

Jamaica Ecoregional Plan

Technical Summary



Essential areas and strategies for conserving Jamaica's biodiversity.

Kimberly John, Ann Sutton, Nathalie Zenny
The Nature Conservancy Jamaica Programme
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JAMAICA ECOREGIONAL PLAN SUMMARY

INTRODUCTION

The Jamaica Ecoregional Planning Project began as part of the Greater Caribbean Ecoregional Assessment (GCERA). Jamaica, the third largest Caribbean island, distinguished by the uniqueness of its biodiversity, with several globally important endemic plants and animals, was selected for in-depth analysis under this project. The Jamaica Ecoregional Plan (JERP), developed in June 2006, outlines the conservation areas and strategies necessary for the survival of Jamaica's freshwater, marine and terrestrial biodiversity. This first iteration is the culmination of a three year effort involving the collection, analysis and synthesis of available biological and socio-economic data relevant to biodiversity conservation on the island and its waters. The 2006 JERP was led by The Nature Conservancy Jamaica Programme and supported by a multidisciplinary group of local and international scientists, technicians and conservation practitioners.

Ecoregional planning is a science-based and data-driven activity aimed at illuminating shared goals and strategies for public and private organisations engaged in the conservation of biodiversity.

Box 1: Who is TNC?

The Nature Conservancy (TNC) is an international non-profit organisation that seeks to preserve the plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. TNC has been actively working to conserve biodiversity in Jamaica since 1989 in collaboration with government, non-government and other agencies.

OBJECTIVES

The objectives of the JERP are:

1. To design a network of conservation areas that will conserve the diversity of species, communities and ecosystems in Jamaica.
2. To guide Jamaica's conservation priorities and actions under the Convention on Biodiversity.
3. To provide a scientific basis and methodology for island-wide conservation planning.

The planning was conducted for three realms; freshwater, terrestrial and marine and then consolidated into a cohesive vision, framework and action plan for conservation.

TECHNICAL APPROACH & RESULTS

Jamaica Ecoregional Planning comprised analyses of the island's biodiversity (habitats, communities and species), human activities that impact the survival and integrity of these systems, and conservation areas and strategies that will conserve biodiversity. The planning steps as outlined in Box 2 generally followed the Geography of Hope (TNC 2000) guidelines, with modifications to fit the Jamaican context. The analysis was based on the best data available at a national scale. ERP is a collaborative process and at all stages, the analysis was subject to **peer review** by local and international experts and environmental managers.

Box 2: Steps in Ecoregional Planning:

- 1) Collect and **analyse information** on habitats, species, human activities, protected areas and conservation projects.
- 2) Establish a **stratification** framework for biodiversity.
- 3) Select and map **conservation targets**: 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) Assess **effectiveness** of current Protected Area network: to establish priorities for protection.
- 8) Design **conservation areas network**
- 9) Develop **conservation strategies**

1) Information Gathering and Management

JERP is an important step towards assembling a national database of biodiversity information in a GIS format. Data gathering was by far the most time consuming step in the planning process and is

still ongoing as more data are generated and the tools for data processing advance. This information is available in the form of maps, spreadsheets and reports.

2) Stratification of the Jamaican Ecoregion (Map 1)

The Caribbean basin was first stratified into freshwater, marine and terrestrial ecoregions (i.e. large areas of land or water defined by their distinct climate, geology and assemblies of natural communities). Stratification of the Jamaican ecoregion is critical in order to account for spatial and genetic variation and to ensure representation and resilience, particularly as it relates to distribution of risks such as disease or natural disturbances such as hurricanes. Terrestrial, freshwater and marine strata are illustrated in Map 1. The freshwater strata, Ecological Drainage Units are groups of watersheds with similar biological, hydrological and climatic characteristics.

3) Conservation Targets (Maps 2-7)

Conservation targets are biological systems (species, ecological communities, and ecological systems) selected to represent the sum biodiversity in a region and the natural processes that maintain it. Two types of targets were selected coarse-filter and fine filter targets:

- **Coarse Filter targets** are ecological systems and communities. Focussing on these habitats ensures the conservation of common and widespread species.
- **Fine filter targets** are single species, assemblages, or communities not adequately represented at the scale of coarse-filter targets. Endangered, endemic, declining, and otherwise unique (such as migratory species) species are candidates for species targets.

- Freshwater Targets:** These included freshwater habitats such as stream networks, lakes and wetlands. These targets were stratified across Ecological Drainage Units (Map 1) to ensure replication of habitat types across the island. Detailed information on the islandwide distribution of Jamaica's freshwater species is limited and in many cases, dated. Therefore special emphasis was placed on selecting freshwater habitats across all environmental gradients such as elevation, geology and hydrology. A total of 17 coarse filter freshwater targets were selected Five endemic aquatic vertebrates were selected as fine filter targets (Box 3)

Box 3: JERP Freshwater Conservation targets

- High altitude headwater streams
- Medium-sized streams
- Large streams
- Karstic streams
- Springs
- Freshwater caves
- Freshwater wetlands
- Coastal springs and streams
- Ponds and lakes
- Endemic fish (4 species)
- Endemic turtle

- Terrestrial Targets:** Seventeen terrestrial targets were identified. These are vegetation classes developed using a simplified geological classification and the best available information on climate. The selection of fine filter targets based on the list of threatened species as defined by IUCN and analyses by Koenig (2004) and Proctor (2003). For plants there were so many potential sites that only sites which support more than four threatened species were selected (Proctor 2003). The selection of fine filter targets was constrained by the availability of geo-referenced information on target distribution. The final list of fine filter faunal targets for Jamaica included Jamaican Iguana, Jamaican Hutia, threatened cave bats,

Box 4: JERP Marine Conservation targets

- Sandy shores
- Rocky shores
- Sea turtle nesting beaches
- Mangroves
- Estuarine areas
- Seagrass beds
- Corals & coral reefs
- Soft bottom communities
- Seabird nesting & roosting areas
- Overwintering shorebird areas
- Cays
- Inshore & offshore banks
- Manatees

endemic frogs, endemic parrots and Giant Swallowtail Butterfly and West Indian Whistling Duck.

- iii. **Marine Targets:** Thirteen marine JERP targets were identified based on ERP criteria and those targets set at a regional level for the Greater Caribbean Ecoregional Assessment (Box 3). These targets range from coarse to fine filter, including ecosystems such as coral reefs, mangroves and seagrass beds, aggregations of breeding and roosting seabirds and migrant shorebirds and manatee occurrences (Box 4).

4) Threats and Ecological Integrity Assessment (Map 8-10)

Threats were defined as human and human-mediated activities that degrade freshwater, marine and terrestrial biodiversity. These include ecological stresses associated with agriculture, point-source pollution, resource extraction, invasive species, and direct habitat destruction and fragmentation. These threats were mapped and summarised into freshwater, marine and terrestrial *cost surfaces*. A cost surface is a map of the sum impact of human activities on biodiversity, described as a *human footprint*. The cost surfaces developed during JERP represent the distribution and area of influence, and intensity of each threat to freshwater, marine and terrestrial biodiversity. The cost surfaces indicate that areas of dense settlement, intensive agriculture and resource extraction have the highest cost for conservation purposes (in red) and rural, less accessible areas have lower associated costs (in green and blue). The threats analysis did not map all threats such as climate change and over-exploitation of freshwater biodiversity although it was recognized that these are major threats to the island’s biodiversity.

Table 1: Top threats to freshwater, marine and terrestrial biodiversity in Jamaica.

Freshwater	Marine	Terrestrial (draft)
Nutrient Loading (agriculture and agro-processing)	Coastal development	Mining
Invasive species (Australian redclaw, and other exotic aquaculture and aquarium species)	Land run-off	Invasive species
Deforestation and removal of riparian vegetation.	Overfishing	Unsustainable use of resources, eg deforestation.
Unsustainable harvesting of freshwater biodiversity.	Solid waste pollution	Poor land use planning

5) Protected Area Gap Assessment (Map 11)

A gap assessment was conducted to determine the effectiveness of the current protected area network in the conservation of freshwater biodiversity and thus to identify and recommend freshwater priorities for protection in a revised conservation area network. Three aspects of the Protected Area Network were analysed:

- Representation: indicates whether the target is represented and replicated sufficiently in the PA network.
- Ecological Integrity: indicates whether the represented targets are in adequate ecological condition and whether factors such as connectivity.

- Management: indicates whether the represented targets are protected in reality by the appropriate management systems.

The gap assessment of Jamaica's protected area network indicated the following:

Freshwater

- 1) *Almost 50% of Jamaica's FW habitats are under or unrepresented in Jamaica's protected area network.*
- 2) *The current PA network fragments freshwater systems and does not preserve the longitudinal and lateral connectivity of freshwater ecosystems.*
- 3) *The existing Protected Areas apart from Blue and John Crow Mountains National Park do not explicitly manage or monitor freshwater ecosystems. Thus the effectiveness of these management systems is poor.*

Terrestrial:

- 4) *All terrestrial targets except wet extrusive were represented. However, several targets are insufficiently protected to guarantee long term survival. These include dry extrusive, dry limestone, dry sedimentary, premontane wet extrusive, premontane wet intrusive, premontane wet ultramafic, wet intrusive, wet limestone.*
- 5) *Connectivity of terrestrial ecosystems was not included in the present protected area network.*

Marine:

- 6) *Overall target representation within PAs in the Northern and Southern Marine Stratification Units (MSUs) is relatively good. However Eastern MSU targets are very poorly represented in the PA system and the entire Pedro Bank MSU has no PA representation*
- 7) *The current PA system does not consider any large seascape functions and connectivity inherent to marine environments*
- 8) *While the assessment reveals a certain level of existing marine biodiversity representation within Marine Protected Areas, the management effectiveness for actually protecting this biodiversity is very poor.*

6) Conservation Goals

Conservation goals define the amount and spatial distribution of targets that are needed to adequately conserve the biodiversity in an ecoregion. Setting such goals enables planners to measure how successfully a network of conservation sites represents and conserves targets in an ecoregion. Jamaica, as a signatory to the Convention on Biological Diversity, has committed to conserving at least 10% of its biodiversity in protected areas by 2015. 10% of the current distribution of targets was used as a minimum goal. Additionally target-specific goals were developed to assign higher conservation goals (up to 50%) to targets that are exceptionally threatened or reduced in size, under-represented in the current protected area network.

The stratification was used to ensure that spatial and genetic variation, and target resilience, was incorporated in conservation areas. Therefore, wherever possible, more than one example of each target was represented in the conservation area network.

7) Conservation Areas (Map 12 and 13)

Conservation areas were selected to efficiently achieve conservation goals for targets. These are areas with high importance for biodiversity combined with relatively low levels of human activity, where it is feasible to implement biodiversity management strategies. Conservation areas for each realm were determined as follows:

SPOT & MARXAN

SPOT and Marxan operate in similar ways to model conservation area networks. Both programmes cluster geographical units of analysis (in this case hexagons of 1km side) by way of an optimisation algorithm that minimises the total cost of a conservation network while selecting sites with the largest amount of conservation targets. The main inputs for SPOT and Marxan were the target distributions, cost surface and conservation goals.

- Freshwater: GIS-based decision-support software SPOT (Spatial Optimisation Tool) and, Marxan, and a Watershed Prioritisation model.
- Terrestrial: Marxan, Connectivity analysis, Relative Biodiversity Index, Fragmentation Analysis and Regional Importance
- Marine: Marxan and a prioritisation of Areas of Marine Biodiversity Significance.

Freshwater, Marine and Terrestrial conservation areas were integrated based on the following criteria:

1. **Overlap:** This includes places where conservation areas are geographically intersected as well as juxtaposed areas that are ecologically connected. Areas important to all three realms were ranked as highest priority followed by areas important to two realms.
2. **Significance:** High Priority areas outside areas of overlap.

Table 2: Priority conservation areas (Integrated Freshwater, Marine and Terrestrial conservation areas)

Conservation Area	DESCRIPTION
Black River/Cockpit/Martha Brae	Area includes Cockpit Country, Black River Upper and Lower Morass, coastal area of South-central St. Elizabeth and Martha Brae watershed, Falmouth wetlands and adjacent coastal areas.
Northeast Portland	Rio Grande and Driver's River watersheds, wet limestone forest and connected coastal area.
Rio Bueno	Rio Bueno watershed, upland wetlands and wet limestone forest, endemic plants, important coastal systems.
Portland Bight	Lower Rio Cobre and Lower Rio Minho, Hellshire Hills, Braziletto Mountains, Portland Ridge and Round Hill including Portland Bight coastal area and cays.
Negril	Coastal Negril, Negril Morass and Fish River Hills.
Upper Cabarita/ Dolphin Head	Includes Upper Cabarita watershed, Dolphin Head and adjacent areas of significant plant endemism.
Yallahs	Yallahs watershed which possibly includes rare vegetation classes due to distinct geology and endemic Yellow Boa.
Pedro Bank	Submerged marine plateau, 90km southwest of mainland Jamaica, includes three small cays, coral reefs and other marine habitats.

9) Conservation strategies (Table 2)

Conservation strategies are activities that either abate the threats to or restore and maintain the ecological integrity of conservation targets. Ideally conservation strategies in ecoregional plans are effective over multiple areas and are prioritised according to how well they protect biodiversity in all three realms (freshwater, terrestrial and marine), feasibility and urgency of action (as in the case with severe threats or narrow windows of opportunity for action). JERP conservation strategies were explicitly linked with the

findings of the Protected Area Gap Assessment and the Threats Assessment, and will be focussed on conservation areas.

Table 3: Summarised JERP conservation strategies	
1. Policy-based actions	<i>Improve policy framework for conservation and develop management and restoration plans for priority conservation areas:</i>
1.1. Policy	<ol style="list-style-type: none"> 1. Support inclusion of inland fisheries and completion of new draft Fisheries Policy and Fishing Bill for Cabinet review and legislation. 2. Revise Protected Area Policy to reflect JERP recommendations such as: <ul style="list-style-type: none"> ▪ Designating and protecting entire river corridors. ▪ developing existing and future mechanisms for protecting freshwater ecosystems (rivers, ponds and caves), on private lands for example. ▪ incorporating high-priority conservation areas identified within JERP 3. Develop policies for community-based management of freshwater ecosystems in critical areas outside of established Protected Areas. 4. Develop a National Freshwater Policy and Plan.
1.2. Management plans	<ol style="list-style-type: none"> 1. Rio Grande Management Plan 2. Black River and/or Martha Brae Management Plan 3. Support implementation of existing Recovery/Restoration Plans for high-priority targets (e.g. Manatee, Sea Turtles, Jamaican Iguana)
1.3. Legislation	<ol style="list-style-type: none"> 1. Develop mechanisms for conservation on private lands e.g. regulations under Watershed Protection Act and promote enactment of draft regulations relating to conservation easements. 2. Support legislation to prevent new introductions of invasive species 3. Support proposed revisions to Forest Act and build capacity for biodiversity conservation
2. Communication and Education-	<i>Improve technical capacity and public awareness in support of conservation</i>
2.1. Formal education	<ol style="list-style-type: none"> 1. Train students in freshwater conservation methods through internships, short courses and volunteer programme.
2.2. Awareness	<ol style="list-style-type: none"> 1. Design and implement a public awareness campaign promoting freshwater conservation and the importance of freshwater ecosystems to Jamaica's society and economy targeting the main players in environmental management and education, funding, conservation and development sectors. 2. Develop and disseminate public education materials (including school curriculum items) on the importance of freshwater ecosystems to Jamaica's society and economy and their status. 3. Develop and disseminate public education materials on Jamaica's fisheries and coral reef crisis and the importance of restoration/protection of these resources in their provision of critical environmental services.
2.3. Capacity-building/ Training	<ol style="list-style-type: none"> 1. Train water resource management and protected area practitioners in freshwater conservation methods (planning, implementation and monitoring). 2. Promote capacity-building of marine managers through JPAT network.
2.4. Other	<ol style="list-style-type: none"> 1. Initiate regular TNC-hosted Caribbean basin-wide conferences/symposia on freshwater biodiversity and conservation
3. Research actions	<i>In collaboration with the University of the West Indies, design an applied National Biodiversity Research framework which will underpin and inform Jamaica's biodiversity conservation and management strategies and address important conservation gaps (species, communities, important ecological phenomena)</i>

Table 3: Summarised JERP conservation strategies	
3.1 FRESHWATER RESEARCH	<p>Primary Freshwater research areas:</p> <ol style="list-style-type: none"> a. Biology, distribution and status of Jamaica’s endemic and migratory freshwater species and riparian communities b. Population dynamics, sustainability and management requirements for economically and nutritionally important freshwater species; e.g. freshwater shrimp, mullets and other freshwater fish. c. Status and distribution of invasive species that harm freshwater systems. d. Compile freshwater database of existing ecological and geographical data on freshwater biological systems in Jamaica. e. Contribution of ecological products and services provided by freshwater ecosystems to Jamaica’s society and economy particularly in priority freshwater conservation areas.
MARINE RESEARCH	<ol style="list-style-type: none"> f. Status of rare, endangered and keystone coastal and pelagic species such as manatees, cetaceans, sharks, turtles, crocodiles g. Historic (and current) fish and conch spawning aggregations h. Marine micro and meiofauna i. Essential breeding, nesting and feeding areas (especially for keystone, rare and endangered species) j. Establish a well-documented historic baseline for conservation targets (species, habitats & ecosystems) k. Develop a national digital bathymetry dataset.
TERRESTRIAL RESEARCH	<ol style="list-style-type: none"> l. Groundtruth southern St. Thomas (and other focal areas) vegetation target status to verify conservation importance. m. Develop and test restoration techniques for high priority targets and invasive species control, e.g. Bamboo n. Develop project to produce revised terrestrial classification and mapping of vegetation classes
3.2 CROSS-CUTTING RESEARCH PRIORITIES	<ol style="list-style-type: none"> o. Research ecological processes (e.g. migration) and connectivity as a basis for refining and revising protected area boundaries p. Explore diversification of fishing practices and selective fishing activities towards reducing fishing pressure at important inland fishery sites (Black River, Rio Grande) and q. Further develop and refine the JERP Cost Surface model for use as an applied management (and predictive) tool as well as a research and learning tool for tertiary-level and Integrated Coastal Management training.
4. Conservation Area Management	<i>Promote protected areas as ecologically functional land and sea-scapes and as a platform for managing and rehabilitating representative ecosystems.</i>
4.1.Functional Land /Seascapes	<ol style="list-style-type: none"> 1. Append lower Rio Grande/ Drivers River to wider Blue and John Crow Mountains Protected Area to create a functional protected area with upstream-downstream connectivity. 2. Protect from Cockpit Country north into downstream Martha Brae watershed and/or south into Black River watershed to create a functional protected area with upstream-downstream connectivity. 3. Improve watershed management in 1-2 priority watersheds (e.g. Rio Grande, Black River, Martha Brae or Drivers River) to demonstrate practical approaches to integrated freshwater, terrestrial and coastal ecosystem management. 4. Target Pedro Bank as an effective offshore Fisheries Management Area with a Management Plan, zoning regulations and surveillance.

Table 3: Summarised JERP conservation strategies	
4.2. Monitoring	<ol style="list-style-type: none"> 1. Develop monitoring networks and protocol to provide current islandwide information on the status of freshwater ecosystems 2. Standardize marine monitoring techniques across Jamaica for comparative national-scale analysis.
4.3. Restoration	<ol style="list-style-type: none"> 1. Control/eradicate invasive species (e.g. <i>Cherax</i>, Bamboo), prevent new introductions and restore native species in critical areas such as Black River watershed and Pedro Bank. 2. Reduce over-harvesting and river-poisoning in Rio Grande watershed through participatory community-based initiatives. 3. Reduce nutrient levels in the following critical conservation areas: <ol style="list-style-type: none"> a. Upper Martha Brae watershed: by piloting and promoting appropriate sewage disposal technology. b. Black River and lower Martha Brae watersheds: through working with agribusiness interests (sugar cane, and aquaculture) to implement appropriate waste-water technology and systems. 4. Restore riparian zones with native species in critical areas: Rio Grande, Black River and Martha Brae.
4.5. Protected areas	<ol style="list-style-type: none"> 1. Build technical and management capacity to manage ecosystems within PAs through a pooled expert base within the Jamaica Protected Areas Trust (JPAT). 2. Conduct management effectiveness assessment within existing PAs. 3. Revise current PA categorization to reflect and conform to international standards. 4. Support active biodiversity management within JERP-identified high-priority Forest Reserves (including development of Management Plans) 5. Promote Conservation Action Planning (CAP) methodology as a method for site-based conservation management 6. Increase level of protection of Morant Point Game Reserve. 7. Designate the Port Antonio Proposed Protected Area under the NRCA Act. 8. Support active biodiversity management within Bowden Fishing Sanctuary.
4.5. Community-based initiatives	<ol style="list-style-type: none"> 1. Support community-based management of inland fisheries (and other resources) in Rio Grande and Black River. 2. Engage the Jamaica Fisherman's Co-operative Union and other south coast co-operatives and fishing associations in advancing the idea of and generating support for co-management of Pedro Bank fisheries
5. Enforcement and Compliance	<i>Strengthen existing structures to ensure compliance with environmental statutes in support conservation areas.</i>
	<ol style="list-style-type: none"> 1. Support the Fisheries Division in training and placing River wardens in priority freshwater conservation areas. 2. Support stakeholders' compliance with water quality standards in critical conservation areas such as Black River. 3. Engage and train Marine Police, JDF Coast Guard, the Courts and fishing communities in active conservation & enforcement
6. Species-based actions	<ol style="list-style-type: none"> 1. Develop Jamaica Red List database
7. Conservation Funding	Raise funding and in-kind contributions to support priority conservation strategies.
	<ol style="list-style-type: none"> 1. Devise long-term sustainable financing strategies specifically targeting PAs through JPAT 2. Mobilise funding for priority freshwater conservation actions as part of the JERP. 3. Engage local private sector at high-priority, high-profile sites for financial and other support (e.g. Pedro Bank)

MAIN PRODUCTS AND CONCLUSIONS

The main products of the Jamaica Ecoregional Plan are as follows:

1. Framework and methodology for integrated biodiversity conservation planning in Jamaica.
2. GIS database of freshwater, marine and terrestrial biodiversity and the socio-economic factors that affect biodiversity (<http://maps.cathalac.org/website/tncmaps/tncmain.html>).
3. Recommended conservation areas and actions for Jamaica's biodiversity. These are available from TNC as full and summary reports for integrated, freshwater, marine, and terrestrial analyses.

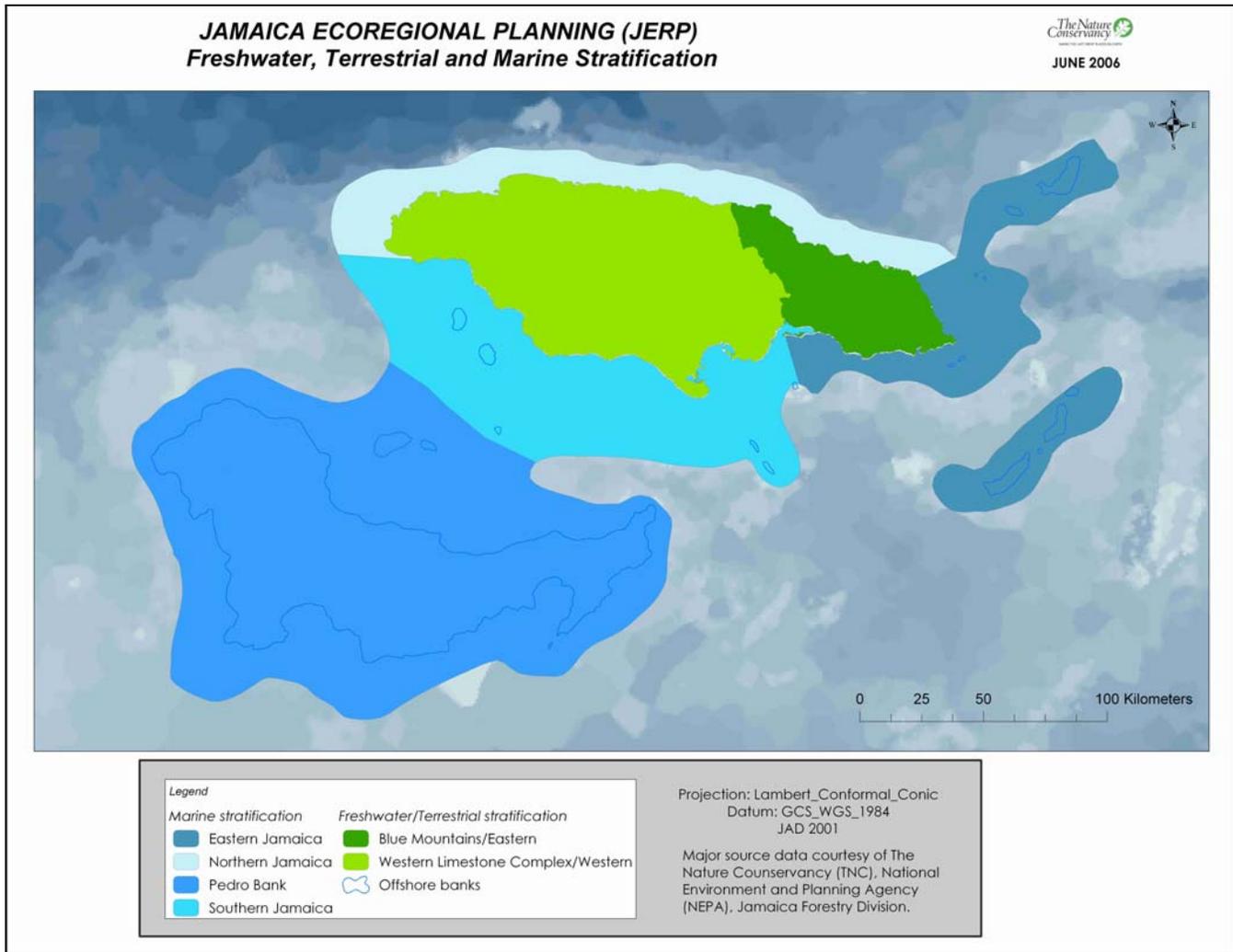
The next steps will be to initiate actions in the highest priority conservation areas and to improve the data used to inform biodiversity conservation.

Finally we hope that this Jamaica Ecoregional Plan will guide comprehensive, effective, highly-leveraged and long lasting conservation in Jamaica. We cannot accomplish this task alone, and hope to work closely with conservation partners and stakeholders to implement the plan and achieve long-awaited conservation success.

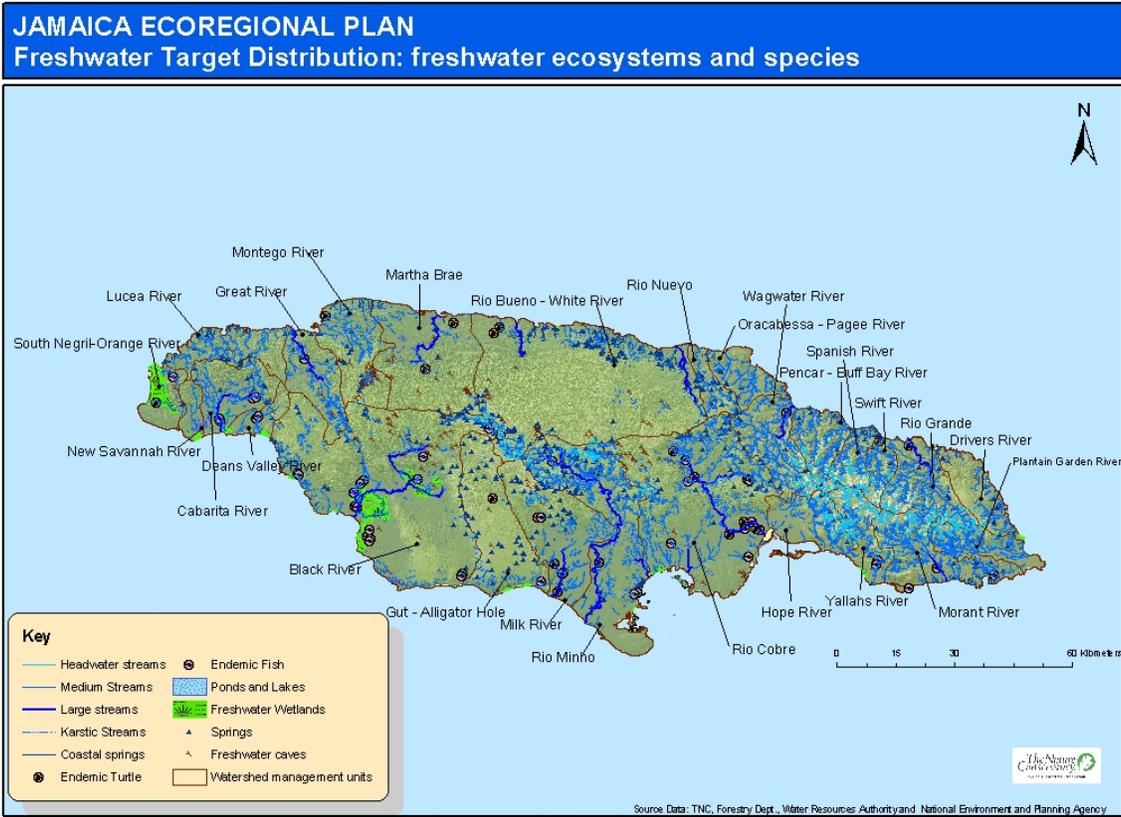
Acknowledgements

TNC Jamaica deeply appreciates the support we received during the ecoregional assessment between January 2003 and June 2006. This assessment for Jamaica was possible only because of the contributions and critique of several persons and agencies. It drew heavily on information that was previously generated and analysed by Water Resources Authority (WRA), National Environment & Planning Agency's (NEPA) Sustainable Watersheds and Information Technology Branches, and the Ministry of Agriculture's Forestry Department and Fisheries Division. Additional support was obtained from the Jamaica Public Service Company, the National Irrigation Commission and the Mines and Quarries Division (MQD) of the Ministry of Land and the Environment.

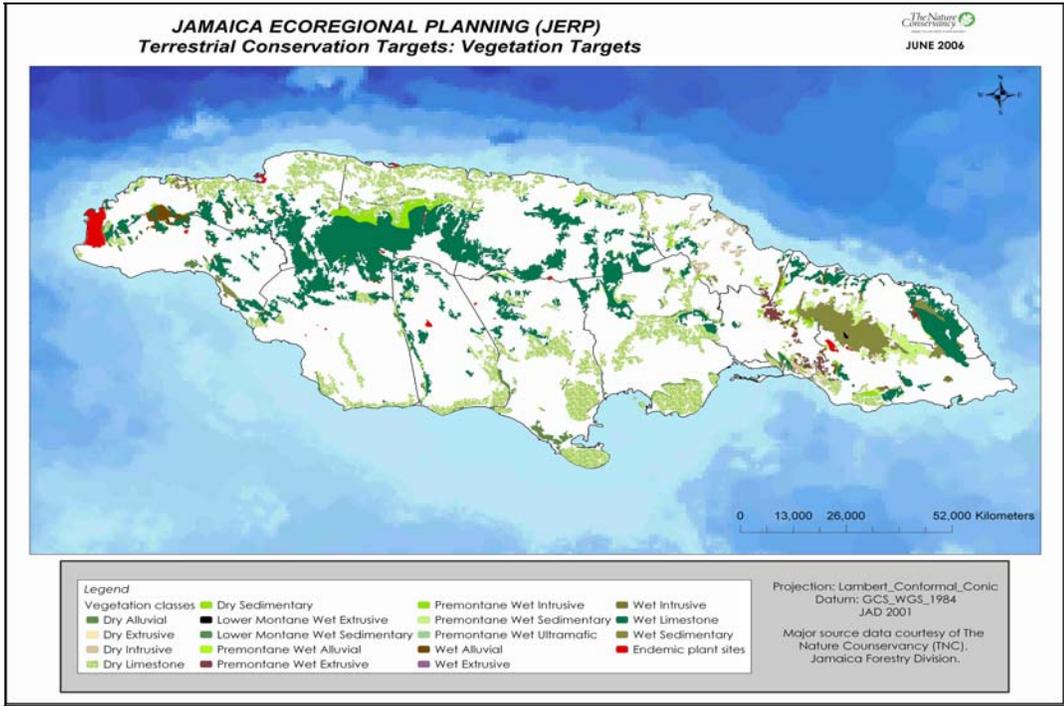
JERP MAPS AND DIAGRAMS:



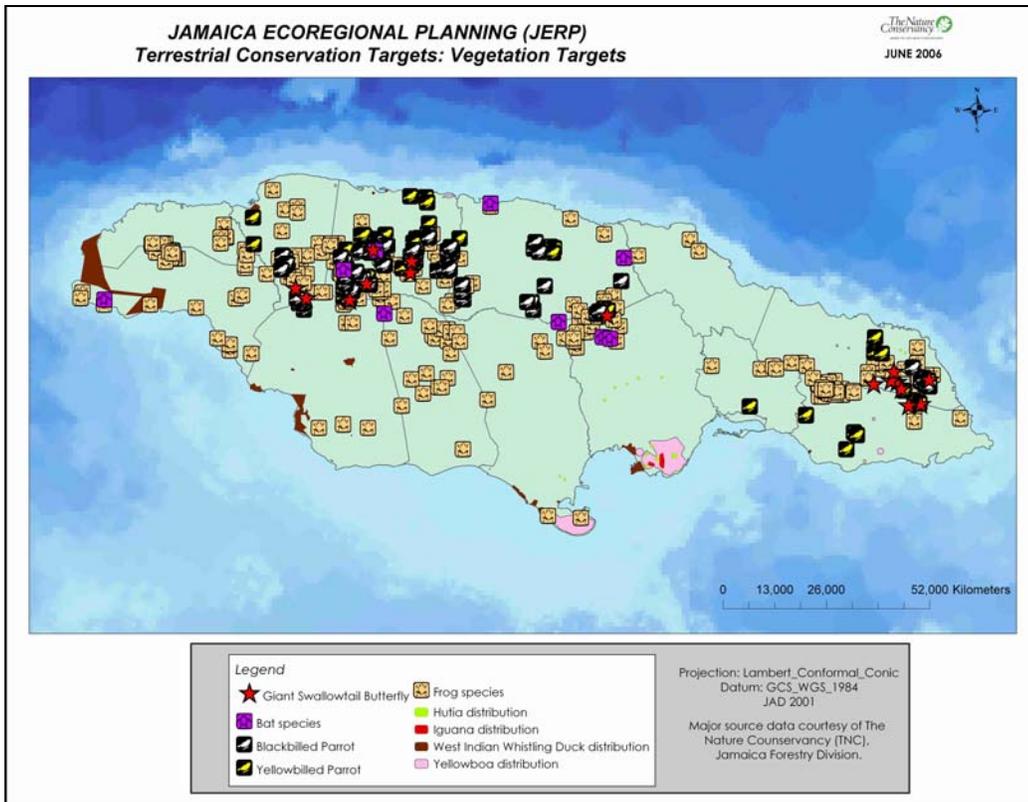
Map 1 Stratification of Freshwater, Terrestrial and Marine Jamaica Ecoregion



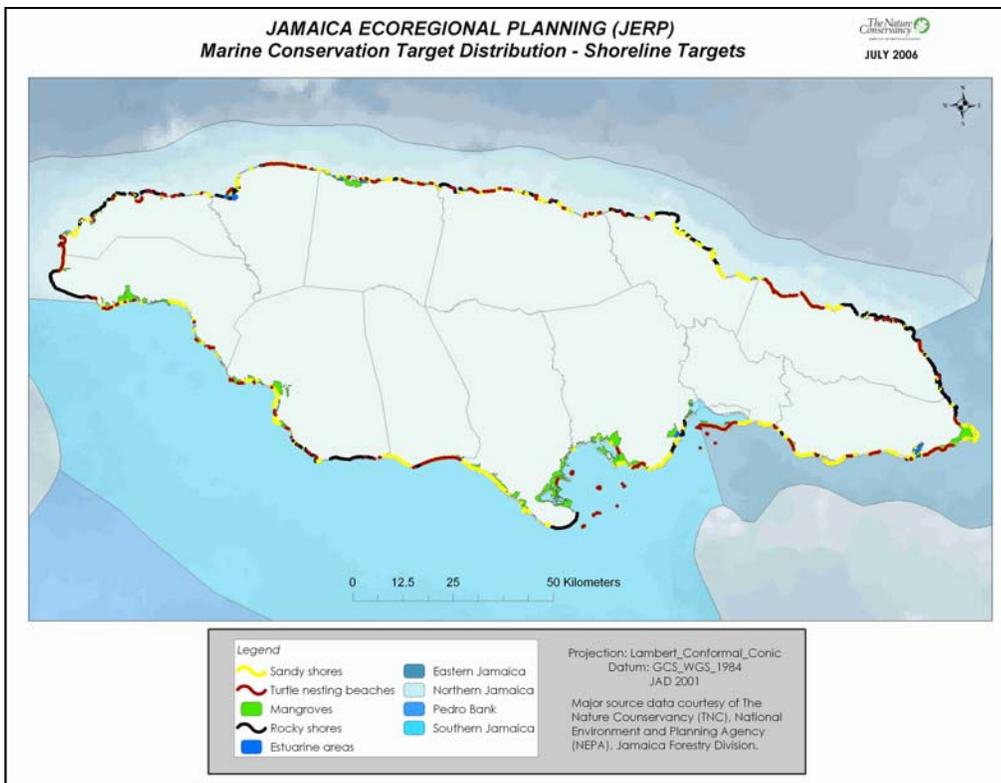
Map 2 Distribution of freshwater conservation targets in Jamaica



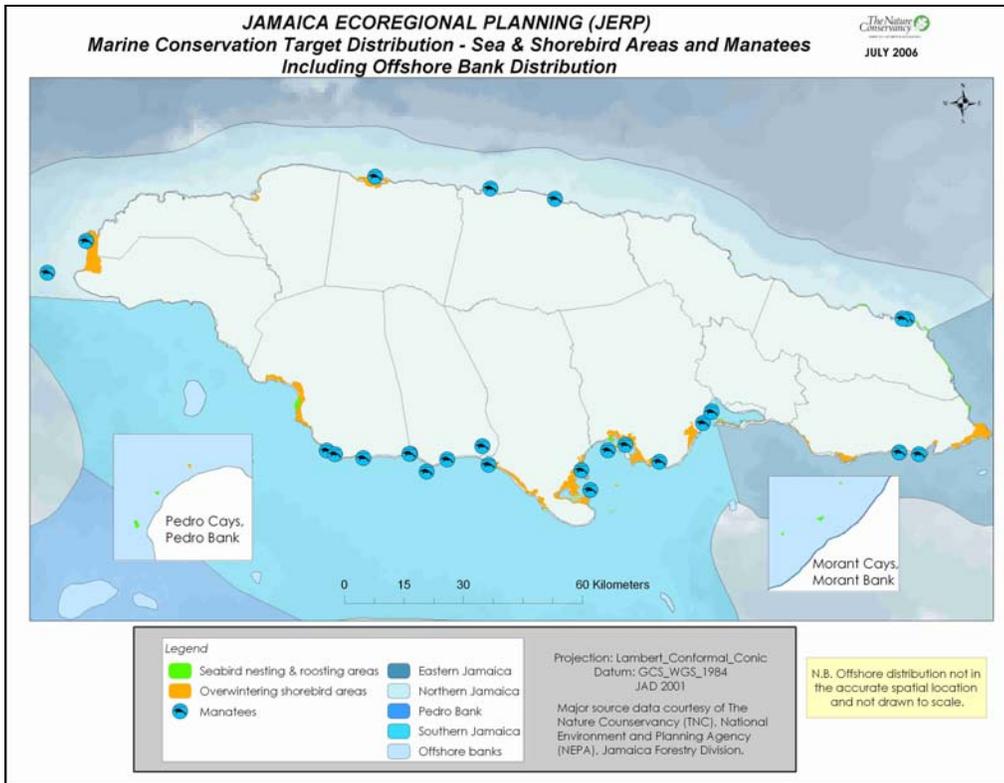
Map 3: Distribution of terrestrial vegetation conservation targets in Jamaica.



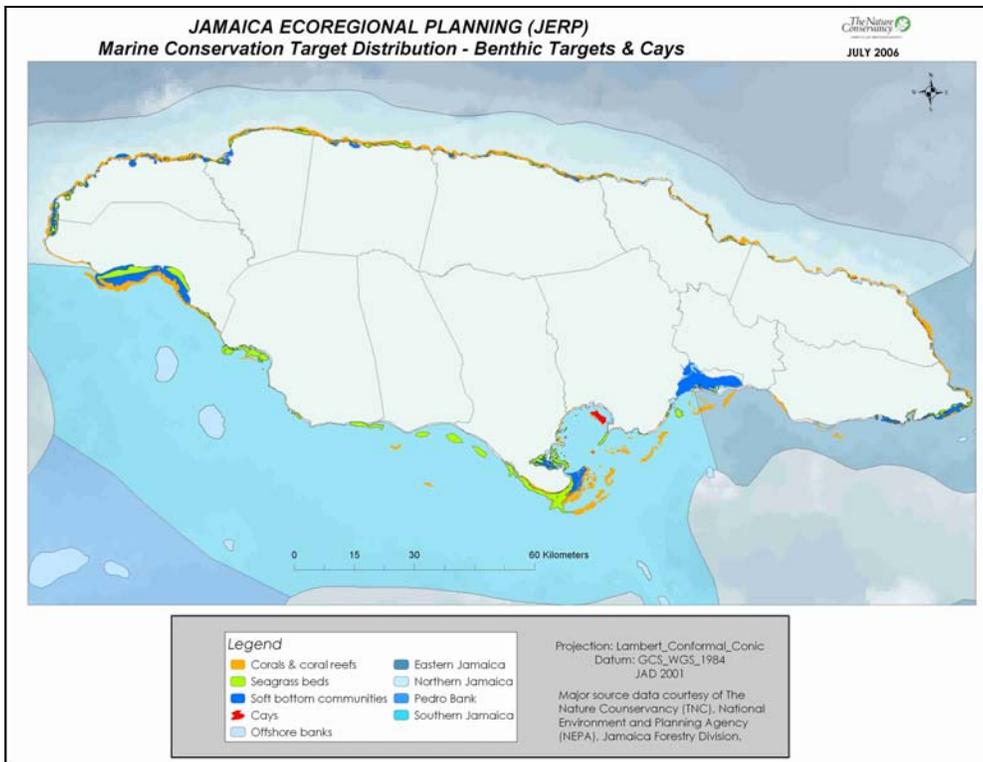
Map 4 Distribution of terrestrial faunal conservation targets in Jamaica.



Map 5: Distribution of marine shoreline conservation targets in Jamaica



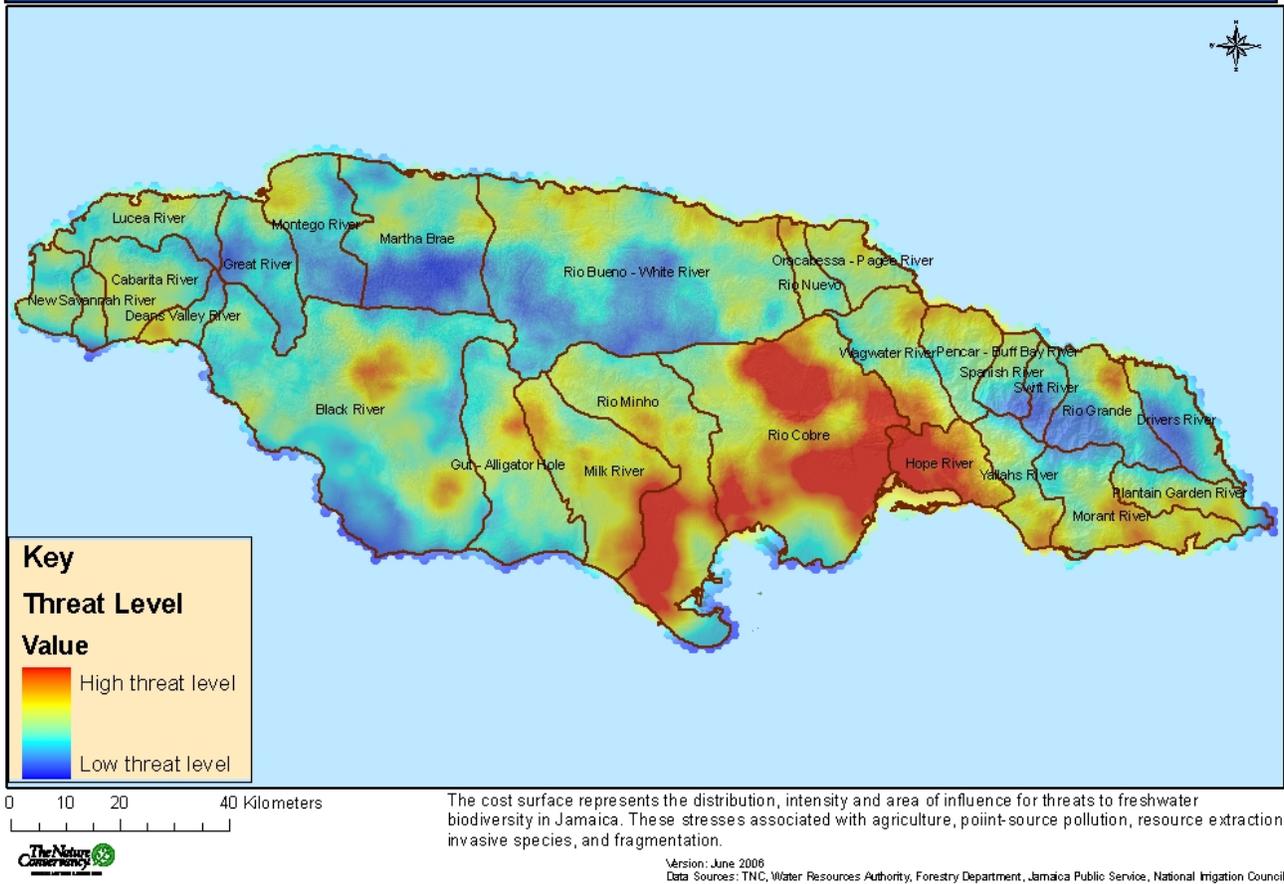
Map 6 Distribution of marine conservation targets in Jamaica, seabird and shorebird areas and manatees.



Map 7: Distribution of marine conservation targets in Jamaica, benthic targets and cays.

JAMAICA ECOREGIONAL PLAN: Freshwater Cost Surface

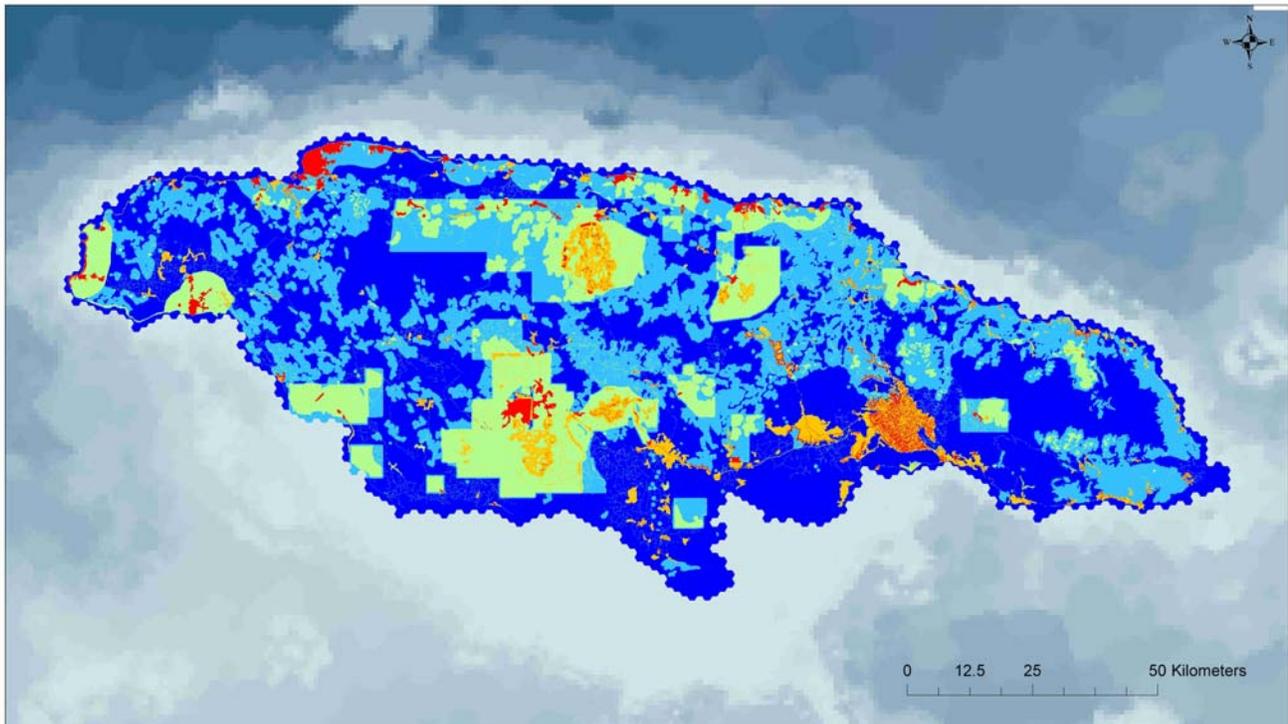
The intensity and distribution of threats to freshwater biodiversity



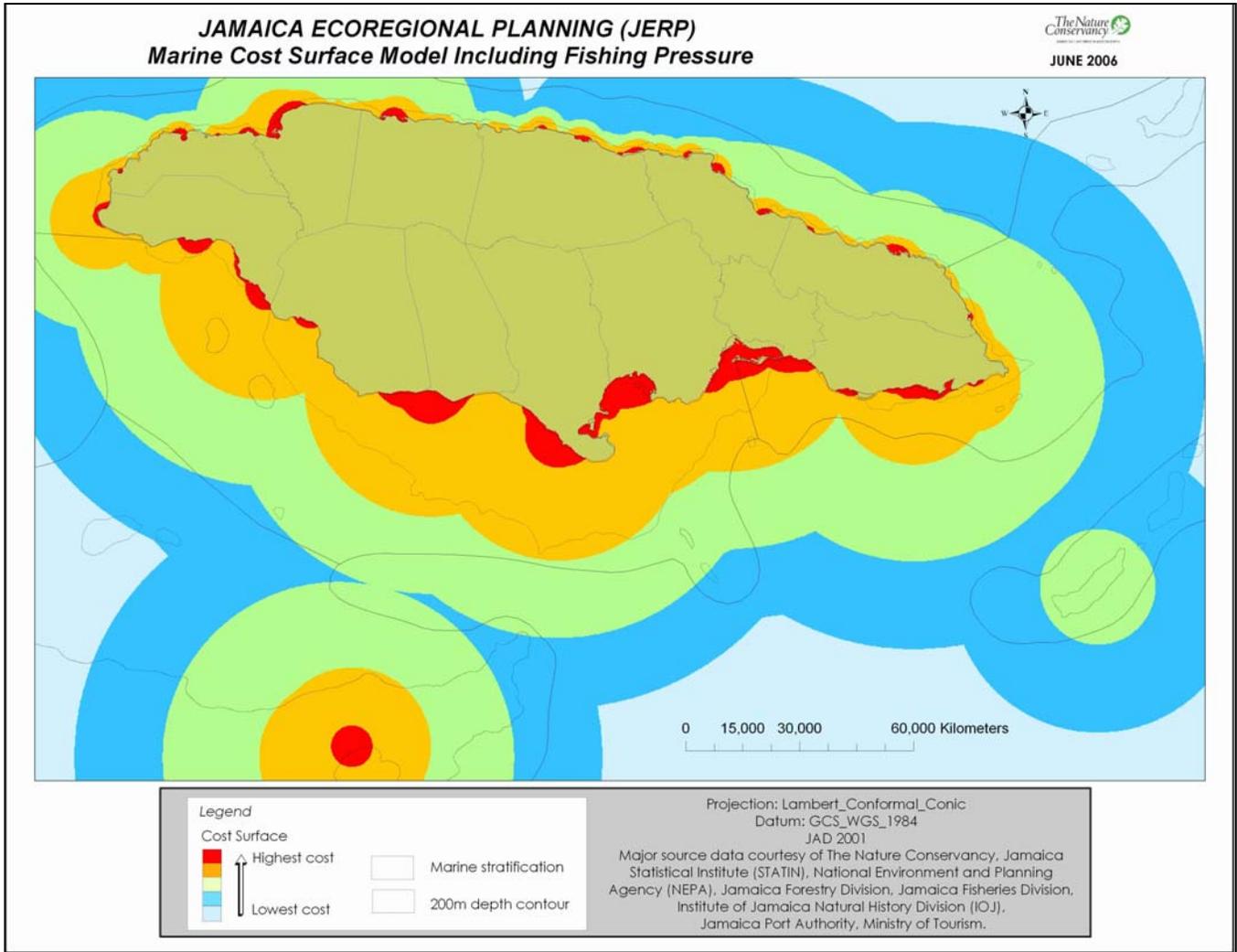
Map 8: Freshwater Cost Surface

JAMAICA ECOREGIONAL PLANNING (JERP)
Terrestrial Cost Surface

The Nature
Conservancy
JUNE 2006

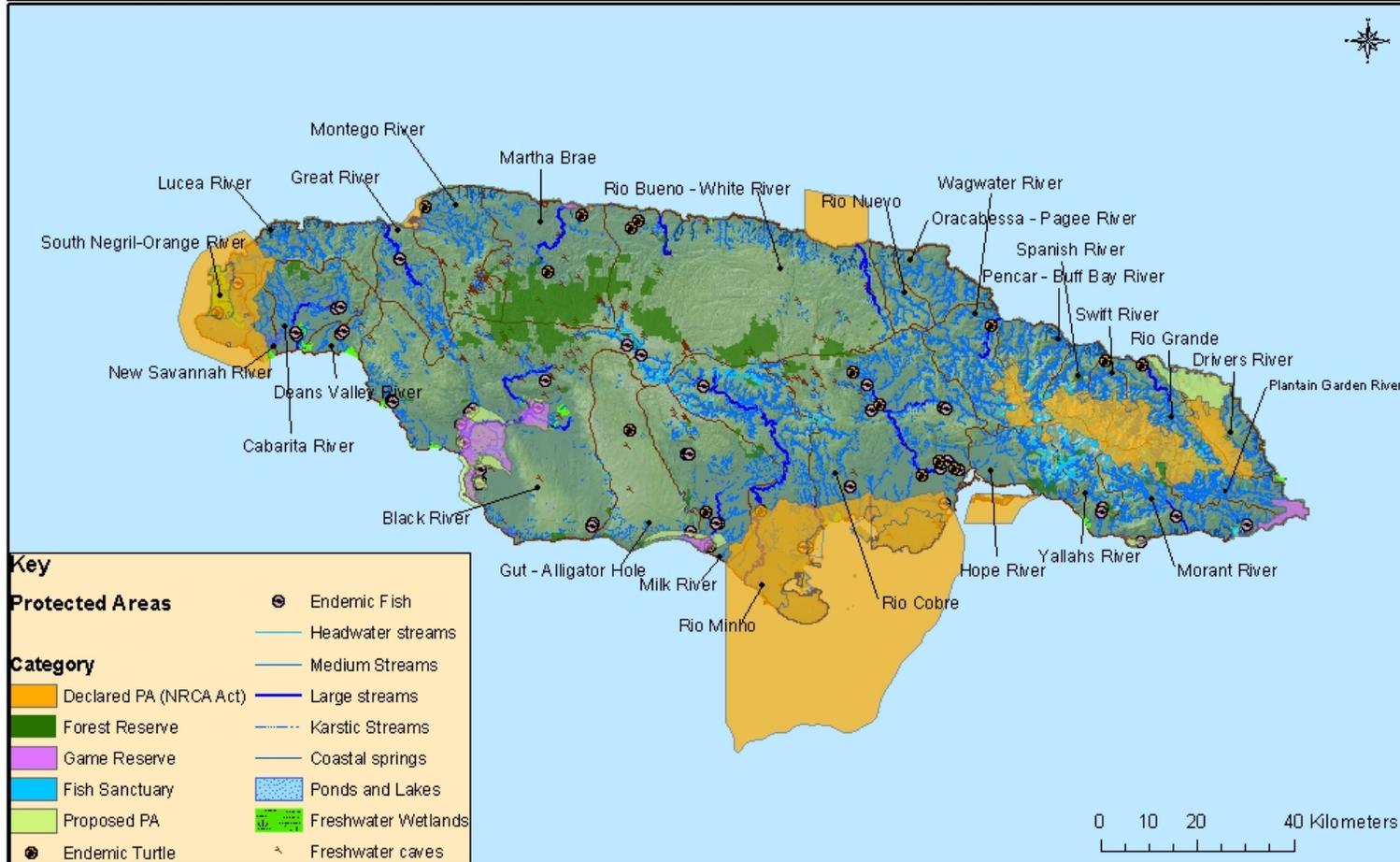


Map 9: Terrestrial Cost Surface



Map 10: Marine Cost Surface

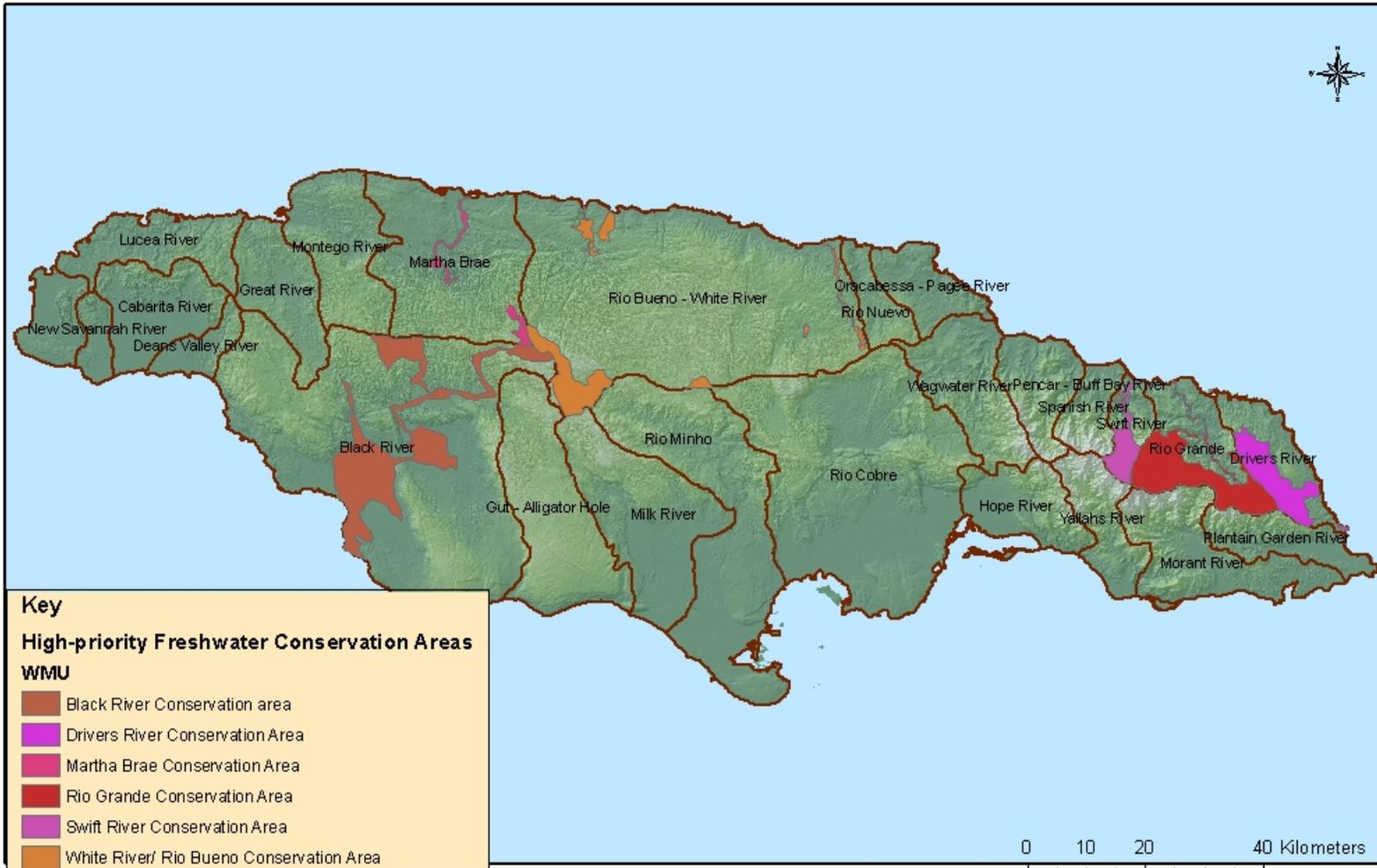
JAMAICA ECOREGIONAL PLAN: Protected Area Gap Assessment- Distribution of Jamaica's protected areas.



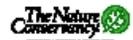
Version: June 2006
Data Sources: TNC, Forestry Department, Water Resources Authority and National Environment & Planning Agency

Map 11: Protected area gap assessment

JAMAICA ECOREGIONAL PLAN: Freshwater Conservation Areas*

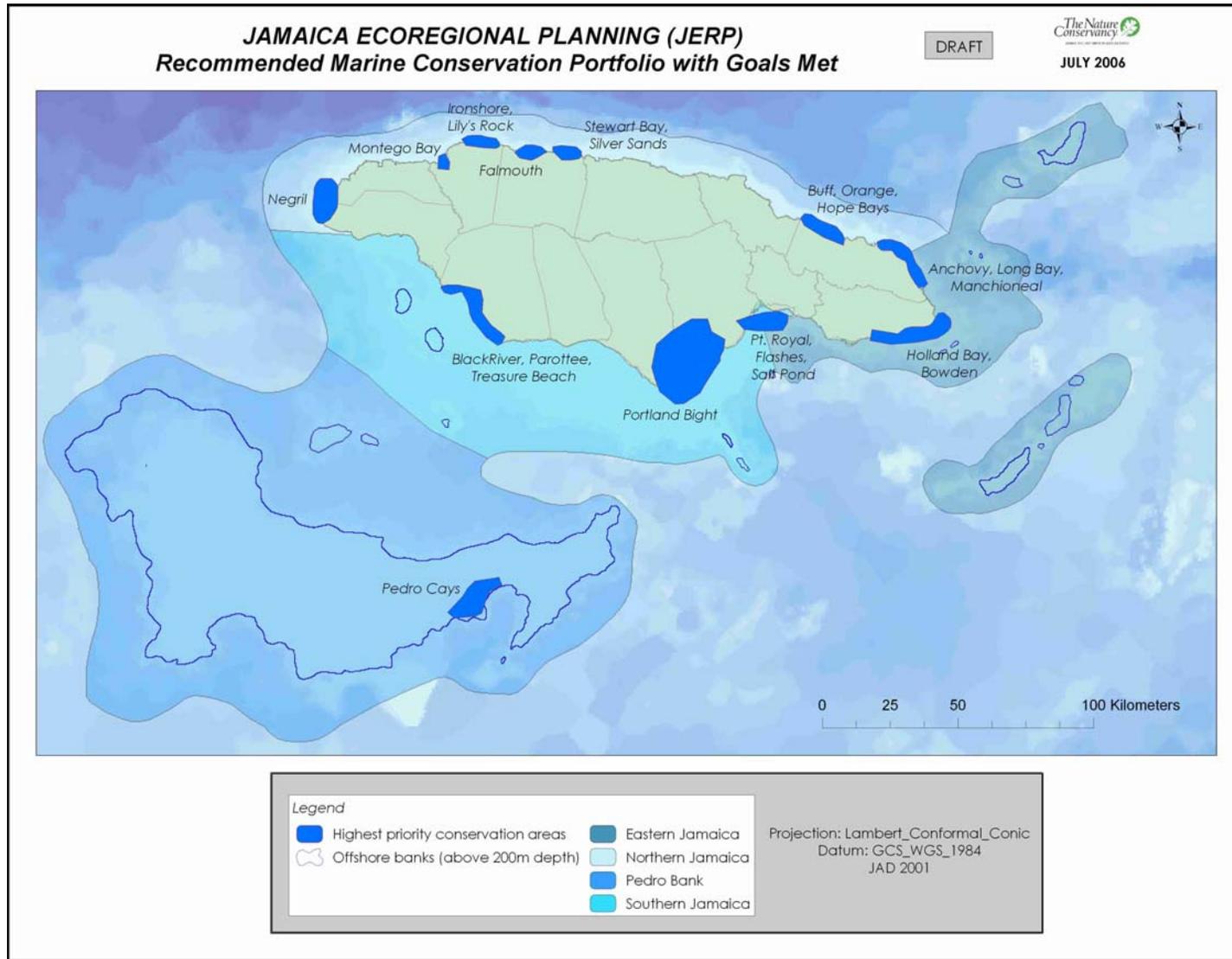


* Freshwater Conservation Areas have high importance for freshwater biodiversity combined with relatively low levels of human activity where it is feasible to implement biodiversity management strategies because of existing protected areas. These areas also meet Jamaica's conservation goals for freshwater biodiversity protection. Conservation areas were determined based on watershed prioritisation analyses, and SPOT and Marxan portfolios.



Version: June 2006
 Data Sources: TNC, Water Resources Authority, Forestry Department, Jamaica Public Service, National Irrigation Council

Map 12: High Priority Freshwater Conservation Areas



Map 13: High Priority Marine Conservation Areas.