Jamaica Ecoregional Plan

The Nature Conservancy Jamaica Programme
June 2006
www.nature.org

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JERP Goal

- The main areas and activities necessary for the conservation of Jamaica's freshwater, marine and terrestrial biodiversity based on the best available data.

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What is Ecoregional Planning (ERP)?

- ERP is an iterative **science-based** planning activity aimed at developing shared **goals**, and **strategies** for organisations involved in **biodiversity conservation**.

- Jamaica ERP (JERP) is led by TNC-J and supported by a multidisciplinary group of local and international scientists, technicians and conservation practitioners.

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Brief History of JERP

- Jamaica Ecoregional Planning started in 2003 as part of Caribbean planning project.
- Jamaica and Puerto Rico were selected as pilot projects.
- The Jamaican conservation community wanted a more detailed ecoregional analysis.
- Freshwater, Marine and Terrestrial analyses conducted on separate but parallel tracks for integration in May and June 2006.

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JERP objectives

1. To design a network of conservation areas that will conserve the diversity of species, communities and ecosystems in Jamaica.
2. To guide TNC Jamaica conservation priorities and actions in the short to medium term.
3. To provide a scientific basis and methodology for island-wide conservation planning.

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ERP Planning Framework

Generally follows Geography of Hope (TNC 2002)

1. Compile and review existing information on biodiversity, human activities, protected areas and conservation projects.
2. Establish a classification framework for Jamaica's biodiversity.
3. Select and map conservation targets: ecosystems, habitats and species.
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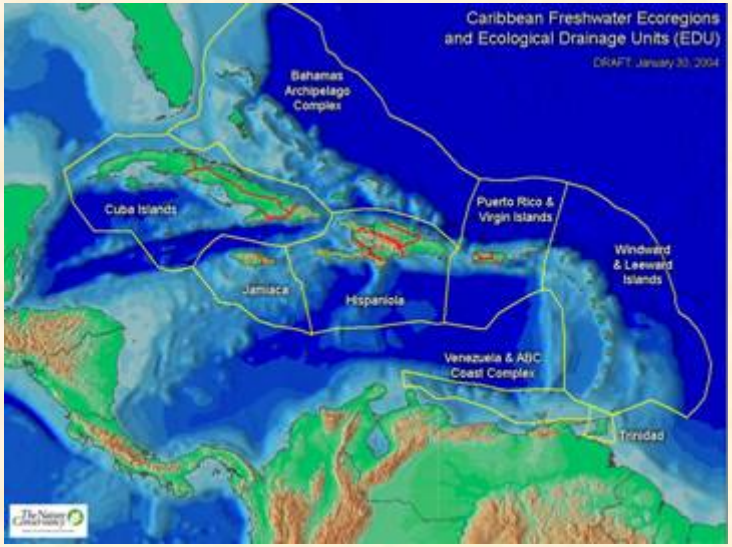
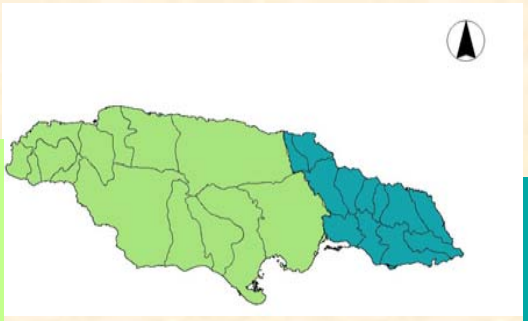
Freshwater Classification Framework

Caribbean Basin
↓
Freshwater Ecoregions
↓
Ecological Drainage Units
↓
Aquatic Ecological Systems

- Jamaica freshwater ecoregion was stratified into two EDUs: 1) the Blue Mountains and 2) the Western Limestone Complex.
- Ecological Drainage Units are ecological entities defined as:
  - *groups of watersheds with similar zoogeographic histories and similar patterns of physiography, drainage density, hydrologic characteristics, and connectivity.*





Western Limestone Complex:

- Low drainage densities,
- High hydrological connectivity between basins
- Predominantly karst limestone hydrogeology
- Longer than those in the east with better developed floodplains and associated wetlands
- Significant underground drainage

Blue Mountains EDU:

- high drainage densities,
- low hydrologic connectivity between basins
- a volcanic/metamorphic hydrogeology
- Rel. short fast-flowing rivers
- High-altitude headwaters

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Marine Stratification

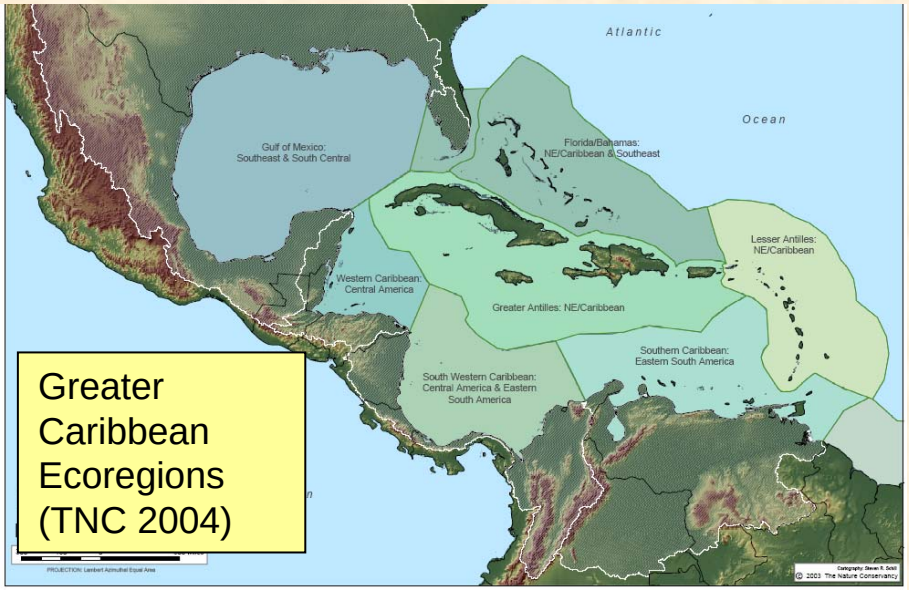
Caribbean ecoregion

Regional marine planning areas: Greater Antilles/NE Caribbean

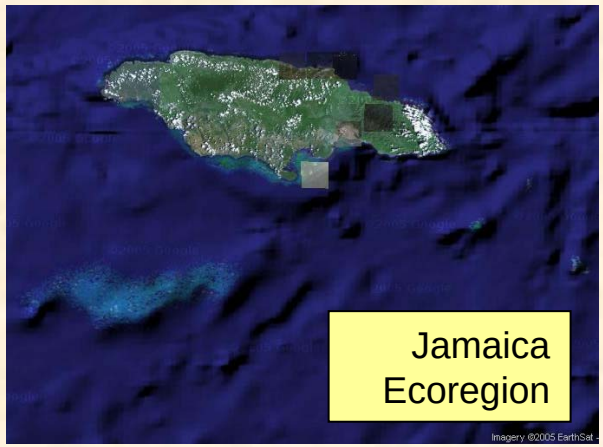
Jamaica ecoregion

Jamaica Marine Stratification Units (MSUs)

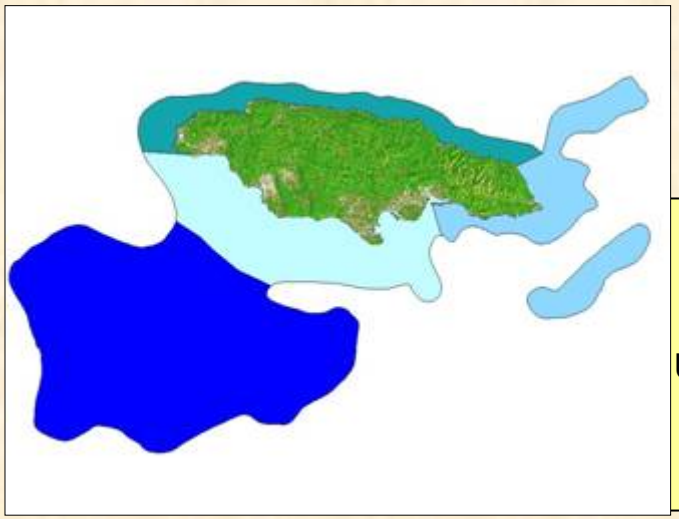
Conservation target occurences



Greater Caribbean Ecoregions (TNC 2004)



Jamaica Ecoregion



Jamaica Marine Stratification Units (MSUs)

Adapted from Sullivan & Bustamante 1999

Determined by oceanographic, geophysical and environmental conditions.

Northern MSU *– narrow island shelf, deep drop-off, more exposed shoreline.*

Southern MSU *– wide island shelf with gradual drop-off, more sheltered coast.*

Eastern MSU *– most exposed to eastern tradewinds, narrowing shelf.*

Pedro Bank *– very large offshore bank system with circulation and currents independent of coastal conditions.*

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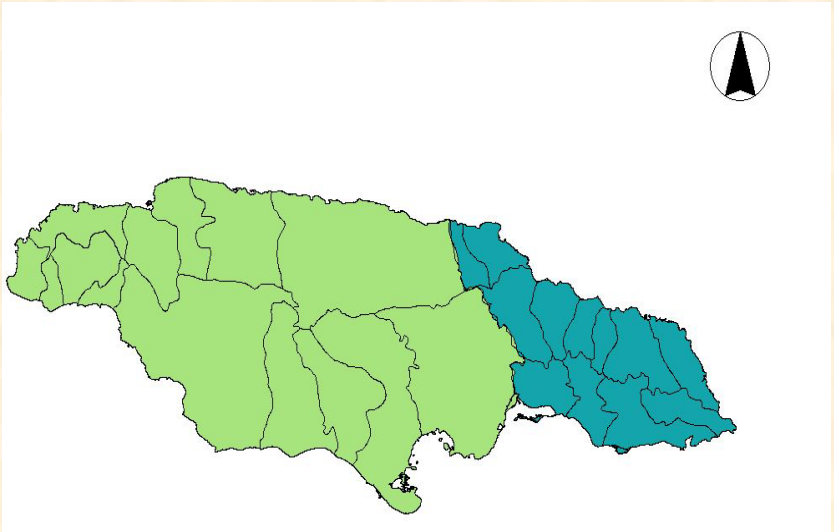
Terrestrial Stratification

- Two stratification units were defined based on geology, topography and climate, biogeography:
  - Blue Mountains (eastern) Stratification Unit
  - Western Limestone Stratification Unit

  N.B. This followed the Freshwater stratification units.



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Conservation Targets

Mapped the distribution of freshwater, marine and terrestrial biodiversity elements or conservation targets (ecosystems, communities and species) across Jamaica. 2 levels were used:

- ***Coarse-Filter-*** ecosystems, and communities. Designed to represent common and widespread species.
- ***Fine-Filter-*** single species, guilds and communities with special requirements. Ensures that endemic, endangered or other unique species are priorities for conservation.

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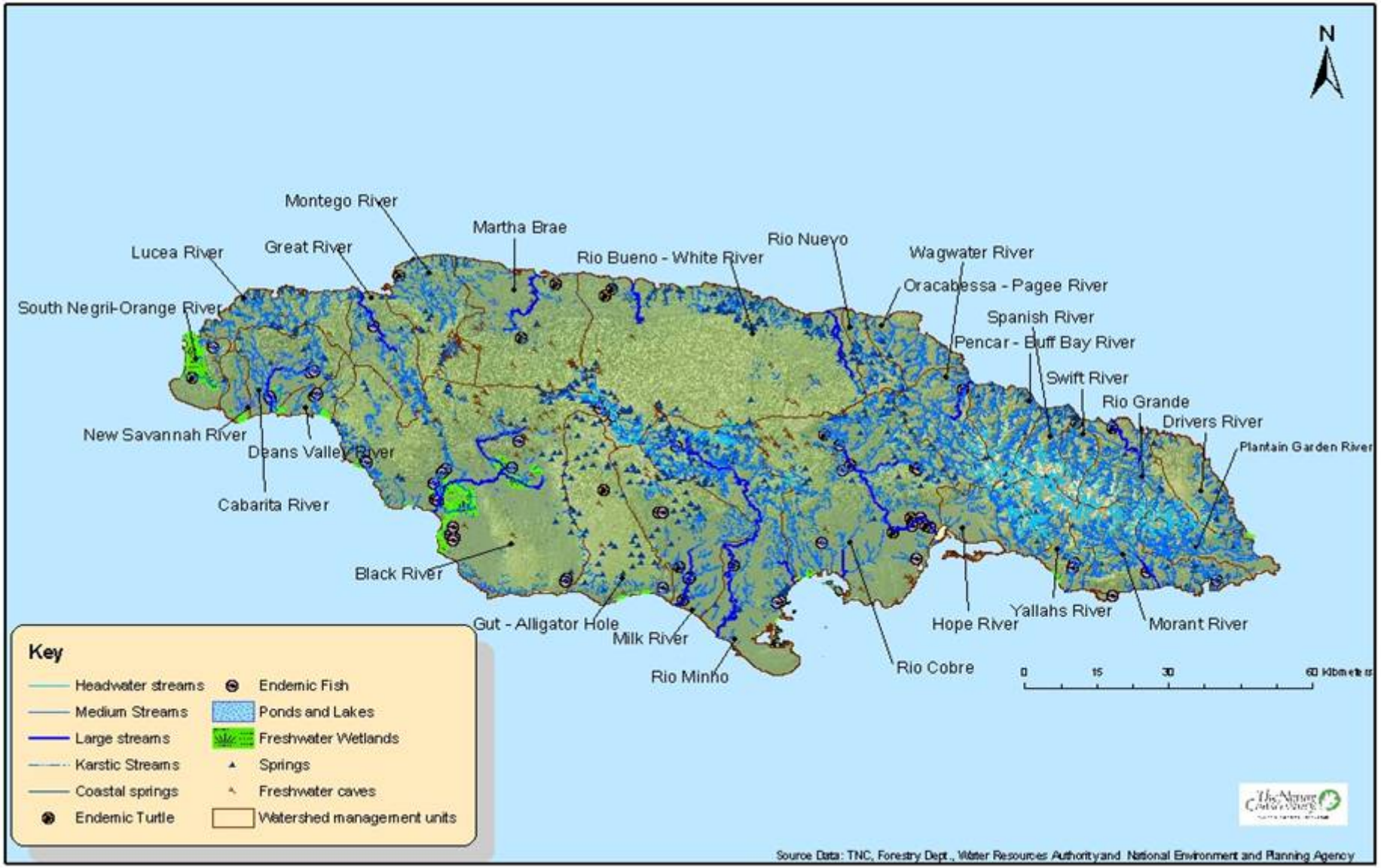
	Freshwater Conservation Targets
Blue Mountain EDU	Small high altitude streams
	Med-sized, low altitude streams
	Large, low-altitude streams
	Small coastal springs and streams
	Freshwater wetlands
	Permanent and ephemeral ponds
	Springs
	Freshwater caves
West/Central EDU	Small, high altitude non-karstic streams
	Large low-altitude streams
	Karstic aquatic systems- *freshwater caves, springs and karstic streams*
	Small coastal springs and streams
	Permanent and ephemeral ponds and lakes.
	Freshwater wetlands
	Med-sized, low altitude, non karstic, streams
Fine Filter	Endemic Fish: *Gambusia melapleura, Gambusia wrayi, Limia melanogaster, Cyprinodon jamaicensis.*
	Endemic turtle: *Pseudemys terrapen*

JAMAICA ECOREGIONAL PLAN
Freshwater Target Distribution: freshwater ecosystems and species



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JAMAICA ECOREGIONAL PLANNING (JERP) MARINE CONSERVATION TARGETS

Fine or Coarse Filter	Target Name	Marine Stratification Unit (MSU)	Major data sources or references used for mapping
Coarse	Sandy shores	N, S, E*	JA Coastal Atlas 1999, Greater Caribbean Ecoregional Assessment 2004, South Coast Atlas 1999, Expert review
Coarse	Rocky shores	N, S, E	JA Coastal Atlas 1999, GCERA 2004, JA Country Environmental Profile 1987, South Coast Atlas 1999, Expert review
Coarse	Mangroves	N, S, E	Forestry Dept. Landuse Map 1999, Alleng 1990, JA Country Environmental Profile 1987, Jamaica's Coastal Resources: A Reconnaissance Report (USAID 1995), South Coast Atlas 1999, Expert review
Coarse	Estuarine areas	N, S, E	*Jamaica's Coastal Resources: A Reconnaissance Report* (USAID 1995), IKONOS satellite imagery, Expert review
Coarse	Seagrass	N, S, E, P	Millenium Mapping 2004-06, JA Coastal Atlas 1999, South Coast Atlas 1999, Expert review
Coarse	Coral reef	N, S, E, P	Millenium Mapping 2004-06, JA Coastal Atlas 1999, South Coast Atlas 1999, JA Country Environmental Profile 1987, Expert review
Coarse	Soft bottom communities	N, S, E	Millenium Mapping 2004-06, JA Coastal Atlas 1999, South Coast Atlas 1999, Expert review
Coarse	Cays	N, S, E, P	Millenium Mapping 2004-06, Topography maps (50k), British Admiralty Nautical Charts, JA Country Environmental Profile 1987, Expert review
Coarse	Offshore banks	S, E, P	Millenium Mapping 2004-06, South Coast Atlas 1999, Munro 1983, Expert review
Coarse	Seabird nesting and roosting areas	N, S, E, P	Haynes, 1987; Downer and Sutton, 1991; Haynes-Sutton, 1997; Expert review
Coarse	Overwintering shorebird areas	N, S, E, P	Based on A. Sutton field research, Expert review
Coarse	Turtle nesting beaches	N, S, E, P	WIDECAST report (in-draft), NEPA GIS dataset based on compilation of field surveys between 1991 and 1995, Expert review
Fine	Manatees	N, S, E	Manatee Mgmt. Plan - Brown 1993, NEPA GIS dataset based on compilation of field surveys between 1982 and 1993 (Fairbairn and Haynes, 1982; Strong, et. al. 1991), Expert review

*N – Northern, S – Southern, E – Eastern, P – Pedro Bank

JAMAICA ECOREGIONAL PLANNING MARINE CONSERVATION TARGETS

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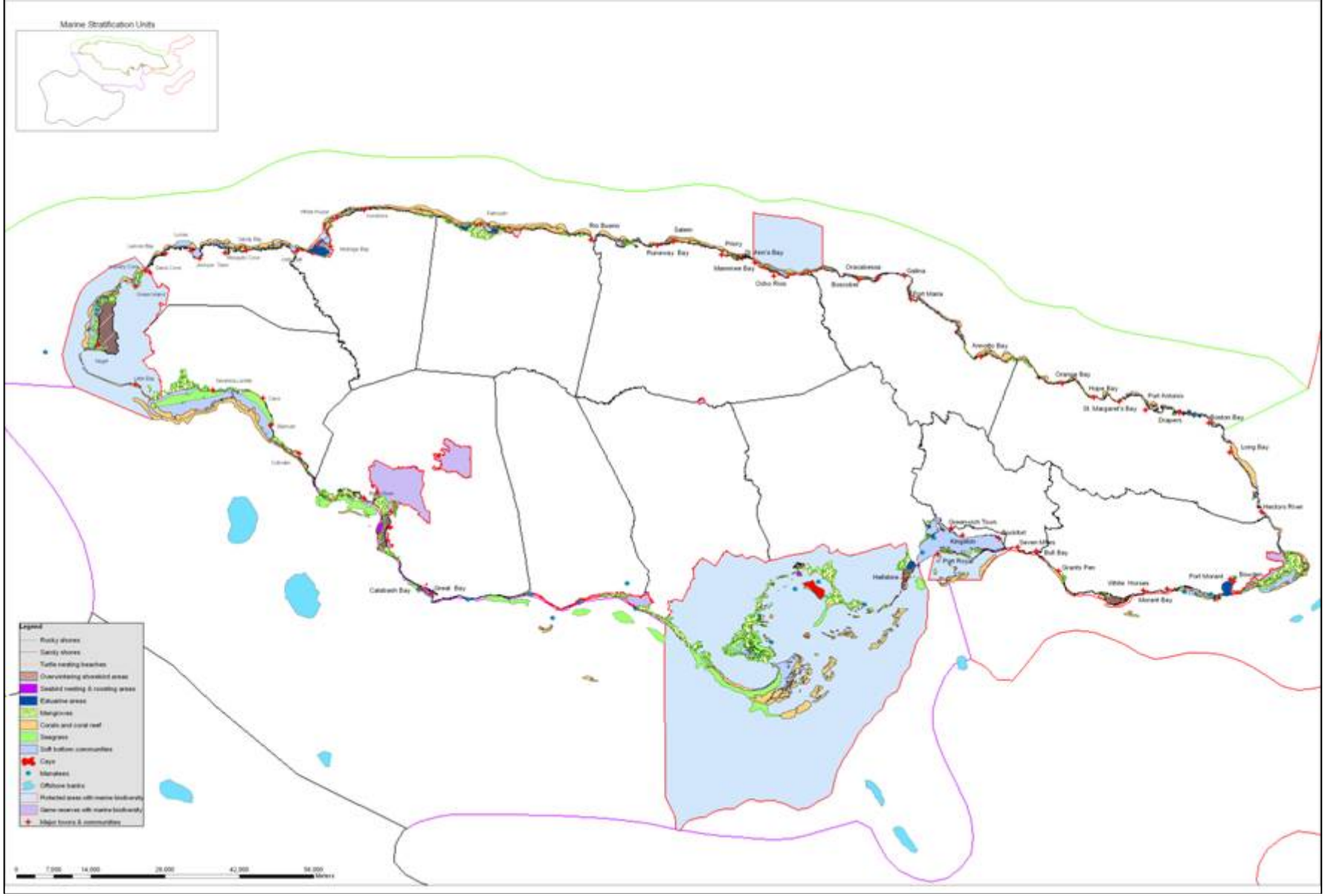
February 2006



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Conservation Goals

Goals refer to the amount and distribution of targets that we want to conserve.

- **Distribution**: Ensures that more than one example of a target is conserved. In this case, at least one occurrence per stratification unit: EDU or MSU.
- **Amount**: Expressed as a percentage of the total.

  E.g. 10 % of freshwater wetland distribution.

Goals are the yardstick by which we measure progress and effectiveness.

Setting conservation goals

Goal scheme	Description
1	Minimum goal of **10%** of all targets (CBD, TNC 2015)
2	Goal of **20%** (IUCN, World Parks Congress 2003 and GoH/TNC recommendations)
3	Adaptive goals based on other literature and status of individual targets.

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Goal calculation example

EDU	Target name	code	Total Amount (km, Ha, or # of occurences)	10%	20%	30%	Adaptive
Blue Mountain EDU	High altitude, headwater streams	630	584.92	58.49	116.98	**175.47**	87.74
	Medium-sized streams	631	2238.73	223.87	447.75	**671.62**	223.87
	Large low-altitude streams	632	38.22	3.82	7.64	**11.47**	19.11
	Coastal springs and streams	633	138.20	13.82	27.64	**41.46**	34.55
	Freshwater wetlands	634	220.94	22.09	44.19	**66.28**	110.47
	Lakes and ponds	635	43.07	4.31	8.61	**12.92**	10.77
	Springs	646	109	11	22	**33**	11
	Freshwater caves	647	9	1	2	**3**	5
Western Limestone EDU	Small high altitude headwater streams: non karstic	636	147.81	14.78	29.56	**44.34**	36.95
	Large low-altitude streams	637	418.76	41.88	83.75	**125.63**	125.63
	Karstic aquatic systems: Freshwater caves	638	214	21	43	**64**	21
	Karstic aquatic systems: Springs	639	417	42	83	**125**	42
	Karstic aquatic systems: Karstic streams	640	1505.35	150.54	301.07	**451.61**	150.54
	Coastal springs and streams	641	166.33	16.63	33.27	**49.90**	49.90
	Lakes and ponds	642	801.79	80.18	160.36	**240.54**	200.45
	Freshwater wetlands	643	12893.59	1289.36	2578.72	**3868.08**	3223.40
	Medium-sized streams: non karstic	645	1850.54	185.05	370.11	**555.16**	185.05

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Threats Assessment

Threats defined as human and human-mediated activities that degrade conservation targets.

- Identify and map threat distribution
- Evaluate threat intensity
- Incorporate into cost surface
- Prioritise critical threats- # of targets affected, and intensity

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Threats to FW biodiversity

Threat class (IUCN)	Activity
Agriculture	Crop cultivation:
	Aquaculture
	Livestock farming
Point source pollution	Bauxite processing
	Sewage
	Factory waste
	Landfill effluent seepage
Infrastructure	Human settlement
	Dams
	Roads
Extraction	Water abstraction (excessive)
	Overfishing :fish (tilapia, mullet, etc), crustaceans (shrimp, crayfish), bussu (neritidae)
	Sand mining (in rivers)
	Limestone quarrying
	Bauxite mining
Invasive species	Invasive animals and plants
Habitat Destruction	Filling in and clearing of wetlands

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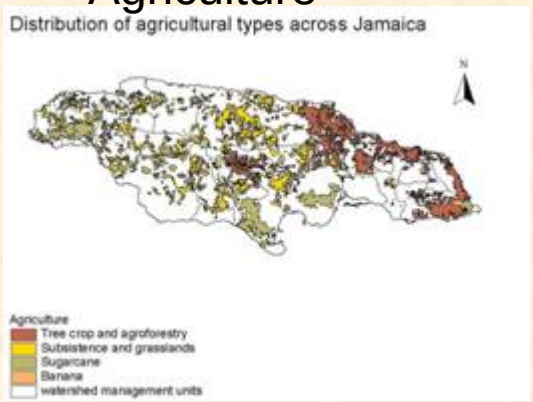
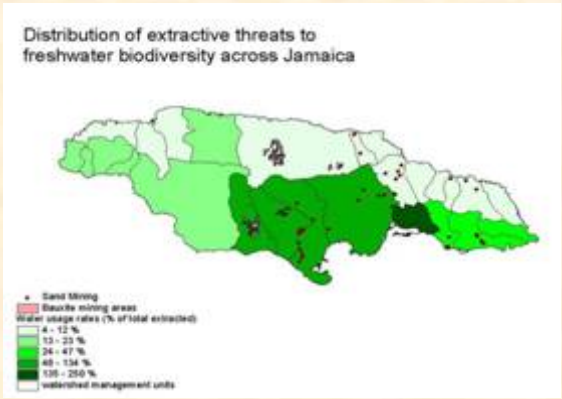
FW Threat Distributions

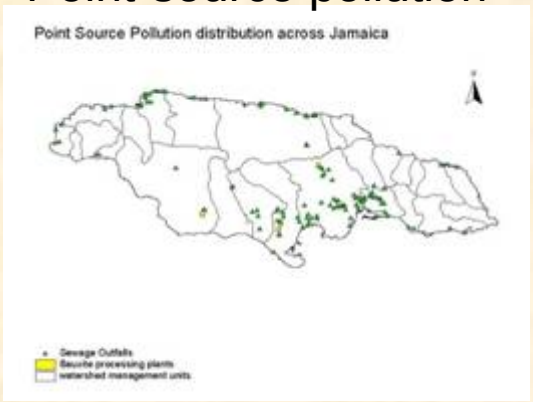
Agriculture



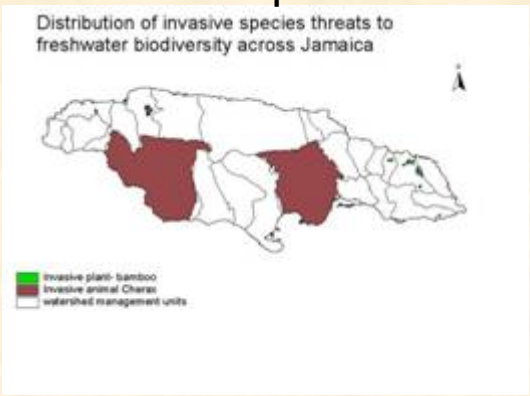
Extraction and dams



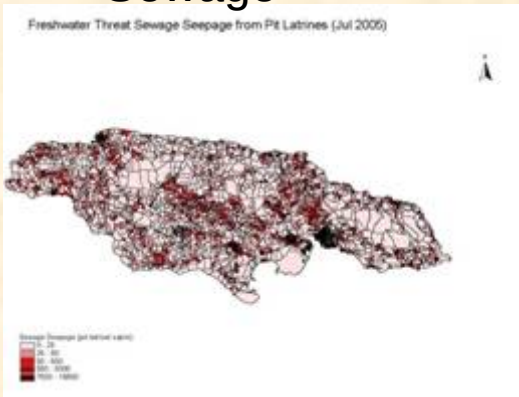
Point-source pollution



Invasive species



Sewage



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Threats to marine biodiversity

Threats category	Primary human/human-mediated activities impacting marine conservation targets	Surrogate data used to estimate and map impact of human/human-mediated activities - Cost Surface model
Direct impact	Careless boating practices (anchorings, groundings, seagrass scars, etc)	Marinas, ports
Climate change	Climate change (associated increase in water temps, sea level rise)	not mapped
Direct impact Contamination	Coastal development/construction (includes land conversion)	Population density, resort areas and hotels, ports, marinas
Sedimentation Contamination	Deforestation & physical deterioration of watershed basins	Agricultural landuse
Direct impact	Dredging	Marinas, ports
Direct impact	Extraction of material from mangroves	Population density
Extraction	Hunting/poaching of animals and/or eggs (reptiles, birds)	not mapped
Direct impact	Hydrological alterations/disruptions (eg. groundwater extraction, irrigation, channelization, damming of rivers and streams)	Dams, Agricultural landuse, water extraction
Contamination	Invasives/domestic animals	General *Perna viridis* distribution (a Pacific oyster)
Direct impact	Irresponsible/careless diving practices	not mapped
Direct impact	Irresponsible/careless fishing practices/gear (eg. dynamite, dragging of nets, abandoned traps)	not mapped
Sedimentation & run-off Contamination	Land run-off (including agricultural, sewage and industrial discharge)	Coastal industrial areas, agricultural landuse, population density, bauxite processing plants, groundwater contamination, sewage outfalls, pit latrines

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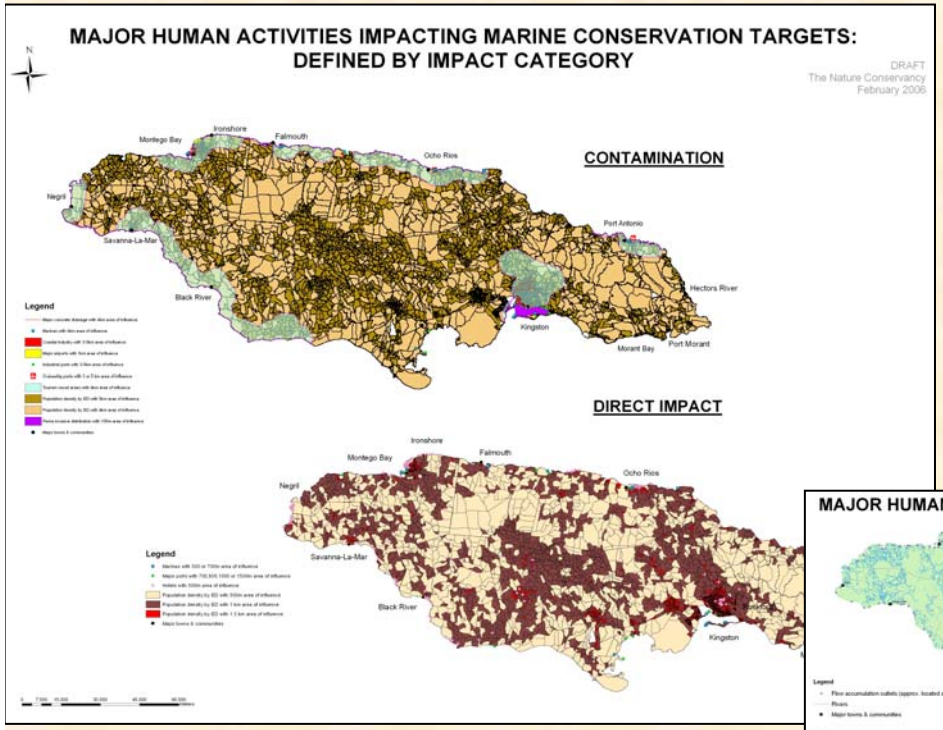
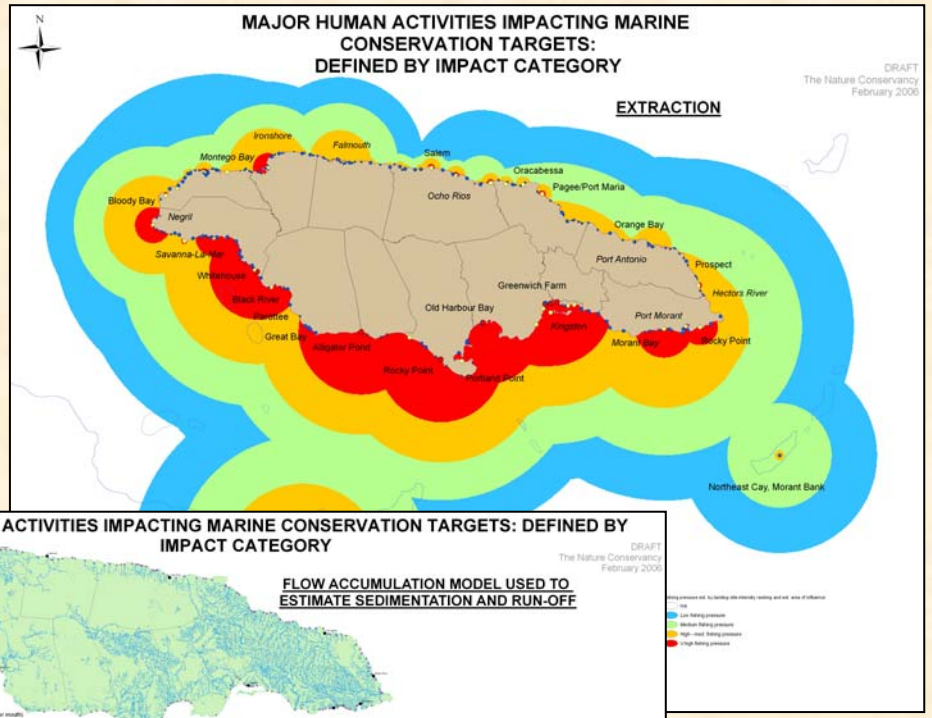
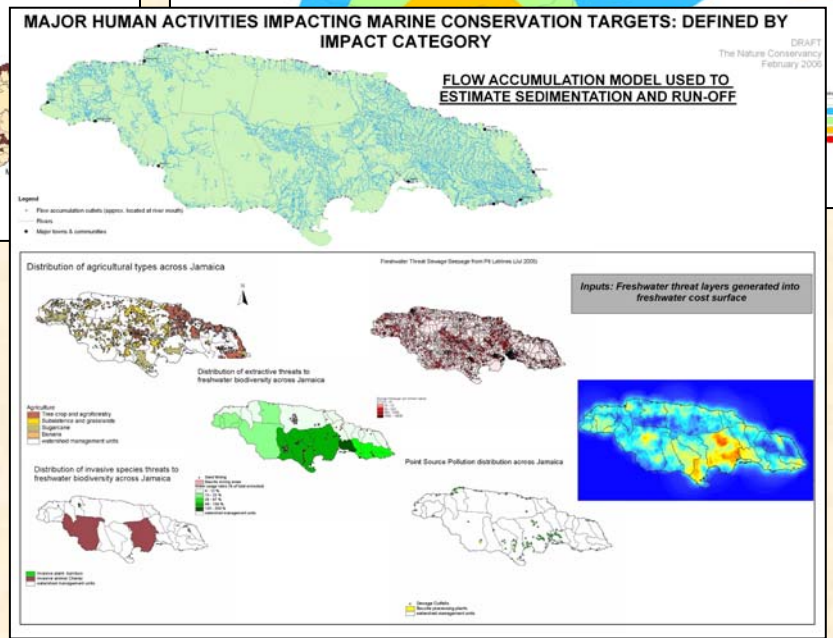
Marine Threat Distributions







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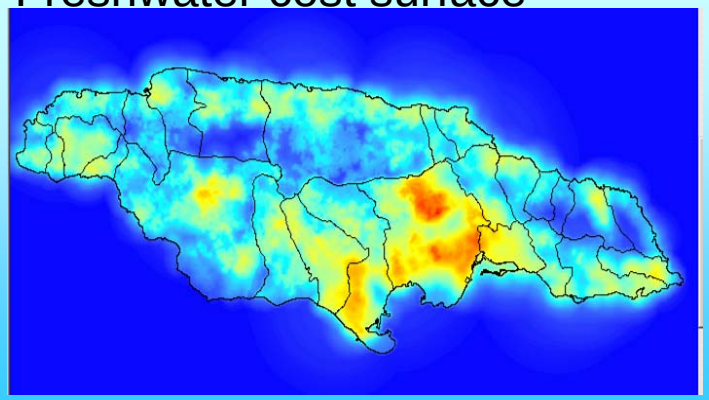
Cost Surfaces

Target occurrences were screened by incorporating cost surfaces in the GIS analyses to follow.

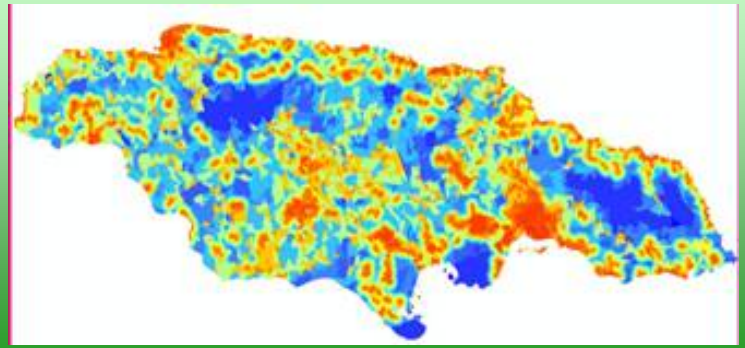
Freshwater cost surface



- The cost surface is a map of the sum impact of human activities on biodiversity, that is, a *human footprint*. Main inputs:
  - Threat distribution
  - Threat intensity
  - Area of influence of threat

Marine cost surface without fishing

Terrestrial cost surface



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Cost Surface inputs*

Activity	Intensity	Extent of influence (km)	Effects
Banana plantation	8	5	Very intensive use of pesticides and fertilisers, also generates solid waste, some evidence of bioaccumulation in aquatic systems, increased runoff and sedimentation
Urbanised area	6	5	Impervious surfaces, disrupt flow regime, reduce base flow, pollutants introduced directly into aquatic systems.
Excessive water abstraction (50-75% of basin total extracted)	4	0.1	Can disrupt instream flow requirements and hydrology, in extreme cases may disrupt upstream/ downstream linkages like dams

*Extracted from cost surface input table

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Protected Area Analysis

Examines the effectiveness of current Protected Area system and highlighted the gaps.

- Representation Gaps: Are the PAs protecting Jamaica's biodiversity adequately?
- Ecological Gaps: Are the Pas in the right place? How can they be better connected to preserve large scale ecological processes?
- Management Gaps: Are the managements systems in place to protect biodiversity in existing Pas?

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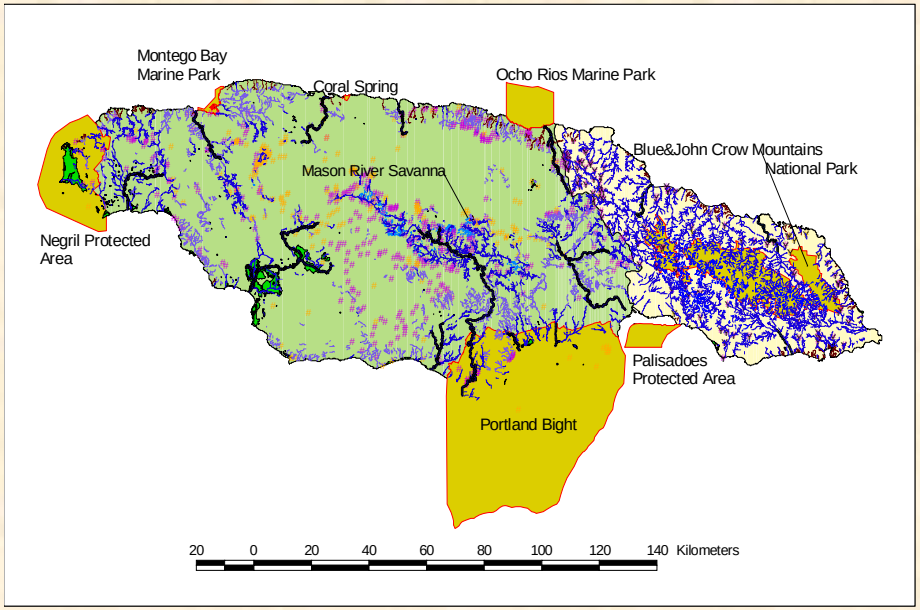
Gap Analysis

The current PA network was overlaid with the conservation target distributions to determine how much of each target is currently protected.

Freshwater



Marine

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Freshwater Gap Results

- Only 6 freshwater habitats are adequately represented (i.e. >10% of their distribution) in the protected area network.)
- 5 habitats (large rivers, wetlands, ponds and caves in the east and high altitude streams in the west) are **completely unprotected**
- The PA network does not protect **ecological connectivity**. (i.e. No complete river systems protected.)

Target	Percentage of target protected
Eastern high altitude headwater streams	61.8%
Western freshwater wetlands	31.2%
Western ponds and lakes	18.7%
Eastern medium-sized streams	13.8%
western large rivers	10.9%
Western medium-sized streams streams	10.5%
Eastern springs	**7.3%**
Western coastal springs	**6.3%**
western springs	**6.2%**
Western freshwater caves	**5.6%**
Western karstic streams	**4.4%**
eastern coastal springs	**0.5%**
eastern large rivers	**0.0%**
eastern wetlands	**0.0%**
eastern ponds and lakes	**0.0%**
western_high altitude streams	**0.0%**
eastern freshwater caves	**0.0%**

KEY- % represented
>20%
10-20%
0-10%
no protection

IUCN BENCHMARK

CRITICAL FRESHWATER HABITATS

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Marine Gap Results

- **8 of 13 targets have > 50% protection**
- **Eastern targets** are very poorly represented in the PA system
  - 15% (2 of 13) of Eastern Jamaica targets have 1 - 2% to of their distribution within PAs
  - 80% (9 of 13) have no protection at all
- **Pedro Bank MSU** has no protection
- **Offshore bank targets in the eastern and southern MSUs** have no protection
- **N. Jamaica Seabird Nesting and Roosting** areas have no coverage

JERP Marine Conservation Target Name	% distribution within declared PAs
Eastern Jamaica Rocky Shore	0
Eastern Jamaica Seagrass	0
Eastern Jamaica Seabird Nesting & Roosting Areas	0
Eastern Jamaica Soft Bottom Communities	0
Eastern Jamaica Manatee Sightings	0
Eastern Jamaica Cays	0
Eastern Jamaica Offshore Banks	0
Northern Jamaica Seabird Nesting & Roosting Areas	0
Pedro Bank Seagrass	0
Pedro Bank Coral & Coral Reefs	0

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ERP Planning Framework

1. Compile and review existing information on biodiversity, human activities, protected areas and conservation projects.
2. Establish a classification framework for Jamaica's biodiversity.
3. Select and map conservation targets: ecosystems, habitats and species.
4. Develop conservation goals: The amount and distribution of biodiversity to be conserved.
5. Conduct threats assessment: Status of human activities that impact biodiversity.
6. Assess ecological integrity of conservation targets
7. Review existing Protected Area Network.
8. Design representative conservation areas network
9. Develop conservation strategies

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Conservation Area Portfolio

Conservation area modelling:

Optimal networks of conservation areas based on the distribution of conservation targets and the selected conservation goals were designed. The following tools were used:

1. ESRI GIS-based tools Marxan and SPOT software, and
2. Non-computerised “common sense” models

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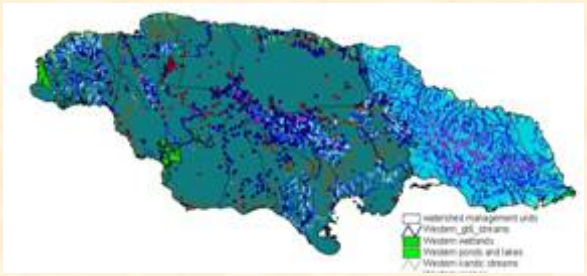
Marxan and SPOT modelling

- Main Inputs:

Targets



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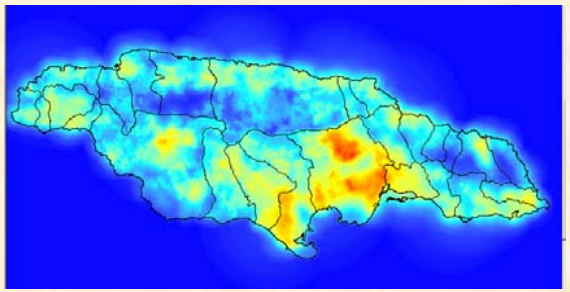
Conservation Goals

10%

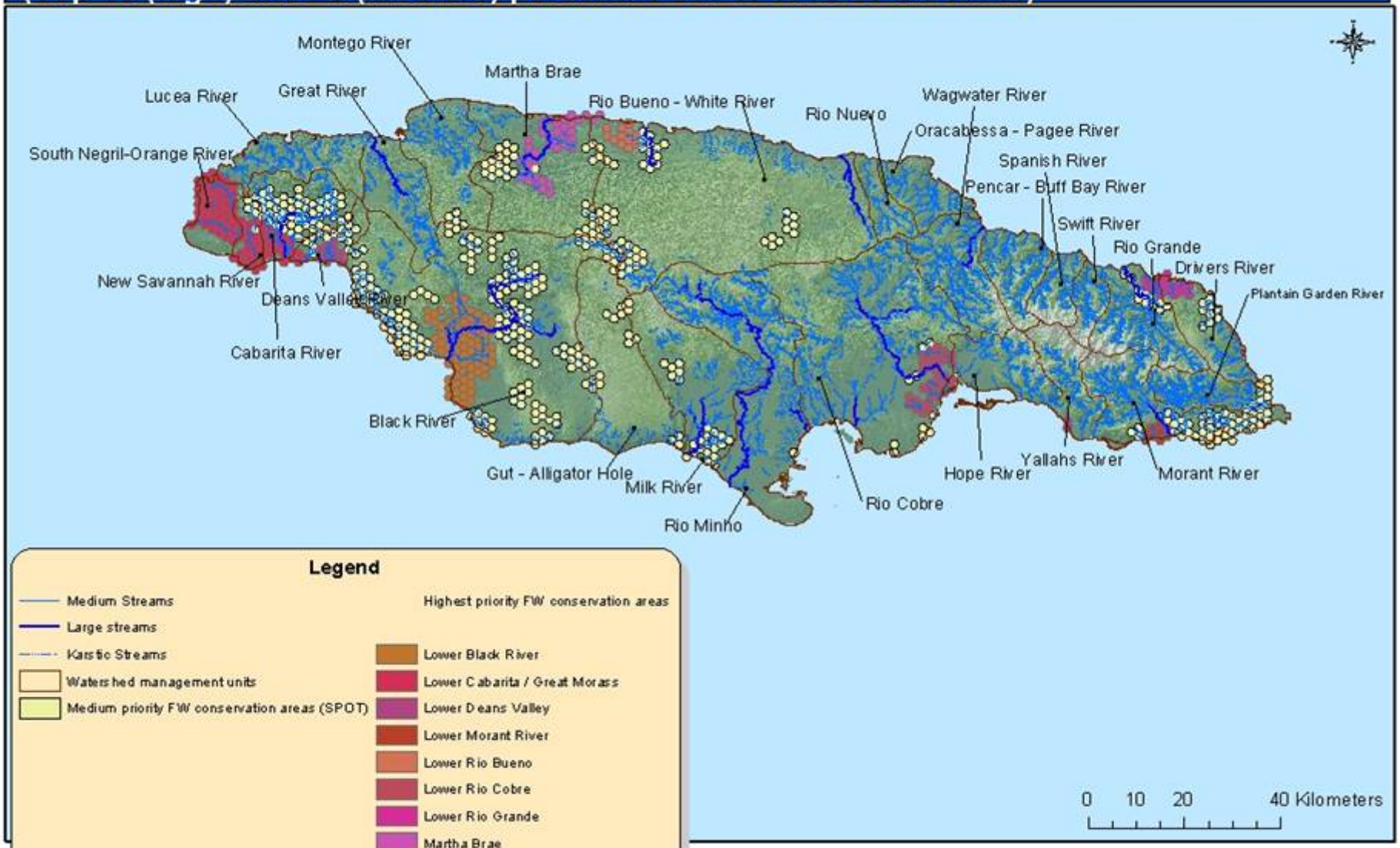
+

+

Cost Surface



JAMAICA ECOREGIONAL PLAN
Core Freshwater Conservation Areas:
(Top 10 (high) and 25 (medium) percentile out of 1800 SPOT runs.)



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Version: Draft March 2006
Data Sources: TNC, Forestry Department, Water Resources Authority and National Environment & Planning Agency

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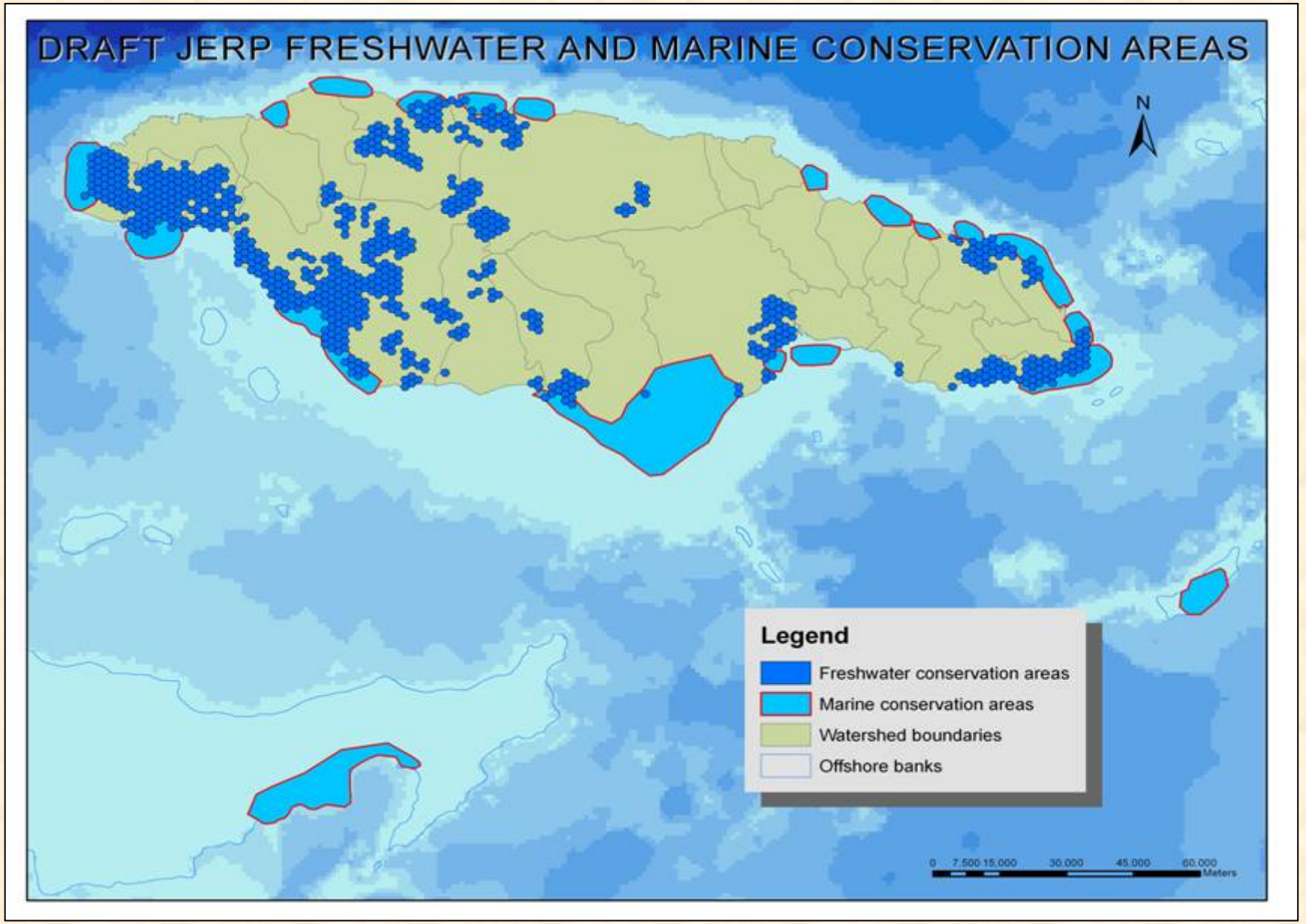

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Strategy Framework

The results of ERP Analyses (eg. Viability analysis, threats analysis, gap analysis) were used to design ecoregional conservation objectives and strategies.

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Main freshwater JERP findings

Ecoregional findings

- Most freshwater habitats insufficiently or completely unprotected in the national Protected Area Network
- Established protected areas fragment entire river systems.
- Top threats on island-wide scale are nutrient loading, deforestation and removal of riverside vegetation and invasive species
- Significant opportunities for freshwater conservation, such as protected areas, Ridge-to-Reef initiatives, environmental education and environmental funding are currently under-utilised.
- Riparian forests are the most degraded or extirpated freshwater community
- Many watersheds and freshwater ecosystems un or under-researched. Up to date information on freshwater biodiversity, practitioners and projects generally absent.
- Insufficient local capacity to assess, plan and implement freshwater biodiversity conservation

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JERP Conservation Strategy example

1) Protect Healthy Freshwater Ecosystems

- Explore existing and future mechanisms for protecting entire river corridors (as protected areas or under watershed protection act, development orders, private land conservation)
- Incorporate lower Rio Grande/ Drivers River into wider Blue and John Crow Mountains Protected Area
- Protect from Cockpit Country north into downstream Martha Brae watershed and/or south into Black River watershed.
- Train water resource management and protected area practitioners in freshwater conservation methods.

JERP Conservation strategy example 2….

2. Mitigate or reduce main threats to marine conservation targets at national and site-scale
   - Explore diversification of fishing practices and selective fishing activities towards reducing fishing pressure at specific pilot sites
   - Improve watershed management in 1-2 priority watershed areas to diminish land-based contamination and sedimentation

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Opportunities for strengthening JERP analysis

- Ground-truthing biological and socio-economic information
- Generating baseline information on biodiversity and threats
- Incorporating climate change models into threats analysis.

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JERP next steps

- Refine draft conservation areas into a network (In progress).
- Integrate Freshwater, Marine and Terrestrial results (May-June 2006)
- Review results with all stakeholders (Mar-June 2006)
- Publish results (June – August 2006)

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Main Results and products

1. Framework and methodology for integrated biodiversity conservation planning in Jamaica.
2. GIS database of freshwater, marine and terrestrial biodiversity and socio-economic factors (http://maps.cathalac.org/website/tncmaps/tncmain.html).
3. A vision of conservation areas and actions for Jamaica's biodiversity.

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End

Questions and Comments are welcome.