size and condition of the game species populations

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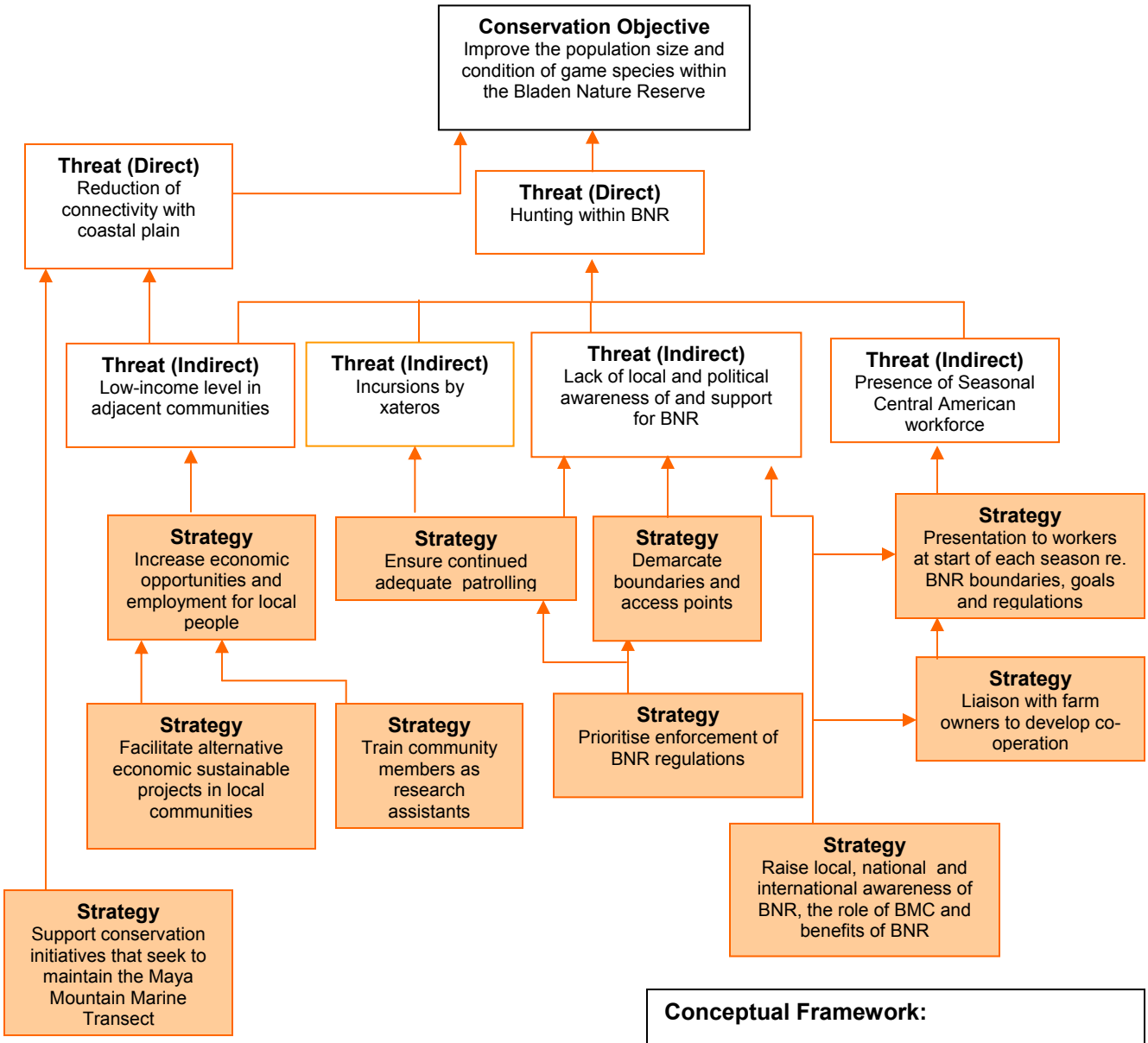
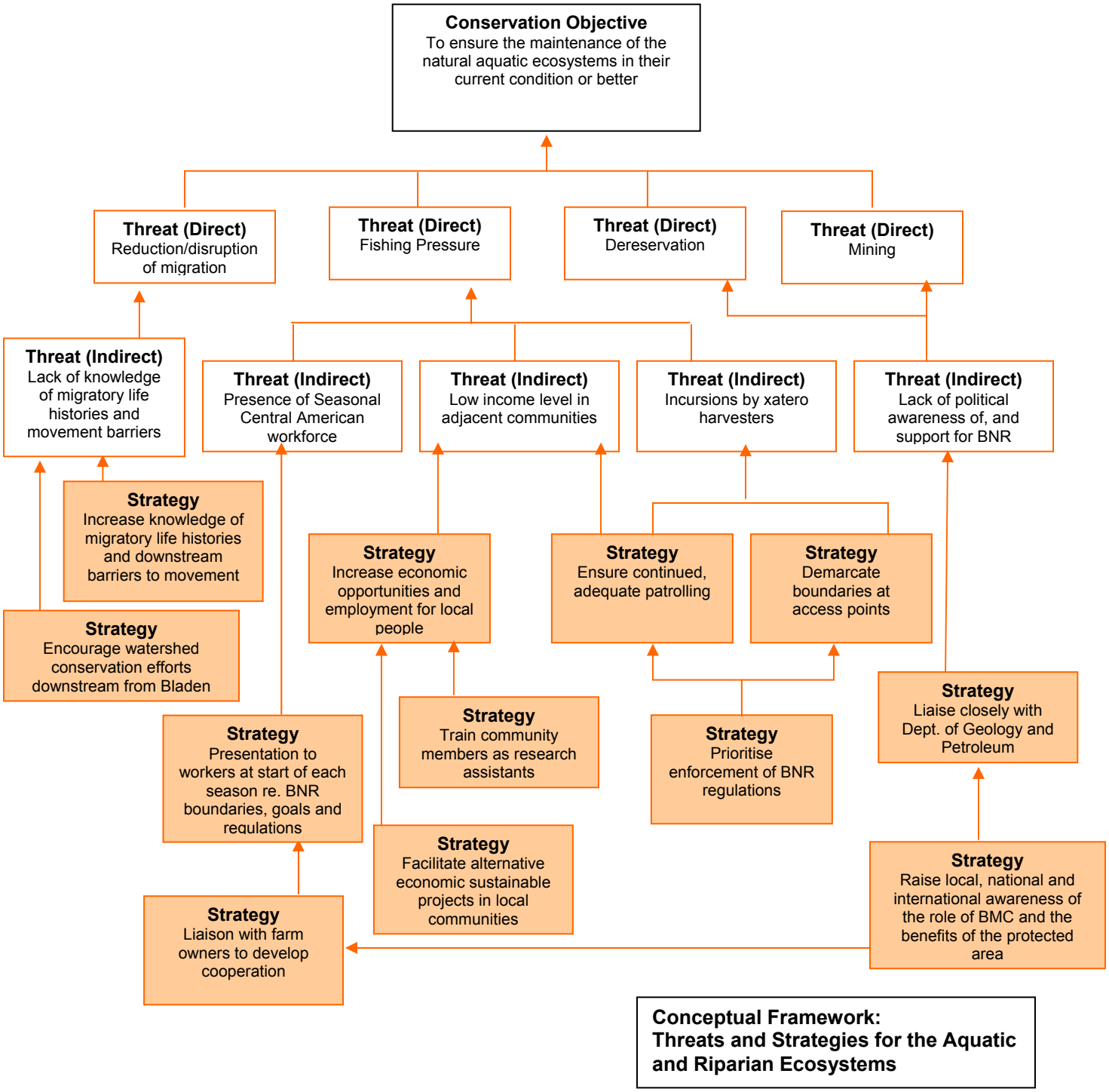


Conceptual Framework:

Threats and Strategies for Game Species

3 Aquatic and Riparian Ecosystems

Objective: To ensure the maintenance of the natural aquatic ecosystems in their current condition or better



Conceptual Framework: Threats and Strategies for the Aquatic and Riparian Ecosystems

Conservation Target: Aquatic and Riparian Ecosystems		
Threat	**Direct / Indirect**	**Strategy and Actions**
Fishing within Bladen Nature Reserve	Direct	**Strategy 1:** Reduce fishing within the protected area by direct and indirect means **Actions:** Develop enforcement plan; Prioritize enforcement of no fishing regulation; Increase patrolling within critical areas (especially Blue Pool) and at critical times; Demarcate boundaries and access points
		Strategy 2: Increase awareness of the benefits of conserving wildlife **Actions:** Raise local awareness of conservation; Raise awareness of the goals and regulations of the protected area towards protection of wildlife
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 direct employment opportunities associated with BNR /BMC; Ensure that local communities have access to economic opportunities associated with the protected area; Develop alternative livelihoods through training and facilitation of market opportunities; Ensure this is tied into a 'no-hunting/no fishing' message
Xatero Activity	Indirect	**Strategy 1:** Ensure there are no incursions into Bladen by xateros (either Guatemalan or Belizean) **Actions:** Identify and map critical access areas for increased patrolling activity; Liaise with BDF and FD in joint patrolling of boundary areas; Keep informed of xatero activity in adjacent protected areas (primarily Columbia River Forest Reserve and Chiquibul National Park) and initiatives arising in the Red Bank area; Develop action plan for rapid implementation if xatero activity is reported within Bladen Nature Reserve
Lack of local and political awareness of and support for BNR	Indirect	**Strategy 1:** Increase awareness of Bladen Nature Reserve and BMC **Actions:** Raise awareness of location and environmental benefits of BNR locally, nationally and internationally; Ensure boundaries are clearly demarcated in critical areas (eg. access routes); Hold workshops and other activities in local communities to increase awareness
Mining	Direct	**Strategy 1:** Raise awareness in Geology and Petroleum Dept. of significance of Bladen in the protected areas system **Actions:** Close liaison with Dept. Geology and Petroleum re. issuing of prospecting and mining licenses within BNR; Annual presentation to Dept. targeted at increasing awareness of significance of Bladen; Increase national and international profile of Bladen; Lobby at ministerial level for continued protection of Bladen from mining impacts; Work with Geology and Petroleum Dept. to integrate TOR for environmental safeguards / actions into any license issued for BNR
		Strategy 2: Develop open communications and working relationship with companies that have been issued licenses for Bladen by Geology and Petroleum Dept. **Actions:** Development of long term mitigation plan to be enacted should mining permit be issued; Presentation to license holder targeted at increasing awareness of significance of Bladen; Increase national and international profile of Bladen;
Presence of Seasonal Central American Workforce	Indirect	**Strategy 1:** Ensure seasonal Central American workforce is aware of the location and regulations of Bladen Nature Reserve **Actions:** Raise awareness through presentation to Trio workers at start of each season re. BNR boundaries, goals and regulations; liaise with farm owners and farm managers to develop cooperation in raising awareness of BNR

4. Upper Elevation Species

Objective: To improve the condition of viable populations of the higher elevation species

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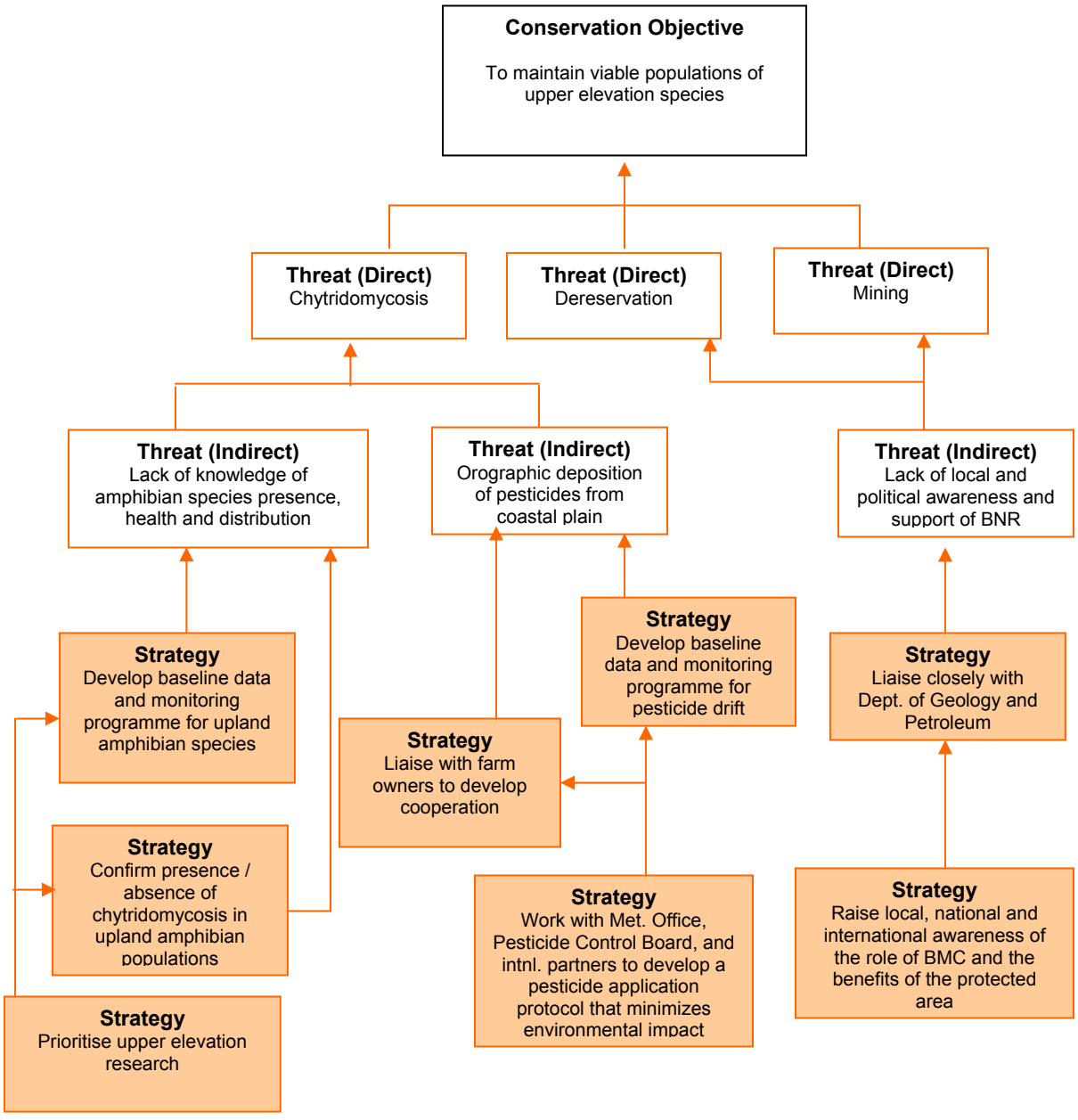
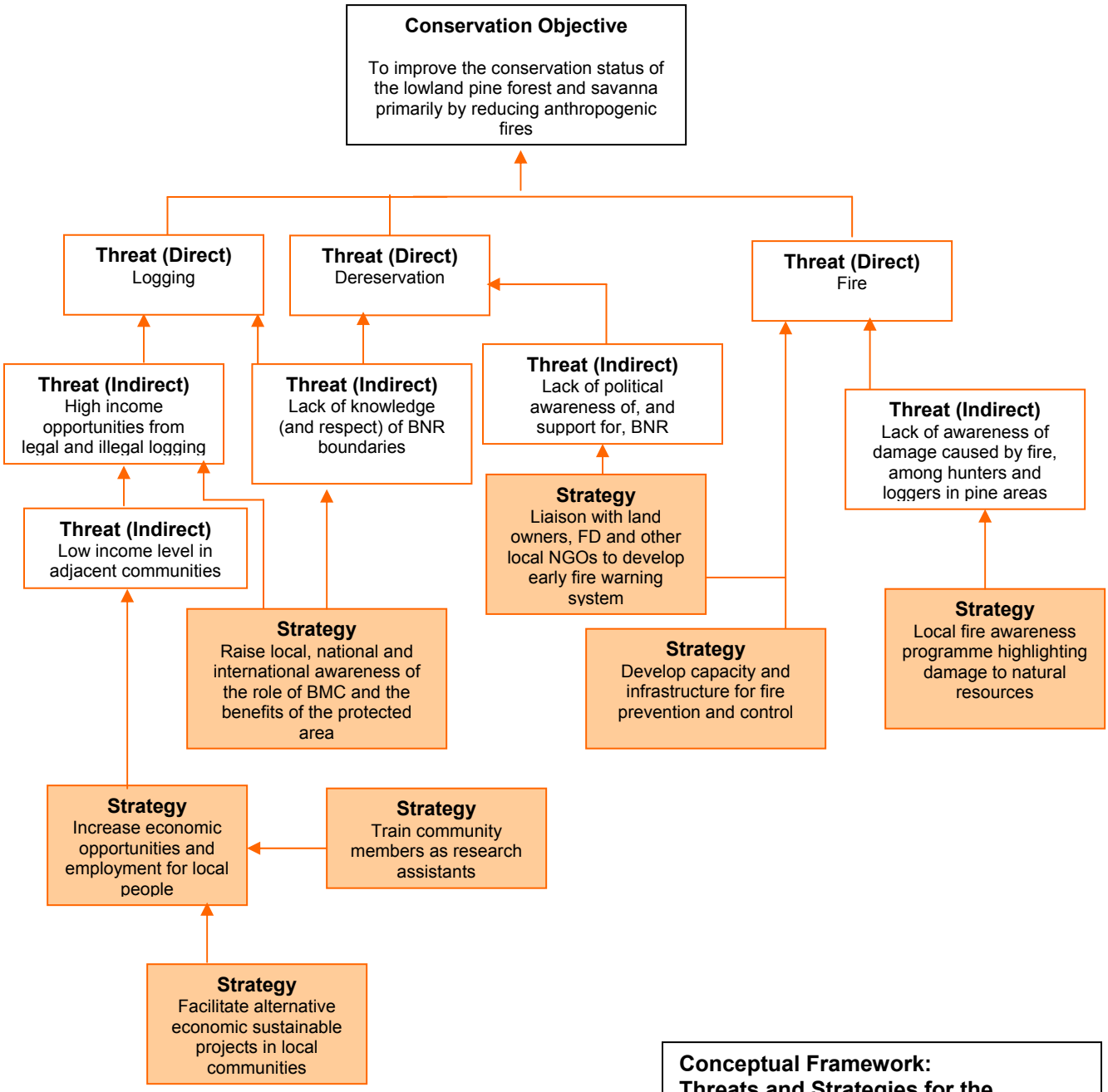


Conceptual Framework: Threats and Strategies for Upper Elevation Species

Conservation Target: Upper Elevation Species		
Threat	**Direct / Indirect**	**Strategy and Actions**
Chytridomycosis	Direct	**Strategy 1:** Increase knowledge of upland amphibian populations **Actions:** Prioritise upper elevation amphibian research; Develop presence / distribution / abundance data for upper elevation amphibian species; Develop monitoring programme for upper elevation amphibian species; Ensure dissemination of data into global amphibian decline strategies
		Strategy 2: Determine whether chytridomycosis exists in the upper elevation amphibian population and develop action plan **Actions:** Prioritise upper elevation amphibian research into chytridomycosis; Develop baseline data and monitoring programme for presence of chytridomycota in amphibian populations; Develop baseline data and monitoring programme of pesticides used in spraying agricultural areas on coastal plain; Develop action plan in liaison with farm owners for mitigation of pesticide drift; Ensure dissemination of data into global amphibian conservation strategies
Lack of knowledge of upper elevation species	Indirect	**Strategy 1:** Increase baseline data on upper elevation species **Actions:** Prioritise research into upper elevation species; Develop baseline of species presence, distribution and abundance in upper elevation areas
Lack of local and political awareness of and support for BNR	Indirect	**Strategy 1:** Increase awareness of Bladen Nature Reserve and BMC **Actions:** Raise awareness of location and environmental benefits of BNR locally, nationally and internationally; Ensure boundaries are clearly demarcated in critical areas (eg. access routes); Hold workshops and other activities in local communities to increase awareness
Dereservation	Direct	**Strategy 1:** Raise awareness in Government of significance of Bladen in the protected areas system **Actions:** Increase local awareness of environmental benefits of Bladen; Increase local support for BNR; Presentation to Minister of Natural Resources and other key officers, targeted at increasing awareness of significance of Bladen; Increase local, national and international profile of Bladen; Increase financial sustainability mechanisms for Bladen
Mining	Indirect	**Strategy 1:** Raise awareness in Geology and Petroleum Dept. of significance of Bladen in the protected areas system **Actions:** Close liaison with Dept. Geology and Petroleum re. issuing of prospecting and mining licenses within BNR; Annual presentation to Dept. targeted at increasing awareness of significance of Bladen; Increase national and international profile of Bladen; Lobby at ministerial level for continued protection of Bladen from mining impacts; Work with Geology and Petroleum Dept. to integrate TOR for environmental safeguards / actions into any license issued for BNR
		Strategy 2: Develop open communications and working relationship with companies that have been issued licenses for Bladen by Geology and Petroleum Dept. **Actions:** Development of long term mitigation plan to be enacted should mining permit be issued; Presentation to license holder targeted at increasing awareness of significance of Bladen; Increase national and international profile of Bladen

5. Lowland Pine Forest

Objective: To improve the conservation status of the lowland pine forest and savanna primarily by reducing anthropogenic fire impacts



Conceptual Framework: Threats and Strategies for the Lowland Pine Forest

Conservation Target: Lowland Pine Forest		
Threat	**Direct / Indirect**	**Strategy and Actions**
Fire	Direct	**Strategy 1:** Develop Fire Management Programme for the lowland pine forest (also include limestone forest) **Actions:** Develop and implement a fire management programme; Train wardens and community participants in fire management; Raise awareness of the problems of unmanaged fires; Liaise with logging concession holders and logging crews in adjacent areas towards cooperation in reducing frequency of anthropogenic fires; Increased vigilance against fires started by hunters and loggers in dry season
Logging within Bladen Nature Reserve	Direct	**Strategy 1:** Reduce logging within the protected area by direct and indirect means **Actions:** Develop enforcement plan; Prioritize enforcement of no logging regulation; Increase patrolling within critical areas and at critical times; Demarcate boundaries and access points; Liaise with FD on enforcement issues; Liaise with logging concession holders and logging crews to raise awareness of boundary location of Bladen; Liaise with adjacent protected area management bodies re. illegal logging activities
		Strategy 2: Increase awareness of the BMC, BNR and the environmental benefits of Bladen Nature Reserve **Actions:** Raise local awareness of conservation; Raise awareness of the goals and regulations of the protected area towards protection of Bladen
High income opportunities from legal and illegal logging	Indirect	**Strategy 1:** Increase liaison with logging concession holders within the Bladen area towards collaboration **Actions:** Ensure collaboration with logging concession holders; Raise awareness of location, boundaries, environmental benefits of protected area with both logging concession holders and logging crews; clearly define boundaries with cut survey lines in critical areas and signage
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 direct employment opportunities associated with BNR /BMC; Ensure that local communities have access to economic opportunities associated with the protected area; Develop alternative livelihoods through training and facilitation of market opportunities; Ensure this is tied into a 'çonservation' message
Lack of local and political awareness of and support for BNR	Indirect	**Strategy 1:** Increase awareness of Bladen Nature Reserve and BMC **Actions:** Raise awareness of location and environmental benefits of BNR locally, nationally and internationally; Ensure boundaries are clearly demarcated in critical areas (eg. access routes); Hold workshops and other activities in local communities to increase awareness
Dereservation	Direct	**Strategy 1:** Raise awareness in Government of significance of Bladen in the protected areas system **Actions:** Increase local awareness of environmental benefits of Bladen; Increase local support for BNR; Presentation to Minister of Natural Resources and other key officers, targeted at increasing awareness of significance of Bladen; Increase local, national and international profile of Bladen; Increase financial sustainability mechanisms for Bladen

Annex 8: International Conventions and Agreements

International Conventions and Agreements of Relevance to Bladen Nature Reserve	
Convention on Biological Diversity (Rio de Janeiro, 1992) Ratified in 1993	To conserve biological diversity, promote the sustainable use of its components, and encourage equitable sharing of benefits arising from the utilization of natural resources
Central American Commission for Environment and Development (CCAD) (1989)	Regional organisation of Heads of State formed under ALIDES, responsible for the environment of Central America. Initiated the Mesoamerican Biological Corridors and Mesoamerican Caribbean Coral Reef Programmes.
Alliance for the Sustainable Development of Central America (ALIDES) (1994)	Regional alliance supporting sustainable development initiatives.
Convention on the Conservation of Biodiversity and the Protection of Priority Wilderness Areas in Central America (Managua, 1992)	To conserve biological diversity and the biological resources of the Central American region by means of sustainable development
United Nations Framework Convention on Climate Change (New York, 1992)	Belize is identified by the 1994 National Inventory as a net remover of CO_2, the high percentage of vegetation cover, estimated to be absorbing 6 billion tons of CO_2 a year against a total emission estimated at 3 million tons
Convention on the Protection of Archaeological, Historical and Artistic Heritage of American Nations	To protect the Archaeological heritage of signatory countries. Several Maya archaeological sites exist within Bladen.
Other International Agreements **UNESCO Man and the Biosphere Programme** (1990) **Convention on Wetlands of International Importance Especially as Waterfowl Habitat** (Ramsar, 1971) **Convention on International Trade in Endangered Species of Wild Fauna and Flora** (Washington, 1973) **International Convention for the Protection and Conservation of Sea Turtles for the Western Hemisphere** (December 21st, 1997) **International Plant Protection Convention** (Rome, 1951) **Convention Concerning the Protection of the World Cultural and Heritage** (Paris, 1972) **Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region** (Cartegena de Indias, Colombia, 1983) **Mundo Maya Agreement**	

Annex 9: Protected Area Categories

Protected Areas Categories under the National Parks System Act and Forest Act			
Category	**Legal Foundation**	**Purpose**	**Activities Permitted**
Nature Reserve	National Parks System Act, 1981	for the protection of biological communities or species, and maintain natural processes in an undisturbed state. ***Bladen Nature Reserve***	Research, education
National Park	National Parks System Act, 1981	for the protection and preservation of natural and scenic values of national significance for the benefit and enjoyment of the general public	Research, education, tourism
Natural Monument	National Parks System Act, 1981	for the protection and preservation of natural features of national significance. Includes:	Research, education, tourism
Wildlife Sanctuary	National Parks System Act, 1981	for the protection of nationally significant species, biotic communities or physical features. Includes:	Research, education, tourism
Forest Reserve	Forest Protection Act, 1927 Forest Act, 1990	for the protection of forests for management of timber extraction and/or the conservation of soils, watersheds and wildlife resources	Research, education, tourism, logging

Annex 10: Work Plan and Data Development

Introduction

The development of this management plan was commissioned at the request of the Forest Department of the Ministry of Natural Resources and the Bladen Consortium.

Workplan Outline:

- Initial meeting with Forest Department and Bladen Consortium to review current background, status, knowledge and goals of Bladen Nature Reserve
- Review of existing data and identification of gaps
- Identification of stakeholders
- Workshop with Bladen Consortium members/ Site visit
- 1st Progress Report
- Second site visit / fieldwork
- Stakeholder consultations and analysis
- 2nd Progress Report
- Production of first draft of management plan for review by stakeholders
- Production of final draft of management plan
- Submission of final draft of management plan

Development of the Management Plan

Development of the management plan will follow the guidelines being established by the National Protected Areas Policy and System Plan (Appendix One), which outlines the strategies to be used in management plan development. This breaks management planning down into a three step procedure:

1. Preparatory Phase
2. Planning Phase
3. Implementation and Review Phase

This consultancy is towards the first two of these phases – the preparatory and planning phases that combine to produce a management plan that can then guide implementation.

1. Preparatory Phase

The Preparatory Phase develops the background to the protected area before the planning process begins. It sets the parameters within which the management plan is to be developed – those areas that will impact the activities permitted within the management plan. This is accomplished through defining the following areas:

- What protected area category does the protected area fall under, and therefore what activities are permitted?
- What are the key features of the area, and the reasons for its protection?
- What are the present and anticipated financial and human capacities of the management body available for the management of the protected area?
- In what ways will the protected area be of benefit to the people of adjacent communities?

An initial meeting was held with the Bladen Consortium members (Forest Department, Ya'axche, BFREE, TIDE and Belize Audubon Society) on Friday, 7th July in Belmopan, to review current background, status, knowledge and goals of Bladen Nature Reserve, and to develop the initial stages of the timeframe for the management planning. A two day workshop of all Consortium members and Wildtracks was then conducted in Punta Gorda at the beginning of September, 2005) ensuring that all members of the organization are clear and in consensus on what they hope to achieve from the management planning process, within the limitations of the legal parameters – and that this is also clear to the consultants.

2. Planning Phase

The Planning Phase was completed through a series of five steps:

Step1:

Data collection, resource assessment, stakeholder assessment

Data collection is the first step in the management process. Data was collated on the geography, biodiversity, the communities and other stakeholders that influence or are influenced by the protected area. Information on present management and management resources was gathered at the September meeting with the Bladen Consortium, and in subsequent meetings.

In comparison with some areas of Belize, there has been a substantial amount of work conducted in and adjacent to Bladen prior to establishment as a Nature Reserve. Major literature contributions to knowledge of the area include:

- **Brokaw N. and Lloyd-Evans (1987). The Bladen Branch Wilderness – A Special Report**

  An initial biological survey of the Upper Bladen Watershed by the Manomet Bird Observatory and Missouri Botanical Gardens took place in 1987, providing the groundwork towards the protection of the area, leading to its declaration as a Nature Reserve in 1990. This covered the environment of the Upper Bladen Branch watershed area (climate, physical features, vegetation, birds and mammals), provided a brief history of human use, and provided justifications and management recommendations for establishment of Bladen as a protected area.

- **Ministry of Natural Resources, Statutory Instrument No. 66 of 1990 (1990)**

  The statutory instrument declared Bladen as a Nature Reserve, containing "97,000 acres… bounded on the northeast by Bladen Branch and Richardson Creek; On the southeast by Deep River Forest Reserve; on the south by a portion of Maya Mountain Forest Reserve; on the west by Columbia Forest Reserve; and on the north by the Maya Divide..".

- **Dunham, Maya Mountain Archaeology Project (1992 – 1995)**

  The Maya Mountain Archaeology Project spent several years working in the Maya Mountains, part of that time being focused on Bladen, with the discovery of nine major classic and pre-classic Maya sites, and a population estimate of over 20,000 people living in the valley during that period.

- **Iremonger, S. & Sayer, (1994). A Rapid Ecological Assessment of the Bladen Nature Reserve, Belize**

  A rapid ecological assessment was conducted in 1994 by The Nature Conservancy, in partnership with Belize Audubon Society and the Ministry of Natural Resources (Belize), as part of the activities supported by the Proyecto Ambiental para Centro America (PACA). This covered a wider range of research fields - vegetation, flora, mammals, birds, reptiles and amphibians, and dragonflies and damselflies – and included a brief human impact analysis of stakeholder communities. Management recommendations were also put forward.

- **Bladen Consortium and the Conservation Division, Forestry Department (1998). Bladen Nature Reserve Management Plan**

  The first management plan was prepared for Bladen Nature Reserve in 1998, drawing principally from information contained within the 1994 REA.

- **Esselman P. (2001) The Monkey River Baseline Study; Basic and Applied Research for monitoring and assessment in southern Belize. Masters Thesis**

  A baseline study on the Monkey River, including work conducted in the Bladen Branch tributary.

- **Meerman J. (2001). A first assessment of damage to terrestrial ecosystems in Southern Belize caused by Hurricane Iris. Report to Government of Belize**
-

  Mapping the relative scale of damage caused by Hurricane Iris to Southern Belize in 2001, including the Bladen area.

Other literature reviewed includes research conducted in adjacent protected areas, on specific species, and on the Maya Mountains, to provide much of the background information for the development of the management plan:

Cockscomb Basin Wildlife Sanctuary

- **Miller B and Miller C. (1999)** Results of a survey of Bats of the Cockscomb Basin Wildlife Sanctuary, June 9-11, 1999

- **Rabinowitz A. and B. Nottingham (1986)** Mammal Species Richness and Relative Abundance of Small Mammals in a Sub-tropical Wet Forest of Central America.

- **Rath T. et al. (1990).** The Cockscomb Basin Expedition Final Report, 11th - 18th June, 1990;

- **Silver, S.C. and L. E. T. Ostro** (2001) Cockscomb Basin Mammal Survey - Final report to the Species Survival Fund, WCS

- **Silver S.C., L. Ostro and J. Davie**s (Date unknown). Density Estimates of Jaguars in Belize as Derived from Camera Trapping Data. Project proposal. WCS.

- **Walker and Walker (2005).** A biodiversity assessment of Cockscomb Basin Wildlife Sanctuary**;** Cockscomb basin Wildlife Sanctuary Management Plan, 2005 – 2010.

Columbia Forest Reserve

- **Parker et al. (1993)** A Biological Assessment of the Columbia River Forest Reserve, Toledo District, Belize. Rapid Assessment Program Working Papers 3, Conservation International.

Maya Mountains and Toledo

- **Bateson, J.H. and Hall**, **J.H.S.** (1977) The Geology of the Maya Mountains, Belize. London HMSO

- **De Vries G. W., M. F. Haines, S. B. Hufnagel, A. K. Laird, K. D. Rearick, and O. Salas** (2003). Enhancing Collaboration for Conservation and Development in Southern Belize. Masters Thesis. University of Michigan.

- **Toledo Institute for Development and Environment** (2002). Maya Mountain Marine Area Transect: Site Conservation Plan. Volume 1.

A number of smaller reports were also made available for review at BFREE, including:

- **Evans, Lisa. (1996).** Bladen Nature Reserve and Nearby Communities. Preliminary Management Recommendations. Warnell School of Forest Resources, University of Georgia. USA

- **Evans, Lisa. (1997).** People on the Edge: Local People and the Management of the Bladen Nature Reserve. Warnell School of Forest Resources, University of Georgia. USA

- **Marlin J. and K. Kampe (1993)**. A Report of the Reptiles and Amphibians in Bladen Nature Reserve. Monkey Bay Wildlife Sanctuary.

- **Reynolds R.P. and J. J. Jacobs. (1995)** Amphibians and reptiles of the Maya Mountains. Unpublished

Other resources being used in the development of background information on Bladen Nature Reserve were:

- Digitized Ordnance Survey map(s) covering the Bladen area
- Land use maps

- Satellite coverage of the area
- Land ownership map for Toledo districts
- The revised Ecosystems map of Belize (Merman, 2004) (http://biological-diversity.info/Ecosystems.htm)
- Data from the Belize Biodiversity Information System (http://fwie.fe.vt.edu/wcs/intro.htm)
- Data from the Central Statistics Office (http://cso.gov.bz)

Step 2:

Consultation to evaluate the resource and socio-economic information

The first round of consultations - creating awareness of the management plan process, gathering information on the views of different stakeholders, and discussing and mapping past, and human use patterns in and around the protected area – was conducted over a series of visits in September and October, 2005. Interviews were conducted with a wide variety of stakeholders – village alcaldes, farmers, hunters, plantation workers, Forest Department forest officers, and protected area wardens from adjacent protected areas, involved in patrols as part of the Bladen Consortium partnership. This, along with the input from the Bladen Consortium and Bladen wardens, provided much of the needed information for developing the viability and threat assessments.

Step 3:

Preparation of the Management Plan

Using the information gathered in the previous steps, an overview of biogeographical and physical information, viability and threat analysis, and draft management objectives were prepared, following the NPAPSP Outline for Protected Areas Management Planning, and presentated to the Bladen Consortium for review, and further discussions covering conservation elements, threats to biodiversity, and possible strategies towards threat abatement.

Step 4:

Review and evaluation of plan, including zonation and objectives

A meeting with Bladen Consortium members was conducted in October, as a forum for discussion of viability and threats, zoning, and development of objectives. These discussions then led on to the development of specific management actions.

Step 5:

Submission of Management Plan to Authorities for Approval

Following any necessary amendments to the management plan, the final draft is to be completed and submitted to the Forestry Department for review and approval.

Data Development

A characterization of Bladen Nature Reserve was completed in 2005 to form the basis of management decisions, and 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.

Species: All eighteen species present within the Bladen Nature Reserve listed by IUCN as globally threatened that are were considered as targets or nested targets (1 critically endangered, 3 endangered, 3 vulnerable and 11 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).

Species Assemblages: Where species have similar requirements, they have been grouped – Game species, for example, is 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

The upper elevation amphibians are a similar species assemblage, and potentially at risk from chytridomycosis, though no work has been done on these species in upland areas in Belize. This conservation target also includes other upland species - birds and plants in particular, that may face similar threats from pesticide drift, one of the suspected causal factors of the reduced immune system seen in amphibian species throughout the upland areas of the region.

Conservation Element: Upper elevation Species	
Amphibians	
Agalychnis moreleti	Morelet's Treefrog
Eleutherodactylus sabrinus	Sabrina's Rainfrog

Eleutherodactylus psephosypharus	Limestone Rainfrog
Eleutherodactylus chac	Chac's Rainfrog
Rana juliani	Maya Mountain Frog
Bufo cambelli	Cambell's Rainforest Toad
Birds	
Electron carinatum	Keel-billed Motmot
Myrmotherula schisticolor	Slaty Antwren
Sclerurus guatemalensis	Scaly-throated Foliage Gleaner
Dendrocincla anabatina	Tawny-throated Leaftosser

Ecosystems: Preliminary information on the ecosystems was interpreted from the Belize Ecosystem Map (Meerman and Sabido, 2001, revised 2004), using ArcView.

Ecosystems of the Bladen Nature Reserve Area	
UNESCO classification	
Broad Ecosystems	**Ecosystem Categories**
Tropical Broadleaf Forest	Tropical evergreen broadleaved lowland hill forest over rolling karstic terrain
	Tropical evergreen broadleaved lowland hill forest over steep karstic terrain
	Tropical evergreen broadleaved lowland hill forest: Vochysia – Terminalia variant
	Tropical evergreen broadleaved lowland forest over poor or sandy soil
	Tropical evergreen broadleaved submontane forest over rolling karstic hills
	Tropical evergreen broadleaved submontane forest over steep karstic hills
	Tropical evergreen broadleaved submontane forest
	Tropical evergreen broadleaved submontane palm forest
	Tropical evergreen broadleaved lower montane forest
	Tropical evergreen broadleaved lower montane palm forest
	Tropical evergreen broadleaved alluvial forest over calcareous soils
	Tropical evergreen seasonal broadleaved lowland hill forest over rolling karstic terrain
	Tropical evergreen seasonal broadleaved submontane forest: Simarouba – Terminalia variant
	Tropical evergreen broadleaved shrubland on steep karstic hills
Pine Forest – Short grass Savanna	Deciduous broadleaved lowland shrubland, well drained, over poor soils
	Deciduous mixed submontane shrubland over poor soils
	Short grass savanna with scattered needle leaved trees
	Short grass savanna with shrubs
Aquatic and Riparian Ecosystems	Deciduous broadleaved lowland riparian shrubland in hills
	River
***Classification follows Meerman and Sabido, 2001 (revised 2004)**	

GIS Metadata – Maps

File:	**Bladen – Actual Vegetation.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Actual Vegetation**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Actual vegetation present in and around Bladen Nature Reserve.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:220,500**
Includes:	**cartografia\Actual Vegetation\Bladen_NR** **cartografia\Actual Vegetation\VisibleVegetation_SelvaMaya**

GIS Metadata – Maps

File:	**Bladen – Connecting PAs.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Connecting PAs**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**A subset of the protected areas with connectivity to Bladen Nature Reserve,** **extending to Port Honduras Marine Reserve. Includes inset map showing location of Bladen NR in Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:628,000**
Includes:	**cartografia\Connecting PAs\anps** **cartografia\Connecting PAs\Bladen_NR** **cartografia\Connecting PAs\Country_Dissolved_1** **cartografia\Connecting PAs\political_boundarys** **cartografia\Connecting PAs\settlements_point**

GIS Metadata – Maps

File: **Bladen – Critical Areas.mxd**

Type: **ArcMap Document**

Location: **cartografia\Critical Areas**

Last Altered: **August 25, 2006**

GIS Software: **ArcGIS v9.0**

Description: **Areas of critical management significance within Bladen Nature Reserve, related specifically to elevated fire risk and risk of illegal incursion. Also contains inset map showing location of Bladen NR within Belize.**

Projection: **UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**

Scale: **1:200,000**

Includes: **cartografia\Critical Areas\Bladen_FireRisk**
cartografia\Critical Areas\Bladen_Incursions
cartografia\Critical Areas\Bladen_NR
cartografia\Critical Areas\political_boundarys

GIS Metadata – Maps

File:	**Bladen – Ecoregions.mxd**
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Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Extent of the Petén-Veracruz Moist Forest ecoregion. Also contains inset map showing location of Bladen NR within Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:4,000,000**
Includes:	**cartografia\Ecoregions\Bladen_NR cartografia\Ecoregions\Country_Dissolved_1 cartografia\Ecoregions\ecorr_wwf cartografia\Ecoregions\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – Ecosystems.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Ecosystems**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Broad ecosystems of the Bladen Nature Reserve area.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:220,000**
Includes:	**cartografia\Ecosystems\Bladen_NR** **cartografia\Ecosystems\Bladen_Shrubland_Brewer** **cartografia\Ecosystems\ecosys_bze_2004c**

GIS Metadata – Maps

File:	**Bladen – Fire Risk.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Fire Risk**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Overview of the risk of fires in and around Bladen Nature Reserve. Also contains inset map showing the location of Bladen NR in Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:200,000**
Includes:	**cartografia\Fire Risk\Bladen_NR** **cartografia\Fire Risk\firerisk** **cartografia\Fire Risk\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – General Location.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\General Location**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Location of Bladen Nature Reserve, showing roads, towns and villages. Also contains inset map showing the location of Bladen NR in Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:200,000**
Includes:	**cartografia\General Location\Bladen_NR** **cartografia\General Location\settlements_point** **cartografia\General Location\Belize Roads** **cartografia\General Location\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – Geology.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Geology**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Geological formations of the Bladen Nature Reserve area, including the Bladen Porphyritic Volcanic rocks.** **Also contains inset map showing the location of Bladen NR in Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:260,000**
Includes:	**cartografia\Geology\Bladen_NR** **cartografia\Geology\Bladen_Volcanics** **cartografia\Geology\geologia** **cartografia\Geology\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – Hydrology.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Hydrology**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Hydrology of the Bladen Nature Reserve area, showing rivers and principal watersheds. Also contains inset map showing the location of Bladen NR in Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:500,200**
Includes:	**cartografia\Hydrology\Bladen_NR** **cartografia\Hydrology\political_boundarys** **cartografia\Hydrology\bz_rivers_esselman_et_al_1** **cartografia\Hydrology\Bladen_Watersheds**

GIS Metadata – Maps

File:	**Bladen – Land Ownership.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Land Ownership**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Ownership of land in the vicinity of Bladen Nature Reserve, showing reserves, private land, areas subject to dereservation, and surveyed private lands. Also contains an inset map showing the location of Bladen NR in Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:260,000**
Includes:	**cartografia\Land Ownership\anps** **cartografia\Land Ownership\Belize Roads** **cartografia\Land Ownership\Bladen_NR** **cartografia\Land Ownership\bz_surveys_incomplete_ln** **cartografia\Land Ownership\bz_tenure_npapsp** **cartografia\Land Ownership\Dereserved_MayaMts** **cartografia\Land Ownership\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – Land Systems.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Land Systems**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Land systems and land system subunits of Bladen Nature Reserve and the surrounding areas. Includes an inset map showing generalised land systems of the reserve and its surroundings.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:260,000**
Includes:	**cartografia\Land Systems\Bladen_NR** **cartografia\Land Systems\Bladen_LSYS_Clip** **cartografia\Land Systems\bz_land_sys_nri_2** **cartografia\Land Systems\Dissolved_NRI_LandSys**

GIS Metadata – Maps

File:	**Bladen – Land Use.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Land Use**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Usage of land in the vicinity of Bladen Nature Reserve, showing other reserves, agriculture, and urban areas.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:470,000**
Includes:	**cartografia\Land Use\Bladen_NR** **cartografia\Land Use\anps** **cartografia\Land Use\Country_Dissolved_1** **cartografia\Land Use\ecosys_bze_2004c** **cartografia\Land Use\political_boundarys** **cartografia\Land Use\settlements_point**

GIS Metadata – Maps

File:	**Bladen – Landscape.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\ Landscape**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Landscape of the Bladen Nature Reserve area.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:220,500**
Includes:	**cartografia\ Landscape\Bladen_NR** **cartografia\ Landscape\Bladen_Shrubland_Brewer** **cartografia\ Landscape\ecosys_bze_2004c** **cartografia\ Landscape\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – Management Zones.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Management Zones**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**The two management zones of Bladen Nature Reserve. Includes an inset map showing the location of the reserve within Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:220,500**
Includes:	**cartografia\Management Zones\Bladen_NR** **cartografia\Management Zones\political_boundarys** **cartografia\Management Zones\Bladen_MgmtZones**

GIS Metadata – Maps

File:	**Bladen – Political Boundaries.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Political Boundaries**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**National boundaries and the districts of Belize, relative to Bladen Nature Reserve.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:1,750,000**
Includes:	**cartografia\Political Boundaries\anps** **cartografia\Political Boundaries\limites_poly** **cartografia\Political Boundaries\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – Potential Vegetation.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Potential Vegetation**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Potential vegetation categories in the vicinity of Bladen Nature Reserve.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:220,500**
Includes:	**cartografia\Potential Vegetation\Bladen_NR** **cartografia\Potential Vegetation\PotentialVeg_Dissolved_Locale**

GIS Metadata – Maps

File:	**Bladen – Priority Areas.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Priority Areas**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Regional priority conservation areas, extending into Guatemala and Mexico.** **Includes inset map showing the location of Bladen Nature Reserve in Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:1,750,000**
Includes:	**cartografia\Priority Areas\Bladen_NR** **cartografia\Priority Areas\CI_Nodes** **cartografia\Priority Areas\limites_poly** **cartografia\Priority Areas\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – Rainfall.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Rainfall**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Local and national average rainfall.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:280,000**
Includes:	**cartografia\Rainfall\Bladen_NR** **cartografia\Rainfall\Rainfall_BERDS** **cartografia\Rainfall\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – Soils.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Soils**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Soils of Bladen Nature Reserve and its vicinity. Includes an inset map showing the location of the reserve in Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:260,000**
Includes:	**cartografia\Soils\Bladen_NR** **cartografia\Soils\soils_bz_utm** **cartografia\Soils\political_boundarys**

GIS Metadata – Maps

File:	**Bladen – Surrounding PAs.mxd**
Type:	**ArcMap Document**
Location:	**cartografia\Surrounding PAs**
Last Altered:	**August 25, 2006**
GIS Software:	**ArcGIS v9.0**
Description:	**Protected areas surrounding Bladen Nature Reserve. Includes an inset map showing the location of Bladen NR within Belize.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**
Scale:	**1:628,000**
Includes:	**cartografia\Surrounding PAs\anps** **cartografia\Surrounding PAs\Bladen_NR** **cartografia\Surrounding PAs\Country_Dissolved_1** **cartografia\Surrounding PAs\political_boundarys** **cartografia\Surrounding PAs\settlements_point**

GIS Metadata – Maps

File: **Bladen – Topography.mxd**

Type: **ArcMap Document**

Location: **cartografia\Topography**

Last Altered: **August 25, 2006**

GIS Software: **ArcGIS v9.0**

Description: **Topography of the region of Belize surrounding Bladen Nature reserve. Includes an inset map showing the location of Bladen NR within Belize.**

Projection: **UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**

Scale: **1:350,000**

Includes: **cartografia\Topography\Bladen_NR**
cartografia\Topography\bz_contours_btfs-mcms_100m-interval
cartografia\Topography\political_boundarys

GIS Metadata

File: **Bladen_NR**

Type: **Shapefile**

Locations: **cartografia\Actual Vegetation**
cartografia\Connecting PAs
cartografia\Critical Areas
cartografia\Ecoregions
cartografia\Ecosystems
cartografia\Fire Risk
cartografia\General Location
cartografia\Geology
cartografia\Hydrology
cartografia\Land Ownership
cartografia\Land Systems
cartografia\Land Use
cartografia\Landscape
cartografia\Management Zones
cartografia\Potential Vegetation
cartografia\Priority Areas
cartografia\Rainfall
cartografia\Soils
cartografia\Surrounding PAs
cartografia\Topography

Contents: **Bladen Nature Reserve perimeter**

Origin:	**Derived from *"Meerman J. C., 2005, Belize Protected Areas Map Shapefile. v.20050412",* published by BTFS. http://www.biodiversity.bz/**	
Process:	**Selection of Bladen NR; exported selected features to new shapefile**	
Usage:	**Delineation of Bladen NR boundary.**	
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, units in metres**	
Geometry:	**Polygon**	
Attributes:	**NOMBRE**	**Reserve name**
	CAT	**Type of reserve (marine, etc.)**
	TIPO	**Ownership (government, private, etc.)**
	UBICACION	**Location**
	CAT_UICN	**IUCN Protected Area category**
	AREA	
	PERIMETER	
	HECTARES	

GIS Metadata

File:	**VisibleVegatation_SelvaMaya**
Type:	**Shapefile**
Locations:	**cartografia\Actual Vegetation**
Contents:	**Vegetation types present within vicinity of Bladen NR**
Origin:	**Derived from Selva Maya dataset *sist_ecol_act***
Process:	**Features close to Bladen NR exported to new shapefile**
Usage:	**Depiction of vegetation categories in and surrounding Bladen NR**
Projection:	**Lambert Conformal Conic, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**

Attributes:

VEGETACION	**Vegetation type**
HECTARES	
DESC_ESP	**Description in Spanish**
DESC_ENG	**Description in English**
PAIS	**Country**
ID	
U_SUELO	**Vegetation / Production Systems / Water**

GIS Metadata

File:	**anps**
Type:	**Shapefile**
Locations:	**cartografia\Connecting PAs** **cartografia\Surrounding PAs** **cartografia\Land Ownership** **cartografia\Land Use** **cartografia\Political Boundaries**
Contents:	**Protected areas across the Selva Maya region**
Origin:	**TNC Selva Maya project (http://www.selvamaya.org/)**
Process:	**n/a**
Usage:	**Depiction of protected areas in Belize**
Projection:	**Lambert Conformal Conic, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**

Attributes:	
NOMBRE	**Protected area name**
CAT	**Type of reserve**
TIPO	**Ownership (government, etc.)**
UBICACION	**Location**
CAT_UICN	**IUCN PA Category**
AREA	
PERIMETER	
HECTARES	

GIS Metadata

File:	**Country_Dissolved_1**
Type:	**Shapefile**
Locations:	**cartografia\Connecting PAs** **cartografia\Surrounding PAs** **cartografia\Ecoregions** **cartografia\Land Use**
Contents:	**Belize boundary**
Origin:	**"politcal_boundaries.shp",**
Process:	**Original multi-district dataset dissolved to produce single polygon for mainland etc.**
Usage:	**Generalised depiction of the shape of Belize**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**None relevant**

GIS Metadata

File:	**political_boundarys**
Type:	**Shapefile**
Locations:	**cartografia\Connecting PAs** **cartografia\Surrounding PAs** **cartografia\Critical Areas** **cartografia\Ecoregions** **cartografia\Fire Risk** **cartografia\General Location** **cartografia\Geology** **cartografia\Hydrology** **cartografia\Land Ownership** **cartografia\Land Use** **cartografia\Landscape** **cartografia\Management Zones** **cartografia\Political Boundaries** **cartografia\Priority Areas** **cartografia\Rainfall** **cartografia\Soils** **cartografia\Topography**
Contents:	**Districts of Belize**
Origin:	**Land Information Centre Spatial Layer (Made public through Paseo Pantera Consortium Univ. of Florida/USAID *Digital Geographic Database: Maya Forest Region: Mexico, Guatemala, Belize. Version 1, August 19110*), further modified by Jan Meerman. http://www.biodiversity.bz/**
Process:	**n/a**
Usage:	**Depiction of political boundaries within Belize.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**ADMIN_L2** **District name, where appropriate** **AREA** **PERIMETER**

GIS Metadata

File:	**settlements_point**
Type:	**Shapefile**
Locations:	**cartografia\Connecting PAs** **cartografia\Surrounding PAs** **cartografia\Land Use** **cartografia\General Location**
Contents:	**Settlements of Belize**
Origin:	**(From Int'l Travel Map of Belize (1:350,000), 2000 GOB Census, 2001 CSO Abstract of Statistics) Jan Meerman, BTFS. http://www.biodiversity.bz/**
Process:	**n/a**
Usage:	**Depiction of position of selected towns and villages relative to Bladen NR**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Point**

Attributes:		
	SETTNAME	**Name of settlement**
	POPULATION	**Settlement size, by population (1=small, 5=large)**
	POPSIZE	**Population**
	TYPE	**Settlement type**

GIS Metadata

File:	**Bladen_FireRisk**
Type:	**Shapefile**
Locations:	**cartografia\Critical Areas**
Contents:	**Areas of high fire risk within Bladen NR**
Origin:	**Derived from *ecosys_bze_2004c (*Meerman*)*. Specific dataset generated for Paul Walker, Wildtracks. Dataset created on August 23, 2006.**
Process:	**Certain features extracted from *ecosys_bze_2004c*. Clipped to conform to Bladen NR boundary. Discrete polygons merged to give two fire risk zones.**
Usage:	**Depiction of areas of high fire risk within Bladen NR.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**RISK** **Description of risk**

GIS Metadata

File:	**Bladen_Incursions**
Type:	**Shapefile**
Locations:	**cartografia\Critical Areas**
Contents:	**Illegal incursion routes into Bladen NR**
Origin:	**Dataset based on information supplied by Paul Walker, Wildtracks. Aug 24, 2006.**
Process:	**n/a**
Usage:	**Indication of points used for illegal entry into Bladen NR**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polyline**
Attributes**:**	**None relevant**

GIS Metadata

File:	**ecorr_wwf**
Type:	**Shapefile**
Locations:	**cartografia\Ecoregions**
Contents:	**Ecoregions in the Selva Maya area**
Origin:	**WWF Ecoregions dataset (Olson, D. M. and E. Dinerstein. The Global 200: Priority ecoregions for global conservation. (PDF file) Annals of the Missouri Botanical Garden 89:125-126). http://www.worldwildlife.org/ [clipped to Selva Maya region]**
Process:	**n/a**
Usage:	**Indication of the location of the Petén-Veracruz Moist Forest ecoregion.**
Projection:	**Lambert Conformal Conic, datum D_Clarke_1866, Clark 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**ECO_NAME Ecoregion name** **(other fields not used)**

GIS Metadata

File:	**ecosys_bze_2004c**
Type:	**Shapefile**
Locations:	**cartografia\Ecosystems** **cartografia\Land Use** **cartografia\Landscape**
Contents:	**Ecosystems of Belize**
Origin:	**Meerman, J. C. and W. Sabido. 2001. Central America Ecosystems Map: Belize.**
	CCAD/World Bank/Programme for Belize. Version 20060405. Major Revision by
	J. Meerman and posted 05 Apr 2006. http://www.biodiversity.bz/
Process:	**n/a**
Usage:	**Depiction of ecosystems within and surrounding Bladen Nature Reserve. Also used**
	as source data for generation of project-specific shapefiles. (*Bladen_Shrubland_Brewer* and *Bladen_FireRisk*)
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**

Attributes:

UNESCO_COD	**UNESCO coding**
NAME	**Names (selected features only)**
RANGE	**Altitudinal range of ecosystem**
LEGEND	
UNESCO_CLA	**UNESCO classificatin**
ECOSYSTEM	**Ecosystem description**
ACRES	
HECTARES	

GIS Metadata

File:	**Bladen_Shrubland_Brewer**
Type:	**Shapefile**
Locations:	**cartografia\Ecosystems** **cartografia\Landscape**
Contents:	**Ecosystems of Belize**
Origin:	**Derived from *ecosys_bze_2004c* (Meerman), based on data supplied to Paul Walker, Wildtracks by Steven Brewer. Generated August 23, 2006.**
Process:	**Selected features extracted from source dataset.**
Usage:	**Indication of a small area within Bladen NR where some vegetation shapefiles have been found to be inaccurate. Used to clarify the present situation.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**None used.**

GIS Metadata

File:	**firerisk**
Type:	**Shapefile**
Locations:	**cartografia\Fire Risk**
Contents:	**Generalised fire risk classifications for Belize**
Origin:	**Jan Meerman, BTFS. Publisher: NPAPSP. http://www.biodiversity.bz/**
Process:	**n/a**
Usage:	**General indication of fire risks in the Bladen area. Also used in determination of areas subject to higher risk of fire for Critical Areas map.**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**TOTALRISK Amalgamated fire risk** **(other fields not relevant)**

GIS Metadata

File:	**Belize_Roads**
Type:	**Shapefile**
Locations:	**cartografia\Ecosystems** **cartografia\Landscape**
Contents:	**Belize road system**
Origin:	**Jan Meerman, http://www.biodiversity.bz/**
Process:	**n/a.**
Usage:	**Depiction of Belizean roads.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polyline**
Attributes**:**	**None used.**

GIS Metadata

File:	**geologia**
Type:	**Shapefile**
Locations:	**cartografia\Geology**
Contents:	**Geology of the Selva Maya region**
Origin:	**TNC Selva Maya project. (http://www.selvamaya.org)**
Process:	**n/a.**
Usage:	**Depiction of geological formations in the vicinity of Bladen NR.**
Projection:	**Lambert Conformal Conic, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**

Attributes:

CRONOLOGIA	**Geological period**
TIPO_DE_RO	**Rock type**
PAIS	**Country**
HECTARES	
CLAVE	

GIS Metadata

File:	**Bladen_Volcanics**
Type:	**Shapefile**
Locations:	**cartografia\Geology**
Contents:	**Area of the Bladen Porphyritic Volcanic rocks**
Origin:	**Shapefile generated specifically for Wildtracks, from georeferenced copy of printed "Geology Map of Belize", Jean H Cornec, 2003. (jcornec@aol.com)**
Process:	**n/a.**
Usage:	**Depiction of the Bladen Porphyritic Volcanics.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**None used.**

GIS Metadata

File:	**Bladen_Watersheds**
Type:	**Shapefile**
Locations:	**cartografia\Hydrology**
Contents:	**Watersheds of the Bladen NR area**
Origin:	**Derived from watershed dataset provided by ICRAN / MAR, WRI, 2005. Derivation generated in 2006 by Adam Lloyd, Wildtracks.**
Process:	**Selected features exported from original dataset; extra attribute added for watershed name.**
Usage:	**Depiction of watersheds of the Bladen NR area.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes**:**	**NAME** **Watershed name**

GIS Metadata

File:	**bz_rivers_esselman_et_al_1**
Type:	**Shapefile**
Locations:	**cartografia\Hydrology**
Contents:	**Belize river network**
Origin:	**Peter Esselman et al. Derived from digitisation of DOS 1:50,000 map sheets.**
Process:	**Selected features exported from original dataset; extra attribute added for watershed name.**
Usage:	**Depiction of rivers of the Bladen NR area.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polyline**
Attributes:	**None used in this project.**

GIS Metadata

File:	**bz_surveys_incomplete_ln**
Type:	**Shapefile**
Locations:	**cartografia\Land Ownership**
Contents:	**Incomplete dataset of survey lines of properties in Belize.**
Origin:	**Fairweather, Chartered Surveyor, Belize, c/o Wildtracks.**
Process:	**n/a**
Usage:	**Depiction of private land holdings in the Bladen NR area.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polyline**
Attributes**:**	**None used in this project.**

GIS Metadata

File:	**bz_tenure_npapsp**	
Type:	**Shapefile**	
Locations:	**cartografia\Land Ownership**	
Contents:	**Information on land tenure in Belize.**	
Origin:	**Fairweather, Chartered Surveyor, Belize c/o Wildtracks**	
Process:	**n/a**	
Usage:	**Indication of location of BFREE property.**	
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**	
Geometry:	**Polygon**	
Attributes:	**STATUS**	**Type of holding (private, etc.)**
	NAME	
	OWNER	
	NOTE	
	PROP_NO	

GIS Metadata

File:	**Dereserved_MayaMts**
Type:	**Shapefile**
Locations:	**cartografia\Land Ownership**
Contents:	**Area of the Maya Mountain Forest Reserve subject to dereservation**
Origin:	**Derived from georeferenced paper map supplied by BFREE showing dereserved area. Digitised by Adam Lloyd, Wildtracks, August 2006.**
Process:	**n/a**
Usage:	**Depiction of area of Maya Mountain Forest Reserve subject to dereservation and subsequent subdivision.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**None used.**

GIS Metadata

File:	**bz_land_sys_nri_2**
Type:	**Shapefile**
Locations:	**cartografia\Land Systems**
Contents:	**Belize land systems, subunits, etc.**
Origin:	**Natural Resource Institute. http://www.nri.org/**
Process:	**n/a**
Usage:	**Depiction of land systems and subunits around Bladen NR.**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**

Attributes**:**

AREA	
PERIMETER	
LANDSYSL_	
LANDSYSL_I	
LSUBUNIT	**Subunit code**
LSYS	**Land system code**
LSUB	**Subunit description**
CURRENT_LA	**Current land use**
(other attributes not used)	

GIS Metadata

File:	**Bladen_LSYS_Clip**
Type:	**Shapefile**
Locations:	**cartografia\Land Systems**
Contents:	**Land systems and subunits within Bladen NR**
Origin:	**Derived from NRI's *bz_land_sys_nri_2* by Adam Lloyd, Wildtracks, 2006**
Process:	**Original dataset clipped to boundary of Bladen Nature Reserve; exported as a new shapefile.**
Usage:	**Depiction of land subunits within Bladen NR**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**AREA** **PERIMETER** **LANDSYSL_** **LANDSYSL_I** **LSUBUNIT** — **Subunit code** **LSYS** — **Land system code** **LSUB** — **Subunit description** **CURRENT_LA** — **Current land use** **(other attributes not used)**

GIS Metadata

File:	**Dissolved_NRI_LandSys**
Type:	**Shapefile**
Locations:	**cartografia\Land Systems**
Contents:	**Generalised land systems in and around Bladen NR**
Origin:	**Derived from NRI's *bz_land_sys_nri_2* by Adam Lloyd, Wildtracks, 2006**
Process:	**Original dataset dissolved by land system, removing subdivisions of polygons for land system subunits.**
Usage:	**Inset map of land systems around Bladen NR**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**LSYS** **Land system code**

GIS Metadata

File:	**Bladen_MgmtZones**
Type:	**Shapefile**
Locations:	**cartografia\Management Zones**
Contents:	**The two management zones of Bladen Nature Reserve**
Origin:	**Georeferenced and digitised from data supplied by Zoe Walker, Wildtracks**
Process:	**n/a**
Usage:	**Illustration of the proposed management zones of Bladen NR**
Projection:	**Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**

Attributes:

CAT	**Zone category**
DESC	**Description of zone purpose**
ACCESS	**Permitted access**

GIS Metadata

File:	**limites_poly**
Type:	**Shapefile**
Locations:	**cartografia\Political Boundaries** **cartografia\Priority Areas**
Contents:	**Outlines for Mexico, Guatemala and Belize**
Origin:	**TNC Selva Maya project (http://www.selvamaya.org/)**
Process:	**n/a**
Usage:	**Illustration of national frontiers**
Projection:	**Lambert Conformal Conic, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes**:**	**PAIS** **Country name in Spanish**

GIS Metadata

File:	**PotentialVeg_Dissolved_Locale**
Type:	**Shapefile**
Locations:	**cartografia\Potential Vegetation**
Contents:	**Potential vegetation categories in the vicinity of Bladen NR**
Origin:	**Derived from *sist_ecol_pot,* TNC Selva Maya project (http://www.selvamaya.org/). Derivation by Adam Lloyd, Wildtracks, 2006.**
Process:	**Selected features exported from *sist_ecol_pot*; dissolved on VEG_POT field to simplify data presentation.**
Usage:	**Depiction of potential vegetation in the Bladen Nature Reserve area**
Projection:	**Lambert Conformal Conic, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**VEG_POT Description of vegetation (other fields removed during dissolve from *sist_ecol_pot*)**

GIS Metadata

File:	**Rainfall_BERDS**
Type:	**Shapefile**
Locations:	**cartografia\Rainfall**
Contents:	**Rainfall isohyets for Belize**
Origin:	**Walker, S. H. 1973. Summary of climatic records for Belize. Land Res. Div. Surbiton, Surrey, England, Suppl. No. 3.Further modified by Jan Meerman.** **Digitised by Adam Lloyd, Wildtracks, 2006 from raster image downloaded from BERDS Map Explorer (http://www.biodiversity.bz).**
Process:	**n/a**
Usage:	**Illustration of relative rainfall levels across Belize and the Bladen NR area**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**INCHES** **Inches of rainfall** **MILLIMETRE** **Millimetres of rainfall**

GIS Metadata

File:	**soils_bz_utm**
Type:	**Shapefile**
Locations:	**cartografia\Soils**
Contents:	**Broad soil types of Belize**
Origin:	**Based on Wright, A. C, et al, 11109. Land in British Honduras. Colonial Res. Publ. No. 24. Note: Generated by PRONATURA for the TNC-led Selva Maya Project (draft form). Further modified to include information from *Baillie, et al. 1993. Revised Classification of the Soils of Belize. NRI Bulletin No. 59.***
Process:	**n/a**
Usage:	**Depiction of soils of the Bladen NR area**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes:	**SUELO** **Soil type** **AREA** **HECTARES** **PERIMETER**

GIS Metadata

File:	**bz_contours_btfs-mcms_100m-interval.shp**
Type:	**Shapefile**
Locations:	**cartografia\Topography**
Contents:	**Broad-scale topographical data for Belize**
Origin:	**BTFS (Jan Meermal et al.), provided by Belize Audobon Society. Contours derived from digitised DOS maps.**
Process:	**n/a**
Usage:	**Depiction of elevation and topography of Bladen NR and surroundings**
Projection:	**UTM Zone 16N, datum NAD 1927, Clarke 1866 spheroid, metres**
Geometry:	**Polygon**
Attributes**:**	**AREA** **PERIMETER** **KEY_NAME_** **Elevation classes** **ELEV1**