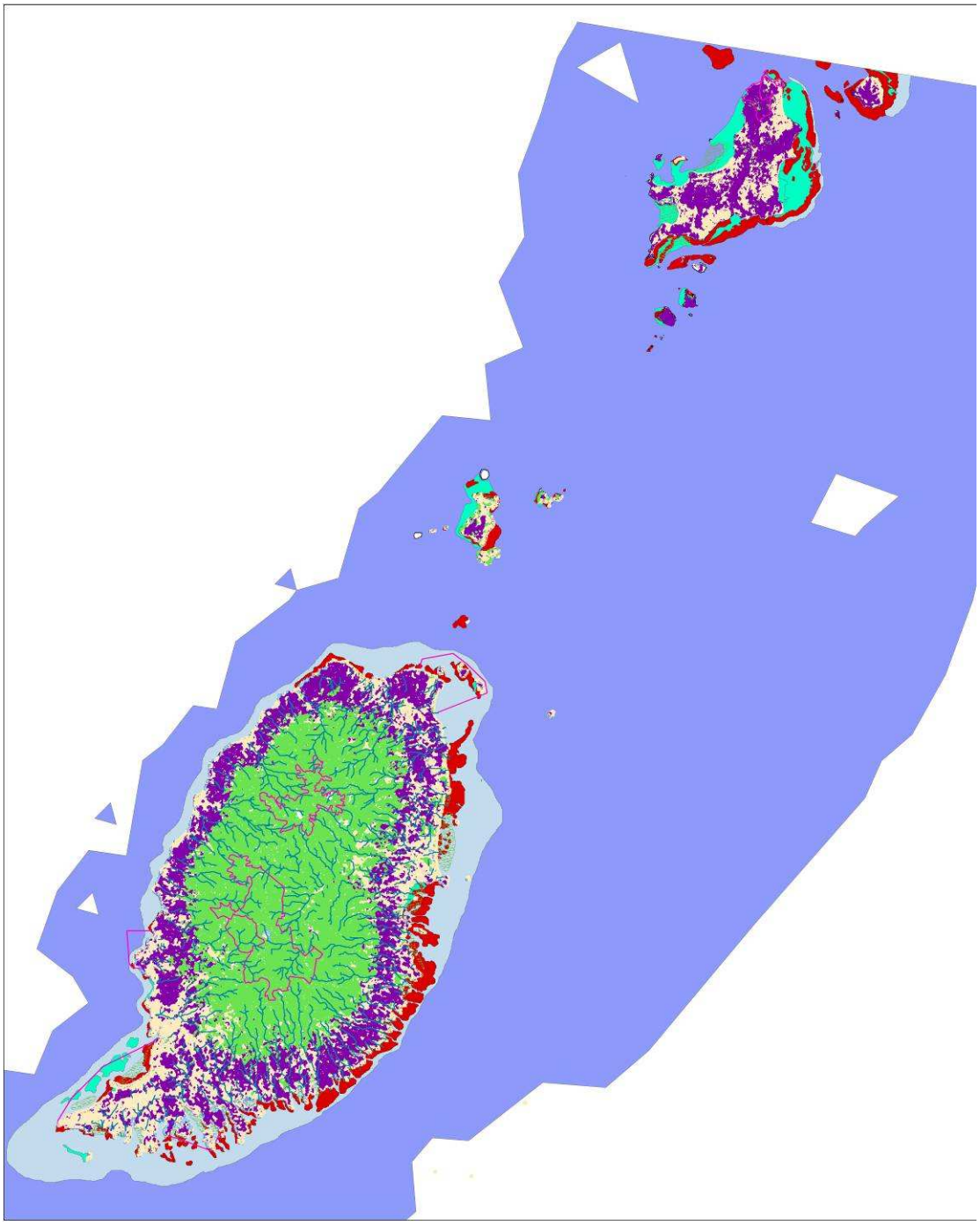
Grenada National Protected Area System Gap Assessment



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National Context

Grenada is an archipelagic nation in the southeast Caribbean. It is located south of St. Vincent and the Grenadines and northwest of Trinidad and Tobago at 12°07′N 61°40′W. The total area of Grenada is 344 square km with a maximum height of 34 km and a maximum width of 19 km. Located at the southern most edge of the Windward Islands, the average temperature of 25 to 29 degrees Celsius is tempered by the northeast trade winds. Yearly precipitation varies from more than 350 centimeters on the windward mountainsides to less than 150 centimeters in the lowlands with the greatest rainfall occurring during the wet season. The wet season lasts from June through December while the dry season lasts from January to May. The population of Grenada totals approximately 90,000 people who are spread amongst three islands: Grenada, Carriacou, and Petite Martinique. Grenada is often known as the tri-island state for its three inhabited islands; however, the small Grenadine Islands that lie south of the Martinique Channel also belong to Grenada.

Grenada is well-known for its natural beauty and resources. The land is volcanic in origin with a mountainous topography. Beginning with Mount Saint Catherine, the highest point at 840 m, elfin woodland dwarfed forests descend to montane rain forests, then to lowland dry forests and finally to mangroves. Lagoons, beaches, coral reefs, bays and rugged cliffs coat the 121 km coastline. With over 450 species of flowering plants and 150 species of birds, including the endemic Grenada Dove, the island is exceptionally rich in biodiversity.

Grenada's natural beauty and resources drive the economy which is largely reliant on agriculture and tourism. Grenada's major agricultural products include bananas, cocoa, nutmeg, mace, citrus, avocados, root crops, sugarcane, maize, and vegetables. Of these, Grenada is a major exporter of bananas, cocoa, nutmeg, fruit, vegetables, and mace. In 2004, 133,865 overnight tourists came to Grenada and stayed for an average of 7.53 nights and spent approximately EC$ 400 million (US$ 148 million). In 2005, 98,548 overnight tourists came to Grenada and stayed for an average of 7.42 nights (spending expenditures not currently available). The drastic decline in tourism in 2005 is largely due to Hurricane Ivan and Hurricane Emily.

On September 7th, 2004, Hurricane Ivan passed directly over Grenada as a Category 3 hurricane. The capital, St. George's, was severely damaged and 39 people were killed. According to a member of the Grenadian parliament, at least 85% of the small island was devastated and damage totaled 815 million US dollars. The following year, Hurricane Emily struck Carriacou and the northern part of Grenada as a Category 2 hurricane on July 14th, 2005. Hurricane Emily caused approximately 110 million US dollars worth of damage. As a result of theses hurricanes, Grenada's commitment to the environment increased as they saw their economy suffer due to the devastation. This commitment to the environment is best found in '*The Grenada 25-25 Declaration'* where: "Recognizing the extreme vulnerability of SIDS [Small Island Developing States] and recalling the impact of Hurricanes Ivan and Emily on the economic, social, ecological and

environmental infrastructure in Grenada in particular" is listed as the second reason for establishing the declaration.

Legislative Authority and Background

In 1994, Grenada declared it's commitment to establish protected areas by ratifying the Convention on Biological Diversity. As a member of the Convention on Biological Diversity, Grenada committed to preserving 10% of its terrestrial and 10% of its marine habitat through: developing a national biodiversity strategy and action plan; integrating biodiversity concerns into national decision-making; creating a national system of protected areas (PAs); developing guidelines for selection, establishment and management of PAs; and, regulating and managing biological resources within and outside PAs.

At the 7th Conference of the Parties (COP-7) of the Convention on Biological Diversity (CBD) in 2004 in Kuala Lumpur, Malaysia, governments adopted an ambitious Program of Work on Protected Areas (PoW). In adopting this PoW, Governments called for rapid "affirmative action" to address the lack of Protected Areas across the globe. At COP-7, a group of 8 international NGOs committed to support the governments in the implementation of this PoW. As a result of this commitment, The Nature Conservancy signed a Memorandum of Understanding (MOU) with the Government of Grenada, in which parties committed to work together in the implementation of this program of work. This MOU is commonly known as the Protected Area National Implementation Support Partnership (NISP).

The ecological gap assessment is a preliminary product of the NISP signed by Grenada and The Nature Conservancy and the analysis fulfills commitments to the CBD to develop guidelines for selection of a system of protected areas. This will form part of Grenada's national biodiversity strategy and action plan.

At the 8th Conference of the Parties (COP-8), in Curitiba, Brazil in 2005, the Grenada cabinet approved the *Declaration of Commitment: 'The Grenada 25-25 Declaration'* which announced Grenada's goal to "effectively conserve at least 25% of the near-shore marine resources and at least 25% of the terrestrial resources by 2020. This declaration significantly increases the area that Grenada had previously committed to protect in the Convention on Biological Diversity and in doing so confirms Grenada's commitment to establish protected areas.

In 2000, *The St. George's Declaration of Principles for Environmental Sustainability in the OECS* was accepted by member states of the Organisation of Eastern Caribbean States (OECS) as the framework to ensure a healthy environment throughout member states. The completed ecological gap assessment will help to fulfill the principles set forth in this declaration, especially Principle 2: "Integrate Social, Economic and

Environmental Considerations into National Development Policies, Plans and Programmes."

The *National Environmental Policy and Management Strategy for Grenada* was developed by the Government of Grenada in 2005 to establish a broad policy framework for environmental management in Grenada. The purpose of the document was to develop a procedure for Grenada to implement *The St. George's Declaration of Principles for Environmental Sustainability in the OECS.* The document seeks to formalize the legal process of enforcing protected area management. It states that "The Government of Grenada will pursue its efforts towards the establishment of an integrated, efficient and effective legislative framework for environmental management."

Grenada is also a signatory to the Ramsar Convention on Wetlands. The Ramsar Convention on Wetlands was signed in Ramsar, Iran, in 1971. It is an international treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The ecological gap analysis may help to identify a wetland site suitable for the "List of Wetlands of International Importance."

Grenada has adapted several legal provisions/instruments leading to the formation of marine protected areas, including:

- Beach Protection Act Cap 29
- Birds and Other Wildlife (Protection) Act Cap 34
- Fisheries Act Cap 108
- Fisheries Conservation Regulations (SRO#24, 1995)
- Fisheries (Marine Protected Areas) Order (SRO#77, 2001)
- Fishing Vessels Safety Regulations (SRO#3, 1990)
- Forest, Soil and Water Conservation Act Cap 116
- National Parks and Protected Areas Cap 203
- Oil in Navigable Waters Act Cap 206
- Physical Planning and Development Control Act, No. 25 of 2002
- Ports Authority Act Cap 247
- Territorial Sea and Maritime Boundaries Act Cap 318
- Tourist Board Act Cap 321
- Yachting Act #17, 2000

The ecological gap analysis will identify possible protected areas and the legal provisions/instruments should provide the necessary legal authority to establish those protected areas.

Ecological GAP Analysis:

At the 7th Conference of the Parties (COP-7) of the Convention on Biological Diversity (CBD) in 2004, governments adopted an ambitious Global *Program of Work on Protected Areas* (PoW). At COP7, a group of 8 international NGOs committed to

support government partners in the implementation of this PoW. As a result of this commitment, The Nature Conservancy, signed a Memorandum of Understanding (MOU) with the Government of Grenada, in which parties commit to work together in the implementation of this program of work. This MOU is commonly known as the Protected Area National Implementation Support Partnership (NISP).

One of the early actions under the Global Protected Areas Program of Work is the completion of a National Protected Areas Gap Analysis. The National Implementation Support Partnership (NISP) Committee had identified the technical leads from various Governmental, Non-Governmental, and Academic institutions to participate in the Grenada Protected Areas System GAP Assessment during a meeting in January 2006. The NISP Committee, composed of Ministry of Agriculture, Lands, Forestry and Fisheries, the Ministry of Health and the Environment, the Ministry of Finance and Planning and The Nature Conservancy, is partnering with the Agency for Reconstruction and Development, St. George's University, the Sustainable Development Council (SDC), RARE, Ocean Spirits and NAWASA on this initiative. The Nature Conservancy through the Parks in Peril project supported by USAID is facilitating this project. The objective of this analysis is to understand how well the current system of protected areas represents Grenada's biodiversity and what actions could be taken to ensure good representation of that biodiversity.

This project will follow the official guide put forward by the Convention on Biological Diversity to conduct gap assessments of protected area systems: Dudley, N., Parrish, J. 2005. Closing the Gap: Creating Ecologically Representative Protected Area Systems. 105 pp.

This guide builds on the best science available for natural resource planning and regional prioritization. It provides a flexible framework for helping government partners complete rigorous gap assessments that eventually lead to more representative and well-designed protected area systems. Once completed, it will be the guiding tool for future actions to be implemented under the CBD Global Program of Work on Protected Areas.

The Grenada Protected Areas System GAP Analysis consisted of a series of three workshops to guide and approve the analysis. The first workshop was held in March 2006 for the purpose of determining the goals of the analysis, selecting biodiversity targets, and assessing management effectiveness of the existing protected areas. The second workshop was held in August 2006 to examine the threats and human activity information which was incorporated into the analysis. The final workshop was held in February 2007 and focused on finalizing the results and developing strategies to fill and prioritize the gaps that were identified.

Conservation Targets:

The first action required for the Gap Analysis is to collect and evaluate the spatial data available which represents the biodiversity of the country. Ideally the spatial data would represent all of the biodiversity at all scale levels from species through ecological systems. Spatial data was not available for most of the biodiversity in the country. The data that did exist was either at too coarse of a scale or of questionable origins. The other main issue for spatial data to be included in the analysis is that the data has to be available for the whole country at the same level of accuracy and scale. While there are some excellent data sets available for specific sites these could not included since they did not cover the country uniformly. Spatial data was gathered through partners and existing data collection/creation efforts by The Nature Conservancy. While many of the data sets collected accurately represent specific habitats others had to be modeled or a surrogate data set used. All of the data was incorporated into a hierarchical classification scheme incorporating the global Major Habitat Type, Ecoregion/Ecosystem, and the fine scale habitat class. All the data transformed to a uniform projection allowing for accurate spatial analysis, the projection used was Universal Transverse Mercator (UTM) Zone 20 North with the datum of WGS 1984.

The terrestrial data is the *International Institute of Tropical Forestry, USDA Forest Service (IITF)* land cover data set derived from satellite imagery at a scale of 30 meters. The classification scheme used is the standard classification scheme of IITF. It was determined that this classification was adequate to cover the terrestrial biodiversity. It was also decided that the habitat classification "Mixed Wood Agriculture" should be included as a target and the other forms of agriculture should not be targets. This habitat was also determined to be a subset of the Windward Island Moist Forest Ecoregion.

The freshwater data was derived by modeling the streams and flows from the topographic data of the islands. There were some additional changes to the Freshwater data in that some streams were wrongly classified and these changes were noted. The freshwater data included two classes of streams. Rivers was the larger class and incorporated all the streams that were above class 7 and Streams included all the streams that were class 4, 5 and 6.

The marine data was the most challenging in that there was not complete biological habitat data available for the whole country. Beaches, rocky shores, tidal pools and mangroves were derived from satellite analysis conducted the previous year as part of TNC's Caribbean Ecoregional Assessment utilizing imagery collected by the IKONOS Satellite, a commercial earth observation satellite that collects images at one and four meter high resolution. Turtle nesting beaches was based on information collected during TNC's Caribbean Ecoregional Assessment. The Coral Reef Habitat, Lagoonal Habitat and the Shelf Slope Habitat data were based on *The Millennium Coral Reef Maps* produced by Dr. Serge Andréfouët of the University of South Florida. This data

set was selected because it offered a comprehensive coverage of the whole country and its geomorphology classification was a good representation of the benthic structures that provide the habitat for the marine biodiversity. It is very important to understand that the data represents the geomorphology of the shallow water habitats and not biological cover. It was recognized that the data for seagrass was from a regional dataset and that it severely under represented the occurrence of seagrass.

The international boundary between Grenada and St. Vincent was determined to be not in the correct place and the boundary was modified to reflect this.

Existing Protected Areas Data

The protected areas included in the GAP Analysis include protected areas which have been formally declared and also shows the contribution of those protected areas which are in the process of being declared. The protected areas which are included in the "**with designation"** category include: Sandy Island/Oyster Bed MPA, Northern (Levera) MPA, Grande Anse MPA, and Mt. St. Catherine Reserve. There are also several Forest Reserves which were left out of the analysis because of lack of information on the geographic boundaries. These included: Mt. Hartman, Perseverence, Mt. Gajo (Mt. Delice), Mt. Moritz, Bagatelle, Tiluries, Botanical Gardens, and Richmond Hill.

Representation GAP Analysis

The representation GAP Analysis was conducted to determine the amount (percentage) of each conservation target represented within the boundaries of a protected area. This spatial analysis was conducted by overlaying the protected areas data onto the conservation target data and determining the hectares of each target represented within the each protected areas compared to the overall hectares of the target within the country. The following table illustrates the percentage of each target currently represented within the protected area system.

Marine Target Representation (Percentage protected; Percentage w/designation)

Level 1: Habitat Medium	**Level 2: Major Habitat Type**	**Level 3: Ecosystems**	**Level 4: Fine Filter Habitats**
Marine **3%; 12%**	Shelf: **3%; 12%**	Reef Habitat: **1%; 9%**	Fore Reef : **1%; 11%**
			Inter-tidal Reef Flat : **3%; 8%**
			Reef Flat : **1%; 7%**
			Shallow Terrace : **0%; 0%**
			Shoal : **0%; 2%**
		Shelf Slope **3%; 11%**	Outer Slope: **0%; 0%**
			Shelf Slope: **3%; 12%**
		Seagrass **10%; 19%**	Seagrass : **10%; 19%**
		Lagoonal Habitat: **0%; 16%**	Lagoon Terrace: **0%; 16%**
	Nearshore **7%; 19%**		Enclosed Lagoon: **0%; 0%**
		Rocky Shore **9%; 17%**	Rocky Shore: **9%; 17%**
		Beaches: **6%; 25%**	White Sand Beach : **7%; 31%**
			Black Sand Beach : **0%; 0%**
			Leatherback Nesting Sites : **5%; 19%**
			Hawksbill Nesting Sites : **4%; 22%**
		Mangroves: **5%; 21%**	Mangroves : **5%; 21%**

Terrestrial and Fresh Water Target Representation (Percentage)

Level 1: Habitat Medium	**Level 2: Major Habitat Type**	**Level 3: Ecoregions**	**Level 4: Fine Filter Habitats**
Terrestrial **8%; 11%**	Tropical Moist Forest **28%; 38%**	Windward Island Moist Forest: **28%; 38%**	Cloud Forest – (Elfin Forest): **30%; 94%**
			Forest Cloud Transitional – (Montane Forest): **30%; 87%**
			Forest Evergreen and Seasonal – (Rainforest): **23%; 29%**
			Mixed Wood Agriculture: **1%; 1%**
	Tropical Dry Forest: **2%; 2%**	Lesser Antillean Dry Forest: **2%; 2%**	Forest Dry Deciduous: **4%; 5%**
			Drought Deciduous Forest: **1%; 1%**
			Forest Semi Deciduous: **1%; 2%**
Freshwater **6%; 7%**	Tropical Island Fresh Water Systems: **7%; 7%**	Fresh Water Bodies: **6%; 7%**	Emergent Wetlands: **16%; 18%**
			Open Water Bodies: **0%; 0%**
		Streams: **5%; 6%**	Class 4-6 Streams: **5%; 7%**
			Class 7-8 Streams: **0%; 0%**

Conservation Goals:

The results of a preliminary representation GAP analysis were presented during the first workshop. This allowed the group to examine the current status of the targets and to make informed decisions on what would be realistically achievable. The first discussions centered on an overall goal for the country and at what level in the classification scheme should the goals be set. It was decided that the country level goals should be set at the Marine Ecosystem/Terrestrial Ecoregion level. The goal of at least 25% at this level should be effectively conserved within a protected area. The groups then decided to set individual Fine Filter Habitat Goals in order to achieve

these larger goals. The goal discussions started off with setting a goal that is considered the best amount ecologically and then was brought down based on what is realistically achievable to the time frame that is selected, by 2020, and considering the limitations on Government resources. The targets ecological significance and environmental services were also considered in the process. The goals were selected to provide greater protection to the upland resources and to marine nursery habitats. Mangroves were considered a valuable resource and it was determined that 50% should be located within a protected area and additional legislation should be crafted to provide additional protection to all mangroves. These decisions were the first effort to include ecological conditions into the analysis. The maps of the current extent of the resources and the protected areas were consulted to determine how realistic the goals were. Since Grenada is comprised of a series of small islands, the stakeholders requested that the marine, terrestrial and freshwater analysis be competed as one gap analysis. The consensus was that since all three ecosystems are especially connected on a small island that the best and most accurate gap analysis would be one that analyzed the system as a whole instead of its individual parts. As a result, the inputs and analysis were completed as one system. The final selection of the goals also reflected a natural stratification of the targets. This was important to incorporate the resiliency principles in the overall final design of the system. The following tables illustrate the final goals which were determined during the workshop.

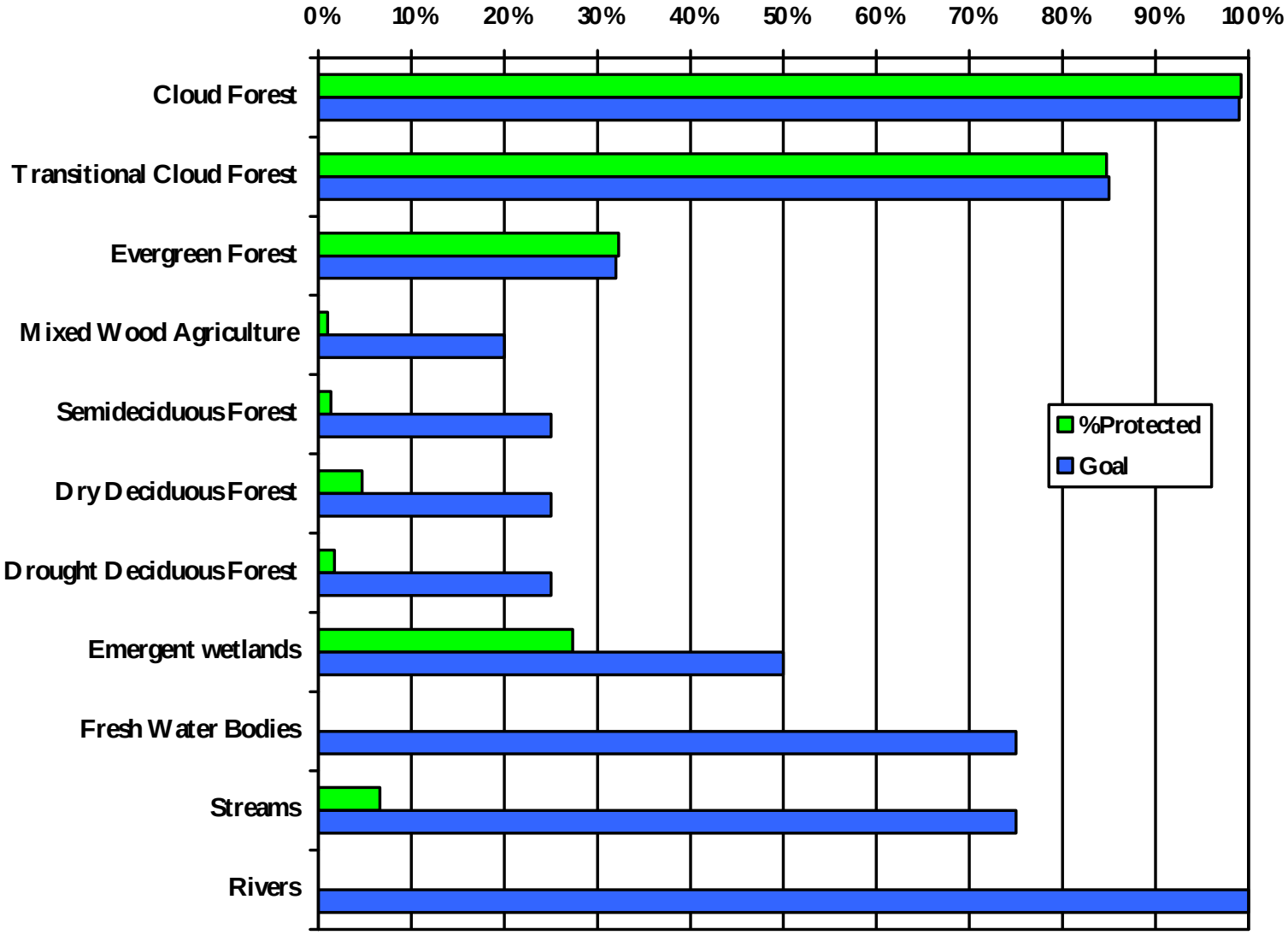
Marine Goals:

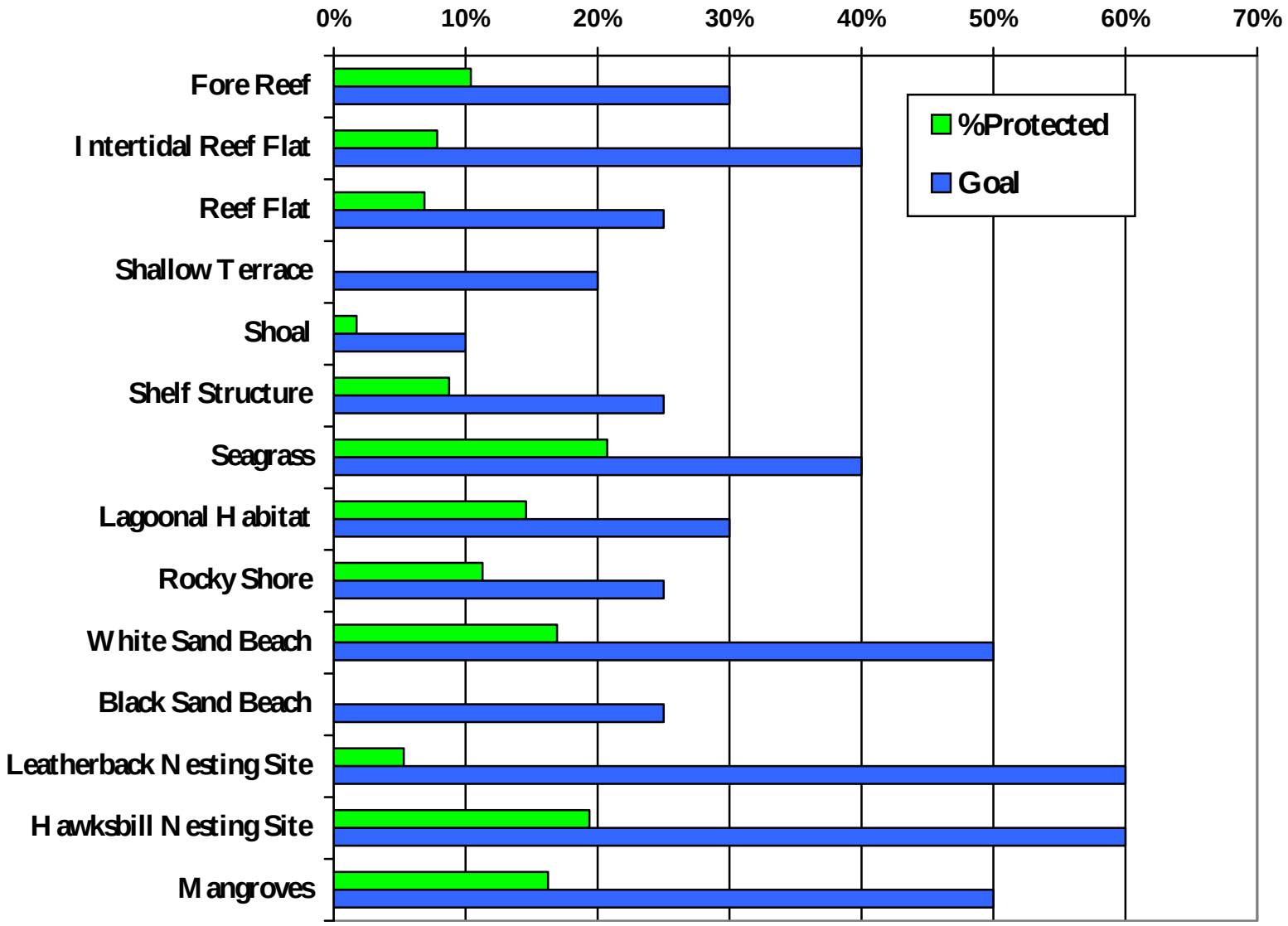
Level 1: Habitat Medium	**Level 2: Major Habitat Type**	**Level 3: Ecosystems Goal: ≥ 25%**	**Level 4: Fine Filter Habitats Individual Goals**
Marine	Shelf	Reef Habitat	Fore Reef **30%**
			Inter-tidal Reef Flat **40%**
			Reef Flat **25%**
			Shallow Terrace **20%**
			Shoal **10%**
		Shelf Slope **25%**	Outer Slope
			Shelf Slope
		Seagrass **40%**	Seagrass
		Lagoonal Habitat **30%**	Lagoon Terrace
			Enclosed Lagoon
	Nearshore	Rocky Shore **25%**	Rocky Shore
		Beaches	White Sand Beach **50%**
			Black Sand Beach **25%**
			Leatherback Nesting Sites **60%**
			Hawksbill Nesting Sites **60%**
		Mangroves	Mangroves **50%**

Terrestrial and Fresh Water Goals:

Level 1: Habitat Medium	**Level 2: Major Habitat Type**	**Level 3: Ecoregions** **Goal: ≥ 25%**	**Level 4: Fine Filter Habitats** **Individual Goals**
Terrestrial	Tropical Moist Forest	Windward Island Moist Forest	Cloud Forest – (Elfin Forest): **Current Level - 94%**
			Forest Cloud Transitional – (Montane Forest): **Current Level – 87%**
			Forest Evergreen and Seasonal – (Rainforest): **Current Level – 30%**
			Mixed Wood Agriculture: **20%**
	Tropical Dry Forest	Lesser Antillean Dry Forest	Forest Dry Deciduous: **25%**
			Drought Deciduous Forest: **25%**
			Forest Semi Deciduous: **25%**
Freshwater	Tropical Island Fresh Water Systems	Fresh Water Bodies	Emergent Wetlands: **50%**
			Open Water Bodies: **75%**
		Streams	Class 4-6 Streams: **75%**
			Class 7-8 Streams: **100%**

The next analysis completed compared the goals to the amount within existing protected areas. This information formed the gap that needs be addressed in the incorporation of new protected areas in order to reach the goals:

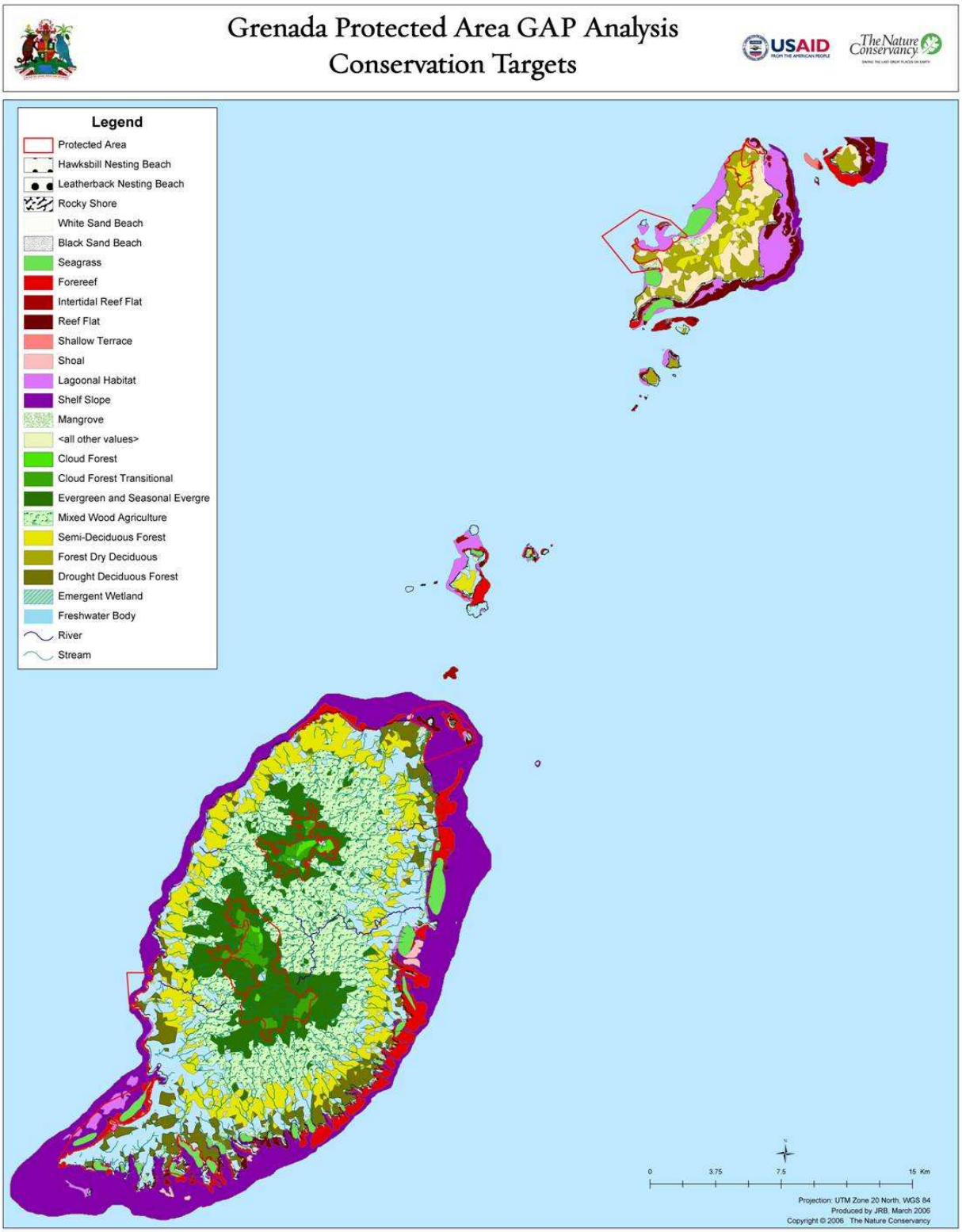

0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Cloud Forest
Transitional Cloud Forest
Evergreen Forest
Mixed Wood Agriculture
Semideciduous Forest
Dry Deciduous Forest
Drought Deciduous Forest
Emergent wetlands
Fresh Water Bodies
Streams
Rivers
%Protected
Goal


0%
10%
20%
30%
40%
50%
60%
70%
Fore Reef
Intertidal Reef Flat
Reef Flat
Shallow Terrace
Shoal
Shelf Structure
Seagrass
Lagoonal Habitat
Rocky Shore
White Sand Beach
Black Sand Beach
Leatherback Nesting Site
Hawksbill Nesting Site
Mangroves
%Protected
Goal

The Grenada Declaration:

Dr. Spencer Thomas, Grenada's CBD Focal Point, presented a draft Declaration of Commitment (Appendix 6). This draft incorporated the goals set by the working group and was reviewed for content. The revised draft was then edited and taken to Dr. Thomas to the Minister of Health and Environment for submittal to Cabinet. The declaration was approved by Cabinet and an announcement and press release were prepared for the 8th Conference of The Parties, COP8. This is a significant statement by the Government of Grenada, in their commitment to effectively conserve the biodiversity of the country and provide leadership in this effort in the Caribbean Region.

Conservation Target Representation within Protected Areas Map:



Environmental Risk and Human Activities

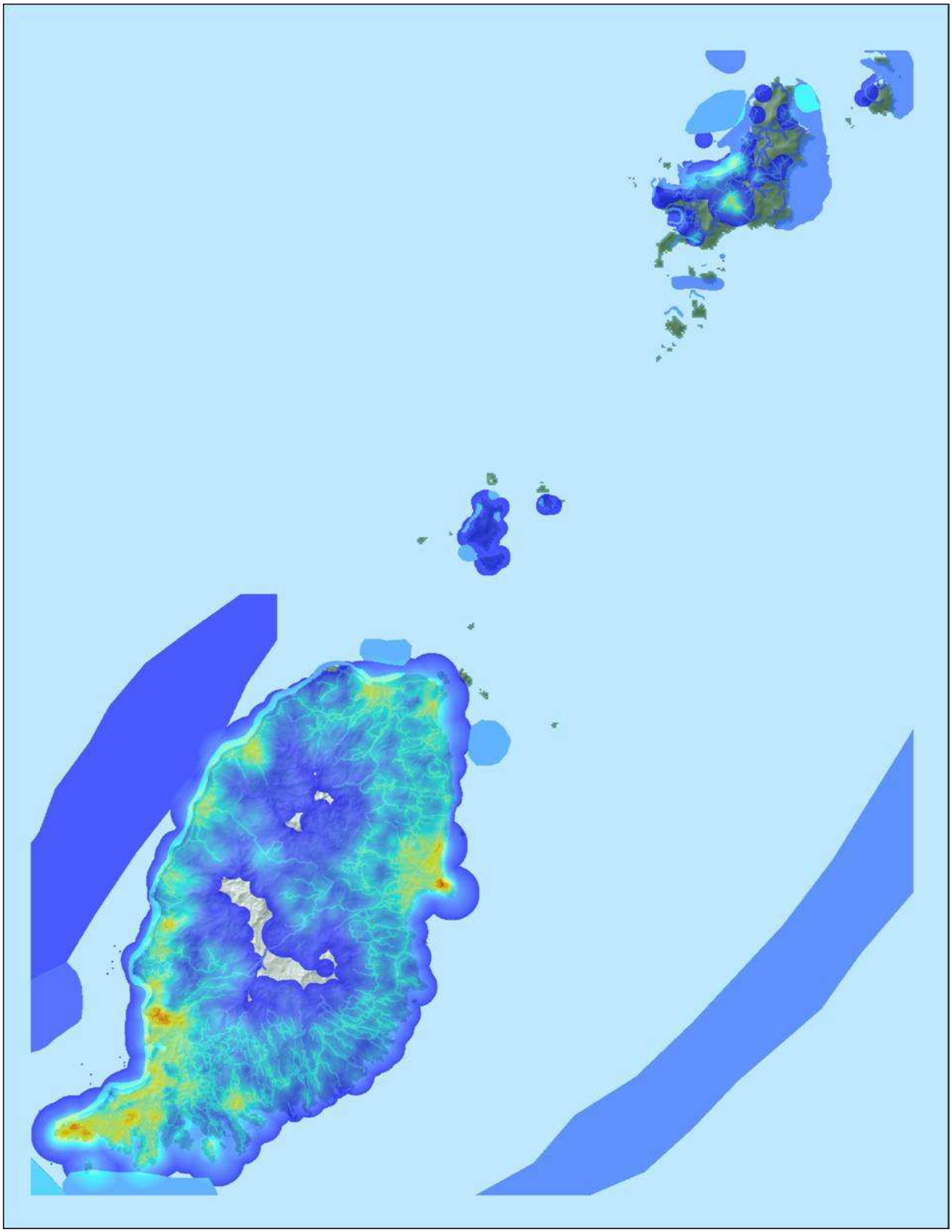
The next stage of the analysis involved the creation of the Environmental Risk data. This data was created to allow for an analysis of the level threats that are currently impacting the biodiversity. Threats to the conservation occurrences were evaluated by the development of a "human footprint" derived from mapped human activities such as roads, development, agriculture, hotels, marinas, ports, population density, fishing intensity, and other extractive industries. The threats were mapped out based on their range of impact and intensity level. The range of impact was expressed by the distance from the activity that the particular activity would still have an impact on biodiversity. The intensity level was based on a relative scale from 0 -100 with 100 being total destruction of all biodiversity. The workgroup evaluated the available spatial data available and determined the distance and intensity values for each activity and adjusted them accordingly for marine, terrestrial and fresh water impacts and within the context of the local conditions. The values were then used to create a Environmental Risk Surface which maps out each occurrence of the human activity and assigns the maximum value for that activity to the actual spatial occurrence and the decreases the intensity value out to the maximum distance of influence. Each resulting dataset was then combined into a cumulative impact map which represented the overall environmental risk to all the biodiversity in the country. The following is the table of human activities with the corresponding distance and intensity values:

Human Activity	Type or value range	T Distance	FW Distance	M Distance	T Intensity	FW Intensity	M Intensity
roads	general	60	60	200	50	50	50
urban	Population value 1-9	500	500	500	5	5	5
urban	10-29	500	500	500	11	11	11
urban	30-49	500	500	500	17	17	17
urban	50-99	1000	1000	1000	25	25	25
urban	100-199	1000	1000	1000	50	50	50
urban	200-499	1000	1000	1000	75	75	75
urban	500-999	1500	1500	1500	87	87	87
urban	>1000	1500	1500	1500	95	95	95
agriculture	cultivated	500	500	500	25	25	25
agriculture	coconut plantation	500	500	500	17	17	17
agriculture	coconut & banana	1000	1000	1000	25	25	25
agriculture	pasture	500	500	500	11	11	11
agriculture	banana	1000	1000	1000	30	30	30

Human Activity	Type or value range	T Distance	FW Distance	M Distance	T Intensity	FW Intensity	M Intensity
tourism	number of rooms 1-4	500	500	500	5	5	5
tourism	4-14	500	500	500	11	11	11
tourism	15-24	500	500	500	17	17	17
tourism	25-49	500	500	500	25	25	25
tourism	50-99	500	500	500	50	50	50
tourism	100-249	500	500	500	75	75	75
tourism	250-499	500	500	500	87	87	87
tourism	500 & above	500	500	500	95	95	95
Tourism	Attractions						
mines and quarries	active or temporarily inactive	500	500	1000	95	95	95
mines and quarries	Inactive	500	500	1000	85	85	85
golf courses	All	300	300	300	87	87	87
airports	Active	1000	1000	1000	90	90	90
airports	Inactive	1000	1000	1000	50	50	50
dumps	All	1000	1000	1000	90	90	90
ports	category 3			500			80
marinas	All	200	200	200	80	80	80
jettys	All			30			40
dive sites	all			50			10
anchorage	yachts/yachts on seagrass			100			30
anchorage	fishing boats			100			20
anchorage	free anchorage, 100s of boats, yachts			100			50
anchorage	small fishing boats			100			10
anchorage	no value			100			10
Conch	All			0			90
Fishing	Beach Seining			50			80
Fishing	Fish Traps			0			60
Fishing	Bottom Fishing			0			30

Human Activity	Type or value range	T Distance	FW Distance	M Distance	T Intensity	FW Intensity	M Intensity
Fishing	Long Lining			0			10
Fishing	Nets			0			60
Fishing	Trolling			0			10

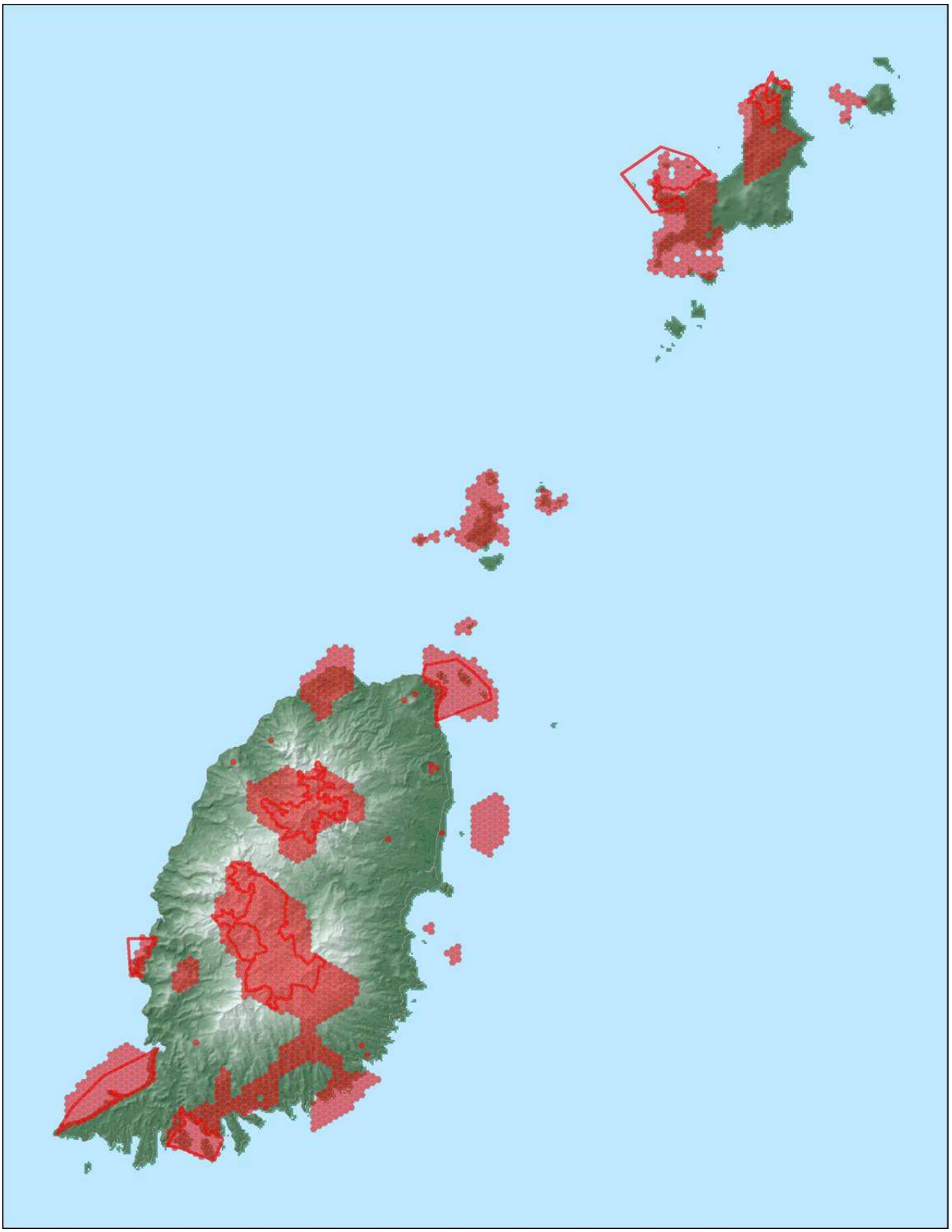
Environmental Risk Map:



Filling the GAPS

The next stage of the analysis consisted of the utilization of the Caribbean Decision Support System developed by TNC and the spatial planning tool MARXAN to select possible a possible portfolio of sites in order to reach the selected goals. The analytical process of the tools uses the spatial data of the conservation targets and overlays a planning unit data set onto the data. The planning unit is a hexagon of 10 hectares in size the shape and size of the planning unit was selected based on the overall data scale used and the types of biodiversity covered. The size and shape allowed for the best approximation of natural contours and for spatial coverage suitable to the overall extent of the analysis. The tool determined the amount of each conservation target represented within each planning unit, and by overlaying the protected areas data the planning units which are already protected were identified. The environmental risk data was then incorporated into the analysis and the value from this data set was selected for each planning unit. The analysis then utilized the MARXAN software to determine the optimal sites to be included in the final system. MARXAN uses simulated annealing to build planning units into an efficient network or portfolio of priority sites. The algorithm runs through one million iterations to build an efficient portfolio using a cost function to evaluate the portfolio during each iteration. The cost of the network is a combination of the environmental risk value of each planning unit, penalties set for not meeting representation goals and the length of the boundary of the network. The algorithm works by iterative improvement, but also has stochastic acceptance of bad choices. This allows the algorithm to choose less than optimal planning units early in the process that may allow for better choices and overall portfolios later. As the program progresses, the criteria for good selection gets progressively more strict until the portfolio is finally built. This process is automatically repeated for a user defined number of runs, often in the order of 200. The resulting data represented the planning units that were selected to reach the conservation goals while minimizing these costs. The first analysis conducted for Grenada resulted in results that the group determined was neither attainable nor realistic. The main reason for this was the ambitious goals of protection for Rivers, and Streams. The team decided to change the goals for these targets to the existing levels of protection and the analysis was conducted a second time. The results of the modified analysis were then utilized in a discussion to determine the final selection of sites for the system of protected areas. The team used the outputs of the analysis along with their local expertise to select the final sites.

Map of the initial analysis results:



Final System and Prioritization

The final portfolio of sites selected by the working group included the existing protected areas, the Southern Grenada Bays and Estuaries, The Grande Anse Marine Area, The Levera Marine and Coastal Area, The Isle D'Rhonde Complex, The White, Saline and Frigate Islands Complex, The Sandy Island/Oyster Bed Marine Protected Area, The Petite Dominic Marine Area, Mt. Hartman, Mt. St. Catherine, The Northeast Grenada Mangroves, and the Southeast Grenada Watershed Corridor.

The team then prioritized each of the new sites based on the ecological importance, the overall threat level to the biodiversity in the site and the feasibility of establishing effective management of the site. The following table is the summary of the prioritization.

3rd PROTECTED AREAS SYSTEM GAP ASSESSMENT
&
PROTECTED AREAS MANAGEMENT STRATEGIES WORKSHOP

Site Prioritization Worksheet

Site	Ecological Importance	Threat Level	Feasibility	Final Ranking
South Coast MPA	Very High	High	Medium	High
Grand Anse	Medium	Medium	Very High	High
Richmond Hill	Low	High	Very High	High
Mt. Hartman	High	Very High	Medium	High
Watershed corridor	Low	High	Low	Medium
Grand Etang	Very High	Low	Very High	High
Annadale	Very High	Low	Very High	High
Mount Moritz	Low	Medium	Very High	Medium
NE Mangroves	Low	High	Medium	Medium
Levera	High	Low	High	Medium
Isle de Rhonde	Very High	Low	Medium	Medium
Sandy Island	Medium	Medium	Very High	High
White/Saline/Frigate	High	Low	Medium	Medium
Carriacou Ridge	Medium	Medium	Low	Medium
High North	High	Very High	Medium	High
Petite Dominic	Medium	Low	Low	Low

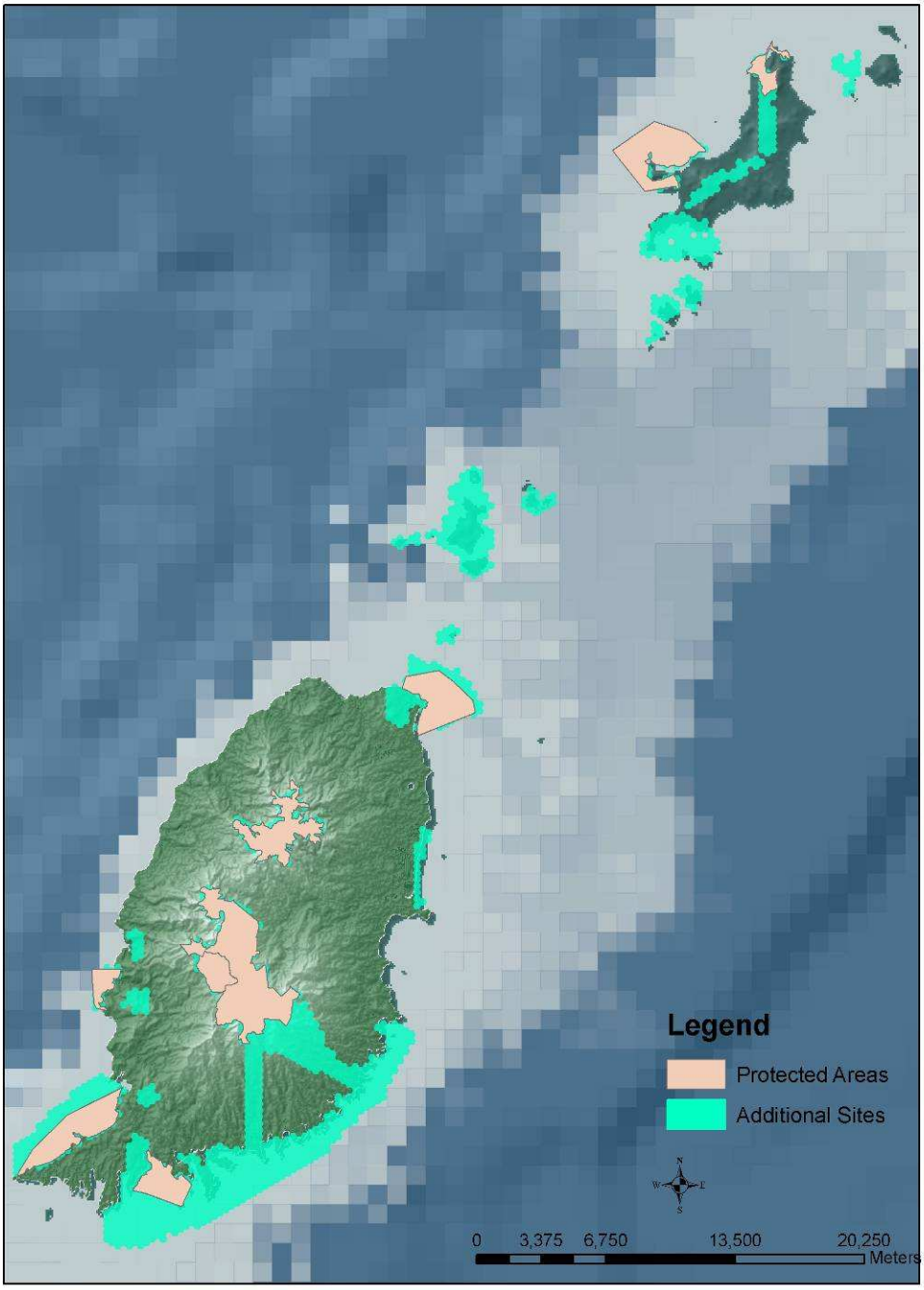
The workgroup then decided on the mechanism for implementation, the lead agency and timelines where created for achieving the CBD commitments of 10% of terrestrial resources by 2010 and 10% of the Marine Resources by 2012, as well as the 25% of both by 2020 made through the Grenada Declaration.. The following table illustrates these results.

3rd PROTECTED AREAS SYSTEM GAP ASSESSMENT
&
PROTECTED AREAS MANAGEMENT STRATEGIES WORKSHOP

Site Strategies Worksheet

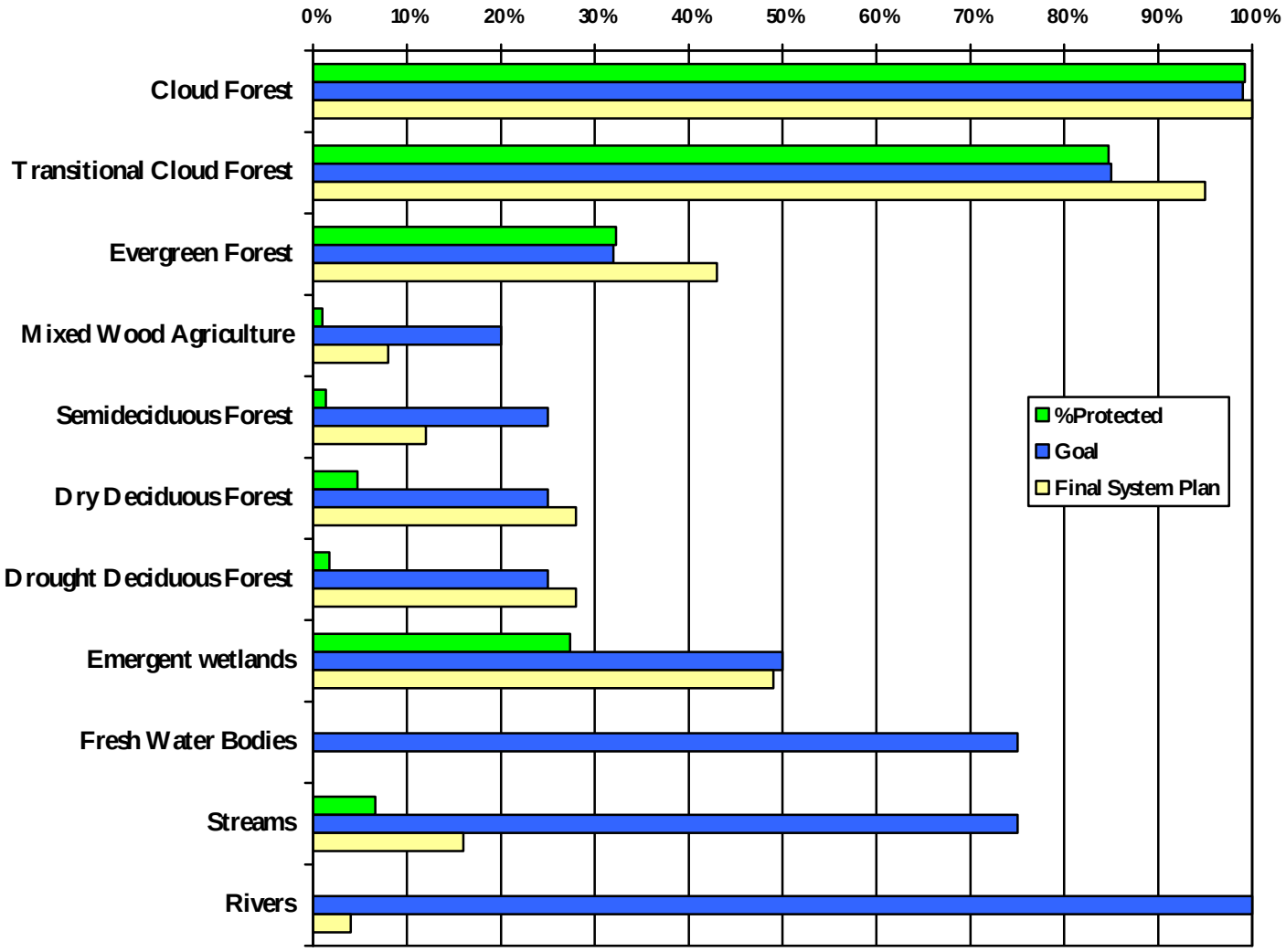
Site	Priority	Mechanism	Lead	Timeframe
South Coast MPA	**High**	MPA	Fisheries MPA Liaison/Management Committee	2012
Grand Anse	**High**	MPA	Fisheries - MPA Unit	2008
Richmond Hill	**High**	Forest Reserve	Forestry Forest Conservation	2008
Mt. Hartman	**High**			
Watershed corridor	**Medium**	Forest Reserve (Public/Private Partnership)	Watershed Management	2015
Grand Etang	**High**			
Annadale	**High**			
Mount Moritz	**Medium**	Forest Reserve	Forestry Forest Conservation	2008
NE Mangroves	**Medium**	Forest Reserve (Public/Private Partnership)	Forest Conservation/Mangrove	2012
Levera	**Medium**	MPA	Fisheries MPA Liaison/Management Committee	2012
Isle de Rhonde	**Medium**	MPA Co-management	Fisheries MPA Liaison/Management Committee	2015
Sandy Island	**High**	MPA	Fisheries MPA Liaison/Management Committee	2007
White/Saline/Frigate	**Medium**	MPA	Fisheries MPA Liaison/Management Committee	2015
Carriacou Ridge	**Medium**	Forest Reserve (Public/Private Partnership)	Watershed Management	2015
High North	**High**	Expand Forest Reserve (Public/Private Partnership)	Forestry Conservation	2012
Petite Dominic	**Low**	MPA	Fisheries MPA Liaison/Management Committee	2015

Grenada's National System of Protected Areas

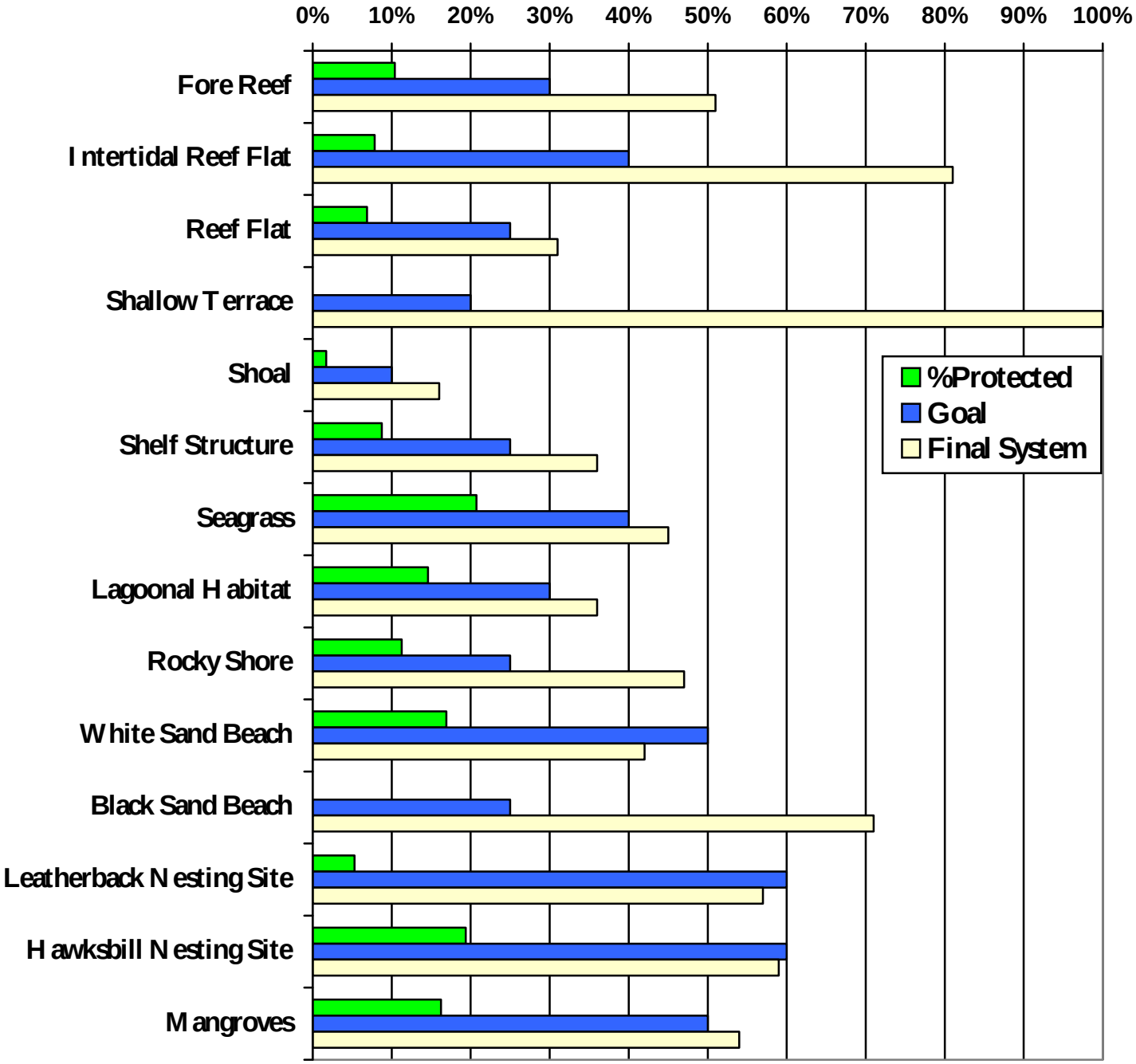


USAID

The Nature Conservancy
Protecting nature. Preserving life.

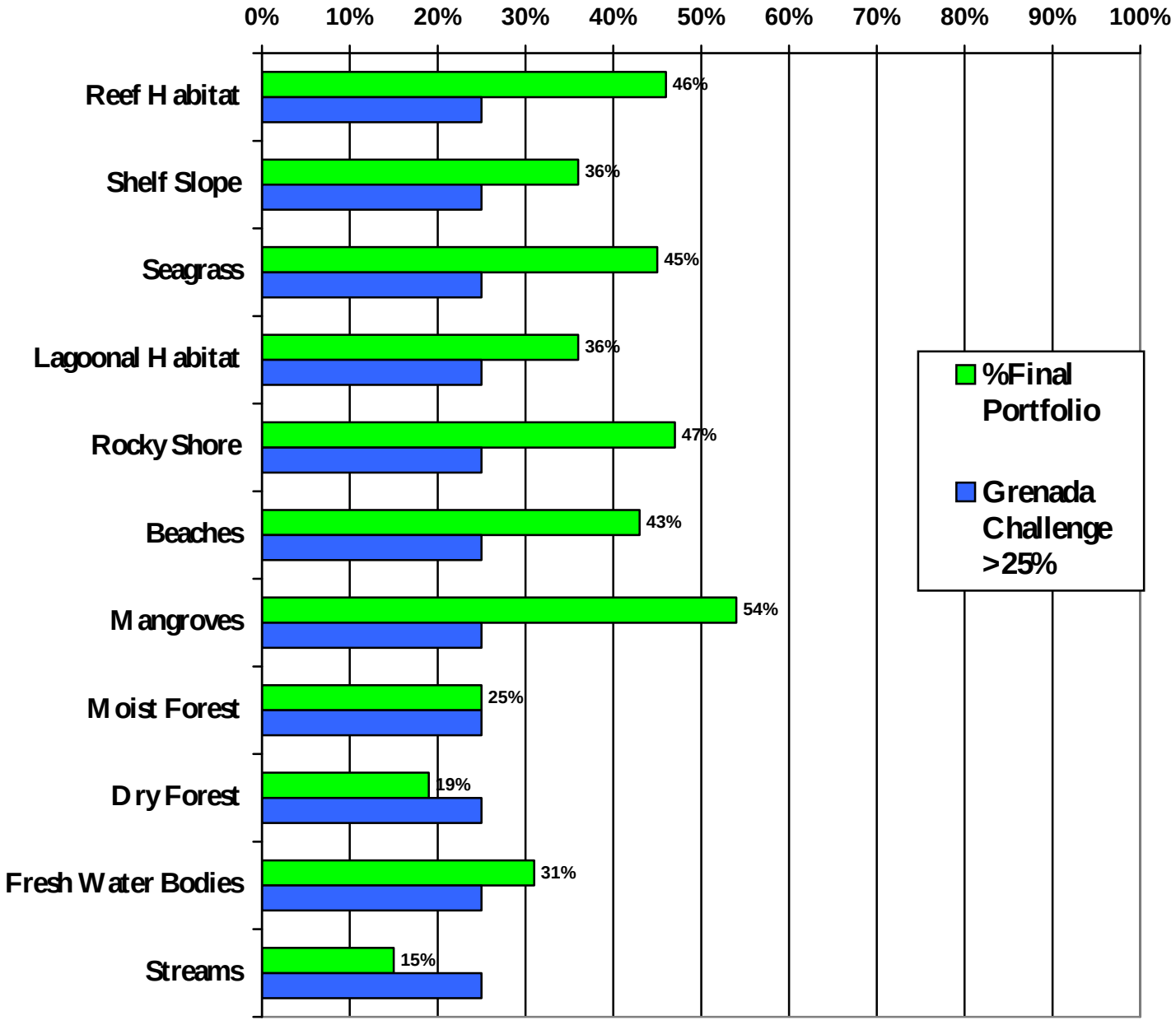


Graph displaying the percentage of each terrestrial habitat currently protected; the percentage goal for the analysis and the percentage represented in the final system portfolio.



Graph displaying the percentage of each marine habitat currently protected; the percentage goal for the analysis and the percentage represented in the final system portfolio.

The following graph illustrates the percentage of protection based on the terrestrial Ecoregions and Marine Ecosystems which at least 25% is the goal of the Grenada Challenge:


0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Reef Habitat
Shelf Slope
Seagrass
Lagoonal Habitat
Rocky Shore
Beaches
Mangroves
Moist Forest
Dry Forest
Fresh Water Bodies
Streams
46%
36%
45%
36%
47%
43%
54%
25%
19%
31%
15%
%Final Portfolio
Grenada Challenge >25%

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Ervin, J.2003.*WWF: Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) Methodology*. WWF, Gland, Switzerland. 52 pp.

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