National Protected Area Systems Analysis

MARXAN Analysis

Introduction

On of the main components of the NPAPSP analysis was a MARXAN analysis. MARXAN is a conservation planning optimization tool (software)[1] that delivers decision support for reserve system design. MARXAN finds reasonably efficient solutions to the problem of selecting a system of spatially cohesive sites that meet a suite of biodiversity targets. Given reasonably uniform data on species, habitats and/or other relevant biodiversity features and surrogates for a number of planning units MARXAN minimizes the "cost" while meeting user-defined biodiversity targets. In many aspects MARXAN is very similar to SPOT, the tool that was used for the Ecoregional Planning analysis.

The Consortium choose to use MARXAN instead of SPOT on the basis that members of the consortium had received training in MARXAN (as part of CZMAI, TNC and WWF input in the consortium) and were thus relatively familiar with the software. Also, MARXAN is supposedly more suitable when marine data are included.

The MARXAN tool allows for the input of numerous variables and can present the results in a number of ways. However, it should be understood that the output is to be used as a tool that will help decision makers come to an ecologically, socially and politically acceptable Protected Areas System design. Central to the analysis is the division of the project area into "planning units". The size of these units is important. Small planning units may give detailed result and thus appear attractive. But the advantage of detailed results is offset by a longer run time of the analysis which can be a very important factor. Also small planning units backfire when relatively few data are available for analysis. In other words, the scale of the planning units needs to be in harmony with the scale of the data input. In this case the size of the (hexagonal) planning units was set at 10 km².

Using this 10 km² grid, the Belize territory was thus divided in 5957 hexagons. The maximum value of each component per10 km² hexagon is 1000 (hectares). In other words; where a particular layer entirely fills a hexagon, its value will be 1000. Where this layer fills only 35% of another hexagon, the value of that hexagon will be for the particular conservation feature is 350.

One important variable in the MARXAN analysis is the "boundary modifier". This boundary modifier dictates the "clumping" of conservation targets. In other words a tight clumping will result in fewer but larger selected areas giving a reduced boundary effect. A more lose clumping will result in more selected areas that are not necessarily linked. Although the cost of managing such a system is higher (higher boundary effect), it allows for a higher level of freedom for the planner, when decisions have to be made during the implementation phase. For this reason the relatively "loose" boundary modifier of 0.02 was used.

MARXAN essentially selects planning units on the basis of the data input. But every different run (200 runs were made during our analysis) it will start at in a random planning unit. The

[1] Software with manuals and other documentation is included in the MARXAN folder on the resource CD

number of times the program selects a planning unit during the 200 runs is indicative for the importance of that planning unit. The program allows for a number of options in which the selection process is being executed;

- “0” option where selections are made irrespective of an existing Protected Areas System.
- “Locked” option in which the set conservation targets are first placed inside the existing PA system and then starts locating the best position for the “left over” conservation goals (this is a gap-analysis in the true sense)
- “Seeded” option whereby the program starts to fit conservation goals inside an existing PA system but there is no guarantee that a these goals will be maintained within this PA system. This method finds the gaps in the existing PA system but also indicates which parts of the existing PA system experience problems (such as certain outside pressures). It even, to some degree shows which parts of the existing PA system may be redundant.
- “Locked out” option which keeps certain planning units outside the analysis. In our case this option was chosen for planning units with numerous agricultural subdivisions.

During a NPAPSP Task Force meeting in January 2005, the Task force opted to go with the “seeded” method but at a later stage, based on feedback obtained during public consultations, it was argued that a comparison between a “locked” and a “seeded” option would give the most useful output.

In the final output MARXAN presents two options. A “best” result and a “solution” result. The best result gives one optimum outcome of the analysis. The result is presented as either a 1 or a 0, essentially a “black and white” situation. The “solution” option gives for each planning unit, the number of times this planning unit was selected. This latter option is more diffuse but gives the planner more freedom to interpret results and for this reason this option will be presented here instead of a “best” result.

The basis for the MARXAN analysis is the conservation feature. In the MARXAN terminology this is often referred to as “Species”. In truth, this conservation feature can be a species, a feature or an ecosystem. The only criterion being that the data representing the conservation feature are uniform for the entire project area. The practical offshoot is, that only geo-referenced (for correct selection of the hexagons) data of nationally researched features could be used. Non-georefenced data or data restricted to a geographical area are useless for the MARXAN analysis. This severely restricts the amount and type of data that can be used for the analysis.

Conservation features

Ecosystems

The basis for the MARXAN analysis was the ecosystem model. The Belize Ecosystem Map (figure 1) recognizes 96 different ecosystems for Belize (Meerman, 2005)[2].

An ecosystem is the complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space. Since vegetation patterns are at the base of the biological environment. Vegetation patterns have been chosen as “proxy” for ecosystems. And since actual distribution patterns and data for specific species are scarce and generally

[2] See Gap Analysis document for a discussion of the Ecosystems map.

incomplete, ecosystems have been taken as a proxy for biodiversity patterns. For this reason, the current MARXAN analysis adopted ecosystems as the principle data input source.

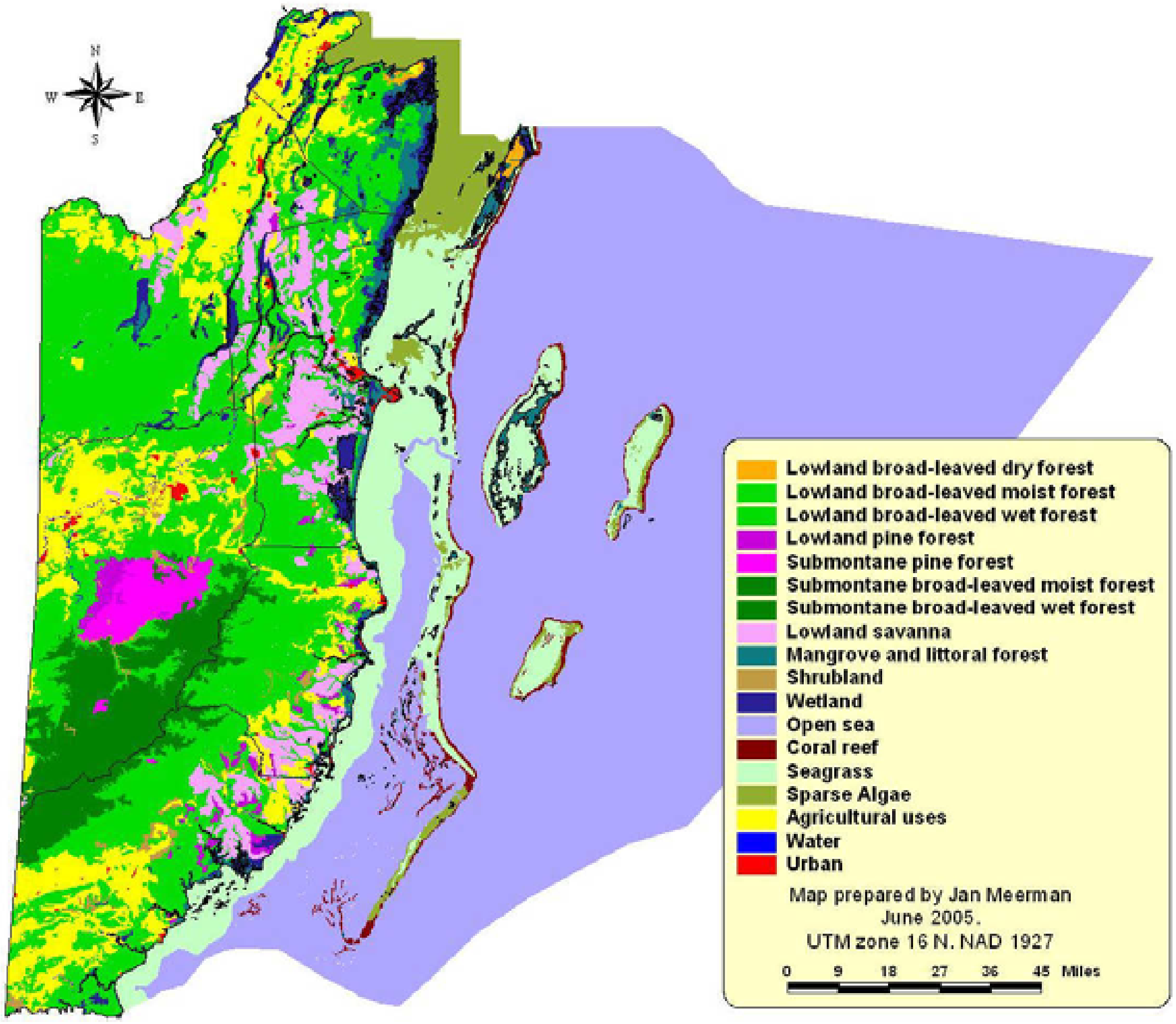

Figure 1 Ecosystems map of Belize - version 2004b (Meerman, 2005). For reasons of scale, the 96 ecosystems have been grouped into 16 broad ecosystem classes.

The full list of ecosystem conservation features is presented as table 3 at the end of this document.

Bioregions

While the Belize Ecosystems Map covers both the terrestrial and marine realm, the marine working group of the Consortium however, expressed the preference of a different approach based on bioregions rather than ecosystems.

This bioregion approach is based not on individual ecosystems, but rather of clusters of ecosystems with similar attributes or functions.

In this case the inner lagoon was split up in a variety of benthic regions based on depth, substrate and vegetation (Figure 2).

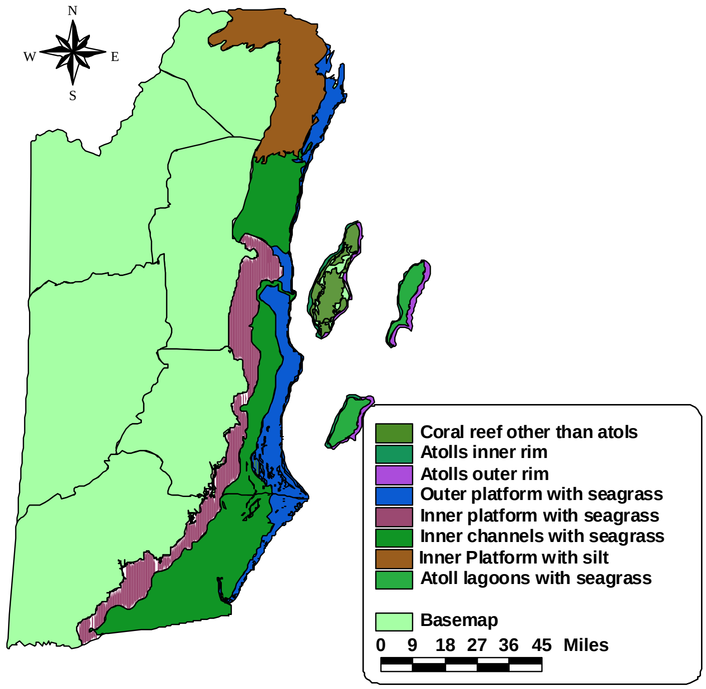

Figure 2. Benthic and Reef bioregions

Also the coral reefs were split up according to ecological functioning. The outer reefs of the atolls are different from the inner (leeward side) reefs and the shelf/platform reefs form a class in their own.

Secondly, the marine part of the country was split up in 7 different geographic zones: north, central, south plus zones for each of the Atolls and the deeper Caribbean (Figure 3).

The idea behind this is that these zones all represent different life zones each with its own characteristics. The practical consequence of it being that the MARXAN analysis will be looking to meet targets in each of these geographic zones.

Superimposed on each other these benthic, reef and geographic zones the marine section was analyzed using these 18 marine bioregions rather than the original 14 ecosystems.

The exact marine bioregions are listed in table 2 at the end of this document.

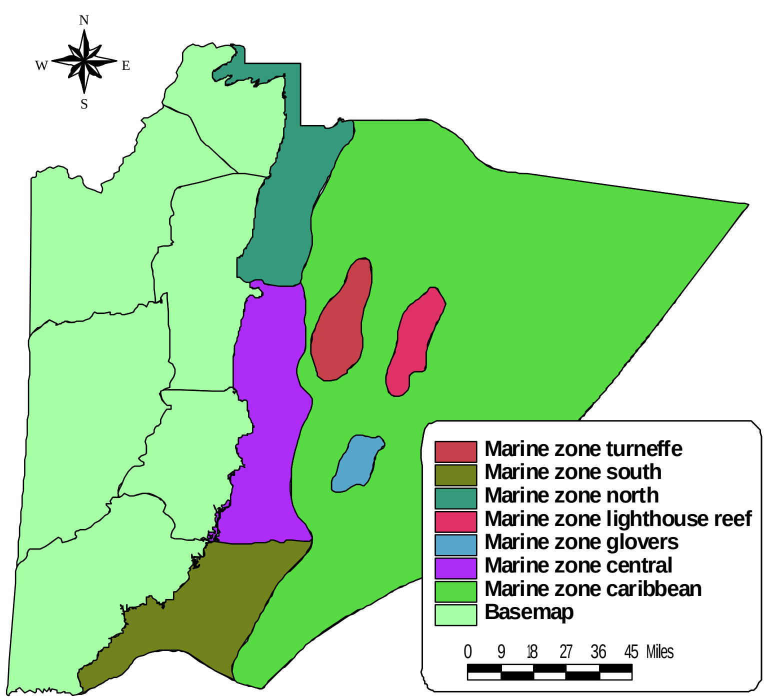

Figure 3. Geographic bioregions

Other non-ecosystem conservation features that could be included in the analysis were:

- Marine connectivity zones,
- Reef resiliency,
- Marine Biodiversity Hotspots,
- Marine bioregions,
- Caves and other geological features,
- Historical sites,
- Previously suggested sites for conservation,
- Biological corridors,
- Critical interconnected regions in the marine realm defined as Mangrove – Sea grass beds – Coral reef within 2.5 km of each other

Also here see table 2 at the end of this document for a full listing.

Biodiversity data

Ideally biodiversity should have been included on a large scale while establishing targets criteria for ecosystems. All ecosystems have importance for biodiversity but no doubt, some are more important than other. But since data on this distinction is not readily available, biodiversity could not be a criterion in the analysis.

A similar data problem exists for actual biodiversity data. To establish which biodiversity data were important for inclusion in the analysis, a list of critical terrestrial and marine species was established[3]. This list follows the IUCN red data list design but should not be marked as a National Red Data List by IUCN standards. In stead, this list could be seen as a first step to the formal acceptance to such a National Red Data List.

Based on this list of critical species, biodiversity data were incorporated in the analysis as much as possible. In general, biodiversity data where included when they were spatially discrete. Unfortunately, for most species, even those species of conservation interest there still insufficient accessible spatial data available that would allow meaningful inclusion in the MARXAN Analysis. As a result, only the species listed below (table 1) were included in the analysis. These species included are to a large extend breeding colonies of seabirds as well as a few marine target species and a few:

- Endemic species (marked with “E”),
- Endangered species (EN)
- Vulnerable species (VU)
- Critically Endangered species (CR)
- Near Threatened species (NT)

[3] See “Critical Species” document included on the resource CD

Table 1. Biodiversity (species) data included in the MARXAN analysis

Birds	Mammals
Agami	Manatee
Boat-billed Heron	
Bridled Tern	**Reptiles:**
Brown Noddy	Loggerhead Turtle
Brown Pelican	Hawksbill
Double-cr Cormorant	Green Turtle
Great Blue Heron	Crocodylus acutus (NT)
Great Egret	Phyllodactylus insularis (E)
Green Heron	
Keel-billed Motmot	**Amphibians**
Laughing Gull	Agalychnis moreletii (CR)
Least Tern	Rana juliani (E)
Little Blue Heron	
Frigatebird	**Fish**
Red-footed Booby	Spawning sites (Lutjanidae, Serranidae)
Redish Egret	
Roseate Spoonbill	**Invertebrates**
Roseate Tern	Epigomphus maya (E)
Sandwich Tern	Erpetogomphus leptophis (E)
Snowy Egret	Citheracanthus meermani (E)
Sooty Tern	Conch nursery sites
Tricolored Heron	
White Ibis	**Flora**
American Woodstork	Ceratozamia robusta (VU)
Yellow-crowned Night Heron	Zamia variegate (EN)
Jabiru	Zamia sp nov1 (E)
Scarlet Macaw	Zamia sp nov2 (E)
Waders/ducks/important wetlands	Aristolochia belizensis (E)
	Passiflora urbaniana (E)
	Passiflora lancetillensis

Each conservation feature was assigned a conservation target indicating the percentage of each ecosystem that would ideally need to be protected in one way or another[4]. A full list of all the 167 conservation targets together with the MARXAN file number, the source of the information and the conservation targets can be found in tables 2 and 3.

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[4] A full explanation and rationale for the conservation target percentage assignment is presented in the "Gap Analysis" document that is provided on the resource CD.

Results

The two different approaches used in the MARXAN analysis include the locked and the seeded option. The log data from the "best" option are included as an appendix to this document. In the locked option, the existing protected area's have been "locked" in and the conservation features can not be reassigned elsewhere (figure 4)[5].

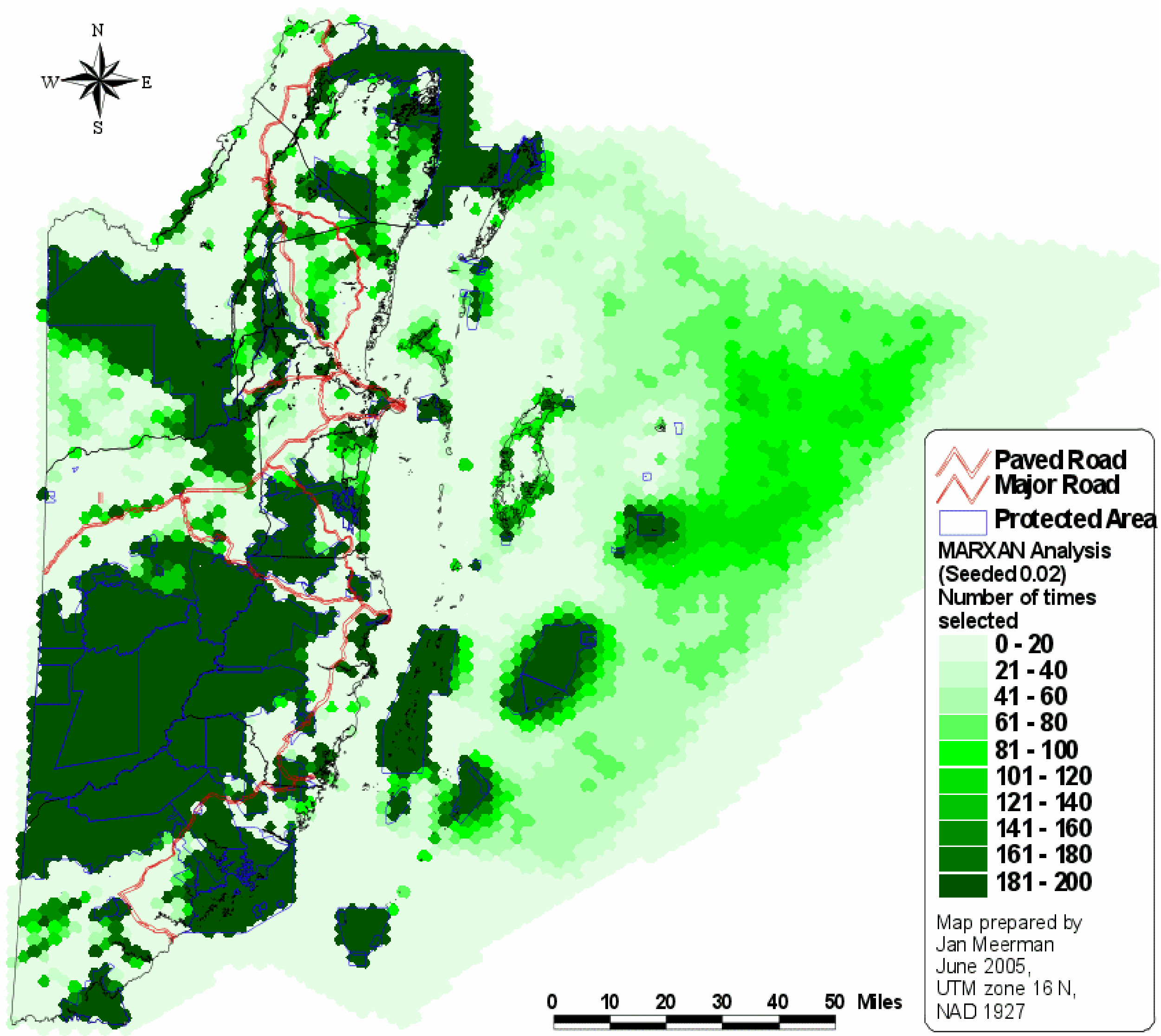

Figure 4. June 2005 MARXAN Analysis Results "Locked" option

Notice in the "locked" version how the existing protected areas are clearly selected, but that there are many areas outside existing protected areas that have been selected (notice biological corridors!). It will be important to compare these results with those of the "Gap Analysis"[6]

[5] Higher resolution images of these maps are available on the resource CD

[6] Report available on resource CD

The second main result is the "seeded" version (figure 5).

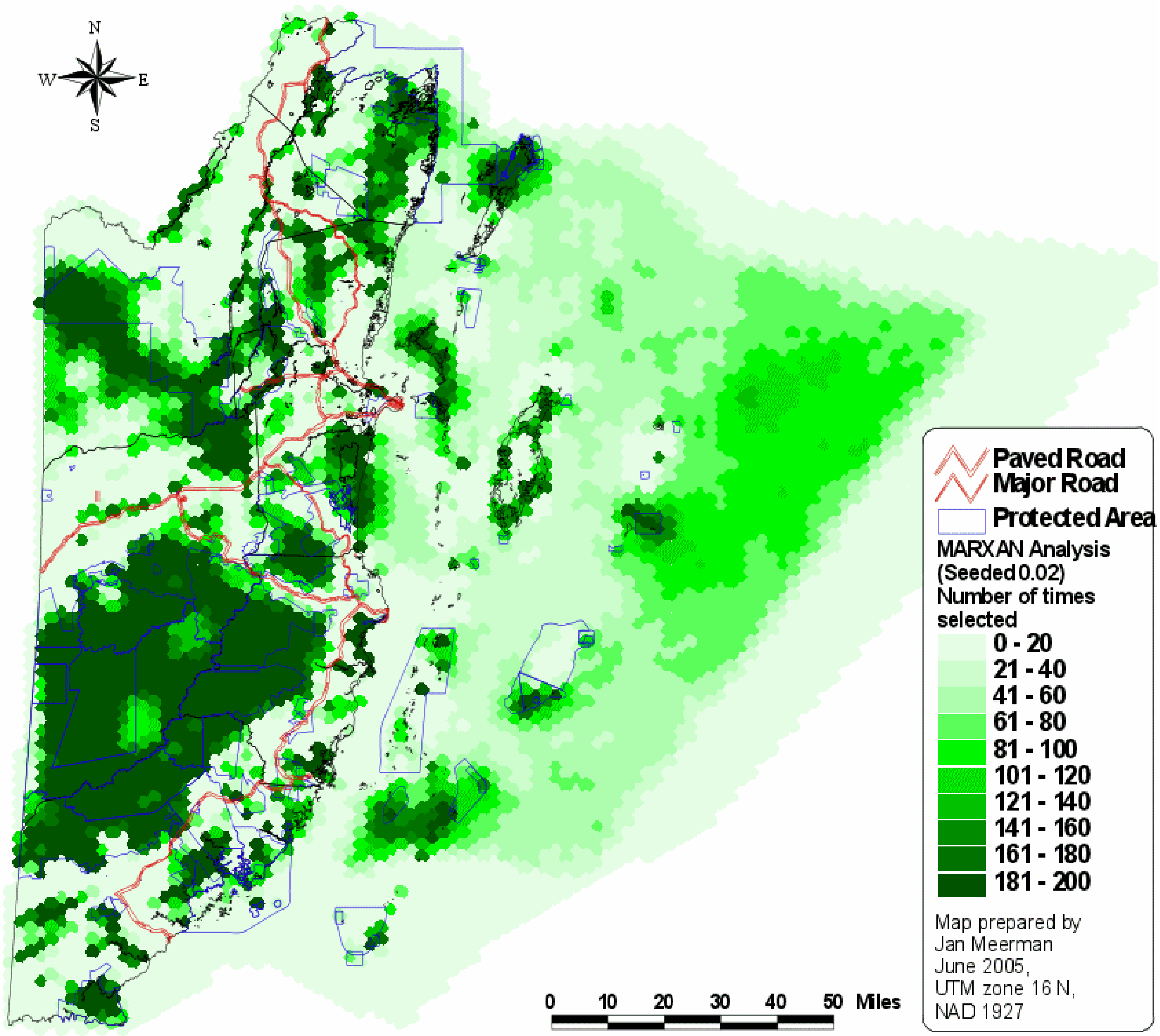

Figure 5. June 2005 MARXAN Analysis Results "Seeded" option

This seeded version tries to place conservation features inside existing protected areas but will place them elsewhere if there are better options available (based on human footprint[7] for example).

The very first conclusion that can be drawn from both the locked and the seeded versions is that marine area results appear very different from terrestrial results. The primary cause for this lies in the large area outside the reef and atolls; in this "exclusive economic" zone, lie very important deep sea habitats with depths up to more than 4,000 m (12,400 ft). A zone, which so far, has eluded the interest of conservation management planners in Belize. However, with the absence

[7] See separate report on the resource CD

of data available for this zone, MARXAN has problems deciding where the optimum planning units are to be placed. Consequently, the picture in the "deep blue" is less defined.

Other reasons for the difference in output between terrestrial and marine sections are that the data are just different. In the terrestrial zone, roads, communities, farming and other land uses are clearly defined and easy to map. In the marine zone, none of this is immediately clear.

Discussion

The "locked" version is particularly interesting as a surrogate "gap analysis" since it locates conservation features that could not be placed inside existing protected areas. The actual ecosystem Gap Analysis[8] indicated ecosystems that were under-represented (based on the identified conservation target percentages) under the current protected area system. And this component of the MARXAN analysis indicates the best placement for these gaps.

The "seeded" version is interesting because it indicates "best" placement of conservation features. It also indicates areas that are less critical for conservation (based on the identified conservation target percentages).

Some observations:

- Importance of General Shipstern area
- Importance of Northern Ambergris area. Many important conservation targets (marine and terrestrial) within close proximity of each other.
- Area south of Shipstern ("Southern Blocks") is important for ecosystem conservation and biological corridors
- Biological Corridors show up very clearly. Particularly in the locked version. Largely these traverse private land. Incentives for landowners to maintain these corridors are needed.
- Parts of rivers such as the Belize River, New River and Rio Hondo score high. They have importance as riverine corridors. In addition they are hydrologically important (environmental services).
- Crooked Tree scores very prominently as well as lands south and west of it. A number of different ecosystems are involved here. Crooked Tree is an important part of the Biological Corridor, linking NE Belize with W Belize.
- Gallon Jug and Yalbac are only moderately selected on the base of current human activities and relatively high agricultural land value.
- A section of the Belize River Valley is fairly strongly selected. Belize River Forests were identified as distinct ecosystem, and are essential in the biological corridor and they come out strongly but on private lands. Incentives needed for at least some of it.
- The highways present a strong influence (human footprint).
- The Maya Mountains Block is a good example of an area that should be managed as one entity with different zonation rather than many separate entities.
- The Moho River comes out strongly. Important link with Lu Ha

[8] See the Gap Analysis document provided on the resource CD.

- The Sarstoon Temash NP comes out strongly in spite of strong impacts from the Guatemala side. Also, much of the Temash River outside the PA is selected.
- Interestingly, the steep karstic hills of Western Toledo are also selected. This in spite of a strong human footprint. These hills are clearly important. There are indications that they have important biodiversity but solid data are lacking.
- Gladden Spit and Laughing Bird Caye with adjacent waters come out in one block of importance.
- The general Golden Stream Area provides a link with terrestrial habitats
- The relative weak position of Sapodilla Cayes and Port Honduras have to be attributed to reported influence of Guatemalan fishermen.
- The deep water ecosystems of Belize have never received any attention, consequently, little is known about them and the MARXAN software could not pinpoint real areas of high importance. More data is clearly needed here. Otherwise there is considerable freedom here to position needed conservation areas.
- The Turneffe Atoll comes out very strongly because of its high connectivity. Many different marine and coastal ecosystems occur here in close proximity of each other. Most of the land is in private hands but there is a clear need for marine protected areas here.
- Northern Turneffe is important as the most important nesting site for the American Crocodile.

Although the MARXAN analysis incorporated as many as 167 conservation features, there is always room for improvement. New data should always be incorporated in any decision making. Particularly the marine sector is open to improvements, particularly on biodiversity issues. The analysis of the deep water ecosystems could be improved by adding data such as Whale Shark migration data and information available from sport fishermen.

Overall, the MARXAN analysis is an important tool in the planning process of conservation planning. However, this analysis should never be used in isolation. The analysis is one tool out of a whole toolbox.

Examples on how to use MARXAN and the other products of the NPAPSP analysis can be used are to be found in a few case studies that were prepared in order to demonstrate potential uses of the various analysis types.

See:

- **Case Study: Gra Gra Lagoon National Park and adjacent areas**
- **Case Study: Jaguar and other wide-ranging species**
- **Case Study: Jabiru Stork**
- **Case Study:**

Table 2. Target cover for conservation teatures other than ecosystems - with rationale

ID # Shape	Name of Target	Type	Source	Env serv	Hist/ Cultural	Scenic	Marine WG	Biodiv	Endang	Endemic	Reprod site	Target%
401	Corridor_primary	Polygon	Meerman et al 2000, Herrera et al., 2002)					80				**80**
402	Corridor_secondary	Polygon	Meerman et al 2000, Herrera et al., 2002)					50				**50**
403	Corridor_crossboundary	Polygon	Meerman et al 2000, Herrera et al., 2002) + Ecoregional Planning 2004					80				**80**
404	Connectivity (buffered) Marine Connectivity expressed as Mangrove – Sea grass beds – Coral reef within 2.5 km of each other	Polygon	Consortium	10			20					**30**
406	Marine Biodiversity Hotspots. (2.5 km buffer)	Polygon	Consortium				20	20				**40**
410	Caves	Point	1:50000 Topo maps + NICH	10	20	10		10				**50**
411	Geologic (Waterfalls, Sinkholes, Natural Arch etc.)	Point	Cornec 2003	10		10		10				**30**
412	Historical (Maya sites, colonial sites)	Point	1: 50000 Topo maps + NICH		20	10						**30**
413	Research interest: Sites with extended research investments (5km buffer)	Polygon	Consortium				20	10				**30**
415	Low_land_value: Areas with low agricultural land value	Polygon	King et al. 1992	10				10				**20**
420	SDA_protected. Areas suggested for protection under the SDA scheme	Polygon	LIC	10				10				**20**
421	Estap_protected Areas identified for protection by ESTAP	Polygon	ESTAP	10	20			10				**40**
422	Narmap managed: Gaps in Protected Areas System identified by 1995 NPAPSP	Polygon	Programme for Belize 1995	10				10				**20**
430	Marine Zone Glovers	Polygon	Consortium				20					**20**
431	Marine Zone Turneffe	Polygon	Consortium				20					**20**
432	Marine Zone Lighthouse	Polygon	Consortium				20					**20**
433	Marine Zone Northern	Polygon	Consortium				20					**20**
434	Marine Zone Central	Polygon	Consortium				20					**20**
435	Marine Zone South	Polygon	Consortium				20					**20**
440	Inner Platform with seagrass	Polygon	Consortium				20					**20**
441	Inner Channel with seagrass	Polygon	Consortium				20					**20**
442	Outer Platform with seagrass	Polygon	Consortium				20					**20**
443	Atoll Lagoons with seagrass	Polygon	Consortium				20					**20**

Table 2. Target cover for conservation teatures other than ecosystems - with rationale

ID # Shape	Name of Target	Type	Source	Env serv	Hist/ Cultural	Scenic	Marine WG	Biodiv	Endang	Endemic	Reprod site	Target%
451	Atolls Inner Turneffe	Polygon	Consortium	10		10		10				**30**
452	Atolls Inner Lighthouse	Polygon	Consortium	10		10		10				**30**
453	Atolls Inner Glovers	Polygon	Consortium	10		10		10				**30**
454	Atolls Outer Turneffe	Polygon	Consortium	10		10		10				**30**
455	Atolls Outer Lighthouse	Polygon	Consortium	10		10		10				**30**
456	Atolls Outer Glovers	Polygon	Consortium	10		10		10				**30**
446	Northern Coastal Inner Platform with silt	Polygon	Consortium				20					**20**
447	Coral Reef (without Atolls)	Polygon	Consortium	10		10		10				**30**
501	Agami	Point	H. Lee Jones, pers.comm.								50	**50**
502	BoatBilledHeron	Point	Consortium								50	**50**
503	Bridledtern	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
504	BrownNoddy	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
505	BrownPelican	Point	Consortium								50	**50**
506	DoubleCrestedCormorant	Point	Consortium								50	**50**
507	GreatBlueHeron	Point	Consortium								50	**50**
508	GreatEgret	Point	Consortium								50	**50**
509	GreenHeron	Point	Consortium								50	**50**
510	LaughingGull	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
511	LeastTern	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
512	LittleBlueHeron	Point	Consortium								50	**50**
513	FrigateBird	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
514	RedFootedBooby	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
515	RedishEgret	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
516	RoseateSpoonbill	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
517	RoseateTern	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
518	SandwichTern	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
519	SnowyEgret	Point	Consortium								50	**50**
520	SootyTern	Point	H. Lee Jones, pers.comm. + Consortium								50	**50**
521	TricoloredHeron	Point	Consortium								50	**50**
522	WhiteIbis	Point	Consortium								50	**50**
523	Woodstork	Point	Consortium + Meerman, J.C. personal database								50	**50**
524	YellowCrNightHeron	Point	Consortium								50	**50**
525	Jabiru	Point	Omar Figuroa						10		50	**60**

Table 2. Target cover for conservation teatures other than ecosystems - with rationale

ID # Shape	Name of Target	Type	Source	Env serv	Hist/ Cultural	Scenic	Marine WG	Biodiv	Endang	Endemic	Reprod site	Target%
526	Scarlet Macaw	Polygon	Consortium						30			**30**
527	Waders_ducks	Polygon	Consortium					10				**10**
528	Keelbilled motmot	Point	Consortium + Meerman, J.C. personal database						10			**10**
540	Loggerhead	Point	Consortium						20		50	**70**
541	Hawksbill	Point	Consortium						30		50	**80**
542	GreenTurtle	Point	Consortium						20		50	**70**
543	Crododylus acutus	Point	Steven Platt pers.comm + Consortium						10			**10**
544	Rana juliani	Point	Meerman, J.C. personal database							10		**10**
545	Crocodylus acutus important nests	Polygon	Steven Platt pers.comm + Consortium								50	**50**
546	Phyllodactylus insularis	Polygon	Meerman, J.C. personal database						10	10		**20**
547	Agalychnis moreletii	Point	Meerman, J.C. personal database						30			**30**
550	Manatee	Polygon	Consortium						20			**20**
560	Epigomphus maya	Point	Meerman, J.C. personal database							10		**10**
561	Erpetogomphus leptophis	Point	Meerman, J.C. personal database							10		**10**
562	Citheracanthus meermani	Point	Meerman, J.C. personal database							10		**10**
570	Spawningsites	Polygon	Consortium								50	**50**
572	ConchSpawning	Polygon	Consortium								50	**50**
601	Ceratozamia robusta	Point	Meerman, J.C. personal database						10			**10**
602	Zamia variegata	Point	Meerman, J.C. personal database						20			**20**
603	Zamia spnov	Point	Meerman, J.C. personal database							10		**10**
604	Zamia sp	Point	Meerman, J.C. personal database							10		**10**
610	Aristolochia belizensis	Point	Meerman, J.C. personal database							10		**10**
620	Passiflora urbaniana	Point	Meerman, J.C. personal database							10		**10**

Gap Analysis: Target cover for ecosystem conservation features with rationale - Table 3

Unesco code	ID # shape file	Count	Ecosystem name	Acres	Hectare	Slope	Rare	Count	Env-serv	Timber	Fisheries	Endemics	Last-wild	Low Ag	Wetland	Total	%Target
IA1a(1)(a)-C	301	3	Tropical evergreen broad-leaved lowland hill forest, Callophyllum variant	22,720	9,195		40	10		20			10			80	**80**
IA1a(1)(a)K-r	303	14	Tropical evergreen broad-leaved lowland hill forest on rolling karstic terrain	54,346	21,993		20			20			10			50	**50**
IA1a(1)(a)K-s	304	17	Tropical evergreen broad-leaved lowland hill forest on steep karstic terrain	92,939	37,611	40	20					10	10			80	**80**
IA1a(1)(a)-VT	302	3	Tropical evergreen broad-leaved lowland hill forest, Vochysia-Terminalia variant	20,486	8,290	40	40	10		20			10			120	**95**
IA1a(1)(b)K	305	9	Tropical evergreen broad-leaved lowland forest c calcareous soils	4,671	1,890		50	10		20						80	**80**
IA1a(1)(b)P	306	41	Tropical evergreen broad-leaved lowland forest c poor or sandy soils	164,828	66,704					20			10			30	**30**
IA1b(1)	307	2	Tropical evergreen broad-leaved submontane forest	64,426	26,073	40	20	10					10	10		90	**90**
IA1b(1)K-r	308	4	Tropical evergreen broad-leaved submontane forest on rolling karstic hills	29,010	11,740		30	10		20			10	10		80	**80**
IA1b(1)K-s	309	7	Tropical evergreen broad-leaved submontane forest on steep karstic hills	32,000	12,950	40	30	10				10	10	10		110	**95**
IA1b(3)	310	3	Tropical evergreen broad-leaved submontane palm forest	29,789	12,055	40	30	10					10	10		100	**95**
IA1c(1)	311	2	Tropical evergreen broad-leaved lower-montane forest	2,138	865	40	50	10						10		110	**95**
IA1c(4)	312	2	Tropical evergreen broad-leaved lower montane palm forest	1,541	624	40	50	10						10		110	**95**
IA1f(2)	313	10	Tropical evergreen broad-leaved alluvial forest	6,094	2,466		40			20						60	**60**
IA1f(2)(a)K	314	32	Tropical evergreen broad-leaved alluvial forest on calcareous soils	31,423	12,716		30			20			10			60	**60**
IA1g(1)(a)	315	28	Tropical evergreen broad-leaved lowland swamp forest	49,770	20,141		20			20						40	**40**
IA1g(1)(a)-AC	316	1	Tropical evergreen broad-leaved lowland swamp forest, Aguacaliente variant	1,082	438		50	10						10	10	80	**80**
IA1g(1)(b)	317	9	Tropical evergreen broad-leaved permanently waterlogged lowland swamp forest	8,477	3,431		40	10						10		60	**60**
IA1g(2)(b)-MA	318	4	Tropical evergreen broad-leaved permanently waterlogged lowland swamp forest with palms. Manicaria variant	6,092	2,465		40	10						10		60	**60**

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Gap Analysis: Target cover for ecosystem conservation features with rationale - Table 3

Unesco code	ID # shape file	Count	Ecosystem name	Acres	Hectare	Slope	Rare	Count	Env-serv	Timber	Fisheries	Endemics	Last-wild	Low Ag	Wetland	Total	%Target
IA2a(1)(a)K-r	321	23	Tropical evergreen seasonal broad-leaved lowlar hill forest, on rolling karstic terrain	92,543	37,451		20			20		10	10			60	**60**
IA2a(1)(a)K-s	322	50	Tropical evergreen seasonal broad-leaved lowlar hill forest on steep karstic terrain	163,958	66,352	40						10	10			60	**60**
IA2a(1)(a)-ST	319	9	Tropical evergreen seasonal broad-leaved lowlar hill forest, Simarouba-Terminalia variant	296,915	120,158	40		10		20			10			80	**80**
IA2a(1)(a)-VT	320	9	Tropical evergreen seasonal broad-leaved lowlar hill forest, Virola-Terminalia variant	68,967	27,910	40	20	10		20			10			100	**95**
IA2a(1)(b)K	323	53	Tropical evergreen seasonal broadleaf lowland forest over lime-rich alluvium	84,099	34,034		20			20						40	**40**
IA2a(1)(b)K-BR	324	6	Tropical evergreen seasonal broad-leaved lowlar forest on calcareous soils, Belize River variant	41,090	16,629		20	10		20						50	**50**
IA2a(1)(b)K-CE	325	15	Tropical evergreen seasonal broad-leaved lowlar forest on calcareous soils, Central Eastern variant	147,368	59,638					40						40	**40**
IA2a(1)(b)K-CW	326	16	Tropical evergreen seasonal broad-leaved lowlar forest on clacareous soils, Central West variant	133,938	54,203					40			10			50	**50**
IA2a(1)(b)K-TP	327	32	Tropical evergreen seasonal broad-leaved lowlar forest on calcareous soils, Tehuantepec-Peten variant	337,578	136,613					40			10			50	**50**
IA2a(1)(b)K-Y	328	31	Tropical evergreen seasonal broad-leaved lowlar forest on calcareous soils, Yucatan variant	116,967	47,335					40						40	**40**
IA2a(1)(b)S	329	54	Tropical evergreen seasonal broad-leaved lowlar forest on poor or sandy soils	63,272	25,606		20			20			10			50	**50**
IA2a(1/2)(a)	330	4	Tropical evergreen seasonal mixed lowland hill forest	935	378	40	50	10		20						120	**95**
IA2a(2)(a)	331	4	Tropical evergreen seasonal needle-leaved lowland hill forest	22,986	9,302		40	10		20						70	**70**
IA2a(2)(b)	332	40	Tropical evergreen seasonal needle-leaved lowland forest	44,283	17,921		20			20			10			50	**50**
IA2b(1)	333	2	Tropical evergreen seasonal broad-leaved submontane elfin forest	255	103	40	50	10						10		110	**95**
IA2b(1)K-r	336	5	Tropical evergreen seasonal broad-leaved submontane forest on rolling karstic hills	71,866	29,083		20	10	20	20			10	10		90	**90**

Note: Target % for a numbe of marine conservation features set to a standard 20% by marine working group

Gap Analysis: Target cover for ecosystem conservation features with rationale - Table 3

Unesco code	ID # shape file	Count	Ecosystem name	Acres	Hectare	Slope	Rare	Count	Env-serv	Timber	Fisheries	Endemics	Last-wild	Low Ag	Wetland	Total	%Target
IA2b(1)K-s	337	8	Tropical evergreen seasonal broad-leaved submontane forest on steep karstic hills	72,376	29,289	40	20	10					10	10		90	**90**
IA2b(1)-ST	334	10	Tropical evergreen seasonal broad-leaved submontane forest, Simarouba-Terminalia variant	111,487	45,117	40				20			10	10		80	**80**
IA2b(1)-VT	335	4	Tropical evergreen seasonal broadl-leaved submontane forest: Virola-Terminalia variant	135,857	54,980	40		10		20			10	10		90	**90**
IA2b(1/2)	338	2	Tropical evergreen seasonal mixed submontane forest	36,942	14,950	40	30	10		20			10	10		120	**95**
IA2b(2)	339	5	Tropical evergreen seasonal needle-leaved submontane forest	43,151	17,463	40	20	10		20			10	10		110	**95**
IA2c(1)	340	1	Tropical evergreen seasonal broad-leaved lower montane elfin forest	26	11	40	50	10						10		110	**95**
IA2f(2)(a)	341	51	Tropical evergreen seasonal broad-leaved alluvial forest	34,485	13,955		30			20						50	**50**
IA2g(1)(a)-SC	342	6	Tropical evergreen seasonal broad-leaved lowlar swamp forest, Stann Creek variant	4,704	1,904		50	10						10		70	**70**
IA2g(1)(a)-Sh	343	55	Tropical evergreen seasonal broad-leaved lowlar swamp forest, short tree variant	95,092	38,483		20							10		30	**30**
IA2g(1)(a)-T	344	183	Tropical evergreen seasonal broad-leaved lowlar swamp forest, tall variant	305,534	123,646					20			10	10		40	**40**
IA3a(1)(a)	345	4	Tropical semi-deciduous broad-leaved lowland forest	15,049	6,090		40	10		20				10		80	**80**
IA5a(1)(a)	346	25	Caribbean mangrove forest; dwarf mangrove scrub	40,674	16,460		20							10	10	40	**40**
IA5a(1)(b)	347	14	Caribbean mangrove forest; freshwater mangrov scrub	28,154	11,394		30							10	10	50	**50**
IA5a(1)(c)	348	151	Caribbean mangrove forest; mixed mangrove scrub	66,436	26,886		20							10	10	40	**40**
IA5a(1)(d)	349	456	Caribbean mangrove forest; coastal fringe mangrove	60,917	24,652		20		20					10	10	60	**60**
IA5a(1)(e)	350	51	Caribbean mangrove forest; riverine mangrove	11,900	4,816		40		20					10	10	80	**80**
IA5a(1)(f)	351	91	Caribbean mangrove forest; basin mangrove	27,881	11,283		30							10	10	50	**50**

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Gap Analysis: Target cover for ecosystem conservation features with rationale - Table 3

Unesco code	ID # shape file	Count	Ecosystem name	Acres	Hectare	Slope	Rare	Count	Env-serv	Timber	Fisheries	Endemics	Last-wild	Low Ag	Wetland	Total	%Target
IB1a(2)	352	4	Tropical deciduous microphyllous lowland forest	1,016	411		50	10						10		70	**70**
IIIA1b(1)(a)K-s	353	15	Tropical evergreen broad-leaved shrubland on steep karstic hills	829	336	40	50							10		100	**95**
IIIA1b(a)LE	354	84	Evergreen broad-leaved lowland shrubland dominated by leguminous shrubs	78,295	31,685		20						10	10		40	**40**
IIIA1b(a)MI	355	28	Evergreen broad-leaved lowland shrubland, Miconia variant	51,470	20,829		20							10		30	**30**
IIIA1f	356	5	Evergreen broad-leaved lowland peat shrubland with Sphagnum	3,715	1,503		50	10						10	10	80	**80**
IIIB1b(a)	357	8	Deciduous broad-leaved lowland shrubland, well-drained, over poor soils	5,994	2,426		40	10								50	**50**
IIIB1b(a)2	358	56	Deciduous broad-leaved lowland disturbed shrubland	45,654	18,476		20									20	**20**
IIIB1b(b)	359	24	Deciduous mixed submontane shrubland over poor soils	35,479	14,358	40	30							10		80	**80**
IIIB1b(f)H	360	5	Deciduous broad-leaved lowland riparian shrubland in hills	7,012	2,838		40	10								50	**50**
IIIB1b(f)P	361	39	Deciduous broad-leaved lowland riparian shrubland of the plains	11,122	4,501		40									40	**40**
SA1a	362	17	River	21,822	8,831		40							10	10	60	**60**
SA1b(4)(b)	363	58	Freshwater Lake	15,748	6,373		40							10	10	60	**60**
SA1b(5)	364	133	Brackish/saline lake	65,673	26,577		20							10	10	40	**40**
SA1d(2)(a)		58	Coral reef of the Caribbean; Shallow Reefs	60,586	24,529		20		20		10					50	**20**
SA1d(2)(b)		72	Coral reef of the Caribbean; Patch Reefs	38,340	15,522		30				10					40	**20**
SA1d(2)(b)/s		5	Coral reef of the Caribbean; Patch Reefs scattered in seagrass beds	37,645	15,241		30	10			10					50	**20**
SA1d(2)(c)		14	Coral reef of the Caribbean; Spur and groove	16,151	6,539		40		20		10					70	**20**
SA3b		2	Caribbean inner lagoon	564,682	228,616			10			10					20	**20**
SA3c		1	Caribbean open sea	177,929	72,036			10			10					20	**20**
SA3d	371	2	Caribbean open sea	183,873	74,443			10			10					20	**20**
SA3f	372	1	Caribbean open sea - mesopelagic/bathyal	1,237,423	500,981			10			10					20	**20**
SA3g	373	2	Caribbean open sea - bathyal	2,340,947	947,752			10			10					20	**20**
SA3h	374	1	Caribbean open sea - abyssal	2,616,269	1,059,218			10			10					20	**20**

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Gap Analysis: Target cover for ecosystem conservation features with rationale - Table 3

Unesco code	ID # shape file	Count	Ecosystem name	Acres	Hectare	Slope	Rare	Count	Env-serv	Timber	Fisheries	Endemics	Last-wild	Low Ag	Wetland	Total	%Target
VA2a(1)(2)	375	50	Short-grass savanna with scattered needle-leave trees	218,741	88,522					20		10		10		40	**40**
VA2b(2)	376	73	Short-grass savanna with shrubs	251,561	101,803							10		10		20	**20**
VA2c(g)	377	5	Short-grass swamp savanna without trees or shrubs	372	150		50	10						10	10	80	**80**
VD1a(1)	378	6	Eleocharis marsh. Note: not as rare as indicated. Partly included as patches in other ecosystems	1,416	573		30							10	10	50	**50**
VE1a(1)	379	45	Marine salt marsh rich in succulents	48,622	19,677		20							10		30	**30**
VF1c(1)L	380	4	Fire-induced lowland fern thicket. Note: disturbance indicator. No conservation priority	5,040	2,040									10		10	**20**
VF1c(1)SM	390	1	Fire-induced submontane fern thicket. Note: disturbance indicator. No conservation priority	258	104	40								10		50	**50**
VIB3a	391	31	Tropical coastal vegetation on recent sediments	3,932	1,591		50		10							60	**60**
VIIB1a	392	7	Tropical freshwater reed-swamp	3,267	1,322		50	10							10	70	**70**
VIIB4	393	93	Tropical lowland tall herbaceous swamp	92,827	37,566		20								10	30	**30**
VIIIA		33	Seagrass Beds	967,086	391,533				20		10					30	**20**
VIIIB1		59	Sparse algae/sand	58,942	23,863		20				10					30	**20**
VIIIB2		6	Sparse algae/silt	250,056	101,237			10			10					20	**20**
VIIIB3		9	Fleshy Brown Algae/Gorgonians	27,506	11,136		30	10			10					50	**20**

Meerman, J.C. June 2005

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Appendix 1: Log of MARXAN run June 9, 2005.

Using 10 km² hexagonal planning units.

Number of Planning Units 5957
Number of Conservation Values 159
Starting proportion 0.00
Boundary length modifier 0.02

Clumping - default step function
Algorithm Used :Annealing and Iterative Improvement
No Heuristic used
Number of iterations 1000000
Initial temperature set adaptively
Cooling factor set adaptively
Number of temperature decreases 10000

Cost Threshold Disabled
Threshold penalty factor A N/A
Threshold penalty factor B N/A

Random Seed -1
Number of runs 200

"Conservation Feature","Feature Name","Target","Amount Held","Occurrence Target ","Occurrences Held","Separation Target ","Separation Achieved","Target Met"
620,Passifloraurbaniana,1.800000,4.000000,0,3,0,0,yes
610,AristolochiaBelizensis,0.400000,2.000000,0,2,0,0,yes
604,Zamiasp,0.200000,1.000000,0,1,0,0,yes
603,Zamiaspnov,0.500000,1.000000,0,1,0,0,yes
602,Zamiavariegata,3.000000,3.000000,0,3,0,0,yes
601,Ceratozamia,0.500000,5.000000,0,5,0,0,yes
572,ConchSpawning,2075.500000,2489.000000,0,12,0,0,yes
570,Spawningsites,0.000000,0.000000,0,0,0,0,no
562,Citheracanthus,0.600000,4.000000,0,4,0,0,yes
561,Erpetogomphus,0.100000,1.000000,0,1,0,0,yes
560,Epigomphusmaya,0.300000,2.000000,0,2,0,0,yes
550,Manatee,41073.000000,59815.000000,0,99,0,0,yes
547,Agalychnis moreletii,3.600000,11.000000,0,10,0,0,yes
546,Phyllodactylus insularis,69.800000,110.000000,0,8,0,0,yes
545,Acutus important nests,292.500000,585.000000,0,2,0,0,yes
544,Ranajuliani,0.600000,6.000000,0,6,0,0,yes
543,Acutus,21.800000,165.000000,0,34,0,0,yes
542,GreenTurtle,8.400000,10.000000,0,9,0,0,yes
541,Hawksbill,32.800000,33.000000,0,26,0,0,yes
540,Loggerhead,14.000000,15.000000,0,12,0,0,yes
528,KBMotmot,4.200000,37.000000,0,20,0,0,yes
527,Waders_ducks,0.000000,0.000000,0,0,0,0,no
526,Scarlet Macaw,47198.100000,133040.000000,0,171,0,0,yes
525,Jabiru,10.800000,11.000000,0,11,0,0,yes
524,YellowCrNightHeron,2.500000,3.000000,0,3,0,0,yes
523,Woodstork,3.000000,3.000000,0,3,0,0,yes
522,WhiteIbis,4.000000,4.000000,0,4,0,0,yes
521,TricoloredHeron,2.500000,3.000000,0,3,0,0,yes
520,SootyTern,1.500000,2.000000,0,2,0,0,yes
519,SnowyEgret,1.000000,2.000000,0,2,0,0,yes

518,SandwichTern,1.500000,2.000000,0,2,0,0,yes
517,RoseateTern,3.500000,4.000000,0,4,0,0,yes
516,RoseateSpoonbill,3.500000,4.000000,0,3,0,0,yes
515,RedishEgret,3.000000,4.000000,0,4,0,0,yes
514,RedFootedBooby,2.000000,4.000000,0,2,0,0,yes
513,FrigateBird,5.000000,6.000000,0,5,0,0,yes
512,LittleBlueHeron,3.500000,4.000000,0,4,0,0,yes
511,LeastTern,3.000000,3.000000,0,3,0,0,yes
510,LaughingGull,2.000000,4.000000,0,3,0,0,yes
509,GreenHeron,4.500000,5.000000,0,5,0,0,yes
508,GreatEgret,2.500000,3.000000,0,3,0,0,yes
507,GreatBlueHeron,2.000000,2.000000,0,2,0,0,yes
506,DoubleCrestedCormorant,3.500000,4.000000,0,4,0,0,yes
505,BrownPelican,4.500000,7.000000,0,7,0,0,yes
504,BrownNoddy,2.000000,2.000000,0,2,0,0,yes
503,Bridledtern,2.000000,3.000000,0,3,0,0,yes
502,BoatBilledHeron,4.500000,5.000000,0,5,0,0,yes
501,Agami,0.500000,1.000000,0,1,0,0,yes
447,Coral Reef,4908.600000,4911.000000,0,54,0,0,yes
446,Northern Coastal Inner Platform with silt,27522.600000,30335.000000,0,40,0,0,yes
459,Atoll Lagoons glovers,3688.474000,3855.530000,0,10,0,0,yes
458,Atoll Lagoons lighthouse,3697.878000,3798.610000,0,7,0,0,yes
457,Atoll Lagoons turneffe,7586.304000,22710.600000,0,45,0,0,yes
456,Atolls Outer Glovers,1048.072000,2397.960000,0,9,0,0,yes
455,Atolls Outer Lighthouse,1856.498000,2304.590000,0,6,0,0,yes
454,Atolls outer Turneffe,1244.248000,2684.800000,0,16,0,0,yes
453,Atolls inner Glovers,656.870000,770.350000,0,3,0,0,yes
452,Atolls inner Lighthouse,509.136000,568.660000,0,4,0,0,yes
451,Atolls inner Turneffe,1134.376000,3572.370000,0,18,0,0,yes
442,Outer Platform with seagrass,32507.400000,55203.000000,0,87,0,0,yes
441,Inner Channel with seagrass,76592.200000,80950.000000,0,113,0,0,yes
440,Inner Platform with seagrass,36808.600000,39506.000000,0,64,0,0,yes
435,MarineZoneSouth,57174.000000,57310.000000,0,67,0,0,yes
434,MarineZoneCentral,64900.000000,89340.000000,0,105,0,0,yes
433,MarineZoneNorthern,48198.000000,62510.000000,0,71,0,0,yes
432,MarineZoneLighthouse,12490.000000,22360.000000,0,26,0,0,yes
431,MarineZoneTurneffe,17268.000000,28010.000000,0,34,0,0,yes
430,MarineZoneGlovers,6898.000000,7120.000000,0,9,0,0,yes
422,Narmap managed,7920.400000,15245.000000,0,61,0,0,yes
421,Estap_protected,27782.400000,27916.000000,0,61,0,0,yes
420,SDA_protected,28017.600000,49183.000000,0,118,0,0,yes
415,Low_land_value,166265.200000,307823.000000,0,660,0,0,yes
413,Research Interest,21942.600000,38603.000000,0,67,0,0,yes
412,Historical,128.400000,135.000000,0,99,0,0,yes
411,Geologic,63.600000,158.000000,0,69,0,0,yes
410,Caves,60.500000,70.000000,0,35,0,0,yes
406,Hotspots_biodiversity,8051.600000,8261.000000,0,17,0,0,yes
404,Connectivity,26450.700000,28185.000000,0,56,0,0,yes
403,Corridor_frontera,167099.200000,167426.000000,0,195,0,0,yes
402,Corridor_secondary,21185.000000,21201.000000,0,52,0,0,yes
401,Corridor_primary,82557.600000,82568.000000,0,172,0,0,yes
393,VIIB4,11259.300000,15081.000000,0,110,0,0,yes
392,VIIB1a,846.300000,1125.000000,0,10,0,0,yes
391,VIB3a,954.600000,1032.000000,0,32,0,0,yes
390,VF1c(1)SM,52.000000,104.000000,0,1,0,0,yes
380,VF1c(1)L,407.800000,1067.000000,0,6,0,0,yes

379,VE1a(1),5903.100000,5966.000000,0,38,0,0,yes
378,VD1a(1),287.000000,448.000000,0,4,0,0,yes
377,VA2c(g),120.000000,141.000000,0,2,0,0,yes
376,VA2b(2),20476.200000,21664.000000,0,80,0,0,yes
375,VA2a(1)(2),35411.200000,35453.000000,0,100,0,0,yes
374,SA3h,197386.600000,197420.000000,0,207,0,0,yes
373,SA3g,203838.800000,203919.000000,0,241,0,0,yes
372,SA3f,100154.400000,100404.000000,0,158,0,0,yes
371,SA3d,14883.000000,18096.000000,0,71,0,0,yes
364,SA1b(5),10630.000000,11106.000000,0,61,0,0,yes
363,SA1b(4)(b),3823.200000,3854.000000,0,48,0,0,yes
362,SA1a,5268.600000,5271.000000,0,116,0,0,yes
361,IIIB1b(f)P,1800.800000,1843.000000,0,25,0,0,yes
360,IIIB1b(f)H,1419.500000,2839.000000,0,36,0,0,yes
359,IIIB1b(b),11486.400000,14358.000000,0,54,0,0,yes
358,IIIB1b(a)2,3695.000000,6311.000000,0,41,0,0,yes
357,IIIB1b(a),1213.000000,1696.000000,0,15,0,0,yes
356,IIIA1f,1202.400000,1217.000000,0,6,0,0,yes
355,IIIA1b(a)MI,6249.000000,6338.000000,0,32,0,0,yes
354,IIIA1b(a)LE,12676.400000,12786.000000,0,84,0,0,yes
353,IIIA1b(1)(a)K-s,319.200000,336.000000,0,7,0,0,yes
352,IB1a(2),287.000000,315.000000,0,3,0,0,yes
351,IA5a(1)(f),5526.500000,5689.000000,0,49,0,0,yes
350,IA5a(1)(e),3853.600000,3874.000000,0,37,0,0,yes
349,IA5a(1)(d),14812.200000,14818.000000,0,117,0,0,yes
348,IA5a(1)(c),10894.400000,13443.000000,0,97,0,0,yes
347,IA5a(1)(b),5697.000000,6089.000000,0,25,0,0,yes
346,IA5a(1)(a),6583.600000,8847.000000,0,32,0,0,yes
345,IA3a(1)(a),4872.000000,4873.000000,0,14,0,0,yes
344,IA2g(1)(a)-T,49460.000000,49473.000000,0,182,0,0,yes
343,IA2g(1)(a)-Sh,11544.000000,11911.000000,0,60,0,0,yes
342,IA2g(1)(a)-SC,1014.300000,949.000000,0,9,0,0,no
341,IA2f(2)(a),6759.000000,6938.000000,0,36,0,0,yes
340,IA2c(1),9.500000,10.000000,0,2,0,0,yes
339,IA2b(2),16586.050000,17411.000000,0,44,0,0,yes
338,IA2b(1,14203.450000,14951.000000,2,40,0,0,yes
337,IA2b(1)K-s,26358.300000,26485.000000,0,66,0,0,yes
336,IA2b(1)K-r,26176.500000,27141.000000,0,58,0,0,yes
335,IA2b(1)-VT,49486.500000,50223.000000,0,99,0,0,yes
334,IA2b(1)-ST,36092.800000,36130.000000,0,91,0,0,yes
333,IA2b(1),96.900000,102.000000,0,2,0,0,yes
332,IA2a(2)(b),8961.000000,8966.000000,0,36,0,0,yes
331,IA2a(2)(a),6510.700000,6633.000000,0,24,0,0,yes
330,IA2a(1,360.050000,379.000000,2,6,0,0,yes
329,IA2a(1)(b)S,13340.500000,13398.000000,0,58,0,0,yes
328,IA2a(1)(b)K-Y,18932.800000,19204.000000,0,59,0,0,yes
327,IA2a(1)(b)K-TP,68305.500000,68611.000000,0,96,0,0,yes
326,IA2a(1)(b)K-CW,27101.000000,27498.000000,0,54,0,0,yes
325,IA2a(1)(b)K-CE,23856.000000,24678.000000,0,63,0,0,yes
324,IA2a(1)(b)K-BR,8315.500000,8679.000000,0,16,0,0,yes
323,IA2a(1)(b)K,13614.000000,13844.000000,0,55,0,0,yes
322,IA2a(1)(a)K-s,39814.200000,40014.000000,0,86,0,0,yes
321,IA2a(1)(a)K-r,22470.000000,22584.000000,0,62,0,0,yes
320,IA2a(1)(a)-VT,26513.550000,26873.000000,0,62,0,0,yes
319,IA2a(1)(a)-ST,96129.600000,96330.000000,0,177,0,0,yes
318,IA1g(2)(b)-MA,1479.000000,1611.000000,0,8,0,0,yes

317,IA1g(1)(b),2058.000000,2756.000000,0,12,0,0,yes
316,IA1g(1)(a)-AC,350.400000,429.000000,0,4,0,0,yes
315,IA1g(1)(a),8057.600000,8459.000000,0,29,0,0,yes
314,IA1f(2)(a)K,7632.000000,7693.000000,0,48,0,0,yes
313,IA1f(2),1481.400000,1522.000000,0,11,0,0,yes
312,IA1c(4),592.800000,624.000000,0,5,0,0,yes
311,IA1c(1),821.750000,865.000000,0,6,0,0,yes
310,IA1b(3),11453.200000,12056.000000,0,33,0,0,yes
309,IA1b(1)K-s,12303.450000,12392.000000,0,31,0,0,yes
308,IA1b(1)K-r,9392.800000,10567.000000,0,30,0,0,yes
307,IA1b(1),23467.500000,24170.000000,0,50,0,0,yes
306,IA1a(1)(b)P,20012.400000,21849.000000,0,58,0,0,yes
305,IA1a(1)(b)K,1512.800000,1518.000000,0,12,0,0,yes
304,IA1a(1)(a)K-s,30092.000000,30237.000000,0,75,0,0,yes
303,IA1a(1)(a)K-r,10995.000000,14999.000000,0,47,0,0,yes
302,IA1a(1)(a)-VT,7874.550000,8289.000000,0,32,0,0,yes
301,IA1a(1)(a)-C,7356.000000,7384.000000,0,16,0,0,yes