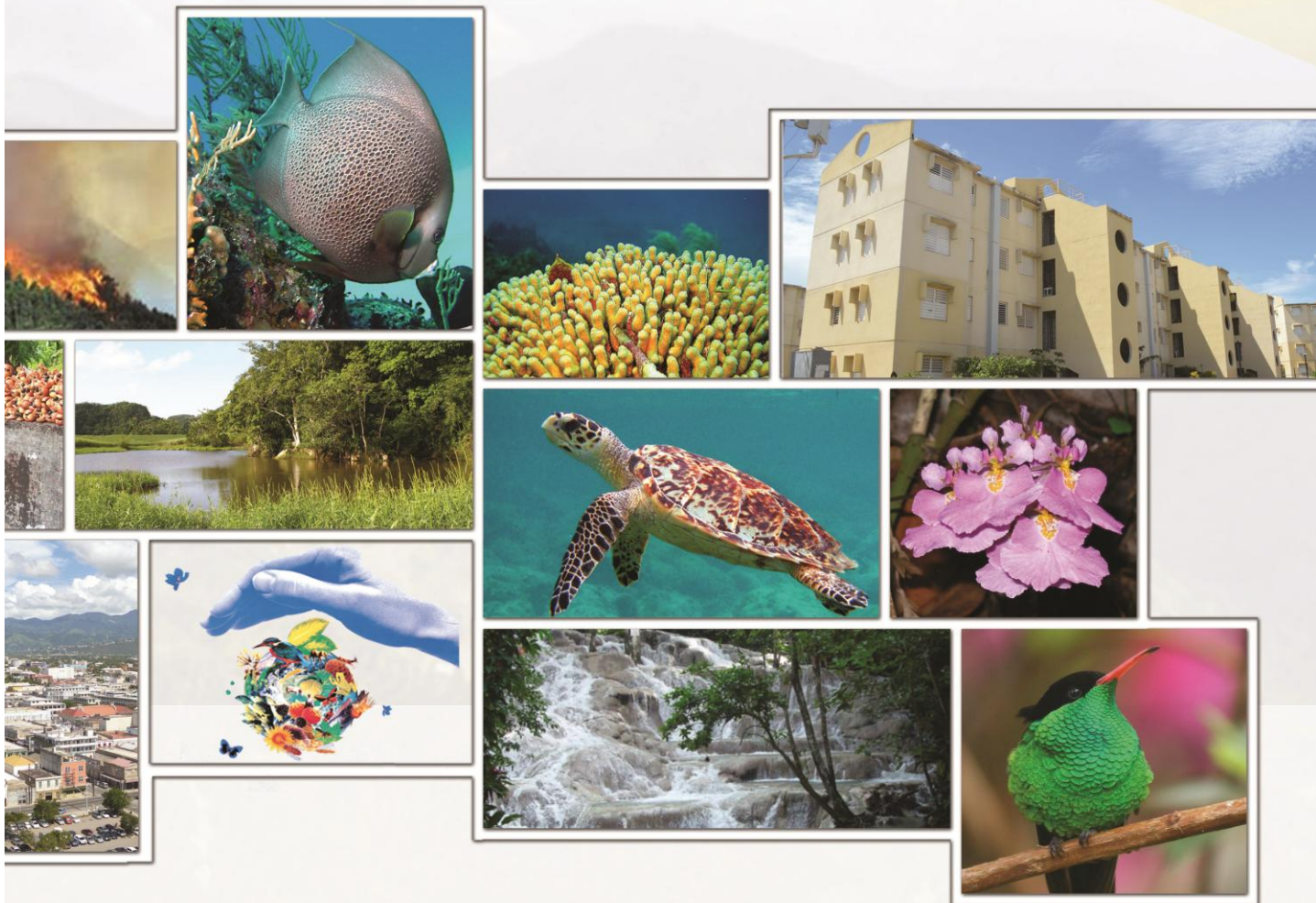




MINISTRY OF ECONOMIC
GROWTH & JOB CREATION



National Environment
and Planning Agency



STATE ^{OF THE} ENVIRONMENT REPORT 2013

Jamaica



State of the Environment Report 2013 Jamaica

STATE OF THE ENVIRONMENT REPORT 2013

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Published by: The National Environment and Planning Agency,

10-11 Caledonia Avenue,

Kingston 5,

Jamaica

(876) 754-7540

www.nepa.gov.jm



This report was prepared with financial support from the European Union



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NATIONAL LIBRARY OF JAMAICA CATALOGUING-IN-PUBLICATION DATA

ISBN 978-976-654-007-4

“Since we’ve been in our mother’s tummy as a tiny cell, we’ve been given an important message from life itself: We’ve gotta learn to hang on, latch on to mother, don’t let go of life man!”

Shabba (Taxi Driver in Kingston, Jamaica)

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LIST OF ACRONYMS

AIA	Advance Informed Agreement
AQI	Air Quality Index
AQMN	Air Quality Monitoring Network
BCH	Biosafety Clearing-House
CABI	Centre for Agriculture and Biosciences International
CARICOM	Caribbean Community and Common Market
CBD	Convention on Biological Diversity
CBO	Community-based Organization
CCADRRP	Climate Change Adaptation and Disaster Risk Reduction Project
C-CAM	Caribbean Coastal Area Management Foundation
CCCL	Caribbean Cement Company Limited
CPHDF	Caribbean Plant Health Directors Forum
CABI	Centre for Agriculture and Bioscience International
CCD	Climate Change Division
CDEMA	Caribbean Disaster Emergency Management Agency
CDRMP	Comprehensive Disaster Risk Management Policy
CFC	Chlorofluorocarbon
CSO	Civil Society Organisations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CHM	Clearing-House Mechanism
CCADRRP	Climate Change Adaptation and Disaster Risk Reduction Project
COP	Conference of the Parties
COCZM	Council on Ocean and Coastal Zone Management
DO	Development Order
DRR	Disaster Risk Reduction
EIA	Environmental Impact Assessment
EMD	Environmental Management Division
EPA	Environment and Planning Act
EUD	Delegation of the European Union
EU	European Union
FMDF	Fisheries Management and Development Fund

FAO	Food and Agriculture Organization
FD	Forestry Department
FMA	Forest Management Areas
GEF	Global Environment Facility
GHG	Greenhouse Gas
GDP	Gross Domestic Product
GHGs	Greenhouse gasses
GIS	Geographical Information System
GPS	Geographical Positioning System
GoJ	Government of Jamaica
HCFC	Hydro-chlorofluorocarbon
HEART/NTA	Human Employment and Resource Training Trust/National Training Agency
INDC	Intended Nationally Determined Contributions (to reduce GHGs)
IABIN	Inter-American Biodiversity Information Network
IAS	Invasive Alien Species
IASNET	Invasive Alien Species Network
IOJ	Institute of Jamaica
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management
JAQMP	Jamaica Air Quality Monitoring programme
JBGL	Jamaica Broilers Group Limited
JB I	Jamaica Bauxite Institute
JCDT	Jamaican Conservation and Development Trust
JEP	Jamaica Energy Partners
JET	Jamaica Environment Trust
JPAT	Jamaica Protected Areas Trust Ltd.
LBS	Land-based Sources (of pollution)
LMO	Living Modified Organisms
LFMC	Local Forest Management Committees
LU	Land Use
JPSCO	Jamaica Public Service Company Limited
MDG7	Millennium Development Goal 7 (Ensure environmental sustainability)

MSTEM	Ministry of Science and Technology, Energy and Mining
MAF	Ministry of Agriculture and Fisheries
MoH	Ministry of Health
MOT	Ministry of Tourism and Entertainment
MoU	Memorandum of Understanding
MT	Metric tonnes
MTWH	Ministry of Transport Works and Housing
MWh	Megawatts per hour
MWLECC	Ministry of Water, Land, Environment and Climate Change
MBMPT	Montego Bay Marine Park Trust
NBSAP	National Biodiversity Strategy and Action Plan (also National Strategy and Action Plan on Biological Diversity in Jamaica)
NBC	National Biosafety Committee
NEGAR	National Ecological Gap Assessment Report
NFMCP	National Forest Management and Conservation Plan
NEGAR	National Ecological Gap Assessment Report
NEPA	National Environment and Planning Agency
NIC	National Irrigation Commission Limited
NHMJ	Natural History Museum of Jamaica
NEPT	Negril Area Environmental Protection Trust
NOR	Noranda Jamaica Bauxite Partners
NPAS	National Protected Areas System (project)
NRCA	Natural Resources Conservation Authority
NGO	Non-Governmental Organization
NRW	Non-Revenue Water
NSA	Non-state actors
NDS	National Development Strategy
NPP	National Physical Plan
NSP	National Spatial Plan
NSS	National Spatial Strategy
NSWMA	National Solid Waste Management Authority
NWC	National Water Commission

OFWMU	On Farm Water Management Unit
ODPEM	Office of Disaster Preparedness and Emergency Management
PA	Protected Area
PAC	Protected Areas Committee
PASMP	Protected Areas System Management Plan
PASMP	Protected Areas System Master Plan
PCA	Pesticides Control Authority (Ministry of Health)
PET	Petrojam
PIOJ	Planning Institute of Jamaica
PM10	Particulate Matter at 10 microns
RiVAMP	Risk and Vulnerability Assessment Methodology Project
STRAP	Sea Turtle Recovery Action Plan
SIDS	Small Island Developing States
SFCA	Special Fishery Conservation Areas
SOE 2013	State of the Environment Report 2013
NPAS	Strengthening the Operational and Financial Sustainability of the National Protected Area System
TCPA	Town and Country Planning Authority
TNC	The Nature Conservancy
TSP	Total Suspended Particulates
UDC	Urban Development Corporation
UWI	University of the West Indies
WMU	Watershed Management Unit
WRDMP	Water Resources Development Master Plan
UNCCD	United Nation Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNESCO	United Nations Educational Scientific and Cultural Organization
UNISDR	United Nations International Strategy for Disaster Reduction
UTECH	University of Technology
UWI	University of the West Indies

WIN	Windalco
WLPA	Wild Life Protection Act
WRI	World Resources Institute
WRA	Water Resources Authority

ACKNOWLEDGEMENTS

The National Environment and Planning Agency (NEPA) wishes to thank the following international and Government of Jamaica institutions for their support, information and guidance:

- European Union
- United Nations Development Programme
- Forestry Department
- Ministry of Agriculture and Fisheries
- Ministry of Science, Technology, Energy and Mining
- Ministry of Education
- Ministry of Health
- Ministry of Water, Land, Environment and Climate Change
- Ministry of Tourism and Entertainment
- National Irrigation Commission
- National Solid Waste Management Authority
- National Water Commission
- Office of Disaster Preparedness and Emergency Management
- Pesticides Control Authority
- Planning Institute of Jamaica
- Statistical Institute of Jamaica
- The Port Authority
- Water Resources Authority

We also wish to thank the following non-governmental organisations and education/research establishments for their time, the provision of data and information and general support in producing this report:

- Bluefields Bay Fisherman's Friendly Society
- Caribbean Coastal Area Management Foundation
- Environmental Foundation of Jamaica
- Jamaica Conservation and Development Trust
- Jamaica Environment Trust
- Mona GIS Geoinformatics
- Montego Bay Marine Park Trust
- Negril Area Environmental Protection Trust
- Oracabessa Bay Foundation and Fisherman's Group
- The Breds Foundation (Galleon SFCA)
- The University of the West Indies (Mona Campus, Jamaica)
- The University of Technology

Table 1: Summary of Environmental Indicators (2013)

	ENVIRONMENTAL INDICATORS	2013
1.	LAND RESOURCES	
1.1	Land areas (km)	10,990
1.2	Percentage of total land area non forest	41%
1.3	Percentage of land area dedicated to mixed use	19%
2.	BIODIVERSITY	
2.1	Total number of endemic plants	925
2.2	Total number of endemic trees	316
2.3	Total number of endemic mammals	7
2.4	Total number of endemic birds	30
2.5	Total number of marine species in shallow, shelf and shore waters	3,128
2.6	Number of species critically endangered	31
2.7	Number of invasive alien species (terrestrial and aquatic)	110
3.	FORESTRY & WATERSHEDS	
3.1	Total forest cover (ha)	441,300
3.2	Forest reserves as a percentage of total land area in Jamaica	10.5%
3.3	Number of the WMUs severely degraded (Total studied was 16 in 2013)	4
4.	PROTECTED AREAS	
4.1	Percentage of total land area protected (excludes forest reserves and heritage sites)	18.1%
4.2	Percentage of total coastal marine area protected	15.1%
4.3	Total number of Ramsar sites	4
4.4	Total number of Special Fishery Conservation Areas	14
4.5	Total number of heritage sites and monuments	205
5.	MARINE & COASTAL RESOURCES	
5.1	Overall state of coral reef health at 23 reef sites monitored at 9 locations	Poor
5.2	Total number of beaches	544
5.3	Major finfish species production (MT)	13,463
5.4	Conch production (MT)	500
5.5	Lobster (MT)	300
5.6	Number of beaches monitored showing high erosion rates (over 10% in 2011-2012)	5
6.	FRESH WATER RESOURCES	
6.1	Annual rainfall (mm)	1,473
6.2	Total exploitable water after deducting ecological demand (million m ³)	3,027.1
6.3	Total water resources allocated (million m ³)	1,203.0
6.4	Total water supplied (million m ³)	910.2
6.5	Percentage of total population with access to reliable drinking water	92%
6.6	Approximate land area under irrigation (ha)	25,000
7.	WATER QUALITY (FRESHWATER)	

7.1	Percentage of WMU's monitoring sites meeting faecal coliform standard	76%
7.2	Percentage of WMU's monitoring sites meeting BOD standard	57%
7.3	Percentage of WMU's monitoring sites meeting phosphate standard	67%
7.4	Percentage of WMU's monitoring sites meeting nitrate standard	95%
8.	WATER QUALITY (MARINE)	
8.1	Percentage of WMU's monitoring marine sites meeting faecal coliform standard	46%
8.2	Percentage of WMU's monitoring marine sites meeting BOD standard	50%
8.3	Percentage of WMU's monitoring marine sites meeting phosphate standard	4%
8.4	Percentage of WMU's monitoring marine sites meeting nitrate standard	19%
9.	AIR QUALITY	
9.1	Percentage of monitoring sites meeting standards for particulate matter TSP/ PM ₁₀	79%
9.2	Percentage of monitoring sites meeting standards for sulphur dioxide	100%
9.3	Percentage of monitoring sites meeting standards for nitrogen dioxide	100%
9.4	Percentage of monitoring sites meeting standards for carbon monoxide	100%
10.	SOLID WASTE MANAGEMENT	
10.1	Estimated total collectable waste (MT)	2,947,353
10.2	Estimated total waste generated island-wide in 2013 (MT)	992,018
10.3	Percentage of total waste generated that is organic	62.2%
10.4	Hazardous waste exported – Lead Acid & Sulphate Batteries(MT)	11,967.1
11.	LIQUID WASTE MANAGEMENT	
11.1	Number of sewage treatment plants	234
11.2	Number of compliant sewage treatment plants	59
11.3	Best performing operating group of sewage treatment plants	Hotels
11.4	Worst performing operating group of sewage treatment plants	Hospitals
12.	MINING	
12.1	Production of Bauxite (MT)	4,707,375
12.2	Production of Alumina (MT)	1,901,753
12.3	Production of Limestone (MT)	1,949,400
12.4	Total mining production (MT)	12,052,328
12.5	Number of licensed quarries	281
12.6	Area of land certified as reclaimed from mining (ha)	656
13.	AGRICULTURE	
13.1	Number of registered farmers	7,840
13.2	Estimated total domestic crop production (MT)	614,912
13.3	Estimated total export crop production (MT)	1,531,049
14.	TOURISM	
14.1	Number of cruise ship passengers entering Jamaica	1,265,268
14.2	Number of stopover passengers entering the two main airports in Jamaica	2,000,000
15.	CONSTRUCTION	

15.1	Total housing starts (units)	2,896
15.2	Total housing completions (units)	5,560
15.3	Housing quality index average score out of 100	73.6
16.	ENERGY	
16.1	Total energy production from fossil fuels (1,000 Barrel of Oil Equivalent)	19,633
16.2	Total energy production from renewable sources (1,000 BOE)	774
16.3	Oil dependency as a percentage of total energy production	95%
17.	NATURAL HAZARDS	
17.1	Total number of genuine fire calls	11,834
17.2	Total number of deaths from fires	19
17.3	Total number of located earthquake events registered (tremors)	133
18.	MAN-MADE HAZARDS	
18.1	Number of oil spills reported and investigated	16
18.2	Number of air pollution incidents	38
18.3	Number of fish kills reported and investigated	5

Information About the National Environment and Planning Agency (NEPA)

NEPA was established in April 2001 as an Executive Agency under the Executive Agencies Act. NEPA was founded to carry out the technical (functional) and administrative mandate of three statutory bodies: the Natural Resources & Conservation Authority (NRCA), the Town & Country Planning Authority (TCPA) and the Land Development & Utilization Commission (LDUC). NEPA currently operates under the following Acts:

- Executive Agencies Act (2001)
- The Natural Resources Conservation Authority Act (1991)
- The Town and Country Planning Act (1958, and amended in 1999)
- The Land Development and Utilization Act (1967, amended in 1976)
- The Beach Control Act (1956, amended in 2004)
- The Watersheds Protection Act (1963, amended in 1991)
- The Wild Life Protection Act (1945, amended in 1999)
- The Endangered Species (Protection, Conservation and Regulation of Trade) Act (2000)

NEPA's operations are financed by recurrent budget allocations from the Government of Jamaica's Consolidated Fund and 50% of the fees collected by the Natural Resources Conservation Authority (NRCA) from the issuing of permits and licences, (Appropriation-in-Aid).

NEPA's vision and mission are:

That Jamaica's natural resources are being used in a sustainable way and that there is broad understanding of environment, planning and development issues, with extensive participation amongst citizens and a high level of compliance to relevant legislation.

To promote sustainable development by ensuring protection of the environment and orderly development in Jamaica through highly motivated staff performing at the highest standard.

NEPA's main areas of intervention are:

- Conservation & Protection (Natural Resources Management)
- Environmental Management
- Spatial Planning
- Compliance & Enforcement
- Applications Management
- Public Education
- Policy and Research
- Legal Services & Standards Management

How This Report is Intended to be Read and Understood

This report is intended to provide a logical and coherent structure in which each main chapter (chapters 2 to 13) contains the following sections:

- *An information box*: description of key terms to facilitate the reader's understanding of each chapter.
- *Background information*: includes information about the relevant legislative and policy framework as well as the strategies and plans established to implement government policies.
- *The state of the environment*: provides information and data about the current situation of the environmental theme covered in each chapter and identifies the main findings from the information and data provided.
- *The main threats and challenges*: provides the reader with information on the main threats, pressures and challenges on the preservation and sustainable use of Jamaica's natural resources (chapters 2 to 7).
- *Conclusions and recommendations*: each chapter aims at providing clear, concise and coherent conclusions and recommendations in the interests of supporting policy dialogue within government, with the private and non-governmental sectors and with international donors to ensure that international commitments and Goal 4 of the **Vision 2030 Jamaica** National Development Plan are met.
- *Useful links and references*: provides a selection of website links where relevant documents and data related to the chapter can be accessed for more information or research.
- *Maps*: Relevant thematic maps of Jamaica referred to in the main text of each chapter are provided at the end of the same chapter.

At the end of the report there is a list of *annexes* which includes one providing details on all photographs in this report.



1. Introduction

The National Environment and Planning Agency (NEPA) is committed to preparing three-yearly reports on the state of the environment in Jamaica. The present report is the sixth which the Government of Jamaica (GoJ) has produced since 1995. The main objectives of the State of the Environment Report 2013 (SOE 2013) are to:

- 1) Provide accurate, timely and accessible information to the general public and government regarding the legislative background and current policy framework in place to protect the environment;
- 2) Report on the current state of the country's natural resources and environmental planning and management capacity;
- 3) Identify the underlying pressures and threats on Jamaica's environment and natural resources; and
- 4) Establish a set of conclusions and corresponding recommendations for each chapter to support policy dialogue on priority issues and encourage funding from the international community in line with Jamaica's environment targets especially those related to international agreements and conventions, the ***Vision 2030 Jamaica National Development Plan (Vision 2030 Jamaica)*** and the Medium Term Socio-Economic Framework.

To assist NEPA in preparing this report, the European Union provided funding for the contracting of two experts to conduct research, meetings, workshops and field visits for data collection and information gathering from government, non-governmental, private and international stakeholders. The experts were contracted by the Particip-led Consortium in Europe between March and October 2015. The planning and reporting activities of these experts were managed by a Steering Committee chaired by NEPA and comprising representation from the following organisations: The Planning Institute of Jamaica (PIOJ), the Delegation of the European Union (EUD) the United Nations Development Programme (UNDP) and the Ministry of Water, Land, Environment and Climate Change.

The Steering Committee agreed that the State of the Environment Report 2013 (SOE 2013) should follow the same sections and chapter sequence structure as the SOE 2010. The four main sections of the report are:

- 1) Section 1: Natural Resources and Ecosystems;
- 2) Section 2: Management and Sustainable Use of the Natural Environment;
- 3) Section 3: Climate Change and Hazards; and
- 4) Section 4: Governance and Education.

It was agreed that new chapters and/new parts to chapters should be added to fill gaps identified in SOE 2010. This resulted in the elaboration of a chapter on Town and County Planning (Chapter 9) in which key economic sectors (Mining, Agriculture and Tourism) from SOE 2010 have been assessed and a fourth key economic sector, Construction, (Transport, Works and Housing) added.

In addition, there are separate chapters for Energy, Climate Variability & Change, s and Environmental Education & Governance.

The Steering Committee also agreed to rework the structure of the chapters so that the reader is introduced first to the legislative and policy framework (past and present) for each environmental theme. This is followed by an assessment of the state of the environment in which validated data are presented, analysed for 2011-2013 and compared with data from SOE 2010. Each chapter then assesses current threats and pressures pertinent to each environmental theme in -identifying key issues to be addressed in the final section of the chapter dedicated to conclusions and recommendations.

A key theme throughout the SOE 2013 is assessing Jamaica's initial progress in meeting the expected outcomes under Goal 4 of **Vision 2030 Jamaica**. The aim of this approach is to support policy dialogue at the intra-institution and inter-institution levels for a more integrated approach to:

- Implementing the recommendations in the report;
- Identifying the priority areas where international cooperation should be harnessed;
- Establishing appropriate internal monitoring to track progress of key areas; and
- Identify lessons learned and best practice in relation to the "Environmental Performance Index" managed by Yale University.

Vision 2030 Jamaica aims to achieve four main national goals supported by 15 expected national outcomes by 2030. These are summarised below. Outcomes 13 to 15 under Goal 4 are assessed in this report.

Goal 1: Jamaicans are empowered to achieve their fullest potential

Outcome # 1 - A healthy and stable population;
Outcome # 2 - World class education and training;
Outcome # 3 - Effective social protection;
Outcome # 4 - Authentic and transformational culture.

Goal 2: The Jamaican society is secure, cohesive and just

Outcome # 5 - Security and safety;
Outcome # 6 - Effective governance.

Goal 3: Jamaica's economy is prosperous

Outcome # 7 - A stable macro-economy;
Outcome # 8 - An enabling business environment;
Outcome # 9 - Strong economic infrastructure;
Outcome # 10 - Energy security and safety;
Outcome # 11 - A technology enabled society;
Outcome # 12 - Internationally competitive industry structures.

Goal 4: Jamaica has a healthy natural environment

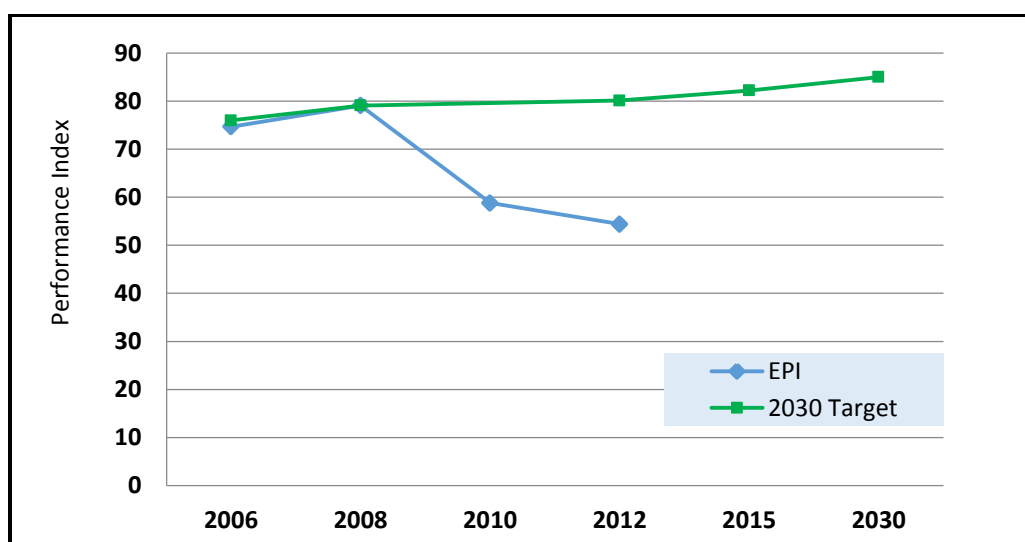
Outcome # 13 - Sustainable management and use of environmental and natural resources;
Outcome # 14 - Hazard risk reduction and adaptation to climate change;
Outcome # 15 - Sustainable urban and rural development.

The achievement of Goal 4 of **Vision 2030 Jamaica** and its expected outcomes will depend heavily on the performance of NEPA and partner agencies in executing their mandate in the following key areas:

- 1) Supporting **effective forward planning** at the national, regional and local levels of government while ensuring the active participation of civil society in the planning and implementation process as prescribed by the Town and Country Planning Act and other relevant legislation;
- 2) Conducting **effective monitoring of the environment** to guarantee, on the one hand, high levels of compliance with national standards relating to air, freshwater and coastal marine water quality and, on the other hand, the monitoring of changes in the natural environment that may have a detrimental effect on natural resources and or socio-economic development;
- 3) Promoting **effective environmental education and awareness** to help engage and empower all Jamaicans in the conservation and sustainable use of natural resources. In addition, apply environmental laws and adhere to codes of practice, including building codes, to increase safety and enhance resilience to disasters and the effects of climate variability and change;
- 4) Providing **adequate levels of law enforcement** to deter those who repeatedly apply bad practices which produce direct and/or hidden costs on the country's economic and social development.
- 5) Continuing to inform the public about progress and developments through **effective reporting and communication** through the mass media.

The GoJ through PIOJ has established a set of environmental performance indicators (EPIs) to track overall progress in reaching Goal 4 of **Vision 2030 Jamaica**. The EPI, which is managed by Yale University in the USA, uses the data provided by participating countries to establish environmental rankings for each country. Currently, Jamaica's overall environmental ranking is number 55 out of 178 participating countries. The following figure shows Jamaica's overall EPI situation since 2000.

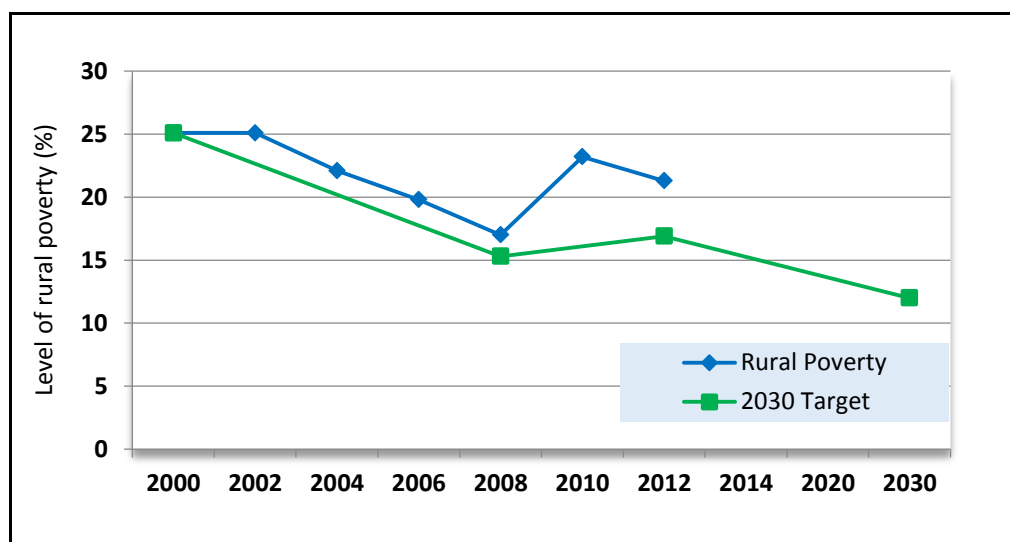
Figure 1: Overall Environmental Performance Index of Jamaica (2013)



Source: DevInfo

Figure 1 indicates that the EPI has dipped since 2010 from the 2030 target line. A number of external factors contributed to this. In particular, prolonged global and financial instability between 2010 and 2011 as well as the steep rise in oil prices, both of which contributed to an increase in the percentage of rural poverty in Jamaica over the 2011-2013 period as can be seen in Figure 2 below.

Figure 2: Percentage of Rural Poverty in Jamaica Against 2030 Target (2013)



Source: DevInfo

Both indicators suggest that the Jamaica needs to do more to reduce poverty and improve its overall environmental performance to meet the 2030 goals in ***Vision 2030 Jamaica***.

This is further justified by a summary of the main findings and conclusions in this report.

1.1 Executive Summary (Main Findings and Conclusions - Chapters 2 to 9)

1) Biodiversity and Ecosystems:

- The Clearing House Mechanism facilitates networking on biodiversity data by species and type. However, no database exists to centralise validated data on Jamaica's biodiversity. As a result, safeguarding biodiversity is difficult because much of the scientific information on Jamaica's biodiversity is fragmented and not regularly updated.
- There is a need to update the system of protected areas established in the Draft Policy for Jamaica's System of Protected Areas (1997) to enhance the coordination of the system to protect and conserve biodiversity and ecosystems as prescribed in the Protected Areas System Master Plan finalised in 2013.
- The number of invasive species increased from 86 to 110 between 2008 and 2013.
- Mainstreaming of biodiversity conservation and sustainable use have not been adequately implemented to ensure that they cross cuts sector policies.
- The Biosafety Committee has not met for several years resulting in limited guidance on issues such as the importation of genetically modified organisms.

2) Forests and Watersheds

- Approximately 40% of Jamaica's land use is taken up by forests.
- Closed Broadleaf forest has decreased over the last decade, due to human activity.
- Some forest categories such as the dry forests have declined considerably over the last decade.
- The updating of the Draft Policy for the Protected Areas Management System has not been finalised. However, the Master Plan for Protected Areas has been drafted and submitted to the GoJ to support and guide forest reserve management.
- The Forestry Department (FD) has drafted a new Forest Policy (2013).
- Many of the country's 26 watershed management units (WMUs) are facing increasing pressures from improper land management and development.
- Four watersheds remain in a critical condition (Hope, Rio Minho, Wagwater and Yallahs).
- There is need for improved coordination and collaboration between the FD, the Water Resources Authority (WRA), the Ministry of Agriculture and Fisheries, and NEPA to ensure a ridge-to-reef approach is applied to their work in strategic watersheds.
- There has been limited research and development of ecotourism in forested areas.

3) Protected Areas

- The absence of a coordinated protected areas system in Jamaica has made it more difficult to establish the effective management of PAs.
- Terrestrial protected areas account for just over 18% of total land area, which means that Jamaica has fulfilled one of the 20 Aichi Targets (relating to the CBD).
- An estimated 15% of coastal marine areas are protected in Jamaica, which also fulfils a second Aichi Target.
- The Fisheries Division has continued to increase the number of Special Fishery Conservation Areas (SFCAs) from 12 to 14 in 2011-2013.
- Reports from civil society groups that support the co-management of the SFCAs suggest progress in rejuvenation of fish stock. One co-management group reported that fish biomass increased by over 500% from 2011-2013.
- There are now 205 national monuments and heritage sites declared in 2013, which

represents an increase of 8 sites since 2010.

- The management of PAs through co-management agreements has helped to engage and empower local communities to exercise greater ownership of natural resources and develop more sustainable practices. It has also strengthened local governance by establishing new partnerships between civil society groups, the local security forces and government institutions. Nevertheless, there is room for improving the contractual arrangements of the co-management agreements, such as in the formal recognition of park wardens and their role in areas such as law enforcement.

4) Coastal Marine Resources

- The coral reef index concludes that the overall state of Jamaica's coral reefs is "poor". This situation has not been aided by over-fishing, changes in water quality and the effects of climate variability and change in water temperature.
- A total of 14 beaches monitored were found to be experiencing erosion from wave action. Negril has been hardest hit with the beach at the Native Son Hotel recording a significant beach loss of over 20%.
- The Fisheries Division has confirmed fish biomass inspection of four commercial fish (Snapper, Grouper, Grunt and Parrot fish) has increased. Meanwhile general fish production figures showed more volatility.
- NEPA's marine water quality monitoring data confirm phosphate levels were over the national standard at most of its monitoring sites. Nitrate levels were also found to be over the standard, but at a fewer number of monitoring sites.
- Levels of faecal coliform were found to be above the national standard at monitoring sites in the coastal marine waters of 9 watershed management units.
- The lack of adequate integrated coastal zone management in coordination with the planning process appears to be a gap which needs to be addressed.

5) Water Resources

- The WRA's current calculation of its water allocations and abstraction data is not done at the watershed level. Therefore it is not possible to determine the water balance in each watershed. This information would support sustainable development planning and closer coordination with NEPA on water quality monitoring.
- The quality of freshwater monitored by NEPA was generally found to be within the national standards, except in six WMUs, which registered high levels of Biological Oxygen Demand, possibly due to high levels of agricultural inputs and poor sewage treatment.
- Freshwater supply to domestic households now covers 92% of the Jamaican population, which is an increase of almost 7% since 2010.
- The Irrigation Commission has continued to expand its services to support irrigated agriculture. In 2013 a total of 11,919 ha were under irrigation.
- According to data from the Meteorological Office rainfall patterns indicate that over the past 60 years there has been a downward trend in monthly precipitation levels.
- A gap in the current legislative framework means there is not an integrated approach to the way water is managed. This is important taking into account the growing effects of climate variability and change.

6) Air Quality

- NEPA currently receives data from a network of 57 monitoring stations, which includes five of its own and a large number owned by the Bauxite Industry.
- Particulate matter concentrations were found to have increased since 2010 at the majority of monitoring sites. Increased volumes of vehicle emissions and Saharan sand dust are likely to have contributed to this.
- Concentrations of sulphur dioxide and nitrogen dioxide were found to be well below the national standards at almost all monitoring sites.
- Emissions of carbon monoxide were found to be well below the national standards.
- Progress in removing Hydro-chlorofluorocarbons (HCFCs) by 2040 continued in 2011-2013. HCFC imports were down by 48.25 MT in 2013 compared to 2009-2010 baseline levels.
- NEPA plans to develop an Air Quality Index in 2016.

7) Waste Management

- Jamaica does not have an integrated waste management policy in place.
- Estimated waste generation has increased from 983,874 MT in 2010 to 992,018 MT in 2013 with organic waste accounting for 62% of all waste generated.
- There is a need to increase the number of garbage trucks from 109 to at least 200 to widen and improve existing solid waste collection services islandwide.
- The country has 8 solid waste disposal sites of which five are close to capacity and considered to be in a critical state.
- The country urgently needs an integrated waste management policy and regulations to support the application of the waste hierarchy that targets waste prevention and recycling.
- Capacity in managing hazardous waste is now being strengthened through the implementation of the Draft National Hazardous Substances and Hazardous Waste Management Policy. In Kingston, the disposal of medical waste has improved since November 2012, due to the opening of the National Medical Waste Management Plant at a cost of approximately US\$3 million.
- The NSWMA plans to launch a pilot project to collect e-waste in 2014 to test, among other things, the logistical needs of managing e-waste.
- The Pesticides Control Authority signed an agreement with the Food and Agriculture Organisation (FAO) in 2013 to eliminate all stocks of obsolete pesticides on the island in accordance with the Basel Convention.
- There are a total of 234 sewage treatment plants in Jamaica in 2013 of which only 59 are fully compliant with national standards. The NWC in particular needs support to increase compliance at 70 of its sewage treatment plants. It is anticipated that this will improve following the launch of the Natural Resources Conservation (Wastewater and Sludge) Regulations in 2013.

8) Town and Country Planning and Key Development Sectors

- A total of 10 Development Orders (DOs) are at different stages of the renewal process in 2013. The updating of five DOs is planned in the period 2014-2016.
- The National Spatial Data Management Division has been established within MWLECC where national spatial data infrastructure is being developed. Efforts are concentrated on the development of two portals: one for geospatial data and the other for metadata.
- The implementation of the Urban Planning and Regional Development Sector Plan began in 2011. It aims to achieve a spatial arrangement of land use that integrates with social and

economic development and satisfies the need for safety, efficiency, aesthetics and social justice. NEPA and other government institutions are working towards the establishment of a comprehensive, efficient and effective planning system that delivers improved physical development and optimisation of land resources; liveable, equitable and ecologically sensitive communities; and vibrant and diversified rural areas.

- A new Draft National Minerals Policy is being prepared for the period 2014-2030 and aims to improve environmental integrity and promote economic development in rural areas supported by the establishment of community-based committees to guide investment in environmental, social and economic projects.
- NEPA has and will continue to play an important regulatory role in the mining and quarrying sector throughout all stages of extraction, including the rehabilitation of mined-out lands. An updated Memorandum of Understanding has been signed between the NRCA and Jamaica Bauxite Institute in 2013, which delegates environmental monitoring of the bauxite industry to the JBI. In addition, JBI will play a technical role on committees such as the Air Quality Evaluation Committee and the Technical Review Committee.
- A new Draft Agricultural Land Use Policy was launched in 2012. The objectives of the policy include ensuring that agricultural land resources are used in an environmentally sustainable way; creating and maintaining diversified, dynamic and progressive agricultural land use; and ensuring that forest lands are conserved, protected and managed to sustain economic growth.
- The Master Plan for Sustainable Tourism Development (2002-2010) continues to promote sustainable development to the benefit of the Jamaican population. The Tourism Linkages Hub promotes the establishment of balanced and integrated development at the regional and local levels. This includes the linking of the agriculture and tourism sectors to promote food production among Jamaican farmers to reduce food imports in the tourism sector.
- The establishment of the National Building Act is in progress. It aims to provide a modern legal framework for the effective regulation and management of buildings and construction to ensure safety in the environment.
- There is a need to increase capacity in the development sectors to mainstream conservation and sustainable use of the natural environment in their sector planning and coordinate activities through the creation of national and local multi-sectoral committees.



Section 1:

Natural Resources and Ecosystems



2. Biodiversity and Ecosystems

What is biodiversity? The United Nations Convention on Biological Diversity (CBD), which was signed and ratified by Jamaica on January 6, 1995, defines biodiversity as: *the variability among living organisms from all sources including, among other things, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems*. In other words, biodiversity is the variation of all life forms that live in water and/or on the land, inclusive of their genetic diversity.

What is an ecosystem? The CBD defines an ecosystem as: *a dynamic complex of plant, animal and micro-organism communities and their non-living environment as a functional unit*. Terrestrial ecosystems include forests, deserts, grasslands and mountains. Water-based ecosystems include lakes, wetlands, estuaries, coral reefs and the sea floor.

What are indigenous and endemic species? Indigenous species have developed naturally (without human intervention) in a specific region or ecosystem and are sometime referred to as “native” to that region of ecosystem. Endemic species have evolved and established themselves in a particular location and have smaller ranges than their indigenous counterparts. Endemic species are highly vulnerable to extinction if their ecosystem is damaged or destroyed. One of the most authoritative and objective international systems for classifying species at high risk of extinction is, “The Red List of Endangered Species” managed by the International Union for the Conservation of Nature (IUCN).

Why are ecosystems and their biodiversity important? The CBD states: *“The Earth’s biological resources are vital to humanity’s economic and social development. As a result there is a growing recognition that biological diversity is a global asset of tremendous value to present and future generations. At the same time, the threat to species and ecosystems has never been as great as it is today.”*

What are ecosystem goods and services? They are essential to socio-economic development through the provision of:

- 1) Commodities such as freshwater, oxygen, fish, wood, medicines, oils, resins and leaves;
- 2) Genetic material to produce new varieties of crops to maintain food security, improve nutrition and support adaptation of agriculture to climate change;
- 3) Pollinators such as bees and other insects for crops, flowers and trees and which provide by-products such as honey, wax and resins;
- 4) Protection, by acting as regulators of rainwater (forests), an obstacle for pests and disease and a barrier to tsunamis, high tides and storm surges (mangroves and coral reefs). For example, studies by the World Bank have found forests in hilly areas with 20 degree slopes or more can save more than 200 metric tonnes of soil per hectare per year than a similar area without land cover cleared for agriculture;
- 5) Production of oxygen and the fixing of carbon dioxide (CO₂), a greenhouse gas (GHG), in the soil, which helps prevent global warming.

2.1 Background to Biodiversity and Ecosystems in Jamaica



Jamaica, known by the Taino in pre-Columbian times, as “the land of wood and water”, has a very rich and varied biodiversity because plants, animals and other living organisms (including fungi and bacteria) have adapted to the many different environmental conditions that exist on and/or around the island. Thanks to these conditions many terrestrial and aquatic ecosystems have evolved in their own separate way. Furthermore, because Jamaica appears to have never been connected to any other land mass unlike other islands in the Caribbean, a large number of its plants and animals have become endemic to specific parts of the island, or are indigenous to the Caribbean.

One of the main reasons Jamaica has a high level of endemic species is the many ecosystems that have developed here, despite its relatively small land mass of 10,990km² (4,240 sq. ml.). There are five main types of forest ecosystems found in Jamaica:¹

- 1) **Wet limestone forests** found in the John Crow Mountains, central and western Jamaica;
- 2) **Predominantly shale forests** of the Blue Mountains and Port Royal Mountains;
- 3) **Dry limestone forests** found almost exclusively in the south of the island in the Hellshire Hills in St. Catherine Parish and Portland Ridge in Clarendon Parish;
- 4) **Alluvial and wetland forests** found in the coastal plains. Wetlands account for only around 2% of total land cover, but they support high amounts of terrestrial and coastal marine biodiversity. For example, mangroves and seagrass beds act as essential early nurseries for many commercial fish such as grunts and snappers;
- 5) **Anthropogenic forests** which have been created by Man, such as Caribbean Pine plantations.

In addition, there are marine-based ecosystems that include **coral reefs, cays and the seabed**. Coral reefs are found around large parts of Jamaica and act as a natural barrier to wave action, which helps reduce beach erosion and the effects of storm surges. They also act as important natural protection for many juvenile and fully grown fish such as parrotfish and doctor fish.

2.1.1 Background on the Legal and Policy Framework on Biodiversity Conservation and its Sustainable Use

Jamaica has ratified a number of international conventions and treaties relating to biodiversity. For example, Jamaica has been a party to the **Convention for Biological Diversity (CBD)** since 1995. This commits the Government of Jamaica (GoJ) to achieving the following three goals of the Convention:

- 1) The conservation of biological diversity;
- 2) The sustainable use of the components of biological diversity;
- 3) The fair and equitable sharing of the benefits arising from the use of genetic resources.

In 2000, the Conference of the Parties (COP) to the CBD adopted a supplementary agreement known as the **Cartagena Protocol on Biosafety**, which Jamaica signed in 2001 and ratified on 25 September 2012. The objective of the Protocol is to protect biological diversity from the potential

¹NEPA/Forestry Department

risks of introducing living modified organisms (LMOs)² through application of the advance informed agreement (AIA) procedure, which ensures that signatory countries are provided with the all the facts required for informed decision-making before agreeing to the import of LMOs into their territory. To facilitate information exchange on LMOs, the Protocol includes the operation of the Biosafety Clearing-House Mechanism.

To support the Parties in achieving the third goal of the Convention, **the Nagoya Protocol** was adopted on October 29, 2010 in Nagoya, Japan. A central aim of this Protocol is to ensure that local people, including indigenous peoples, benefit fairly from any knowledge they disclose on genetic resources that leads to the commercialisation of new products, including new crop varieties, medicines, cosmetics, industrial products, etc. The protocol is expected to enter into force in 2014.

Other important international commitments to protecting biodiversity and safeguarding ecosystems include accession to the **Convention on International Trade in Endangered Species of Fauna and Flora (CITES)** which entered into force in Jamaica on July 22, 1997 and the **United Nations Framework Convention for Climate Change (UNFCCC)** ratified by Jamaica on April 5, 1995.

The implementation of these and other international agreements and conventions is provided through a number of Parliamentary Acts and national policies. Some of the most significant include: The Wild Life Protection Act (1945); The Beach Control Act (1956); The Town and Country Planning Act (1958); The Watersheds Protection Act (1963); The Fishing Industry Act (1976) and Regulations; The Natural Resources Conservation Authority Act and Regulations (1991); The Forestry Act (1996); The Aquaculture, Inland and Marine Products and By-products (Inspection, Licensing and Export) Act (2000); and The Endangered Species (Protection, Conservation and Regulation of Trade) Act (2000).

In addition, the GoJ prepared and launched the **National Strategy and Action Plan on Biological Diversity in Jamaica (NBSAP)** in 2003. It became the country's first comprehensive framework to conserve biodiversity and ensure its sustainable use. Seven main goals were established in the NBSAP and a total of 37 projects proposed to achieve the goals in the period 2003-2010, (17 projects were identified as priority). The goals are:



- 1) Conserve Jamaica's biodiversity;
- 2) Promote sustainable use of biological resources;
- 3) Facilitate access to biological resources to promote developments in biotechnology and ensure benefit sharing;
- 4) Ensure safe handling and use of LMOs;
- 5) Enhance resource management capacity;
- 6) Promote public awareness and education and community empowerment;
- 7) Promote regional and international cooperation and collaboration in support of the implementation of the CBD.

In 2010 the Fourth National Report for CBD was published for the period 2004-2009. It concluded advances had been made in areas such as:

- Initiation of the formulation of a national Biosafety framework which includes a draft Biosafety Policy;
- Establishment of a National Clearing-House Mechanism at the Natural History Museum of Jamaica at the Institute of Jamaica (IOJ);

²Also known as Genetically Modified Organisms (GMOs)

- Development of the Biosafety Clearing House at the IOJ;
- Formation of an Invasive Alien Species Working Group;
- Declaration of three RAMSAR (wetland) sites;
- Improvement of inventories and research on different categories of flora and fauna;
- Establishment of the need to have a healthy natural environment as one of the four main goals of **Vision 2030 Jamaica**, launched in 2009;
- Developing a clearer legislative and policy framework for biodiversity, including efforts to establish Local Forest Management Committees (LFMCs); implement commitments to sustainable tourism in the Master Plan for Tourism Development 2001-10; and establish a coherent policy on the establishment of a system of protected areas; and
- On-going implementation, or completion, of 13 project profiles of the 37 identified in the NBSAP.

The Report also highlighted the main threats to Jamaica's biodiversity and the implications of biodiversity loss. The most significant threats to biodiversity loss concern:

- Habitat loss due to poor planning and enforcement relating to human interventions in areas such as agriculture, forest plantations, mining, housing and large-scale hotels;
- The impact of invasive alien species (IAS);
- Inadequate environmental education and awareness of the value of natural resources, coupled with inadequate engagement and/or capacity of local stakeholders in the conservation and sustainable use of their biodiversity;
- Pollution, especially from liquid and solid waste; and
- The effects of climate change.

2.2 The Current State of Jamaica's Biodiversity 2011-2013



The **Jamaica Clearing-House Mechanism**, a department of the Natural History Museum of Jamaica (NHMJ) at the Institute of Jamaica, serves as Jamaica's biodiversity network within the international network of Clearing-Houses that support the CBD. Through this network information is gathered and distributed between specialist organisations, research institutes, etc. in order to compile, among other things, lists on the current state of their areas of biodiversity specialisation.

The latest numbers of Jamaica's indigenous and endemic species up to 2013 are summarised in Table 2 below and compared, where possible, with data provided in the State of the Environment Report for 2010.

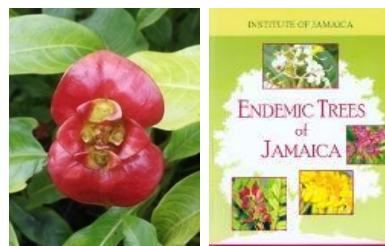
Table 2: Number of Known Endemic Terrestrial-Related Species in Jamaica (2010 & 2013)

Species by Type	2010		2013	
	Total No. of Indigenous	Total No. of Endemic	Total No. of Indigenous	Total No. of Endemic
Plants				
Plants*	3,304	925	3,304	925
Trees (1)	-	-	No data	316
Palms (2)	10	7	10	7
Orchids (3)	230	60	227	60
Bromeliads (4)	60	22	60	26
Ferns (5)	579	67	579	67
Cacti (6)	20	10	15	4
Grasses (7)	200	1	200	1
Mammals				
Bats(8)	21	2	21	5
Other mammals (9)	2	2	2	2
Birds				
Land birds (10)	67	30	67	30
Shore/Seabirds (10)	39	1	39	1
Amphibians				
Frogs (11)	22	22	21	21
Reptiles				
Crocodiles (12)	-	-	1	0
Lizards (12)	-	-	29	28
Snakes (12)	-	-	9	9
Freshwater turtles (12)	-	-	1	1
Seawater turtles (12)	-	-	4	0
Arthropods & other invertebrates				
Ants (13)	59	6	59	6
Carabid beetles (14)	-	-	No data	No data
Scolytid & Platypodid beetles (14)	-	-	69	31
Butterflies (15a)	116	20	136	38
Moths (15b)	-	-	730	>292
Lampyridae Fireflies (16)	48	45	48	45
Grapsid crabs (17)	9	9	9	9
Jumping spider (18)	26	20	26	20
Rotifer (19)	211	<21	211	<21
Land snails (21)	514	505	561	499
Fish				
Freshwater fish (12)	-	-	29	4

Sources: *Catalogue of Seed Plants of the West Indies, P. Acevedo & M. Strong, Smithsonian Museum, 2012; (1) Endemic Trees of Jamaica by Dr Keron Campbell (2010); (2) SOE 2010; (3) SOE 2010 and Orchids of Jamaica by A. Gloudon and C. Tobisch, (Second Edition, 2014); (4) SOE 2010 and NHMJ-IOJ; (5) SOE 2010; (6) SOE 2010, cactiguide.com and NHMJ-IOJ; (7) SOE 2010; (8) SOE 2010 and Bats of Jamaica, by Hugh H. Genoways, Robert J. Baker, John W. Bickham & Carlton J. Phillips, (University of Nebraska-Lincoln, Texas A&M University and Texas Tech University, 2005); (9) SOE 2010/Windsor Research Centre (WRC) website and Schubart et al and Diesel et al; (10) SOE 2010 and Birdlife International; (11) SOE 2010, Blair Hedges – Caribherp.org; (12) idem; (13) SOE 2010; (14) SOE 2010 and Bright (1972); (15a) SOE 2010, Warren A., University of Florida; (15b) M.J.C Barnes, Moths of Jamaica, 2002; (16) SOE 2010 and WRC website; (17) SOE 2010 and WRC; (18) SOE 2010; (19) SOE 2010, WRC website and Koste et al 1993; (20) SOE 2010 and G. Goodfriend and G. Rosenberg (WRC website); (21) SOE 2010 and Fishbase.org;

The main findings from Table 2 are summarised as follows:

- 1) There are 3,304 known species of vascular plants. This fact ranks Jamaica first in the Caribbean for endemic plants³.
- 2) Jamaica has 316 endemic trees, all of which have been recorded in one publication by the Institute of Jamaica (pub. 2010).
- 3) There are currently 26 endemic species of bromeliads in Jamaica. This is a net increase of four endemic species since 2010 and is due to the reclassification of native species (NHMJ).
- 4) There are 227 indigenous species of orchid, of which 60 (26%) are classified as endemic to Jamaica. Most of Jamaica's orchids are epiphytes that attach themselves to hosts such as trees. Jamaica has the smallest orchids in the world (*Lepanthes sp.*)⁴.
- 5) There are 15 indigenous species of cacti, of which four are endemic. This represents a reduction of six endemic species of cacti, which are believed to have been lost in the wild since 2010 due to the loss of their habitat and removal by collectors (NHMJ).
- 6) There are 21 native species of bats of which five are currently classified as endemic. Three species of bats have been reclassified as endemic since 2010. Jamaica's bats belong to six families: Noctilionidae (1 species); Mormoopidae (4 species); Phyllostomidae (7 species); Natalidae (2 species); Vespertilionidae (2 species) and; Molossidae (5 species). Research is ongoing to determine whether the Jamaican Flower bat (*Phyllonycteris aphylla*) may also be endemic. Bats are crucial to seed dispersal and thus, forest regeneration in Jamaica⁵.
- 7) There are 67 indigenous species of land birds of which 30 are endemic to Jamaica. In addition, there are 39 shore/marine birds, which include one endemic species. Jamaica ranks first in the Caribbean and 17th in the world for endemic birds. There are four endemic genera in Jamaica, which include the following: two *Trochilus spp.* (streamer tails); *Euneornis campestris* (Orangequit); *Loxipasseranoxanthus* (Yellow-shouldered Grassquit) and; *Nesopsar nigerrimus* (Jamaican Blackbird).⁶



³ Jamaica Clearing House Mechanism, (Natural History Museum of Jamaica - Institute of Jamaica).

⁴ The Natural History Museum of Jamaica

⁵ The Windsor Research Centre

⁶ Birdlife International



8) There are nine indigenous species of *Grapsidae* (grapsid crabs) all of which are endemic to Jamaica. The majority live in supratidal habitats, but a few have adapted to freshwater and terrestrial habitats. One species, *Metopaulias depressus*, is unique because it completes its lifecycle inside the bromeliad flower.⁷

9) Jamaica has 21 indigenous species of frogs all of which are endemic to Jamaica. Among the species is the *Osteopilus crucialis*, (Jamaican snoring frog), which lay their eggs in water found within bromeliads.

10) There are 29 species of indigenous lizards of which 28 are endemic to Jamaica. Other reptiles include 9 endemic species of snakes and one freshwater turtle (*Trachemys terrapin*), also known as the Jamaican Slider, which is also an endemic species. This confirms there are very high levels of endemism for both the reptile and amphibian categories in Jamaica.



11) Endemic species of arthropods and other invertebrates are highly abundant in Jamaica. For example, there are 45 species of Lampyridae fireflies and 45% of all known Scolytidae and Platypodidae beetles are endemic to Jamaica. However, scientific research suggests there could be many more species still to be discovered in Jamaica.⁸



12) Jamaica has an exceptionally high number of species of land snails. Currently there are around 500 endemic species reported. However, an on-going three-year national survey indicates that there may be as many as 700 endemic species of snails.

⁷L. G. Abele & D. B. Means, University of Florida, 1977

⁸Smithsonian Institute/WRC

Table 3 provides data on the current status of marine-related biodiversity according to the latest data that has been published on marine species.

Table 3: State of Marine Species in Jamaican Shallow, Shelf or Shore Waters (2005)

Taxon	Number of Species	Taxon	Number of Species
Phytoplankton	374	Mollusca	825
Macroalgae	386	Bryozoa	64
Porifera	194	Chaetognatha	10
Cnidaria	204	Echinodermata	88
Ctenophora	6	Hemichordata	2
Nematoda	81	Chordata	75
Annelida	100	Cephalochordata	1
Crustacea	455	Vertebrata	637

Sources: G. R. Warner and I. Goodbody, "Jamaica", *Caribbean Marine Diversity: The known and unknown*, Lancaster DES Tech Publications, 2005.

The data in the above table confirms Jamaica has a large number of marine species found in its shallow, shelf and shore waters. Most striking the large number of molluscs. However, current studies indicate that Jamaica may have as many as 700 species of snails (WRC). This suggests Jamaica is a world hotspot for the evolution of this species.



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2.2.1 The Current State of Endangered Species on the IUCN's Red List



A number of Jamaica's endemic species remain in danger of extinction in the short or long-term. The International Union for the Conservation of Nature (IUCN) Red List is respected internationally as one of the main ways of monitoring endangered species worldwide and provides information and analysis on the status, trends and threats to species in the interest of supporting biodiversity conservation at the country, regional and global levels. Table 4 summarises the species by type currently on the IUCN Red List of Threatened Species compared to 2010.

Table 4: State of Species in Jamaica on the IUCN Red List (2010 & 2013)

Species Group	Critically Endangered		Endangered		Vulnerable		Near Threatened		Data Deficient		Total	
	2010	2013	2010	2013	2010	2013	2010	2013	2010	2013	2010	2013
Mammals*	1	1	0	0	4	2	0	0	x	0	5	3
Birds**	2	2	1	1	7	7	x	11	x	0	10	21
Reptiles*	3	1	1	0	1	0	x	1	x	0	5	2
Amphibians*	5	0	1	2	x	0	x	0	x	1	6	2
Freshwater Fish	x	0	x	0	x	0	x	0	x	0	x	-
Molluscs (land)*	x	0	x	x	x	x	x	x	x	x	x	-
Arthropods/ Invertebrates*	x	0	x	0	x	0	x	0	x	0	x	-

Species Group	Critically Endangered		Endangered		Vulnerable		Near Threatened		Data Deficient		Total	
	2010	2013	2010	2013	2010	2013	2010	2013	2010	2013	2010	2013
Plants*	x	0	X	1	x	1	x	1	x	x	x	3
Total											21	31

*2010 data taken from SOE 2010 and 2013 data from the IUCN Red List; x = No data;** Taken from Birdlife Int.

Table 4 confirms the status of some endangered species has changed between 2010 and 2013:

- 1) 2 mammals have been removed from the list;
- 2) 11 endemic species of birds have been added to the Red List;
- 3) 3 species of reptiles have been removed from the Red List;
- 4) 4 species of amphibians have been removed from the Red List;
- 5) 3 endemic species of plants have been added to the Red List.

2.2.2 The Current State of Invasive Alien Species (IAS) in Jamaica



The Subsidiary Body on Scientific, Technical and Technological Advice of the CBD defines alien species as, “a species occurring outside its normal distribution” and invasive alien species as, “alien species which threaten ecosystems, habitats or species”. The current number of IAS in Jamaica is provided in

Table 5. The number is subdivided into terrestrial and aquatic (freshwater and saltwater) ecosystems and compared with data provided by CHMJ and in SOE 2010. It confirms that there has been a significant increase (9%) in terrestrial IAS from 2010-2013.

Table 5: Number of Invasive Alien Species in Jamaica (2010 and 2013)

Type of Invasive Alien Species by Terrestrial and Aquatic ecosystems	2010	2013
Animals (terrestrial)	46	51
Animals (aquatic: fresh and salt water)	No data	17
Plants (terrestrial)	40	40
Plants (aquatic: fresh and salt water)	No data	2
Total IAS	86	110

Source: IOJ; Red = High increase in threat level; Orange = No change since 2010; Green = threat has reduced

There are a number of important reasons why IAS are a major threat to Jamaica’s biodiversity and its economy. These include:

- The small size and geographic isolation of Jamaica means it is highly vulnerable to the effects of IAS;
- The high number, but often small habitat range, of many endemic plants and animals found in Jamaica means some species can be lost quite quickly due to IAS;
- The growing interest to import pets and plants, both legally or illegally, means there is a greater chance that some will subsequently escape and proliferate;
- The growth in shipping trade and ports in Jamaica increases the opportunities for alien species to establish themselves;
- IAS establish themselves quickly as predators, competitors for food and habitat, or transmitters of disease because they have one or more of the following attributes:

- They reproduce and grow more quickly than local species;
- They have no known natural predators to control their numbers;
- They are highly resilient because they can adapt quickly to local environments and over time are able to cope even with doses of chemicals applied by humans;
- They usually act in an aggressive manner so they can invade a territory or aquatic ecosystem in order to dominate it and which may ultimately lead to its destruction.

The Invasive Alien Species Working Group is responsible for listing and monitoring IAS in Jamaica. The Jamaica CHM participates in this process, and has coordinated the development of criteria for listing IAS. Currently, the Inter-American Biodiversity Information Network (IABIN), a regional effort involving 19 countries (including Jamaica), maintains data and sources of information on IAS. However, in 2013 an open source version of the CHMJ's database (known as I3N-J) started development with support from IABIN. Public access to information on IAS is scheduled in 2014-2015.

Within the Caribbean region, Jamaica is also a participant in the Caribbean Invasive Alien Species Network (CIASNET), which is a collaborative effort involving scientists, national executing agencies and partners (Bahamas, the Dominican Republic, Jamaica, St. Lucia and Trinidad and Tobago), the Caribbean Plant Health Directors Forum (CPHDF), and regional and international organisations such as Global Environment Facility (GEF), the United Nations Environment Programme (UNEP) and Centre for Agriculture and Bioscience International (CABI) among others. In September 2013 NEPA, with the support of CIASNET, published a poster on some of the most prolific and potentially destructive IAS in Jamaica (see Figure 4).

The project: **Mitigating the Threats of Invasive Alien Species in the Insular Caribbean (MTIASIC)**, funded by GEF, conducted research on the, "Economic Impact of IAS in the Caribbean - Case Studies" in 2013 (published by Centre for Agriculture and Biosciences International - CABI). The report concluded IAS produce, "a negative impact on crop and pasture production, human and animal health, biodiversity and a multitude of other goods and services provided by ecosystems and as such pose one of the biggest threats to economic development on this planet." It justified this conclusion through a series of case studies designed to inform governments on the potential economic costs of IAS in order to take informed decisions on their control and/or elimination measures. Cost-Benefit Analyses (CBA) was applied in all five case studies on IAS. The results of all five case studies confirmed it was economically far more beneficial to act on IAS than the "do nothing" approach.

The issue of "willingness to pay" to protect ecosystems and their biodiversity has also been studied by the University of the West Indies (Institute of Sustainable Development) on behalf of NEPA since 2013. The study confirms that local people are prepared to pay on average up to US\$9 to preserve biodiversity and the local environment on the basis of the following values or views:

- Use value of the site;
- Site value as a place to live (for its beauty, ecological services, peacefulness, etc.);
- Opportunity to promote tourism;
- Local knowledge derived at the site from living with biodiversity and its ecosystem; and
- Payments are made to local institutions.

The UWI study concluded that Jamaicans are willing to pay up to 3% of national income (J\$15 billion) on environmental management if it can be funded through local mechanisms that are trusted and transparent in their operations.

2.2.3 The Current State of Biosafety in Jamaica

The Cartagena Protocol on Biosafety to the Convention on Biological Diversity (2003) governs the safe handling, transport and use of living organisms (LMOs)⁹ that are produced by modern biotechnology. The main objective of the Protocol is to ensure LMOs do not produce adverse effects on biological diversity or human health.

The Jamaican government became a signatory to the Protocol on June 4, 2001, although it was not ratified until September 25, 2012. A National Biosafety Committee (NBC) was established with responsibility for implementing the objectives of the Cartagena Protocol and providing advice on the potential impact of the release of LMOs on human health and the environment. The NBC is a multi-sectoral committee involving institutions such as NEPA, several ministries including those responsible for Agriculture and Health, the Scientific Research Council and the Office of the Prime Minister.

To facilitate the exchange of information on LMO and assist the Parties to better comply with their obligations under the Protocol, the Biosafety Clearing-House (BCH) was established and met several times prior to the ratification of the Cartagena Protocol. The focal point for the BCH mechanism remains the NHMJ and in 2012 it launched a new web page on Biosafety to provide information on relevant Laws and Regulations, contact information, projects, etc.

Since 2011 the NBC has not met to guide and supervise the use of LMOs. However, NEPA is responsible for the issuing of permits and licences before LMOs can be introduced in line with the provisions under the NRCA Act (1991). NEPA reports that no permits were issued relating to the import of LMOs between 2011 and 2013.

⁹ Also known as genetically modified organisms (GMOs)

2.3 The Main Threats Facing Jamaica's Biodiversity

Jamaica's National Ecological Gap Assessment Report (NEGAR) defines “threat” as, “the combination of stresses, or negative impacts that directly or indirectly affect the viability of targets and the human activities that are the sources of these stresses (Groves et al. 2000).” From this it identified the main threats to terrestrial, freshwater and marine biodiversity, which are summarised in Figure 3.

Figure 3: Main Threats to Marine, Freshwater and Terrestrial Biodiversity in Jamaica

Threats to Marine Biodiversity	Threats to Freshwater Biodiversity	Threats to Terrestrial Biodiversity
Coastal development	Nutrient loading	Mining activities
Land run-off	Invasive species and exotic species	Invasive species
Overfishing	Deforestation and removal of riparian strip	Unsustainable use of resources
Solid waste pollution	Unsustainable harvesting of freshwater biodiversity	Poor land use planning

Source: NEGAR, 2009

The threats indicated have remained highly relevant throughout the period 2011-2013. In addition, new threats have emerged in this period:

- Marine biodiversity: invasive species (lionfish) and coastal marine pollution due to the improper disposal of solid and liquid waste and the increased use of farm inputs such as agro chemicals (see Chapter 6).

- Freshwater biodiversity: inadequate treatment of liquid waste prior to discharge at an increasing number of inefficient and aging sewage plants (see Chapter 8).
- Terrestrial biodiversity: inadequate disposal of solid and toxic waste, including the growth of e-waste (see section on e-waste in Chapter 8).

2.4 Conclusions and Recommendations

Table 1 in Annex 1 provides a summary of the government's progress in meeting its commitments to the CBD, which centre on the establishment of a clear and coherent policy on biodiversity conservation. Table 2 in the same annex lists advances in meeting the Aichi Targets 2011-2020, which were established to support the implementation of the CBD. The most important conclusions and recommendations derived from these tables are:

- 1) Biodiversity conservation and its sustainable use have been integrated into ***Vision 2030 Jamaica***, but not adequately into sector development policies, strategies and plans. For example, the FD has found a strong perception remains among many Jamaicans that forests are termed "bush", which implies it is to be cleared for agriculture or settlement. Seagrass and mangroves are also considered barriers to tourism or development among some investors and private operators.

Recommendations

- a) Ensure that the conservation and sustainable use of biodiversity and ecosystems are fully integrated into key sector policies to support the GoJ's commitment to meet Goal 4 of the 2030 Vision NDP and international agreements relating to biodiversity such as the CBD, CITES and the Cartagena Convention).
 - b) Promote greater environmental education and awareness to counter balance this perception by providing information and data on the economic and social values of the environmental services derived from the conservation of natural resources and their use through sustainable practices.
- 2) The Protected Areas System Master Plan (PASMP) designed to protect the country's endemic species and their ecosystems has been updated in 2013, but the new Draft Policy on the System of Protected Areas has not been approved by GoJ.

Recommendation

GoJ should ensure approval of the new draft policy on PAS and the PASMP as soon as possible as the PAS is central to preserving the country's endemic biodiversity and will support the country's efforts in guaranteeing basic public services such as water supply, consolidating carbon sinks and supporting disaster risk reduction and resilience to climate variability and change.

- 3) A centralised monitoring system that provides access to the state of biodiversity by type in Jamaica and on Biosafety has not been established to support informed decision making on biodiversity conservation and Biosafety protection.

Recommendation

Establish a national template and a database management system that centralises information on the country's biodiversity and Biosafety (through their respective Clearing House Mechanisms), ensuring at least one qualified person is employed to operate and maintain the system and deliver annual reports. The format provided in Table 4 could be used as a starting point in assessing this recommendation.

- 4) There is a need to strengthen NEPA's capacity in areas such as planning, monitoring and law enforcement.

Recommendations

- a) Strengthen the planning and management capacity of NEPA to ensure Jamaica's biodiversity and ecosystems can be comprehensively protected, conserved and used sustainably both within the PAS and where biodiversity remains unprotected. This should be developed through the effective implementation of the Urban and Regional Planning's Sector Plan 2009-2030 (see Chapter 9) to ensure that ecosystem services are fully integrated into sector, local and regional development plans.
 - b) Improve public funding and attract national and international investment dedicated to supporting the development of planning and management capacity.
 - c) Enhance the law enforcement capacity of NEPA in coordination with relevant law enforcement institutions to secure more effective application of environmental laws and regulations with the active participation of local communities and wardens. Particular emphasis should be given to increasing the application of the "polluter pays" principle and surveillance of illegal activities such as logging and fishing in protected areas.
- 5) The general public remains largely unaware of the economic value and social benefits of biodiversity and ecosystems.

Recommendations

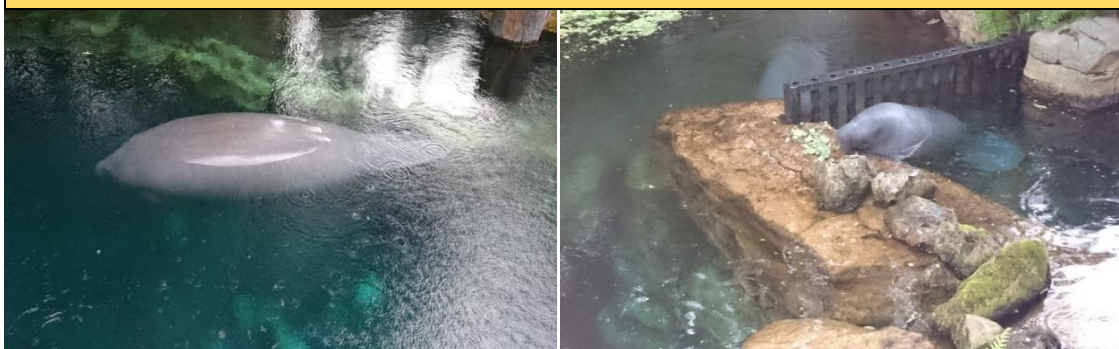
- a) Identify and implement a communication strategy to improve intra- and inter-institutional coordination at the national, regional and local levels and with civil society and non-state actors.
- b) Establish an official government document that provides guidance on the financial valuation of environmental services of forests and selected biodiversity.
- c) Support efforts to promote and expand applied research, such as that promoted by the Science and Technology Division of MSTEM to develop Jamaica's Neutraceuticals sector (products derived from food, drink and other natural sources that are used to provide health benefits, such as natural medicines).
- d) Promote the engagement and participation of the private sector in supporting the long-term conservation of biodiversity and ecosystems and ensure adoption of environmentally-friendly actions that improve economic sustainability over the medium to long-term as well as enhance public health, security and social cohesion.

- e) Promote the importance of establishing and implementing coordinated land use and spatial planning to avoid the fragmentation or damage of habitats and ecosystems, which are in the national interest (*Vision 2030 Jamaica*).
- 6) The Biosafety Committee has not met since 2011 to provide guidance on the introduction and use of LMOs.

Recommendation

Allocate resources for developing the Biosafety Clearing-House Mechanism in Jamaica and for facilitating meetings of the Committee.

Case study 1:
Sightings of the West Indian Manatee in Jamaica (*Trichechus manatus*)



Manatee (*Trichechus manatus manatus*)

In 2013 NEPA published a report on sightings of the critically endangered West Indian Manatee in Jamaica (locally known as the Sea Cow) between 1982 and 2012. Aerial surveys in 1982-93 estimated Jamaica's manatee population was between 13 and 100, mainly concentrated in Portland Bight and between Black River and Rio Minho. In 1998 the results of two surveys (Lefebvre et al. 2001) estimated the manatee population was down to around thirty animals. Between 2006 and 2007, three manatees were reported in the Castle Cove area of Portland and three in Montego Bay Harbour. However, in 2012 only one manatee was sighted close to Fort Charles beach in St. Elizabeth suggesting the manatee in Jamaica is close to extinction.

The main threat to manatees in Jamaica is human activity which has caused the destruction of their habitats (mangroves and seagrass beds) injury from propellers or entanglement in fishing nets, although NEPA's report suggests the number of deaths from fishing nets has decreased due to improved education and awareness training of fishermen.

What can be done to save the manatee? Five main actions are required:

- 1) Conservation of the manatee needs to become a government priority if future generations are to know, enjoy and observe the animal in the wild.
- 2) Greater partnerships should be forged between government and local communities, volunteers and other stakeholders to provide information on manatee sightings in a structured and standardised manner that includes the number of animals, whether a calf is present, the activity the animals were engaged in, the exact location of the sightings and time of day.
- 3) The protection of seagrass beds and breeding areas must be promoted and enforced to ensure that citizens remain supportive of government efforts to save the animal. This includes educating sectors such as agriculture, mining and tourism on the need to reduce pollutants in the water systems.
- 4) Regular education and awareness campaigns are required to promote conservation of the manatee's habitat (which could include incentives for those who report sightings correctly to NEPA).
- 5) Tourist operators and local boat operators need to allow free passage of these animals when they are sighted.

Case Study 2: The State of Marine Turtles in Jamaica

According to NEPA's Sea Turtle Report 2012, the general trend in the number of sightings of all four turtles continues to decline (in terms of dry runs and nesting sites) due to:

- A lack of adequate monitoring (NEPA had only two index beaches for monitoring until 2011)
- Poaching of turtles for their eggs, meat and shells;
- Poor fishing techniques, in particular the drowning of turtles in fishing nets;
- Pollutants in the water and solid waste on the beaches;
- Removal of seagrass;
- Illegal sand mining.



Green Turtle



Hawksbill Turtle



Leatherback Turtle



Loggerhead Turtle

In response, the Sea Turtle Recovery Action Plan (STRAP) was launched in 2011 with the support of the United Nations Environment Programme and other stakeholders. It's main objective is to bring about the sustained recovery of depleted turtle stocks by:

- Increasing the number of monitoring sites to at least six index beaches;
- Establishing effective surveillance of nesting sites with volunteer groups;
- Prioritising regular national surveys to improve information about foraging grounds, nesting habitats and monitoring of populations at index beaches and foraging grounds;
- Supporting community-based volunteer initiatives to monitor and protect nesting beaches.

The Sea Turtle Report (2012) confirms that implementing STRAP is challenging due to inadequate funds and human resources to ensure effective monitoring. However, four community-based groups have been mobilised and trained by the Jamaica Environment Trust (JET) with funding from the Environment Foundation of Jamaica (EFJ). These groups are: Bluefields Bay Fishermen's Friendly Society (Westmoreland); Treasure Beach Turtle Group (St. Elizabeth); and Portland Environment Protection Association and Free Winifred Beach Benevolent Society (Portland).



One of the most successful marine turtle rescue initiatives in Jamaica is at Oracabessa, (St. Mary) where complete records on hawksbill turtle nesting sites and turtle hatchling releases have been recorded for over 10 years.



Case Study 3:

IAS

- Responses to the Lionfish Invasion in Jamaica



The Lionfish is originally from the Pacific ocean, but has been introduced by accident into the Caribbean where it is aggressively eating up local fish stocks at an alarming rate because it has no predators to control it. The Discovery Bay Marine Laboratory of the University of the West Indies (UWI-DBML) has studied the Lionfish and observed it can eat 20 juvenile fish such as Snapper and Grunt in just one feeding session. The social, economic and environmental costs of losing fish stocks to this aggressive and highly reproductive fish are therefore worrying as it could have a devastating effect on the livelihoods of many fisherfolk and on Jamaica's fishing industry as a whole.

Responses to the Lionfish invasion have been encouraging since 2011. Most significant has been the National Lionfish Project within a larger Regional Project entitled Mitigating the Threat of Invasive Alien Species in the Insular Caribbean funded by the Global Environment Facility (GEF) and the United Nations Environment Programme (UNEP) Campaign and led by UWI-Discovery Bay Marine Laboratory and NEPA. One of the main focus areas of the project has been the training of fishermen on how to catch the fish, remove their poisonous spines (using protective gloves and shears) and on consuming the fish as an alternative to depleted stocks of commercial fish such as Snapper and Grunt.

Anecdotal evidence from fishermen who participated in the Project, claim the number of fish being caught in 2013 is at 50% less than in 2010. Monitoring by UWI-DBML also confirms sightings are down and believes the main reason is the growing appetite of fishermen and the restaurant trade to consume the fish, especially on the North coast. Furthermore, some restaurants have developed specific dishes using Lionfish, which is proving popular with tourists and residents.



have

least

local

Useful Links and References:

Information on NEPA's Biodiversity Branch:

<http://www.nepa.gov.jm/publications/brochures/brochures/biodiversity%20terms.pdf>

The Convention on Biological Diversity (Aichi Targets):

<https://www.cbd.int/sp/targets/>

Jamaica Clearing House Mechanism and Biosafety Clearing House Mechanism

http://jamaicachm.org.jm/ioj_wp/

The Economic Impact of IAS in the Caribbean by CABI:

http://www.cabi.org/Uploads/CABI/aboutus/Scientists%20output/Economic_impact_in_the_Caribbean.pdf

Caribbean Invasive Alien Species Network (CIASNET)

<http://www.ciasnet.org/ciasnet-org/about-us/>

The Non-use Value of the Cockpit Country by the Windsor Research Centre

<http://www.cockpitcountry.com/EcoVal.html>

Summary of Economic Valuation Studies and their Policy Reference for Jamaica

http://pdf.wri.org/working_papers/coastal_capital_jamaica_literature_review_summary_table.pdf

The Millennium Ecosystem Assessment

<http://www.millenniumassessment.org/en/index.html>

Maps:

Figure 4: Poster of a selection of Invasive Alien Species in Jamaica (2013)

Figure 5: Biodiversity hot-spots in Jamaica (2013)

Figure 5: Biodiversity Hotspots in Jamaica (2013)



Source: Critical Ecosystem Partnership Fund (CEPF): Caribbean Islands Biodiversity Hotspot, Ecosystem Profile Summary, Jamaica (p.14). Note the report identified six conservation corridors in the Caribbean which it considered to be of global importance. Two of these corridors are found in Jamaica: Cockpit Country-North Coast forest-Black River Great Morass and Portland Bight.



3. Forests and Watersheds

What is a forest? A forest is an ecosystem characterised by a more or less dense and extensive tree cover, often consisting of stands varying in characteristics such as species, composition structure, age class and associated processes. A forest ecosystem will also include meadows, streams, fish and wildlife. Forest also includes industrial forest, non-industrial private forests, plantations and protection forests (The Dictionary of Forestry). Forests are divided into three different layers: the forest floor, the understory and the canopy.

What is forestry? The profession embracing the science, art and practice of creating, managing, using and conserving forest and associated resources for human benefit and in a sustainable manner to meet desired goals, common needs and values (ref. ibid). The Forestry Department (FD) is mandated by the Forest Act (1996) to sustainably manage forest reserves, forest management areas and forests on Crown lands, in accordance with the National Forest Sector Plan. The FD also promotes the conservation and development of forests on private lands and conducts public awareness and education on forest resources.

What are primary and secondary forests? Primary forest is untouched native old-growth virgin forest. Closed Broad Leaved Forest at least 5 metres tall and with interlocking crowns is the closest to primary forest that exists today. Its location is in parts of the Cockpit Country and the Blue and John Crow Mountains Reserves of Jamaica. Secondary forest is where human activity has taken place, but has not set off “succession processes” that disturbed the canopy in a major way (U. Chokkalingham, et al, FAO/CIFOR).

Why are forests important? Forests provide a number of important environmental services, such as:

- Acting as important regulators of rainfall, (a mature tree’s leaf canopy can intercept as much as 3,000 litres of rainfall), that slow down runoff and thus help to reduce the impact of floods and droughts;
- Providing an important source of the Jamaica’s drinking water needs, especially in the eastern region;
- Protecting soils and reducing sedimentation of water supplies, drainage systems and coral reefs;
- Acting as important barriers to disease and a home to many pollinators such as bees and butterflies;
- Providing oxygen to sustain life (a mature, healthy tree produces on average 120 kg. of oxygen per year, which is 70% of the annual oxygen needs of an adult human being);
- Helping to reduce energy needs (trees placed around buildings can reduce air conditioning needs).
- Providing medicines and other economic products derived from the forest ecosystem.

What are watersheds? A watershed is a drainage basin or catchment for a main river and its tributaries. It supplies water by surface runoff, or sub-surface infiltration into aquifers that can be tapped by drilling wells. Topography is the key element shaping a watershed. (NEPA). The boundary of a watershed is defined by the highest elevations (ridges) surrounding the river, which in the case of Jamaica drain into the sea (reefs). Jamaica is divided into 26 watershed management units which may include one or more rivers with their associated catchment areas.

Why are watersheds important? All Jamaicans live within a “watershed management unit” that provides them with freshwater as well as other environmental services. Protection of forests within the upper watersheds and along the riparian strips helps ensure freshwater is made available to support sustainable human activity as well as the ecological functions of the river system itself.

3.1 Background to Jamaica's Forests and Watersheds

Forests: Jamaica embodies forest ecosystem services through the provision of wood and water. In addition, given Jamaica's mountainous topography and tropical weather systems, forests protect soils from erosion and major landslides that can cause major flooding and contamination of freshwater sources, as well as damage to coral reefs. Jamaica has four main types of forest (Johnson 1988), which have evolved differently because of the existence of different environmental conditions and edaphic elements:

- 1) **Limestone forests:** supported on limestone or soil derived from limestone parent rock. It can be dry as in the case of Hellshire Hills; Moist - Cockpit Country or wet – John Crow Mountains.
- 2) **Shale forests:** supported on shale or conglomerate soils for example west and southern sections of the Blue Mountain Forest Reserve.
- 3) **Lowland dry forests:** these include the Tall and Short Open Dry Forests. These forests are found in areas with below average rainfall, such as Clarendon and southern St Thomas Parishes.
- 4) **Wetland forests (include mangroves and other swamp forests)** are most commonly associated with coastal regions, but are also found in some inland areas, such as in St. Elizabeth.

In terms of international agreements, national Acts, policies, strategies and plans most relevant to forest conservation and sustainable use, Jamaica is committed to, among others:

- The **Convention on Biological Diversity (CBD)**, which includes meeting the relevant Aichi Targets 2011-2020, in particular Targets 11 and 14 (see Annex 1a at the end of this report);
- The **UN Forum on Forests**, which promotes long-term political commitments to forest management, conservation and sustainable use and also requests Voluntary National Reports to be submitted;
- The **UN Framework Convention on Climate Change (UNFCCC)**, which has a direct relationship with Aichi Target 15 concerning the reduction of greenhouse gases and increasing carbon sinks (see Annex 1b);
- The **UN Convention to Combat Desertification (UNCCD)** that promotes the need for all parties to prepare, adopt and implement a National Action Plan in which actions against deforestation and land degradations are considered important to combat desertification and drought;
- The **Forest Act (1996)** governs the organization and functions of the Forestry Department and the way forest reserves and forest management areas are to be declared, managed and protected;
- The **Forest Regulations (2001)** outlines the framework under which the FD can address infringement and violations within forest estates;
- The Draft **Forest Policy (2013)** which aims at guiding the sustainable management of Jamaica's forest resources through 8 guiding principles:
 - a) Transparency and accountability
 - b) Precautionary approach
 - c) Sustainable development and intergenerational equity
 - d) Varying management approaches
 - e) Participation and collaboration
 - f) Protection and sustainable use of Biodiversity

- g) Best Science
- h) Recognizing the value of forest lands, good and services.
- **National Forest Management and Conservation Plan (NFMCP)** of 2001, which is currently undergoing revision to produce a new plan.
- **The Strategic Forest Management Plan 2010-2015** provides details on how the operational strategies and actions of the NFMCP are to be implemented during this time period.

Watersheds: Jamaica has 10 hydrological basins in which there are over 100 streams and rivers in addition to a large underground river network.¹⁰ To facilitate the management of natural resources and their ecosystems found within these basins a total of 26 Watershed Management Units (WMUs) were established (see Figure 11 at the end of this chapter). The size of each WMU ranges from 46.6 Km² (South Negril–Orange River) to 1,638.8 Km² (Black River). Figure 11 confirms most of the country's watersheds have rivers that flow either north or south from a central ridge which traverses through the centre of the country from the Blue and John Crow mountains in the east and the Cockpit Country in the west.

The protection of Jamaica's upper watersheds dates back to the 1800s when a series of strategic forest reserves were created¹¹. Since independence a number of government initiatives and Parliamentary Acts have been responsible for protecting the country's watersheds and forest ecosystems. The most important is the **Watershed Protection Act** (1963). In addition, other relevant Acts include:

- The **Wild Life Protection Act** (1945);
- The **Mining Act** (1947);
- The **Floodwater Control Act** (1958);
- The **Land Development and Utilization Act** (1966), which established the Land Development and Utilization Commission (LDUC), which since 2001 has been administered by the NRCA;
- The **Quarries Control Act** (1984);
- The **Town and Country Planning Act** (1988), which established the Town and Country Planning Authority (TCPA), which has also been administered by the NRCA since 2001;
- The **Rural Agricultural Development Act** (1990);
- The **Natural Resources Conservation Authority Act** (1991), which included provisions for watershed protection and management;
- The **Water Resources Act** (1995), which established the Water Resources Authority (WRA);
- The **Forest Act** (1996) and **Forest Regulations** (2001), which includes provisions for forest management and planning; and
- The **National Solid Waste Management Act** (2001).

In 2003, the Watershed Policy for Jamaica (final draft) was prepared to establish a coherent and more integrated approach to watershed management and the environmental services they provide, in particular regulating rainfall runoff and protecting fragile soils from contaminating freshwater supplies and increasing the risks of floods¹². The policy has six specific goals, summarised as follows:

- 1) A coherent and rationalized legislative and institutional framework for integrated watershed

¹⁰ NRCA, National Report on Integrating the Management of Watersheds in Jamaica, 2001

¹¹ NEPA: http://www.nepa.gov.jm/symposia_03/Papers/Watersheds.pdf

¹² 60% of Jamaica's landmass is 230 metres or more above sea level and characterised by steep slopes of 20 degrees or more and a predominance of limestone-derived soils.

- management in place to support sustainable development;
- 2) Provision and development of adequate human resources for effective watershed management is delivered;
 - 3) Adequate financing for watershed management is secured;
 - 4) Availability of improved technical capacity for effective watershed management;
 - 5) Increased public awareness for improved participation in watershed management;
 - 6) Initiatives to encourage proper Land Use supported.

3.2 The current state of Jamaica's Forests and Watersheds

3.2.1 The Current State of Jamaica's Forests Managed by the Forestry Department Under the Forest Act

In 2012-2013 the Forestry Department, with support from the European Union under the Climate Change Adaptation and Disaster Risk Reduction Project, conducted the: "Land Use Cover Assessment: A Comprehensive Assessment of Forest Change between 1998 and 2013" for Jamaica. The assessment used improved technology to the one conducted in 1998, based on a methodology of remote sensing, the collection of ground-truth data and cross-checking against archival land use data. Table 6 shows the current state of forest cover.

Table 6: Change in Forest Cover in Jamaica Between 1998 and 2013 (in '000 Hectares)

National Classes of Forest (in 2013)	1998	Land use (%)	2013	Land use (%)	LU Change in 2013	% Loss/Gain
Forest Land Use						
Closed Broadleaf	88.2	8.0	84.6	7.7	- 3.6	- 4.1
Disturbed Broadleaf	174.8	15.9	175.3	16.0	0.5	0.3
Short Open Dry	12.1	1.1	2.6	0.2	- 9.5	- 78.5
Tall Open Dry	42.0	3.8	37.6	3.4	- 4.4	- 10.5
Bamboo*	3.0	0.3	-	-	-	-
Mangrove forest	9.7	0.9	9.8	0.9	-0.1	1.0
Swamp/Riparian forest	2.2	0.2	0.1	0.0	- 2.1	- 95.5
Forest Plantation**	8.2	0.7	8.3	0.8	0.1	1.2
Secondary Forest***	-	-	123.0	11.2	123.0	-
Total (change in forest cover)	332.0	30.3	441.3	40.2	109.3	32.9
Mixed Land Use						
Bamboo and Fields	29.0	2.6	-	-	- 29.0	-
Bamboo & Disturbed Broadleaf	12.7	1.2	36.8	3.4	-24.1	189.8
Bauxite & Disturbed Broadleaf	2.9	0.3	-	-	- 2.9	-
Fields & Disturbed Broadleaf	118.0	10.8	166.4	15.2	48.4	41.0
Fields/Disturbed Broadleaf& Pine plantation	8.2	0.7	-	-	- 8.2	-
Disturbed Broadleaf & Fields	166.0	15.1	-	-	- 166	-

Total (change in mixed use)	336.8	30.7	203.2	18.5	- 133.6	39.7
Non-Forest Land Use						
Non-Forest land use	411.6	37.5	447.6	40.8	36	8.7
Water	16.0	1.5	5.2	0.5	- 10.8	- 67.5
Total (change non-forest use)	427.6	39.0	452.8	41.3	25.2	5.9
Grand Total	1,096.4	100	1,097.3	100	0.9	0.1

Source: Forestry Department, 2013; * Bamboo included in Non-Forest Land use;

Previously classified as Fields/Disbursed broadleaf and pine plantation; *New classification for 2013

Table 6 indicates that approximately 40% (441,295 ha) of mainland Jamaica is covered by forest compared to the estimated 30% identified in 1998. This change is mainly attributed to improvements in satellite technology that now produce sub-metre satellite images for remote sensing purposes, whereas in 1998, 30 m. images were used. The change is not due to a major increase in reforestation, as can be seen in Table 7.

Table 7: Land Area Reforested and Deforested in Jamaica in Hectares (2006-2013)

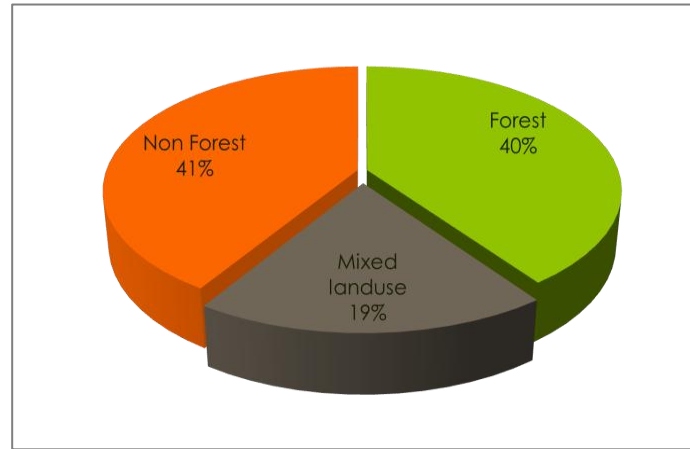
Action	2006	2007	2008	2009	2010	2011	2012	2013	Total
Reforestation (A)*	174	253	150	281	200	274	163	50	1,545
Deforestation (B)#	339	338	338	337	337	337	336	-1,437	925
Balance (A-B)	-165	-85	-188	-56	-137	-63	-173	1,487	620

Source: Forestry Department; * Reflects areas planted on lands managed by the Forestry Department and does not include Private lands; #Includes an upward revision of forest cover in 2013 following the Land Use Cover Assessment in 2013 in Jamaica.

The main findings from the Table 6 and Table 7 are;

- 1) The current state of land cover in Jamaica indicates that approximately 40% is forest, almost 19% of the country is classified as having mixed land use (a combination of any of the forest broad classification with that of non-forest) and the remaining 41% of the mainland is classified as non-forest inclusive of bamboo (which in 1998 was considered as contributing to forest cover), crop plantations, quarries, water bodies, infrastructure etc.

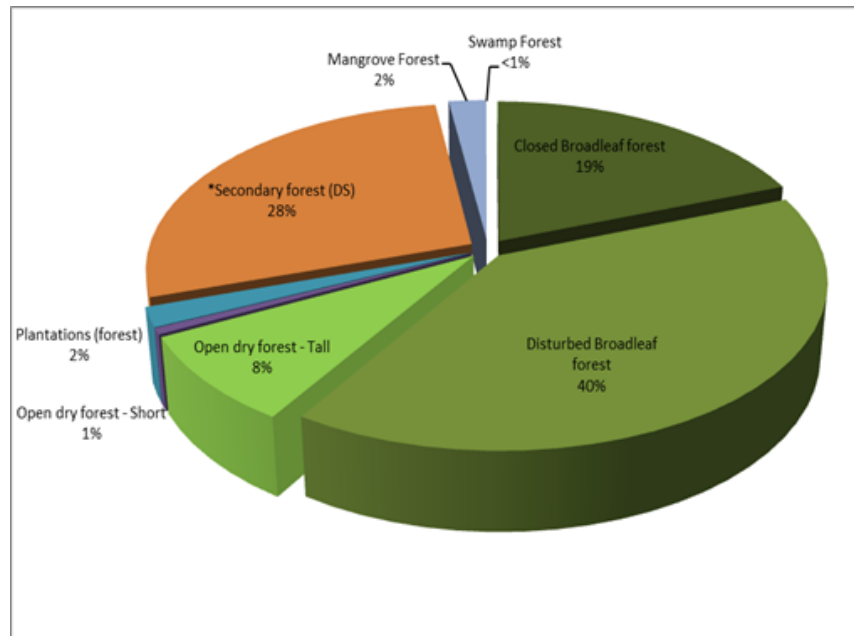
Figure 6: Percentage of the Various Categories of Land Use (2013)



Source: Forestry Department Land Use change Assessment 2013

- 2) Table 6 confirms that there has been a small gain of 620 ha. in reforestation between 1998 and 2013. This gain (0.4%) is mainly attributable to re-growth of secondary forest (ruinate forest) and to a lesser extent to an increase of forest plantations. However, although forest cover at the national level has increased, the quality of Jamaica's forests has decreased in 2013 in all forest types (FD);
- 3) The following pie graph summarises the current state of Jamaica's forests based on the national classifications used as a result to the above-mentioned land use cover assessment.

Figure 7: Percentage of Forest Classifications at the National Level (2013)



Source: Forestry Department Land Use change Assessment 2013

- 4) Broadleaf forest (closed and disturbed) noted for its stratification and high levels of biodiversity¹³ accounts for almost 59% (263,000 ha) of total forest cover (441,300 ha) in 2013;
- 5) Closed Broadleaf forest cover has experienced a decrease of 4.1% (3,600 ha) in relation to the percentage cover registered in 1998. Although this is a relatively small land area, it is cause for concern given the high levels of biodiversity found in these forests and given its officially protected status by the State. In addition, the increase in disturbed broadleaf forests due to the spread of bamboo represents a further threat to the country's biodiversity, with an estimated increase in cover of 189% since 1998;
- 6) Short open dry forest mainly found in the south of the country has experienced highest loss in terms of land area since 1998. Approximately 78.5% (9,500 ha) of Short Open Dry forest was converted to bare land and to a lesser extent cultivations between 1998-2013;
- 7) The second largest loss of forest by land area was Tall Open Dry forest, which lost over 10.5% (4,400 ha) to bare land and buildings & other infrastructure between 1998 and 2013;
- 8) Mangrove forest cover has remained stable between 1998 and 2013. Meanwhile, over 95% of Swamp forest has been lost to non-forest land uses between 1998 and 2013 (2,100 ha). The main changes of use have occurred as a result of increases in: cultivations, herbaceous wetland and buildings and other Infrastructure;
- 9) The amount of disturbed broadleaf forest due to bamboo invasions rose from 1.4% in 1998 to 3.4% in 2013, which represents an increase of almost 250% over the 15 years period. Figure 8 shows examples of how bamboo has invaded upland areas in St. Andrew parish.

Figure 8: Bamboo Invasions in Upland Forests of St. Andrew



- 10) Secondary forest, which accounts for over 11% of land area under forest, has been introduced as a new classification for forests where disturbance has affected more than 25% of total forest area and represents the most degraded of the various classes of forest currently used in Jamaica;

The FD reported that the area of forests protected under the Forest Act, has declined as a percentage of total land area from 9.8% in 2010 to 8.9% in 2013. More information on protected areas can be found in Chapter 4.

¹³ Broadleaf trees usually grow beyond 5m in height and their crown cover extends beyond 10%. *Disturbed Broadleaf* refers to disturbance of less than 15 % of the total broadleaf forest area. More pronounced disturbances in this forest class (i.e. between 15 and 25% of broadleaf cover) are classified as Secondary forest.

3.2.2 The Current Demand for Forest Products

Table 8 summarises the trend in estimated demand for wood products between 2008 and 2013.

Table 8: Estimated Annual Demand for Lumber in Metres Cubed Jamaica (2008-2013)

Lumber by type	2008	2009	2010	2011	2012	2013
Coniferous Imported	83,129	64,331	87,384	96,820	81,056	276,670
Coniferous Produced	719	198	269	112	199	209
Total soft woods	83,848	64,529	87,653	96,932	81,255	276,879
Hardwoods Imported	5,926	2,389	1,680	1,306	1,083	3,390
Hardwoods Produced	370	222	3,536	617	517	776
Total hard woods	6,296	2,611	5,216	1,923	1,600	4,166
Grand Total	90,144	67,140	92,869	98,855	82,855	281,045

Source: STATIN, External Trade; FAO Questionnaire for period 2008-2013;

Table 8 shows that estimated demand for lumber in Jamaica has generally increased year on year with the exception of 2009 following the global financial crisis. Demand for hard woods has increased and put pressure on Jamaica's forests, especially closed broadleaf forests. Demand for Soft wood increased dramatically in 2013, which may be due in part to the rehabilitation period in the aftermath of Hurricane Sandy in November 2012.

3.2.3 The Current State of Jamaica's Watersheds

NEPA is responsible for monitoring the country's watersheds within the Watershed Management Units (WMUs). A major objective is the identification of negative land use issues in order to identify appropriate responses to address their degradation.¹⁴ In 1999, the 26 WMUs were classified according to their level of degradation under the National Watershed Classification and Monitoring Programme.¹⁵ Monitoring has continued with limited resources since 1999, with the most recent monitoring taking place in the period 2012-2013 when a total of 16 WMUs were monitored (on the basis that they were of highest priority in terms of watershed degradation).

The 16 WMUs monitored were: Oracabessa-Pagee, Wag Water, Buff Bay-Pencar, Spanish River, Swift River, Rio Grande, Plantain Garden, White River/Rio Bueno, Martha Brae, Montego River, Great River, Lucea River, South-Negril/Orange River, Carbaritta River, Deans Valley River, and Black River. In all cases the WMUs were monitored in the upper and lower areas to ensure wider coverage of each watershed. The results of the monitoring showed watershed degradation remains prevalent in all 16 of

¹⁴ Currently this is administered by the Ecosystems Management Branch of NEPA to highlight the results of the monitoring activities conducted by the Watershed Management Units. The following parameters are monitored at least once a month: vegetative cover/deforestation; land use; solid waste disposal methods; number of blocked drains/gullies/sinkholes; land slippage/landslides; flooding; status of rivers; special drainage features and biodiversity habitats.

¹⁵ The National Watershed Classification and Monitoring Programme, NRCA/CAD Inc., used the following parameters: 1) geology; 2) soils (susceptible to erosion); 3) land use and vegetative cover; 4) slope; 5) rainfall; 6) landslide potential; 7) stream density; 8) road density; 9) WMU boundaries (upper watersheds).

the WMU assessed. The main findings of the report are:

- 9 WMUs showed that flooding, improper solid waste disposal and soil erosion were prevalent;
- 7 WMUs experienced landslides, deforestation, clearing of wetland, stream bank erosion and informal settlement;
- Flooding, improper disposal of solid waste and soil erosion are the most common issues facing the 16 WMU monitored;
- The most degraded WMUs are found in eastern Jamaica such as Hope River, Pencar-Buff Bay, Orcabessa-Pagee, Rio Grande, Wag Water River and Yallahs River;
- The least affected WMUs included Deans Valley River and Lucea River.

Limited resources have prevented an update of the watershed classification map produced in 1999. However, the overall findings from NEPA's monitoring exercises indicate that the same four watersheds remain critically degraded now and they were then. (Figure 12) One important observation that will be addressed in the future is that water quality within the watersheds is added as a parameter to support the watershed classification process.

The degradation of many of the country's watersheds is due to a number of factors that include:

- The absence of a fully coordinated and updated policy response to watershed conservation and the sustainable use of natural resources such as forests under the Forest Act. For example, more emphasis should have been given to supporting local communities to establish buffer zones around protected areas, forest reserves and forest management areas in which sustainable agriculture (such as agro-forestry) and/or eco-tourism are promoted;
- Insufficient law enforcement and fines to send a clear message to law breakers that illegal logging, unauthorized land use changes and improper waste disposal are being prosecuted efficiently and effectively. In addition, insufficient law enforcement may have acted as a disincentive for many local people to support government efforts to protect the country's forest ecosystems;
- Inadequate levels of training and the provision of resources and incentives to engage the public in the conservation and sustainable use of the country's forest resources.
- Inadequate levels of environmental education and awareness programmes targeted at communities in the most degraded watersheds.

However, during the period 2011-2013, the Forestry Department was supported by the Climate Change Adaptation and Disaster Risk Reduction Project (CCADRRP), to help address the protection and sustainable management of forest reserves and improve watershed management. The following is a summary of some significant developments during this period.

- ✓ Establishing a dedicated branch for “Enforcement and Compliance” with its primary function being to patrol and monitor forests to detect offences under the Forest Act and Regulations. In 2013, a toll free hotline was also established to support public participation in the monitoring of illegal activities.¹⁶
- ✓ Engaging and empowering local community participation in the co-management of forest reserves through the creation of Local Forest Management Committees (LFMC). There are currently 18 LFMCs across seven parishes.
- ✓ Implementing consistent and targeted public awareness and education campaigns, which have included school programmes, community consultations, media articles and announcements and development of social networking.¹⁷
- ✓ Updating the forest resource inventory as a result of the Land Use Cover Assessment in 2012-2013.
- ✓ Promoting the expansion of forestry, especially on steep slopes and gullies. Particular focus has been given to promoting the Private Forestry Programme whereby private landowners who establish/rehabilitate forest are entitled to tax breaks.
- ✓ Expanding the size of areas protected under the Forest Act.
- ✓ Reforesting of 1,545 ha (see also Table 7 above).
- ✓ Implementing the annual reforestation programme, which includes the establishment of fire breaks.
- ✓ Developing and implementing local forest management plans designed to incorporate both the physical and social aspects of forest management.
- ✓ The revision of the legislative framework governing the management of forests at the national level.

3.3 The Main Threats to Jamaica's Forests and Watersheds

The Land Use Cover Assessment 2012-2013 has highlighted the following pressures and threats that Jamaica's forests are currently facing:

- The encroachment by farmers and informal settlers into forested areas, especially in the upper watersheds and riparian forests (along river banks), in the interests of establishing subsistence agriculture. This situation has not been helped by the general perception among many informal settlers and subsistence farmers that forested lands are fertile and produce high yields. In fact, the opposite is often the case given that the nutrient flux of most forested soils in Jamaica is not sustainable beyond a few years and this forces farmers to move into new forested areas; thus maintaining the process of degradation of forest resources and their environmental services.
- Illegal logging for lumber, especially for highly prized hardwoods such as Jamaican Mahogany and Blue Mahoe, but also for trees to make yam sticks, scaffolding, fence poles and posts, or wood for charcoal kilns all of which contribute to reducing the quality of the country's forests.
- Infrastructural development to link up major conurbations in Jamaica, in particular the opening up of new roads such as the development of Highway 2000 and the North-South

¹⁶ The toll free number is: 1-888- FORESTS became operational in August 2013 to aid the public to report illegal activities such as squatting, cutting of trees, forest fires, pasturing of animals, or the cultivation of crops.

¹⁷ The Forestry Department has both Facebook and Twitter accounts.

Highway, which facilitate greater access to forested areas for agriculture expansion and development.

- Bauxite mining which requires the removal of forest before the ore can be extracted. When this removal occurs in areas of native Limestone Forest (such as in the Cockpit Country) the impact can be highly detrimental to biodiversity and to the quality of groundwater. Furthermore, following mine closure, the area may only be grassed or restored with non-native trees.
- The effects of climate variability and change are leading to longer dry periods, which make forests more vulnerable to fires, drought and more intense hurricanes,. When coupled with deforestation, this has increased human vulnerability to disasters and the loss of natural barriers to the spread of disease and the reproduction of pollinators, especially in the most critical watersheds.

Deforestation was also highlighted in the Watershed Status Monitoring Report 2013 as a major threat to the health of the country's watersheds, because its effects include increased levels of soil erosion, landslides and the widening of river banks all of which may increase human vulnerability to disasters and help breakdown the ecological functions of the ecosystem. Other major threats to Jamaica's watersheds include:

- The improper disposal of domestic garbage, such as into gullies, drainage ditches and rivers, which may include domestic appliances ("e-waste"¹⁸) and toxic waste, which has contaminated both freshwater and the country's coastal areas, Marine Parks and fish sanctuaries when this waste is washed out to sea.
- The increased use of chemical inputs in farming and inadequate sewage treatment, which has increased the amount of nutrients in the river systems and coastal areas of many WMUs (see more on this in Chapter 6).
- The expansion of settlements that put additional pressures on already limited natural resources within the watershed, in particular water supplies. In such cases this increases the stress levels on those resources and may lead to water shortages if there is a prolonged period of drought.
- The drainage of swamp and wetlands, which has caused increased levels of salinisation of freshwater resources in coastal areas, especially in the south of the country.
- The increase in demand for water, including water for irrigation agriculture, which has been exacerbated by the growing threat of prolonged droughts attributed to climate variability and change.

3.4 Conclusions and Recommendations

Jamaica's forest ecosystems and watersheds are crucial to the survival of its inhabitants and the vast majority of the country's biodiversity. Furthermore, as global warming and the demand for water grows, the importance of preserving and expanding forests as carbon sinks and water regulators becomes ever more imperative.

The GoJ recognises the importance of introducing a more coherent and coordinated approach to the way the country's forests, protected areas and watersheds are managed in order to secure a healthy environment for all over the long-term. This recognition underpins work currently under including the

¹⁸More information on e-waste can be found in Chapter 8.

preparation of a new draft Forest Policy, a new draft policy for Protected Areas, and the development of new draft policies to support areas such as solid and liquid waste management and a national policy on adaptation to climate change.

The following conclusions and recommendations are currently being assessed by the GoJ to improve the conservation and sustainable use of the country's forests and watersheds:

- 1) There is a need to ensure that the legal, institutional and managerial mandates of the Forestry Department are closely coordinated with the mandates of NEPA and WRA in relation to the integrated management of WMUs.

Recommendations

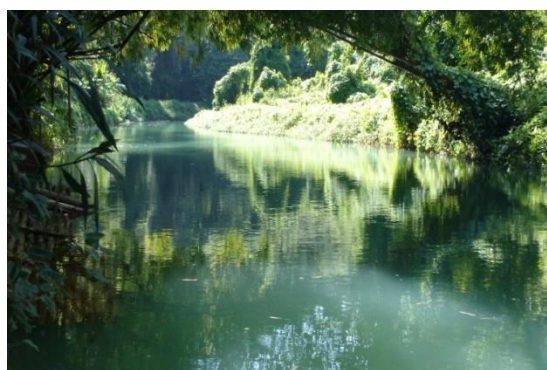
- a) Ensure that the new Forest Policy which is now under review, establishes a coordinated policy framework with other key actors. This framework should give priority to the rehabilitation of WMUs (especially upper watersheds) to help safeguard protected areas, promote conservation agriculture and reduce human vulnerability to hazards such as landslides, floods and drought. Key actors should include MWLECC (including FD, NEPA, WRA), MoAF, Local Government, ODPEM and other stakeholders deemed relevant.
 - b) Rehabilitate the Watershed Management Council as a major driver to achieve the outcomes under Goal 4 of the Vision 2030 National Plan (based on the ridge-to-reef approach), ensuring the above-mentioned stakeholders are fully represented.
 - c) Strengthen the existing Forest Conservation Fund (see also Chapter 4 on the FCF) to support and widen the development of locally-based forest management initiatives, conservation agriculture (based on agro-forestry) and promote income generating activities from these practices linked to pre-determined markets such as tourism (see also Chapter 9, section on tourism) and export markets to sustain livelihoods and conservation practices.
- 2) The Forestry Department has promoted greater participation of civil society in the identification and implementation of Forest Management Plans (nine so far). However, this needs to be widened to help promote a national network of co-management agreements through which forestry plays an integral part in sustaining agriculture, tourism and other economic development within WMUs.

Recommendations

- a) Ensure that the database on land cover held within the FD can be accessed by other government agencies in MWLECC to support watershed, land use and spatial development planning.
- b) Develop capacity in the collection, processing, interpretation and monitoring of forest data to support forest, and watershed policy and development planning, as well as to provide empirical data to guide reforestation initiatives and public education and awareness campaigns.
- c) Conduct forest ecosystem valuations to support annual public investment decision-making in the interest of securing sustainable development, safeguarding the environmental services of forests and enhancing access to international climate finance.
- d) Where boundaries are not clearly defined with marker posts, demarcate forest reserves

- with the participation of the local communities.
- e) Establish/update management plans for the forest reserves incorporating the recommendations of the forest ecosystem valuations and emphasising their role in sustaining development and reducing the risk of hazards such as landslides, floods and droughts.
- f) Support the FD to develop local income generating activities to support job creation linked to the conservation and sustainable use of forest ecosystems especially through eco-tourism and adopting best practice standards for forest products.

Figure 9: Examples of Eo-Tourism With High Potential for Promoting Local Development While Safeguarding the Country's Forests and Watersheds



Rafting and river walks along Martha Brae River



Ecotourism opportunities at Bluefields

- 3) Greater public participation and education are required to support the effective management of forest ecosystems. This commitment is currently being developed through the establishment of 18 LFMC which includes three LFMC established to co-manage 400 ha of forest in two critically degraded WMUs following the closure of the Climate Change Adaptation and Risk Reduction Project (CCARRP) in 2013.¹⁹

Recommendations

- a) Allocate government resources to support the development and consolidation of LFMCs as part of an inclusive approach to the management and protection of the country's forest ecosystems.
- b) Establish long-term partnerships with donors, the private sector and non-governmental organisations to support the expansion on LFMCs.
- c) Ensure that empirical data are provided to the local community, non-state actors and private landowners to support reforestation initiatives and develop public education and awareness campaigns.

Other highly pertinent conclusions and recommendations include:

- 4) Land use policy and planning needs to be more effective to ensure the long-term protection and sustainable use of the country's forest reserves.

¹⁹Funded by the European Union and executed by UNEP and the Forestry Department

Recommendations

- a) Assess the feasibility of establishing spatial development plans in which the watershed is the unit of analysis to support a “ridge-to-reef” approach to land capability mapping and land use planning in which disaster risk reduction and adaptation to climate change are fully integrated.
 - b) Prioritise the establishment/consolidation of forest reserves in the upper watersheds and along the banks of all main rivers that provide drinking and/or irrigation water. Where critical areas are identified within private lands a negotiation procedure should be adopted to ensure compliance with existing laws supported by warning letters where necessary. In extreme situations that are critical to ecosystem sustainability and disaster risk reduction, a compulsory acquisition should be considered (if a mutual agreement on land management cannot be reached with the land owner).
 - c) Special attention should be given to communicating the importance of protection/rehabilitation of riparian forest along all main rivers and around flood plains in the interests of disaster risk reduction and adaptation to climate change (see also Chapters 11 and 12).
- 5) The improper disposal of solid and liquid waste represents a growing threat to the country’s forests and watersheds and therefore, in promoting sustainable economic development.

Recommendations

- a) Ensure the removal of all major contaminating agricultural and livestock activities, in particular pig and cattle farms, sugar cane and banana plantations, agriculture processing plants, based in, or directly next to, water sources.
 - b) Introduce environmental mitigation measures where mines and quarries and Industrial activity are directly contaminating surface/ground water.
 - c) Establish a coordinated programme with the WRA and NWC to upgrade/replace deficient sewage treatment plants (see also Chapter 8).
 - d) Establish new waste disposal sites where they are close to/over planned capacity and pose a major threat to health and/or contamination to the natural environment.
- 6) Law enforcement and the Judiciary need greater sensitization to support institutions such as the FD and NEPA in applying environmental laws and regulations more effectively.

Recommendations

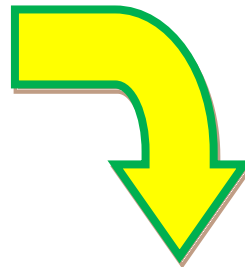
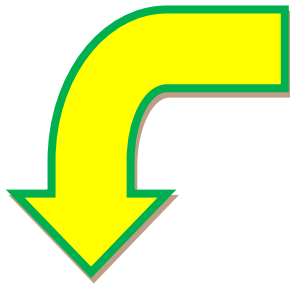
- a) Increase capacity within the Jamaica Constabulary Force in the application of environmental laws and regulations, such as the Forest Act and its regulations (including any changes to the Act).
- b) Strengthen the capacity of the judicial system to adjudicate environmental crimes and infringements.
- c) Support greater environmental education in secondary schools and promote awareness of the importance of developing civic responsibilities relating to law enforcement to protect the natural and built environments and natural resources.

- 7) The watershed classification methodology does not include a parameter on water quality to help define the level of degradation of each WMU.

Recommendations

- a) All water quality monitoring data collected by NEPA, WRA and NWC should be managed at the WMU level and shared through a central repository (see also Chapter 6).
- b) Identify the weightings to be applied to the watershed classification methodology to ensure that water quality is reflected in the scoring system for each watershed.
- c) Allocate finance to facilitate watershed classification assessments at least once every five years.

Case study 4:
Agro-forestry: Promoting Trees of Multiple Use and Cultural Heritage -Pimento Tree (*Pimenta dioica*)



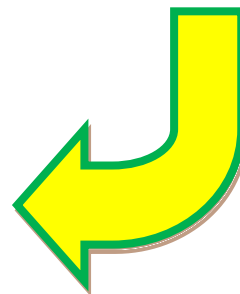
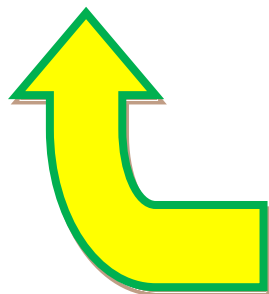
Pimento trees produce one of the only spices native the Western Hemisphere. These trees preserve the soil and fix carbon dioxide in the soil



Careful pruning can provide pimento wood and leaves to cook authentic Jerked food



Pimento seeds are dried and ground and can produce a good income for famers



Other crops can be produced by farmers to provide the ingredients for Jerk Cuisine, which is part of Jamaica's heritage since the Maroons

Useful Links and References:

Information on the Forest Act (1996)

<http://moj.gov.jm/sites/default/files/laws/The%20Forest%20Act.pdf>

Draft Forest Policy 2012-2024:

http://www.forestry.gov.jm/PDF_files/Public/Draft_Forest_Policy.pdf

Information on the Watershed Protection Act (1963)

<http://www.moj.gov.jm/sites/default/files/laws/Watersheds%20Protection%20Act.pdf>

Information on watershed policy

http://www.nepa.gov.jm/policies/watershed/policy_information.htm

Information on the definition of watersheds and watersheds as management areas

http://www.nepa.gov.jm/symposia_03/Papers/Watersheds.pdf

Maps:

Figure 10: Forest Reserves, Forest Management Areas and Crown Lands managed by Forestry Dept. (2013)

Figure 11: Hydrological river basins and Watershed Management Units in Jamaica (2013)

Figure 12: The State of Jamaica's Watershed Management Units in 2013

Figure 10: Forest Reserves, Forest Management Areas and Crown Lands managed by the Forestry Department (2013)

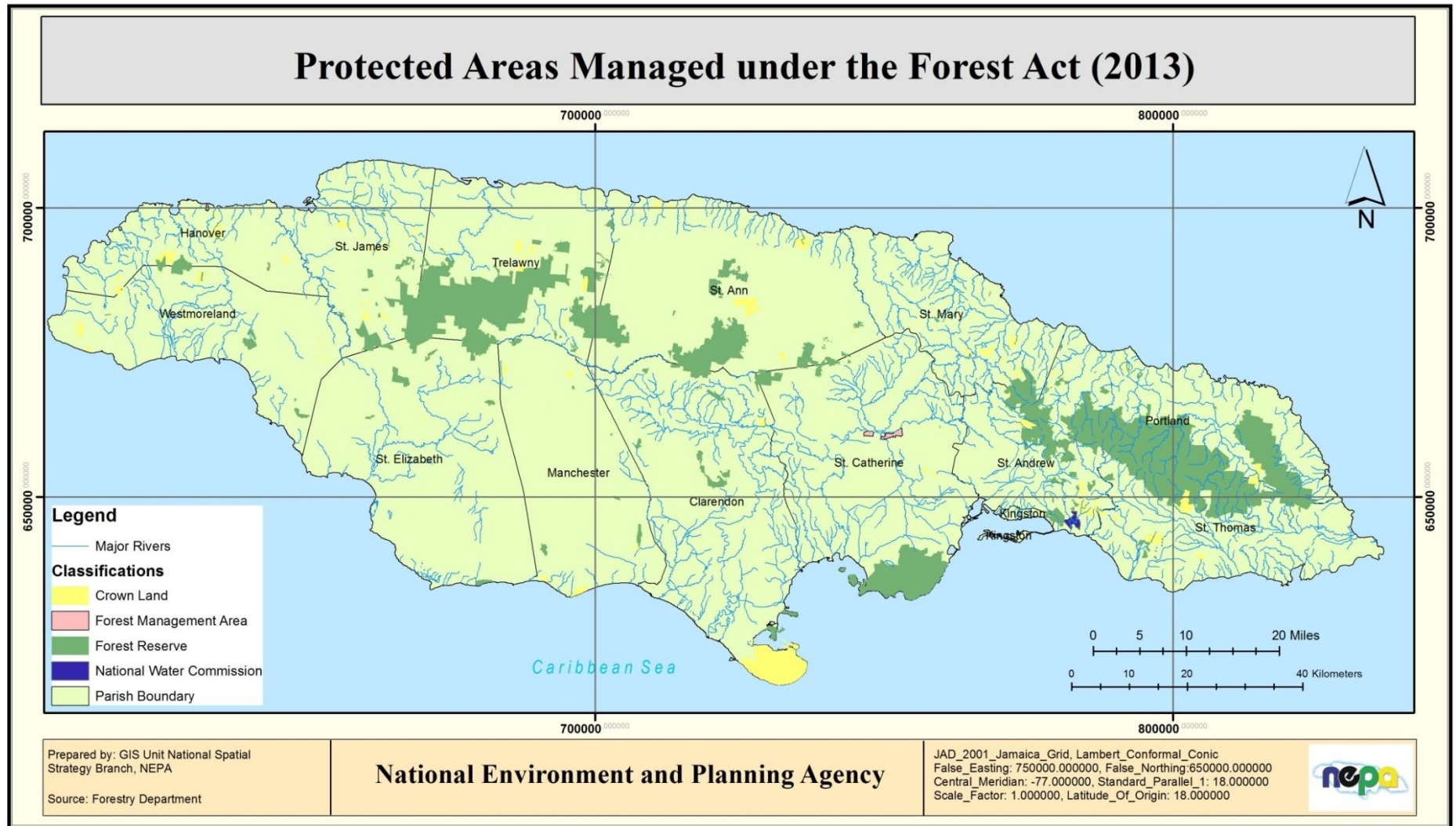


Figure 11: Hydrological River Basins and Watershed Management Units in Jamaica in 2013

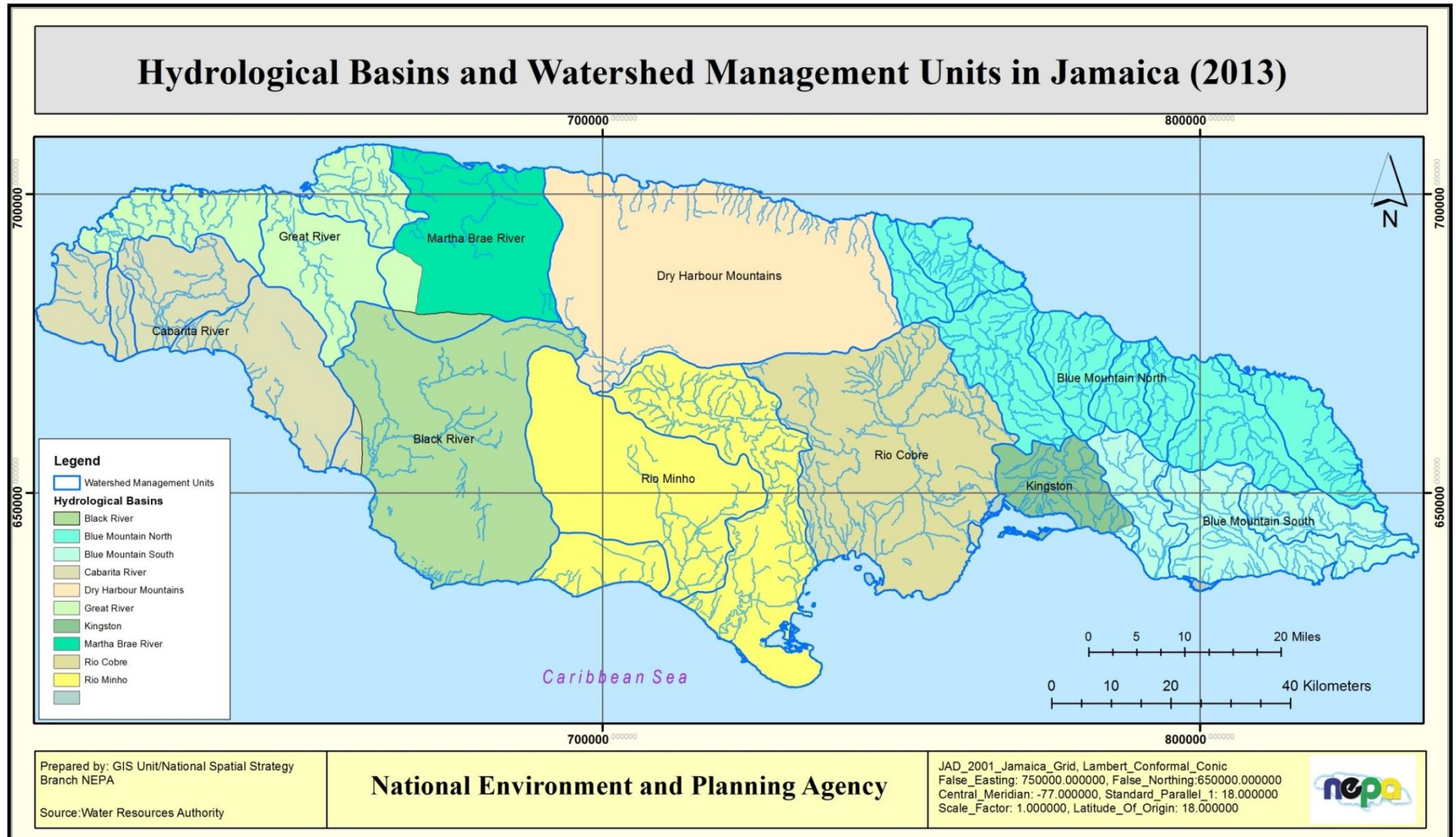
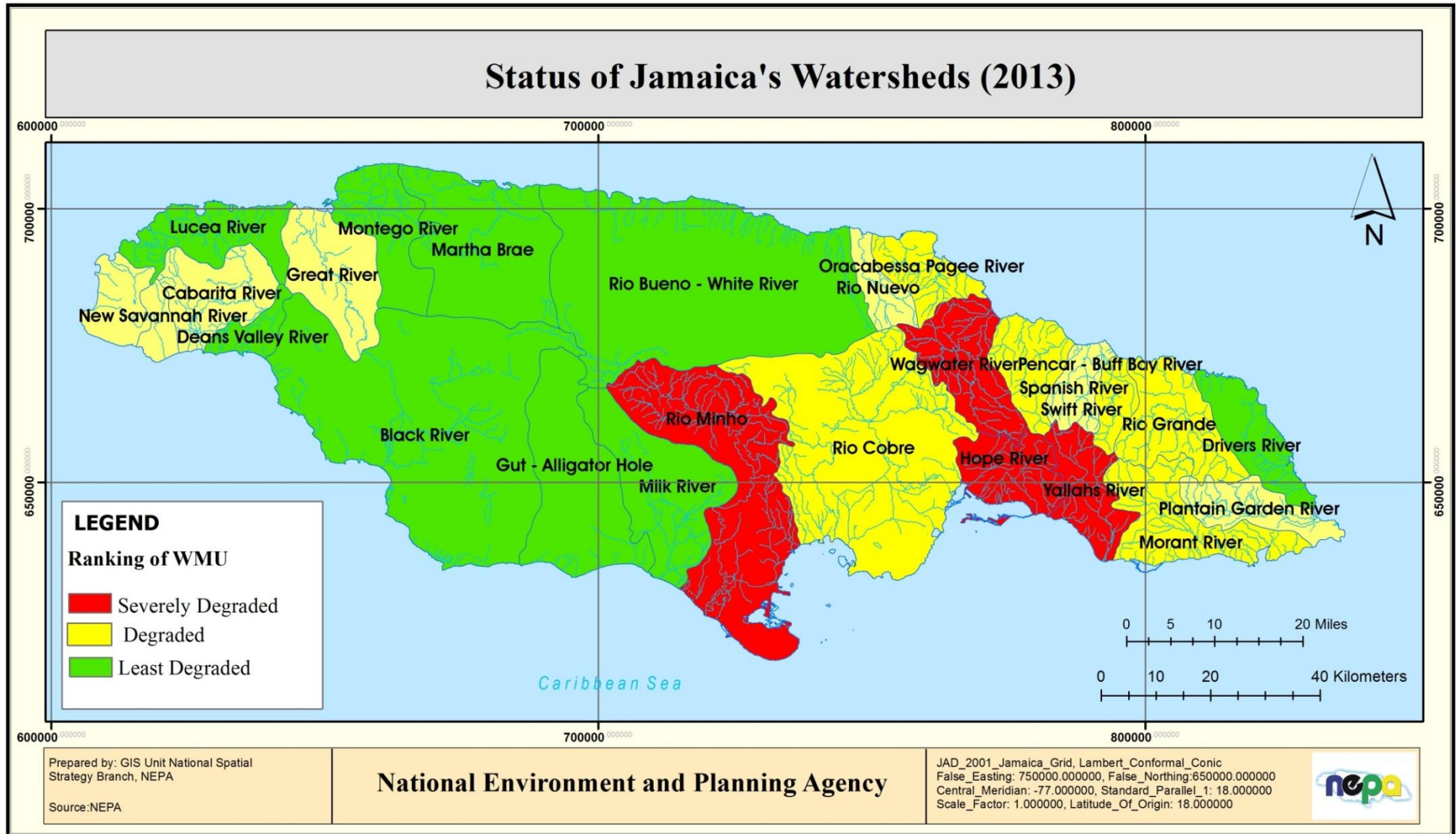


Figure 12: State of Jamaica's Watersheds (Level of Degradation) in 2013





4. Protected Areas

What are Protected Areas? The CBD defines PAs as, “a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives”. The Protected Areas System Master Plan for Jamaica, proposed in 2013, defines a protected area as, “a clearly defined geographical area of land and or water that is dedicated to and managed for the long-term conservation and sustainable use of its ecological systems, biodiversity and/or specific natural, cultural or aesthetic resources.”

Why are there different types of Protected Area? Protected areas are classified according to their purpose and functions. Areas that are recognised at the national/international level for their natural, ecological and/or cultural values are usually designated as national parks, marine parks, forest reserves, special fishery conservation areas, protected national heritage and other protected areas which can be land, marine, or a combination of both and which provide access to the general public. Other categories include game reserves and sanctuaries (usually to protect animals), forest management areas (forested areas of land outside a forest reserve to protect the biodiversity within them, or grown to produce forest products, conserve water and soils, for recreation, etc.).

Why are protected areas important? The pressures of population growth, economic development and the effects of climate variability and change are growing and impacting negatively on our country’s biodiversity and ecosystems, natural land and seascapes and cultural resources such as monuments and historical buildings. The best way to help prevent their degradation and loss is by placing them under official protection. In this way present and future generations can learn more about them and benefit from the ecosystem goods and services they provide and which help sustain Jamaica’s socio-economic development. In addition, safeguarding the country’s heritage is important in defining Jamaica’s identity and pride.

What goods and services do protected areas provide? Terrestrial protected areas act as important regulators of rainfall. Tree canopies can temporarily capture large amounts of rainfall, which ensures soils are better protected and freshwater remains available for longer in watershed. Land-based PAs are also an important source of oxygen production, fix large quantities of CO₂ and are natural barriers to disasters such as floods and landslides. Aquatic-based PAs provide safe breeding grounds for many types of fish and shellfish and protect coastlines from wave erosion and storm surges. PAs also offer a wide variety of recreational opportunities including hiking, caving, rafting and surfing all of which contribute to development of local economies.

Why is effective land use planning and enforcement important for Protected Areas? A protected area is one type of land use. It is important for different land uses to be managed effectively and the Town and Country Planning Act enforced to ensure that development (housing, mining, tourism, etc.) and/or illegal encroachment (squatting, slash and burn agriculture, logging, etc.) do not degrade PAs by causing permanent changes of land use and the reduction or loss of the ecological services they provide.

4.1 Background to Jamaica's Protected Areas

A number of international conventions and agreements to which Jamaica is a party require the protection of natural resources. These include the Convention on Biological Diversity (CBD) and the Convention on the Illegal Trade of Endangered Species (CITES). In November 1997 the Draft Policy for Jamaica's System of Protected Areas was prepared to support the establishment of a protected areas system (PAS). A central aim of the policy was the establishment of improved coordination and management of Jamaica's protected areas (PAs) considering that four government institutions are responsible for their administration under the following legislation:²⁰

- **Forest Act** (1996) governing the establishment and management of forest reserves, forest management areas, etc. by the Forestry Department (FD);
- **Fishing Industry Act** (1976) governing the establishment and management of special fishery conservation areas (SFCAs) and fishing licences by the Fisheries Division;
- **Natural Resources Conservation Authority Act** (1991), governing the creation and management of national parks, marine parks, protected areas in terrestrial and marine areas by the Natural Resources Conservation Authority (NRCA);
- **Wild Life Protection Act** (1945), governing declaration of game reserves/sanctuaries by NRCA from 1991;
- **Beach Control Act** (1956), governing the use and protection of beaches by the NRCA from 1991;
- **Watersheds Act**(1963) governing the management of watersheds by NRCA together with FD and other government agencies;
- **Jamaica National Heritage Trust Act** (1985), governing mainly the creation and management of heritage sites and monuments by the Jamaica National Heritage Trust.



One of the main provisions in the Policy was the need to establish a Protected Areas System (PAS) in which the PAs managed under the NRCA be categorised in accordance with the terms used by the International Union for the Conservation of Nature (IUCN) at that time:

- 1) IUCN Category I: National Nature Reserve/Wilderness Area (designed to protect lands or waters with unique biodiversity(flora and fauna) or other ecological values which require strict protection;
- 2) IUCN Category II: National Park/marine Park (large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities);
- 3) IUCN Category III: Natural Monument or Feature (to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature, or even a living feature);
- 4) IUCN Category IV: Habitat/Species Management Area (aims to protect particular species or habitats and management reflects this priority);
- 5) IUCN Category V: Protected Landscape/Seascape (where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological,

²⁰Excludes mention of any binding amendments since the Acts took effect

- cultural and scenic value; and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values);
- 6) IUCN Category VI: Managed Resource Protected Area (sustainable natural resource management where low-level non-industrial use of natural resources compatible with nature conservation is allowed).

In 1998 the Council on Ocean and Coastal Zone Management (COCZM) was established to produce a comprehensive policy for the ocean and coastal resources management, in line with the requirements of international commitments and non-binding international instruments. In June 2000 the Council launched the White Paper, “Toward Developing a National Policy on Ocean and Coastal Zone Management”, and with the support of USAID²¹ developed several draft policies including, “The Mangrove and Coastal Wetlands Protection Draft Policy”, which aimed to bridge the gap in protecting Jamaica’s wetlands ecosystem and guide the designation of wetland protected areas under the Ramsar Convention.

The government’s commitment to conserving biodiversity was subsequently defined in the 2003 National Strategy and Action Plan on Biological Diversity in Jamaica, in line with the requirements of the CBD (see also Chapter 1). However, the establishment of the PAS based on a comprehensive system of classification of PAs did not materialise due to the existence of at least five Acts of Parliament in which the provisions relevant to PA classifications were not coherent or coordinated.²²

In 2006 the Protected Areas Committee (PAC) was established to guide the preparation of a Protected Areas System Master Plan (PASMP) in line with the requirements of CBD and in the interest of ensuring greater clarity and coherence in the way PAs would be identified, managed and financed. The PAC was supported by the creation of three technical working groups on ecology, sustainable finance and capacity development.

Later, in 2009 two important developments occurred. First, the GoJ officially approved and launched the **Vision 2030 Jamaica** National Development Plan in which four main goals were established, including Goal 4: “Jamaica has a healthy environment”. This confirmed that the conservation of the environment and the sustainable use of its natural resources was a priority. Second, the National Ecological Gap Assessment Report (NEGAR) was prepared in conformity with the requirements of the CBD. The NEGAR:

- 1) Identified where the existing protected areas fell short in adequately protecting a representative sample of all marine, terrestrial and freshwater biodiversity in the country.
- 2) Provided clear recommendations for bridging the gaps and implementing conservation of at least 10% of these areas as follows:
 - Black River: establish a PA and thereby improve the protection status of Black River from a Game Reserve and Ramsar Site to be able to capture terrestrial, freshwater and marine ecosystems critical to the overall health and functionality of the river, riparian and estuarine areas;
 - Portland Bight & Negril: their respective management objectives should include special management attention to mitigate freshwater-specific threats and other potential upstream issues as well as integrated management of marine, terrestrial and freshwater targets;

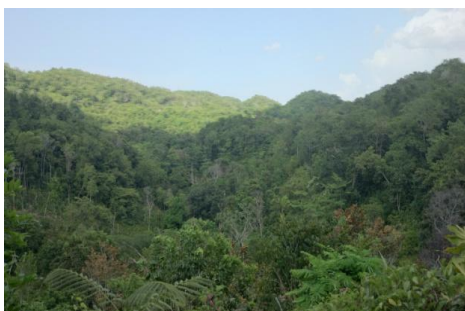
²¹Development of Environmental Management Organizations (DEMO) Project

²²Working Paper on the, “Categorisation of Protected Areas in Jamaica” by The Nature Conservancy, 2003.

- Cockpit Country & Blue and John Crow Mountains – Adopt management measures for freshwater systems in addition to species which could include such actions as regulations for maintenance of river buffer zones, and other terrestrial ecological system-based conservation strategies that support and maintain the watershed.
- 3) Reiterated the need to harmonise Jamaica's protected area management categories, cross referencing with the International Union for the Conservation of Nature (IUCN) categories where applicable, and standardise their application at the national scale.
- 4) Recommended the establishment of a centralised database in which environmental parameters should be monitored to support the management of the PAS.
- 5) Proposed a national implementation plan to action the above recommendations.

4.2 The Current State of Jamaica's Protected Areas in the Period 2011-2013

4.2.1 The Current Legal Framework for Protected Areas



The review and updating of the Draft Policy for Jamaica's System of Protected Areas continued between 2011 and 2013 with the support of the project; *Strengthening the Operational and Financial Sustainability of the National Protected Area System – NPAS (2010-2016)*. One of the main aims of the review process is to secure the effective protection and management of the country's biological diversity, ecosystems and natural/local heritage in line with expected outcome 13 in *Vision 2030 Jamaica* for Goal 4.

Positive developments that have taken place between 2011 and 2013 include:

- 1) The finalisation of the **Draft Protected Areas System Master Plan: Jamaica (PASMP)** in 2013. This was achieved following public consultations in February 2010 and November 2012 in Kingston and in December 2012 in Montego Bay. The main elements of the PASMP focus on:
 - Ensuring consistency with the draft Policy for Jamaica's System of Protected Areas (1997), the NBSAP (2003) and *Vision 2030 Jamaica*;
 - Guiding and supporting the implementation of selected national and sectoral strategies including the Medium Term Socio-Economic Policy Framework 2012-15, the Strategic Forest Management Plan 2010-14, the Master Plan for Sustainable Tourism Development (2002) and the Culture Industries and Values Sector Plan within *Vision 2030 Jamaica*;
 - Establishing a comprehensive and representative PAS that:
 - Contributes to the long-term ecological viability of protected land/seascapes and freshwater ecosystems;
 - Maintains ecological processes and systems; and
 - Preserves the country's natural and cultural heritage.
 - Supporting the implementation of CBD and other relevant international Conventions including, CITES, the Convention on Wetlands of International Importance especially as waterfowl habitat (Ramsar Convention), and the World Heritage Convention.
- 2) Identification of five crosscutting strategic outcomes are expected:
 - The PAS is integrated into sector or local planning frameworks, with increased capacity for site management and mechanisms in place to address key threats;
 - The effective participation of local communities and other stakeholders in planning,

- establishment, governance and management of PAs;
 - Enhanced management of PAs is supported by greater financial sustainability of the PAS at the national level;
 - Planning and management capacity is enhanced within the PAs;
 - Management capacity of the PAS at the national level is improved to ensure effective conservation of biological and cultural heritage.
- 3) Identification and implementation of an action plan to meet the above-mentioned targets during the period 2013 to 2017, using a mix of traditional funding streams for PAs and funding from the GEF, part of which will be used to establish the Protected Areas Trust Fund to help safeguard funding of PAs over the long-term.
 - 4) Supported a review of the Fishing Industry Act and the identification of regulations for the Special Fishery Conservation Areas established by the Fisheries Division since 2006 (under Orders privileged through Section 18 of the Fishing Industry Act of 1975);
 - 5) An assessment of the provisions in the Jamaica National Heritage Trust Act;
 - 6) Support in the review of the Forest Act which commenced in 2013, in which a major area of review is the future role of the Forestry Department with respect to its Forest Reserves, some of which coincide with other PAs, in particular under the NRCA Act (1991).

4.2.2 The Current State of Protected Areas and Heritage Sites and Monuments in Jamaica to 2013

Table 9 summarises the current number of Jamaica's protected areas, sites and monuments, together with information on the relevant enabling legislation and total land area of the protected areas. Figure 15 shows the current location of Jamaica's protected areas. The main findings from this table are summarised as follows:

- 1) The total number of protected areas, sites and monuments has increased to 365 in 2013, which represents a net increase of 20 since 2010.
- 2) There are currently 160 protected areas²³ in Jamaica (terrestrial and marine), which represents a net increase of 12 PAs since 2010. The increase relates to 9 new Forest Management Areas, 2 new SFCAs and one new Ramsar site.
- 3) Approximately 2,000 km² are designated as protected areas, which is equivalent to over 18.1% of Jamaica's total land area (10,990 km²). This situation confirms Jamaica has met the CBD's Aichi Target 11 which requires all signatory countries to have at least 17% of their land area protected by 2020 (see also Annex 1). In addition, there are over 115,000 ha. of forest reserves, which confirms almost 315,000 ha. or 28.6% of total land area has some form of protection status in Jamaica.
- 4) Forest Reserves approved under the Forest Act of 1996 and managed by the Forestry Department account for 36.7% of protected land in Jamaica. No new forest reserves were established in 2011-2013, but Forest Management Areas (FMAs) increased by 9 to a total of 11 FMAs by 2013.
- 5) Approximately 2,000 km² (15%) of Jamaica's archipelagic marine resources are legally protected in Jamaica²⁴, which confirms Jamaica has also met the Aichi Target 11, which requires signatory countries to protect at least 10% of its coastal-marine area by 2020;

²³ Refers to PA declared under different Acts such as the Beach Control Act, the Forest Act and the Natural Resources Conservation Authority Act

²⁴ Equivalent to 1.1% of Jamaica's total marine area

- 6) The Fisheries Division has increased the number of Special Fishery Conservation Areas (SFCAs) from 12 in 2010 to a total of 14 in 2013, signifying a further 1,707 ha. of coastal marine resources are now declared protected.
- 7) 205 heritage sites and monuments are protected by the Jamaica National Heritage Trust (JNHT) as at 2013. A total of 7 new national monuments were declared between 2011 and 2013. No new heritage sites were designated in the same period. However, the Blue and John Crow Mountains (including Golden Vale in Portland Parish) is in the process of being designated as a new National Heritage Site by early 2014. This is part of a process to achieve World Heritage Site status by the United Nations Educational, Scientific and Cultural Organization (UNESCO).
- 8) A large number of government agencies continue to be responsible for the management of different PA types (19 in total), which has not facilitated the management of Jamaica's PAs as a system. However, the GoJ is committed to establishing a new Draft Policy on the System of Protected Areas System in Jamaica.

Table 9: Protected Areas, Heritage Sites and Monuments by Type (2013)

Protected Area/Site Type	Enabling Legislation & Responsible Agency	No. 2010	No. 2013	Total Land Area* (ha)	Total Marine Area* (ha)
Land-based					
National Park**	NRCA Act (NEPA)	1	1	78,200	-
Protected Area (terrestrial)**	NRCA Act (NEPA)	4	4	56,045	148,300
Environmental Protection Area**	NRCA Act (NEPA)	1	1	25,900	16,000
Game Reserve#	Wild Life Protection Act (NEPA)	5	5	-	-
Game Sanctuary#	Wild Life Protection Act (NEPA)	13	13	-	-
Forest Reserves	Forest Act (Forestry Department)	102	102	99,509	-
Forest Management Area	Forest Act (Forestry Department)	2	11	15,911	-
TOTAL (PAs)**		128	137	275,565	164,300
Marine-based					
Marine Parks	NRCA Act (NEPA)	2	2	-	19,900
Protected Areas***	Beach Control & NRCA Acts (NEPA)	2	2	1,350	14,385
Special Fishery Conservation Areas	Fishing Industry Act (Fisheries Division)	12	14	-	8,694
Ramsar (wetland) sites	None	3	4	37,765	-
TOTAL		19	23	39,115	42,979
Heritage					
National Monument	JNHT Act (JNHT)	177	184	-	-
Protected National Heritage	JNHT Act (JNHT)	21	21	-	-
TOTAL (Heritage)		198	205	-	-
GRAND TOTAL (all types)		345	365	314,680	207,279

Source: NEPA, Forestry Department and JNHT; * Total land and/or marine area; ** PA may contain other protected area types; *** Includes the Ocho Rios Marine Park Protected Area, which was declared a PA under the Beach Control Act and also designated as a PA under section 5(b) (1) of the NRCA Act in August 1999; # All Game Sanctuaries declared under the Wild Life Protection Act are also Forest Reserves as they have the same regulations.

PAs managed under the NRCA Act, Beach Control Act and Wildlife Protection Act:

Table 10 provides a summary of the current status of PAs administered by NRCA/NEPA.

Table 10: Protected Areas by Type, Date and Area Managed by NEPA (2013)

Type and name of Protected Area	Designated (Date)	Land (ha)	Marine (ha)
National Parks			
Blue and John Crow Mountains*	26 Feb 1993	78,200	-
Environmental Protection Areas			
Negril Environmental Protection Area	28 Nov 1997	25,900	16,000
Other Protected Areas (NRCA Act)			
Palisadoes-Port Royal PA***	18 Sep 1998	800	6,000
Coral Spring-Mountain Spring PA	18 Sep 1998	163	-
Portland Bight PA***	22 Apr 1999	55,000	142,300
Mason River PA***	12 Nov 2002	82	-
Marine Parks (NRCA Act)			
Montego Bay MP**	05 Jun 1992	-	1,400
Negril MP**	04 Mar 1998	-	18,500
Ocho Rios Marine Park PA (coastline)	16 Aug. 1999	1,350	-
Protected Areas under the Beach Control Act			
Ocho Rios Marine Park PA (marine area)	07 Apr 1966	-	13,385
Port Royal PA	08 May 1967	-	1,000
Total Area		161,495	198,585

Source: NEPA; * Includes Forest Reserves under FD; **Includes SFCA; *** Includes a Ramsar site.

Key issues concerning the current state of PAs managed under the NRCA Act are summarised as follows:

- 1) A number of PAs still do not have regulations and a formally approved management plan. This has implications on establishing effective governance of the PAs, in particular the application of co-management agreements with local communities and non-state actors.
- 2) Some of the PAs managed under the NRCA Act also incorporate other protected area categories within them. For example, the Blue and John Crow Mountains National Park contains pre-existing forestry reserves managed by the FD and the two Marine Parks include SFCAs established by the Fisheries Division (see also Table 13 on SFCAs below). This situation means there is an overlap of jurisdiction involving NEPA, the FD and the Fisheries Division, which is currently under review by the GoJ in the interest of establishing coherent legislation and policies to manage the country's forests and PAs.
- 3) The NGOs responsible for the co-management of PAs under the NRCA Act have witnessed an increase in human encroachment over the period 2011-2013, which has produced a negative impact on natural resources including the loss of closed broadleaf and swamp forests reported

in Chapter 3.



The NRCA is also responsible for the management of wetlands of international importance (Ramsar sites) under **The Ramsar Convention**, which seeks “the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world”.

Table 11 summarises the current number of Ramsar sites designated as wetlands of international importance in Jamaica, together with information on the date they were officially designated and details about their land and marine area.

Table 11: Ramsar Sites Managed by the NRCA in Jamaica (1997-2013)

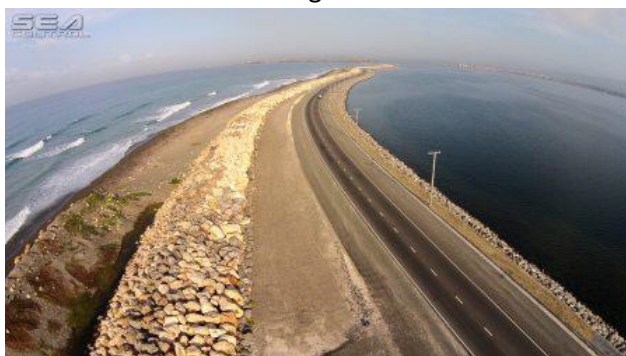
Name of Ramsar Site & Number	Designation Date	Land & Marine Area* (ha)
Black River Lower Morass (No. 919)	07 Oct 1997	5,700
Palisadoes-Port Royal (No. 1454)*	22 Apr 2005	7,523
Portland Bight Wetlands and Cays (No. 1957)**	02 Feb 2006	24,542
Mason River (No. 1990)***	06 Dec 2011	82
Grand Total		37,847

Source: NEPA & Ramsar Convention Secretariat; * Part of the Palisadoes-Port Royal PA;

Part of the Portland Bight PA; * Part of the Mason River PA, Bird Sanctuary and Ramsar site

Table 11 confirms that three of the Ramsar sites fall within the “Other Protected Areas under the NRCA Act” indicated in Table 9. The current state of the country’s Ramsar sites is summarised as follows:

- 1) The number of Ramsar sites has increased from three to four since 2010 following the declaration of an inland wetland site in Jamaica within the Mason River PA. Approximately 430 plant species are found at this site of which 11% are endemic and listed as “vulnerable” in the IUCN Red List. Examples include *Bactris jamaicana* (Prickly Palm), *Calyptanthus nodosa* and *Cordia troyan*. The site also contains several species of the moss *Sphagnum* spp. which are essential for the existence of the morass. Likewise, it is also important for the endemic *Mellisuga minima*, the migratory species *Oporomis agilis*, and carnivorous plants such as the native *Drosera capillaries*, *Utricularia* spp., and *Dionaea muscipula*.
- 2) The Ramsar sites do not have specific legislation and regulations in place to support their protection and sustainable use, which has not facilitated their management under the above-mentioned co-management agreements.
- 3) The natural environment within the Ramsar sites has experienced negative impact. This is mainly due to human activity within, or close to these sites. For example, the Palisadoes shoreline protection and rehabilitation works



between 2010 and 2012, which included the upgrading of the Palisadoes Highway to the Norman Manley International Airport, required replanting of mangroves and rehabilitation of sand dunes lost during construction.

PAs managed under the Forest Act: Table 12 provides a summary of the current status of PAs administered by the Forestry Department (FD) under the Forest Act. All PAs designated under the Forest Act are managed by FD. This includes Game Sanctuaries declared under the Wildlife Protection Act (1945), because they have the same regulations as Forest Reserves. The FD currently manages 102 Forest Reserves under the Forest Act, which covers a land area of 99,509 ha. In addition, the FD manages 11 Forest Management Areas and forested Crown Land (Other Protected Areas) amounting to 15,929 ha. of forest which were designated under the Forest Regulation (2001).²⁵

Table 12: Estimated Percentage of Forest Area by Type and its Protection Status (2010 & 2013)

Forest Type	Forest Reserve		Other Protected Areas		Forest not protected		TOTAL	
	2010	2013	2010	2013	2010	2013	2010	2013
Forest								
Closed Broadleaf	5.8	5.5	0.1	0.2	2.1	2.1	8.0	7.7
Disturbed Broadleaf	1.1	1.0	0.2	0.3	14.6	14.7	15.9	16.0
Short Open Dry	0.1	0.0	0.4	0.0	0.6	0.2	1.1	0.2
Tall Open Dry	0.6	0.6	1.3	1.3	2.0	1.5	3.9	3.4
Mangrove	0.1	0.1	0.5	0.5	0.3	0.3	0.9	0.9
Swamp/Riparian Forest	0.0	-	0.1	0.0	0.1	0.0	0.2	0.0
Forest Plant. (soft & hard woods)	0.6	0.4	0.0	0.0	0.2	0.3	0.8	0.8
Secondary Forest*	-	0.6	-	0.5	-	10.0	-	11.2
Forest total	8.3	8.2	2.6	2.8	19.9	29.1	30.8	40.2
Mixed Land Use								
Disturbed Broadleaf Forest and Non-forest Land Use**	0.7	-	0.3	-	14.1	-	15.1	-
Non-forest Land Use & Disturbed Broadleaf Forest***	0.8	-	0.4	-	13.9	-	15.1	-
Fields & Secondary Forest	0.4	0.6	0.4	0.1		14.4		15.2
Bamboo & Secondary Forest	0.1	0.1	-	0.0	1.1	3.3	1.2	3.4
Mixed forest total	1.5	0.7	0.7	0.1	28.0	17.6	30.2	18.5
TOTAL (forest and mixed)	9.8	8.9	3.3	2.9	47.9	46.8	61.0	58.6

Source: FD (Forest Resource Assessment 2010 Country Report and Land Cover Assessment, 2013); *New category used in 2013; **Replaced by Disturbed Broadleaf forest and Fields and Secondary forest categories; ***Replaced by the following categories: a) Bamboo and Fields; b) Bamboo and Disturbed Broadleaf; c) Bauxite and Disturbed Broadleaf and; d) Fields and Disturbed Broadleaf.

The main findings from Table 12 are:

- 1) The percentage of Closed Broadleaf forest found in forest reserves has decreased by 0.3% between 2010 and 2013. This is significant given the majority of Jamaica's endemic species are

²⁵ The Jamaica Gazette

found in these forests.

- 2) Short Open Dry forests have experienced major loss according to the data registered in 2013. This may be due to data limitations in 2010. Nevertheless, the current status of this forest category indicates that just 0.2% of these forests remain and that these are found mainly in areas that are not protected.
- 3) Protected Swamp forest and Riparian woodland have been largely lost by 2013. This is a worrying development given the importance of this category in reducing the effects of flooding and maintaining specific types of biodiversity that perform a number of ecological functions, such as filtering of nutrients and keeping water temperature down.
- 4) The introduction of Secondary Forest as a new classification in 2013 reflects the need to recognise the increase in human interference in protected and unprotected forests which has led to the reduction in the quality of these forests (see also Table 7 in the Chapter 3).
- 5) The increase of bamboo, particularly in unprotected forested areas, has increased considerably from 1.2% to 3.4% between 2011 and 2013 and confirms the species is an invasive species that needs to be controlled in coming years.



PAs managed under the Fishing Industry Act (Special Fishery Conservation Areas): Table 13 summarises the current status of Special Fishery Conservation Areas (SFCAs), declared and planned, administered by the Fisheries Division under Section 18 of the Fishing Industry Act (1975).

Figure 16 shows the location of the 12 SFCAs currently established and managed by the Fisheries Division (see also the section on SFCAs in

Chapter5). SFCAs were first established in 1979 as Marine Protected Areas (MPAs) by the Fisheries Division. However, since 2009 the number of SFCAs has increased substantially in response to the depletion of fish stocks around the island due to overfishing. A major objective of SFCAs is to empower local fisher folk in the protection of spawning grounds so fish can thrive before they leave the area and can be caught legally. This practice, known as the “spill-over effect” ensures fisher folk benefit from participating in the co-management of the SFCAs.

Table 13: Designated and Proposed Special Fishery Conservation Areas (2013)

Name of SFCA and date declared	Date Declared #	Name of Co-Management Institution(s)	Approx. Area (ha)
Declared Special Fishery Conservation Areas			
Bogue Island Lagoon SFCA (St. James)*	1979	Montego Bay Marine Park Trust	73
Port Morant Harbour Lagoon (St Thomas)	1986	Fisheries Division	217
Bluefields Bay SFCA (Westmoreland)	28 July 2009	Bluefields Bay Fisherman’s Friendly Society	1,347
Discovery Bay SFCA (St. Ann)	28 July 2009	Alloa Fisherman’s Association	163
Galleon SFCA (St. Elizabeth)	28 July 2009	The Breds Foundation	259
Galleon Harbour SFCA (St. Catherine)**	28 July 2009	C-CAM Foundation	1,714
Orange Bay SFCA (Hanover)	28 July 2009	Negril Area Environmental Protection Trust	533

Name of SFCA and date declared	Date Declared #	Name of Co-Management Institution(s)	Approx. Area (ha)
Salt Harbour SFCA (Clarendon)**	28 July 2009	C-CAM Foundation	1,066
Three Bays SFCA (St. Catherine)**	28 July 2009	C-CAM Foundation	1,203
Montego Bay Point SFCA (St. James)*	31 July 2009	Montego Bay Marine Park Trust	304
Oracabessa Bay SFCA (St. Mary)	23 Feb. 2010	Oracabessa Bay Found. & Fisherman Group	83
Sandals Boscobel SFCA (St. Mary)	23 Feb. 2010	Sandals Foundation (private initiative)	107
South West Cay SFCA (Pedro Bank)	15 May 2012	Jamaica Environment Trust	1,298
Sandals Whitehouse SFCA (Westmoreland)	15 May 2012	Sandals Foundation (private funding)	327
Total			8,694
Newly identified Special Fishery Conservation Areas			
Fish Bay (St. Catherine)	-	Fisheries Division	No data
Rocky Point (St. Thomas)	-	Rocky Point Fisher Folk Association	No data
Bird Cay (Pedro Bank)	-	The Nature Conservancy (private funding)	No data

Source: Fisheries Division, Ministry of Agriculture and Fisheries; * Located in Montego Bay Marine Park; ** Located in Portland Bight PA.

Note the change in the term Fish Sanctuaries to SFCAs took place in 2012.

The main findings on the current state of SFCAs:

- 1) The Fisheries Division in conjunction with the Fisheries Advisory Board has increased the number of SFCAs from 10 to 12, with another three identified for approval in 2014. This indicates that there is now a growing commitment to using SFCAs as a means of rehabilitating fish stocks and preserving coastal marine habitats.
- 2) The participation of fisher folk in law enforcement within the SFCAs has generally increased the levels of compliance among the local fishing community and helped to identify repeat offenders.
- 3) The SFCAs are educating the local community in the development of an integrated approach to their management, in particular the need to preserve coastal marine resources such as mangroves, seagrass beds, coral reefs and beaches as means to increasing fish stocks.
- 4) The majority of SCFA are recording improvements in fish stocks (see also Chapter 5). In some cases they have been above expectations and contributed to galvanising a new sense of local identity. One of the most successful SFCA is at Oracabessa Bay where the Foundation and Fishermen's Group have reported positive developments as shown in Figure 13.

Figure 13: Summary of Progress in the Oracabessa Bay SFCA (2011-2013)



Photography by: Krishna Desai

- 5) The SFCA are opening up opportunities to diversify the local economy other than by fishing. This helps to reduce the pressure on fish stocks and the dependency on fishing.
- 6) The SFCA have generally not led so far to the mobilisation of local sources of income, or partnerships with the private sector, to reduce their dependency on government funding.
- 7) Some SFCA have been successful in mobilising funding from the donor community. For example, the Oracabessa Foundation and Fishermen's Group has successfully secured grants from:
 - Seacology (US\$ 30,000) to establish and equip its office;
 - GEF Small Grants Programme (US\$ 50,000) for its coral replanting programme, reclaiming beach habitat for the turtle rescue programme and to purchase a patrol boat;
 - CARIBSAVE Project (US\$ 99,000) to hire a manager for the SFCA, train and improve working conditions for wardens (including the purchase of law enforcement equipment);
 - Environment Fund of Jamaica (J\$ 1,000,000) to fund the management plan, signage, website development, etc.



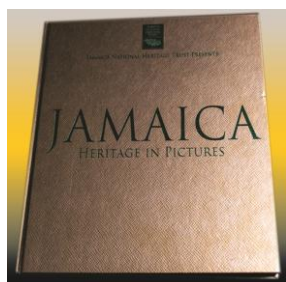
PAs managed under the Jamaica National Heritage Trust Act: The Jamaica National Heritage Trust (JNHT) is responsible for the identification, preservation and regulation of delicate national sites and monuments that satisfy the criteria established in the JNHT Act. For example, sites that have historical, cultural, architectural and/or educational value. The Trust also conducts research on its sites and monuments and records precious objects or works of art to be preserved. Records are also kept on species of botanical or animal life of national interest and which need protecting.

Table 14: Number of Designated Heritage Sites and Declared National Monuments by Parish (2013)

Name of Parish/ Municipal Council	No. of Monuments Declared	No. of National Heritage Sites Designated
Clarendon	4	1
Hanover	8	-
Kingston	29	2
Manchester	8	2
Portland	11	1
St. Andrew	22	6
St. Ann	14	-
St. Catherine	17	-
St. Elizabeth	8	4
St. James	25	-
St. Mary	9	1
St. Thomas	7	1
Trelawny	14	-
Westmoreland	8	1
Underwater Cultural Heritage*	-	2
Total	184	21

Source: JNHT; *Pedro Banks & St. Ann's Bay Shipwreck Site

The JNHT added 7 new declared national monuments between 2011 and 2013. There are currently 205 protected sites in Jamaica (184 national monuments and 21 national heritage sites). Figure 17 shows the location of these monuments and sites. In addition, the JNHT has conducted research, preserved artefacts and produced a number of publications. New developments in 2011-2013 include:



Jamaica Heritage in Pictures contains information and images of over 160 of Jamaica's most important historic sites and monuments including the Spanish Bridge at White River (St Ann); Green Grotto Caves (St Ann); Admiral Mountain (St Andrew); Holy Trinity Cathedral (Kingston); Colbeck Castle (St Catherine) and; Alligator Pond (St Elizabeth). The publication supports the Trust's efforts to highlight some of Jamaica's most important historical sites as well as some of the artefacts uncovered from them. It also highlights a selection of unprotected heritage sites and monuments it plans to declare under the Act.

Hanover Parish Church (Lucea) was declared a National Monument on 28/03/2013. The Church was established around 1725 and is the oldest church in the Parish. Interesting features include the north transept which was added in 1837 and evidence of an abandoned tunnel has been found linking the Church with nearby Fort Charlotte. A unique feature of the Church is the domed capping of its steeple, which has replaced the original steeple that was severely damaged by an earthquake in 1957. The



Lucea Town Hall and Clock Tower were also gazetted as a new protected monument in March 2013.



The Great House of the founding father of the Rastafari Movement, Leonard Howell, was declared a national monument at The Pinnacle, St. Catherine on 12/09/2013. The Pinnacle is a shrine to the Rastafarian Movement, because it is where the first Rastafari community of about 4,500 members was established in 1940 under the motto “One God, One Aim, One Destiny”. The protection of the Great House prevents the private landowner from any interference and tourists can visit the site. The Rastafari Movement, which currently has over one million followers worldwide, has requested that the

JNHT acquires the land and expands the protected area.

4.2.3 The Current State of Co-management Agreements in Protected Areas



Co-management agreements engage other government entities or non-state actors (NSA) in the day-to-day management of many of the PAs mentioned in

Table 14 above. The agreements primarily span 1-3 years, but in some cases may last up to 10 years. Table 15 provides a summary of the co-management agreements that are currently in operation, or under review, with NEPA, the FD and JNHT. It excludes the co-management partners working with the Fisheries Division in the SFCAs as they have already been provided in

Table 14 above.

Table 15: Protected Areas with co-management agreements in operation/negotiation (2013)

Main Government Stakeholder and Name of Protected Area(s)	Name of Co-management Institution and Government Institution(s) Responsible
NEPA	
Blue & John Crow Mountains Nat. Park	Jamaica Conservation and Development Trust (NEPA/FD)
Montego Bay Marine Park	Montego Bay Marine Park Trust (NEPA)
Negril Marine Park	Negril Area Environmental Protection Trust and the Negril Coral Reef Preservation Society (NEPA)
Portland Bight Protected Area	Caribbean Coastal Area Management Foundation (NEPA/FD)*
Forestry Department	
Bull Head Forest Reserve (Clarendon)	Northern Rio Minho LFMC (FD)
Dolphin Head Forest Reserve (Hanover)	Dolphin Head LFMC (FD)
Lancaster Forest Reserve (Portland)	Buff Bay LFMC (FD)
Pencar Forest Reserve (St. Mary)	Pencar LFMC (FD)
Smithfield Forest Reserve (Hanover)	Smithfield LFMC (FD)
Jamaica National Heritage Trust	
National Monument – Town of Falmouth (Trelawny)	Falmouth Heritage Renewal (JNHT)

Source: NEPA, FD and JNHT; * Restricted to management zones only within the PA.

The application of co-management agreements has been effective in managing the country's natural resources and in terms of PA management.²⁶ This has contributed to implementing **Vision 2030 Jamaica** and commitments to meeting other national targets and international agreements by:

- 1) Mobilising local communities to participate in the conservation and sustainable use of natural resources;
- 2) Promoting democratic decision-making and accountability through the establishment of management committees for the PAs, especially in areas such as approval of the management plans, monitoring progress and the sharing of results;
- 3) Encouraging local communities to play an active role in law enforcement and compliance in the interest of developing an inclusive approach to governance, conservation and sustainable development;
- 4) Empowering local communities to be more self-reliant and resilient through access to training, information and finance;
- 5) Providing new opportunities for research with universities and research institutions in which local knowledge is recognised and valued.

Nevertheless, the GoJ recognises that there is a need to improve the implementation of co-management agreements and a number of priority issues and capacity building needs have been identified.²⁷ These include:

- 1) Increasing human and financial resources. Currently NSAs have faced delays in receiving funds and technical assistance, which has limited the implementation of co-management agreements.

²⁶ CBD - Fourth National Report for Jamaica, edited version (2013), pp 63

²⁷ Ibid

- 2) Improving the dissemination of Information at the national level as part of a process of improving coordination among and within relevant agencies. Currently, there is insufficient cross-fertilisation of ideas, lessons learned and best practice at the intra and inter-institutional levels of government and with stakeholders to optimise the management of Pas.
- 3) Determining the value of biodiversity and the corresponding goods and services it provides. Currently, local, regional and national land use and development planning has generally excluded this value from the decision-making process.
- 4) Increasing the use of scientific and traditional knowledge. To date the value of this knowledge has generally not been fully incorporated into management decisions.
- 5) Improving public awareness and education at all levels. In most cases environmental education and awareness initiatives have been ad hoc in nature.
- 6) Increasing skills in financial resource mobilization. Currently, there is too much dependency on government funding, rather than on income generation from locally-based activities and partnerships with the private sectors and donor organizations.

4.2.4 Current Financial Facilities that Include Support to Protected Areas



The Environment Foundation of Jamaica (EFJ) was formed in 1993 as part of a debt-for-nature swap between GoJ and the Enterprise for the Americas Initiative Debt Reduction Agreement (USA). EFJ has represented an important source of funding for civil society organisations between 2011 and 2013. For example, in 2012 a total of J\$ 39.8 million was approved for grants to support environment-related activities around the country. For example:

- Public education on ecosystems management at Bluefield's SFCA;
- Biodiversity awareness campaigns in schools;
- Training on the prevention of river poisoning and other forms of pollution in Buff Bay Valley in conjunction with the NGO JCDT responsible for the management of the Blue and John Crow Mountains National Park;
- Providing information on the control the lionfish to the Portland Environment Protection Association;
- Building capacity within PAs, such as supporting the elaboration of the management plan and installation of signs for the SFCA at Oracabessa Bay (see also the end of section 4.2.2 above).

The Forest Conservation Fund (FCF) was established in 1998 to pave the way for a subsequent debt-swap agreement with the USA in 2004 and which requires the GoJ to deposit US\$16 million over a period of 19 years into the FCF in exchange for a debt write-off. FCF is managed by the Jamaica Protected Areas Trust Ltd. (JPAT) as a public-private initiative. JPAT approves short and long-term grants over three years to eligible entities such as environment, forestry or conservation NGOs, and local community-based organisations. In 2011-13 JPAT provided grants to a number of NGOs associated with seven PAs including the Blue and John Crow Mountains National Park, the Cockpit Forest Reserve and the Portland Bight Protected Area.

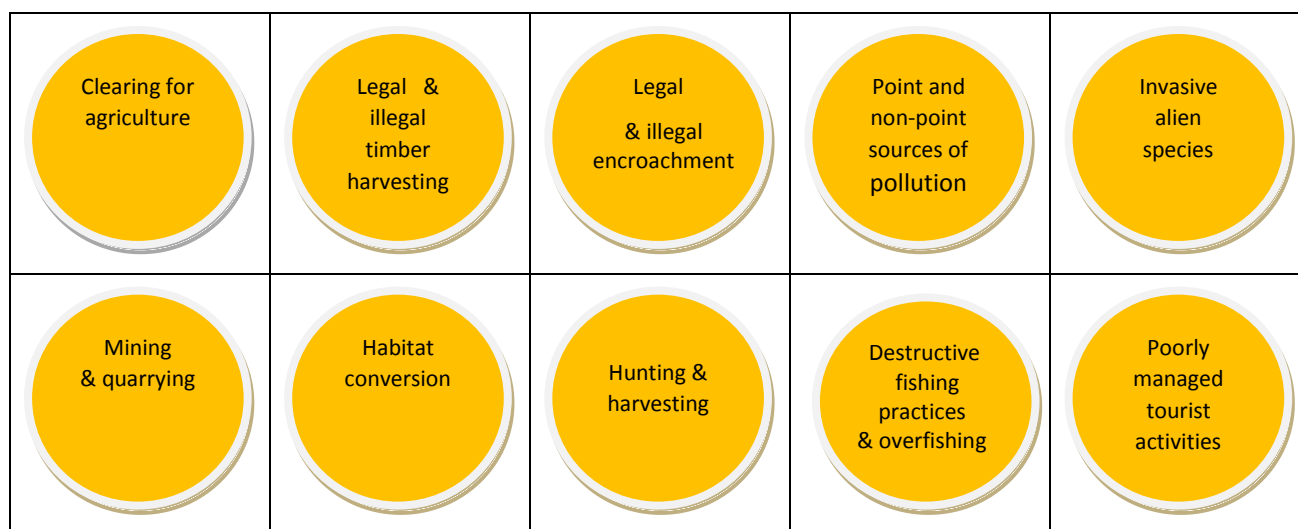
The Fisheries Management and Development Fund (FMDF) was established in 2009 out of the Conch Export Levy Act 2009 (Conch Act). Its mandate is to facilitate the development of the fishing industry by supporting projects within its thematic focus such as: conch management, special fishery conservation areas, research and development, improvement in the production systems, capacity

building, enforcement, public education and outreach. The FMDF is administered by a Board of Directors, appointed by the Minister of Agriculture and Fisheries. In 2013 over J\$75 M was disbursed to finance special fishery conservation areas, and over a total of 150M was disbursed to finance projects.

4.3 Current Threats to Jamaica's Protected Areas

The Protected Areas System Master Plan: Jamaica 2013-2017 highlights a range of external threats and pressures that compromise the health and integrity of the country's PAs, which are summarised in Figure 14 below.²⁸ A number of these threats have also been reconfirmed by the Land Use Cover Assessment 2012-2013 (see Section 3.3 in Chapter 3).

Figure 14: Main Threats to Jamaica's Protected Areas



Source: Protected Areas System Master Plan: Jamaica 2013-2017

The current legislative, policy and regulatory framework for establishing, governing and monitoring PAs are not effective in facing these threats and reducing their impact. In addition, greater integration of PA planning and management is required in the development and land use planning system to ensure that a coherent, holistic and coordinated approach is established to prevent and/or mitigate the above-mentioned threats.

4.4 Conclusions and Recommendations

The total number of protected areas, heritage sites and monuments in Jamaica has grown to 363 in 2013. In percentage terms PAs now cover approximately 18% of the country's landmass and 15% of its archipelagic waters, which is above the CBD's targets of 17% and 10% respectively by 2020 (Aichi Target 11) and supports GoJ's commitment to other relevant international agreements and national policies, strategies and plans, including Goal 4 of **Vision 2030 Jamaica**. Furthermore, the GoJ is committed to expanding its protected areas further in coming years to comply with its international commitments including CBD's recommendation that national governments commit themselves to protecting an additional 10% of terrestrial land where such protection will enhance existing PAs.²⁹ This

²⁸ Taken from the National Report on Management Effectiveness, Assessment and Capacity Development Plan for Jamaica's System of Protected Areas, 2007

²⁹ Other pertinent multilateral agreements include: the Ramsar Convention, CITES, UNCLOS, UNFCCC and the World Heritage Convention

is particularly important in countries like Jamaica, where high levels of endemic species are found (see also Chapter 2).

Nevertheless, Jamaica's PAs are facing an increasing range of threats and pressures that risk compromising the health and proper functioning of their ecosystems, which provide services and products that are crucial to sustaining Jamaica's socio-cultural and economic development in line with the goals of ***Vision 2030 Jamaica***. This situation is not aided by the complex legislative and policy framework that currently governs the way PAs are categorised, planned, managed, monitored and evaluated. In response, the GoJ reassessed the legislative and policy framework governing the country's PAs in the interests of establishing a new policy and master plan for the management of PAs. In 2013 the Protected Areas System Master Plan (PASMP) was submitted to Cabinet for approval.

The main conclusions and recommendations that are currently being assessed by the GoJ in the light of the PASMP submission are:

- 1) The current legislative and policy framework governing PAs is complex, fragmented and contains overlaps. This makes it difficult to develop and manage a comprehensive network of PAs that will help sustain the socioeconomic development of the country in line with the expected outcomes and goals of ***Vision 2030 Jamaica*** and the Medium Term Socio-Economic Policy Framework.

Recommendations

- a) Establish a policy framework and master plan that improves coherence in protected areas management based on:
 - A system approach dedicated to establishing a fully coordinated, integrated and participatory decision-making process among key government agencies and partners;
 - Management objectives focused on delivering tangible benefits and supporting the achievement of national development goals;
 - Full integration into the national, sector and local development and land use planning process;
 - Expanding the protected areas system so that it is fully representative of Jamaica's biological and cultural heritage (terrestrial, inland water and marine ecosystems).
- 2) The effective participation of local stakeholders at all levels of planning, establishment, governance and management of the country's PAs and heritage sites has not been established to date.

Recommendations

- a) Engage more local communities and other stakeholders in all aspects of the PAS through training and other support activities (based on lessons learned and best practice identified from existing co-management agreements).
- b) Ensure site-based PA planning and management including objectives, targets, management strategies and monitoring programmes are agreed with the active involvement of stakeholders.
- c) Empower local communities and other stakeholders to take an active role in the Integration of disaster risk management and adaptation to climate variability and change

in all aspects of the PAS, especially site-based planning and management of PAs.

- 3) The government agencies and stakeholders have insufficient technical capacity in the management of the national protected areas system, PAs and the valuation of their ecological services and products.

Recommendations

- a) Scale-up capacity building programmes to improve the planning, design, demarcation³⁰, management and monitoring skills of government staff and stakeholders at the PAS and PA site levels.
 - b) Develop capacity in the application and use of social and economic valuations/incentives to establish an enabling environment for the establishment and management of individual PAs and to enhance the role of the PAS at the national level.
 - c) Enhance capacity in monitoring of results-based targets and goals to support and guide planning and management of PAs and the PAS at the national level.
- 4) Education, public awareness programmes, scientific research and local knowledge have not been systematically used to support the establishment and management of PAs and the PAS.

Recommendations

- a) Increase the general public's exposure to cost effective and incremental (rather than ad hoc) environmental education and awareness programmes in which scientific research and local knowledge are recognized, valued and applied.
 - b) Ensure training of professionals in government and among stakeholders integrates scientific and local knowledge to help raise professional standards and develop a fully participatory and inclusive approach to the management of PAs and the PAS.
- 5) The current management of Pas lacks adequate finance from government and a system for establishing greater financial sustainability through internal income generating activities and initiatives.

Recommendations

- a) Secure adequate resources from government and international sources to fund the implementation of the PAS as per the above-mentioned recommendations and taking into account latest studies on the development of payment for ecosystem services (PES)³¹.
- b) Identify viable local income generating activities and initiatives, building on lessons learned and best practices from PAs in Jamaica and other countries, that enhance the sustainability of PAs and which contribute to building resilience at the local level.
- c) Promote the development of environmental accounting³². The valuation sequence (using cost benefit analysis and mitigation/damage assessment) should start by identifying the

³⁰This includes ground-truthing of PAs.

³¹ For example, "Integrated Management of the Yallahs River and Hope River Watersheds – Payment for Ecosystem Services Scheme", M. Mason, Institute for Sustainable Development, UWI-Mona, 2012.

³²One of the most well known examples is the World Bank's WAVES initiative.

ecosystem service provided, quantify the service flows and then value the flows in monetary and social terms.

- d) Establish a financial facility to support the long-term development of the PAS in Jamaica.

Useful Links and References:

Policy for Jamaica's System of Protected Areas November 1997:

http://www.nepa.gov.jm/policies/protected_area/Protected-Areas-Policy-1997.pdf

"Toward Developing a National Policy on Ocean and Coastal Zone Management" covering the need to protect coral reefs, seagrass beds and mangroves:

http://www.nepa.gov.jm/symposia_03/Policies/OceanandCoastalZoneManagementPolicy.pdf

Information about the Ramsar Convention:

<http://www.ramsar.org/wetland/jamaica>

Draft policy and regulation on, "The Mangrove and Coastal Wetlands Protection":

http://www.nepa.gov.jm/new/legal_matters/policies_standards/docs/policy/draft_policy_mangrove_coasta_protection.pdf

The National Strategy and Action Plan on Biological Diversity:

<https://www.cbd.int/doc/world/jm/jm-nbsap-01-p1-en.pdf>

Working Paper – Categorisation of Protected Areas in Jamaica (draft) produced by The Nature Conservancy (TNC) on PAs in 2004:

<http://www.nepa.gov.jm/publications/reports/PASP/Categorization-of-Protected-Areas-draft.pdf>

Jamaica's National Ecological Gap Assessment Report (NEGAR):

http://www.forestry.gov.jm/PDF_files/ProtectedAreasDocuments/Jamaica%27s%20National%20Ecological%20Gap%20Assessment%20Report%20Final.pdf

Information about the heritage sites and monuments protected by the Jamaica National Heritage Trust

http://www.jnht.com/about_jnht.php

Relevant information on valuing eco-services from protected areas and ecosystems since 2010:

http://www.ecosystemvaluation.org/dollar_based.htm

http://www.cockpitcountry.com/LFMP/Cockpit_NRV.pdf

<http://www.marineecosystems-services.org/node/8504>

<http://www.wri.org/our-work/project/coastal-capital-economic-valuation-coastal-ecosystems-caribbean>

http://pdf.wri.org/working_papers/coastal_capital_jamaica_fisheries.pdf

http://www.nepa.gov.jm/eias/Westmoreland/Negril/Long_Bay/Negril%20Rapid%20NRV%20Final.pdf

Information on Payment of Environmental Services:

www.iadb.org/projectDocument.cfm?id=37802239

Information on the Jamaica National Heritage Trust:

www.jnht.jm

Maps:

Figure 15: Protected Areas and Special Mining Lease Sites in Jamaica (2013)

Figure **16**: Special Fishery Conservation Areas declared by the Fisheries Division (2013)

Figure 17: Jamaica's National Heritage Sites managed by the JNHT (2013)

Figure 15: Protected Areas and Special Mining Lease Sites in Jamaica to 2013

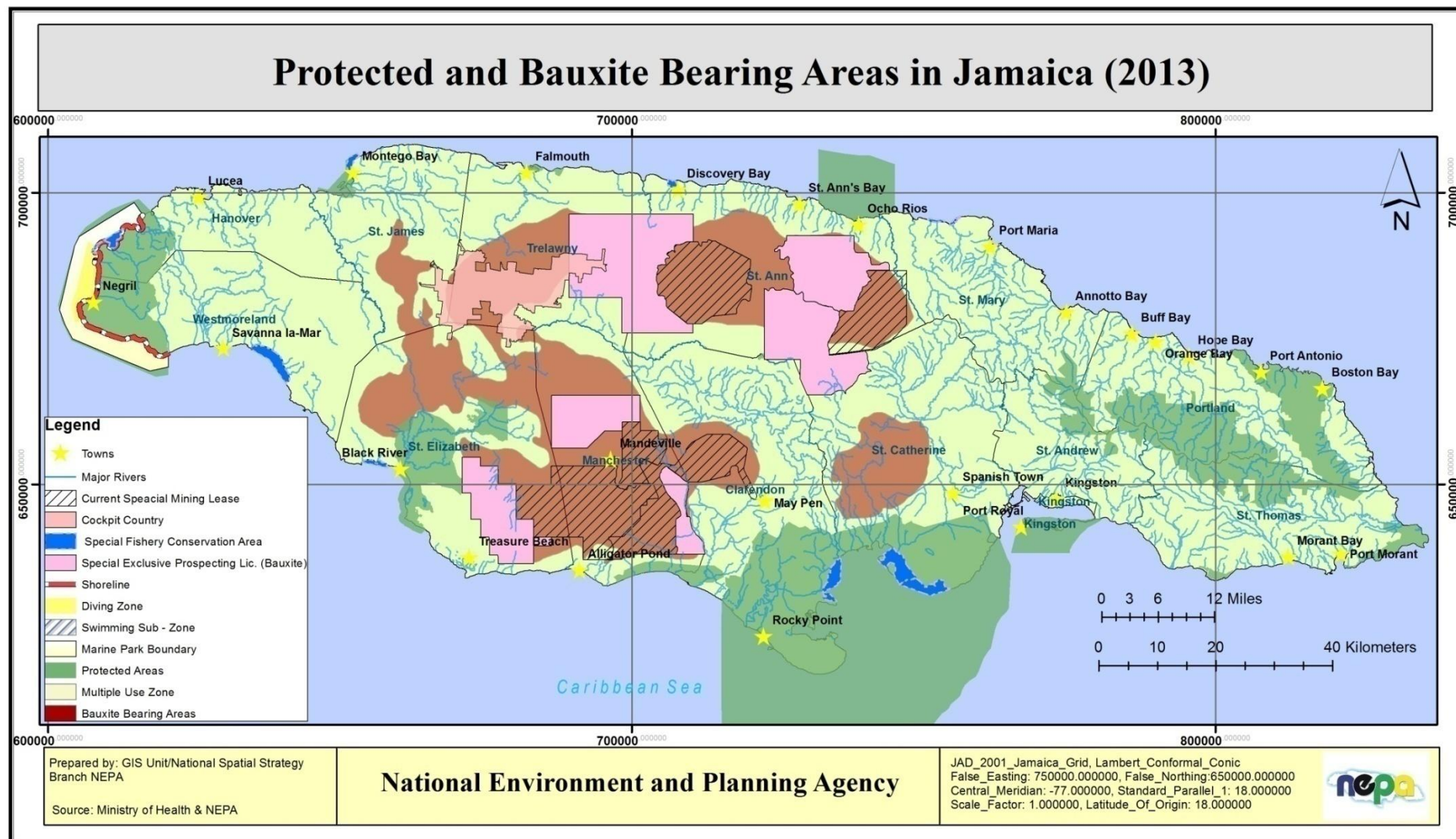


Figure 16: Special Fishery Conservation Areas Declared and Managed by the Fisheries Division (2013)

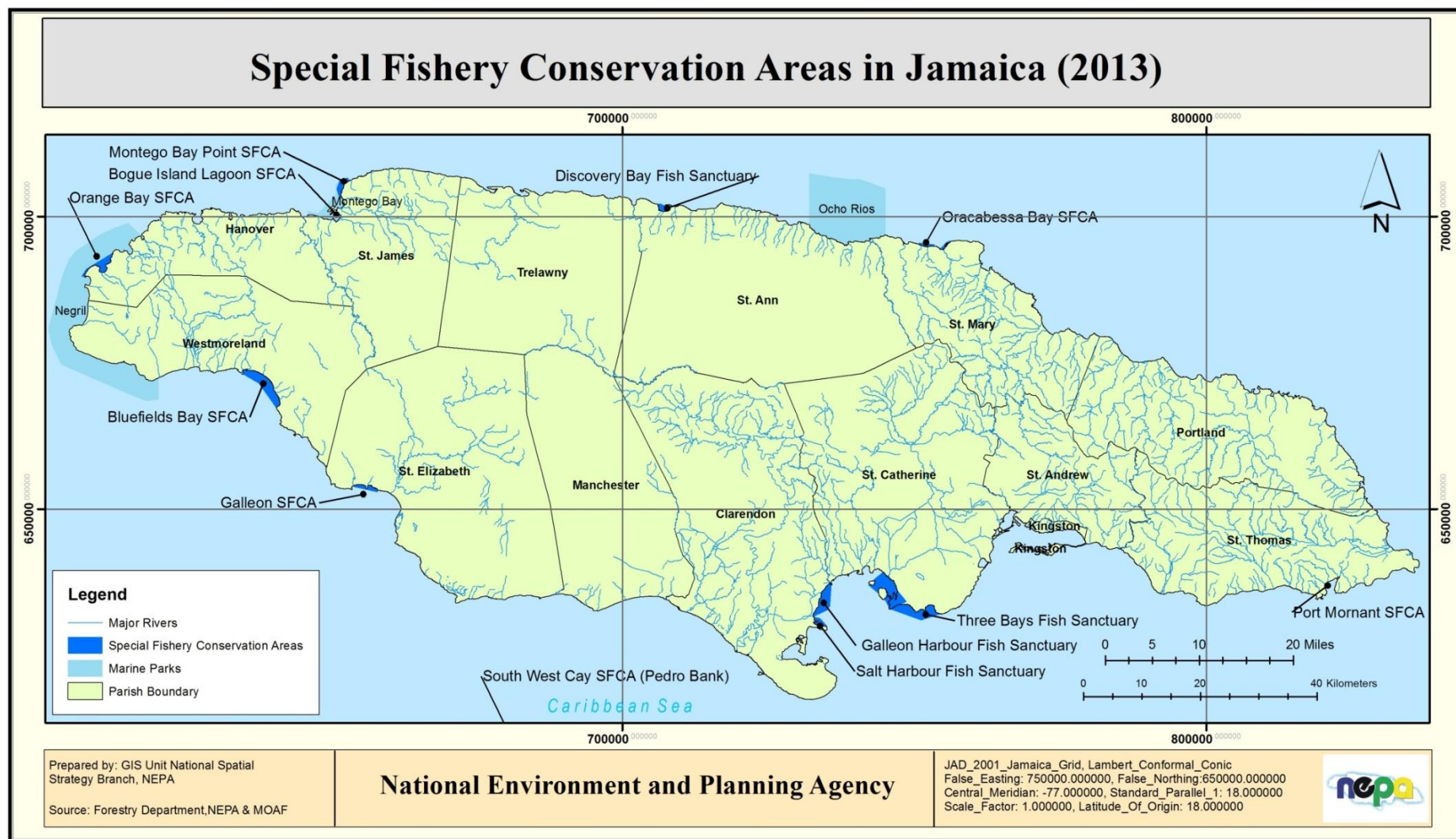
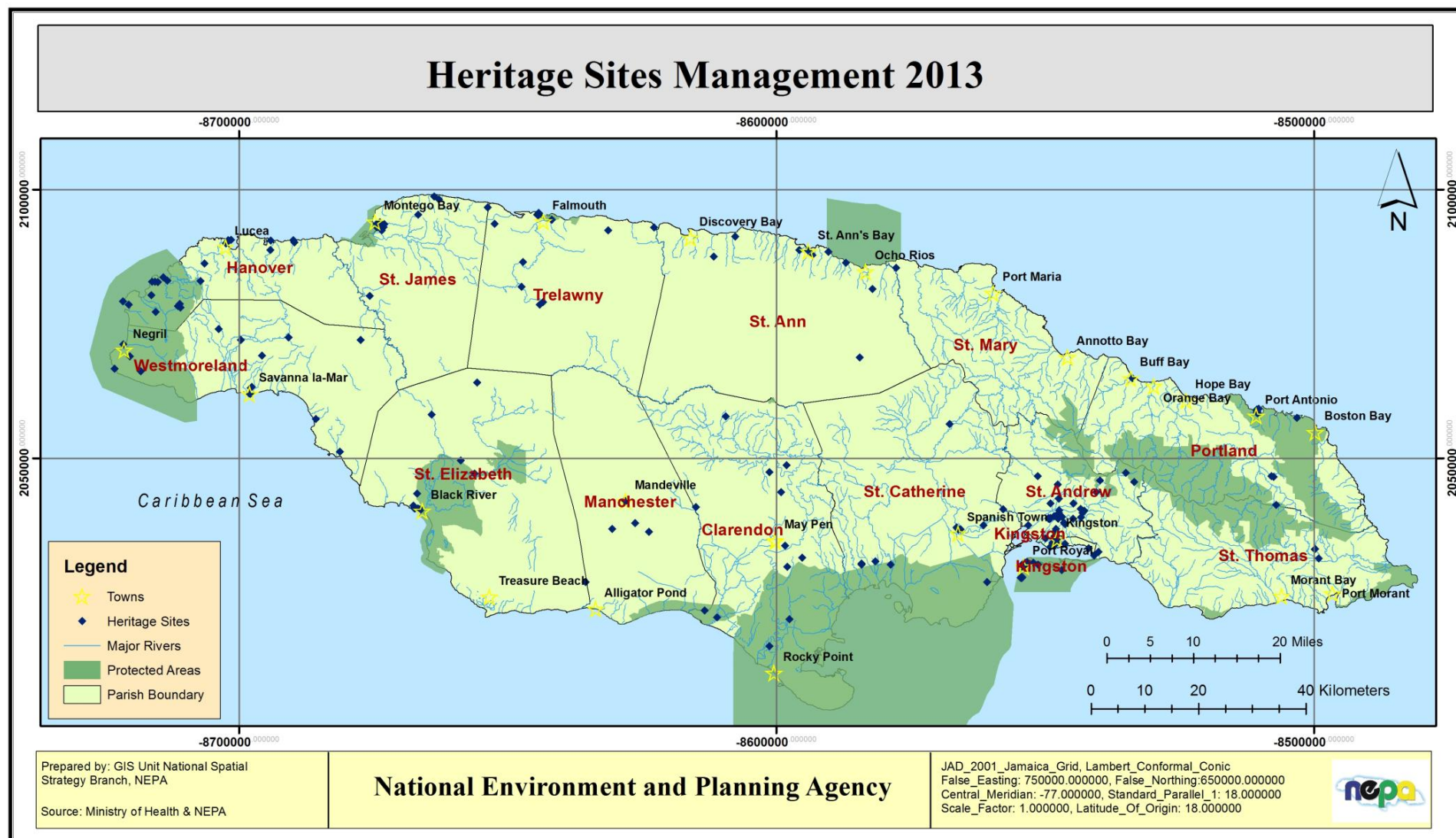


Figure 17: Jamaica's National Heritage Sites Managed by the JNHT (2013)





5. Coastal and Marine Resources

What are coastal and marine resources? This refers to all the living organisms and their ecosystems that are influenced by the sea. They include estuaries, harbours, bays, wetlands (including mangroves), beaches, rocky shorelines, cays, seagrass beds, coral reefs and the high seas.



What are mangroves? Mangroves are one of only a few tropical plants that have adapted to survive in salty water along the shores, estuaries and coastal areas of tropical countries like Jamaica. Salt normally kills plants, but mangroves have created an elaborate root system that can filter out as much as 90% of the salt in the seawater. Meanwhile the leaves store freshwater and excrete excess salt. The mangrove breathes by growing many long thin roots that stick up out of the sea water like snorkels.

These roots also help stabilise the mangrove tree. Furthermore, some species of mangrove have developed a unique way to reproduce itself by producing seed pods that germinate on the tree. When these seed pods fall they are ready to take root immediately. There are 69 species of mangrove in the world. Jamaica has four species: Red (*Rhizophora mangle*), Black (*Avicennia germinans*), White (*Laguncularia racemosa*) and Buttonwood (*Conocarpus erectus*) species.

What is seagrass? Seagrass is a flowering plant that grows in shallow marine waters normally up to 10 m. in depth. Seagrass beds provide food and shelter for many marine animals including fish, spiny lobster, queen conch, shrimp, stony crab, sea turtles and the manatee. The seagrass bed is also home to microorganisms that help produce almost half of the sediments found in Jamaica's sandy beaches. Seagrass help to filter nutrients and sediments in the water that is vital to protecting coral reefs and water quality. Seagrass meadows are also known to reduce wave energy. The International Union for the Conservation of Nature confirms that there are 60 known species of seagrass. Three species are commonly found in Jamaica: *Syringodium sp.*, *Halodule sp.* and *Thalassia sp.*.





What is Hard Coral (*Scleractinia*)? This order of corals (also known as Stony Coral) belongs to the *Hexacorallia* subclass. They are animals consisting of thousands of identical coral polyps which have six tentacles and secrete calcium carbonate (a type of limestone) to create a hard skeleton that grows over time. The coral polyp can only grow its skeleton with the help of tiny algae called *zooxanthellae*. Hard corals are very susceptible to disease, changes in sea

temperature and water quality. When they experience these changes they expel the symbiotic algae and turn white. This process is known as **coral bleaching**. Hard coral species have different growth forms, (boulder, plate, branching, encrusting, etc.).

What is Soft Coral (*Alcyonacea*)? This order of corals has eight tentacles and belongs to the *Octocorallia* subclass of corals. Unlike hard corals they do not form calcium carbonate skeletons, or rely on algae to develop. Instead, they produce tiny spiny tentacles called sclerites that help to deter predators. To feed they capture free floating zooplankton from the water column using their sclerites, which can produce a sting to kill their prey. Soft corals are more resilient to changes in water temperature and quality than hard corals are. Soft corals found in Jamaica include sea fans, sea plumes, and sea rods and whip corals.



What are Sponges (*Peripheral*) Sponges are highly porous invertebrates that have a multicellular structure that feed on the organisms that pass through their pores and tiny channels. They are some of the oldest life forms and are unique in that they do not have a mouth or a digestive, nervous or circulatory system. Other marine invertebrate animal classes include echinoderms, molluscs, crustaceans and polychaetes.

Why are coastal marine resources important? Jamaica's economy is heavily dependent on beach-related tourism which is the main sector of employment for Jamaica's workforce. In addition, there are many fishing communities dependent on coastal marine resources to maintain their livelihoods and supply fish to the tourism sector. The conch and lobster industry generates foreign exchange for Jamaica's economy. Furthermore, the ecological services of coastal and marine resources are vital to safeguarding the safety of coastal communities. Coral reefs, seagrass and mangroves together reduce the effects of floods caused by storm surges, act as filters of nutrients and pollution and provide safe spawning sites and nurseries for many fish, shellfish and other sea creatures.

5.1 Background to Jamaica's Coastal and Marine Resources

Jamaica has approximately 1,022 km. of coastline that is mainly made up of:

- 1,240km of coral reefs consisting of hard, soft and black coral species, sponges and other living organisms. Various sources, including the previous SOE 2010, have confirmed that mean hard coral cover of up to 10 metres in depth fell dramatically between 1970 and 2000. Since 2001 NEPA has conducted routine monitoring at various sites around the island to track the state of the country's coral reefs.
- Seagrass beds found around large parts of the shoreline, mainly up to 10 m. in depth. There is no routine monitoring conducted on seagrass beds, but a number of sources, including anecdotal evidence, confirm seagrass beds have declined, especially in tourist areas where they have been cleared by many resorts and hotels.
- 290km. of coastline covered by mangrove and swamp forests, which currently account for almost 10,000 ha. –equivalent to almost 1% of Jamaica's land use in 2013.³³ These forests have traditionally been cleared for agriculture, housing and/or tourism development.³⁴
- Almost 300 beaches (many of which many are white sandy beaches) made from calcareous material. A number of beaches have suffered from erosion due to natural and human-induced causes that relate to sea level rise; intense storms and hurricanes; damage or clearing of coral reefs, seagrass beds and mangroves; illegal sand mining and hotel developments that do not fully comply with the setback limits.
- Rocks: Rocky coastline accounts for almost half of Jamaica's total coastline.

As mentioned in Chapter 1 on Biodiversity, Jamaica has been a party to the Convention on Biological Diversity (CBD) since 1995, which requires the conservation and sustainable use of the world's biological diversity including coastal/marine living resources as well as those on land. Other international Conventions which are directly related to safeguarding the country's coastal marine resources include:

- The **Ramsar Convention**, which promotes the conservation and effective management of wetland areas and up to 6 metres below sea level, ratified by Jamaica in 1998;
- The **Bonn Convention** dedicated to protecting migratory species (terrestrial, marine and avian), which Jamaica has not yet ratified;
- **CITES a convention** designed to regulate the trade of endangered species by enforcing a licensing system on all imports, exports, re-exports and introduction from the sea of plant and animal species covered by the Convention. Jamaica ratified the convention in 1997;
- The **Cartagena Convention**, which is aimed at the protection and development of the marine environment of the wider Caribbean Region. There are three Protocols under this Convention:
 - a) Oil Spills Protocol (entered into force in 1986) and ratified by Jamaica in 1987;
 - b) Specially Protected Areas and Wildlife Protocol (SPAW) (entered into force in 2000), but has not yet been ratified by Jamaica; and
 - c) Land-based Sources of Marine Pollution Protocol (entered into force in 2010) and aims to reduce priority pollutants and promote co-operation in monitoring, research, and exchange of scientific and technical information on land-based pollution (not yet ratified)

³³ Land Use Cover Assessment: A Comprehensive Assessment of Forest Change between 1998 and 2013 (see also Table 6 in Chapter 3);

³⁴ Removal of mangroves has also not been aided by a general perception among many Jamaicans that they are major breeding grounds for mosquitoes.

by Jamaica).

- **The MARPOL Protocol**, which absorbed the Convention for the Prevention of Pollution from Ships, ratified by Jamaica in 1991;
- The **Convention on Oil Pollution Preparedness, Response and Co-operation** establishing measures for dealing with maritime oil pollution incidents, which was signed by Jamaica in 2001, but not ratified so far (2013);
- The **Convention on the Law of the Sea**, which defines the rights and responsibilities of nations with respect to their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources;
- The **Convention on Protection of Underwater Cultural Heritage**, to support the *in-situ* preservation of heritage such as ship wrecks on the seafloor.
- **The London Convention**, designed to prevent marine pollution caused by the dumping of waste and other matter at sea.

The implementation of the above Conventions is supported by the following national legislation and standards:

- **Wild Life Protection Act** (1945) the country's main statute for the protection of animals and birds and regulates hunting.
- **Beach Control Act** (1956) and associated regulations, which defines the role of the Beach Control Authority and addresses granting of licences for beach uses, safety, acquiring and maintaining public beaches and protecting beach resources.
- **Fishing Industry Act** (1975) and **Regulations** (1976),³⁵ which provides for, among other things, the role of the Licensing Authority in areas such as issuing of licences, permitted fishing equipment and registering of boats.
- **Maritime Areas Act** (1996) which declares Jamaica to be an archipelagic state and makes provisions with respect to Maritime Areas.
- **Aquaculture, Inland and Marine Products and By-products (Inspection and Licensing) Act** (1999) and associated regulations addressing inspection, licensing and export.
- **NRCA Act Wastewater & Sludge Regulations** gazetted on 24/04/2013 are designed to regulate the construction, modification and operation of wastewater treatment facilities and the discharge of sewage and trade effluent through the granting of licences under the **NRCA (Permit and Licences) Regulations**. The Regulations provide the requirement for discharge fees which are payable based on the quality of the pollution load being discharged to the environment (see also Chapter 8).
- **Draft National Ambient Water Quality Standards** (2009) for marine and freshwater, which are monitored at various sites around the island by NEPA (see also Chapter 6).

The implementation of the above-mentioned pieces of legislation and standards is provided through the following national policies, strategies and plans, among others:

- The Draft Coral Reef Protection and Preservation Policy and Regulation (1997);
- The Draft Mangrove and Coastal Wetlands Policy and Regulations (1997);
- The Action Plan for Corals and Reefs in Jamaica (APCAR), which is coordinated by NEPA and designed to improve understanding on coral reef ecosystems and reduce the negative impact of human activities on them (such as through improved regulations, policies and/or enforcement). The APCAR also provides information to the International Coral Reef Initiative

³⁵Includes the Fishing Industry (Conservation of Conch (Genus Strombus)) Regulations, 2000

(ICRI).

- The Draft Beach Policy (2000), which includes details on the Legal Regime regarding access to the Foreshore, the Floor of the Sea and Beaches in Jamaica; the status of beaches in Jamaica; key issues (including public access, management, facilities, safety, pollution, water quality, beach uses, beach erosion, protection of natural resources and marine protected areas) and; the policy itself based on six objectives, which address the above-mentioned issues.
- The Draft National Fisheries Policy (2008): provides a framework for the formulation of strategies designed to address challenges and opportunities within the industry), including food security, poverty alleviation, and the globalisation of trade, including their impact on more than 23,300 fisher folk registered by the Fisheries Division. The policy addresses resource management in capture fisheries by seeking to control access to Jamaica's inshore and offshore fisheries. The policy also addresses resource restoration in overfished areas through improving monitoring, control, surveillance, and enforcement initiatives. It also establishes fisheries management areas administered by management plans and advances support for research and economic opportunity within aquaculture and capture fisheries.

5.2 The Current State of Jamaica's Coastal Marine Resources 2011-13

5.2.1 Current State of Policies, Strategies and Plans Supporting the Sustainable Use of Jamaica's Coastal Marine Resources

The GoJ has continued to fulfill its commitment to establishing the sustainable management of its coastal-marine resources in the period 2011-2013. A selection of some of the most important developments in this period are summarised as follows:

1) Designation of Protected Areas in coastal and marine areas and their management

- A fourth Ramsar site was officially designated on June 14, 2012 within the Mason River Protected Area. Although an inland wetland site, the designation of this Ramsar site supports the conservation prospects of unique endemic biodiversity found in one of Jamaica's four types of wetlands (plaustrine wetland in which marshes, swamps and/or bogs are found).
- No new marine parks were added in the period 2011-2013. However, two new Special Fishery Conservation Areas (SFCA) were gazetted in May 2012 at South West Cay in Pedro Bank and Sandals Whitehouse in Westmoreland parish (see also Table 13 in Chapter 4).
- The Draft Master Plan for Protected Areas 2013-2017 was finalised in 2013. The creation of a Protected Areas System is foreseen to preserve Jamaica's biological and cultural heritage relating to both terrestrial and marine environments. (More details on this can be found in Chapter 4).

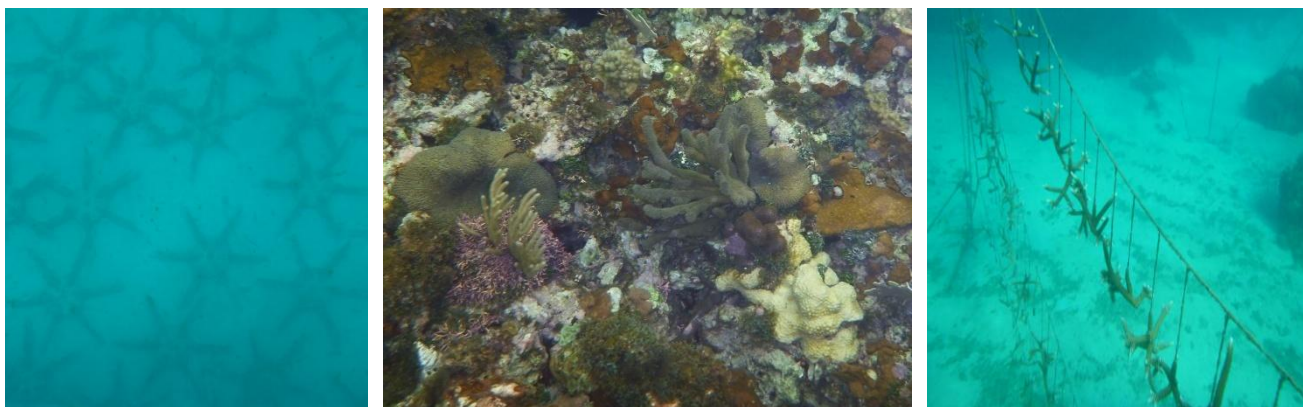
2) Coastal Zone Protection and Management

- The development of a **National Coastal Resources Policy** progressed in the period 2011-2013. This aims to supersede the Draft Coral Reef Protection and Preservation Policy and Regulation (1997) and the Draft Mangrove and Coastal Wetlands Policy and Regulations (1997). The draft policy is expected to be finalised in 2014.

3) Action Plan for Corals and Reefs (APCAR) in Jamaica

- NEPA has continued to coordinate and monitor progress of the APCAR and continued to fulfill its reporting obligations to the International Coral Reef Initiative (ICRI) in the interests of supporting and promoting a better understanding of coral reef ecosystems worldwide as well as identifying ways to reduce the negative impact of human activities on them (through improved regulations, policies and enforcement).
- The APCAR has contributed to the official establishment of an ecosystem-based approach that focuses on conserving the ecological aspects of the coastal environment. This approach also encourages the active participation of the local population in the sustainable use of the coastal marine resources to safeguard resources for present and future generations. Progress in meeting the APCAR's nine conservation targets in the period 2011-13 are summarized as follows:
 - Work started on updating the Coastal Atlas of Jamaica in particular the inventory of shoreline characteristics which will include web-based maps of coral reef habitats.
 - Commencing long-term monitoring and assessments of reef health and trends: this has been coordinated by NEPA with the support of volunteers from the Jamaica Coral Reef Monitoring Network. The latest ICRI Member's Report submitted by NEPA was for the reporting period July 2012 to October 2013.
 - Supporting strategic research to respond to the major threats to reef health;
 - Incorporating the human dimension into coral reef conservation strategies: an optimal network of Marine Protected Areas that includes capture and no-take zones;
 - Reducing pollution and habitat destruction.
 - Facilitating alternative livelihoods to reduce dependence on the exploitation of reef species.
 - Building public awareness and participation in coral reef conservation and rehabilitation.
 - Restoring damaged reefs.

Figure 18: From left to right: On-going Rehabilitation of Coral Reefs in Montego Bay (Coral Plantation), Negril Marine Park (Coral Regeneration) and Oracabessa Bay SFCA (Staghorn stems) in 2013



Source: see Annex 2

4) The development of a Draft National Fisheries Policy:

- The National Fisheries Advisory Board, with the support of the Food and Agriculture Organisation of the United Nations (FAO), continued reviewing the development of a new draft policy proposal that began in 2009. It is hoped that the draft policy will be finalized by 2015 and adopted as a Green Paper by Parliament to start the process of enactment. The main developments in the policy review in 2011-2013 have been the agreement on the need to overhaul existing fisheries-related laws, in particular the Fishing Industry Act (1975). This will tackle new challenges to safeguard the livelihoods of over 23,300 registered fishers operating from 187 licensed fishing beaches³⁶ and ensure the fisheries sector continues to generate around 3% of GDP growth in the coming years. New challenges that are not covered in the existing Fisheries Act include:
 - The sustainable management of fish stocks for both subsistence and commercial activities, although a management plan is to be implemented for the conch industry;
 - The expansion of SFCA to help recover the coastal marine and pelagic fish stocks;
 - Invasive Alien Species management involving the active participation of local fisher folk and education campaigns;
 - Adapting to the effects of climate change, which is likely to have a negative impact on fishing beaches, on the movement and breeding habits of fish stocks, and which will result in more sediments and nutrients washed into coastal waters from more frequent and/or intense storms, as well as increased acidification of sea water, etc.

5) The development of a new **Draft Beach Policy**:

- The elaboration of the new policy is currently addressing the following issues and challenges:
 - Limited access of the general public to the country's bathing beaches due to, among other things, the rise in the number of hotels and resorts, the installation of piers, water decks and other structures and the use of 187 beaches for fishing.
 - Addressing the rehabilitation and maintenance requirements of the country's most critical beaches (for tourism and/or the fishing sector) many of which have been

³⁶ PIOJ Economic and Social Survey – Jamaica, 2013 section 10.8

- severely damaged (most recently by Hurricane Sandy in 2012);
- Establishing coherence with the commitment of the Ministry of Agriculture and Fisheries to support sustainable marine fisheries management, (a component of the “Improving Jamaica’s Agricultural Productivity Programme”), which supports the rehabilitation and upgrading of a number of fishing beaches in the period 2011-2013;
- Protecting beaches for specific migratory species, such as seabirds and turtles, in line with the government’s current considerations on becoming a signatory to the Convention on Migratory Species (Bonn Convention). Also taking into account NEPA’s expansion of index beaches from two to six to improve monitoring of the nesting habits of Jamaica’s four species of endangered marine turtles around the island.
- Improving the effectiveness of local communities’ participation in beach and coastal marine management in order to promote greater self-regulation on the protection and upkeep of beaches, shores and reefs. This is in line with initiatives such as the turtle rehabilitation and monitoring initiative and the “Coral Bleach Watch Programme” launched in 2012 at two locations. The launch involved local community volunteers who were trained the previous year in how to apply the monitoring correctly.



5.2.2 Current State and Trends of Jamaica’s Coral Reefs (2013)

Figure 21 and Figure 22 at the end of this chapter show the location and threat level of Jamaica’s coral reefs (2011). The following data summarises key statistics on Jamaica’s coral reefs in 2013, based on data collected by the World Resource Institute:³⁷

- There are approximately 1,240 km² of coral reefs around Jamaica’s coastline.
- NEPA has monitored a total of 32 coral reef sites since 2011.
- There are 64 known species of Hard Coral (Scleractinia). They include Brain coral (*Platygyra daedalea*), Finger coral (*Porites porites*) and Staghorn coral (*Acropora cervicornis*).
- There are 43 known species of Soft Coral (Alcyonacea). Soft corals found in Jamaica include sea fans (*Gorgonia*), sea plumes (Bipinnate) and sea rods (*Plexaura homomalla*).
- There are 8 known species of Black Coral (*Antipathes*). They possess a black or brown



³⁷Coastal Capital: Jamaica – The Economic Value of Jamaica’s Coral Reefs, R. Waite et al, 2011.

skeleton.³⁸

In 2011, NEPA commenced a comprehensive health assessment of Jamaica's reef ecosystem to produce the report: "Coral Reefs of Jamaica – An Evaluation of Ecosystem Health: 2011". As a follow up to this report NEPA produced the Coral Reef Health Index Report Card: 2013,³⁹ which used reef data from 23 reef sites in nine coastal marine areas –Montego Bay Marine Park, Negril Marine Park, Ocho Rios Marine Park, Oracabessa Bay Special Fishery Conservation Area, Sandals Boscobel Special Fishery Conservation Area, Palisadoes-Port Royal Protected Area, Falmouth, Discovery Bay, and Belmont in Westmoreland). The CRHI Report Card was produced following an assessment of six indicators under two indices:⁴⁰

1) Coral Index:

- Coral cover (measured the proportion of reef surface covered by live hard corals).
- Coral recruitment (measured the density of coral recruits per square metre on the reef).

2) Reef BIOTA Index:

- Msacro-algal cover - measures the amount of damaging fleshy algae on the reef.
- Herbivorous fish abundance - measures the biomass of surgeonfish and parrotfish (the most important grazers of algae that threatens to overgrow the reef);
- Commercial fish abundance - measures the biomass of commercially significant fish (such as Grunts, Groupers and Snappers).
- Sea urchin (*Diadema* sp.) abundance - measures the density of the long-spined sea urchin, (a key grazer of reef algae).

The overall finding of the CRHI Report Card for 2013 was **overall health of Jamaica's coastal reefs remains "poor"**. It found 6 of the 23 sites assessed were "critical" and a further 16 sites were in a "poor" state. The remaining site was ranked "fair" confirming none of the 23 sites was in a good, or very good state. The results of the evaluation are shown in the following Table 16.

Table 16: Results for the Site Specific Coral Reef Health Index (2013)

Location	Monitoring Site	Coral Index	Reef Biota Index	Coral Reef Health Index
Montego Bay Marine Park	Airport Reef West	2.5	1.8	2.2
	Classroom Reef	2.5	1.5	2.0
	Sergeant Major	2.5	1.8	2.2
	Sunset Beach Mooring	2.0	1.5	1.8
Falmouth	Oyster Bay	2.5	1.8	2.2
	Relocation Site 1	2.5	1.5	2.0
	Relocation Site 3	2.5	1.3	1.9
Discovery Bay	Dairy Bull	2.5	1.8	2.2
	Pear Tree Bottom	2.0	1.3	1.7

³⁸Also called Little Thorn Corals, they make black/brown skeletons with tiny thorns on the surface to warn predators

³⁹Published in 2014

⁴⁰The assessments at each site applied standard reef assessment techniques to ensure uniformity of data collection. For example, each reef assessment applied the point intercept method to assess substrate cover at 0.5 m. intervals along four 20 m. long transects and used a sampling quadrat measuring 25 cm² placed at 0, 5, 10, 15 and 20m. intervals along the same four above-mention transects to measure the density of hard coral recruits.

Location	Monitoring Site	Coral Index	Reef Biota Index	Coral Reef Health Index
Ocho Rios Marine Park	Dickies Reef	2.5	2.0	2.3
	Dunns River	2.0	1.5	1.8
	RIU Nursery	1.5	1.8	1.7
	Sewage End	2.5	2.3	2.4
Sandals Boscobel Special Fishery Conservation Area	Channel Edge	2.5	2.0	2.3
Oracabessa Bay Special Fishery Conservation Area	Golden Eye Beach Bar	1.5	1.3	1.4
	Outer Bank	2.5	1.5	2.0
	Rock Edge	1.5	1.3	1.4
Palisadoes-Port Royal Protected Area	Drunkenman's Cay	3.0	3.0	3.0
	Lime Cay	3.0	1.5	2.3
Belmont, Westmoreland	Peter Tosh Reef	2.5	2.5	2.5
Negril Marine Park	Bloody Bay	1.5	2.3	1.9
	El Punto Negrilo	2.5	2.0	2.3
	Little Bay	2.5	1.8	2.2

Source: NEPA; Coral Reef Health Index: Critical (1 - 1.8); Poor (>1.8 - 2.6); (>2.6 - 3.4); Good (>3.4 - 4.2)

Colour Codes used: Red = Critical Reef; Orange = Poor Reef; Green = Fair Reef

A major factor that has contributed to the above-mentioned finding has been the slow progress in establishing an effective management system to support the recovery of the reef ecosystem, in particular:

- 1) Application of zoning to facilitate the establishment of more no-take zones (or Special Fishery Conservation Areas) to help reduce the effects of over-fishing;
- 2) Greater conservation efforts to reduce the fishing of herbivorous fish, especially major reef cleaners such as Parrotfish (*Scaridae*) and Surgeonfish (*Acanthuridae*) sub families, which control algae growth in coral reefs;
- 3) More effective participation of fishermen and other stakeholders in areas such as supporting effective local law enforcement and monitoring.

Coral Bleaching

NEPA found no clear evidence of bleaching of coral colonies in the period 2011 to 2013. Signs of stress were identified in some cases, but this was determined to be probably due to non-thermal disturbances. This is partly explained by the fact all locations with a dataset spanning 9-13 months recorded average temperatures of 28.2°C to 28.6°C. Sea Surface Temperature data between November 2011 and January 2013 indicated that the coolest period was from January to March and peak warm temperatures from August to October at all sites – which is normal – and corresponds with the active period of the hurricane season in Jamaica (June-November).

5.2.3 The Current State of Jamaica's Beaches (2013)



Jamaica has 795 km. of shoreline of which approximately 30% is characterized as sandy beach.⁴¹ The country's white sandy beaches found along the north and west coasts of the country, formed mainly from white calcareous deposits, remain crucial to Jamaica's economic and social development. The country's beaches⁴² also provide important ecological services, which help to sustain the tourism industry and the livelihoods of coastal marine communities. These services include: sediment storage and

transport; wave dissipation and associated buffering against extreme weather events; dynamic response to sea level rise; breakdown of organic materials and pollutants; water filtration; nutrient mineralization and recycling; storage of water in dune aquifers and groundwater discharge through beaches; maintenance of biodiversity and genetic resources; a source of nutrients for some fish; nesting sites or rookeries for turtles and shorebirds; and scenic vistas and recreational opportunities.⁴³

Currently, there is inadequate assessment of the economic value of the ecological services of Jamaica's beaches to support development planning and adaptation to climate variability and change. However, NEPA has been conducting beach erosion monitoring since 2006.⁴⁴ In 2011 this was expanded to 36 official annual monitoring sites, based at seven locations around the country. The expansion was in recognition of the need to learn more about beach erosion trends to support the review of the Beach Policy and the establishment of coastal zone protection and management, taking into account the growing threats of climate variability and change and the pressures of the tourism industry on beach use.

⁴¹Beach Policy for Jamaica (2000), based on data taken from the Coastal Zone Planning Project funded by the Swedish International Development Agency.

⁴²Defined as, *the zone of unconsolidated material (sand or gravel), whether natural or manmade, that extends from the low water mark landward to the vegetation line, or to the crest of the primary dune, or to a line of debris deposited by wave action (usually the effective limit of storm waves), or a combination of such factors* (Beach Policy, pp.3)

⁴³Defeo et al., 2009

⁴⁴The natural process of wave action that breaks down and removes rocks, stones and sediment from the shoreline and which may lead to the rebuilding of beaches, or their development elsewhere

Table 17 shows the current state of beach use in Jamaica in relation to 2010.

Table 17: Designated Beach Uses in Jamaica (2010 and 2013)

Beach use*	2013
Public Bathing beaches	87
Fishing Beaches	121
Hotel/resort beaches	61
Guest house and villa beaches	275
Total	544

*Source: NEPA; *There have been no changes in beach use since 2010*

Between 2011 and 2012 data collected at the 36 monitoring sites followed a standard methodology.⁴⁵ In March 2013 NEPA published its first report on initial trends on beach erosion entitled, “Beach Erosion – Status and Trends: 2012”. The data recorded at the 36 sites over the two year period together with the extent of beach erosion or accretion is summarised in

⁴⁵ The methodology includes quarterly beach profile assessments in order to develop an average beach width each year. Additional assessments are undertaken in the event of storms or hurricanes. Data are analysed using Beach Profile Analysis software developed by the Caribbean by the UNESCO/COSALC Project.

Table 18. Figure 23 at the end of this Chapter shows the location of beach erosion sites. The main findings from this Table are summarised in the following manner:

- 1) **Portland:** the general trend along the stretch of beach in Long Bay is a mix of erosion and accretion. Longbay 4 is the only site recording net erosion at a rate of 2.11 m/year while other sites recorded net accretion as high as 1.54 m/year.
- 2) **Palisadoes to Port Royal peninsular:** data confirms variability in the rates of shoreline change. However, for the first time since monitoring commenced in 2007, sites such as Port Royal B and Shipwreck experienced a decrease in shoreline width exhibiting a 4.279 m/year and 2.676 m/year loss respectively. Surfer's C beach was the only site that had previously recorded a decrease in shoreline, which recorded a net increase of 4.09 m/year in 2012.
- 3) **Burwood:** the beach at Burwood 1 lost 1.82 m./year when compared to data reported in 2011, while Burwood 2 experienced little change.
- 4) **Bluefields:** both beach sites at Bluefields experienced a net increase in beach width in 2012 compared to 2011.
- 5) **Font Hill:** registered a small net increase in beach width in 2012 as opposed to 2011.
- 6) **Jackson Bay:** Jackson Bay East recorded a net loss in beach width, whereas Jackson Bay West increased its beach width by 3.21 m. in relation to 2011.
- 7) **Negril:** eight of the 16 sites assessed along the Long Bay and Bloody Bay stretch of Negril experienced a net loss in beach width for 2012. Severe erosion was witnessed at the beach of the Native Son hotel, where beach loss was calculated at 4.55 m. in relation to average mean width in 2011. Meanwhile, eight beaches at Negril experienced accretion. The highest rate of accretion in Negril was witnessed at the Mahogany Inn monitoring site, where the beach profile was 5.39 m. greater than in 2011.

Table 18: Beach Erosion Rate Trend 2011-2012

Location and Name of Monitoring Site	Mean Beach Width 2011 (m)	Mean Beach Width 2012 (m)	Beach Gain/Loss (m)	Percentage change
Portland				
Chalet	16.633	18.144	1.511	9.08%
Longbay 1	18.142	18.158	0.016	0.09%
Longbay 2	23.825	25.363	1.538	6.46%
Longbay 3	26.630	27.856	1.226	4.60%
Longbay 4	48.970	46.857	-2.113	-4.31%
Palisadoes to Port Royal				
Port Royal B	62.886	56.544	-6.342	-10.08%
Port Royal A	70.824	72.699	1.875	2.65%
Port Royal C	57.728	57.806	0.078	0.14%
Surfers A	40.189	47.449	7.260	18.06%
Surfers C	38.783	42.870	4.087	10.54%
Surfers B	29.229	36.868	7.639	26.14%
Shipwreck	49.393	44.821	-4.572	-9.26%
Airport Runway	44.468	43.862	-0.606	-1.36%
Maritime	55.726	56.502	0.776	1.39%
Burwood				
Burwood 1	19.597	17.778	-1.819	-9.28%
Burwood 2	23.684	24.070	0.386	1.63%
Bluefields				
Bluefields 1	11.812	13.968	2.156	18.25%
Bluefields 2	16.318	17.679	1.361	8.34%
Font Hill				
Font Hill	20.287	21.237	0.950	4.68%
Jackson Bay				
Jackson Bay East	22.990	19.650	-3.340	-14.53%
Jackson Bay West	38.250	41.459	3.209	8.39%
Negril				
Native Son	21.691	17.146	-4.545	-20.95%
Swept Away	27.925	24.184	-3.741	-13.40%
Crystal Waters	26.249	23.184	-3.065	-11.68%
Negril Cabins	24.870	24.397	-0.473	-1.90%
Negril Cabins 1	21.859	21.420	-0.439	-2.01%
Negril Beach Club	43.978	43.643	-0.335	-0.76%
Sandals Negril	27.925	27.672	-0.253	-0.91%
Riu 2b	20.695	20.471	-0.224	-1.08%
Grand Lido	30.713	31.016	0.303	0.99%
Riu 2b	37.918	39.553	1.635	4.31%
Our Past Time	27.838	29.800	1.962	7.05%
Merrils 3	24.905	27.970	3.065	12.31%
Negril Gardens	27.070	30.952	3.882	14.34%
Charela Inn	29.689	34.225	4.536	15.28%
Community Beach	22.045	26.667	4.622	20.97%
Mahogany Inn	19.807	25.197	5.390	27.21%

Source: NEPA, report on Beach Erosion – Status and Trends: 2012

An important conclusion from the study is that natural coastal erosion processes indicate that they have been changing in recent decades, which suggests poorly planned human activity and greater volatility in weather patterns are important contributory factors. For example, five of the eight locations where monitoring is occurring have confirmed beach erosion and accretion is taking place at different rates, which confirms a large number of Jamaica's beaches are experiencing rapid change. Further assessment in the coming years is required to determine why this is happening. Initial interpretations are that there is a natural shifting of beach deposits from some beaches to others, (long shore transport) as well as out to sea (offshore deposition). However, where erosion and accretion rates are high (above 5%) natural and man-made factors would appear to have exacerbated the situation, such as storms and hurricanes or unsuitable human activity on or close to the beaches. This appears the case at the beach monitoring sites at Native Son, Swept Away and Crystal Waters in Negril, where the amount of beach loss is very high and requires an urgent response to address the high vulnerability of hotel amenities established along these beaches.

Access and services at Jamaica's beaches: the status of Jamaica's 87 public bathing beaches is not systematically monitored due to limited resources. However, access to public beaches in the west and north of the country has improved following important upgrades to road infrastructure and the GoJ is committed to developing at least one public beach in each Parish for Jamaicans. Approximately J\$ 252 million has been committed by GoJ⁴⁶ to upgrade six public beaches with improved access, parking, children's play areas, picnic furniture, restrooms, lifeguard towers, etc. The beaches concerned are: Boston (Portland), Burwood (Trelawny), Great Bay (St. Elizabeth), Norman Manley Beach Park (Westmoreland), Providence Beach Park (St. James) and Salem (St. Ann).



In addition, NEPA continued to support the implementation of the Blue Flag programme, a voluntary beach certification scheme to promote sustainable beaches and marinas, until 2012.⁴⁷ In 2010-2011 Blue Flags were issued to the following hotels/marinas:

2010: Bluefields-Westmoreland; Couples Swept Away-Negril; Merrills 1-Negril;

2011: Couples-Negril; Grand Palladium Lady Hamilton Resort & Spa-Montego Bay; Bay Beach-Ocho Rios and; Errol Flynn Marina-Port Antonio.

However, the Blue Flag certification scheme was discontinued in Jamaica from 2013. Important factors behind this decision include the annual costs involved in obtaining certification and the effects of Hurricane Sandy, which caused widespread damage to Jamaica's beaches in November 2012.

The current status of the country's 121 fishing beaches indicates that there is improper management at a number of sites, which has not been facilitated by inadequate levels of organisation of fisher groups and by conflicts over land tenure (Fisheries Division). However, improved organisation of fishing communities within SFCAs has contributed to improved management of fishing beaches. This is particularly the case at the SFCAs at Oracabessa and Bluefields where beach management has also been coordinated with turtle rescue programmes enjoyed technical and financial support from international projects such as Caribsave, funded mainly by the UK government.

⁴⁶ Funding will be primarily from the Tourism Enhancement Fund (TEF).

⁴⁷ The Blue Flag certification scheme confirms the participating hotel/resort has put in place commitments to maintaining water quality, public safety and services, environmental management and education and information



5.2.4 The Current State of Mangroves and Seagrass Beds (2013)

Mangroves: The largest areas of mangroves are found in the Black River Lower Morass (approximately 6,000 ha) and the Negril Great Morass (approximately 2,300 ha). These wetlands together represent 70% of wetland cover in Jamaica and contain not only large areas of mangrove forest, but also swamp forests and

marshlands. Mangrove forests are also protected at three wetland sites of international importance under the Ramsar Convention in the Black River Lower Morass; the Palisadoes-Port Royal Wetlands and; Portland Bight Wetlands and Cays (see also Chapter 4).

However, GoJ agencies have no standard procedure in place to assess land cover of mangroves and other forest types in wetlands. As a result it has been difficult to determine the current loss of wetlands and mangroves.⁴⁸ However, since 2010 NEPA has been engaged in mapping Jamaica's wetlands in the interests of ranking them for conservation purposes. Estimates in 2010 indicated the main coastal wetland areas of the country where mangroves are found amounted to approximately 11,674 ha.

Meanwhile, the Land Cover Assessment conducted by the FD in 2012-2013 indicates that there were approximately 9,800 ha of mangroves in 2013 (see also 9 in Chapter 3). Table 19 below shows the land area of the country's main wetland sites in 2013 (above 80 ha). Figure 21 at the end of this Chapter shows the current location of Jamaica's mangrove forests around.

The main finding from this table is that wetlands and mangroves are decreasing in many coastal areas due to human activity and that this has important implications on sustaining Jamaica's social and economic development. For example, the loss of mangroves means:

- Major breeding grounds for fish, crabs, shrimps, prawns and other commercial and non-commercial marine life are being lost, which reduces the possibilities of sustaining the livelihoods of over 23,000 licensed fisher folk as well as many more who fish informally. Studies by NEPA indicate that over 220 species of fish use mangroves to lay their eggs and feed. This includes many commercial fish such as grunt, snapper, snook, tarpon, barracuda and mackerel. Furthermore, important reef cleaners such as the Rainbow Parrotfish (*Scarus guacamaia*), are highly dependent on mangroves for breeding;
- Natural breakers of wave action are being lost at a time when the effects of climate variability and change are rising, such as the intensity of storms and hurricanes, which makes coastal areas more vulnerable to erosion, flooding and damage from tidal surges and;
- Natural filters that improve water quality through the control of sediments and the filtering of unwanted nutrients, such as sewage and some agricultural inputs, are being lost at a time when there are indications that nutrient levels in coastal marine areas are increasing (see Chapter 6);
- Natural habitats for more than 200 species, (including birds, bats, the American crocodile and the last remaining manatee) are disappearing, which has implications on diversifying the

⁴⁸ NEPA, General Information on Jamaica's Mangrove Wetland Resources

- economy into eco-tourism, maintaining the health of fish stocks, controlling insects, etc.;
- Carbon sinks are being lost, which contributes to increasing GHG emissions of methane and carbon dioxide that contribute to global warming).

Table 19: Main Wetland Areas in Jamaica (2013)
(hectares)

Name of Wetland Area	Parish	Description of Wetland Type(s)	Ha.
Black River Lower Morass	St. Elizabeth	Riverine/Estuarine; Marsh with Swamp, Forest and Mangal	6,000
Negril Great Morass	Hanover	Estuarine; Marsh and Swamp Forest	2,400
Cabarita Swamp	St. Catherine	Marine/Estuarine; Mangal	1,600
The Great Morass	St. Thomas	Marine; Mangal	1,600
West Harbour	Clarendon	Marine; Mangal	1,600
Canoe Valley	Manchester	Riverine/Estuarine; Marsh with Swamp, Forest and Mangal	1,200
Falmouth & Salt marsh	Trelawny	Marine/Estuarine; Marsh and Mangal	1,070
Amity Hall	St. Catherine	Marine; Mangal	480
Great Salt Pond	St. Catherine	Marine/Estuarine; Mangal	448
Manatee Bay	St. Catherine	Marine; Mangal and Marsh	370
Carita	Westmoreland	Estuarine; Mangal and Marsh	240
Kingston Harbour	Kingston & St. Andrew	Marine/Estuarine; Mangal	200
Cockpit-Salt River	Clarendon	Riverine/Marine; Marsh and Mangal	160
Cow Bay	St. Thomas	Estuarine; Marsh	146
Mason River	Clarendon	Palustrine; Marsh	80
Peartree Bottom	St. Ann	Riverine; Marsh	80
TOTAL			11,674

Source: NEPA, 2010 data



Seagrass (a group of *angiosperms*): They are found around Jamaica's shoreline, particularly in lagoons, bays and shallow coastal areas normally up to 10m in depth, depending on water clarity, beyond which they normally find it more difficult to perform photosynthesis. Figure 21 at the end of this Chapter provides information on the main areas where seagrass meadows are found in Jamaica. The **Draft National Policy for Seagrasses** (1996), prepared with funding from USAID, outlines the goals and specific strategies to protect

and conserve seagrass in Jamaica.

However, the current state of seagrass cover is not known due to a lack of funding to support regular monitoring at designated sites and the implementation of conservation actions. Instead, NEPA relies on specific studies on seagrass health and cover. For example, the Risk and Vulnerability Assessment Methodology Project (RiVAMP) conducted a beach study at Negril in 2009-2010 in which it identified the link between beach erosion and the loss of seagrass beds and coral reefs. The CARICOMP monitoring network (which includes the Discovery Bay Marine Laboratory) also conducted a long-term study on seagrass beds in the Caribbean using data collected twice yearly between 1993 and 2012. It confirmed wide variations in community total biomass (285 to > 2000 g. Dry m⁻²), although the general trend over the period has been a loss of biomass, with some sites witnessing a collapse of seagrass beds.

Anecdotal evidence from NGOs managing the country's three Marie Parks also indicates seagrass beds continue to be cleared by a number of large hotels and resorts. The general loss of seagrasses is in part due to a lack of adequate environmental education and awareness of their ecological services, which include:

- Slowing down wave action and currents by acting as baffles (mini breakers);
- Stabilising sediment movement and filtering out nutrients to improve water quality;
- Providing a habitat and food for many fish, shellfish, turtles, manatees, etc.;
- Regulating the food system by attracting migratory organisms to help sustain the coastal ecosystem.

The economic value of these services is not well documented in Jamaica. However, a study conducted on seagrass in the USA⁴⁹ confirmed the value of seagrass meadows to the coastline economy of the state of Texas amounted to between US\$9,000 to US\$28,000 per 0.40 ha (1 acre). Furthermore, it estimated the total economic value of seagrass in the state of Florida amounted to approximately US\$55.4 billion in 2010.

5.2.5 The State of Fish Stocks in Jamaica (2013)



The fishing industry in Jamaica continues to account for around 3% of Jamaica's exports and employs an estimated 23,300 registered fisher folk (2013), plus a large number who are unregistered. The majority of the fisheries sector is comprised of small artisanal fisher folk who fish with small boats around the mainland and offshore, especially at Morant Banks and Pedro Banks which together cover approximately 12,000km² and are major fishing grounds for conch and lobster.

Industrial fishing is mainly confined to Queen Conch (*Strombus gigas*), which is geared mainly to the export market and fished under a quota system established by the Fisheries Division. The industry is regulated by national and international legal instruments and agreements including CITES supported by NEPA through the implementation of the Endangered Species Act (2000).

The current state of Jamaica's fish biomass and density of four commercial fish is provided in Table 20. The data were obtained at 13 selected reef sites and is compared with data collected in 2010.

⁴⁹ Hunter R. Wert "Keep off the Seagrass! Why these vital grasses are vanishing", 13 March 2011

Table 20: Fish Biomass and Density of Four Commercial Fish Species (2010 and 2013)

Fish Name	Biomass Total (g/100m ²)		Biomass Average* (g/100m ²)		Density Total (#)		Density Average* (#)	
	2010	2013	2010	2013	2010	2013	2010	2013
Parrotfish	2,122.64	18,790.98	163.28	939.55	77.86	758.83	5.99	37.94
Grunt	473.92	2,206.73	36.46	110.34	13.54	45.25	1.04	2.26
Snapper	323.59	324.28	24.89	16.21	5.34	4.5	0.41	0.23
Grouper	180.51	585.55	13.89	29.28	7.28	15.25	0.56	0.80
Total	3,100.66	21,907.54	238.52	1,095.38	104.02	823.83	2.00	10.30

Source: NEPA (Reef Monitoring Sites); *Average biomass is per fish; average density is average number of fish for a site

Data were collected from marine protected areas at sites located in and around the Oracabessa Bay Special Fishery Conservation Area (St. Mary), the Ocho Rios Marine Park (St. Ann), the Discovery Bay Special Fishery Conservation area (St. Ann), the Montego Bay Marine Park – MBMP (St. James), Negril Marine Park (Westmoreland), the Palisadoes-Port Royal Protected Area (Kingston), the Bowden Special Fishery Conservation Area (St. Thomas), Rocky Point (St. Thomas) and Drapers (Portland). The main findings from Table 20 are as follows:

- 1) Total fish biomass has increased for all four fish types, confirming fish are breeding successfully and that their protection in the SFCAs is supporting this development;
- 2) Fish biomass averages have increased for all types except Snapper. This indicates fish are developing within the SFCAs, which has important implications on the future production of fish eggs and the development of the “spill-over effect”, given larger fish produce more eggs;
- 3) The small increase in total biomass of Snapper, but a reduction in their biomass average and density total suggests they are breeding at the monitoring sites, but are either migrating out as they grow bigger, or the bigger fish are still being illegally caught, perhaps at night when there are no wardens on patrol;
- 4) The increase in average biomass and density of parrotfish (576% and 633% respectively) is a very positive development and indicates that this important reef cleaner is settling within the monitoring sites. The increased presence of parrotfish is also a positive sign that supports the coral reef rehabilitation initiatives being promoted under the APCAR mentioned earlier in this Chapter, which includes reef rehabilitation programmes at the country’s Marine Parks;
- 5) The SFCAs are achieving their main objectives and represent a positive contribution to the country’s efforts to recover fish stocks and promote a healthier marine environment.

Table **21** and Table 22 provide data collected by the Fisheries Division on fish production trends from open waters in metric tonnes and the value of domestic landings of Jamaica's most important commercial fish, seafood and tilapia fish farming production from 2008 to 2013.

Table 21: Jamaica Fish Production in Metric Tonnes (MT) (2008-2013)

Fish Type	2009	2010	2011	2012	2013
Artisanal (Finfish)	12,544	11,390	14,208	9,464	13,463
Conch	400	440	400	550	500
Lobster (industry)	150	200	250	300	300
Shrimp	105	284	45	63	-*
Others	6	-*	4	-*	-*
Total Production	13,205	12,314	14,907	10,377	14,263
Total Tilapia Value	5,030	3,900	1,100	582	836
Grand Total	18,235	16,214	16,007	10,959	15,099

Source: Fisheries Division, Ministry of Agriculture and Fisheries; * No data

Table 22: Value of Domestic Landings by Registered Fisherfolk in US Dollars (2009-2013)

Fish Type	2009	2011	2012	2013
Artisanal (Finfish)	41,486,939	46,989,624	31,297,687	44,525,660
Conch	2,600,000	2,600,000	3,575,000	3,250,000
Lobster (industry)	1,200,000	2,000,000	2,400,000	2,400,000
Shrimp	735,000	315,000	440,300	-*
Others	-*	32,000	-*	-*
Total Fish Value	46,021,939	51,936,624	37,712,987	50,175,660
Tilapia-freshwater	13,581,000	2,970,000	1,570,320	2,257,200
Total Value	59,602,939	54,906,624	39,283,307	52,432,860

Source: Fisheries Division; * No data (no data also for 2010)

The main findings from the two above-mentioned tables are summarised as follows:

- 1) Trends in total marine fish production show an upward, but also volatile, trend. For example, fish production was markedly down in 2012, which is partly due to adverse weather, in particular the effects of hurricane Sandy in October 2012. This also produced a large drop in the value of domestic landings in 2012;
- 2) Trends in tilapia production have declined. One reason appears to be increased competition from imported frozen fish such as Mangrove Snapper and Grunt. In August 2013, the Observer newspaper announced a private venture would be rectifying the drop in production of the indigenous Red Tilapia by introducing fish farming of Silver Tilapia which test trials confirmed was a much faster growing fish than its indigenous counterpart, which means the costs of production can be brought down. The goal is to boost Silver Tilapia output by over 4,000 MT within three years⁵⁰;
- 3) Trends in the value of fish landings indicate that there is a gradual decline in the value of fish landed. For example, the value of total fish catch in 2009 was higher than in 2013 even though fish landings were higher in 2013. One possible explanation is that as fish stocks dwindle so fishermen may be catching less economically valuable fish varieties, such as Wenchman (*Pristipomoidis aquilonaris*), and Grunt (*Haemulon album*) that fetch lower prices.⁵¹

⁵⁰ Jamaica Observer, Business section, 08 August 2013.

⁵¹ A Reefs at Risk assessment conducted by the WRI and The Nature Conservancy (TNC) as part of the Coastal Capital project (2010-13) confirmed the pressure from over-fishing affects approximately two-thirds of reefs, and watershed-based sources threaten over 60%.

However, the growth of Special Fishery Conservation Areas (SCFA) reported in Chapter 4 (see Table 13 and Figure 15) represents a concerted effort by the Fisheries Division to support local fishing communities to:

- Engage local fisher folk in the protection and rehabilitation of remaining fish stocks;
- Educate fisher folk on fish stock conservation methods, such as the protection of large fish on the grounds they produce and fertilise many more eggs than smaller ones.⁵²
- Allow fish to grow and then move out of the SCFA where they can be caught (the spill-over effect).

This approach has proved popular with local fisher folk because it empowers and disciplines them to develop their management skills, respect the local rules they help to set and participate in control and vigilance activities. In addition, new opportunities in tourism and tourism-related activities become more evident as fish stocks return, which in turn will reduce the dependency on fishing. These are major reasons why the Fisheries Division is committed to expanding the SCFAs further, with the identification of three new potential SFCAs in the pipeline (see end of Table 13 in Chapter 4).

5.2.6 The State of Coastal Marine Water Quality in Jamaica (2013)

NEPA is responsible for conducting annual marine water quality monitoring in collaboration with other GoJ agencies and in accordance with the national marine water standards established in 2009 and which relate to the NRCA Act (1991). This is at designated coastal marine sites, together with some major rivers and estuaries such as Black River (St. Elizabeth), Hope River (Kingston and St. Andrew) and Montego River (St. James).

Table 23 provides details of the parameters and water quality standards currently applicable in Jamaica.



Table 23: Summary of Water Quality Parameters and Standards for Salt and Freshwater (2009)

Parameter & Symbol*	Standard & Unit		Why the Parameter is Monitored
	Freshwater	Seawater	
Phosphate (P) (reactive phosphorus)	0.01-0.8 Mg/litre	0.001-0.003 mg/litre	Phosphates are used in detergents and agricultural fertilisers to enhance plant growth. When washed into water bodies they help stimulate algal blooms that remove sunlight and consume the dissolved oxygen that waterborne creatures need to survive.
Nitrate (N) (Nitrogen)	0.1-7.5 mg/litre	0.007-0.014 mg/litre	Nitrates are used in food preservatives and fertilisers to promote healthy crop growth. Nitrates also stimulate algal growth. When algal blooms kill waterborne creatures, microorganisms (bacteria) increase to consume them, thus reducing further dissolved oxygen levels.
Biochemical	0.8-1.7	0.0-1.16	When nutrients from sewage, fertilisers, domestic waste, etc. are

⁵² For example, the Breds Foundation at the Galleon SFCFA has produced a video with support from the Caribsave project to educate fisherfolk showing a Snapper weighing 2.7kg (6lb) produces over 3 million eggs, whereas one weighing 0.45 kg (1lb) only produces around 36,000 eggs.

Parameter & Symbol*	Standard & Unit		Why the Parameter is Monitored
	Freshwater	Seawater	
Oxygen Demand - BOD (O)	Mg/litre	mg/litre	washed into the sea, aerobic organisms convert dissolved oxygen as energy to consume the nutrients. When BOD levels rise above 4.0 mg/litre most waterborne creatures will die.
pH (Acidity)	7.00-8.40	8.00-8.40	High acidity affects the ecological functions of many waterborne creatures such as calcium carbonate producers (hard corals, shellfish, etc.). High pH levels in seawater also indicates that increased amounts of carbon dioxide (CO ₂) are being dissolved, which supports research into global warming and fish migrations.
Total Coliform	-	2-256 MPN/100mL	Total Coliform levels are an indicator of potential contamination of water by pathogenic organisms that can be harmful to public health and the ecological functions of ecosystems. Low levels indicate less vulnerability to “unfriendly” bacteria called faecal pathogens.
Faecal Coliform	-	<2-13 MPN/100mL	Faecal Coliform is a bacteria directly associated with fresh faeces. If the Faecal Coliform level is above the standard, public health is at risk because the faecal pathogens can cause diarrhoea, vomiting, stomach infection, etc.

Source: WRA; *other parameters for freshwater: Calcium, Chloride, Magnesium, Potassium, Silica, Sodium, Sulfate, Hardness, Total Dissolved Solids and Conductivity

Since 2010 NEPA has increased the number of marine and freshwater monitoring sites now total over 300 sites (see

Figure 24). Standard procedure under current public funding allocations is to take two samples per year from each site. However, the goal remains to increase the sample rate to four times per year at each site to establish more reliable monitoring.

NEPA conducts the analysis of all water samples at its own laboratory located in Kingston. The results of this analysis are used to support NEPA and other government agencies take informed decisions in relation to maintaining public health and safety; identifying point and non-point sources of pollution and the main polluters and; the identification and/or review of policies, strategies and plans relating to the protection, conservation and sustainable use of coastal marine goods and services.

Table 24 and

Table 25 summarise the marine water quality monitoring data collected for four key parameters (Nitrates, Phosphates, BOD and Faecal Coliform) by NEPA for each WMU in 2009 and 2013.

Table 24: Results of Castal Marine Water Quality Monitoring of Nitrates and Phosphates (2009 & 2013)

Watershed Management Unit	Parameter & Year			
	NO ₃ ⁻ (mg/l)		PO ₄ ³⁻ (mg/l)	
	2009	2013	2009	2013

Watershed Management Unit	Parameter & Year			
	NO ₃ ⁻ (mg/l)		PO ₄ ³⁻ (mg/l)	
	2009	2013	2009	2013
Black River	0.719	0.109	0.035	0.455
Cabarita River	0.200	0.067	0.041	0.297
Deans Valley	0.500	0.053	0.046	0.461
Drivers River	0.930	0.433	0.048	0.298
Great River	0.702	0.168	0.074	0.025
Gut- Alligator Hole River	0.659	0.494	0.054	0.066
Hope River	0.777	0.090	0.028	0.315
Lucea River	1.200	0.264	0.039	0.172
Martha Brae	1.118	0.453	0.337	0.351
Milk River	0.246	1.097	0.141	0.304
Montego River	1.581	1.467	0.205	0.479
Morant River	1.049	0.180	0.068	0.244
New Savannah*	0.106	0.030	0.206	0.378
Oracabessa - Pagee River	0.250	0.039	0.027	0.159
Pencar - Buff Bay	1.165	0.194	0.389	0.198
Plantain Gardens	0.767	0.103	0.022	0.699
Rio Bueno - White River	1.390	0.994	0.066	0.144
Rio Cobre	1.462	0.123	0.082	0.066
Rio Grande	1.246	0.171	0.081	0.066
Rio Minho	1.530	0.028	0.070	0.224
Rio Nuevo*	0.155	0.189	0.002	0.171
South Negril - Orange River	0.608	0.120	0.150	0.408
Spanish River	1.374	0.182	0.066	0.328
Swift River	1.270	0.116	0.091	0.244
Wagwater River	0.068	0.002	0.191	0.002
Yallahs*	0.571	0.221	0.089	0.177

Source: NEPA Water Quality Monitoring Laboratory; * No monitoring sites

Table 25: Results of Coastal Marine Water Quality Monitoring of Faecal Coliform and Biological Oxygen Demand (2009 and 2013)

Watershed Management Unit	Parameter & Year			
	FC (MPN/100ml)		BOD (mg/l)	
	2009	2013	2009	2013
Black River	5.7	7.2	1.09	1.92
Cabarita River	2.0	142.3	0.75	5.25
Deans Valley	1.5	7.6	1.50	1.62
Drivers River	15.0	148	0.88	0.66
Great River	2.3	2.6	0.85	0.72
Gut- Alligator Hole River	3.1	9.3	0.75	1.33
Hope River	44.6	9.8	1.77	1.08
Lucea River	5.5	226.8	1.10	1.54
Martha Brae	13.4	66.1	1.24	2.97

Watershed Management Unit	Parameter & Year			
	FC (MPN/100ml)		BOD (mg/l)	
	2009	2013	2009	2013
Milk River	1.5	40.3	1.30	1.95
Montego River	13.8	115.3	1.83	1.55
Morant River	10.7	6.4	1.07	0.75
New Savannah*	2.5	11.8	1.53	1.22
Oracabessa - Pagee River	4.9	82.3	0.72	0.73
Pencar - Buff Bay	13.5	7.3	1.11	0.68
Plantain Gardens	1.6	3.7	0.56	0.53
Rio Bueno - White River	7.3	21.7	1.05	0.61
Rio Cobre	8.7	41.7	2.30	2.05
Rio Grande	31.5	119.6	1.36	1.06
Rio Minho	2.5	2.7	1.50	0.81
Rio Nuevo*	124.8	4.4	0.72	0.40
South Negril - Orange River	3.5	19.3	1.8	1.02
Spanish River	6.8	292.5	0.80	0.70
Swift River	29.6	9.4	0.84	0.40
Wagwater River	19.5	0.9	0.54	0.85
Yallahs*	4.2	13.8	0.38	0.98

Source: NEPA (Water Quality Monitoring Laboratory).

The results in Table 24 and

Table 25 are presented by WMU to facilitate analysis of possible correlations between fresh and seawater quality data and trends in the country's 26 main watersheds (see also Chapter 6). To facilitate analysis, the colour coding applied is as follows:

- Red: contaminated - consolidated data at the monitoring sites in the WMU over one year confirms the parameter measured was over the national standard;
- Orange: threatened - data collected over one year confirms the parameter measured was close to the national standard and could only be considered of fair quality;
- Green: good - data collected over one year confirms the parameter measured was well under the national standard and thus considered to be of good quality or better.

The main findings from Table 23 are summarised as follows:

- 1) Nitrate levels were over the national standard in coastal marine waters monitored at all 26 WMUs (100%) in 2009. This dropped to 21 WMUs (81%) in 2013, which confirms nitrate levels remain too high at the majority of monitoring sites in coastal marine waters of Jamaica.
- 2) Phosphate levels were over the national standard in coastal marine waters monitored at 25 (96%) WMUs in 2009 and again in 2013, which confirms phosphates are also at very high levels at most sites. This may have implications on the rehabilitation of coastal marine resources, in particular coral reef rehabilitation efforts in the SFCAs and Marine Parks in general.
- 3) The WMU for Wag Water registered major improvements in both nitrate and phosphorus levels at the monitoring sites in its coastal marine waters in 2013 compared to 2009.

Figure 25 and

Figure 26 show the status of faecal coliform and BOD at NEPA's water quality monitoring sites in 2013. The main findings from

Table 25 are:

- 1) Faecal coliform levels were over the national standard at monitoring sites in 9 WMUs (35%) in 2009, but rose to 13 WMUs (50%) in 2013, which suggests a rise in the amount of raw or poorly treated sewage is entering many of Jamaica's coastal marine waters.
- 2) A total of 9 WMUs (35%) experienced a shift in faecal coliform levels from below the national standard in 2009 to above the standard in 2013.
- 3) Only 5 WMUs (19%) experienced improvements in faecal coliform levels from above the national standard in 2009 to below the standard in 2013.
- 4) A total of 4 (15%) WMUs saw faecal coliform levels remain over the national standard in both 2009 and 2013 at the coastal marine monitoring sites (WMUs for Drivers, Martha Brae, Montego and Rio Grande rivers).
- 5) BOD levels were over the national standard at monitoring sites in 10 WMUs (38%) in 2009, but rose to 14 WMUs (53%) in 2013.
- 6) A total of 9 (35%) of WMUs remained over the BOD standard in 2009 and 2013 (Deans Valley, Hope, Martha Brae, Milk, Montego, New Savanna, Rio Cobre, Rio Grande and South Negril-Orange WMUs). This situation may also have a negative impact on the Negril and Montego Bay Marine Parks and SFCAs.
- 7) Only one WMU (Rio Minho) saw BOD levels improve significantly from above the national standard in 2009 to well below the standard in 2013.

In terms of possible correlations between the BOD and faecal coliform levels:

- There are three WMUs that did not meet either faecal coliform or BOD standards at NEPA's coastal monitoring sites in either 2009 or 2013 (Martha Brae, Montego River and Rio Grande WMUs);
- 9 WMUs (35%) indicated a rise in both faecal coliform and BOD levels between 2009 and 2013;
- 4 WMUs (15%) registered a drop in both faecal coliform and BOD levels between 2009 and 2013;
- 3 WMUs (12%) registered faecal coliform and BOD levels over the national standard in 2009 and 2013;
- 2 WMUs experienced low levels of faecal Coliform and BOD in both 2009 and 2013 (Great River and Plantain Gardens).

The overall trend identified in Table 24 and

Table 25 is that coastal marine water quality is down at the monitoring sites of 11 WMUs in 2013 when compared to 2009. NEPA recognises the limited number of coastal marine monitoring sites may not be fully representative of the whole coastal marine area of each WMU, but it does enable greater dialogue between NEPA and collaborating agencies on issues such as:

- Developing a methodology to compare coastal marine and freshwater quality monitoring at the WMU level to support the identification of potential correlations over time (see Tables 28 and 29 in Chapter 6) and promote the “ridge to reef” approach to water quality monitoring in the WMUs;
- Producing data at the WMU level to guide the land use planning process and facilitate community participation in the management of natural resources (terrestrial and marine);
- Prioritizing the allocation of scarce resources to WMUs where ecological goods and services are being compromised by high levels of pollutants;
- Guiding the development of environmental education and awareness programmes and campaigns.

5.3 The Main Threats to Coral Reefs, Beaches, Mangroves and Seagrass in 2013



Jamaica's coastal marine resources are facing increasing levels of degradation due to a number of pressures and threats. This situation puts at risk their ability to perform their ecological functions in a normal way, which is crucial to maintaining a healthy coastal marine environment and the continued provision of essential goods and services that support economic growth and facilitate social development. The main threats to coastal marine resources and

their ecosystems are summarised in Figure 19.

Figure 19: Specific Threats to Jamaica's Coastal Marine Resources (2013)

Removal of reefs, seagrass, mangroves for development	Illegal fishing, over-fishing & unintended by-catch	Land-based pollution of marine resources	Sea level rise and storm surges	Invasive alien species
Beach sand extraction & dredging	Draining of wetlands	Discharges of ballast water, oil and waste from ships	Destructive fishing practices	Poorly managed tourist activities

Source: UNEP, Caribbean Environment Programme (under the Cartagena Convention), 2010-2014

The recent expansion of beach monitoring sites, the continued expansion of SFCAs and the completion of the Land Cover Assessment by FD in 2013 (see Chapter 3) are all intended to help GoJ address key threats to coastal marine resources under the current policy framework. In addition, the lessons learned from these developments are supporting the current review of national policy, in particular the formulation of the National Coastal Resources Policy.

Nevertheless, dealing effectively with these threats will remain challenging until the current legislative, policy and regulatory framework has addressed current gaps, such as the development of inventories for mangroves and seagrass beds as mentioned above in 5.2.4. Other challenges to be addressed

include:

- Ensuring integration of coastal marine resources management into wider development and land use/spatial planning, watershed management and adaptation to climate variability and change⁵³;
- Resolving land tenure issues and conflicts, which jeopardise the effective management of coastal marine resources;
- Dedicating more resources to capacity building and education in order to actively engage and empower local people in the management and regulation of their coastal marine resources, the reduction in use of polluting substances (especially those containing nitrates and phosphates);
- Establishing a more effective communication strategy to establish a sustainable fishing industry in response to the rise in compressor diving for conch and lobster;⁵⁴
- Enhancing capacity within the judicial system to process environmental offences and violations quickly;
- Ensuring the levels of fines and jail sentences for offenders act as effective deterrents to those who willingly break national and local laws and regulations;
- Establishing a more integrated waste management system that includes the establishment of sanitary waste disposal sites and an efficient and effective network of sewage treatment plants.

Figure 20: Entrance to the National Solid Waste Management Authority's Waste Disposal Site at Doctor's Wood, Buff Bay (Portland)



- Greater opportunities to develop alternative livelihoods in many coastal areas in the interests of reducing dependency on fishing;
- The need for long-term approaches to the eradication, or sustained control of invasive alien species. Although there has been progress in controlling the numbers of lionfish in many parts of the country by promoting the consumption of the fish, research shows they are highly adaptable, reproduce quickly



⁵³ This includes a planned response to the effects of mass tourism on local services and coastal ecosystems, such as docking of mega cruise liners from 2011 and expansion of hotels/resorts

⁵⁴ The compressor allows a conch fisher to dive to the ocean floor for many hours to catch and shell conch underwater. This fishing technique is highly dangerous, but it allows the extraction of the conch from its shell underwater where it is very difficult to control the harvesting of only mature conch.

and feed mainly at night. They are also very greedy meaning they can decimate fish stocks quickly (the photograph to the right shows the amount of juvenile fish one adult lionfish can eat in one feed). This includes a planned response to the effects of mass tourism on local services and coastal ecosystems, such as docking of mega cruise liners from 2011 and expansion of hotels/resorts.

5.4 Conclusions and Recommendations

Jamaica's coastal marine resources are currently facing many threats, which in some cases have already caused major degradation to mangroves and seagrasses, beaches, fish stocks and marine water quality. Indeed, according to UNEP-CEP, Jamaica has experienced the highest levels of overfishing in the Caribbean and this situation has important implications on the coastal marine ecosystem's capacity to function properly. This situation is compounded by the threats of IAS (in particular lionfish), the rise of garbage production and its inadequate management and the growing effects of climate variability and change.

The current situation facing the country's coastal marine resources threatens the livelihoods of many citizens and private investors that depend on these resources for their livelihoods and/or to stimulate economic growth. Furthermore, if the environmental and social values of coastal marine resources were identified, the economic benefits over the medium to long-term would almost certainly outweigh the short-term benefits derived from poorly managed developments. On this basis the following conclusions and recommendations are made in line with the on-going preparation of new draft policies for National Coastal Resources, Fisheries and Beaches:

- 1) The current policy framework governing Jamaica's coastal marine resources contains gaps and does not facilitate a coherent and integrated approach to establish effective coastal zone management based on the conservation and sustainable use of coastal marine resources.

Recommendations

- a) The development of the Draft National Coastal Resources Policy establishes a fully coordinated approach to coastal zone management which is fully coherent with relevant existing and new draft policies currently being finalised, in particular:
 - The present Watershed new Draft Beach Policy;
 - The new Draft Fisheries Policy;
 - The new Draft Forest Policy;
 - The new Draft Protected Areas Policy.
 - b) The planning, management and monitoring of coastal marine resources should be integrated into the wider planning process of development and land use/spatial plans ensuring the participation of local communities is effective and responsive to their knowledge and needs.
 - c) The policy and regulatory framework for coastal marine resources should fully integrate risk management and adaptation to climate variability and change to secure the long-term sustainability of coastal marine resources.
- 2) The rehabilitation of coastal marine resources is showing positive results in the Marine Parks and SFCAs with total fish biomass of selected species up in all cases between 2010 and 2013

(although in the case of snapper it was a very small increase). However, the results of coastal marine water quality monitoring in 2009 and 2013 indicate that the levels of nitrates, phosphates and faecal coliform remain high and, therefore, a threat to the rehabilitation of coastal marine resources.

Recommendations

- a) The WMUs establish a “ridge-to-reef” approach to planning, management and monitoring in the interests of directly connecting conservation in the upper and middle watersheds with the conservation of the coastal marine ecosystem;
 - b) Identification and ranking of main point and non-point sources of pollution of marine and freshwater in each WMU;
 - c) Identify priority projects to reduce main pollution sources, such as sewage treatment plants, measures to reduce the use of nitrates and phosphates and improving solid waste management (in coordination with the NSWMA);
 - d) Allocate resources to promote education and awareness among local communities on the direct and indirect benefits of reducing pollutants and managing solid waste in the WMUs.
- 3) The issues of land tenure in many coastal areas together with access to coastal marine resources remains unresolved and in contention.

Recommendations

- a) Ensure land tenure issues and access are fully identified and integrated into the national and local development and land use/spatial planning process ensuring the participation of civil society;
 - b) Prioritise resources to strategic areas where land tenure issues and access need to be resolved in order to make progress on conserving and using coastal marine natural resources sustainably;
 - c) Establish a communication strategy to support the resolution of land tenure issues and achieve improved access to public beaches.
- 4) There is inadequate law enforcement and sufficient deterrents currently in place to discourage illegal fishing, destruction of reefs, seagrasses and mangroves, illegal development on beaches and polluting of coastal marine water resources.

Recommendations

- a) Regulations and fine structures are improved and implemented to discourage illegal and inappropriate activities and practices on coastal marine resources, with a specific focus on punishing repeat offenders and criminals;
- b) Ensure the “polluter pays principle” is applied across all sectors;
- c) Promote and support the mobilisation of local community groups in the expansion of small and manageable SFCAs and Marine Parks that build on current best practices and lessons learned;
- d) Promote more environmental stewardship programmes in schools in the interests of establishing “environmental ambassadors” in local communities, especially where there are SCFAs and Marine Parks.

Case Study 5: Managing Waste at the Port Authority



Kingston Container Terminal Managed by the Port Authority

Until 2011 the safe removal and transport of ship waste out of Jamaica's main ports (Kingston, Montego Bay and Ocho Rios) posed a challenge for the Port Authority (PA). Waste, including oily waste, had to be stored at the docks until the contents had been inspected. Then it had to be repackaged and marked for reuse or disposal. This process took time and there were cases of waste spills. Furthermore, it was not always known where the waste was taken after it left the port gates.

To address this problem a study, funded by German Cooperation, was launched to identify solutions. The study was coordinated with the Shipping Association of Jamaica and concluded that there was a need to formalise the whole process of waste management from unloading to disposal of waste. Since 2011 permits now have to be issued at three levels to manage port waste:

- 1) The PA makes it mandatory for all ships to request a permit before disposing of their waste in Jamaica. This allows the PA to know in advance the type and quantity of waste to be handled and whether it complies with environmental laws and policy.
- 2) NEPA must issue a permit to a registered waste disposal company before waste can exit the port. In this way waste movement can be tracked to destination.
- 3) Final users or disposers of the waste must have a permit from NEPA before they can receive the waste for use/disposal ensuring coordination with the National Solid Waste Management Authority

Useful Links and References:

Detailed Information about NEPA's CRHI Report Card 2013:

http://www.nepa.gov.jm/new/media_centre/publications/2013_Coral_Reef_Report_card.pdf
www.icriforum.org

If you are interested to know more about the challenges facing the coral reefs of Jamaica watch the video at:

<http://jablogz.com/2014/07/jamaicas-coral-reefs-are-dying-fast-this-sobering-video-shows-how/>

Caribbean Black Sea Corals (University of Puerto Rico):

http://www.caribjsci.org/dec05%20Special%20issue/41_492-507.pdf

Video by a local resident on the construction of the new port terminal at Falmouth

<https://www.youtube.com/watch?v=rU516vfqxqU>

Information about the Blue Flag Voluntary Programme in Jamaica until 2013

<http://www.blueflag.org/menu/awarded/sites/2011/southernhemisphere/jamaica/jamaica/portantoniomarina>

Proposed national policy for Seagrasses in 1996

www.nepa.gov.jm/symposia_03/Policies/NationalPolicyfortheConservationofSeagrasses.pdf

Impact of the port according to the Falmouth News

<http://falmouthpo.com/pictures-erosion-falmouth-sea-wall-main-road-cruise-ship-port-construction/>

Videos on the Fish Sanctuaries in Jamaica:

<https://www.youtube.com/watch?v=iQ77ehISrlo&spfreload=10>

<https://www.youtube.com/watch?v=cGIFEXJTFQY>

Maps:

Figure 21: Location of coral reefs, seagrass beds and mangroves in Jamaica (2013)

Figure 22: Level of threat to coral reefs due to over-fishing (2011)

Figure 23: State of erosion and accretion of beaches monitored in Jamaica (2013)

Figure 24: Location of NEPA's marine and freshwater monitoring sites (2013)

Figure 25: NEPA's marine water quality monitoring sites showing faecal coliform levels (2013)

Figure 26: NEPA's freshwater water quality monitoring sites showing BOD levels (2013)

Figure 21: Location of Coral Reefs, Seagrass Beds and Mangroves in Jamaica (2013)

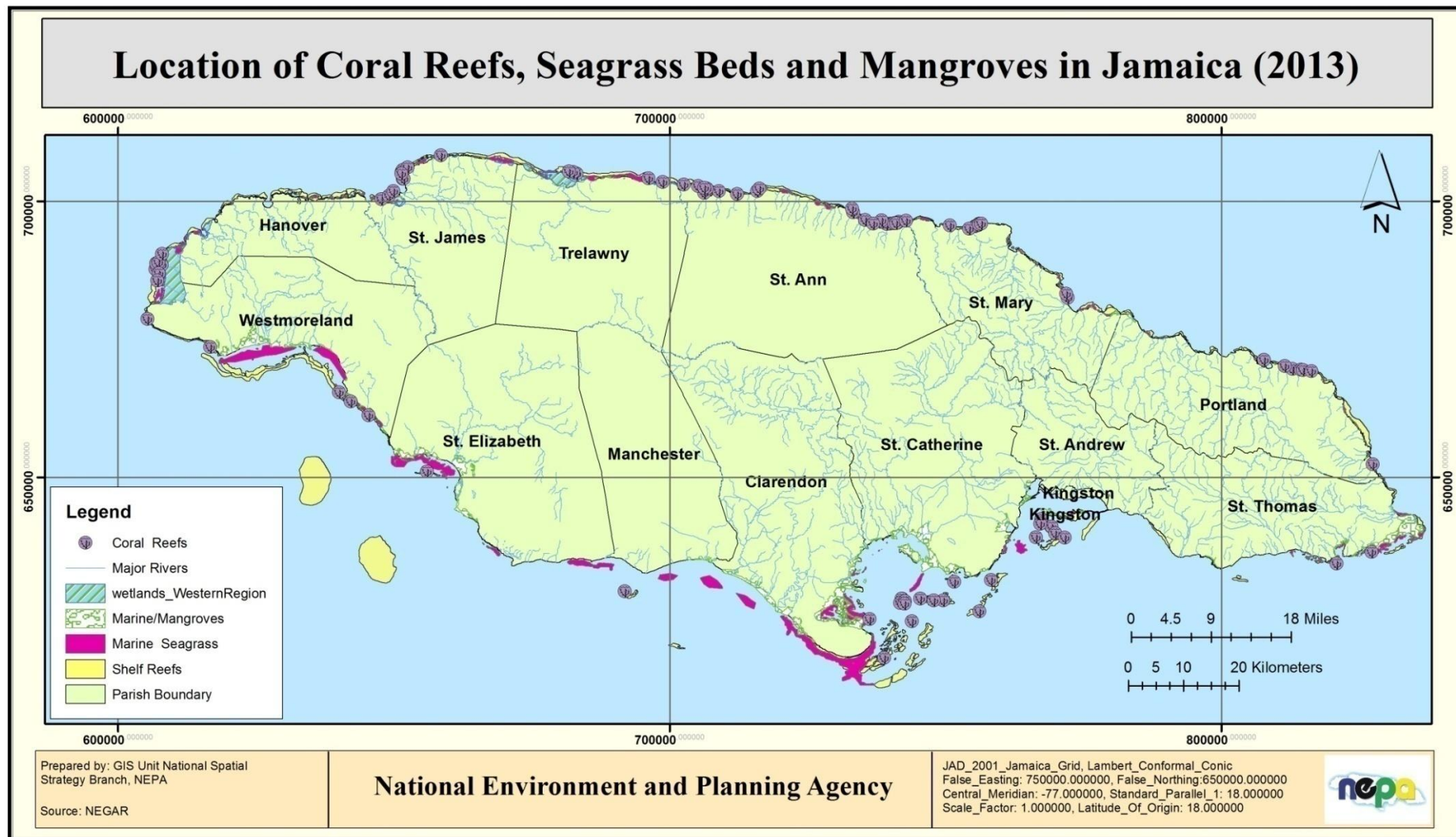


Figure 22: Level of Threat to Coral Reefs From Over-Fishing (2011)



Source: Burke, L.K. Reyta, M.Spalding, and A.Perry, 2011. *Reefs at Risk Revisited*, WRI.

Figure 23: State of Beach Erosion or Accretion at NEPA's Monitoring Sites (2013)

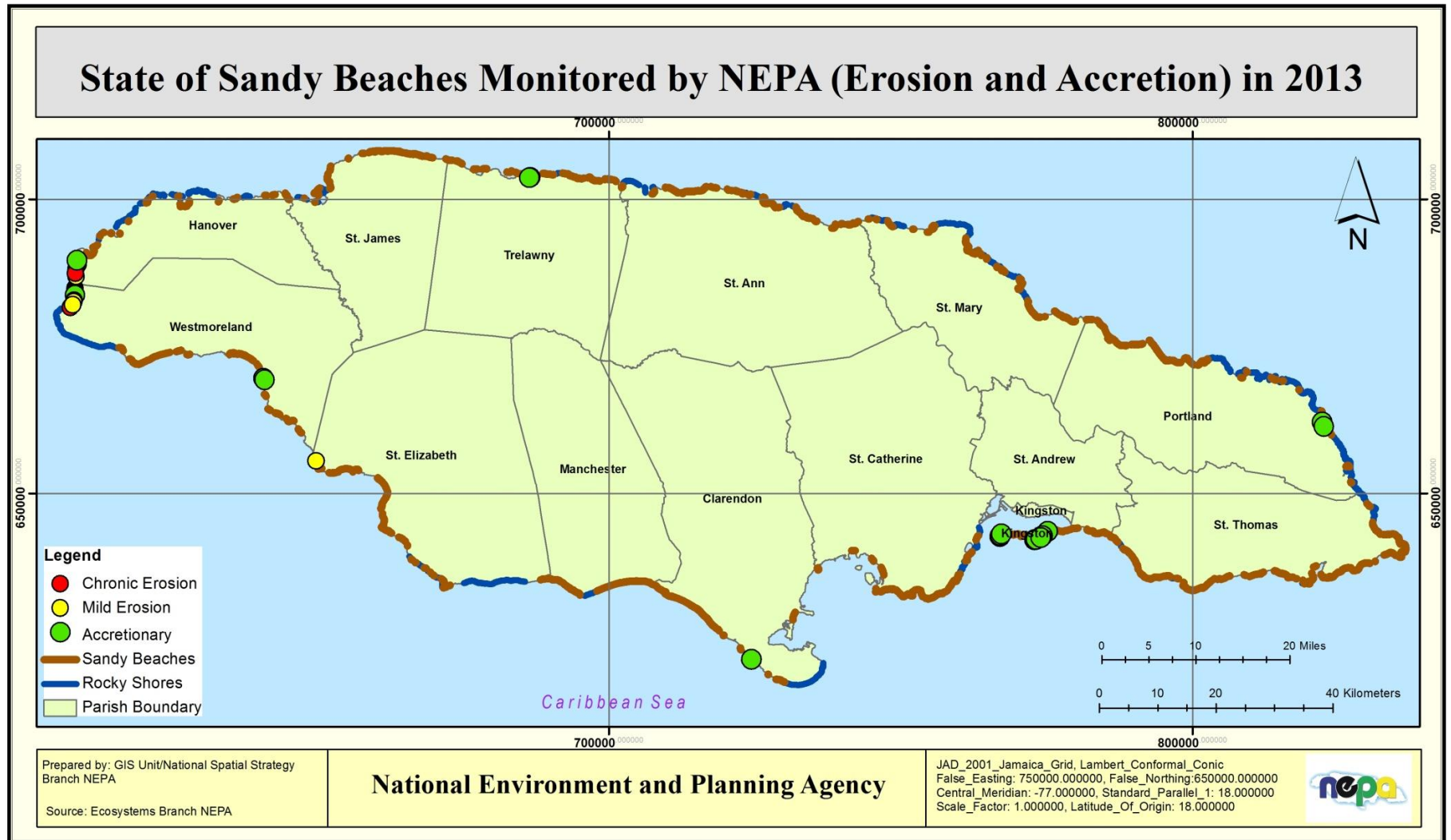


Figure 24: Location of NEPA's Marine and Freshwater Monitoring Sites (2013)

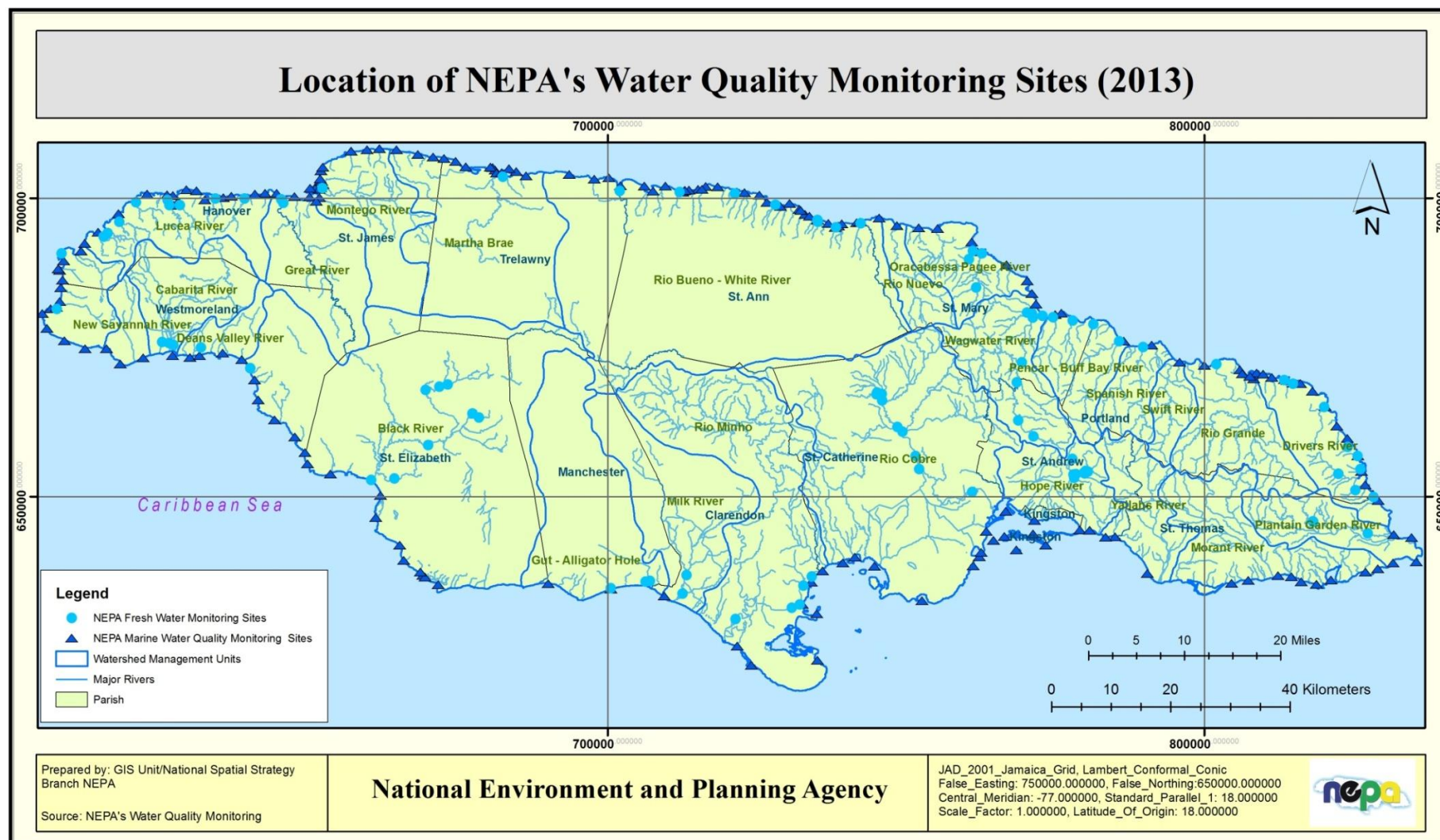


Figure 25: NEPA's Marine Water Quality Monitoring Sites Showing Faecal Coliform Levels Recorded (2013)

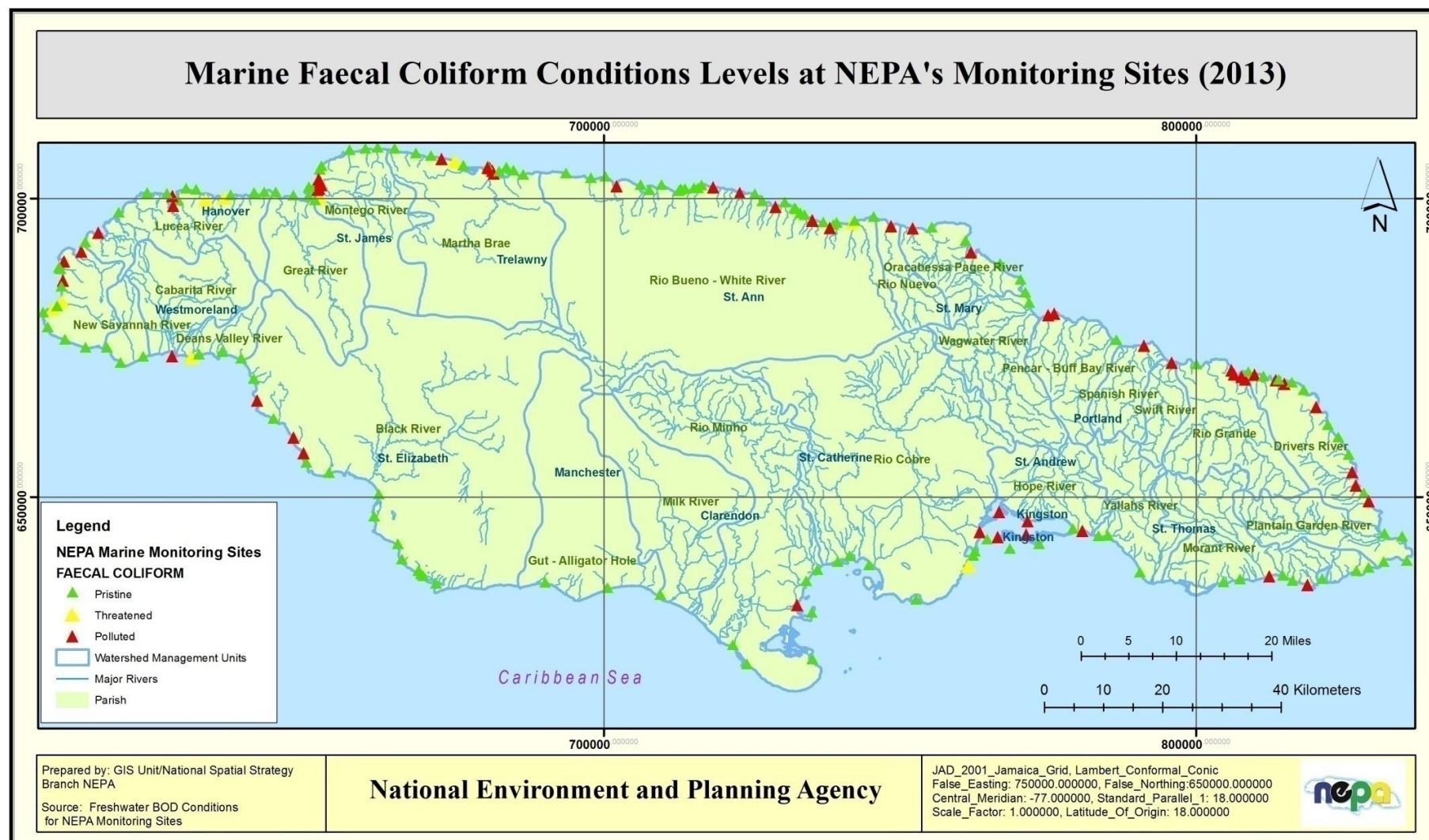
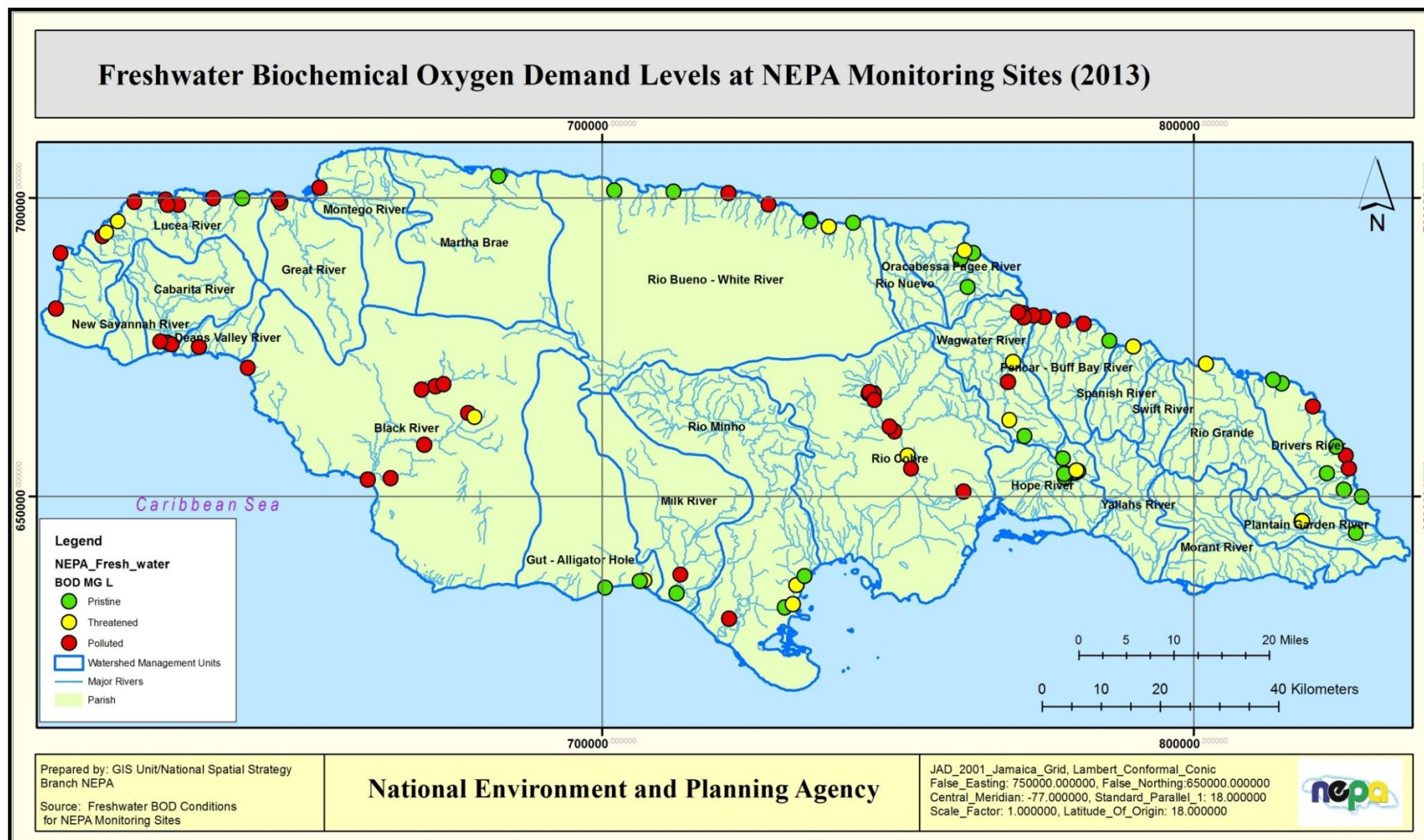


Figure 26: NEPA's Freshwater Quality Monitoring Sites Showing BOD Levels Recorded (2013)





6. Freshwater Resources

What are freshwater resources? Jamaica's freshwater resources relate to all the rainwater it has collected in its streams, rivers, ponds, lakes, reservoirs, wetlands and underground caverns and aquifers. It excludes brackish and sea water. Freshwater resources are replenished through the water cycle.

What is the water cycle? The water cycle starts with evaporation of the sea and transpiration from the land. As the water vapour rises it condenses into clouds. When the water vapour cools at altitude droplets are made and falls as rain. The rainwater then makes its way back to the sea or collects in lakes. Some of this water infiltrates the soil and rocks and collects below the ground in aquifers, caverns and lakes. The karstic limestone regions of Jamaica have many underground caverns and rivers. Because of the country's geology underground water is far more important to Jamaica than surface water.



Why is the water cycle important? The water cycle ensures a constant supply of freshwater that is crucial to sustain all terrestrial plants and animals (plants are approximately 90% water, while humans are over 70% water at birth). The water cycle also enables hydro-electricity production and provides waterfalls and caverns to facilitate tourism and recreation. Water is still often taken for granted even though scientists estimate the Earth's water (fresh and sea) accounts for far less than 1% of its total mass! (Universe Today)

Who is responsible for allocating and monitoring our water resources? The Water Resources Authority (WRA) is responsible for ensuring the rational and equitable allocation of the nation's water resources and monitoring their quantity and quality through continual assessment. The WRA is also responsible for promoting the effective management, conservation, protection and optimal use of these resources. The National Water Commission (NWC) is responsible for providing potable water to the majority of Jamaicans and treating waste water and sewage effluent, while the National Irrigation Commission Limited (NIC) provides irrigation services to the agriculture sector and drainage services in the Black River area.

Why do freshwater quality monitoring? This is crucial to safeguarding public health and safety, protecting wildlife and their ecosystems and helps to identify polluting sources so that the "polluter pays principle" can be exercised by law.

6.1 Background to Freshwater Resources in Jamaica

The **Water Resources Act** (1995), enacted into law on 1st April 1996, provides for the planning, management, protection and controlled allocation and use of the water resources of Jamaica. In addition it provides for water quality control and the establishment and functions of the Water Resources Authority (WRA). The Act has been instrumental in enabling WRA to establish two progressive developments:

- 1) An inventory of the country's freshwater resources and demands by domestic, irrigation, industrial and tourism sectors to prepare the Water Resources Development Master Plan (WRDMP) from which it determines the projected growth in freshwater demand by sector well into the new millennium. The Water Resources Master Plan guides the WRA in identifying and publishing the optimal allocation of Jamaica's freshwater in line with projected growth by sector while ensuring the preservation of the ecological functions of the natural environment within the water cycle.
- 2) The declaration of water quality zones to enable WRA to identify pollution sources and apply the 'the polluter pays' principle, through the Natural Resources Conservation Authority (NRCA).

WRA monitors the country's freshwater supply within the country's 10 main hydrological basins, within which there are 26 Watershed Management Units or WMUs. See Figure 11 for the geographical location of the 26 WMUs in Jamaica and the 10 hydrological basins within which they fall. The country's 26 WMUs cover one or more river catchments (sub-watersheds). Because of Jamaica's land formation the Blue and John Crow Mountains divide most of the Eastern part of the country into river drainage systems that flow either north or south into the sea. Likewise the Cockpit Country divides the western part of the country into river drainage systems that also flow north or south. Due to the limestone geology of the Cockpit Country a large part of the drainage system takes place underground (through conduits and caverns), supplying water to wells to the north and south as well as maintaining base flow for rivers such as Rio Bueno, Martha Brae and Black River among others. WRA estimates that approximately 84% of Jamaica's freshwater is provided by underground sources, while about 16% comes from surface water.



Following the recognition that watershed management actions taken by Government had no unifying set of principles to provide guidance to ensure a coherent approach to watershed management, the **Draft Watershed Policy for Jamaica** (2003) was prepared. Building on the National Integrated Management Programmatic Framework, the policy set out the principles that should guide decision-making by the agencies that have functions in relation to watersheds. The main section of the policy (section 3) provides the Government's vision, policy goals and objectives, together with the strategy and action plan to guide the implementation of the policy.

The National Integrated Watershed Management Council, (comprised of representatives from NEPA, Forestry Department, WRA, Ministry of Agriculture/RADA, NWC, local authorities, civil society groups, etc.) was entrusted with coordinating the progress and achievement of the following specific policy

goals:

- Goal 1:** A coherent and rationalised legislative and institutional framework for the integrated management of watersheds on a sustainable basis is put in place.
- Goal 2:** Provision and development of adequate human resources for effective watershed management.
- Goal 3:** Adequate financing for watershed management is secured.
- Goal 4:** Availability of improved technical capacity for effective watershed management.
- Goal 5:** Increased public awareness for improved participation in watershed management.
- Goal 6:** Initiatives to encourage proper land use supported.

Other relevant legislation and policies relating to freshwater supply, use and monitoring quality include:

- **The Irrigation Act (1949)** which sets out the roles of the Irrigation Authority (currently the NIC) in relation to irrigation schemes, its powers to abstract, divert, impound and distribute water, and outlines specific drainage responsibilities in the Black River area;
- **National Water Commission Act (1980)** which gives the NWC the responsibility for public water supply and sewerage and sewage treatment systems. Separate regulations deal with the setting and collection of tariffs for water and sewerage services and environmental obligations;
- **The Public Health Act (1985);**
- **The NRCA Act (1991)** which includes provisions for the discharge of effluents and general pollution of water resources;
- **Jamaica Water Sector Policy (1999)** which deals with water resource management, urban water, drainage and sewerage, rural water and sanitation, irrigation water;
- **Water Sector Strategy and Action Plan (2004)** which includes targets on service provisions in all major towns by 2020 and the rehabilitation of existing non-compliant facilities;
- **Draft Jamaica National Sanitation Policy (2005);**
- **Wastewater and Sludge Regulations (2012)** (described in Chapter 5.1).

6.2 The Current State of Jamaica's Freshwater Resources

In response to *Vision 2030 Jamaica*, one of the most significant developments in 2011-2013 has been the preparation of a new **Draft Water Sector Policy** (published February 2014). The policy maintains its key commitments, in particular, access for all to the country's freshwater and sanitation services, but includes new commitments to establishing integrated water resources management (IWRM) and incorporating adaptation to the effects of climate variability and change in the interests of strengthening resilience in the sector. The goal of IWRM is to support government agencies, in particular WRA, NEPA and the Climate Change Division, *"promote the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"*.⁵⁵ To support the implementation of IWRM, expansion of Water Resources Management Committees (WRMCs) are proposed in each of Jamaica's watersheds with the goal of enhancing

⁵⁵ From the Global Water Partnership and Integrated Water Resources Management Framework, 2002

participation in areas such as abstraction, discharge, land use practices and services provision.

6.2.1 Current State of Freshwater Supply to the Residential Sector

The WRA is responsible for monitoring stream flows on a regular basis in accordance with Section 16 of the Water Resources Act (1995), and the **National Water Resources Master Plan** (to 2030). The monitoring of surface water is done through a network of some 129 surface river gauging stations of which 52 carry out spot measurements and 77 provide real time continuous data using both automatic and manually operated recorders. In addition, WRA monitors 284 groundwater points, mainly at wells around the island using manual gauges. Three types of wells are monitored: Pumping wells (normally deep wells), non-pumping wells (usually abandoned pumping wells) and small diameter boreholes, (to monitor underground aquifer levels). One of the main tasks of WRA is to calculate total “exploitable potential water” from surface and underground water sources in order to determine water allocations for domestic, industrial, irrigation and other purposes.

In terms of the current statistics concerning access to water supply, the following achievements have been registered in 2013:⁵⁶

Main Achievements on Water Supply to Jamaica’s Population in 2013

- ✓ Approximately 92% of Jamaicans have access to improved and reliable supply of drinking water⁵⁷, which is up from 85% reported in SOE 2010. This confirms GoJ is meeting the United Nations Millennium Development Goal 7C;⁵⁸
- ✓ Approximately 8% of the Jamaican population (about 230,000 inhabitants) still need to be provided with reliable supply of drinking water if GoJ is to meet its target of 100% coverage by 2020;
- ✓ Approximately 70% of the population has access to a piped water supply;
- ✓ Approximately 5% of the population has access to public standpipes;
- ✓ Approximately 16% of the population has improved their access to freshwater through rainwater harvesting tanks, which also has increased their resilience to droughts.

Source: MWLECC

The main service providers of potable water in Jamaica in 2013 are:

- The National Water Commission (NWC), providing water to well over 70% of the population;
- Parish councils supplying communities in rural or marginal areas;
- Bauxite companies supplying to communities neighbouring their mines;
- Private water companies mainly supplying water to specific clients.

The current exploitable potential water in relation to current water allocations and supplied by WRA to all sectors is summarised in Table 26 and compared with data from SOE 2010.

⁵⁶ STATIN, included in the new Draft Water Sector Policy (published in February 2014)

⁵⁷ Reliable water supply refers to 24 hours a day in urban settlements and 18 hours per day in rural areas

⁵⁸ Target 7C states: *Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation.*

Table 26: Total Exploitable Water, Allocations and Abstractions for All Sectors (2010 and 2013)

Exploitable Water& Allocation	2010 (million m ³)	2013 (million m ³)
Total exploitable potential water (in Master Plan)	3,929.7	3,929.7
Water resources deducted for ecological demand	902.6	902.6
Total exploitable potential deducting ecological demand	3,027.1	3,027.1
Allocations to sectors (from all 10 hydrological basins)		
Residential (domestic)	306.43	364.93
Commercial (including bottling)	1.14	1.11
Industrial	267.88	1,151.63
Agricultural (irrigation)	348.24	405.32
Tourism	28.17	29.62
Total water resources allocated	951.86	1,952.61
Reported water quantity abstraction*		
Residential (Domestic)	236.0	No data
Commercial	57.0	No data
Industrial	91.0	No data
Agricultural	521.2	No data
Tourism	5.0	No data
Total water resources supplied	910.2	-
Balance of water allocation after supply	292.8	-

Source: WRA; *does not include non-revenue water (leaks, illegal abstraction or authorised non-billed abstraction);

Note: some sources have multiple usages so primary usage was assessed and placed as main usage.

Table 26 confirms that the total amount of exploitable potential water in Jamaica far exceeds current water supplied to all sectors and this is expected to continue until 2025. However, in 2011, WRA and the Jamaica Institute of Engineers highlighted the following observations:⁵⁹

- The southern region of the country has a higher water demand than the north;
- There is a water shortage problem in the Kingston hydrological basin;
- A water shortage is projected by 2025 in the Rio Cobre hydrologic basin;
- Inter-basin transfer between southern hydrological basins only redistributes the scarcity of water resources in the long-term;
- The total exploitable surplus (mainly through underground water resources) is greater on the northern side of the island than the south.

In addition, decreasing water quality is a problem in some WMUs (see Figure 10 in Chapter 5).

⁵⁹ Exploring the State of Development of Water Resources Management in Jamaica, 22 September 2011

6.2.2 Current State of Freshwater Quality

An important part of WRA's mandate is to monitor the quality of freshwater resources and, in collaboration with NEPA, the Ministry of Health and NWC, issue the "Jamaica National Ambient Water Quality Standard". NEPA also has a mandate for conducting freshwater quality monitoring at selected rivers and estuaries such as Black River (St. Elizabeth), Hope River (St. Andrew) and Montego River (St. James) in addition to doing coastal marine quality monitoring (see Figure 25 in Chapter 5). Table 27 provides the latest ambient water quality standards for freshwater (2009).

Table 27: Ambient Water Quality Standards (2009)

Parameter	Measured as	Standard Range	Unit
Calcium	(Ca)	40.0-101.0	mg/litre
Chloride	(Cl)	5.0-20.0	mg/litre
Magnesium	(Mg ²⁺)	3.6-27.0	mg/litre
Nitrate	(NO ₃ ⁻)	0.1-7.5	mg/litre
Phosphate	(PO ₄ ³⁻)	0.01-0.8	mg/litre
Potassium	(K ⁺)	0.74-5.0	mg/litre
Silica	(SiO ₂)	5.0-39.0	mg/litre
Sodium	(Na ⁺)	4.5-12.0	mg/litre
Sulphate	(SO ₄ ²⁻)	3.0-10.0	mg/litre
Hardness	(CaCO ₃)	127.0-381.0	mg/litre
Biological Oxygen Demand	(O)	0.8-1.7	mg/litre
Total Dissolved solids	-	120.0-300	mg/litre
pH (acidity)	pH	7.00-8.40	-
Conductivity	-	150.0-600	µS/cm

Source: NEPA

Table 28 and Table 29 summarise the consolidated results of freshwater quality monitoring using four parameters in 2009 and 2013 (nitrates, phosphates, faecal coliform and bio-chemical oxygen demand). They are presented by WMU in order to facilitate a comparison with the results of coastal marine water quality monitoring for the same four parameters⁶⁰ presented in Table 24 and

Table 25 and Figure 25 and

Figure 26 in Chapter 5). The traffic light colour coding applied in these tables has been repeated to facilitate comparison and the identification of possible correlations in data.⁶¹

⁶⁰Based on the standard ranges for fresh and coastal marine water

⁶¹Red (contaminated: over the relevant standard), orange (threatened: close to the relevant standard) and green (good: under the relevant standard)

The main findings on nitrate and phosphate levels at the monitoring sites within 23 WMUs are presented in

Table 28 are summarised as follows:

- 1) Nitrate levels at the freshwater monitoring sites of all 23 WMUs (100%) where data were collected were well under the national standard in 2009 and again in 2013, with one exception at Gut-Alligator Hole River where a significant increase was registered;
- 2) Phosphate levels have increased at the monitoring sites of 17 WMUs in 2013;
- 3) There are currently 7 WMUs reporting phosphate levels over the national standard, whereas in 2009 none existed; and
- 4) A total of 13 WMUs remained under the national standard for nitrate and phosphate levels in both 2009 and 2013.

Table 28: Consolidated Results for Water Quality Monitoring on Nitrates and Phosphates (2009 & 2013)

Watershed Management Unit	Freshwater				Marine			
	NO ₃ ⁻ (mg/l)		PO ₄ ³⁻ (mg/l)		NO ₃ ⁻ (mg/l)		PO ₄ ³⁻ (mg/l)	
	2009	2013	2009	2013	2009	2013	2009	2013
Black River	3.675	4.878	0.057	0.591	0.719	0.109	0.035	0.455
Cabarita River	0.863	0.498	0.263	2.001	0.200	0.067	0.041	0.297
Deans Valley	0.294	no data	0.107	no data	0.500	0.053	0.046	0.461
Drivers River	1.507	1.823	0.040	0.268	0.930	0.433	0.048	0.298
Great River	2.492	2.860	0.115	1.063	0.702	0.168	0.074	0.025
Gut- Alligator Hole River	5.760	7.998	0.046	0.045	0.659	0.494	0.054	0.066
Hope River	2.018	1.291	0.529	1.809	0.777	0.090	0.028	0.315
Lucea River	1.091	0.916	0.162	0.125	1.200	0.264	0.039	0.172
Martha Brae	2.714	2.869	0.057	0.081	1.118	0.453	0.337	0.351
Milk River	5.138	3.842	0.313	0.160	0.246	1.097	0.141	0.304
Montego River	2.883	5.683	0.716	2.999	1.581	1.467	0.205	0.479
Morant River	2.975	no data	0.119	no data	1.049	0.180	0.068	0.244
New Savannah*					0.106	0.030	0.206	0.378
Oracabessa - Pagee River	0.424	0.383	0.183	0.254	0.250	0.039	0.027	0.159
Pencar - Buff Bay	0.901	0.506	0.097	0.367	1.165	0.194	0.389	0.198
Plantain Gardens	1.497	1.413	0.152	0.690	0.767	0.103	0.022	0.699
Rio Bueno - White River	3.979	4.590	0.076	0.284	1.390	0.994	0.066	0.144
Rio Cobre	5.739	4.602	0.516	0.890	1.462	0.123	0.082	0.066
Rio Grande	1.584	0.742	0.095	0.062	1.246	0.171	0.081	0.066
Rio Minho	4.744	4.689	0.339	0.524	1.530	0.028	0.070	0.224
Rio Nuevo*					0.155	0.189	0.002	0.171
South Negril-Orange River	1.318	0.689	0.448	3.412	0.608	0.120	0.150	0.408
Spanish River	0.563	0.316	0.058	0.167	1.374	0.182	0.066	0.328
Swift River	0.510	4.848	0.064	0.167	1.27	0.116	0.091	0.244
Wagwater River	0.790	0.213	0.221	0.979	0.068	0.002	0.191	0.002
Yallahs*					0.571	0.221	0.089	0.177

Source: NEPA Water Quality Monitoring Laboratory; Note: grey boxes refer to rivers not monitored

The main findings of the fresh and coastal marine water quality data in

Table 28 are as follows:

- 1) The high phosphate levels recorded at the freshwater monitoring sites of 3 of the 7 WMUs that were over the national standard, appear to have had no impact on phosphate levels recorded at the coastal marine sites for the same WMUs in 2013 (WMUs for Great River, Rio Cobre and Wagwater River).
- 2) There is a possible correlation between the rise of phosphate levels at both freshwater and coastal marine monitoring sites in 4 WMUs (Cabarita, Hope, Montego and South Negril-Orange rivers). This is most evident at the WMUs for Montego River and South Negril-Orange River, where there were large increases in phosphate levels in both fresh and marine waters in 2013. This could also have a negative impact on the marine conservation work currently taking place at the Montego Bay and Negril Marine Parks and SFCAs located there.

Table 29 below provides information on the current faecal coliform and BOD levels in freshwater monitored at sites in 23 WMUs in 2009 and 2013 and is compared with data collected on the same parameters for coastal marine water quality monitoring in these WMUs.

Table 29: Consolidated Results for Water Quality Monitoring on Faecal Coliform and BOD (2009 & 2013)

Watershed Management Unit	Freshwater				Marine			
	FC (MPN/100ml)*		BOD (mg/l)		FC (MPN/100ml)		BOD (mg/l)	
	2009	2013	2009	2013	2009	2013	2009	2013
Black River	227.4	69.2	9.33	2.71	5.7	7.2	1.09	1.92
Cabarita River	25.0	19.1	24.59	19.44	2.0	142.3	0.75	5.26
Deans Valley	no data	no data	4.12	no data	1.5	7.6	1.50	1.62
Drivers River	443.3	200.5	1.14	1.47	15.0	148	0.88	0.66
Great River	89.5	93.9	1.72	1.64	2.3	2.6	0.85	0.72
Gut- Alligator Hole River	43.1	83.5	0.75	1.71	3.1	9.3	0.75	1.33
Hope River	523.2	28.8	1.42	1.33	44.6	9.8	1.77	1.08
Lucea River	439.5	126.1	2.07	2.24	5.5	226.8	1.10	1.54
Martha Brae	381.3	15.1	0.77	1.08	13.4	66.1	1.24	2.97
Milk River	254.2	46.1	0.90	1.22	1.5	40.3	1.30	1.95
Montego River	170.0	42.0	6.38	6.18	13.8	115.3	1.83	1.55
Morant River	1.5	no data	2.27	no data	10.7	6.4	1.07	0.75
New Savannah*					2.5	11.8	1.53	1.225
Oracabessa - Pagee River	539.9	70.8	1.12	1.13	4.9	82.3	0.72	0.73
Pencar - Buff Bay	631.4	230.0	3.82	4.51	13.5	7.3	1.11	0.68
Plantain Gardens	276.7	111.3	2.11	0.62	1.6	3.7	0.56	0.53
Rio Bueno - White River	239.2	99.6	1.34	0.68	7.3	21.7	1.05	0.61
Rio Cobre	658.6	48.6	18.08	3.54	8.7	41.7	2.30	2.05
Rio Grande	481.0	37.0	2.27	0.60	31.5	119.6	1.36	1.06
Rio Minho	45.5	37.0	1.02	1.50	2.5	2.7	1.50	0.81
Rio Nuevo*					124.8	4.4	0.72	0.40
South Negril-Orange River	41.2	20.8	4.74	5.78	3.5	19.3	1.80	1.02
Spanish River	68.5	350.0	1.50	1.70	6.8	292.5	0.80	0.70
Swift River	no data	86.3	1.90	1.94	29.6	9.4	0.84	0.40
Wagwater River	379.6	24.0	1.18	1.16	19.5	0.9	0.54	0.85
Yallahs*					4.2	13.8	0.38	0.98

Source: NEPA Water Quality Monitoring Laboratory. Note: Grey boxes refer to rivers not monitored. *Applied by NEPA

The main findings following analysis of the data in Table 29 are summarised as follows:

- 1) Faecal coliform levels have come down at the monitoring sites in 17 of the 21 WMUs (81%) providing data for 2009 and 2013;
- 2) 5 WMUs (24%) were over the faecal coliform national standard at their monitoring sites in 2013, whereas in 2009 14 WMUs (67%) were over the standard;
- 3) Faecal coliform levels were over the standard in 4 WMUs (19%) in 2009 and 2013 (Drivers, Lucea, Pencar and Plantain Gardens), but concentration levels declined in all four WMUs;
- 4) Faecal coliform levels increased beyond the national standard at the monitoring sites of only one WMU (5%) between 2009 and 2013 (Spanish River);
- 5) 9 WMUs (43%) were over the BOD national standard at their monitoring sites in 2013, whereas 13 WMUs (62%) were over the standard in 2009;
- 6) BOD levels were over the national standard at monitoring sites in 6 WMUs (29%) in both 2009 and 2013; and
- 7) BOD levels increased beyond the national standard at the monitoring sites of only one WMU (5%) between 2009 and 2013 (Gut-Alligator Hole).

Concerning possible correlations emerging from the data in Table 29 for faecal coliform and BOD in fresh and coastal marine waters, the following observations are made:

- A total of 3 (12%) WMUs show clear signs that high levels of faecal coliform registered at freshwater monitoring sites in the WMUs at Drivers, Lucea and Spanish River have had a direct impact on corresponding coastal marine monitoring sites in the same WMUs. For example Spanish River experienced a dramatic rise in faecal coliform in 2013, which was also observed at the coastal marine sites in 2013.
- There appears to be some correlation between the high levels of BOD at both freshwater and coastal marine sites in the WMUs for Cabarita, Lucea, Montego, Rio Cobre and South Negril-Orange Rivers.

There are two main trends that appear to be establishing themselves from the freshwater quality monitoring data in

Table 28 and Table 29. First, there is the rise of phosphate levels at the monitoring sites in the majority of WMUs. Second, there is regular contamination of faecal coliform and BOD at the monitoring sites in two WMUs (Lucea and Pencar). Both trends could impact negatively on the country's natural resources (terrestrial and marine) and, therefore on socio-economic development.

6.2.3 Current State of Water Supply to Irrigation Schemes in Jamaica



The National Irrigation Commission Ltd. (NIC), an executive agency within the Ministry of Agriculture and Fisheries, is responsible for managing, operating, maintaining and expanding existing (and future) irrigation schemes and systems established by GoJ or the private

Irrigation water is managed under the **Irrigation Act** (1949). The National Irrigation Commission Ltd. (NIC), an executive agency within the

sector. It also provides drainage services in the Black River area and collects fees from the users of the irrigation and drainage services it provides. The present infrastructure managed by NIC is summarised in Table 30.

Table 30: Current Infrastructure Managed by NIC (2013)

Name of Irrigation Scheme	Pump Stations	Wells	Canals	Pipes (km.)
Rio Cobre	18	22	26	31.01
St. Dorothy	8	7	28	-
Yallahs	3	3	-	15.21
Mid Clarendon	32	32	153	36.10
Duff House/New Forest	2	4	-	26.00
Hounslow	5	5	-	41.40
Beacon Little Park	3	3	-	27.83
Seven Rivers	-	-	-	2.96
Colbeck	1	1	-	5.13
Braco	1	-	-	8.60
Total	73	77	207	194.24

Source: NIC Ltd.

Table 30 confirms the NIC's infrastructure is located mainly in the dry zone areas of the south of the country (see Figure 30) and depends heavily on a network of pipes, wells and pump stations to transport water to the 10 irrigation schemes established in Jamaica. Total number of NIC consumers in 2011-2012 stood at 1,730. The water allocated to irrigation agriculture was estimated to be 405.32 million cubic metres (see Table 26 above⁶²). Water abstraction comes from four main sources: rivers, wells, mini reservoirs and dams. The following table shows the agricultural land area served by NIC irrigation systems in the period 2010-2013.

Table 31: Land Area Served by NIC Irrigation Systems in Hectares (2010-2013)

Land	2010	2011	2012	2013
NIC Irrigation Systems	12,417	11,852	13,007	11,919

Source: NIC Ltd.

Currently, the only water quality parameters applied by the NIC concern electrical conductivity, sodium absorption ratio (SAR) and sodium levels. As such, there is no comprehensive set of parameters and standards in place to regulate the quality of irrigation water. For this reason the NIC advises that its water should not be used for domestic purposes.

A key function of the NIC is to manage its water resources as efficiently and effectively as possible, especially as droughts are becoming more common and prolonged. Furthermore, **Vision 2030 Jamaica** requires agriculture and other key sectors to develop capacity in hazard risk reduction and adaptation to climate change (Outcome 14). One response of the NIC has been to strengthen On-Farm Water Management Units (OFWMUs) at the 10 irrigation schemes mentioned in Table 30.

The OFWMUs are designed to plan, direct and implement on-farm water management and drainage techniques and optimise scarce water resources through the introduction of new water saving techniques, technologies and training. Drip and sprinkler irrigation, introduction of drought resistant

⁶² Also see the Auditor General's Department Performance Audit Report of the NIC, June 2013, p.8

crops, mulching of soils to retain moisture, catchment ponds and application of fertigation⁶³ are examples of these new techniques and technologies that have been established through the OFWMUs. In addition, there are plans to introduce solar powered pumps.

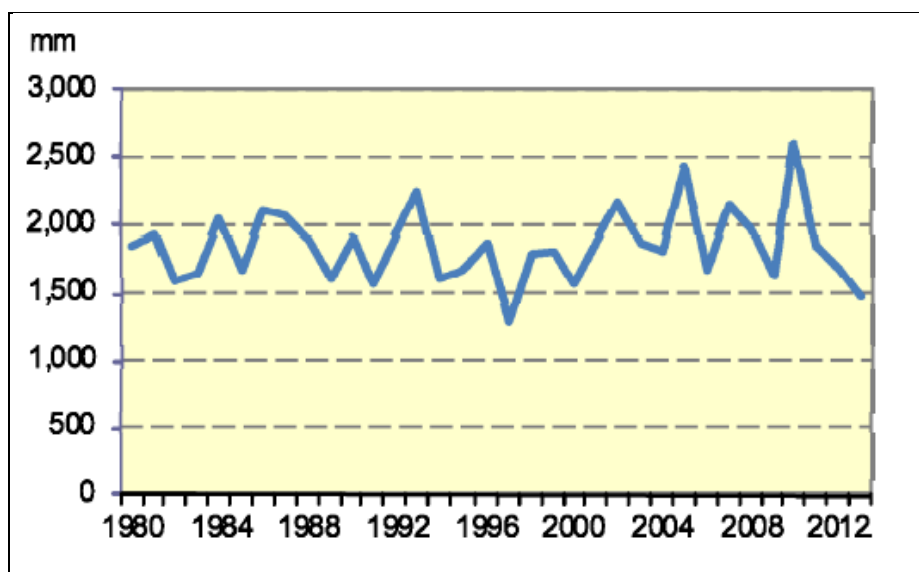
6.3 Current Threats to Freshwater Resources

Climate variability and change: One of the growing threats on Jamaica's freshwater resources is climate variability and change due to global warming. Projections from a number of sources including the University of the West Indies⁶⁴ and Food and Agriculture Organisation (FAO)⁶⁵ indicate that rainfall will become more variable and less. Prolonged droughts are, therefore, likely to increase in Jamaica in coming decades. These projections have important implications for the use and management of the country's water resources, in particular surface water abstraction. For example, the Mona and Hermitage reservoirs in Kingston and St. Andrew and major irrigation schemes at Rio Cobre, Sevens River and Braco (Clarendon) rely heavily on river water abstraction.

The following figures and tables provide information to substantiate the argument that the current trends in rainfall are being affected by the effects of climate variability and change.

Figure 27 shows annual mean rainfall for the period 1980-2013. It confirms Jamaica has been experiencing a gradual increase in rainfall variability. In addition, there has been a marked drop in mean annual rainfall over the period 2011-2013.

Figure 27: Mean Annual Rainfall in Jamaica in Millimetres (1980 to 2013)



Source: Meteorological Service of Jamaica/STATIN

Figure 28 compares mean monthly rainfall for the period 1951-1980 and 1971-2000. The line graphs confirm that mean monthly rainfall has been less in the latter period for all months except February.

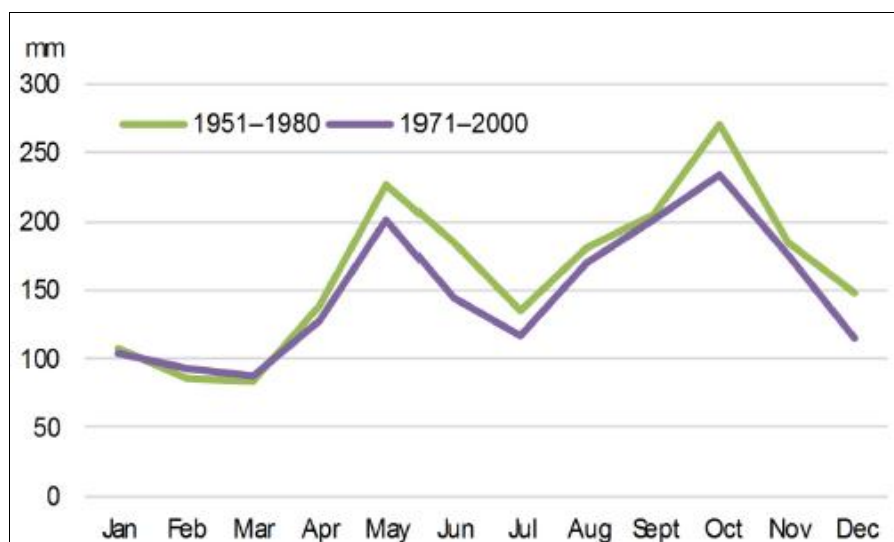
⁶³ The application of liquid fertilisers in the irrigation system

⁶⁴ Climate Studies Group, Department of Physics, 2013

⁶⁵ Climate Change and Agriculture, Agriculture Sector Support Analysis, 2013

This also provides further evidence to suggest global warming is contributing to this trend, which is likely to produce a negative impact on Jamaica's water resources in coming decades.

Figure 28: Mean Monthly Rainfall Patterns Compared in Two Periods Between 1951 and 2000



Source: Meteorological Service of Jamaica/STATIN

Table 32 provides a breakdown of annual mean rainfall by month between 2011 and 2013. It confirms there has been a year-on-year drop in annual mean rainfall since 2011.

Table 32: Mean Monthly and Annual Rainfall in Jamaica in Millimetres (2011-2013)

YEAR	Month (mm)												Total (Year)
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
2011	82	82	69	86	207	295	200	186	183	243	67	74	1,774
2012	69	50	133	192	137	91	89	200	190	205	142	92	1,590
2013	45	55	69	89	212	90	107	193	205	167	150	92	1,474

Source: Meteorological Service of Jamaica

Table **33** shows two examples of mean annual temperatures recorded in Kingston and St. Andrew and in St. Mary. In both cases the data confirms that the trend in mean annual temperature is on the rise, which, when compared with the findings on mean annual rainfall above, suggests longer and hotter dry periods are emerging.

Table 33: Annual Mean Temperature in Kingston and St. Andrew and St. Mary (2011-2013)

YEAR	Month (°C)												Mean Annual
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Kingston & St. Andrew													
2011	20.5	20.6	20.0	21.0	21.7	22.7	22.7	23.0	22.9	22.5	22.0	20.7	21.7
2012	20.2	20.5	20.2	20.8	22.1	23.0	23.5	22.9	22.6	22.2	22.0	21.2	21.8
2013	20.8	20.9	20.5	22.0	22.1	23.5	22.8	23.5	23.4	23.4	22.4	21.9	22.2
St. Mary													
2011	22.1	22.1	22.1	23.3	23.8	25.4	25.2	25.5	25.2	24.6	23.8	23.1	23.9
2012	22.3	22.5	22.9	23.7	25.0	25.6	26.2	25.6	25.2	25.1	23.7	23.5	24.3
2013	23.0	22.6	22.7	24.1	24.6	26.0	26.0	26.0	-	-	24.1	23.8	24.2

Source: Meteorological Service of Jamaica/NOAA

Threats to freshwater quality: There are a number of pollutants that are primarily washed into the country's water system in times of heavy rainfall, or which infiltrate ground water.

- **Phosphates:** The rise in phosphates reported in 6.2.2 represents a significant threat to water resources. The two main sources of phosphate pollution in Jamaica are fertilizers for agriculture and cleaning agents which are used widely by the hotel trade and for domestic purposes; **Agricultural chemicals and processing:** the application of pesticides, herbicides and other chemical inputs to protect crops and improve yields are widely used in Jamaica. In addition, the processing of sugar, coffee and other plantation crops produces effluent, which if not treated can affect water quality, such as increase the levels of BOD.
- **Non-compliant sewage systems:** the aging stock of sewage treatment systems has increased the risk of inadequately treated sewage effluent entering freshwater resources. This can lead to a rise in faecal coliform, especially near the point sources, which has been detected at water quality monitoring sites in a number of the country's watersheds (see 6.2.2 above). A new licensing system will be in place from 2014 to encourage operators to invest in improved treatment plants or risk enforcement notices. GoJ also plans to link sewerage systems of major towns to a central treatment system. More information on liquid waste management can be found in Chapter 8.
- **Salt Water Intrusion:** the WRA reports the salinity of both surface water and ground water from the sea represented in the past a major source of groundwater contamination in Jamaica. This was notable in southern coastal areas where there was over pumping and the creation of large pumping depressions. A major cause of salt water intrusion is the over abstraction of freshwater from wells. In response to this threat, WRA have increased enforcement of the WRA Act to ensure all pumping of ground water is done above sea level. In some cases wells have been closed due to non-compliance. In addition, the WRA has also established plans to improve field well designs and conduct artificial aquifer recharge to increase the freshwater lens and reduce salt water intrusion.



- **Mining and quarrying:** mining waste contains a number of pollutants such as hard metals which must be carefully monitored as it can threaten both surface and groundwater quality. The waste from bauxite refining represents a threat to water resources where there are red mud lakes in unsealed limestone depression/mined-out areas, or close to surface water systems. In addition, many sink holes and pits have become local garbage dumps, or have been filled during the land reclamation of mined out lands. This has affected wildlife (such as the loss of nesting sites for bats) and the way rainwater is drained and feeds into aquifers. In response to these negative impacts, GoJ has increased monitoring and tightened regulation of the bauxite industry in order to apply the polluter pays principle from 2013. WRA confirms that the introduction of scavenger wells which siphon off contaminated water before reaching safe aquifers has been a positive development and the stacking and drying of red mud has contributed to improving water quality.⁶⁶ Finally, the capping of bauxite waste with topsoil and the planting of trees and grass has helped to protect water resources and promote agricultural development.
- **Suspended and bedded sediments:** deforestation, reported in Chapter 3, is a major cause of soil erosion, particularly where it occurs on steep slopes or involves the removal of riparian strips along rivers and streams. This produces an increase in suspended and embedded sediments in the river system, which can contaminate water abstracted for drinking water purposes and cause flooding in the lower reaches where bedded sediments have raised the riverbed or estuary floor. However, there is no systematic sediment monitoring carried out in Jamaica.
- **Flood water contamination:** WRA is responsible for flood water control in coordination with other government institutions, such as ODPEM, based on the Floodwater Control Master Plan. Flood control activities include preparation of flood plain maps, identification of early warning systems and support the identification of measures to capture floodwaters to recharge aquifers.

Water leaks, burst mains and theft

A considerable amount of water is lost each year as a result of these issues. This water, called “non-revenue water” (NRW), is not accounted for through the billing system. Defects in drinking water supplies, in particular, leaks and burst pipes, account for the majority of NRW.

Theft of piped water through illegal connections or modifications to the water supply system is a problem in some urban areas. Unauthorised abstraction or over-abstraction of water sources is also a problem, especially in remote areas where it is abstracted to support the expansion of agriculture development, which often precipitates the loss of riparian forest.

Authorised non-metered consumption by the Fire Brigade and other licensed institutions may also threaten water resources temporarily, especially in times of severe drought when water abstraction to put out forest fires can be considerable.



⁶⁶Monitoring is on-going within NEPA to determine if the drying of red mud increases particulate matter in the air.

Table 34 provides a summary of total NRW as a percentage of total allocation to NWC during the financial years 2010-2011 to 2012-2013.

Table 34: Total Non-Revenue Water as a Percentage of NWC Water Allocation (2010 and 2013)

Water Type	Year (million m ³)		
	2010-2011	2011-2012	2012-2013
Total allocation to NWC (system input volume)	291.56	303.47	295.77
Authorised consumption (billed)	94.66	93.99	90.00
Non-Revenue Water (leaks, authorised non-metered use, theft)	196.90	209.48	205.77
Percentage of water lost against total allocation	69.6%	69.0%	67.5%

Source: NWC; by financial years (01 April to 3 March)

Table 34 reveals that the percentage of NRW has remained consistently high between 2010 and on a gradual increasing trend. This indicates that there is a high level of inefficiency with the distribution networks run by NWC and requires government attention, especially taking into account the growing effects of climate variability and change (see Chapter 11) and the degradation of watersheds, in particular those that depend on surface water sources (see Chapter 3).

6.4 Conclusions and Recommendations

The WRA confirms that Jamaica has a surplus of freshwater resources to meet current and projected human and ecological needs to 2025. Furthermore, there remains a considerable surplus of water when total water abstractions are deducted from the water allocations established in the Water Resources Master Plan (approximately 25%). However, the lack of an integrated approach to the way the country's water resources are managed has not facilitated their efficient and effective management. In response to ***Vision 2030 Jamaica***, the GoJ has addressed this issue by producing a new Draft Water Sector Policy and Implementation Plan.

The successful implementation of the new draft policy will depend on how far the new institutional arrangements proposed to manage Jamaica's water resources are effective in preventing, controlling or mitigating the current threats facing Jamaica's water resources. These threats have a bearing on both the quantity and quality of these resources. Indeed, the growing threats to water quality are significant as they can impact negatively on public health, induce the loss of biodiversity, disrupt or breakdown ecosystems and impede socio-economic growth. In addition, the emerging trend of longer and hotter dry periods, matched with more variable and less rainfall, represents a major threat to freshwater resources in watersheds where surface water abstraction is important and/or surface run-off has increased due to deforestation and land degradation.

In the light of new policy developments and plans, and taking into account the large number of threats to both the quantity and quality of Jamaica's water resources, the following conclusions and recommendations are made:

- 1) WRA has a clear mandate to manage water resources, but this has not been adequately integrated into the wider context of forest and watershed management and land use/spatial planning.

Recommendations

- a) Develop IWRM in all 26 WMUs, based on the establishment of WRMCs;
 - b) Establish WRMCs that are inclusive, participatory and transparent, ensuring they include representatives from civil society and relevant government agencies including, but not limited to, MWLECC (in major watersheds), NEPA, the Forestry Department, NWC, the Ministry of Health, the Ministry of Agriculture and Fisheries, NIC (where applicable) and the NSWMA;
 - c) Guarantee the WRMCs actively participate in:
 - Strategic activities such as development and land use/spatial planning (particularly at the local government level), in the interests of developing and implementing water resource management plans that are coherent and coordinated with the planning process;
 - Specific activities such as planning for abstraction, land management and service provision to reduce potential conflicts concerning the equitable use of water resources.
 - d) Establish a ridge-to-reef approach to developing the water resources management plan in the interests of strengthening the protection of strategic areas within each watershed and its coastal marine waters, (such as upper reaches, steep slopes, riparian strips, flood plains, estuaries, wetlands/mangroves and reefs);
 - e) Up-scale plans where two or more WRMCs and WMUs need to coordinate their plans and resources in the interests of preserving ecosystem products and services that are at high risk of being lost;
 - f) Encourage WRA to breakdown its data on water allocations and abstractions by WMU in order to facilitate a coordinated response with other government agencies to improve watershed management, especially in the most critical watersheds.
- 2) Cost recovery for the regulatory services associated with protecting, managing and monitoring water resources (fresh and marine) is low and this has affected the quality and reach of these services throughout the country.⁶⁷

Recommendations

- a) Ensure all major abstractors of water and dischargers of treated effluent contribute to the costs of the regulatory services through a fee-based payment system (scaled according to level of abstraction and discharge);
- b) Ensure the costs associated with the rehabilitation of water resources that have been contaminated are fully met through the application of the polluter pays principle;
- c) Assess the options for increasing and sustaining public investment in water resources conservation and its sustainable use;
- d) Ensure the costs that cannot be recovered from the resource-use fees and payments of

⁶⁷For example, water quality monitoring should be based on quarterly rather than six-monthly sampling, which is currently the case at NEPA

penalties and fines are guaranteed through alternative and permanent funding sources, (includes funding from central government).

- 3) Disaster risk reduction and adaptation to climate variability and change have not been adequately addressed in water resources management in Jamaica.

Recommendations

- a) Ensure that disaster risk reduction (DRR) and adaptation to climate variability and change are established as cross-cutting objectives in the WRMCs water resources management plans and strategies;
 - b) Ensure DRR and adaptation to climate variability and change are coherent with the policies and strategies of the Office for Disaster Preparedness and Emergency Management (ODPEM) and the Climate Change Division (CCD) within MWLECC;
 - c) Identify and replicate best practice relating to DRR and adaptation to climate variability and change in water resources management in the interests of reducing human vulnerability to disasters caused by flooding, droughts and landslides among others;
 - d) Develop capacity to produce meteorological, hydrological and climatological modelling in a coordinated manner involving the Meteorological Service of Jamaica, WRA and CCD to support the WRMCs identify risk maps for each WMU, which in turn are used to support IWRM.
- 4) The current regulatory system for fresh and coastal marine water resources is not supported by integrated water quality monitoring to help identify pollution sources from ridge to reef and facilitate a coordinated approach to the way watersheds and coastal marine resources are managed and information disseminated.

Recommendations

- a) Ensure the WRA, NEPA, local stakeholders and other collaborating agencies establish a coordinated ridge-to-reef approach to water quality monitoring and reporting in each WMU and its coastal marine waters;
- b) Ensure that freshwater quality monitoring data are included as a variable when assessing watershed degradation levels and review the water quality standards for irrigation and marine water;
- c) Support WRA and/or NEPA to conduct water quality monitoring of groundwater given that a large percentage of Jamaica's freshwater comes from this source;
- d) Widen the scope of the monitoring system by engaging the effective participation of the local population in the monitoring and law enforcement process. For example, engage local groups in identifying contaminated sites and offenders as well in monitoring the implementation of measures agreed with GoJ authorities to prevent, control or mitigate sources of pollution, or correct poor land management;
- e) Ensure that part of the income raised from water use fees is dedicated to sustaining the monitoring system proposed;
- f) Ensure the effective dissemination of information and data to all main stakeholders

throughout the monitoring process.

- 5) Drinking water supply and wastewater management services have made significant gains in reaching the GoJ targets of 100% water supply to all Jamaicans and 60% of towns having sewerage networks by 2020. Nonetheless, the NRW rate is high due primarily to leaks and there is inadequate capacity to fully treat raw sewage in several watersheds.

Recommendations

- a) Promote greater private sector participation (through public-private partnerships or direct contracts) in the provision of urban and rural water supply and sewerage/sanitation services where it can help GoJ agencies achieve policy objectives and the goals of the Vision 2030 Jamaica.
 - b) Establish clearer rules and regulations for water supply and sewerage providers operating in urban areas (Utility Service Areas) and rural areas where it is not economical to operate piped systems (Non-Utility Areas);
 - c) Provide incentives to encourage water supply providers to invest in improved infrastructure and services and that include the reduction of NRW (for the water supply sector) and improved facilities to fully treat raw sewage to national standards on effluent discharge.
 - d) Improve the overall regulation of water supply and sewerage providers, which in the case of the latter aims to support the effective application of the polluter pays principle;
 - e) Ensure a safety net approach is applied to cover the poorest and most marginalised individuals and families.
- 6) The NIC does not have a full set of water quality parameters and standards to measure the quality of irrigation water, which may have negative implications for the development of organic agriculture and wider public health issues for those who come into contact with irrigation water

Recommendations

- a) Identify and implement water quality parameters and standards that meet international requirements regarding the production of organic and niche market crops;
- b) Establish a new water quality monitoring capacity within NEPA to independently monitor irrigation water samples;
- c) Train farmers and their OFWMUs on maintaining minimum standards for irrigation water quality.

Useful Links and References:

Water Resources Act (1996):

<http://moj.gov.jm/sites/default/files/laws/Water%20Resources%20Act.pdf>

Jamaica Water Sector Policy

http://www.wra.gov.jm/pdf/water_policy_2004.pdf

Information about WRA:

<http://wra.gov.jm/>

Information on the objectives of the National Irrigation Commission Ltd.:

<http://www.nicjamaica.com/about-us/history-of-the-nic/>

Information about the National Water Commission:

<http://www.nwcjamaica.com/>

Information about water statistics in Jamaica (GoJ):

<http://STATINja.gov.jm/>

Information about water statistics on Jamaica (United Nations):

https://unstats.un.org/unsd/environment/envpdf/Country_Snapshots_Aug%202013/Jamaica.pdf

Maps:

Figure 29: Hydrostratigraphy in Jamaica Showing the Areas of Underground Rivers (light blue areas) and Surface Waters (other), 2013

Figure 30: Location of Irrigation Schemes Managed by the National Irrigation Commission Ltd. in Jamaica (2013)

Figure 29: Hydrostratigraphy in Jamaica Showing the Areas of Underground Rivers (light blue areas) and Surface Waters (other), 2013

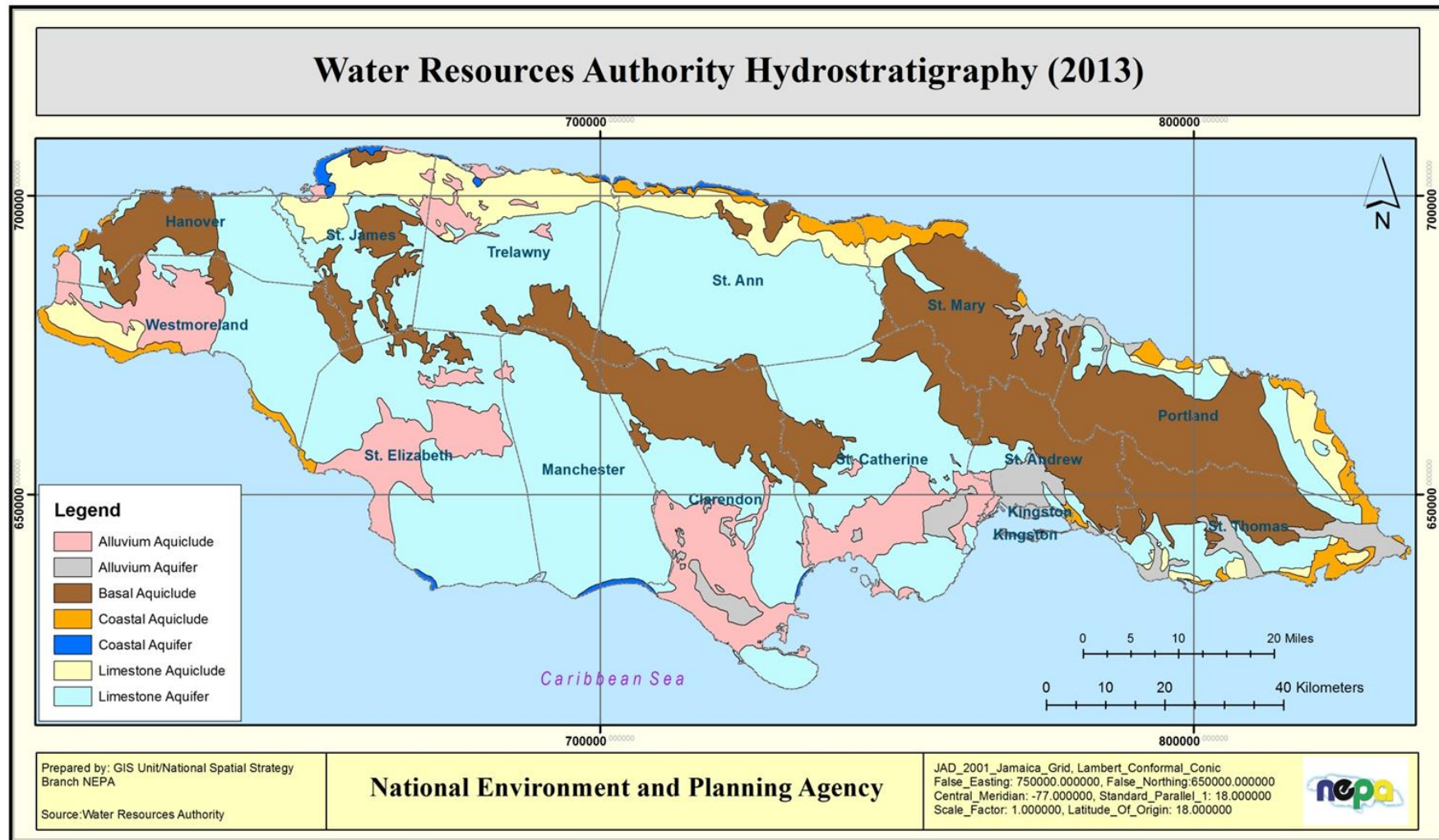
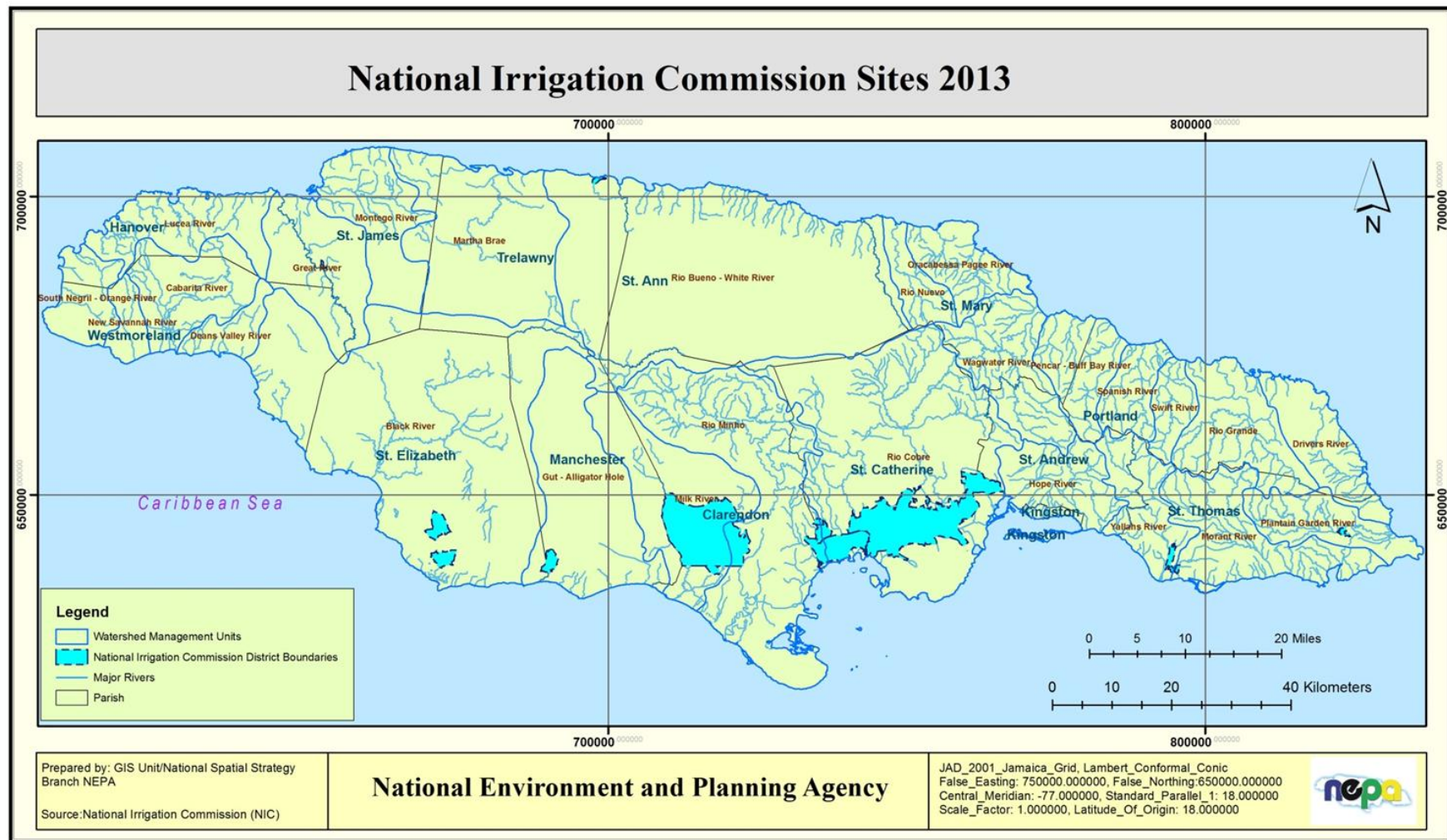
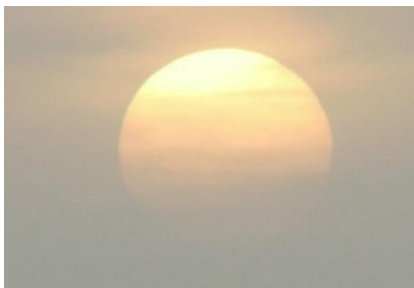


Figure 30: Location of Irrigation Schemes Managed by the National Irrigation Commission Ltd. in Jamaica (2013)



Section 2:

Management and Sustainable Use of the Natural Environment



7. Ambient Air Quality

What does ambient air quality mean? It refers to the level of particulates and harmful gases found in open air, whereas indoor air quality refers to the state of air found within enclosed spaces. The measurement of ambient air quality is done through a network of monitoring stations that take recordings of air quality parameters and standards set by GoJ in 1996. Recordings are usually taken near ground level and not directly from pollution sources.

What are the main pollutants monitored by NEPA and why? The following pollutants are currently monitored by GoJ. Health references are taken from the United States Environment Protection Agency:

- **Total suspended particulate matter (TSP) and PM₁₀** are tiny particles produced from dust blown into the atmosphere and products of combustion of fuel to make energy, smelt ores, etc. Particulate matter (PM) bigger than 10 microns is commonly seen as haze, or smog and may irritate the eyes, nose and throat, but does not penetrate the lungs. However PM at 10 microns (PM₁₀) and lower (now measured in many developed countries at 2.5 microns (PM_{2.5})) can penetrate the lungs where it may stimulate asthma, bronchitis, respiratory infections and even cancer.
- **Sulphur dioxide (SO₂)** is produced when fuels containing sulphur are burnt to make energy. SO₂ penetrates the lungs and is known to cause or worsen respiratory diseases and aggravate existing heart disease. High concentrations can cause acid rain, which damages trees and buildings.
- **Nitrogen dioxide (NO₂)** is produced as a result of fuel combustion to make energy. Like SO₂ it can affect the respiratory system and increase the acidity of raindrops. It may also contribute to increases in biochemical oxygen demand in water which can affect, or even kill, aquatic life.
- **Carbon monoxide (CO)** produced as a result of fuel combustion and burning of gas. CO is very dangerous and can kill humans when it is produced in confined spaces without adequate ventilation.
- **Photochemical oxidants (ozone)** these are formed in the air when NO₂ and volatile organic compounds (VOCs) such as peroxyacyl nitrates and aldehydes react to ultra-violet (UV) light. They also can affect the respiratory system.
- **Lead** produced from combustion of fuels containing lead. Traces may also be emitted from mining and smelting activities where lead is present in the ore and soils. Lead particulates accumulate in the bones and affect the nervous system, kidney function and the reproductive system.
- **Greenhouse gases (GHGs)** are attributed to global warming. GHGs monitored by NEPA include sulphur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), hydro-chlorofluorocarbons (HCFCs) and carbon dioxide (CO₂). Other GHGs include perfluorocarbons (PFCs), sulphur hexafluoride (SF₆), methane (CH₄) and non-methane volatile organic compounds (NMVOCs).

Why is air quality monitoring important? Clean air is essential for all living things and maintaining a healthy environment. Controlling air quality through monitoring represents an investment (rather than a cost) in maintaining a healthy environment and protecting human health.



7.1 Background on Ambient Air Quality Monitoring and Reduction of Ozone Depleting Substances and Greenhouse Gases

7.1.1 Background on Ambient Air Quality Monitoring in Jamaica

The **Natural Resources Conservation Authority Act** (1991) established the Natural Resources Conservation Authority as the main government institution responsible for air quality monitoring in Jamaica. The Act responds to both national interests and international commitments to protect the environment including ambient air quality.

In 1996, the GoJ approved a set of **National Ambient Air Quality Standards** for a list of air pollutants recognised internationally to be detrimental to human health and the natural environment in general (see Table 35 below). This was supported by the establishment of the **Natural Resources Conservation (Permits and Licences) Regulations** (1996).

Table 35: National Ambient Air Quality Standards in Jamaica (1996)

Parameter (Pollutant)	Averaging Time	Standard (maximum concentration in µg/m ³)
Total Suspended Particulate Matter (TSP) ¹	Annual 24 hours	60 150
PM ₁₀ ²	Annual 24 hours	50 150
Lead (Pb)	Calendar quarter	2
Sulphur dioxide (SO ₂)	Annual 24 hours 1 hour	80 Primary, 60 Secondary ³ 365 Primary, 280 Secondary 700
Photochemical oxidants – ozone (O ₃)	1 hour	235
Carbon monoxide (CO)	8 hours 1 hour	10,000 40,000
Nitrogen dioxide (NO ₂)	Annual 1 hour	100 400

Source: NRCA (NEPA) ¹ All particles and aerosols with aerodynamic diameter of 100 micrometers or less measured by the high volume sampling method; ² Refers to particles with an aerodynamic diameter of 10 micrometers or less as measured by the PM10 sampler; ³ Secondary standards are designed to protect public health and welfare. They represent the long-term goal for air quality and provide the basis for an anti-degradation policy for unpolluted areas of the country and for continuing development of pollution control technology.

In 2006, guidance on air quality standards was established in the **Natural Resources Conservation (Air Quality) Regulations** (2006). The Regulations included provisions for:

- Issuing of licences by the NRCA to regulate large industries which emit air pollutants, such as:
 - Power plants using fossil fuels to make electricity;
 - The alumina industry;
 - Large quarrying and mining facilities;
 - The cement and concrete industry⁶⁸;
 - The refined petroleum products and bulk storage industry (petrol, kerosene, fuel oils,

⁶⁸ Heating of limestone and other materials at over 1,400°C to produce clinker, which is then combined with gypsum to produce cement.

etc.);

- Payment of annual discharge fees by licensed facilities, based on actual emissions and employing the polluter pays principle;
- Annual reporting of emissions and pollution-related incidents and prevention;
- Punitive sanctions to be applied (warnings, control orders, administrative penalties, etc.).

The introduction of these regulations ensured the upgrading of Jamaica's air quality monitoring stations to sample the parameters listed in

Table 37. By 2010 the NRCA had a total of three air quality monitoring stations in operation in Kingston and St. Andrew involving a network of 54 air quality monitoring stations⁶⁹ and issued 27 Air Pollutant Discharge Licences mainly to the bauxite industry and Emission limits were also set on the sulphur content allowed in the fuel used for industrial activity to prevent increases in SO₂ emissions.

In 2010 NEPA drafted the **Jamaica Air Quality Management Programme (JAQMP)** in support of meeting **Vision 2030 Jamaica** goals. Important elements of the JAQMP include widening the AQMN, standardisation of air quality monitoring data collection, improving the processing and validation of data, production and evaluation of air quality assessments and improving quality assurance and control for ambient and source monitoring. The JAQMP also represents an important means to guiding policy direction on air quality as well as the development of risk assessment and management, supported by the implementation of an **Air Quality Index (AQI)**. NEPA envisages the AQI could start for major urban areas from 2016 if data collection is consolidated as planned.

7.1.2 Background on the Reduction of Ozone Depleting Substances and GHG Emissions in Jamaica

Jamaica is a party to the **Vienna Convention for the Protection of the Ozone Layer** 1988) and the associated **Montreal Protocol on Substances that Deplete the Ozone Layer** (1989). Since accession to the Vienna Convention and the Montreal Protocol in 1993, GoJ has been actively working on meeting legally binding targets on the reduction of contaminants known to damage the Earth's Ozone Layer.⁷⁰ These targets include the phase out of chlorofluorocarbons (CFCs) by 2006 and hydro-chlorofluorocarbons (HCFCs) by 2040.

In 1997, the National Ozone Unit was established within the NRCA to oversee projects designed to phase out the use of ozone depleting substances. Between 1997 and 2006 Jamaica successfully phased out the use of CFCs. This was achieved through a number of interventions including the introduction of legislation banning the importation of equipment containing CFCs and Halon from March 1998. This included banning of motor vehicles, heavy vehicles and marine vessels using CFCs in their air conditioning units (1999), the introduction of quotas on the consumption of CFCs between 1999 and 2005 and application of duty waivers on equipment used for retrofits. Preparations to plan the phase out of HCFCs by 2040 also started in the period 1997-2006.

In January 1995, Jamaica became a signatory to the **United Nations Framework Convention on Climate Change (UNFCCC)** designed to secure the reduction of greenhouse gases (GHGs), which are attributed to global warming (see more details on the greenhouse effect in Chapter 11).

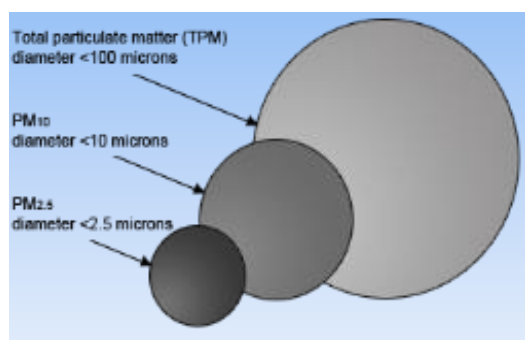
⁶⁹ Jamaica Air Quality Monitoring Programme, 2010

⁷⁰ The Ozone Layer is found in the upper atmosphere (Stratosphere). When it is damaged it has less capacity to filter out harmful ultra-violet B rays (UV-B) that are known to cause skin cancer and reduce crop yields.

Between 2000 and 2005 GHG inventories were compiled for the following sectors: Energy; Industrial Processes and Product Use; Agriculture, Forestry and Other Land Use and; Solid Waste. Initial GHG reporting in 2006 by NEPA confirmed trends in the emissions of CO₂, CH₄ and N₂O increased gradually, with a minor drop in emissions observed in 2004. In compliance with the UNFCCC, the GoJ submitted its consolidated GHG Inventory to the UNFCCC Secretariat in 2009.

7.2 The Current State of Jamaica's Ambient Air Quality, Reduction of Ozone Depleting Substances and GHGs (2011-13)

7.2.1 State of the Air Quality Monitoring Network



The air quality monitoring network (AQMN) currently has 62 monitoring stations; five more than at the launch of the JAQMP in 2010. These include new monitoring stations on Marcus Garvey Drive following the commissioning of a new 66 MW power plant in 2012, at Washington Gardens (St. Andrew) and at Waterford, (Portmore). The performance of the AQMN has also been improved through the relocation of some monitoring stations. In addition, NEPA and the Ministry of Transport, Works and Housing are assessing the

introduction of national motor vehicle emissions standards, in line with the objectives of the JAQMP to address the gaps in current regulations and standards for air quality management. Figure 33 at the end of this chapter shows the current location of the AQMN, which is summarised as follows:

- 31 stations measure samples of Total Suspended Particulates - TSP (50% of the network);
- 28 stations measure samples of Particulate Matter at 10 microns - PM₁₀ (42% of the network);
- 57 stations have PM samplers for TSP or PM₁₀ (92% of the network);
- 17 stations can sample multiple parameters including SO₂ and/or NO₂ levels (26% of the network);
- 3 stations have CO analysers (5% of the network);
- 2 stations have O₃ analyzers (3% of the network);
- 44 monitoring stations in the AQMN (77%) are owned and operated by the Bauxite sector.

By 2013, the total number of Air Pollutant Discharge licences issued by the NEPA was 30 (see Table 74 in Chapter 13).⁷¹ This represents a net increase of three licences since 2010. Each licence requires the participating facilities to self-monitor pollutant concentrations and the submission of regular reports to NEPA. The submission of these reports together with the monitoring data collected from NEPA's own monitoring sites has facilitated the development of a dynamic partnership with 34 industrial facilities as well as other stakeholders including government agencies, private companies and education and research entities. For example, in 2013 NEPA and the Jamaica Bauxite Industry (JBI signed a new Memorandum of Understanding I) which includes improving air quality management in line with the JAQMP.

⁷¹ Excludes NEPA's own monitoring stations (see Table 34)

The following subsections 7.2.2 to 7.2.7 provide summaries of the improved level of data now being recorded through the AQMN and which was consolidated in the Annual Ambient Air Quality Report for 2012. The above-mentioned partnerships facilitated the review of this report and continue to provide on-going support and capacity building to NEPA on results analysis and risk assessments as well as on the establishment of the, "Airshed Development Plan" in the JAQMP.

7.2.2 Current State of Particulate Matter Concentrations Between 2011 and 2013

Table 36 provides a summary of the annual average particulate matter concentrations (TSP or PM₁₀) recorded in ambient air through the AQMN between 2011 and 2013.

Table 36: Annual Average Particulate Matter Concentrations in Ambient Air in Jamaica (2011-2013)

Monitoring station / Operator* & Year Commissioned	Parameter Sampled	Annual Average of µg/m ³			Other Sampling
		2011	2012	2013	
Kingston, St. Andrew and Portmore Airshed					
1a. Crossroads/NEPA (2006)	TSP	69.46	79.32	70.00	-
1b. Crossroads/NEPA (2012)	PM ₁₀	-	-	41.73	-
2. Harbour View/NEPA (2006)	TSP	29.96	32.72	30.02	-
3a. Old Hope Road/NEPA (2006)	TSP	32.94	53.41	50.75	-
3b. Old Hope Road/NEPA (2012)	PM ₁₀	-	-	38.34	-
4. Washington Gdns/NEPA (2012)	PM ₁₀	-	-	53.68	-
5. Portmore/NEPA (2012)	PM ₁₀	-	-	51.65	-
6. Harbour View/CCCL (2011)	PM ₁₀	-	No data	No data	-
7. College Commons/CCCL(2008)	PM ₁₀	21.97	24.46	17.44	-
8. Rockfort Mineral/CCCL (2008)	PM ₁₀	74.79	78.65	80.85	O3
9. Maritime Inst./CCCL(2008)	PM ₁₀	28.51	34.14	30.82	-
10. Marcus Garvey Dr./JEP (2013)					SO ₂ , NO ₂
11. Garmex/JEP (2009)					SO ₂ , NO ₂
12. Garmex/JPSCO (2009)	PM ₁₀	No data	No data	No data	SO ₂ , NO ₂
13. Petrojam/PET (2009)	PM ₁₀	45.42	35.64	34.94	SO ₂ , NO ₂
14. Bournemount Dr./JPPC (2009)	PM ₁₀	No data	84.66	62.26	SO ₂ , NO ₂
Old Harbour Bay Area, St. Catherine Airshed					
15. Terminal/JPSCO (2011)	PM ₁₀	-	No data	No data	SO ₂ , NO ₂
Port Esquivel/WIN (2007)#	TSP	26.90	27.48	28.05	-
16. Bunting Prop./WIN (2011)	PM ₁₀	No data	No data	No data	-
17. Free Town/JBGL (2011)	PM ₁₀	-	-	43.47	-
18. Longville Park/JEP (2009)	PM ₁₀	-	31.81	34.46	SO ₂ , NO ₂ ,
19. Longville Park/JEP (2011)	PM ₁₀	-	-	34.46	SO ₂ , NO ₂ ,
20. Lauder Wood/JPSCO (2008)					SO ₂ , NO ₂ O3
21. Spring Village/JBGL (2011)	PM ₁₀	42.21	42.77	57.19	SO ₂
Northern St. Catherine Airshed					
22. Orangefield/WIN (2007)	TSP	34.43	49.70	53.13	SO ₂ , NO ₂ ,
Mud Stacking/WIN (2007)#	TSP	89.52	79.59	80.31	-

Monitoring station / Operator* & Year Commissioned	Parameter Sampled	Annual Average of $\mu\text{g}/\text{m}^3$			Other Sampling
		2011	2012	2013	
23. Hayfield Close/WIN (2007)	TSP	28.01	57.78	55.55	SO ₂ , NO ₂
24. Amity Hall/WIN (2007)	TSP	15.36	48.02	39.73	-
25. Brighton Street/WIN (2007)	TSP	36.36	36.81	55.55	-
26. Clapham/WIN (2007)	TSP	29.42	25.50	29.59	-
27. Faith's Pen/WIN (2007)	PM ₁₀	22.93	22.40	24.6	-
28. Hayfield Club/WIN (2007)	PM ₁₀	25.99	24.60	33.09	-
Vere Plains, Clarendon Airshed					
29. New Bowens/JAM (2007)	PM ₁₀	26.12	32.93	34.38	SO ₂ , NO ₂ , CO
30. Hayes Com Piece/JAM (2007)	PM ₁₀	41.21	51.30	48.14	SO ₂ , NO ₂ , CO
31. Kemps Hill/JAM (2007)					SO ₂ , NO ₂ , CO
South Eastern Manchester Airshed					
32. Ballynure /JAM (2007)	PM ₁₀	17.59	22.97	18.03	-
33. Broadleaf /JAM (2007)	PM ₁₀	19.77	26.91	22.98	-
34. Windsor/JAM (2007)	PM ₁₀	31.15	27.05	24.48	-
35. Asia/JAM (2007)	PM ₁₀	20.42	23.43	22.56	-
Northern Central Manchester Airshed					
36. Mile Gully/JAM (2007)	PM ₁₀	22.69	25.81	22.08	-
37. Kendal/WIN (2007)	TSP	35.92	34.61	46.46	SO ₂ , NO ₂
38. Kendal 2/WIN (2007)	TSP	No data	No data	No data	-
39. Mud Lake South/WIN (2007)	TSP	No data	No data	No data	-
40. Mud Lake East/WIN (2007)	TSP	No data	No data	No data	-
Mud Lake West/WIN (2007)#	TSP	No data	No data	No data	-
Southern St. Elizabeth Airshed					
41. Lr Westminster/Alpart (2010)	TSP	31.89	32.99	31.47	-
42. Brinkley/Alpart (2007)	PM ₁₀	36.07	34.53	31.18	-
43. Steven Run/Alpart (2010)	TSP	23.29	28.85	24.3	-
44. Myersville/Alpart (2007)	TSP	29.64	33.50	30.73	-
45. Gazeland/Alpart (2010)	TSP	34.29	36.33	31.71	-
46. Sports Club/Alpart (2007)	TSP	29.89	32.60	30.19	-
Montego Bay Airshed					
47. Bogue/JPSO (2007)					SO ₂ , NO ₂
North Eastern St. Ann Airshed					
48. Farm Town/NOR (2007)	TSP	18.56	34.50	28.38	-
49. Old Folly/NOR (2007)	TSP	41.65	31.35	27.02	-
50. Bengal/NOR (2007)	TSP	32.95	40.54	29.64	-
51. Queens Road/NOR (2007)	TSP	26.90	33.43	25.39	-
52. Clinic/NOR (2007)	TSP	19.95	30.67	25.71	-
53. Rosseau/NOR (2007)	TSP	18.01	59.82	No data	-
54. Farm Town/NOR (2007)	TSP	No data	No data	No data	-
South Central St. Ann Airshed					
55. Calderwood/NOR (2007)	TSP	32.95	47.33	33.11	-
56. Clydesdale/NOR (2007)	TSP	19.95	31.61	26.71	-
57. Green's Hill/NOR (2007)	TSP	18.01	31.15	30.40	-

Source: NEPA, 2013; * see List of Abbreviations for the full name of operator; # Provide data to NEPA on a voluntary basis; colour index used is: Red: over standard; Orange: close to standard and; Green: well below standard (under $0.25 \mu\text{g}/\text{m}^3$).

The main trends identified from Table 36 for TSP and PM_{10} for 2011-13 are:

- The overall trend for TSP and PM_{10} concentrations is increasing in the majority of cases, which indicates that mitigation measures will be required to reduce this trend.
- Total recorded emissions of particulate matter from licensed industrial facilities were 12,080 MT in 2012 compared to 13,000 MT in 2009⁷², which confirms there has been an overall decrease in particulate emissions from licensed industrial facilities between 2009 and 2012;
- Four monitoring sites saw a year-on-year decrease in TSP or PM_{10} emissions (Petrojam, Windsor Brinkley and Old Folly);
- The majority of monitoring sites saw an increase in TSP and PM_{10} from 2011 to 2012, followed by a drop in 2013, but not below 2011 levels (except at College Commons, Lower Westminster, Gazeland, Bengal and Queen's Road);
- Three sites registered PM levels above the standards at Crossroads, Rockfort Mineral and at the Mud Stacking Station, which is a source station that is not officially part of the AQMN;
- Three sites have registered consistently low levels of TSP and PM_{10} (College Commons, Faith's Pen and Ballynure);
- PM concentrations in Northern St. Catherine and Kingston-St. Andrew have experienced the most significant increases in PM at the vast majority of their monitoring stations;
- In general ambient air quality in Kingston and St. Andrew has too much PM. However this improves away from the industrial area around Kingston Harbour and major road junctions.

The specific exercise of air quality monitoring of dust particulates produced from dried red mud stacking when mining bauxite is not conducted in Jamaica due to the expensive technology required to distinguish red mud dust from other PM. However, XRD analysis is performed at four specific locations. NEPA is currently exploring the possibility of identifying a potential pilot project with The International Centre for Environment and Nuclear Science (ICENS) at the University of the West Indies (UWI) in Jamaica to monitor red mud dust levels at selected sites.



7.2.3 Current State of Sulphur Dioxide (SO_2) Concentrations Between 2011 and 2013

There are a total of 17 monitoring stations equipped to monitor SO_2 concentrations in ambient air. The majority of these stations are owned by the Bauxite industry and their main task is to conduct sampling of ambient air to determine daily concentrations of SO_2 and to facilitate average concentrations on an annual basis. The results of SO_2 monitoring between 2011 and 2013 are provided in following

Table 37. The colour index used is for indicative purposes only to show the level of compliance on SO_2 emissions.

⁷² NEPA: Ambient Air Quality Report, 2012.

Table 37: Annual Average of Sulphur Dioxide Concentrations Recorded in Ambient Air (2011-2013)

Monitoring station / Operator* & Year Commissioned	Parameters Sampled	Annual Average of µg/m³			Other Sampling
		2011	2012	2013	
Kingston, St. Andrew and Portmore Airshed					
10. Marcus Garvey Dr./JEP (2009)	SO ₂	No data	No data	No data	NO ₂
11. Garmex/JEP (2009)	SO ₂	No data	No data	No data	NO ₂
12. Garmex/JPSCO (2009)	SO ₂	17.89	22.51	21.10	PM ₁₀ , NO ₂
13. Petrojam/PET (2009)	SO ₂	12.64	14.17	14.95	PM ₁₀ NO ₂
14. Bournemount Dr./JPPC (2009)	SO ₂	No data	No data	22.46	PM ₁₀ NO ₂
Old Harbour Bay Area, St. Catherine Airshed					
15. Terminal/JPSCO (2011)	SO ₂	-	-	14.83	PM ₁₀ NO ₂
18. Longville Park/JEP (2009)	SO ₂	19.22	24.57	12.81	PM ₁₀ NO ₂
19. Longville Park/JEP (2011)	SO ₂	-	-	No data	PM ₁₀ NO ₂
20. Lauder Wood/JPSCO (2008)	SO ₂	9.02	3.15	5.81	NO ₂ O ₃
21. Spring Village/JBGL (2011)	SO ₂	-	-	4.00	PM ₁₀
Northern St. Catherine Airshed					
22. Orangefield/WIN (2007)	SO ₂	13.6	16.29	No data	TSP, NO ₂
23. Hayfield Close/WIN (2007)	SO ₂	2.3	4.58	No data	TSP, NO ₂
Vere Plains, Clarendon Airshed					
29. New Bowens/JAM (2007)	SO ₂	8.66	10.88	5.53	PM ₁₀ NO ₂ CO
30. Hayes Com Piece/JAM (2007)	SO ₂	4.19	5.78	4.96	PM ₁₀ NO ₂ , CO
31. Kemps Hill/JAM (2007)	SO ₂	12.73	22.02	2.80	NO ₂ CO
South Eastern Manchester Airshed					
-					
Northern Central Manchester Airshed					
37. Kendal/WIN (2007)	SO ₂	No data	No data	No data	TSP, NO ₂
Southern St. Elizabeth Airshed					
-					
Montego Bay Airshed					
47. Bogue/JPSCO (2007)	SO ₂	No data	13.09	7.99	NO ₂
North Eastern St. Ann Airshed					
-					
South Central St. Ann Airshed					
-					

Source: NEPA, 2013; * see List of Abbreviations for the name of operators; the colour index used is: Red: over the permitted standard; Orange: close to the standard; Green: well under the standard (Secondary under $25 \mu\text{g}/\text{m}^3$).

Note: some stations did not have adequate data or were discontinued.

The main findings from this table include:

- 1) The levels of sulphur dioxide emissions in Jamaica were found to be consistently below the national standard between 2011 and 2013;
- 2) Total emissions of SO₂ in 2012 amounted to 68,690 MT compared to 82,160 MT in 2009, which confirms SO₂ emissions are in general on a downward trend in Jamaica;
- 3) The trend in emissions of SO₂ is, in most cases, down indicating fuel savings and/or the use of

- fuel with a low sulphur content have been applied successfully during the period 2011-2013;
- 4) SO₂ monitoring and reporting capacity improved with three new monitoring stations in 2011-2013.

Indications are that improved efficiency in reducing emissions of SO₂ is enhanced through the application of Air Pollutant Discharge Licences and application of the polluter pays principle by NEPA.

7.2.4 Current State of Nitrogen Dioxide (NO₂) Concentrations Between 2011 and 2013

NO₂ is produced together with SO₂ as a result of burning fossil fuels to produce energy, smelt ores, produce cement, etc. Monitoring of NO₂ is therefore carried out at the same sites where SO₂ concentrations are measured. Table 38 summarises the results of NO₂ monitoring in 2011-2013.

Table 38: Annual Average Nitrogen Dioxide Concentrations Recorded in Ambient Air (2011-2013)

Monitoring station & Operator & Year Commissioned*	Parameter Sampled	Annual average of µg/m³			Other Sampling
		2011	2012	2013	
Kingston, St. Andrew and Portmore Airshed					
10. Marcus Garvey Dr./JEP (2009)	NO ₂	No data	No data	No data	SO ₂
11. Garmex/JEP (2009)	NO ₂	No data	No data	No data	SO ₂
12. Garmex/JPSCO (2009)	NO ₂	21.87	24,32	32.4	SO ₂ PM ₁₀
13. Petrojam/PET (2009)	NO ₂	11.41	12.53	13.62	SO ₂ PM ₁₀
14. Bournemount Dr./JPPC (2009)	NO ₂	No data	22.1	21.41	SO ₂ PM ₁₀
Old Harbour Bay Area, St. Catherine Airshed					
15. Terminal/JPSCO (2011)	NO ₂	No data	No data	No data	SO ₂ PM ₁₀
18. Longville Park/JEP (2009)	NO ₂	15.32	29.48	36.88	SO ₂ PM ₁₀
19. Longville Park/JEP (2011)	NO ₂	No data	No data	No data	SO ₂ PM ₁₀
20. Lauder Wood/JPSCO (2008)	NO ₂	5.00	12.78	8.78	SO ₂ O ₃
21. Spring Village/JBGL (2011)	NO ₂	No data	No data	No data	SO ₂ PM ₁₀
Northern St. Catherine Airshed					
22. Orangefield/WIN (2007)	NO ₂	No data	6.43	No data	SO ₂ TSP
23. Hayfield Close/WIN (2007)	NO ₂	No data	No data	No data	SO ₂ TSP
Vere Plains, Clarendon Airshed					
29. New Bowens/JAM (2007)	NO ₂	5.17	14.12	8.39	SO ₂ PM ₁₀ CO
30. Hayes Com Piece/JAM (2007)	NO ₂	16.03	15.61	7.55	SO ₂ PM ₁₀ CO
31. Kemps Hill /JAM (2007)	NO ₂	No data	8.50	5,02	SO ₂ CO
South Eastern Manchester Airshed					
-					
Northern Central Manchester Airshed					
37. Kendal /WIN (2007)	NO ₂	6.52	No data	No data	SO ₂ PM ₁₀
Southern St. Elizabeth Airshed					
-					
Montego Bay Airshed					
47. Bogue/JPSCO (2007)	NO ₂	3.39	3.56	3.15	SO ₂
North Eastern St. Ann Airshed					
-					
South Central St. Ann Airshed					
-					

Source: NEPA, 2013; * see List of Abbreviations for the full name of operator; the colour index used is: Red: over the permitted standard; Orange: close to the standard; Green: well under the standard (under $0.25 \mu\text{g}/\text{m}^3$).

Note: some stations did not have adequate data or were discontinued.

The main findings from Table 38 are summarised as follows:

- 1) In general the levels of nitrogen dioxide concentrations in Jamaica are well below the national standard for the period 2011-2013;
- 2) The drop in NO_2 concentrations at most sites for the period 2011 and 2013 indicates that the use of fuel with lower sulphur content and improvements in fuel efficiency have been applied successfully in line with current regulations on air quality;
- 3) Only two monitoring sites saw a year-on-year rise in NO_2 concentration levels (Garmex-JPSCO and Longville Park-JEP);
- 4) Total emissions of NO_2 in 2012 were calculated at 39,700 MT compared to 41,527 MT in 2009, confirming there is a general downward trend in NO_2 concentrations in Jamaica;
- 5) The emphasis on the “polluter pays” also appears to have been an incentive for industry to improve efficiency of operations.

7.2.5 Progress in Reducing Carbon Monoxide Emissions



Carbon monoxide (CO), which is produced from the burning of fossil fuels, is currently monitored at three sites in Clarendon parish. Monitoring of this odourless and highly dangerous gas is limited due to a lack of resources. However, plans to introduce national motor vehicle emissions standards will support increased monitoring capacity of CO.

Table 39 summarises average daily concentrations of carbon monoxide gas at the three monitoring sites for CO between 2011 and 2013.

Table 39: Monitoring of Carbon Monoxide Emissions 2011-2013

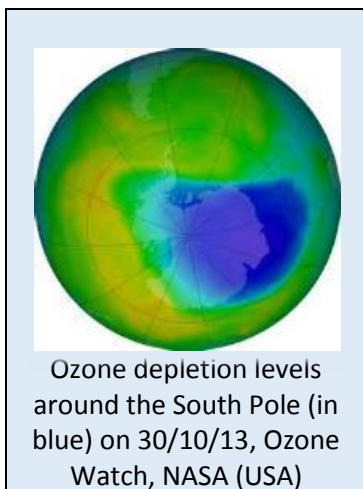
Monitoring station & Operator & Year Commissioned	Parameters Sampled	8 Hours Average (µg/m³)		
		2011	2012	2013
Vere Plains, Clarendon				
New Bowens/JAM (2007)	CO	866	683	474
Hayes Com Piece/JAM (2007)	CO	419	1,361	687
CLA Scale Gate (2013)**	CO	-	-	1,480

Source: NEPA; * Relocated from Kemps Hill (JAM); the colour index used is: Red: over the permitted standard; Orange: close to the standard; Green: well under the standard for 8 hours (under $2,500 \mu\text{g}/\text{m}^3$).

The main finding from

Table 39 is that average daily CO concentrations have remained well below the permitted maximum of $10,000 \mu\text{g}/\text{m}^3$ per day. Furthermore, the Annual Ambient Air Quality Report, 2012, did not report any cases of CO poisoning in 2011-2012.

7.2.6 Progress in Phasing Out Ozone Depleting Substances



Jamaica successfully phased out the use of chlorofluorocarbons (CFCs) in 2006 – four years ahead of the Montreal Protocol’s 2010 phase out target date and was recognised for this achievement in Montreal in 2007. The phasing out of other ozone depleting substances, in particular Hydro-chlorofluorocarbons (HCFCs) has progressed during the 2011-2013 period. Most significant has been implementation of the “Phase-Out Management Plan for HCFCs” supported by UNEP and UNDP.

Implementation of the plan began in 2012 with the official agreement of GoJ to establish import quotas for HCFCs and to start reducing imports of goods and equipment containing HCFCs from 2013. To facilitate monitoring of HCFC imports NEPA established the import level of HCFCs in 2009-2010 as the country’s HCFC baseline (in 2013) from which all future monitoring of HCFCs will be tracked.

NEPA confirms that the first year of results on controlling HCFC imports have been positive with HCFC import levels down to 48.25 metric tonnes. Other activities initiated in 2012-2013 under the phase-out management plan for HCFCs have included training of trainers on alternatives to HCFCs and good refrigeration practices (for customs officers and other enforcement officials) and instruction on the application of refrigerant identifiers to prevent the illegal trade of HCFCs in Jamaica.

7.2.7 Progress in Reducing Greenhouse Gas Emissions



The GoJ currently records GHG emissions in the annual emissions inventory produced by NEPA to support the elaboration of Ambient Air Quality Reports. However, the inventory is limited to recording GHG emissions from the 30 licensed facilities that report under the regulations and as mentioned above in 7.1.2, does not currently capture GHG emissions from motor vehicles or the sugar industry.

The latest data available on carbon dioxide (CO₂) emissions refer to the GHG Inventory submitted to the UNFCCC in 2009. The following trends were identified:

- CO₂ emissions increased by almost 32% from 9,531 Gg in 2000 to 13,956 Gg in 2005;
- CO₂ emissions from the energy sector increased by 46% in the same period, which was mainly due to increases in fuel consumption by the bauxite and alumina industry and transport sectors;
- There was little change in the magnitudes of the sources and sinks for CO₂ in agriculture, forestry and other land use;
- In the industrial processes and products use sector, the CO₂ emissions from the cement industry increased, whereas for lime manufacture they declined;
- CO₂ (and CH₄) emissions in the waste sector increased. The contribution from managed disposal sites decreased while that from unmanaged sites increased.

As part of GoJ's efforts to reduce CO₂ (also known as the carbon footprint), NEPA in collaboration with other government agencies, has supported the implementation of the **Draft National Environmental Stewardship Policy** (2010), which aims at reducing energy consumption and improving indoor air quality (see also Chapter 11, section 11.2).

One of the main GoJ responses to developing improved information management and monitoring of GHG emissions in the period 2011-2013 has been the creation of the Climate Change Division (CCD) within MWLECC in 2012. Currently, the CCD is in the process of establishing a network of government agencies, education establishments and research institutions to develop improved monitoring of CO₂ and other GHG emissions as well as developing its modelling capacity on future GHG projections and climate-related trends (based on current and future economic growth scenarios).

The development of this capacity is intended to support, among other things, the identification of "Intended Nationally Determined Contributions" (INDCs)⁷³ which represent a collective effort of all the parties to limit global warming to below 2°C relative to pre-industrial levels. The GoJ plans to submit its INDC at the Conference of the Parties (COP) on climate change, which will be held in Paris at the end of 2015. To this regard, GoJ is engaged in the on-going assessment of:

- Reduction of GHG emissions by developing more renewable energy and reducing dependency on conventional power plants that supply almost 95% of Jamaica's electricity through the burning of oil, coal or natural gas;
- Adaptation to the effects of climate variability and change, in particular for key sectors such as water supply, agriculture, tourism and transport (see also Chapter 11).

7.3 Current Threats to Jamaica's Air Quality

Threats to Jamaica's air quality come from two main sources. First, pollution generated from point sources, in particular the generation of particulate matter. Point source categories in Jamaica include electricity producers that use fossil fuels to produce energy; industrial concerns and hotels that generate their own energy using internal combustion engines (generators); industrial processing of materials, food, non-food goods, etc.; petroleum products and solvents that evaporate or produce noxious gases and; waste incinerators (for both domestic and hazardous waste).

The second threat to air quality comes from non-point sources of pollution, which are generally more difficult to manage and control because they involve smaller stationary and/or mobile producers of pollutants. They include the transport sector, in particular motor vehicles, which is not currently regulated in Jamaica. Other categories include kilns and ovens to produce bricks, charcoal, etc.; fires induced by man or natural causes; localised burning of solid waste (in particular domestic waste) and refrigerants and coolants containing damaging substances and which are not adequately disposed of.

In addition, non-point sources of pollution may come from volcano explosions and major fires in the Caribbean and Central American regions and desert sand dust from the Sahara region, which can be carried into the Caribbean through high winds in the upper atmosphere. Figure 31 provides a summary of main threats to Jamaica's air quality from both point and non-point sources of pollution in 2013.

⁷³INDCs were adopted at the Conference of the Parties on Climate Change in Warsaw, 2013.

Figure 31: Specific Threats to Jamaica's Air Quality (2013)

Point Sources		Non-Point Sources	
Electric utility generation	Power generators using fossil fuels	All types of motor vehicles	Kilns and ovens
Petroleum and solvent evaporation	Waste incineration	Fires (natural and man-made)	Refrigerants and coolants
Industrial processing & manufacturing	Airports and ports	Sahara sand dust	Volcano dust

Source: NEPA

7.4 Conclusions and Recommendations

The implementation of the JAQMP has progressed in the period 2011-2013. Improvements to AQMN through the installation of new and upgraded monitoring stations, together with the increase in the number Air Pollutant Discharge Licences to 30, in addition to NEPA's five air quality monitoring stations, has facilitated the systematisation of data collection. The establishment of a partnership network is also providing on-going capacity building within NEPA. This has included the centralisation of data collection and enhancing data validation techniques, both of which are essential prerequisites to building the foundations of an Air Quality Index. GoJ recognises the creation of the AQI will enhance the country's capacity to assess and manage air pollution risks caused in particular by non-point sources such as fires and vehicle emissions in densely populated areas and road junctions.

The current state of Jamaica's air quality is generally good in all categories except for particulate matter concentrations, where the general trend is up on 2010 levels at a number of monitoring sites, particularly in Kingston and St. Andrew and St. Catherine parishes. Annual average readings of sulphur dioxide, nitrogen oxide and carbon monoxide all confirmed low concentration levels of these gases at

all the point sources monitored. Table 40 summarises the estimated percentage of emissions of major pollutants by groups of regulated industries. It confirms the alumina industry is the main producer of PM and the electric power sector is the largest producer of sulphur dioxide and nitrogen dioxide.

Table 40: Percentage of Emissions of Major Pollutants by Regulated Industries (2009 & 2013)

Pollutant	Alumina Industry*		Electric Power Generation		Cement and Concrete		Refined Petrol. Products & Bulk Storage		Other Sources	
	2009	2013	2009	2013	2009	2013	2009	2013	2009	2013
Sulphur Dioxide (SO ₂)	46%	43%	47%	49%	1%	< 1%	4%	5%	2%	2%
Nitrogen Dioxides(NO _x)	16%	12%	75%	83%	5%	3%	3%	< 1%	1%	2%
Particulate Matter (PM)	53%	68%	23%	7%	15%	2%	0%	<1%	9%	22%

Source: NEPA

Efforts to reduce GHGs and phase out ozone depleting substances such as HCFCs have progressed in 2011-2013. This has been aided by the creation of the Climate Change Division within MWLECC in 2012 and implementation of the first stage of the Phase-Out Plan for HCFCs by 2040, supported by UNEP and UNDP, which confirmed a reduction in the imports of HCFCs in 2013. The creation of the CCD is significant as it has facilitated the creation of a national network of government, private and non-government institutions to work on reducing Jamaica's carbon footprint. This will support the updating of the GHG inventory (2009) and aid the identification of Jamaica's Intended Nationally Determined Contributions (to reduce GHGs), which have to be submitted at the COP planned in Paris, end 2015.

Based on the objectives in the JAQMP and taking into account the above results, developments and findings, the following conclusions and recommendations are made:

- 1) Data quality has improved over the period; both in terms of data recovery and validation for major pollutants, but recovery rates still need to increase at some monitoring stations to establish accurate annual average concentrations data.

Recommendations

- a) Establish effective application of quality assurance and control at all monitoring sites based on best practice, demand-led training support and, in priority cases, investment in technology transfer;
 - b) Improve NEPA's capacity to oversee all aspects of quality assurance and control in relation to the implementation of the Air Pollutant Discharge Licences, through greater partnership with the private sector and research establishments;
 - c) Standardize and simplify the formats for data reporting in order to facilitate the development of an online data management system for the AQMN within NRCA/NEPA.
- 2) There are cases where particulate matter concentrations have remained above, or close to the maximum permitted standards in the period 2011-2013. This is due to a combination of gaps in current regulations and standards, the need for greater vigilance and inadequate enforcement of laws and regulations linked to air pollution matters.

Recommendations

- a) Identify funding sources to support the Ministry of Transport, Works and Housing in collaboration with NEPA, to establish and promulgate regulations for vehicle emissions and the testing of vehicle emissions by 2016;
 - b) Promote greater self-regulation of emissions within the sugar industry, placing specific attention on a major reduction in the burning of sugar cane waste;
 - c) Support NEPA to acquire a pilot monitoring station capable of measuring PM at 2.5 microns (PM_{2.5}) at a priority site in the interests of improving risk assessments on public health (namely at an existing site in the Kingston metropolitan area);
 - d) Establish a test site at one of the oldest TSP monitoring stations to trial cost effective air quality monitoring equipment produced at UTECH to determine the feasibility of updating parts of the AQMN with this technology;
 - e) Strengthen the enforcement capacity of NEPA to ensure the polluter pays policy is applied more effectively to act as a deterrent to poor management and repeat offenders;
 - f) Promote greater vigilance and detection of air pollution through the mobilization of civil society supported by education and awareness programmes.
- 3) The application of effective risk assessments on air pollution and the development of risk management responses in collaboration with other agencies such as ODPEM have not been widely implemented.

Recommendations

- a) Provide training of trainers in air pollution risk assessment and develop risk assessments as multi-task assignments involving the participation of key stakeholders;
- b) Support development of an Air Quality Index for Jamaica, starting in major towns by 2016, building on lessons learned and best practice from other AQI shown in Figure 32 below;
- c) Improve inter-institutional coordination by strengthening the role of the Air Quality Evaluation Committee during the development of the AQI;
- d) Increase the participation of civil society in the development of risk management strategies (in collaboration with OPDEM) to reduce the effects and long-term impact of air pollution on public health at strategic sites (road junctions, waste disposal sites, bauxite mines and major quarries, food processors, etc.);
- e) Promote civil society and private sector participation through regular cost effective education and awareness initiatives, such as the distribution of posters (Figure 32).

Conclusions and Recommendations on Reducing GHGs Emissions⁷⁴

- 4) The GHG inventory has not been updated since submission to the UNFCCC Secretariat (2009).

Recommendations

- a) Establish a centralised database on GHG emissions within CCD to facilitate the up-dating of the inventory in line with UNFCCC reporting requirements;
- b) Provide training to key government agencies to develop capacity in preparing the GHG

⁷⁴ Recommendations have been established in coordination with those highlighted in Chapter 11.

- inventory for sectors such as agriculture, land use planning, forestry and solid waste;
- c) Establish a formal partnership with national (and international) education/research establishments to develop an effective modelling capacity in Jamaica, in the interests of guiding cost effective actions to be taken to reduce GHG emissions.
 - d) Establish a working group to support the elaboration of the “Intended Nationally Determined Contributions” (INDCs), to be submitted in November 2015.

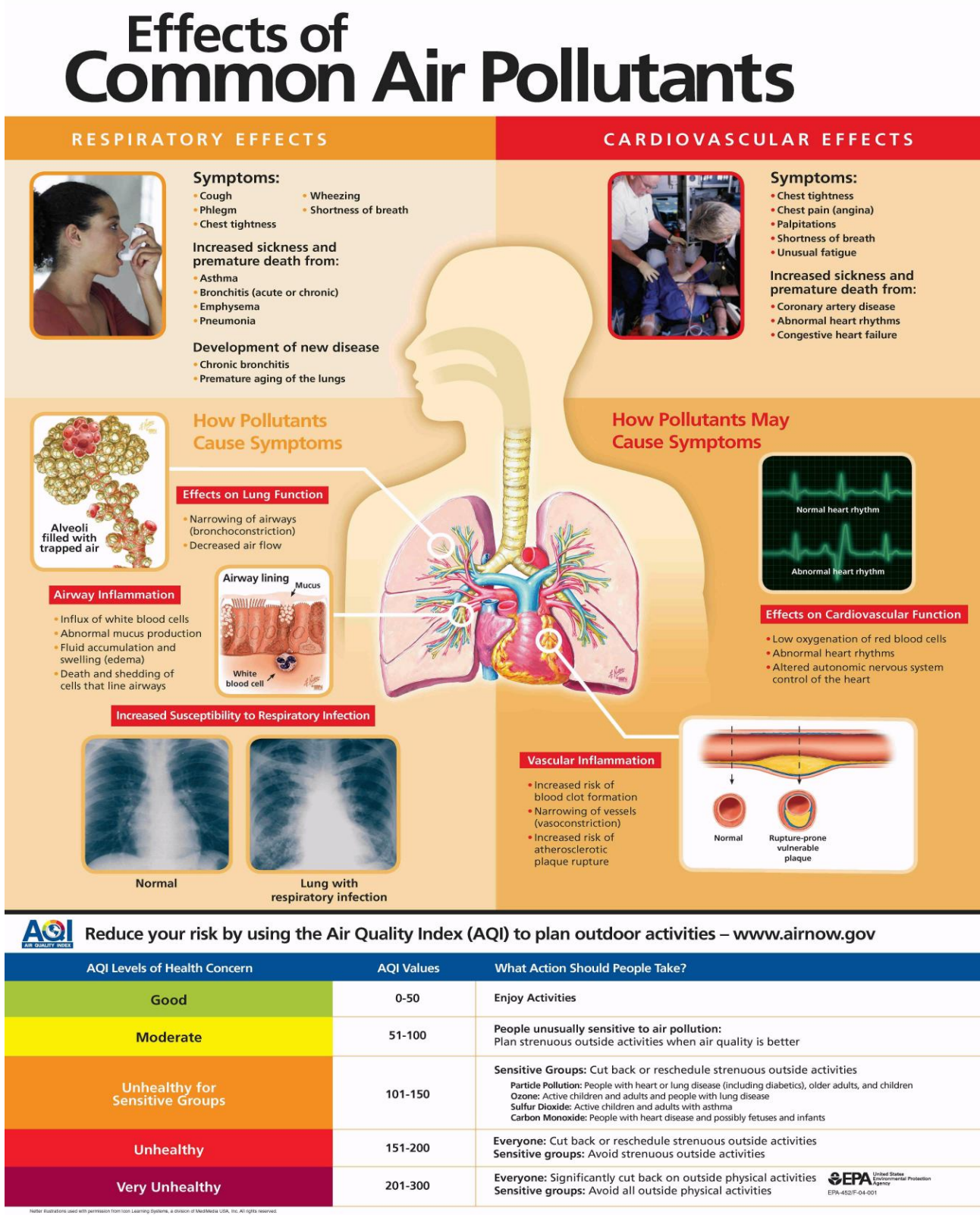
Conclusions and recommendations on reducing ozone depleting substances:

- 5) The Phase-Out Management Plan for HCFCs has fulfilled its objectives in the first phase of activities.

Recommendation

Prepare the implementation of phase two, ensuring greater support from private companies and civil society through regular education and awareness campaigns.

Figure 32: Effects of Common Air Pollutants and Air Quality Index in the USA (2013)



Useful Links and References:

Air quality standards and regulations under the NRCA Act (1991)

http://www.nepa.gov.jm/legal/nrca_act_lpart1.htm

Air Quality Standards Regulations Guidelines for Jamaica (1996)

http://www.nepa.gov.jm/standards/air_quality_standards_regulations.pdf

Air quality regulations (2006):

http://www.nepa.gov.jm/regulations/NRCA_Air_Quality_Regulations_August_2006.pdf

NRCA Ambient Air Quality Guideline Document (2006):

<http://www.nepa.gov.jm/regulations/air-ambient-guideline-2006.pdf>

The Jamaica Air Quality Management Programme (2010)

<http://www.nepa.gov.jm/airquality/The%20Jamaica%20Air%20Quality%20Management%20Programme.pdf>

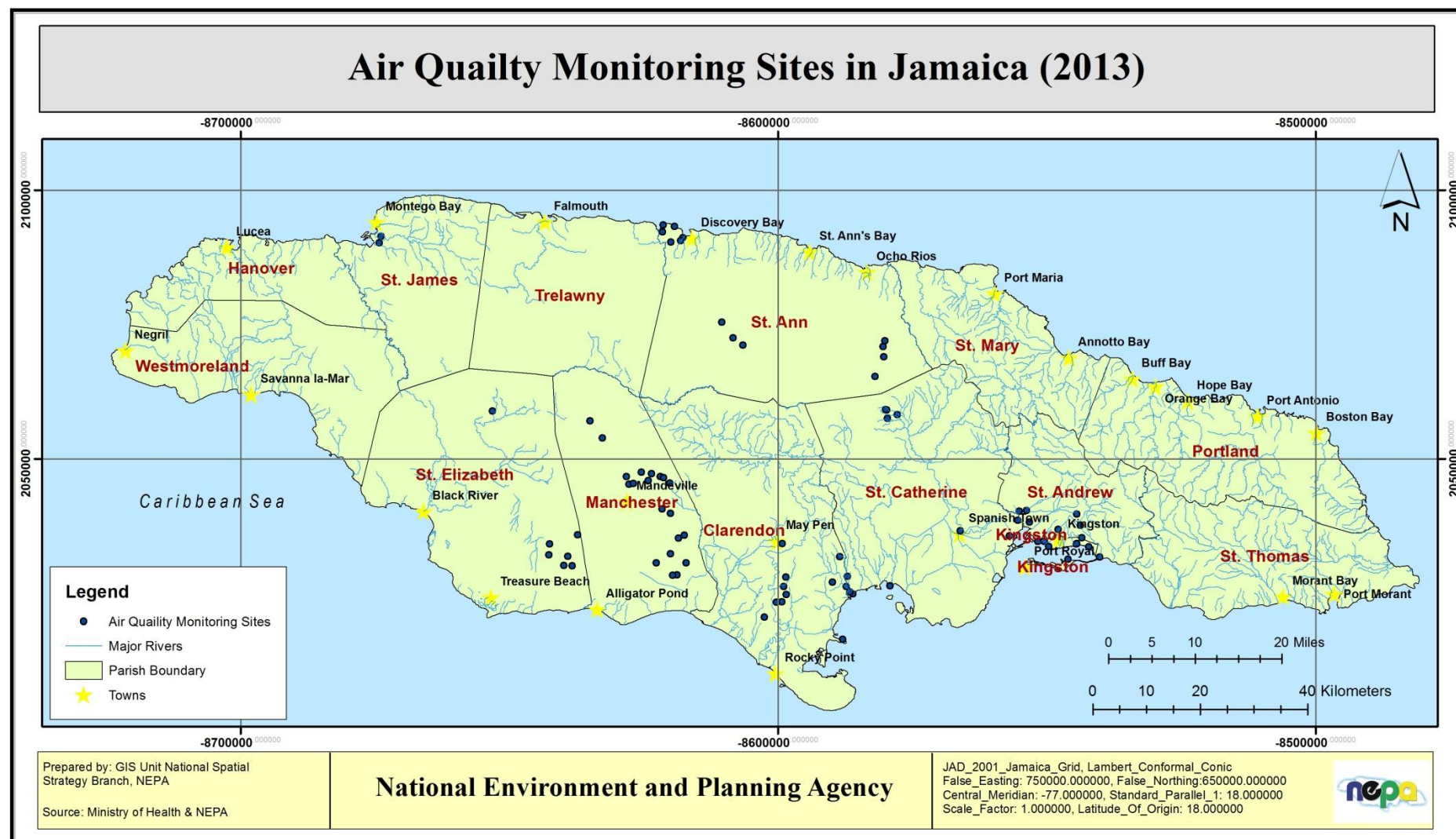
The Annual Ambient Air Quality Report 2012 (NEPA):

http://www.nepa.gov.jm/air-quality/Ambient_Air_Quality_Report_2012_final.pdf

Maps:

Figure 33: Location of ambient air quality monitoring sites (2013)

Figure 33: NEPA's Air Quality Monitoring Stations in Jamaica (2013)





8. Waste Management

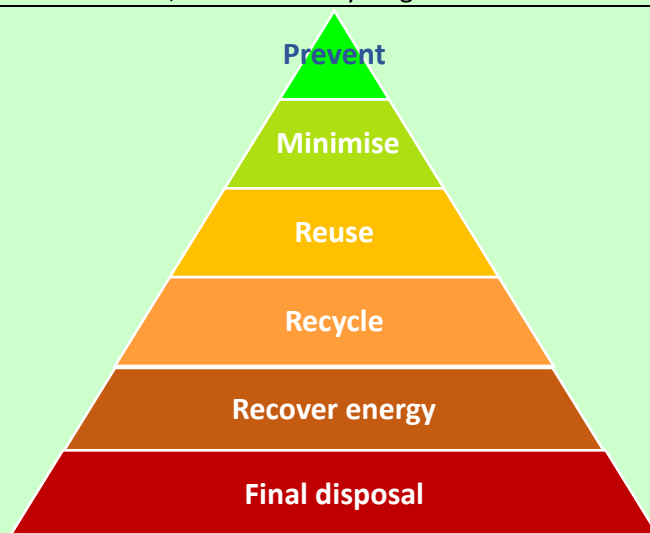
What is waste? Waste refers to all unwanted and unusable materials that the owner/user wishes, or is required, to throw away. Waste categories include:

- Solid waste: food waste, plastics, glass, cardboard, tins, electric appliances (e-waste), tyres, etc.;
- Liquid waste: sewage sludge, lubricants, inks and dyes, soap cleaners, etc.;
- Hospital waste including blood, syringes, bandages, expired medicine, containers, etc.;
- Agricultural waste: animal slurry, sacks, plastic sheets, fertilisers, etc.;
- Industrial waste including mining waste, building rubble, waste packaging, waste metals, etc.;
- Hazardous waste: chemicals, acids, pesticides, paints, etc. and their containers.

What is waste management? The United Nations describes waste management as “all those activities and actions required in managing waste from its inception to its final disposal” (1997). It includes:

- Collection, transport, treatment and disposal of waste;
- Control, monitoring & regulation of the production, collection, transport, treatment and disposal of waste;
- Prevention of waste production through in-process modification, reuse and recycling.

What is the waste management hierarchy? This is the order of preference to reduce and manage waste in the interests of sustainable development. The most preferred options are to prevent or minimise waste generation. Other options are to reuse, recycle or recover the energy from waste in order to obtain the maximum benefits from products and materials. The least favoured option is the final disposal of waste into solid waste disposal sites, or through incineration, which is generally considered as costly and a potential threat to public health over the long-term. The waste management hierarchy has been adopted by many countries, including those in the European Union and the USA.



What is life cycle thinking? To support the application of the waste management hierarchy, life cycle thinking encourages decision-makers and consumers to understand and assess all stages of a product's life cycle to determine the best options to minimise environmental impact (from production to final disposal). This is particularly important to support the management of hazardous wastes such as chemicals.

Why is waste management important? Waste management contributes to protecting the environment and safeguarding human health by preventing or reducing the negative effects and long-term impact associated with the generation of waste through to its final disposal. By preventing or reducing these negative effects and impacts, waste management also saves money, which is good for economic growth.

8.1 Background to Jamaica's Waste Management

8.1.1 The Legal Framework Governing Waste Management

Jamaica is a party to a number of international agreements and conventions which are committed to implementing the waste management hierarchy. International commitments relating to the protection of the marine environment include, among others:

- The Convention for the Protection and Development of the Marine Environment in the Wider Caribbean – Cartagena Convention (1983) together with the following Protocols of the Convention:
 - **Oil Spills Protocol** (entered into force in 1986);
 - **Land-based Sources of Marine Pollution Protocol** (entered into force in 2010);
- The **MARPOL Protocol** (entered into force in 1983), covering prevention of pollution of the marine environment by ships;
- The **International Convention on Oil Pollution Preparedness, Response and Co-operation** (1990);
- The **Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter - London Convention**(entered into force in 1975);
- **Barbados Programme of Action for the Sustainable Development of Small Island Developing States** (1994), in which Section III deals with specific action on the “Management of Wastes”.

International commitments to the management of hazardous chemicals and waste mainly centre on the following three conventions:

- **Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal**, (1989);
- **Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade**, (1998);
- **Stockholm Convention on Persistent Organic Pollutants**, (2004).

The management of waste in Jamaica is governed by a number of laws and policies, which include specific provisions to implement the above international agreements and conventions. Furthermore, since the launch of ***Vision 2030 Jamaica*** the effective management of waste, based on the waste management hierarchy, represents a major prerequisite to meeting Goal 4: Jamaica has a healthy natural environment. Currently the legal and policy framework in place to achieve GoJ's national and international commitments on waste includes, among others:

1) For Solid Waste:

- **National Solid Waste Management Act** (2002), which establishes the National Solid Waste Management Authority (NSWMA) and its functions with respect to the comprehensive management of waste. These include the issuing of licences relating to the collection, storage, transportation and disposal of solid waste. It also includes sections on the recycling of waste, offences and penalties and on enforcement and appeal.

- **National Solid Waste Management Policy (2000),⁷⁵** which establishes the framework for standard setting and the regulatory agency, the National Solid Waste Management Authority (NSWMA) that facilitates the private sector as the principal service provider. The policy also emphasizes cost recovery options, establishment of sanitary landfills and solid waste management.
- **National Land Policy (1997),** which includes allocation of appropriate sites for the disposal of solid and hazardous waste.

2) For Wastewater:

- **Natural Resources Conservation Authority (NRCA) Act (1991),** which regulates effluent discharges. Through the **NRCA Permits and Licences Regulations (1996)** and its Amendment (2004), a permit must be obtained from the NRCA prior to the construction and operation of a new waste water treatment facility and a separate licence is required for the discharge of trade and sewage effluent. There are established standards for sewage and trade effluent quality and meeting the standards is a condition of every licence granted by the Authority (NRCA) through NEPA. Two standards exist for sewage effluent - standards for some existing facilities (which are defined as facilities in operation prior to 1997); and those for new facilities (licensed after 1996).
- **The NRCA Wastewater & Sludge Regulations (2013)** are designed to regulate the construction, modification and operation of wastewater treatment facilities and the discharge of sewage and trade effluent through the granting of licences to operators under section 38 of the NRCA Act (1991). The Regulations provide the requirement for discharge fees which are payable based on the quality of the pollution load being discharged to the environment.
- **Draft National Ambient Water Quality Standards (2009)** for marine and freshwater, which were reviewed in 2009 (for marine water) and are monitored at various sites around the island (for more information see Chapter 6).
- **Water Sector Policy, Strategy and Action Plan (2004),** which has as its main objectives to ensure that all households have access to water and to sewer in all major towns by 2020. Also, the policy aims to rehabilitate existing non-compliant facilities to achieve compliance with the standards.
- **Draft Jamaica National Sanitation Policy (2005)** which is the first of its kind in the Caribbean. It aims to ensure that acceptable water supply and sewage and excreta disposal systems will be available in all homes, schools and public places.
- **National Water Commission Act (1963)** amended in 1965, 1973 and 1980 which gives the NWC responsibility for public water supply systems and public sewerage and sewage treatment;
- **Public Health Act (1974)** and the **Health Policy and Strategic Plan (2006-2015),** which address air, soil and water pollution and the sanitary collection and disposal of garbage and other waste matter;
- **The National Housing Policy for Jamaica and Implementation Plan (2011),** which includes provisions for housing stock to have appropriate sanitary services and to avoid hazardous events.

3) For Hazardous waste:

⁷⁵ The elaboration of a comprehensive waste disposal policy since the enactment of the National Solid Waste Management Act in 2002 has not been realised to date.

- **The Natural Resources Conservation (Permits and Licences) Regulations (1996) and Amendment Regulations (2004)** which make provision for the issuance of a permit for the storage, transportation or disposal of hazardous wastes;
- **Natural Resources Conservation (Hazardous Wastes) (Control of Transboundary Movements) Regulations, 2002** which requires NEPA to issue environmental permits before any exportation of hazardous waste can take place.⁷⁶

8.2 The Current State of Solid Waste Management in Jamaica (2011-2013)



The National Solid Waste Management Authority (NSWMA) has a broad mandate that includes public cleansing; environmental monitoring; providing standards, regulations and expertise with regard to solid waste management; participating in inter-institutional efforts concerning pollution and environmental control; allocating limited financial resources to priority actions; educating the public on solid waste management and; supporting enforcement of the NSWMA Act and pertinent regulations.

Responsibilities of the NSWMA includes waste reduction activities, improvement in waste collection systems and improving services relating to recycling, storage, transportation, treatment, disposal and curtailment of illegal dumping of waste.

Since the launch of *Vision 2030 Jamaica* in 2011 the vision of the authority is to be recognised as a model waste management entity by 2030 that provides services and standards comparable to developed countries. Currently, the NSWMA manages the country's solid waste under four "wastesheds" in which there is one or more solid waste disposal sites (see Figure 35 at the end of this Chapter). In summary they are:

- Riverton Wasteshed, managed by MPM waste Management Ltd. (MPM Wasteshed);
- North Eastern Wasteshed, managed by NEPM Waste Management Ltd. (NEPM Wasteshed);
- Retirement Wasteshed, managed by WPM Waste Management Ltd. (WPM Wasteshed);
- West Kirkvine Wasteshed, managed by SPM Waste Management Ltd. (SPM Wasteshed).

The following sub-sections assess the current state of waste generation, characterisation, collection and disposal in Jamaica for the period 2010-2013.

⁷⁶The Regulations made it illegal to import hazardous waste into Jamaica.

8.2.1 Current state of solid waste generation 2010-2013

Table 41 shows the current state of estimated total collectable solid waste between 2010 and 2013.

Table 41: Estimated Total Collectable Solid Waste in Jamaica in Metric Tonnes (2010-2013)

Year	Estimated Collectable Waste
2010	785,290
2011	698,026
2012	730,435
2013	733,602
TOTAL	2,947,353

Source: NSWMA

The main finding from Table 32 is that total collectable solid waste island-wide has increased between 2011 and 2013, but has not reached the amount recorded in 2010. The NSWMA estimates domestic waste accounts for about 70% of all collectable solid waste, with the remaining 30% coming from commercial and industrial sources.

The estimated total quantity of domestic waste generated in Jamaica between 2010 and 2013 is provided in

Table 42.

Table 42: Estimated Total Waste Generated by Wasteshed/Parish in Metric Tonnes (2010-2013)

Name of Wasteshed/Parish and Disposal Site Used*	2010	2011	2012	2013
MPM Wasteshed				
St. Thomas (Riverton)	34,257	34,366	34,366	34,541
Kingston & St. A. (Riverton)	241,676	242,447	243,105	243,677
St. Catherine (Riverton)	188,084	188,683	188,279	189,641
SPM Wasteshed				
Clarendon (Martin's Hill)	89,379	89,664	89,908	90,119
Manchester (Martin's Hill)	69,237	69,458	69,646	69,810
St. Elizabeth(Myersville)	54,789	54,963	55,112	55,242
WPM Wasteshed				
Westmoreland (Retirement)	52,548	52,715	52,858	52,982
Hanover (Retirement)	25,354	25,435	25,504	25,564
St. James (Retirement)	67,006	67,219	97,402	67,560
Trelawny (Retirement)	27,417	27,504	27,579	27,644
NEPM Wasteshed				
St. Ann (Tobolski)	62,858	63,058	63,229	63,379
St. Mary (Tobolski)	41,448	41,580	52,643	41,791

Portland (Doctor's Wood)	29,821	29,915	29,997	30,068
TOTAL	983,874	987,007	1,029,628	992,018

Source: NSWMA; * Based on estimates of 1kg.per capita per day as a proxy by the NSWMA

Table 42 confirms that the trend in domestic waste generation is increasing in almost all parishes year-on-year from 2010 to 2013. St. James and St. Mary saw a major increase in domestic waste generation in 2012. Kingston and St. Andrew generate on average over 20% of all Jamaica's domestic waste.

8.2.2 Solid Waste Characterisation (2006 & 2013)

In 2013 the NSWMA conducted a waste characterisation and generation study to reassess the waste streams generated and collected from households within the Riverton wasteshed. The aim of the study was to support local government and non-government entities engaged in solid waste management to improve their waste collection, recovery and disposal services as well as guide the development of strategies to improve efficiency, set up recycling of waste and promote other actions designed to reduce waste at disposal sites.

The methodology applied in the study, which took into account the constraints of limited financial resources, was as follows:

- a) The communities comprising the sample (see table below), were selected from a primary list of all communities within the Riverton Wasteshed based on the following factors:
 - The perception of the community income levels, i.e. high, middle or low;
 - Location within the Riverton Wasteshed;
 - Predominantly residential with clearly defined geographic boundaries;
 - Largely homogenous with regard to income and other factors which may be used to define the community;
 - Having a twice-weekly or weekly collection schedule.
- b) Conducted over a period of 6 days, between 12 to 22 March 2013
- c) One sample of waste was taken from each community based on an average of 25 houses using a tipper truck;
- d) Sorters were briefed on identifying waste according to set categories that had to be bagged;
- e) Bagged waste by category was weighed and the total recorded;
- f) All recorded data gathered for each community was analysed using the weighted average technique.

The results of the study are provided in

Table **43**. The average composition rate for each category is compared with the results of a similar study conducted by NSWMA in 2006.

Table 43: Composition of Waste collected at selected communities in the Riverton Wasteshed (2013)

Waste Category	Johnson Town (%)	Mona Heights (%)	W. Great Portmore (%)	Cherry Gardens (%)	Eltham (%)	Point Hill (%)	Average 2013 (%)	Average 2006* (%)
Compostable	58.2	69.9	47.4	74.0	63.2	60.5	62.2	69.0
Paper	11.2	9.2	12.6	8.5	10.7	4.5	9.5	5.9
Plastics	14.8	8.0	17.5	6.5	10.4	14.6	12.0	13.9
Glass	1.8	4.0	1.7	1.7	3.1	5.1	2.9	2.4
Cardboard	4.9	5.3	9.8	4.0	4.8	5.2	5.7	3.7
Wood/Board	0.3	0.0	1.1	1.0	0.0	0.0	0.4	0.3
Metal/Tin	2.0	1.8	3.5	1.0	2.8	3.0	2.4	2.3
Textile	6.8	1.8	6.4	3.2	5.0	7.1	5.1	2.3
E-waste/other	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2
TOTAL	100	100	100	100	100	100	100	100

Source NSWMA; *SOE 2010

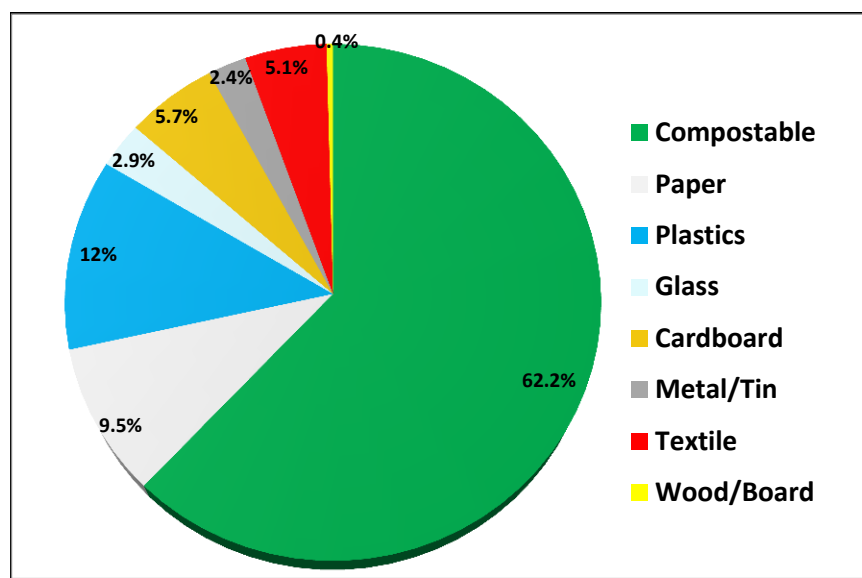
The following pie graph shows the percentage distribution of waste categories provided in the above table for 2013.

The main findings from the study are summarised as follows:

- 1) The average mass of waste sorted per community was 409.25 kg;
- 2) Households in urban areas generated an average of 18.29 kg. each collection day (3.5 days);
- 3) Households in rural areas generated an average of 12.53 kg. each collection day (3.5 days);
- 4) If 12.35 kg. is divided by the mean household size of 3.5 persons⁷⁷ and then divided by 3.5 days for each collection day, the generation of domestic waste per person is approximately 1kg./person/day;
- 5) The total kilograms of waste generated by the selected communities in 2013 (2,456 kg.) was less than in 2006 (3,040 kg.);
- 6) Organic waste accounted for approximately 62% of all waste generated in rural and urban communities in 2013 (see

⁷⁷ Jamaica Survey of Living Conditions, 2011

7) Figure **34**), down from 69% in 2006.

Figure 34: Waste Composition of Selected Communities in Riverton Wasteshed (2013)

Source: NSWMA

- 8) The generation of plastics was down in 2013 in relation to 2006, indicating that some plastics are probably sold direct, or given, to private recyclers rather than disposing of them;
- 9) The generation of cardboard and paper was higher in 2013 than in 2006, suggesting a possible increase in packaged goods and materials in the market place.

8.2.3 Current State of Solid Waste Collection (2011-2013)

The NSWMA estimates that its solid waste services cover approximately 70% of the total population in Jamaica (2013). The same percentage was reported in SOE 2010, confirming around 30% of collectable solid waste generated in the country remains uncollected.

The NSWMA collects the vast majority of domestic waste using a fleet of garbage collection trucks and skip carriers that can collect up to 8 MT of garbage in a run.



Table 44 provides details of the number of vehicles in the fleet that are government owned, or contracted from the private sector. However, due to the aging fleet of vehicles available not all may be in service. This situation, together with the fact solid waste generation is increasing year on year, means the capacity of NSWMA to collect waste is decreasing. In June 2012 the NSWMA responded to this situation by stating it urgently needed a fleet of at least 200 garbage trucks to both widen and improve existing services island-wide.

Table 44 provides details of the number of vehicles the NSWMA have estimated are necessary to provide such services in each of the four wastesheds in Jamaica.

Table 44: Current Number of the NSWMA's Fleet of Garbage Trucks Owned/Contracted (2013)

Name of Wasteshed & Owner of Garbage Trucks	No. of Garbage Trucks in Service	Estimated no. of New Trucks Required
MPM Wasteshed		
Government garbage trucks	10	55
Contracted private garbage trucks	45	
SPM Wasteshed		
Government garbage trucks	9	22
Contracted private garbage trucks	14	
WPM Wasteshed		
Government garbage trucks	14	6
Contracted private garbage trucks	2	
NEPM Wasteshed		
Government garbage trucks	11	8
Contracted private garbage trucks	2	
TOTAL	109	91

Source: NSWMA

To finance waste collection services the NSWMA receives an annual budget from the Ministry of Local Government and Community Development. This was approximately J\$ 2.2 billion in 2011. However, after factoring in fixed costs the NSWMA does not have adequate funds to cover the fuel and maintenance costs needed to run its fleet effectively. To cover this shortfall, the NSWMA enters into commercial services, whereby its commercial clients enter into a contract with NSWMA to collect and dispose of its waste. These contracts generate over J\$ 200 million a year and the vast majority is used to purchase fuel and truck maintenance. As a result there are not enough funds to invest in new vehicles.

In response to this situation the NSWMA has attempted to secure funds for investment from international donors. Currently, the NSWMA is benefiting from the Inner City Basic Services Project, funded by a loan of US\$ 38.8 million from the World Bank which targets 12 communities in Kingston St. Andrew (4 communities), St. Catherine (6 communities), Clarendon and St. James (2 communities). In 2012 one new compactor truck (valued at J\$ 13 million) was acquired. The new truck is able to collect much more solid waste in a single run than conventional trucks and represents an important addition to the current fleet. In addition, a gated compound to store 55 skips, the training of 56 environmental wardens, recycling initiatives and environmental awareness campaigns are planned with the NSWMA for 2013-14. The European Union has also supported the NSWMA and negotiations are in place to secure a new collection truck for St. Thomas by 2014. However, overall vehicle numbers remain too low to meet current needs.

Are more refuse trucks the answer to current solid waste problems? Additions to the current fleet are essential if Jamaica is to secure a healthy environment as prescribed in *Vision 2030 Jamaica*. However, even if funds can be raised to operate them effectively, the presence of more and better trucks also means more solid waste for the disposal sites. Currently, all solid waste disposal sites are either close to capacity, or not in suitable locations. For example, the Riverton solid waste disposal site is expected to reach maximum capacity in 2014, and the waste disposal sites at Doctor's Wood in Buff Bay (Portland) and Church Corner (St. Thomas) are located close to coastal marine waters or river sources.

In the light of the current challenges of improving collection services, the Government of Jamaica, has started discussions on identifying the alternatives available. It is too early to report on these discussions, although the possible privatization of at least part of the collection service may be an option given a study conducted by UWI for NEPA in 2013 confirming Jamaicans are prepared to pay a little more in exchange for improved services.⁷⁸

Why do some people prefer not to use NSWMA collection services? Apart from the financial constraints limiting collection services to around 70% of the population, the NSWMA confirms that people in a section of Jamaican society retain their own cultural perceptions on the disposal of their waste. Three main practices currently hinder collection services:

- First, too many people still burn their garbage, believing it is a suitable and hygienic means of rapidly disposing of solid waste. Indeed, these fires can be seen in rural and urban areas throughout Jamaica on a daily basis, such as in the hills around Kingston. These fires emit dioxins and other contaminants that are detrimental to public health and waste valuable public resources when they get out of control and require the Fire Brigade to intervene.
- Second, the NSWMA reports a possible trend in stockpiling different types of waste that can be sold on to recycling companies (see Table 46 below). For example, the stockpiling of plastics to sell in bulk appears to be a major reason why the NSWMA has observed fewer plastics entering the Riverton waste disposal site in 2013 compared to 2006. This is despite an increase in imported plastics over the same period. Low increases in the amount of metals, glass and wood reported in



⁷⁸ C. Mason, Institute of Sustainable Development, UWI-Mona.

- Table 43, also indicate similar stockpiling behaviour. NSWMA has also confirmed cases of private stockpiling of used tyres and used lead acid batteries (ULAB), for metal recycling opportunities. However, these substances pose serious threats to human health in the form of fires, surface water contamination and, in the case of tyres, the breeding of insects.
- Third, the dumping of domestic waste in nearby gullies, sinkholes, drainage canals and rivers is still practised by many individuals throughout the country, especially where NSWMA coverage is low. However, the dangers of this practice include the blockage of drains and streams causing flooding, or damage to coasts, beaches and coral of reefs when the waste is washed out to sea. This is a particular problem in Montego Bay according to the Montego Bay Marine Park.

8.2.4 Current Status of Jamaica's Solid Waste Disposal Sites (2011-2013)

NEPA issues licences and regulates the NSWMA and its thirteen official solid waste disposal sites. Figure 35 shows the location of these sites in each of the four wastesheds managed by NSWMA. Regulatory activities at the waste disposal sites includes, among other things, monitoring to control the access of only legally accepted waste into the disposal sites; checking for seepage of waste residues into water sources or neighbouring areas and; and enforcing strict rules on the burning of waste. Meanwhile, NSWMA is responsible for ensuring that persons do not enter its sites without authorisation.

Over the reporting period, both regulators and operators faced some major challenges with respect to the implementation and enforcement of the National Solid Waste Management Act. None of the NSWMA sites had an environmental permit during 2011-2013.

A major challenge for the NWSMA is that many of its solid waste disposal sites are at a critical state of capacity due to the lack of a national waste management policy that promotes the waste hierarchy.

Table 45 shows the planned and current state of waste disposal capacity at these sites. The NSWMA confirms that a number of sites are in a critical state, especially as waste generation is increasing in most parishes and municipal areas as indicated in

Table 42.

Table 45: Planned and Current Capacity of Jamaica's Solid Waste Disposal Sites (2013)

Name of Waste Disposal Site and Management Division	Planned Capacity(ha)	Index on State of Capacity
MPM Wasteshed		
Riverton (St. Catherine)	43.50	Critical
Church Corner (St. Thomas)	1.21	Critical
SPM Wasteshed		
Martin's Hill (Manchester)	7.82	Satisfactory
Myersville (St. Elizabeth)	3.70	Limited
WPM Wasteshed		
Retirement (St. James)	10.96	Critical
NEPM Wasteshed		
Doctor's Wood (Portland)	4.94	Critical
Tobolski (St. Ann)	3.98	Limited
Hadden (St. Ann)	4.86	Critical

Source: NSWMA

Other significant challenges facing the NSWMA include:

- None of the solid waste disposal sites are sanitary landfills meaning there is no systematic sorting of waste categories for recycling, re-use, confined storage of hazardous waste, or to support the development of energy from waste;
- Limited resources to generate income from waste, such as the sale of compost bags, or wood chippings at the sites;
- Direct involvement in domestic waste collection operations as the NSWMA does not have a clear mandate;
- None of the sites have adequate equipment to help extend the life of the landfill sites. For example, the NSWMA is not equipped with:
 - Compacting equipment to compress waste in the landfill;
 - Tyre and plastic shredders to reduce waste volume and enhance recycling opportunities;
 - Waste oil receptors to accept oil that is not collected by operators licensed by NEPA;
- Inappropriate location of some landfill sites in socially and environmentally sensitive areas, such as Doctor's Wood and Church Corner waste disposal sites, confirmed in a study conducted by IDB in 1999.



8.2.5 Advances in Improving Solid Waste Management in Jamaica (2011-2013)

Waste transport permits: an important area of progress since 2012 has been the requirement by NEPA for environmental permits for all private contractors who transport ship waste (including waste oil) out of Jamaica's ports. As a result, it is now possible to trace where contractors deposit ship waste. This has facilitated a crackdown in illegal dumping of such waste and ensured that it is now received at the country's designated solid waste disposal sites within the four regional wastesheds.

Environmental education and awareness: the NSWMA is required under the National Solid Waste Management Act to promote environmental education and awareness, with a particular focus on waste reduction at source (i.e. at the home, or office). Responses to this mandate include, among others:

- Launching the "Clean Schools Competition" in 2013 to promote initiatives such as waste-to-art
- Engaging private companies to sponsor education initiatives, such as Scotia Bank for the Clean Schools Competition;
- Promoting clean-up messages on waste collection vehicles, such as "Litterbugs Will Pay" or the provision of call numbers to report uncollected waste;



Recycling: The growth of recycling initiatives and companies between 2011 and 2013 has been encouraging. However, there are no data available to indicate how much of Jamaica's total collectable solid waste is recycled. The NGO, Jamaica Environment Trust (JET) has been one civil society organisation that has been actively promoting the importance of recycling. For example, it has set up a recycling centre for plastics and glass at its headquarters at Earth House on Waterloo Road, Kingston. In addition, its website provides a list of recycling companies for the benefit of the general public and private companies. The list

is provided in Table 46.

Table 46: Summary of Companies and NGOs in the Recycling Business, Jamaica (2013)

Company/ Civil Society Organisation	Waste Categories Recycled
RPJL in Kingston, St. Mary, St. Thomas and Manchester	Plastics
Jamaica Recycles in Kingston and Montego Bay	Plastics, cardboard, paper, tin
Jamaica Environment Trust in Kingston	Plastics (PET1, HDPE2), glass
Allenco International in Kingston and St. Elizabeth	Plastics (1-7), paper, cardboard, tyres
Plastic Recyclers of Jamaica in St. Elizabeth	Plastics
Hear the Children's Cry in Kingston	Paper, cardboard, newspaper, magazines
Jamaica Society for the Prevention of Cruelty to Animals	Paper
Ace Recycling Jamaica Ltd. In Kingston	Paper, cardboard
Collins Material Recycling in Kingston	Cardboard
Garbage Disposal & Sanitation Services (GDSS), Kingston	Glass bottles
Cartridge World in Kingston	Printer, toner cartridges
Global Ink in Kingston	Printer/toner cartridges (black toners only)
Cartridge Collection Ltd. in Kingston	Printer/toner cartridges
Kurbriton Ltd. In Clarendon	Used car batteries
Caribbean Recycling Company Ltd. in Kingston	Used car batteries
INET Jamaica Ltd. In Kingston and Portland	Used car batteries, plastic, scrap metal

Source: Jamaica Environment Trust



Waste-to-energy: converting waste to energy has been a practice in the Sugar industry for several years, where the waste from sugar cane (bagasse) is used to generate electricity to help run the sugar plants. However, converting domestic waste into energy has not been established at the country's solid waste disposal sites to help manage the growth in garbage generation. In response to this situation the Ministry for Science, Technology, Energy and

Mining (MSTEM) is working on a draft policy on "Energy-from-Waste". The policy intends to promote the use of the organic waste stream to generate electricity and biogas and produce by-products such as fertilizer and liquid filtrates.

An important driver of the waste-to-energy initiative is the Petroleum Corporation of Jamaica (PCJ). In 2011 it assessed the feasibility of developing two waste-to-energy projects involving the construction of two facilities designed to convert organic waste by thermal mass burn incineration. It concluded they were feasible and would make important contributions to:



- Enhancing waste management capacity;
- Improving public health and safety at the sites and in general;
- Diversifying Jamaica's energy mix to reduce dependency on conventional oil and coal power stations.

Decisions on these plants are expected following the finalisation of the draft Waste-to-Energy policy in 2014, together with a review of the current legal framework concerning waste management, given there are questions about ownership of the waste stream, where such facilities should be installed and whether the incineration of waste should be considered a “green energy”.

Another waste-to-energy initiative that has gained interest since 2011 has been the installation of bio-digesters. This technology converts organic waste (human waste can also be used) through anaerobic digestion. The Scientific Research Council (SRC) has been at the forefront in developing this technology in Jamaica. A private company (CaribShare) has also confirmed it has plans to build the country’s first urban bio-digester to provide at least 2,000 MWh of electricity per year to a housing development in Kingston.



Composting: this uses micro-organisms or worms (vermin-composting) to break down organic matter into rich soil. The NSWMA claims that if most households did composting on a regular basis, there would be far less pressure on the country’s landfills given organic domestic waste currently accounts for an estimated 70% of all waste at the landfills. In addition, the need for waste-to-energy projects would be far less. However, composting is not widely practised, because many people have a preference for burning their garden waste and binning their food waste.

Nevertheless, the NSWMA has continued to develop its composting capacity since it first began composting in 2009 at the Riverton and Retirement Disposal Sites. For example, in 2012 the NSWMA signed an agreement with the Japan International Cooperation Agency (JICA) to improve and expand its composting facility and to improve capacity in compost and landfill management. Currently, the Parks and Gardens Division of the NSWMA claims its composts are now 100% natural and uses them on a daily basis in public green spaces and the gardens of government buildings in the interest of saving money. It also promotes composting through its website noting that compost:

- ✓ Adds organic matter and improves soil structure;
- ✓ Provides valuable plant nutrients and trace minerals and promotes plant root development;
- ✓ Lessens reliance on synthetic fertilizer;
- ✓ Saves and manages water thereby improving soil porosity, drainage and aeration;
- ✓ Increases plant tolerance to drought conditions;
- ✓ Increases plant resistance to certain diseases;
- ✓ Organic compost has proven to be more effective than raw manure as the latter can re-infect livestock with internal parasites, bacteria and viruses.

Source: NSWMA

Liquid fertilizers and bio-pesticides: the production of low-cost and environmentally friendly liquid fertilisers is applied in the sugar and distillery industries to help manage their sludge waste. Indeed, the sugar industry is able to make considerable costs savings by recycling its sludge. There are also cases among smallholders who have also developed bio-pesticides by using farm/kitchen waste, which not only cuts input costs, but avoids handling dangerous chemicals. However, more needs to be done

to promote this cost effective technology in Jamaica.



Scrap metal recycling for export: Table 47 shows the status of scrap metal exports for 2011-2013. The large drop in exports in 2012 was due to a temporary ban on exports by GoJ in 2011. The ban was lifted following the introduction of new regulations in 2013, which require all of scrap metal dealers to be licensed and inspected regularly to ensure they are not trading in illegal metal items belonging to public or private property.

Table 47: Selected Scrap Metal Exports in Metric Tonnes (2011-2013)

Type of Scrap Metal	2011	2012	2013
Aluminium waste and scrap	369	130	679
Other ferrous waste and scrap	107,953	5,371	7,781
Alloy steel and stainless steel scrap	22	12	-
Cast iron scrap	872	-	32,670
Copper scrap	9	-	29
Other	-	-	20
Total	109,225	5,513	41,179

Source: STATIN

Environmental Codes of Practice for Industries – ISO 14001 and Codes of Practice: the National Certification Body of Jamaica (NCBJ), a legal entity of the Bureau of standards of Jamaica, has been responsible for issuing internationally recognised environmental certificates to ISO 14001 standards since 2007. The aim of these certificates is to encourage private companies to adopt environmentally friendly management practices in areas such as waste reduction, energy conservation and resource management. In return companies are able to improve their image and gain access to markets that require the certificate to do business. NCBJ had issued a total of 19 ISO 14001 certificates by 2013. NEPA has also been promoting “Codes of Practice” (COP) for the Coffee industry of Jamaica since its endorsement by the Coffee Industry Board (CIB) in 2001. The codes describe the environmental practices that are needed to ensure consistent excellence at all stages of the industry, thereby maintaining and improving the competitive advantage of Jamaican coffee.



Clean-up campaigns: Government agencies, schools, private companies and civil society groups have all continued to do rubbish clean up campaigns. However, most of these campaigns are one-off or irregular once-a-year campaigns that have only a short-term effect. One civil society group that is preparing to address this by promoting a more sustained approach to community-student-tourism partnerships is the Jamaica Environment Trust (JET), which will launch its campaign based on the slogan:

**Nuh dutty up
Jamaica!**

8.3 The Current State of Hazardous Waste Management in Jamaica (2011-2013)



Jamaica produces hazardous waste as a result of industrial activity (solvents, waste oil, heavy metals, e-waste, etc.); agricultural activity (mainly expired pesticides and their containers); commercial activity (paint, toners, asbestos, car lead acid batteries, replaced car parts, e-waste etc.); household activity (disinfectants, paints, non-biological cleaners, drugs, batteries, e-waste, fluorescent light bulbs, etc.) and; hospital and medical care (used syringes, bandages, out-of-date drugs, radio-active materials from x-ray machines, blood, disinfectants and other chemicals, etc.). However, Jamaica continues to lack an integrated hazardous waste management policy and regulations and this includes a life cycle management approach to hazardous wastes.⁷⁹

In response to this situation GoJ is in the process of developing the **Draft National Hazardous Substances and Hazardous Waste Management Policy**. Currently hazardous waste is regulated by different institutions and regulations. For example, the Environmental Health Unit within the Ministry of Health controls public health issues related to all types of waste including hazardous wastes and pesticides are regulated, managed and controlled by The Pesticides Control Authority. In addition, some large industries, such as the bauxite mining sector and petroleum-based companies are regulated by institutions specifically set up to monitor, evaluate and research their activities; namely the Jamaica Bauxite Institute (JBI) and the Petroleum Corporation of Jamaica (PCJ).

However, commercial companies are not adequately regulated and usually lack the necessary know-how to manage their hazardous waste effectively and efficiently. Furthermore, due to the added costs associated with transporting and disposing of hazardous waste safely (in particular its transport abroad for treatment and disposal), some companies resort to improper practices. These include:

- Illegal dumping of hazardous waste in the natural environment;
- Repackaging of the waste as household waste;
- Dumping of hazardous liquid wastes and chemicals into sewerage and drainage systems;
- Storing hazardous waste, such as waste engine oils, in improper and often unmarked containers in poorly secured out-buildings in urban and rural areas where children may play, or animals graze.

The impact of these practices is not fully known. However, NEPA and the Water Resources Authority (WRA) do regular water quality monitoring to determine whether heavy metals from hazardous wastes are present in the country's freshwater resources and whether they meet the national standards for freshwater (see also Chapter 6). According to WRA, there are cases where groundwater has been contaminated by hazardous waste, which has forced the closure of some wells. This situation is a cause for concern; especially taking into account a study conducted by WRA in 2007, which confirmed approximately 25% of groundwater sources were unsuitable for extraction due to high contamination levels.

⁷⁹This includes the production, packaging, storage, use, separation and disposal/shipment stages of a product's life In line with international agreements such as the Rotterdam Convention (on the importation of hazardous chemicals) and the Basle Convention (on trans-boundary movements of hazardous wastes and their disposal)

One of the most successful responses to improper practices associated with hazardous waste was the Used Lead Acid Battery project (ULAB project). The project was promoted by the GoJ in 2005 in response to the growing problem of informal recycling of ULABs⁸⁰ and has since led to the development of an export industry for this waste that complies with the Basel Convention.

⁸⁰There were over five million ULABs imported into Jamaica in the period 1994-2004 in which time backyard stockpiling and smelting of lead grew steadily (NEPA/NSWMA).

Table **48** summarises the quantity of ULABs exported in the period 2011-2013 with official permits granted by NEPA.

Table 48: Quantity of Lead Acid Batteries and sulphate Exported in Metric Tonnes (2011-2013)

Type of Waste	No. of Permits	2011	No. of Permits	2012	No. of Permits	2013	Total Permits	Total Exported
ULAB	8	5,871.30	4	3,744.20	3	1,738.00	15	11,353.50
Lead Sulphate	-	-	1*	613.60	-	-	1	613.60
Total	8	5,871.30	5	4,357.80	3	1,738.00	16	11,967.10

Source: NEPA; * Permit also allowed the export of 581.4 MT of ULABs, which have been included under "ULAB"

The main finding from

Table 48 is that almost 12,000 MT of lead acid and lead sulphate have been safely removed from the environment and transported abroad in conformity with the Basel Convention between 2011 and 2013. This has contributed to safeguarding public health and the natural environment and at the same time helped to generate foreign exchange.

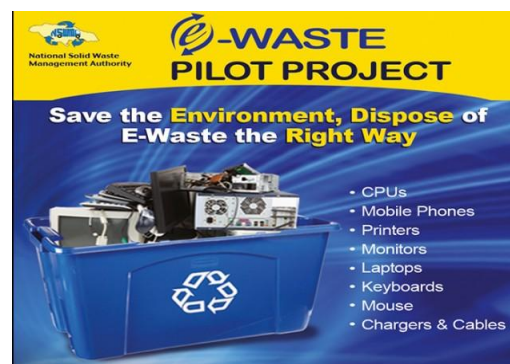


Medical waste: the Ministry of Health (MOH) estimates a total 1,596MT of medical waste is currently generated in Jamaica (2012), of which 83% is produced by its public health care facilities such as hospitals and clinics. The Environmental Health Unit within the Ministry of Health (MoH) is responsible for supervising the management of medical waste and its disposal in accordance with the **Draft Medical Waste Policy** (2006). Throughout Jamaica, excluding Kingston, waste disposal continues to depend on aging incinerators and burn boxes. These incinerators are known to emit dioxins, furans and volatile organic compounds which are dangerous to public health. Furthermore, MoH confirms that due to the limited capacity of these incinerators, there is an urgent need to replace many of these incinerators.

In Kingston, the disposal of medical waste has improved since November 2012, due to the opening of the National Medical Waste Management Plant at a cost of approximately US\$3 million. The plant is the first of its kind in the country to use a non-incineration automated system to treat medical waste, which involves steam sterilisation of medical waste followed by shredding to reduce waste volume and facilitate safe handling prior to disposal. The added environmental and social benefit of the plant is the absence of toxic emissions of the above-mentioned compounds. The MoH currently treats around 65,000 kg. of medical waste per month and covers approximately 60% of medical waste in Kingston and St. Andrew.

The opening of the new plant has been a factor in the MOH's decision in 2013 to review the current draft policy on medical waste management in the interests of producing a new one based on the principles of waste minimisation, waste segregation and establishment of regional waste collection and treatment facilities that are environmentally sound. The new draft policy will be finalised by 2015.

Electronic waste (e-waste): in 2011 GoJ agreed to develop a policy to manage electronic waste in recognition of the growing problem of discarded electrical items, such as broken-down domestic appliances, computers, printers, mobile phones, etc. The policy will place importance on the refurbishing of top grade e-waste and recycling of their metals, which include small amounts of copper, silver, gold, platinum, copper and rare metals. Development of the draft policy is on-going and scheduled to be finalised in 2014. The NSWMA has plans to start a six-month pilot project to collect e-waste in 2014 to test, among other things, the logistical needs of managing e-waste.



CAUTION PESTICIDES

Obsolete pesticides and pesticide containers: The Pesticides Control Authority (PCA), a statutory body under the MOH and governed by the **Pesticides Act**, is responsible for regulating the control and usage of pesticides, as well as the storage and disposal of obsolete pesticides (expired pesticides). Jamaica has limited facilities to store these highly hazardous materials. In response, the PCA signed an agreement with the Food and Agriculture Organisation (FAO) in 2013 to eliminate all stocks of obsolete pesticides on the island. To do this training will be provided to prepare the hazardous waste for international shipment in line with the requirements of **The Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations** (2002), which governs the trans-boundary shipment of hazardous wastes in line with the Basle Convention.

FAO and the PCA estimate two large ship containers will be needed to transport the waste (weighing around 60 MT). However, before this can be done FAO will train the PCA on how to package, correctly label and store the obsolete pesticides, which is compulsory before they can be transported out of the country to a registered company that has a high temperature hazardous waste incinerator.

The disposal of obsolete pesticides forms an integral part of a wider programme by FAO to enhance capacity in the management of the whole life cycle of pesticides including their containers, for which Jamaica has no specific facility or clear policy to date. In addition, the issuance of permits by NEPA to companies who wish to export all hazardous materials will be strengthened.

8.4 The Current State of Wastewater Management in Jamaica (2011-2013)



the distribution of STPs in Jamaica.

There are currently a total of 234 sewage treatment plants (STP) monitored by NEPA throughout the country (2013). A total of 73 STP were under the management of National Water Commission (NWC), the statutory body responsible for providing water supply and wastewater services to the majority of the population of Jamaica. The remaining STP are owned and/or operated by the hotel sector, other government agencies, hospitals, private companies and public housing development agencies. Figure 35 at the end of this Chapter shows

NWC treatment plants have capacities ranging from 0.53 million litres per day (MLD) to 39.7 MLD at the Soapberry Wastewater Plant (St. Catherine), which is the largest STP in Jamaica. Currently, NWC provides services to the following sources: domestic, industrial, rainwater and infiltration. NWC confirms approximately 500,000 Jamaicans are connected to their sewerage systems.

NEPA is responsible for regulating the effluent and sludge discharged from all sewage plants. In 2012 NEPA issued 82 law enforcement actions on sewage plant contractors and in 2013 this rose to 101. To support the regulatory process, GoJ gazetted the **Natural Resources Conservation Authority (Wastewater and Sludge) Regulations** (2013). The new regulations provide more powers to NEPA to apply the polluter pays principle (from 2014). Important new powers include the capacity to:

- Issue warnings to start the enforcement process and encourage sewage plant operators to produce a compliance plan (which would allow the temporary suspension of the enforcement process during the time it takes to improve the plant);
- Issue larger fines when warnings and compliance are not adhered to by STP owners;
- Revoke permits of sewage plant operators who continue to allow poorly treated effluent to enter river systems, which in extreme cases may also lead to prosecution in the courts for endangering public health and/or damaging the natural environment.

The regulations represent an important commitment to meeting the Protocol Concerning Pollution from Land-Based Sources and Activities (LBS Protocol), which came into force in 2010 under the Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention). NEPA also plans to increase its effluent monitoring capacity from 2 to 4 times a year. However, this will depend on forthcoming public investment reviews agreeing to cover the additional costs involved.

The number of STPs by parish/municipal council that are compliant with national standards in 2013 is summarised in Table **Table 49** and compared with data from 2010.

Table 49: Level of Compliance of Sewage Treatment Plants by Parish (2010 and 2013)

Name of Parish & Watersheds	2010			2013		
	No. of Plants	Compliant (No.)	Compliant (%)*	No. of Plants#	Compliant (No.)	Compliant (%)*
Kingston & St. Andrew(Rivers: Hope, Yallahs, Wagwater & Rio Cobre)	18	10	56%	44	9	28%
Portland(Rivers: Rencar-Buff Bay, Spanish, Swift, Rio Grande & Drivers)	7	2	29%	12	3	25%
St. Thomas(Rivers: Yallahs, Morant, Plantain Garden River, Rio Grande, Drivers)	4	4	100%	6	2	33%
Clarendon(Rivers: Milk River, Rio Bueno, White & Rio Minho)	20	7	35%	21	3	14%
Manchester(Rivers: Black, Gut-Alligator Hole, Milk & Rio Bueno-White River)	6	2	33%	8	3	38%
St. Ann	20	14	70%	25	9	36%

(Rivers: Rio Bueno-White River)						
St. Catherine (Rivers: Rio Cobre, Milk River)	33	9	27%	51	9	18%
St. Mary (Rio Bueno-White, Oracabessa- Pagee, Rio Nuevo, Wagwater Pencar-Buff B.)	8	3	38%	12	4	33%
Hanover(Rivers: South Negril-Orange, Cabarita, Lucea & Great River)	7	3	43%	6	3	50%
St. Elizabeth(Rivers: Black River Gut- Alligator Hole)	4	2	50%	6	1	17%
St. James(Rivers: Great River, Black River, Montego River, Martha Brae)	17	6	35%	21	7	33%
Trelawny(Rivers: Martha Brae, Rio Bueno- White River, Black)	6	1	17%	8	1	13%
Westmoreland (Rivers: S. Negril-Orange, Dean's Valley, New Savannah, Black & Great)	15	3	20%	14	5	36%
TOTAL	165	66	40%	234	59	25%

Sources: Environmental Health Unit, Wastewater Status Report Jan. to Oct. 2010, Environmental Health Unit and Wastewater Results 2013, NEPA Sewage Results Database Red = non-compliant (0-29.9%); orange = close to maximum standards (30-69.9%); green = compliant (over 70%). # The total includes plants for which there is no data for 2013; * Note: the compliance percentage was calculated using the number of plants for which there was data (not the total number of plants)

Table 50 summarises the number of STPs by owner category that are compliant with national standards in 2013 compared to 2010. The national standards can be found in Table 27 in Chapter 6.

Table 50: Summary of STPs Level of Compliance by Owner Category (2010 and 2013)

Name of Owner/Operator	2010			2013		
	No. of Plants	No. Compliant	Compliant (%)	No. of Plants	No. Compliant	Compliant (%)*
NWC	66	17	26%	73	3	4%
Hotel	28	17	61%	26	14	54%
Government	38	14	37%	36	10	33%
Hospitals	9	0	0%	5	1	25%
TOTAL	141	48	34%	139	28	20%

Source: Environmental Health Unit, Wastewater Status Report for January to October 2010 and Environmental Health Unit, Wastewater Results 2013, NEPA Sewage Results Database; # The total includes plants for which there is no data for 2013; * The compliance percentage was calculated using the number of plants for which there was data (not the total number of plants); Red = non-compliant (0-29.9%); orange = close to maximum standards (30-69.9%); green = compliant (over 70%);

The main findings from **Table 49** and **Table 50** indicate that:

- 1) Compliance levels have declined since 2010 at the majority of STPs. On average only one in four STPs meet national standards;
- 2) NWC's performance in this area has been particularly poor and the trend suggests there are too many redundant STPs still in operation. This is confirmed by NWC's plan to rehabilitate up to 44 sewage treatment plants for the period 2011-2013 (SOE 2010). In many cases this has not yet happened;
- 3) The hotel sector has the best performance for compliance. Nevertheless, there are still an 46% of hotels that are not compliant, which indicates application of the polluter pays principle will be necessary from 2014 to encourage investment in this sector, or face hefty fines;
- 4) The hospital sector maintains very poor performance. The indications are that new plant, or alternative ownership will need to be assessed and an alternative found in 2014-2015.

In terms of reported improvements to the STPs, the main progress to end of 2013 was as follows:

- Overhaul of the Port Antonio (Portland) sewage and drainage systems was agreed in 2012 with a contract valued at J\$1.65 billion over three phases. Work on the first phase is in progress.
- A new sewage treatment plant at Turtle Crawl (Portland) has been agreed. It will be connected to the Port Antonio system. The cost is included under the J\$41.66 billion contract just mentioned. Work is in progress.
- An agreement has been signed to improve the Harbour View sewage treatment plant starting in 2014.
- Road sewerage improvements have been carried out in Kingston and St. Andrew and other towns islandwide.
- The new Soapberry sewage treatment facility has continued to work efficiently since its inauguration in 2007. However, the NSWMA has reported regular abuse through the illegal dumping of hazardous liquids into the system, which requires a communication response together with improved enforcement.

Disposal of sewage sludge: The disposal of sewage effluent and sludge following treatment is now regulated by NEPA under the **Natural Resources Conservation (Wastewater and Sludge) Regulations** (gazetted in April 2013, under the NRCA Act). The Regulations make it mandatory for anyone who wishes to dispose of sewage sludge, or discharge trade or sewage effluent into rivers or the sea to have a licence. The issuing of licences enables NEPA to enforce the taking of samples of effluent and sludge at the end of the treatment process by operators and to ensure adequate operation and maintenance of treatment plants. Where necessary, this may include the implementation of a compliance plan.

Sludge to energy: NEPA is looking at reviewing current policy and regulations in the interest of promoting public-private partnerships in sludge-to-energy projects given that there is a rise in the use of sludge by some industries, such as the cement industry. This would also help meet international obligations such as the **LBS Protocol** and reduce the disposal of treated sludge at the country's landfill sites.

8.5 Conclusion and Recommendations

The 2011 to 2013 period has witnessed some important developments in addressing Jamaica's need to improve the management of solid, hazardous and liquid waste. Most significant has been the move to introduce more licences and permits to control the way waste is managed and transported. For example, the ban on scrap metal recycling for export in 2011 allowed time to prepare new regulations that require all scrap metal merchants to be licensed to handle scrap metal and undergo inspections.

There is also an on-going review taking place to prepare the Draft National Hazardous Substances and Hazardous Waste Management Policy. Also significant is the gazetting of the Natural Resources Conservation Authority (Wastewater and Sludge) Regulations in 2013. These regulations will support national efforts from 2014 to upgrade the sewage treatment system applying, where necessary, compliance plans as part of its application of the polluter pays principle.

There are other important developments such as the installation of new facilities to treat hospital waste in Kingston and St. Andrew and raw sewage in Portland. The PCA is also making preparations to export of the country's stockpile of obsolete pesticides for incineration and safe disposal abroad with support from FAO and ULAB exports continue of – both under the terms and regulations of the Basel Convention. Nevertheless, GoJ recognises there is still a need to do a lot more to improve the way waste is managed in Jamaica, especially solid waste given that the trend in waste generation is up and several landfills have limited spare capacity.

Based on the findings in this report and latest developments concerning waste management policy the following conclusions and recommendations are made:

- 1) The current policy framework for solid waste management does not establish a fully integrated approach to the way the waste hierarchy should be applied, managed, monitored and controlled.

Recommendations

- a) Draft an integrated solid waste management policy and introduce appropriate regulations as a government priority to support the application of the waste hierarchy in which targets are established on the percentage of total solid waste that is to be reused, recycled and disposed by 2030.
- b) Ensure that the policy provides clear provisions on the involvement of citizens in preventing, reusing and recycling of waste based on the sorting of waste at source.
- c) Ensure the new policy is supported by new provisions in the Containerisation Act to guide citizens on the storing of waste in appropriate containers that are colour coded.
- d) Establish the national provisions necessary to allow for the privatization of all solid waste collection, starting with pilot projects to identify lessons learned and best practice to consolidate the legal and regulatory framework for private solid waste collection services in all areas, including informal settlement areas (squatter settlements).
- e) Ensure a sustainable financial mechanism is in place to implement the proposed integrated solid waste management policy and apply effective enforcement to help improve the quality of public service delivery.

- 2) The current state of many of Jamaica's solid waste disposal sites is critical and there is currently no sanitary landfill site in Jamaica.

Recommendations

- a. Along with the development of the proposed integrated waste management policy, identify new sanitary landfill sites to replace the solid waste disposal sites and identify external donor finance to support the establishment of at least one sanitary landfill site to manage all aspects of the solid waste hierarchy. This should be, focused on prevention, reuse and recycling, with the latter developed as a means to generate income for the NSWMA. Such income streams include the production of compost, wood chippings and the sale of valuable metals, high-density Polyethylene plastics and paper to the recycling industry.
 - b. Assess the opportunities for establishing a public-private partnership to manage the new sanitary landfill site proposed as well as improve the current management of the country's other solid waste management sites that are in a critical state.
 - c. Identify a suitable donor or donors to provide co-finance to implement the new sanitary landfill project and finance the purchase of a priority list of equipment to improve the management of waste. This includes waste oil (specific containers), tyre and other voluminous waste that needs to be broken down (shredders and compacters etc). Income could also be generated from recycling (compost boxes, scrap metal containers, etc.) to help offset costs of operation and maintenance at the sites.
 - d. Assess the feasibility of developing a waste to energy project based on a reliable organic waste stream in one of the country's wasteshed in order to reduce the country's dependency on oil imports to generate energy (see also Chapter 10).
- 3) There is limited capacity and investment in the management of hazardous wastes in Jamaica, especially concerning the commercial sector.

Recommendations

- a) Ensure the Draft National Hazardous Substances and Hazardous Waste Management Policy is in keeping with the provisions in the proposed integrated solid waste management policy proposed above, and focuses on applying lifecycle thinking to hazardous waste streams such as pesticides and cleaning agents.
 - b) Support the implementation of the Draft National Hazardous Substances and Hazardous Waste Management Policy by providing specific training of trainers and the provision of equipment necessary to develop lifecycle thinking and storage of hazardous waste. This includes the separation, safe packaging and storage of hazardous wastes to be exported abroad for recycling or high temperature incineration.
 - c) Identify the most sustainable financial option available to implement lifecycle thinking within the private sector (industrial and commercial), including the introduction of incentives to apply cost effective solutions to implement lifecycle thinking.
 - d) Ensure adequate financing is in place to apply the polluter pays principle to commercial operators who fail to clean up their act on hazardous waste management.
- 4) The current monitoring of wastewater effluent and sludge by NEPA is based on bi-annual sampling and there is no index in place to rank the best and worst performing STPs in the

country.

Recommendations

- a) Establish quarterly sampling of treated effluent at all priority sites.
 - b) Establish a centralised database on all water quality monitoring and establish an index to rank the country's sewage systems and identify priority sites where quarterly monitoring is needed.
 - c) Provide training of trainers to develop the enforcement arm of NEPA in the interests of applying the polluter pays principle more effectively. The aim should be to secure new investment in wastewater treatment as an alternative to the revocation of licences (where there is compliance by the operator).
- 5) There remains a low level of public awareness on the effects of poor waste management and the benefits of applying the waste hierarchy, in particular the need to reduce, reuse and recycle waste.

Recommendations

- a) Support the development of a national communication strategy to promote waste prevention, reduction and reuse/recycling based on the waste hierarchy and lifecycle thinking in the case of hazardous substances and waste.
- b) Focus the communication strategy on the commercial sector and youths aged 12 to 25 years at schools and higher education establishments.
- c) Assess ways of establishing sustained partnerships with civil society and the private sector for reducing waste generation, promoting recycling and the reuse of waste through initiatives (such as producing knick-knack jewellery); and training community wardens to help stop illegal dumping and burning of waste.

Useful Links and References:

Information about the NSWMA and the National Solid Waste Management Act (2001):

<http://www.nswma.gov.jm/index.php>

Information about the environmental education initiatives of the NSWMA (2013-14):

http://www.nswma.gov.jm/NSWMA_Newsletter_JanJune2014.pdf

Information about the Recycling Centre at the Jamaica Environment Trust

<http://www.jamentrust.org/education/recycling/recycle-depot.html>

How to make your own garden compost and save money:

1) Video on how to use your plastic bottles to make incredible kitchen gardens:

<https://www.youtube.com/watch?v=-uDbjZ9roEQ>

2) Information on how to make compost, liquid fertilisers and bio-pesticides using kitchen waste:

http://www.bbc.co.uk/gardening/htbg/module7/making_your_own_compost1.shtml

<http://www.motherearthnews.com/organic-gardening/gardening-techniques/liquid-fertilizers-zm0z11zhun.aspx?PageId=2>

<https://www.youtube.com/watch?v=yQjVOFDH3S0>

<http://tech4agri.com/2013/02/12/vermitechnology-an-introuction/>

The Environmental Codes of Practice of the Coffee Industry of Jamaica

http://www.nepa.gov.jm/symposia_03/Policies/COPCoffeeIndustry.pdf

Maps:

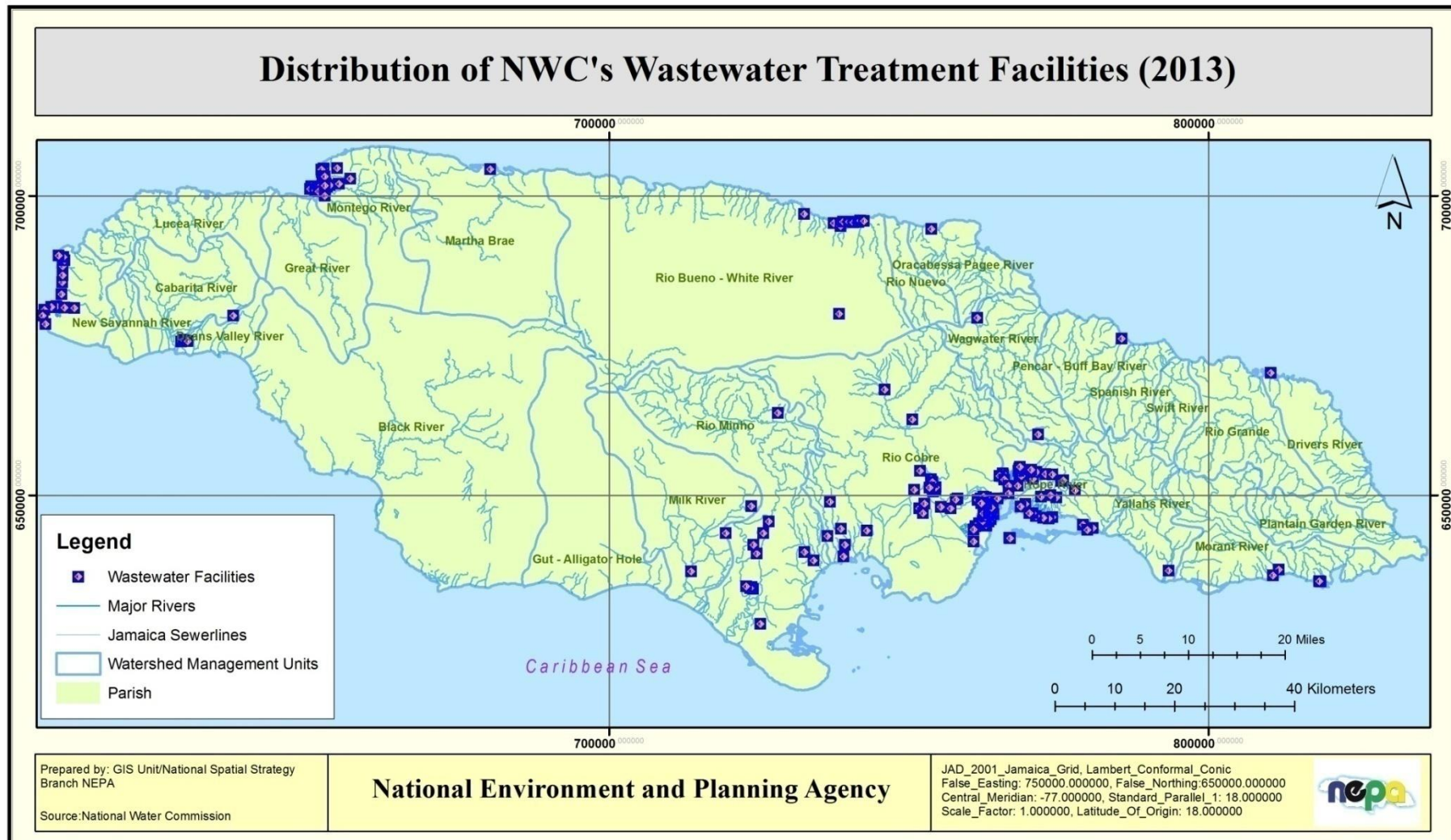
Figure 35: National solid waste disposal locations and their wastesheds (2013)

Figure 36: Location of NWC's Wastewater Treatment Facilities in Jamaica (2013)

Figure 35: National Solid Waste Disposal Locations and Their Wastesheds (2013)



Figure 36: Location of NWC's Wastewater Treatment Facilities in Jamaica (2013)





9. Town and Country Planning and Key Development Sectors

What is town and country planning (TCP)? This is a system of government planning used to plan how land should be used, balancing economic development and environmental quality (Collins Dictionary). TCP is a dynamic process because of the changing needs of citizens and their social and economic behaviour which results in the need to allocate land to accommodate new industrial, commercial and residential development. Town and country planning in Jamaica is governed by The Town and Country Planning Act - TCPA (1957).

What are Development Orders? To implement the TCPA Development Orders (DOs) are required. DOs prescribe the type of development which can take place in a defined area (such as a parish). The main aim of DOs is to guide orderly, balanced and sustainable development. However, before any such development can take place planning permission must be approved by the national/local authorities who are responsible for regulating building and planning approvals. The Town and Country Planning Authority is responsible for preparing DOs after consultation with the Local Authority.

What is spatial planning? Spatial planning goes beyond land use issues by focusing on the allocation of resources and investment in line with national development goals. In Jamaica these goals are established in the *Vision 2030 Jamaica* and supported by outcome indicators. Preparation of the National Spatial Plan (NSP) is the responsibility of the Prime Minister's Office. The NSP aims at providing the framework for Jamaica's development to 2030. Major issues in the NSP include improvements to infrastructure, regeneration of communities (including disadvantaged communities) and improving natural resources management in which disaster risk reduction and adaptation to climate change are fully integrated.

Why is the planning system important? The planning system has a profound impact on the quality of life, because its outcomes influence the quality of both the built and natural environments. For example, sound and effective planning can increase the value of property, enhance investment that creates jobs and promote civic pride and identity. The planning system also encourages the participation of members of civil society to voice their opinions and views on development issues and planning permission. This exercises democracy and promotes social inclusion.

What are the key development sectors? Key development sectors refer to those identified in the *Vision 2030 Jamaica* that are central to the country's economic growth and social development, but which place significant pressure on natural resources. For the purposes of this report, the following key sectors are assessed within the planning system framework:

- Mining and quarrying
- Agriculture
- Tourism
- Construction (transport, works and housing)

9.1 Background to Town and Country Planning

Jamaica's planning system is mainly governed by the **Town and Country Planning Act (TCP Act)**, which was promulgated in 1957. It established the Town and Country Planning Authority (TCPA) together with Advisory Planning Committees and Local Planning Authorities to guide and control development in Jamaica. The Act defines development as, *"The carrying out of building, engineering, mining, or other operations in, on, over, or under land or making of any material change in the use of any buildings or other land"*.⁸¹

A central component in the TCPA is the preparation, confirmation and modification of **Development Orders (DOs)** to guide and regulate the types of development to be permitted within a specific boundary (mainly at the parish/municipal level). The confirmation of a DO was seen as an important prerequisite to guide Local Planning Authorities in the granting of planning permission and in supporting elaboration of local development plans (LDPs). The majority of DOs were prepared and promulgated in the 1960s. Table 51 below provides a summary of the current status of DOs in Jamaica to 2013.

The first attempt at spatial planning to guide national development over the long-term was the elaboration of the **National Physical Plan (NPP)** for Jamaica 1970-1990. This was subsequently updated for the period 1978-1998 to include proposals for a **National Development Strategy (NDS)**, in which key sectors such as Agriculture, Housing and Tourism were addressed. In addition, the NPP included a **National Settlement Strategy (NSS)** designed to control urban sprawl and promote efficient and sustainable towns.

However, by the mid-1990s it was clear the planning system had several deficiencies with regard to national spatial planning issues. In 1996 the **Draft National Land Policy** was launched to provide the, *"framework to enhance the efficient planning, management, development and use of land...in order to achieve complementary and compatible development which is in harmony with economic and socio-cultural factors."*

However, by the turn of the new millennium it was apparent that the planning system had limitations and gaps in making the appropriate spatial links between land use planning and the economic development path of the country. These limitations included:

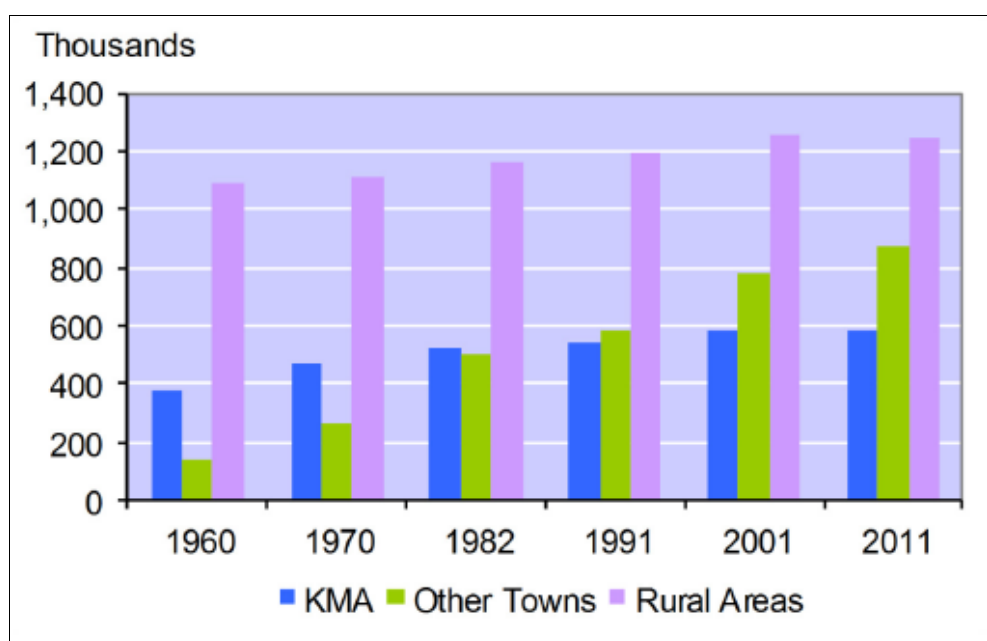
- Inadequate resources and capacity within the planning system to implement and modify development plans and DOs in line with the socio-economic transformation of the country since the 1960s. One example is the steady rise in population growth, especially in the parish capitals (Other Towns) as can be seen in Figure 37 below.
- Weak synergies between policies, strategies, plans and budgets, which contributed to high rates of development outside of the formal planning system. It was that estimated informal development accounted for 50-70% of all development in Jamaica.⁸²
- The lack of a formal national spatial plan to guide development over the long-term.⁸³
- Absence of targets, indicators and monitoring to track progress towards objectives.
- A large number of public agencies with their own planning powers, some of which overlapped and, in some cases conflicted, with the provisions in the TCP Act.⁸⁴

⁸¹ Section 5 (2) of the TCPA

⁸² The National Land Policy, 1996, p. 1.

⁸³ Towards Strategic Spatial Planning in Jamaica, NEPA, 2011

⁸⁴ **Vision 2030 Jamaica**, Urban Planning and Regional Development Sector Plan, p.10

Figure 37: Population Growth in Jamaica (1960-2011)

Source: STATIN

In 2001 GoJ responded to this situation by merging the Natural Resources Conservation Authority (NRCA), the Town Planning Department (TPD) and the Land Development and Utilization Commission (LDUC).⁸⁵ The aim was to bring the following laws under one roof (through the establishment of NEPA) in the interest of coordinating environmental, planning and land development policies:

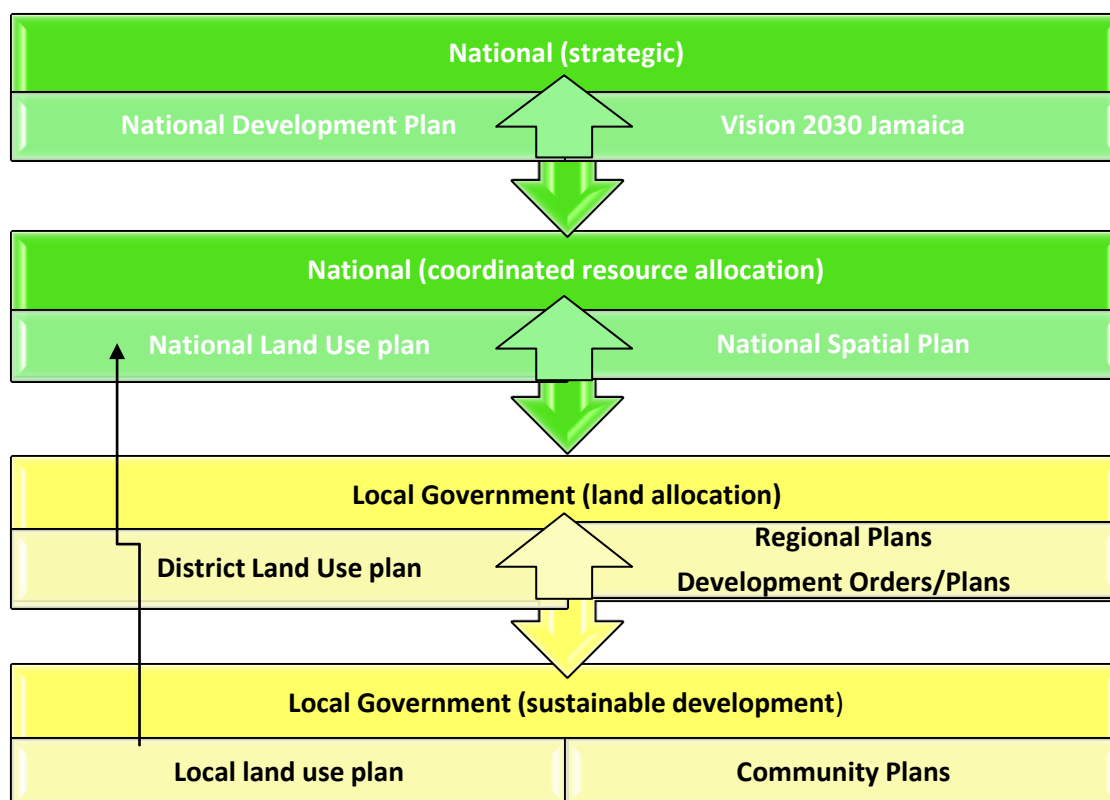
- **Beach Control Act (1956);**
- **Watershed Protection Act (1963);**
- **Wildlife Protection Act (1945);**
- **Natural Resources Conservation Authority Act (1991);**
- **Town and Country Planning Act (1957) and;**
- **Land Development and Utilisation Act (1966).**

Nevertheless, to secure a more robust and integrated policy and legislative framework for the above-mentioned institutions, a number of reforms were suggested within government:

- Repeal of the Land Development and Utilisation Commission Act;
- Establishment of a National Environment and Planning Agency (NEPA) Act;
- Review the Town and Country Planning Act and update all DOs by 2013;
- Establishment of an Environment Act.

In 2010 a Green Paper proposed the creation of an Environmental Regulatory Authority (ERA) to assume the duties of environmental monitoring and enforcement carried out by NEPA and proposed enhancing NEPA's role in the promotion of environmental education and awareness-related actions. It also proposed elaborating and implementing a **National Spatial Plan (NSP)** and **National Spatial Strategy (NSS)**. Figure 38 shows where the NSP (and NSS) was intended to fit within the planning process in Jamaica.

⁸⁵ The NRCA and the LDUC

Figure 38: Alignment of the Planning Process with the *Vision 2030 Jamaica*

Source: NEPA (based on FAO's Development Series 1, 2011)

Meanwhile, the Planning Institute of Jamaica (PIOJ) was entrusted with preparing the **Urban Planning and Regional Development Sector Plan 2009-2030** (Sector Plan)⁸⁶ with the participation of a number of government agencies, including NEPA. The overall aim of the Sector Plan was to set out how urban planning and regional development would contribute to implementing ***Vision 2030 Jamaica***.

9.2 The Current State of the Planning System in Jamaica (2011-2013)

9.2.1 The Current State of the National Spatial Plan (2011-2013)

The preparation of the NSP has progressed between 2011 and 2013 under a project financed by the Caribbean Development Bank (2010-2012). Main activities concentrated on:

- Setting a national context for spatial planning at the local level;
- Optimising the use of land and natural resources by providing a framework for making sustainable location choices;
- Improving the capacity of government to formulate, coordinate and implement integrated rural development policies and programmes that address spatially unbalanced development.

⁸⁶ A total of 31 sectors prepared sector plans to implement ***Vision 2030 Jamaica***

On completion of the NSP expected outputs include a situation analysis of spatial development and the National Settlement Strategy in Jamaica; identification of development scenarios outlining alternative strategies to reach **Vision 2030 Jamaica** goals; assessment of key economic sectors ; and identification and implementation of an Action Plan for the NSP.

Prior to the launch of the NSP activities the **National Spatial Data Management Division (NSDMD)** was established to coordinate, implement and manage national programmes and projects dedicated to the development of Geographical Information Systems (GIS).⁸⁷ One of the most significant developments in 2011-2013 has been the establishment of a **national spatial data infrastructure (NSDI)**. Currently, efforts are concentrated on the development of two portals; one for geospatial data and the other for metadata. Following their completion the NSDI will provide internet access to view, transfer, order, advertise, disseminate and store geospatial data and metadata from government, private, non-profit sources and academia.

The development of the NSDI will support GoJ efforts in a number of areas including development of the NSP and disaster risk reduction. According to a GIS Growth Evaluation Survey in 2013 (PIOJ), the number of public and private institutions that use GIS maps as an integral part of their work is increasing. Nevertheless, internal assessments indicate a number of government agencies still need to improve their GIS capacity and its use in their planning.

9.2.2 The Current State of Development Orders (2009-2013)

Progress in reviewing and updating the country's DOs in 2009-2013 is summarised in Table 51.

Table 51: Current Status of Development Orders in Jamaica to 2013

Parish/Municipality/Area	Date DO Confirmed	Status of Update*	Year Update completed
St. Thomas	1965 (Coast)	Draft (Parish)	2010
Kingston and St. Andrew	1966	Draft	2013 (on-going)
Spanish Town ¹	1964	Draft (Parish excl. Portmore)	2009
St. Catherine (Bog Walk, Linstead & Ewarton) ¹	1965		
St. Catherine	1965 (Coast) ²	To be reviewed	-
Portmore	Not applicable		
Clarendon	1982	Draft	2013
Manchester	1976	Provisional DO	2013
St. Elizabeth	1966 (South) ³	Draft	2013 (on-going)
Negril and Green Island Area	1984	Provisional DO	2013
Westmoreland (excl. Negril & Green Island)	1978	To be reviewed	-
Hanover	1962 (Coast)	To be reviewed	-
St. James	1982	Draft	2010
Trelawny	1982	Provisional DO	2013
St. Ann	2000	To be reviewed	-
St. Mary	1963 (Coast)	To be reviewed	-
Portland	1963 (Coast)	Provisional DO	2013
Total	16		10

Source: NEPA; ¹ to be updated as an integral part of the DO for St. Catherine parish; ² to be updated as an integral part of the DO for St. Catherine parish and DO for Portmore Municipal Council; ³ to be updated as an integral part of the DO for St. Elizabeth parish; * Includes updates reviewed by CPC

⁸⁷ The NSDMD is currently located within the Ministry of Water, Land, Environment and Climate Change.

The main findings from Table 51 are:

- There are 10 DOs at different stages of renewal, of which four have been gazetted and published as provisional DOs.
- The review of most DOs is focused at the parish/municipal level, which in some cases has required the merging of existing DOs that focus on a specific area of the parish (such as coastal areas only).
- Five DOs had not started the updating process by 2013. However, plans to update Hanover and Westmoreland (excluding Negril and Green Island) are scheduled to commence in 2014 with funding support from the Tourism Enhancement Fund (TEF). The DO for Portmore will be prepared together with a Sustainable Development Plan, which is being funded by the National Housing Trust).
- The target of reviewing all DOs by 2013 has not been met and a new target date is to complete draft/provisional DOs in all parishes and municipal areas by the end of 2015.
- One of the main changes in the updating process of the DOs has centred on zoning communities and state-permitted commercial activities to reduce the scope for commercial operators to set-up businesses without planning permission in residential zones.

9.2.3 Progress in the Implementation of the Urban Planning and Regional Development Sector Plan (Sector Plan 2009-2030)

The Sector Plan 2009-2030 (Final Draft) was launched in 2011 as part of the implementation, monitoring and evaluation framework for **Vision 2030 Jamaica**. The Sector Plan's vision is to achieve: *"A spatial arrangement of land use that integrates with social and economic development and satisfies the need for safety, efficiency, aesthetics and social justice."* The main goals and expected outcomes of the Sector Plan are summarised in

Table 52.

Table 52: Goals and Expected Outcomes of the Sector Plan 2009-2030

Sector Goals	Sector Outcomes
1) Comprehensive, efficient and effective planning system	1a) A strategic and integrated framework for delivering sustainable development established 1b) The role of Local Authorities in place and Plan making strengthened
2) National land-use and development planning that guides physical development and optimises scarce land resources	2) Development sectors integrated into the planning framework and create balanced and integrated development
3) Liveable, equitable and ecologically sensitive communities	3) Places where people are proud to live created
4) Vibrant and diversified rural areas	4) A process of growth and diversification in the rural economy/rural areas created

Source: **Vision 2030 Jamaica**, Urban Planning and Regional Development Sector Plan

The plan stresses that urban planning and regional development will achieve successful outcomes if there is a focus on:

- Implementation of urban growth management strategies;
- Continued reduction in poverty;
- Revitalisation of key urban centres;
- More resilient communities;
- Rural development;
- Planned infrastructural development.

The implementation of the Sector Plan is the responsibility of GoJ's main ministries, departments and agencies responsible for all sectors (economic, social, cultural, environmental and governance). Following is a summary of the progress made towards meeting the above-mentioned goals.

Goal 1: A comprehensive, efficient and effective planning system

In relation to expected outcome 1a: *a strategic and integrated framework for delivering sustainable development established* the most significant developments.

- 1) The elaboration of a common methodology to guide the preparation of Development Plans, as an alternative to Development Orders.⁸⁸
- 2) Development of the regional planning framework to facilitate greater cross-border cooperation between local planning authorities.
- 3) Identification of new planning legislation has commenced to promote a more transparent, accountable and streamlined approach to plan preparation and regular updating every five years. The new draft is planned for 2015/16 after clarifying its mandate vis-a-vis the NSP and policies and strategies relating to, among others, housing, protecting prime agricultural land and strengthening of law enforcement.
- 4) The planning framework is being adapted to respond to current and future challenges brought about by globalisation, urbanisation, demographic changes, natural hazards and climate change. This will be supported by:
 - The introduction of outcome indicators;
 - Hazard mapping to reduce vulnerability to disasters;
 - Enhancing the resilience of development to the effects of climate change;
 - Promoting low energy housing and commercial buildings;
 - Locating new development in locations that help reduce travel times;
 - Placing greater emphasis on zoning, infrastructure priorities and the concentration of public and private investment; and
 - Improving the application of development control.
- 5) The information base is being improved to support informed decision-making and aid future monitoring of land use changes and their impacts. This includes the GIS and remote sensing information being established by NSDMD and at the government agency level.
- 6) Commitments to establish greater autonomy for local authorities to approve minor development applications and save resources for more complex applications at the national level.

⁸⁸ It is envisioned that Development Plans will eventually replace Development Orders and they will be made legal instruments to provide legislative support for the Local Planning Authorities to guide sustainable development for each Parish. So far, one Parish, Manchester, has completed a Parish Local Sustainable Development Plan (LSDP) with funding support from CIDA and NHT. This plan is now being utilised as a model for the preparation of similar plans for the remaining parishes. St. Elizabeth, Westmoreland, Clarendon and Trelawny are poised to commence their local planning initiatives. They are now preparing a budget for submission to the Sugar Research Institute for funding support.

In relation to expected outcome 1b: *The role of Local Authorities in place and plan-making strengthened*, progress includes:

- 1) The establishment of sustainable development plans, which have helped refocus parish development in a more integrated fashion to promote social, economic and environmental sustainability;
- 2) The development of local policies, standards for development and the preparation of guidelines at the various local planning authorities;
- 3) The improvement of citizen participation in decision making through the strengthening of Parish and Community Development Councils (PDCs and CDCs);
- 4) However, a number of planned actions have not been achieved so far, including:
 - Intra- and inter-governmental assignments and delegation of functions and responsibilities;
 - The building of local capacity to establish a properly resourced planning services;
 - Greater financial autonomy and management of local authorities with an improved legal framework due to a lack of government resources to support these processes;
 - Difficulty in implementing the planned actions within the parish sustainable development plans due to sector-based approach system in Jamaica.

Goal 2: National land use and development planning that guides physical development and optimises land resources

Progress made in achieving the expected outcome – “*Development sectors integrated into the planning framework and create balanced and integrated development*”:

- 1) Sector policies and strategies are in the process of being updated to ensure development proceeds in an orderly and balanced manner to meet the Vision 2030 goals.⁸⁹ This is being coordinated with the elaboration of the NSP in the interests of:
 - Establishing the integration of social and economic policies with spatial planning policies so that they become mutually reinforcing; and
 - Ensuring there is a sustainable supply of land to meet current and future development needs.
- 2) Developing closer alliances between regional economic strategies and regional spatial strategies with a view to :
 - Integrating sector plans at the regional level;
 - Implementing parish development plans with a long-term development strategy;
 - Improving cross-boundary collaboration between local authorities to deal with shared problems, needs or opportunities.
- 3) Preparing the groundwork for the identification of strategic regional centres to promote more balanced regional socio-economic development. This includes:
 - Preparing more detailed urban and regional development plans within the framework of national spatial policies.
 - Improving institutional coordination on urban and spatial planning.
- 4) Communicating the importance of having economic development in sustainable locations that will benefit investors over the long-term.

⁸⁹This includes current policies relating to the Agriculture, Mining, Tourism and Construction sectors addressed in the subsections below in this Chapter

Goal 3: Liveable, equitable and ecologically sensitive communities

Progress in achieving the expected outcome – *“Places where people are proud to live”*, has mainly focused on:

- 1) Supporting the development of more effective town centre planning and policies that:
 - Allow greater flexibility in the application of mixed use development;
 - Promote spatially efficient land use and land supply to attract business and new housing;
 - Develop integrated public transport and making walking and cycling accessible in new developments;
 - Preserve historic buildings to integrate their potential in town centre redevelopment.
- 2) Promoting the establishment of safer and fairer towns, in particular:
 - Recognising the specific needs of women, children, the infirmed and disabled in planning and development;
 - Improving safety of pedestrians with sidewalks and lighting;
 - Improved water, sanitation and drainage to dispose of waste water and enhance flood control;
 - Integrating disaster mitigation and emergency plans;
 - Improved access to green space.
 - Improved access to local government decision-making and action.

The Local Planning Authority in Manchester has been particularly active in promoting places where its inhabitants are proud to live. This has included refurbishment of the childhood home of National Hero Right Excellent and former Chief Minister and Premier, Norman Manley, in Roxborough. There has also been commencement of a major project to rehabilitate the town centre with a new shopping and business development; reconstruction of the Cecil Charlton Park; and new lighting, fencing, beautification and low level curbs for the elderly and wheelchair users in the parish capital, Mandeville.

Figure 39: Town Centre Improvements in Mandeville Initiated in 2013



Goal 4: Vibrant and diversified rural areas

Progress in achieving the expected outcome – *“a process of growth and diversification in the rural economy/rural areas created”* has been limited because investment in public services and sustainable infrastructure in rural areas is primarily planned to begin 2014. Furthermore, policy on the preservation of agricultural land through agricultural zoning and issues of land tenure systems is still in discussion.

The following subsections look at how far key sectors of the Jamaican economy are aligning their policies and strategies to meet Goal 4 of **Vision 2030 Jamaica**, in particular Outcome 15: *Sustainable urban and rural development*. The subsections also take into account the meeting of Goal 2 of the Sector Plan 2009-2030: National land use and development planning that guides physical development and optimises land resources, which is a major prerequisite to achieving Outcome 15. Additionally, the Technical Review Committee, a subcommittee of the NRCA-TCPA, meets monthly to review applications for all categories of permits for development and involves stakeholders such as Jamaica Promotions Corporation (JAMPRO), JBI, Mines and Geology Division and the TCPA among others. The key sectors selected are: **Mining and Quarrying, Agriculture, Tourism and Construction**. Each subsection commences with an introduction on the current status of the sector, followed by a policy review and current state of reducing environmental impact.

9.3 Mining and Quarrying



The mining and quarrying sector accounted for about 2.2% of GDP in 2013, down from 4.1% in 2006 (MSTEM). Jamaica's share of world production of bauxite was 4% in 2013, while alumina accounted for approximately 2% of world production in the same year (MSTEM). The sector's share of GDP has declined in recent years due mainly to the drop in world prices for aluminium since the financial crisis in 2008, which led to the closure of three of the country's four alumina plants in 2009. To date only one of these three plants has reopened. In terms of employment in 2012-13, the sector employed around 4,700 permanent staff and as many as 1,500 temporary workers (equivalent to approximately 0.5% of the Jamaica's employed workforce).⁹⁰ Total estimated deposits of main minerals are shown in

⁹⁰ STATIN

Table **53** and production of main minerals in

Table 54. Figure 42 shows the location of current mining and quarrying activity in Jamaica.

Table 53: Estimated Deposits of Main Minerals in Million Tonnes (MMT) Jamaica in 2013

Mineral	Estimated Reserves*
Bauxite	1,600
Clay	160
Gypsum (incl. up to 30% anhydrite)	29
Limestone (Dolomitic)	2,700
Limestone (whitening grade)	1,115
Limestone (chemical, industrial grade)	5,750
Alluvial sand and gravel	600
Black Sands (incl. iron & titanium oxide)	19
Marble	-
Aggregate (skid resistant)	1,401

Source: MSTEM; * to qualify as a mineral deposit it must have been demarcated and there are quantifiable data relating to tonnages, mineral type, etc.

Table 54: Production of Main Minerals in Metric Tonnes (2010-2013)

Mineral	2010	2011	2012	2013
Bauxite*	4,303,442	5,143,463	4,759,647	4,707,375
Alumina	1,575,312	1,959,238	1,753,505	1,901,753
Clay	5,000	4,200	30,600	12,000
Gypsum	147,100	79,500	64,800	48,300
Limestone	1,956,100	2,451,000	2,232,600	1,949,400
Alluvial sand and gravel	2,750,000	2,475,200	2,589,900	1,902,400
Silica sand	13,000	14,000	13,900	15,800
Marble	-	100	100	100
Pozzolan	139,500	130,400	107,200	112,300
Marl/Fill	2,155,000	1,140,200	1,186,000	1,197,600
Shale	202,300	226,900	250,500	205,300
Total	13,246,754	13,624,201	12,988,752	12,052,328

Source: Mines and Geology Division/MSTEM; * Includes bauxite equivalent of alumina and crude bauxite

Table 54 confirms that there has been a decrease in production of most minerals between 2010 and 2013. However, there was an increase in the number of quarrying licences.

Table 55: Number of Licensed Quarries in 2005, 2010 and 2013

No. Licensed Quarries (2005)	No. Licensed Quarries (2010)	No. Licensed Quarries (2013)
218	243	281

Source: MSTEM

Quarrying associated with the increase in licences are related to limestone, sand and gravel. These minerals are widely used in the construction sector. In addition, licences have been granted to quarry whitening grades of limestone (calcium carbonate), which is particularly sought after by the toothpaste industry.

9.3.1 Policy Responses to Achieve Outcome 15 of *Vision 2030 Jamaica to 2013*

Legislative and policy developments: the legal framework governing mining is provided in the **Mining Act (1947) and Regulations** (amended 2004). All quarrying operations in Jamaica are governed in accordance with the **Quarries Control Act (1983)**. In 2013 a bill to amend the Quarry Act was submitted to Cabinet. The amendment calls for improving the relationship between quarrying and other forms of land use and promulgating legislation and regulations to improve controls on the illegal transportation, storage and trade of minerals.

The **Draft National Minerals Policy 2010-2030** guides the development and operation of the mining and quarrying industry. However, in response to **Vision 2030 Jamaica** and the launch of the Sector Plan, the Ministry for Science Technology Energy and Mining (MSTEM) commenced a review of this policy. Currently the new draft policy for the period 2014-2030 is nearing completion with support from the Inter-American Development Bank. The objectives of the new draft policy will focus on:

- Establishing an integrated and efficient minerals industry which promotes economic development and adds value to the Jamaican economy.
- Improving environmental integrity and socio-cultural values to ensure conformity to the Sector Plan 2009-2030 while avoiding mineral exploitation in areas protected under different laws. Such legislation includes the policy for the National System for Protected Areas (which specifies no mining in protected areas where there are endangered species on the IUCN Red List (see also chapters 1 and 3);
- Improving human resource capabilities.
- Stimulating sustainable rural development through the development of linkages with other sectors.

The Draft National Minerals Policy 2010-2030 also addresses ways of establishing a fully sustainable mining and quarrying sector to promote long-term economic growth in the rural sector and for the national economy as a whole. This implies the establishment of a more responsible, cleaner and integrated mining industry within the wider economy.

9.3.2 Progress in Reducing Environmental Impact to 2013

The mining and quarrying industry is currently in the process of implementing the following actions, some of which are already incorporated in the current National Minerals Policy 2010-2030, but which will be given added impetus:

- Encouraging investment in cleaner technology to reduce energy consumption, water needs, solid and liquid waste and lower emissions to improve competitiveness.
- Improving the management of mineral resources through effective land management, orderly extraction and the use of tailings (ore waste) in order to reduce losses of the resource base, protecting biodiversity and diversification (such as the potential extraction of rare metals from red mud waste produced by the Bauxite industry).
- Identifying (and gazetting) mineral development zones and ensuring they are integrated in the development planning process as prescribed in the Sector Plan.
- Encouraging investors to enhance their corporate commitment to high environmental and ethical standards (adoption of best practice from developed countries).
- Adopting international best practice on reducing environmental impact and improving health and safety (where is suitable and relevant to Jamaica).
- Enforcing “Life of Mines Plans” to ensure they are implemented correctly during and post

mining operations, with particular emphasis given to improving land reclamation⁹¹ and infrastructure following mine closure.

- Establishing community-based committees to improve relations between the local communities and the mining companies and to channel part of the profits of the mining industry into local environmental and social projects.

Other related initiatives include:

- The production of geo-chemical maps by the International Centre for Environment and Nuclear Sciences (ICENS) at the University of the West Indies (as reported in SOE 2010). The maps provide information on the distribution of heavy metals (especially on cadmium) and are currently being used to assist urban and rural planning as well as sector planning (in particular the Ministry of Agriculture and Fisheries).
- The preparation of the Hillside Development Manual for Jamaica (to be published in 2014). The manual sets out guidelines for improving hillside development practices in Jamaica with the objectives of reducing human vulnerability to disasters, preserving the natural environment and safeguarding mineral deposits from informal settlers and squatters by promoting methods to minimise the risks associated with hillside development. These risks include landslides, debris floods and erosion that destroy the natural and aesthetic quality of the environment.

Compliance with environmental laws: NEPA plays an important role in regulating the mining and quarrying sector to ensure that it complies with environmental laws, in particular the NRCA Act (1991). One of its main functions is to review the environmental aspects of quarry licence applications submitted under the Quarries Control Act.⁹² MGD provides technical support to the Quarries Advisory Committee. The consultative relationship between MGD, NEPA, WRA, MoH, NWH, Parish Councils and other government institutions facilitates law enforcement against practices that produce negative environmental impact that goes beyond national standards and regulations.

With respect to the Bauxite/Alumina Industry, a Memorandum of Understanding (MoU) was updated and signed between the NRCA and JBI in 2013 to replace the original MoU signed in 1994. The MoU delegates environmental monitoring of the industry to the JBI. In addition, the MoU allows JBI to play a technical role on a number of committees, including the Air Quality Evaluation Committee and the Technical Review Committee to deliberate on the process of Development Approvals.

The issuing of mining permits by MGD represents an important means of regulating the Bauxite/Alumina Industry where the production of red mud waste is a problem. A number of permits were issued for changes to the red mud disposal sites, such as dyke lifts, new storage areas and effluent containment. Specific conditions were included for impact mitigation and monitoring. With respect to closure planning, The JBI has been the central coordinating agency for administering the closure plan for red mud areas. This may involve establishing a vegetation cover (phyto-stabilisation), which was executed at a number of sites at Kirkvine and are now complete, and is now listed as an



⁹¹ The current practice of laying top soil over red mud deposits and then grassing has not always been successful considering that the water retention of the top soil can be compromised. Grassing alone also leaves the top soil open to erosion in the rainy season.

⁹² Applications are also reviewed by other government institutions, such as WRA, MoH and the relevant Local Authority

international best practice by the International Aluminium Institute.

In mined out areas there are legal requirements for lands to be certified as satisfactorily rehabilitated within 3 years of being deemed mined out by MGD. The change in the Mining regulations supports diverse end uses. The National Restoration Committee provides research and development of end use of mined out lands. This involves the establishment of pasture, forestry, agriculture, playfields, resettlement housing, construction of primary schools, etc. Current compliance levels for reclamation of mined-out lands are shown in **Table 56**.

Table 56: Amount of Reclaimed Mining Land Presented and Certified in Hectares (2010-2013)

Year	Reclaimed Land Presented for Certification	Land Certified as Reclaimed	% of Land Certified
2010	480	440	91.7
2011	628	622	99.0
2012	516	509	98.6
2013	657	656	99.8
Total	2,281	2,227	97.3

Source MGD/MSTEM

The above Table confirms that the Bauxite Industry has maintained consistently high levels of compliance in land reclamation of mined out lands between 2011 and 2013 (over 98%).

9.4 Agriculture



The Agriculture, Forestry and Fisheries sector accounted for 6.7% of GDP in 2013, which was 0.5% down from 2012.⁹³ Important export crops include sugar, coffee, bananas, citrus and pimento.⁹⁴ The number of registered farmers has decreased significantly. In 2008 the number of registered farmers was 18,522, whereas in 2013 the number was down by more than half to 7,840.⁹⁵

Employment in agriculture is composed primarily of smallholders, cooperatives and large-scale

⁹³ STATIN

⁹⁴ Citrus and coffee registered an increase in export earnings in 2013 (PIOJ).

⁹⁵ Agriculture Land Management Division, Ministry of Agriculture and Fisheries

farms and plantations. Smallholders are mainly subsistence farmers cultivating in hilly areas who have limited access to training, information and resources to develop modern sustainable farming practices. Farming cooperatives involve groups of mainly smallholders who work together to improve access to farm inputs and markets. Large farms and plantations generally occupy prime agricultural land dedicated to the above-mentioned cash crops, or to raising cattle. These farms require high amounts of chemical inputs, water and energy to operate mechanized farming methods. The long-term sustainability of this type of agricultural system is increasingly vulnerable due to the effects of climate variability and change, in particular prolonged droughts and more intense rainfall patterns (see Chapter 6).

Table 57 confirms that the fall in employment in agriculture was accompanied by a decline in the amount of active farmland from 1978 until 2008. However, this has been reversed in the period 2010-2013. By 2013 land use dedicated to agriculture had reached similar levels to 1996. Figure 43 at the end of this Chapter shows the distribution of agriculture land use in Jamaica.

Table 57: Estimated Amount of Land Use for Agriculture in Hectares (1978-2012)

Agricultural Land Use Category	1978	1996	2007	2012
Crops	311,600	177,600	149,700	No data
Pasture	230,800	95,600	45,800	No data
Total Active Farmland	311,600	273,200	195,500	-
Inactive farmland	222,200	134,200	114,400	No data
Use not reported	-	14,100	9,200	No data
Total Farmland*	533,800	421,500	319,200	-

Source: STATIN/ECLAC; * Jamaica = 1,099,000 Ha (or 10,990 km²)

The increase in land use for agriculture is mainly due to a drive by the Ministry of Agriculture and Fisheries (MOAF) to cultivate inactive farmland and promote agriculture parks (Agro Parks) from 2012. The Agro Parks support farming cooperatives to increase local production and food processing towards reducing dependency on imported crops and diversifying production away from export crops such as sugar and bananas because of the major reduction in subsidies from the EU to support the export of such crops.

Table **58** indicates that the positive trend in agricultural land use since 2010 has resulted in a corresponding increase in total domestic crop production, in particular, the production of condiments, vegetables and potatoes, despite the drop in the number of registered farmers over the same period. The Rural Agriculture Development Authority (RADA) has been particularly active in bringing about these new developments, which includes the introduction of the Agro Parks, the introduction of new farming techniques and technology transfer.

Table 58: Estimated Domestic Crop Production in Metric Tonnes (2010-2013)

Crop	2010	2011	2012	2013
Legumes	3,930	5,091	5,261	5,501
Vegetables	165,457	223,545	224,131	233,226
Condiments	34,706	44,712	46,854	52,295
Fruits	38,002	38,742	45,023	46,325
Cereals	2,626	2,968	3,121	2,996
Plantains	29,826	35,335	36,203	30,937
Irish Potatoes	11,222	15,333	15,396	17,421
Sweet Potatoes	34,512	42,091	42,165	44,224
Yams	136,785	134,620	145,059	138,834
Other Tubers	42,181	48,459	45,713	41,670
Sorrel	1,057	1,212	1,213	1,483
Total	500,304	592,108	610,139	614,912

Source STATIN

Meanwhile, the trend in export crop production has been more erratic. Table 59 confirms that the overall trend is down, with total production figures in 2013 lower than those recorded in 2010. The reduction in banana production was due to the mentioned reduction of EU banana subsidies that were accompanied by financial support to promote agricultural diversification; as well as hydro-meteorological events have affected production, most recently Hurricane Sandy in 2012.

Table 59: Estimated Export Crop Production in Metric Tonnes (2010-2013)

Crop Type	2010	2011	2012	2013
Sugar Cane (milled)	1,390,100	1,518,300	1,475,200	1,402,600
Bananas	53,649	46,660	47,473	37,211
Citrus*	117,440	106,922	97,072	83,758
Coffee (cherry)	9,121	8,099	6,687	6,984
Cocoa (processed)	545	200	557	399
Coconut	95	96	96	97
Total	1,570,950	1,680,277	1,627,085	1,531,049

Source MoAF; * Oranges, grapefruit, ortanique and ugli;

9.4.1 Policy Responses to Achieve Outcome 15 of *Vision 2030 Jamaica to 2013*

The launch of *Vision 2030 Jamaica* and the Sector Plan in 2011 led to a major policy review within MoAF. This review between 2011 and 2013 is focused on attaining sustainable rural development and optimising land resources. Here is a summary of the main results:

- Draft National Land Policy of Jamaica (1997): MoAF has participated in the review of the DNLP, which proposes to establish greater coordination of rural development issues within the planning system with the goal of preserving agricultural land, especially prime farmland, from development. It is proposed that this will be supported by the up-dating of the National Settlement Strategy, in which greater emphasis will be given to, among other things, protecting agricultural land from urban sprawl. In addition, the new Draft Policy

proposes to integrate adaptation to climate variability and change, especially in relation to agricultural land management;

- **Launch of the Draft Agricultural Land Use Policy (2012):** The goals of the policy are:
 - Ensure agricultural land resources are used in an environmentally sustainable manner;
 - Create and maintain a diversified, dynamic and progressive agricultural land use;
 - Ensure forest lands are conserved, protected and/managed to secure sustainable economic and social benefits;
 - Work with other public services, such as planning to bring about developmental and/or welfare activities through infrastructure and support services.

The new policy also assesses the potential effects of climate change on agriculture and recognises the importance of adopting farming techniques that are adapted to the effects of climate change. It also promotes exploring risk transfer through accessible and affordable insurance schemes. To support the adaptation process, the policy looks at registering the effects of climate change on production and productivity in a centralised database, which will also support informed decision-making on future policy direction). In addition, the policy looks at enhancing the GIS capacity of the Agriculture Mapping Unit (in areas such as agro-climatic and crop suitability data sets) and ensuring the Rural Agricultural Development Authority (RADA) is strengthened to deliver sustainable and adapted agriculture with the farming community.

- **Food and Nutrition Security Policy (2013):** A new draft of the policy was finalised in 2012 defining a new commitment to promoting the reduction of food import substitution in favour of local production oriented to meeting newly defined food and nutritional goals. This represents a stronger commitment to developing the qualitative aspects to farming, rather than just being concerned with production targets. The policy also addresses improving access to nutritional food sources islandwide. The policy was approved by Cabinet in 2013 and a Food and Nutrition Security Action Plan is being formulated with stakeholders.
- **Implementation Plan for the National Plant Health Policy:** The plan, finalised in 2013, provides details on how the policy will be implemented. Areas of particular interest to the environment include building capacity in areas such as quarantine management and emergency response to the outbreak of pests.
- **National Organic Policy (2013):** the policy covers the way organic food and farming systems must operate, the accreditation of certification bodies, the development of national organic standards and the legislation that will govern the production and trade of organic food. In addition, it provides details on the role of the GoJ in supporting research, the provision of qualified extension services, training programmes to farmers, the removal of fiscal disincentives to promote the sector, and the marketing of organic products.
- **National Fee Policy and Fee Structure for the Development Applications Approval Process (2012):** the policy introduces a standardised fee structure across all Local Planning Authorities in response to the proliferation of fees imposed by commenting agencies and the non-standardised fee structure operated by local planning (which includes planning permission for development on agricultural lands).

9.4.2 Progress in Reducing Environmental Impact to 2013

The increase in agriculture production in the period 2010-2013, particularly in market garden and root crops, has also resulted in an increase in agricultural-related waste (including agro-industrial waste) and a rise in the use of inorganic fertilizers, especially those containing phosphates. This is confirmed by the data in

Table 60.

Table 60: Quantity of Inorganic Fertilisers Imported by Type in Metric Tonnes (2010-2013)

Fertiliser Type	2010	2011	2012	2013
Ammonium nitrate	216	529	594	245
Ammonium sulphate	10,542	8,421	5,891	10,861
Di-ammonium phosphates	4,320	6,456	-	-
Other potassic fertilisers other than potassium chloride or potassium sulphate	2,984	9,542	3,301	8,815
NPK complex	2,066	2,050	8,040	5,982
Other N and P compounds	57	28	-	-
Other N and K compounds	76	195	-	28
Potassium chloride	182	71	-	-
Urea	3,168	2,466	5,907	2,071
Other	143	99	226	40
TOTAL	23,754	29,857	23,959	28,042

Source: STATIN

The rise in imports of inorganic fertilizers containing phosphates since 2010 is a major concern as it correlates with the increase in phosphates recorded in both fresh and coastal marine water quality reported in Chapter 6. This situation indicates that:

- 1) Land management needs to be improved within many farms to reduce soil erosion and reduce the needs for inorganic inputs through natural responses (such as through composting and the application of Integrated Plant Nutrition (IPN));
- 2) The costs of production are likely to increase as dependency on inorganic outputs rises;
- 3) The hidden costs to biodiversity and ecosystems are also likely to grow, especially when coupled with the effects of climate variability and change, and this is likely to impact negatively on rural livelihoods and economic development.

Table 61 shows pesticide imports between 2009-2010 and 2011-2012. It reveals that total pesticide imports increased by over 15% in 2010-2011 in relation to the previous year, which correlates with the increase in domestic crop production (see

Table 58).⁹⁶ However, the increase in pesticide imports such as herbicides and fungicides, indicates that the implementation of low chemical input interventions such as through Integrated Pest Management (IPM), has not had any significant impact on pesticide import levels.

Table 61: Quantity of Pesticides Imported by Type in Metric Tonnes (2009-2012)

Type of Pesticide	2009-2010	2010-2011	2011-2012
Herbicide	1,200	1,603	1,629
Insecticide	730	914	631
Fungicide	407	244	628
Nematicide	13	17	3
Rodenticide	61	50	58
Others	40	58	125
TOTAL	2,451	2,886	2,775

Source: Pesticide Control Authority

The impact of irrigated agriculture on water resources is also a growing concern where water abstraction is dependent on surface water resources. It was reported in Chapter 6 that droughts and temperature have been trending upward over the last 50 years and this has put increasing stress on surface water resources, especially in the south of the country where many of the country's export crops are produced under irrigation. Furthermore, irrigated land area has increased since 2010 (see Table 31 in Chapter 6) and is planned to increase further according to the NIC's National Irrigation Development Master Plan



The clearing of forest for agriculture is another activity that impacts negatively on soils and surface water resources. Chapter 3 confirms that there has been a loss of forests to mixed uses involving agriculture. This has affected forest quality and also exacerbated soil erosion, which has resulted in increasing human vulnerability to the risks of floods and contributed to the degradation of coral reefs. Land clearing also releases carbon dioxide and other GHGs fixed in the soil by trees and plants. It is estimated that agriculture produces over 25% of total global GHG emissions.⁹⁷

Positive responses to reducing the environmental impact of the agriculture sector include fulfilment of commitments to international agreements and conventions. For example:

- The Pesticides Control Authority (PCA), a statutory body within the Ministry of Health and mandated under the **Pesticides Act** (1975), added six new pesticides to the list of substances officially prohibited from use in Jamaica, in line with the **Rotterdam Convention**



⁹⁶ Imports were mainly for agriculture use (1,035 MT) followed by pesticide manufacture (936 MT), PCA Annual Report 2011

⁹⁷ Intergovernmental Panel on Climate Change, 2011

controlling the importation of hazardous pesticides.⁹⁸

- The PCA has continued its programme of phasing out Persistent Organic Pollutants (POPs) in accordance with the **Stockholm Convention**. POPs are highly dangerous to human health and wildlife because they breakdown very slowly in the environment, which allows unacceptable concentrations to build up in soils and water sources over time. This has included the complete phasing out of endosulfan and carbofuran;
- The PCA is also preparing to transport its stockpile of obsolete pesticides out of the country for safe disposal in accordance with the **Basel Convention** (see Chapter 8).

At the national level, GoJ has promoted the reduction of environmental impact from agriculture in a number of areas, including:

- Strengthening controls on the purchase and use of pesticides by the PCA. This has involved the issuing/renewal of licences, inspections of pesticides in the market place, training days for farmers and issuing of award certificates to the most compliant registered wholesalers and retailers of pesticides. Since 2011 the PCA has also embarked on public education about pesticide use and safety;
- Promoting Agro Parks since 2012 as a means of reducing food imports through the expansion of a fully integrated agricultural production system approach that covers all aspects of the agricultural value chain from pre-production planning through to marketing. By the end of 2013 seven of the nine Agro Parks identified had commenced intensive production techniques (such as greenhouses) to produce a variety of vegetables, condiments, fruits and tubers in which particular attention is being given to developing organic products for niche markets both home and abroad.
- Expanding agro-forestry to promote sustainable agriculture, especially among hillside farmers. This approach has also been incorporated into both the new Draft Forest Policy 2012-14 (Goal 8) and the Agriculture Land Use Policy (2012). Agro-forestry has also been promoted to help rehabilitate some of the country's watersheds. For example the MAJIC project⁹⁹ funded by USAID has supported local farmers in recovering degraded watersheds through agro-forestry, which is also designed to support adaptation to climate change. Another example has been at Buff Bay Valley, where the local community and school children established agro-forestry farming to support rehabilitation of their watershed in 2011.



⁹⁸The list concerns the banning of pesticides stipulated by the Food and Agriculture Organisation of the United Nations (FAO) to be highly dangerous to human health and wildlife.

⁹⁹Marketing and Agriculture for Jamaican Improved Competitiveness

- Promotion of organic farming. RADA has supported this initiative and also promoted “good agricultural practices” in the Agro Parks, while the Jamaica Organic Agriculture Movement (JOAM) is active in promoting the development of a sustainable and economically viable organic agriculture sector in Jamaica. This includes promoting environmental and social responsibility, such as promoting the ban on burning of land for agricultural development and communicating the economic loss associated with soil erosion. A significant breakthrough for JOAM has been the decision of a company from the USA (Farm up Jamaica) to assist farmers in Jamaica grow more targeted organic crops to reduce imports and increase exports of organic produce.
- Promoting agro-tourism based on organic farming: This has mainly been restricted to the coffee industry. However, since 2012 RADA has been supporting Agro-Tourism Farmers’ Markets in a number of parishes. This includes Westmoreland and St. James, with funding from the Tourism Enhancement Fund (TEF).
- Farmer diversification initiatives based on environmentally friendly practices. RADA has been active in promoting fruit tree crop programmes and processed food products, which includes promotion of traditional, new and unique products from Jamaica, designed to diversify and increase income from farming. Products include sauces, pickles, seasoning, spices, jams, honey, dried fruits, vegetables and condiments, etc. This activity can also reduce post-harvest crop losses. However, so far this activity remains limited to mainly family-based companies and small enterprise, although there are niche markets both on the island and abroad where the demand for these products is high. Other diversification initiatives concern the training of farmers in off-farm or non-farm related activities.
- Promotion of public-private partnerships to develop tree, flower and/or agricultural nurseries; compost manufacturers, farm machinery repairers, etc. RADA has also been active in promoting water saving technologies such as rainwater harvesting and drip irrigation;
- Application of Codes of Practice by MoAF to support and promote export crop producers. These codes include commitments to reducing environmental impact during all aspects of operations from field activities through to the handling, packaging and storage of products;
- Green Cane Harvesting has continued to expand as a viable way of reducing the emission of dangerous substances such as dioxins and furans. Currently, the sugar industry is not subject to air quality monitoring (see the chapter on Air Quality), so the green cane harvesting initiative remains voluntary.
- Greenhouse production has continued to grow in Jamaica and is proving to be an effective way to reduce the effects of climate change. MoAF confirmed domestic agriculture had grown by 22.5% in the last six months of 2013 alone and that greenhouse production represented an important way of reducing the import bill. The “Improving Jamaica’s Agricultural Productivity Project” (IJAP) with funding from the Canadian International Development Agency (CIDA) is one example where environmentally friendly production of vegetables in greenhouses has been highly (2008-2012). The Bauxite industry has also supported greenhouse production as part of its rehabilitation programmes following mine closure (see previous subsection). One of the latest examples is the water catchment and greenhouse project at Tobolski, St. Ann, involving 400 farmers.



9.5 Tourism



Tourism and entertainment accounted for over 7% of the country's GDP in 2013 and direct employment in the industry is estimated at over 80,000 according to the Ministry of Tourism and Entertainment (MOT). Economic forecasts by MOT indicate tourism will remain an important sector for income generation, job creation and foreign exchange earnings. The Jamaica Tourist Board (JTB) estimated that more than US\$ 2.05 billion was generated in 2012.

MOT's mission is to work with its partners in the establishment of policies, programmes and systems, the promotion of activities and the creation of products and services that contribute to sustainable growth and development in Jamaica through Tourism". The sector embraces a large number of services that make Jamaica a major tourist destination in the world (JTB).¹⁰⁰ These services include accommodations such as hotels and resorts, restaurants, shopping-related activities, transportation including the two international airports and cruise liner terminals.

The following table provides details of the number of cruise ship arrivals and passenger numbers between 2011 and 2013.

¹⁰⁰ The Travel and Tourism Competitive Index (TTCI) of the World Economic Forum ranked Jamaica 65 out of 140 countries in 2011 and 67/140 in 2013.

Table 62: Cruise Ship Arrivals and Passenger Numbers (2011-2013)

Port	2011	2012	2013
Cruise ship arrivals			
Montego Bay	101	110	86
Ocho Rios	153	139	124
Falmouth	110	135	154
Port Antonio	3	3	-
Total Arrivals	367	387	364
Passengers			
Montego Bay	250,491	338,972	237,956
Ocho Rios	417,520	393,445	380,876
Falmouth	456,442	586,578	646,436
Port Antonio	1,028	1,088	-
Total Passengers	1,125,481	1,320,083	1,265,268
Average passengers/ship	3,067	3,411	3,476

Source: Jamaica Tourist Board (JTB)

Table 62 confirms that the average number of passengers per ship arrival has grown each year even though the number of arrivals actually went down in 2013. This is mainly due to the opening of a new mega cruise liner terminal at Falmouth in 2011, where passenger numbers have increased by over 327,000 since 2010¹⁰¹. The number of stopover passengers entering the country's two major airports has also grown year-on-year between 2012 and 2013; most significant was reaching two million stopovers for the first time in Jamaica's history in December 2013. According to figures from the JTB the average intended stay of foreign nationals visiting Jamaica has remained just short of 9 days per person between 2011 and 2013. The vast majority of foreign nationals come from three countries: USA, Canada and the UK. Meanwhile non-resident Jamaicans stayed on average almost double the spent by foreign nationals (17.4 days in 2013).

9.5.1 Policy Responses to Achieve Outcome 15 of *Vision 2030 Jamaica to 2013*

The Tourist Board Act (1955), governs the Jamaica Tourist Board. In addition, there are a number of Acts dealing with specific areas of tourism such as the **Resort Cottages (Incentive) Act** (1971), the **River Rafting Act** (1970) and the **Tourism Enhancement Act** (2014). Implementation of the Tourist Board's main activities are guided by the **Master Plan for Sustainable Tourism Development (MPSTD)**, for the period 2002-2010. These five objectives of the MPSTD centre on moving the industry onto a sustainable development path that benefits the Jamaican population:

- Promote growth based on a sustainable market position (founded on Jamaica's natural, cultural and historical heritage);
- Enhance visitor experience through increased types and quality of attractions (to promote word of mouth referrals and repeat visitors);
- Establish community-based development in which local communities play a major role in defining, developing and managing the tourism experience, with increasing emphasis given to bottom-up planning;
- Develop an inclusive industry that benefits Jamaicans and promotes gender equality; and
- Ensure environmental sustainability in order continued degradation does not threaten the future of the industry.

The MPSTD targets to 2010 included 2.2 million stop-over arrivals and 2.2 million cruise passengers. When compared with the figures provided above for 2013, achievement rates in percentage terms were 58% and 91 respectively. In terms of visitor expenditure the target for 2010 was US\$ 2.93 million whereas JTB estimated it was US\$ 2.05 million in 2012 (70%).

Since 2010 policy direction has been guided by the adoption of **The Corporate Plan 2010-2013**. The Plan has been designed to support the implementation of *Vision 2030 Jamaica* and the MPSTD beyond 2010. Supporting policies include, among others, the **Public Sector Modernisation Vision and Strategy** (2002-2012) and **The National Security Policy** which (2011). The Corporate Plan is also guided by a number of environmental policies and strategies. These include **Toward Developing a National Policy on Ocean and Coastal Zone Management** (2000) and **Towards a National Strategy and Action Plan on Biological Diversity in Jamaica** (2003), in which the sustainable use of biological resources is a priority.

A significant development in 2011-2013 has been to promote sustainable development of the sector through the establishment of a framework that strengthens current linkages and forges new alliances with key development sectors. This framework, known as the Tourism Linkages Hub,

¹⁰¹ Total passenger numbers in 2010 was 909,619 (JTB).

development complies with the goals of the Sector Plan to establish more balanced and integrated development within the regional and local contexts. The sectors where MOT has targeted linkages and growth include:

- Tourism and agriculture where there is potential to increase the amount of locally sourced consumed by the sector;¹⁰²
- Tourism and local manufacture where there is potential to provide a number of processed products to the sector, such as processed food products, textiles goods, furniture, crafts and health-related products;
- Tourism and entertainment where there are opportunities to link tourism to the country's cultural diversity, in particular the music industry and national heritage; and
- Integrating the tourism sector within planning to promote places that Jamaicans are proud to live in (Goal 3 of the Sector Plan).

9.5.2 Progress in Reducing Environmental Impact to 2013

The tourism sector faces a number of growing environmental challenges identified in this report and which put at risk the sustainable development of the sector in the medium and long-term. These challenges centre on:

- Loss of coastal marine biodiversity and damage to ecosystems (see Chapters 2 and 3);
- Loss of fish stocks due to over-fishing and poor fishing practices (see Chapter 5);
- Beach erosion and accretion, especially in the Negril area as well as cases of illegal beach sand removal for construction purposes (see Chapter 5);
- Depletion of coastal marine water quality in many areas, especially due to phosphate-based farm inputs and cleaning agents (see Chapter 6);
- Inadequate solid and liquid waste management, which has also contributed to reducing coastal marine water quality (see Chapter 8);
- Inadequate levels of renewable energy production in the sector (see Chapter 10);
- The effects of climate variability and change, in particular relating to storms and hurricanes (see Chapter 12);
- Inadequate resources to keep check of informal development and enforcement of planning permission conditions; and
- Increasing demands for freshwater from both accommodations and cruise ships. Table 63 highlights the amount of water consumed in 2013 at the country's main ports.

Table 63: Water Consumption of Vessels at Tourist Ports in Cubic Metres (2013)

Tourist Port Name	Water Consumption
Ocho Rios (Reynolds Pier)	7,596
Ocho Rios (Lannaman & Morris)	57,465
Montego Bay	10,433
Falmouth	4,934
Errol Flyn Marina	389
Total	80,817

Source: Port Authority

¹⁰² MOT confirms import leakage is high in Jamaica estimating that only 30% of food consumed by the sector is produced in Jamaica.

The response of MOT to these challenges has been slower than had been planned in the MPSTD.¹⁰³ This situation has not been helped by the devastating effects of Hurricane Ivan (2004) and Sandy (2012) as well as the financial and economic crisis (2008-2009) along with high oil prices, which has had a long-term effect on the sector's overall performance. Nevertheless, the MOT is moving away from a highly entrenched sector-based growth approach to a multi-sector one that embraces the establishment/consolidation of sector alliances through its Tourism Linkages Hub.

Specific actions designed to improve the quality of the environment have also been promoted by the MOT/JTB and partners. These include:

- Finalisation of the **Draft Community Based Tourism Policy** (2013). The policy aims at diversifying the tourism industry, in particular focusing on promoting sustainable entrepreneurial initiatives.
- On-going development of a policy for management of water-based activities to safeguard coastal marine resources by improved zoning of water sport activities.
- Consolidation of the Multi-Hazard Contingency Programme designed to coordinate with the Office of Disaster Preparedness and Emergency Management (ODPEM) to integrate a disaster risk reduction strategy within the JTB and in particular through the Ministry's Tourism Emergency Management Committee (TEMC).
- Establishment of the Tourist Linkages Council and Task Force to promote greater integration with other sectors aimed at improving and diversifying the tourism sector and promoting sustainable development. The main areas where this has advanced so far include:
 - A partnership with MoAF/RADA concerning the launch of Agro-Tourism Farmers' Markets. A total of four took place with positive results for participating farmers in four major tourism areas, including Negril and Montego Bay; and
 - Establishment of a Road Map Strategy in collaboration with the Ministry of Health and the Jamaica Promotions Corporation to promote Health and Wellness Tourism from 2014.
- Increasing cooperation with the planning system to establish sustainable development at the parish capital level through the promotion of the country's heritage. Case study 7 at the end of this chapter provides the example of Falmouth, Trelawny, where this is type of integrated forward planning is developing in Jamaica.

Finance and support from the Tourism Enhancement Facility (TEF) has also helped build linkages with other sectors to promote sustainable development. Their initiatives include support to local government on landscape upgrading, environmental maintenance and transformation projects in towns such as Ocho Rios, Falmouth and Negril. Financial support has also been given to the Jamaica National Heritage Trust in the restoration of newly declared heritage sites and monuments (see also chapter 4).

Finally, GoJ remains committed to underpinning its corporate and master plans on the findings of the **Jamaica Social Policy Evaluation** (JASPEV), which will be used to shape tourism policy in areas such as environment and education to meet Goal 4 of the Vision Plan by 2030.

¹⁰³The World Economic Forum ranked Jamaica 97 out of 140 countries for its approach to environmental sustainability in its 2013 Travel and Tourism Competitive Index (TTCI) which was lower than its ranking in 2011 and 2009.

9.6 Construction (Transport, Works and Housing)



The Ministry of Transport, Works and Housing (MTWH) was established in January 2012 following a decision to transfer the housing portfolio from the Ministry of Water and Housing (which became the Ministry of Water, Land, Environment and Climate Change - MWLECC). Currently, the construction sector accounts for 2.3% of GDP (2013) and employs an around 90,000 people (excluding temporary employees). The MTWH has a large portfolio of activities including:

- Project development involving planning, design, construction and monitoring and evaluation, especially for affordable housing and developing the transport network.
- Squatter management.
- Regulating the country's transport system which includes (2012):
 - 282 km. of urban roads;
 - 844 km. of main roads; 717 km. of secondary roads and 3,255 km of tertiary roads
 - 800 bridges;
 - 331 km. of rail track, plus six privately owned mining railway lines;
 - 10 km. of pipelines for the petroleum industry;
 - A fleet of buses and bus terminals;
 - Two international airports and four aerodromes; and
 - Ten specialised seaports and three public deep water ports.

The provision of affordable and appropriate housing for Jamaica's population has remained a major challenge. This is mainly due to steady population growth since the 1960s (see Figure 37) and house building start rates below projected needs. In 2011 the targeted housing need requirement of 15,000 units per annum had a shortfall of about 2,600 units, plus an estimated 2,400 units in need of replacement each year.¹⁰⁴

Table 64 shows the number of house starts and completions by the country's main house builder, the National Housing Trust (NHT).

Table 64: Housing Starts and Completions by the National Housing Trust (2010-2013)

Construction Type by National Housing Trust	2010 (Units)	2011 (Units)	2012 (Units)	2013 (Units)
Housing starts	1,278	1,466	1,790	1,689
Total housing starts	2,674	6,405	1,790	2,896
Housing completions by the National Housing Trust	1,452	1,618	2,676	1,621
Total housing completions	2,999	3,644	4,334	5,560

Source: PIOJ

Table 64 confirms housing completions by NHT, have increased continuously over the 2010-2013 period, which has helped reduce the shortfall. However, a large percentage of housing is built on greenfield sites in the Kingston metropolitan area and around the parish capitals.

¹⁰⁴ MTWH, National Housing Policy and Implementation Plan (Final), 2011, p.9

Table 65 shows the percentage of housing stock complying with the housing quality index of the Jamaica Survey on Living Conditions.

Table 65: Percentage of Housing Stock Complying with the Housing Quality Index

Indicator	2008 (%)	2010 (%)	2012 (%)
Detached units	77.6	80.8	81.6
Ownership of units	62.7	61.7	60.2
Walls of block and steel	72.0	70.7	69.2
Own use of flush toilets	62.9	63.2	64.8
Indoor taps	53.9	54.0	54.0
Electricity for lighting	92.7	92.9	93.1
Use of own kitchen	92.9	93.2	92.6
Adequacy of living space	53.8	55.2	58.4
Average Housing Quality	73.5	73.8	73.6
HQI (modified)	71.4	71.5	72.0

Source: Jamaica Survey of Living Conditions; * 1.01 persons or less per habitable room

Table 65 indicates the trend in the quality of housing stock in Jamaica has improved very slightly with around 28% of all housing stock non-compliant with the index. This situation confirms that there is a need to address this situation if the sector is to meet Outcome 15 of **Vision 2030 Jamaica** (more on vulnerability to natural disasters can be found in Chapter 12).

Growth in transport infrastructure has been recorded since 2010 under the Jamaica Development Infrastructure Programme, with major infrastructure developments focusing on:

- The Road Infrastructure Programme, which includes rehabilitation and enhancement of the road system in new and existing residential areas and links to the main road system (including bridges, drainage, pavements, etc.). The programme aims at enhancing urban and suburban mobility and safety, improving accessibility and lowering transport costs.
- The construction of new sections of the North-South Link Toll Highway (to be completed by 2016) and the South Coast Highway Improvement Project (to be completed by 2014), both of which aim to establish a national modern highway network.
- Development of a Logistics/Transshipment Port in the Portland Bight Protected Area, which is still under a scoping study.
- Improvements to the country's two international airports, including the construction of new Control Towers (in 2014) and development of the East Airfield at NMIA.

9.6.1 Policy Responses to Achieve Outcome 15 of Vision 2030 Jamaica to 2013

The mission of MTWH is to, “develop and implement the programmes which will foster sustainable infrastructure and the efficient and effective delivery of housing solutions and transport services, thereby enabling persons to pursue their social and economic interests.” The policy framework of the MTWH comprises:

- **In Transport:** The **National Transport Policy** (2004) supported by the **Vision 2030 Jamaica Transport Sector Plan 2009-2030** implemented from 2011. The strategic vision of the plan focuses on improving the domestic transport system and the development of

Jamaica as a regional, hemispheric and global transport and logistics hub or junction. One of the specific goals of the plan is to establish an environmentally sustainable transport sector (both in terms of sustainable transport infrastructure and services and high energy security, conservation and efficiency).

- **In Works: The White Paper for a Construction Industry Policy** (2007), which centres on making the construction industry more cost effective and competitive through improvements to safety, environmental factors, registration of professionals and enterprises, development of skills and so forth.
- **In Housing:** There are a number of policies that support the implementation of the **National Housing Act** (1969). These include:
 - **Housing Public Private Partnership Policy** (2008), which sets out the objectives of public private partnerships in delivering more affordable and adequate housing solutions on Government and private lands. Among its 7 objectives is the adherence to proper planning guidelines, procedures and/or approval process, and which encourages adequate provision of infrastructure and the incorporation of environmental considerations into development plans.
 - **Joint Venture Housing Policy and Guidelines** (2003) which provides provisions to deliver affordable housing solutions within the framework of the National Settlement Strategy and in accordance with the UN-Habitat agenda and twin goals of adequate shelter for all and sustainable human settlements;¹⁰⁵
 - **Draft National Housing Policy and Implementation Plan for Jamaica** (2011), which aims to achieve: *“safe, sanitary and affordable shelter for all”* under National Outcome 15 of Goal 4 of **Vision 2030 Jamaica**. Its main focus is on improving the flow of housing, the development of institutions to finance housing, and adequate land supply. The policy defines the enabling framework and regulatory functions of the Ministry to support the private sector in becoming the main driver of affordable, appropriate and sustainable housing choices together with the specific subsidies it can offer to those most in need but lacking resources.

9.6.2 Progress in Reducing Environmental Impact to 2013



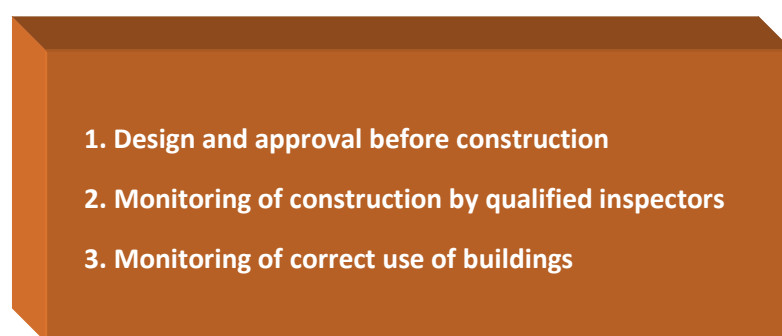
The construction industry represents one of the main threats to the country's natural environment given its mandate as one of the main drivers of economic and social development; development that in most cases involves construction activities on greenfield sites. Housing and road construction are major contributors to the loss of agricultural land to development and with this land use change there are hidden costs to the environment when it is inadequately planned and enforced. One of the main hidden costs is soil erosion during the period when new roads and buildings consolidate themselves. The launch of the Draft Housing Policy and Implementation plan for Jamaica in 2011 represents a major commitment by MTWH to meet Outcome 15 of **Vision 2030 Jamaica** and establish a more sustainable path to meeting housing needs. However, the implementation plan is not supported by two important elements. These are:

- 1) The absence of an official **National Building Code** (NBC). In response GoJ is preparing the **National Building Act**, which will provide a modern legal framework for the effective

¹⁰⁵ The Agenda is linked to the achievement of the Millennium Development Goals in particular Goal 7: Ensure Environmental Sustainability, in which there are specific targets on improving the lives of slum dwellers and improving access to safe drinking water and sanitation

regulation and management of buildings and construction to ensure safety in the environment based on the implementation of many of the principles in the NBC and increased penalties for non-compliance. The Building Act is recognised as an important means to empowering local authorities and their communities to, not only establish compliance in building standards, but also meet Outcome 14 of **Vision 2030 Jamaica** by building human resilience to all forms of hazards, especially the reduction of floods and landslides. With the support of the Jamaica Institute of Engineers, the NBC is likely to adopt compliance levels similar to those proposed by The Bureau of Standards of Jamaica (BSJ).¹⁰⁶ The three levels are shown in Figure 40.

Figure 40: Three Levels of Compliance in the Building Code Proposed by BSJ and JIE



Source: The Bureau of Standards of Jamaica

- 2) The absence of **strategic environmental assessment** (SEA), through which regional scoping of land is conducted to support the identification of suitable land to accommodate future housing growth needs. This would also support the application of **environmental impact assessments** - EIA where deemed necessary in areas designated for major housing and infrastructure development (over 50 units).

Furthermore, under the **Housing Act** (1969) there are specific provisions which allow the Housing Minister to acquire, hold and dispose of land and to be involved in the approval and preparation of housing schemes, parallel to the planning system which could lead to building on prime agricultural land. The **Transport Authority Act** (1987) also confers special planning powers on the Transport Minister. This situation complicates the creation of a comprehensive planning system (Outcome 15, Strategy 1 of **Vision 2030 Jamaica**) and inhibits greater inter-institutional coordination as prescribed in the Sector Plan as required to deliver a coordinated, balanced, integrated and sustained approach to development.

In response to the problem of squatting on greenfield sites, including forested sites, in Jamaica the Housing Division has established **Guidelines for Dealing with Informal Settlers** and initiated preparation of a separate policy to deal with informal settlers.¹⁰⁷ In this way, greater provision will be available to develop participation and social engagement with the poorest groups of society in order to find mutually acceptable affordable and sustainable housing solutions. Identification of the policy will be done in partnership with the Participatory Slum Upgrading Programme (PSUP) implemented by the United Nations Human Settlements Programme (UN-HABITAT) and funded by the European Union.

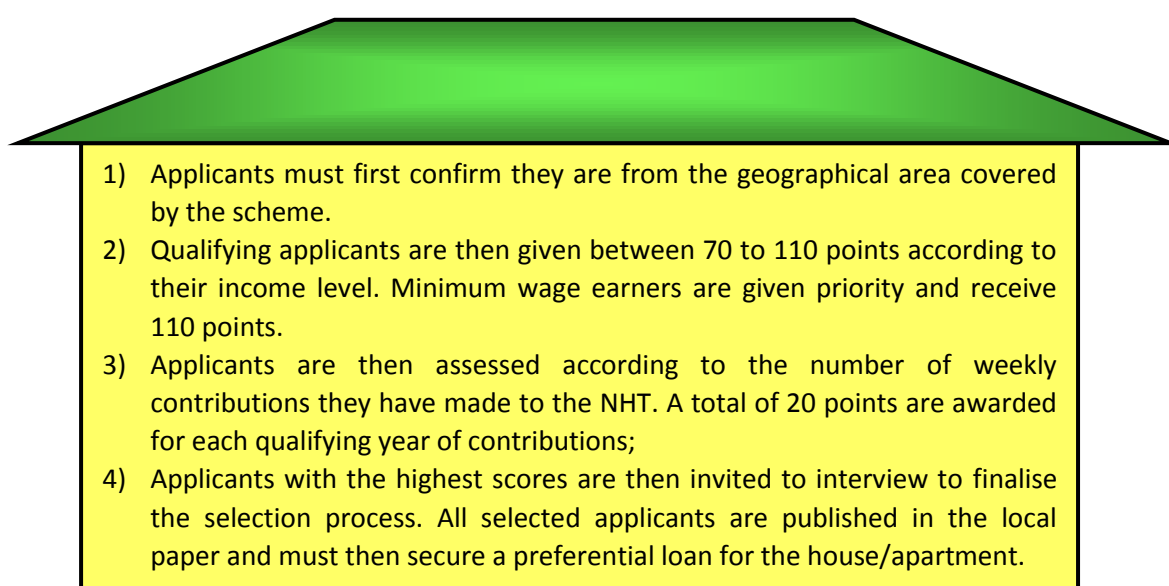
¹⁰⁶ This was the first major review of building standards since the original standards of 1901.

¹⁰⁷ Also referred to as the Squatter Policy

Land titling: under its current mandate the Housing Division has stepped up its commitments to increasing land titling as a means of empowering a new generation of landowners to either prevent or contain informal settlements, as well as gain greater access to public and private services.

NHT's approach to affordable housing: the NHT has established procedures to deal with the high demand for its affordable housing schemes, especially when they are in well located areas. This is based on the application of a points system to applicants that are awarded as shown in Figure 41:

Figure 41: Points System Applied by the NHT for New Housing (2013)



9.7 Conclusions and Recommendations

Jamaica's planning system continues to face major challenges that must be dealt with before the country can be set on a sustainable rural and urban development path and reach Outcome 15 of **Vision 2030 Jamaica**. GoJ recognises that land use planning cannot address these challenges without effective spatial planning to address current problems of urban sprawl, much of which has been informal in nature and encroached on agricultural and ecologically sensitive land.

The NSP and NSS have advanced in this respect in the period 2011-2013 as has the updating of DOs in the majority of parishes/municipal areas of Jamaica. Particular attention is being given to establishing a more integrated approach to the planning system in line with the goals and outcomes identified in the Urban Planning and Regional Development Sector Plan 2009-2030. This is based on the establishment of a spatial arrangement of land use that integrates with social and economic development, respects the environment and satisfies the needs for safety, efficiency and social justice. A key goal of such an approach is the creation of places where Jamaicans are proud to live, work and play.

There has been progress in the collection of data and development of the GIS national database. As this consolidates, the NSP will be guided by better monitoring and evaluation of development and its effects on the natural environment to support conservation of natural resources and their sustainable use to 2030. An assessment of four key sectors to the Jamaican economy and its social

development indicates that there are positive developments taking place. These are both in terms of policy and actions on the ground to reduce environmental impact. Less environmental impact will facilitate a more balanced regional development.

The Mining and Quarrying sector is now working closely with NEPA and other government agencies to develop a more sustainable and socially responsible approach to the development of the sector, while still generating wealth for the Jamaican economy. The Agriculture and Tourism sectors are also forging alliances to address import leakages in the area of food imports and the integration of environmental conservation, as well as conservation's sustainable use in policy and plans to help sustain growth of the sectors. The construction sector has also introduced new policies that focus on establishing sustainable infrastructure and quality housing to enable Jamaicans to pursue their economic and social interests.

Furthermore, preparations are underway to introduce the Building Act, which will establish long awaited building standards on the construction industry with a view to enhancing safety and reducing human vulnerability to disasters. This will also contribute to securing the goal of creating places where Jamaicans are proud to live and do business.

In line with current policy developments and the findings in this report the following conclusions and recommendations are made:

- 1) The development of the NSP and NSS has progressed, but not yet been finalised to allow the planning system develop a fully integrated framework to deliver sustainable development in Jamaica. As a result the issues such as the upgrading of DOs into development plans has not taken place as envisaged in the Urban Planning and Regional Development Sector Plan.

Recommendations

- a) Assign financial and human resources to ensure the development of the NSP continues following the ending of CDB financial support at the end of 2012.
 - b) Ensure the Medium-Term Socio Economic Policy Frameworks that monitor the results of the 31 Sector Plans established to implement ***Vision 2030 Jamaica*** do not maintain a sector-based approach to tracking progress. Rather PIOJ in collaboration with other government agencies and non-state actors, should ensure all progress is tracked on a multi-sectoral approach that establishes the integrated planning framework and balanced development foreseen in the Sector Plan.
 - c) Ensure the consolidated with a stable budget of the information and data management system needed to guarantee the application of effective spatial planning
 - d) Provide adequate training of trainers to develop both spatial planning and disaster risk reduction (DRR) capacity within the planning system (at national and local planning authority levels).
- 2) The mining and quarrying, agriculture ***and tourism sectors have plans in place to meet Outcome 15 of Vision 2030 Jamaica***. However, there needs to be a multi-sectoral committee in place to ensure that development planning is properly interconnected with transport infrastructure policy and carefully planned housing programmes that support the establishment of growth areas, where population increase is greatest.

Recommendations

- a) Support the establishment of multi-sectoral committees to track progress of sectors that can be clustered to promote the development of strategic regional centres (such as along the Southern Highway route between Kingston and Mandeville and along sections of the north coast between Montego Bay and Port Antonio).
 - b) Assign resources to support the tourism and agriculture sectors in consolidating a partnership in which agro-forestry and greenhouse development, is specifically designed at in growth. This will establish conservation agriculture to reduce the tourism sector's import of an estimated 70% of its food and drink needs.
 - c) Coordinate closely with the Ministry of Local Government and Community Development during the process of local government reform. This is critical particularly as it relates to plans to establish the Local Economic Development (LED) programme, which will be targeted to support public-private partnerships and community-based enterprise. This would provide an opportunity to link food production and processing with the tourism sector.
 - d) Identify a logistical hub to diversify the economy and propel Jamaica as a sustainable regional and global centre for the container shipping industry. It is important however, that this does not threaten the proper functioning of the country's coastal marine ecosystem or the protected areas system currently being finalised (see Chapter 4).
 - e) Ensure housing development focuses on the spatial development needs of strategic growth areas to 2050, when population growth is projected to peak.
- 3) The development sectors have recognised the need to focus on sustainable approaches in their sector plans, in which greater recognition is provided to conservation and sustainable use of the natural environment. Nevertheless, there is limited internal capacity within these sectors to deliver this goal, together with DRR and adaptation to climate change, as effective cross-cutting objectives.

Recommendations

- a) Provide training of trainers to develop the internal capacity of sectors such as mining and quarrying, agriculture, tourism and construction in integrating effective and coordinated environmental management and risk mapping, based on the ridge-to-reef approach (see also chapter 3).
- b) Introduce the Building Act as soon as possible ensuring at the same time that there are resources in place to guarantee a building code can be enforced effectively.
- c) Ensure the development sectors, in coordination with the planning system, strictly enforce any encroachment into protected areas, natural areas that are prone to disasters (such as flood plains, storm surges), areas prone to subsidence, and areas where surface water abstraction is already/projected to be over-stressed.
- d) Support all actions with a carefully managed communication strategy based on the economic benefits of sound environmental management to establish DRR and adaptation to climate change.

Case Study 7: The Falmouth Redevelopment Plan (2011)



The Master Plan for Falmouth's development seeks to preserve the town's rich heritage whilst making provisions for areas of the town to become renewed in harmony with the built and natural environment. The plan provides a good example of how an integrated sector approach to local and regional planning can better manage the Historic Town of Falmouth with respect to land use, development control, infrastructure upgrades/maintenance and socio-economic growth based on tourism, heritage and services.



The redevelopment of the waterfront and the reclaimed lands are pivotal to the sustained socio-economic growth of the Historic District that is naturally constrained for development as a result of the eco sensitive wetlands. This has had particular importance since the opening of the new port terminal for two major reasons. First the terminal is a fenced-in area, which does not encourage tourists to leave the terminal's shopping area. Second, the new terminal has contributed to the damaging of road infrastructure and coastal areas.



Useful Links and References:

Urban Planning and Regional Development Plan (final draft, NEPA, 2011):

http://www.nepa.gov.jm/planning&development/vision_2030.pdf

The Mining Act (1947)

<http://moj.gov.jm/sites/default/files/laws/Mining%20Act.pdf>

The Quarries Act (1984)

<http://moj.gov.jm/sites/default/files/laws/Quarries%20Control%20Act.pdf>

The National Minerals Policy 2010-2030 (2011)

http://www.caribbeanelections.com/eDocs/strategy/jm_strategy/jm_minerals_policy_2010.pdf

Information on the Hillside Development Manual (2014)

<http://www.mgd.gov.jm/services/products/guide-to-quarry-licence.html?view=category&id=5>

Information on agriculture policies:

<http://www.moa.gov.jm/AboutUs/departments/policies.php>

Information on the Master Plan for Sustainable Tourism Development:

<http://www.mot.gov.jm/content/tourism-master-plan>

Information on the World Economic Forum Travel and Tourism Competitive Index:

<http://www3.weforum.org/docs/TTCR/2013/Jamaica.pdf>

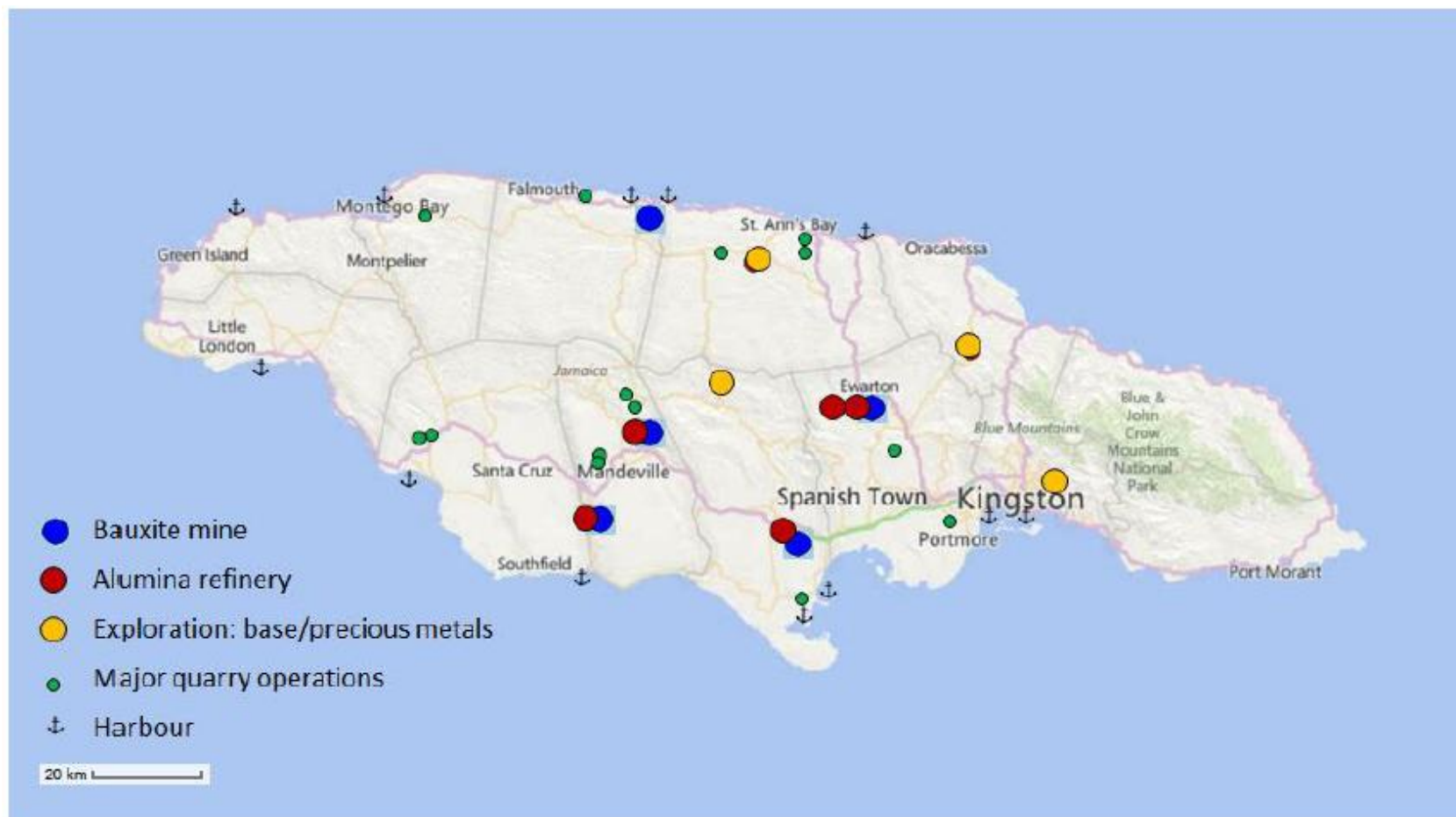
Maps:

Figure 42: Location of Major Mines in Jamaica (2013)

Figure 43: Land use dedicated to agriculture in Jamaica (1998)

Figure 44: Map Showing Main Areas of Tourism in Jamaica (2013)

Figure 42: Location of Major Mines in Jamaica (2013)



Source: MSTEM, Draft Minerals Policy, map prepared by SNL Metals and Mining, Stockholm, (prepared in 2013, published 2014).

Figure 43: Land use dedicated to agriculture in Jamaica (1998)

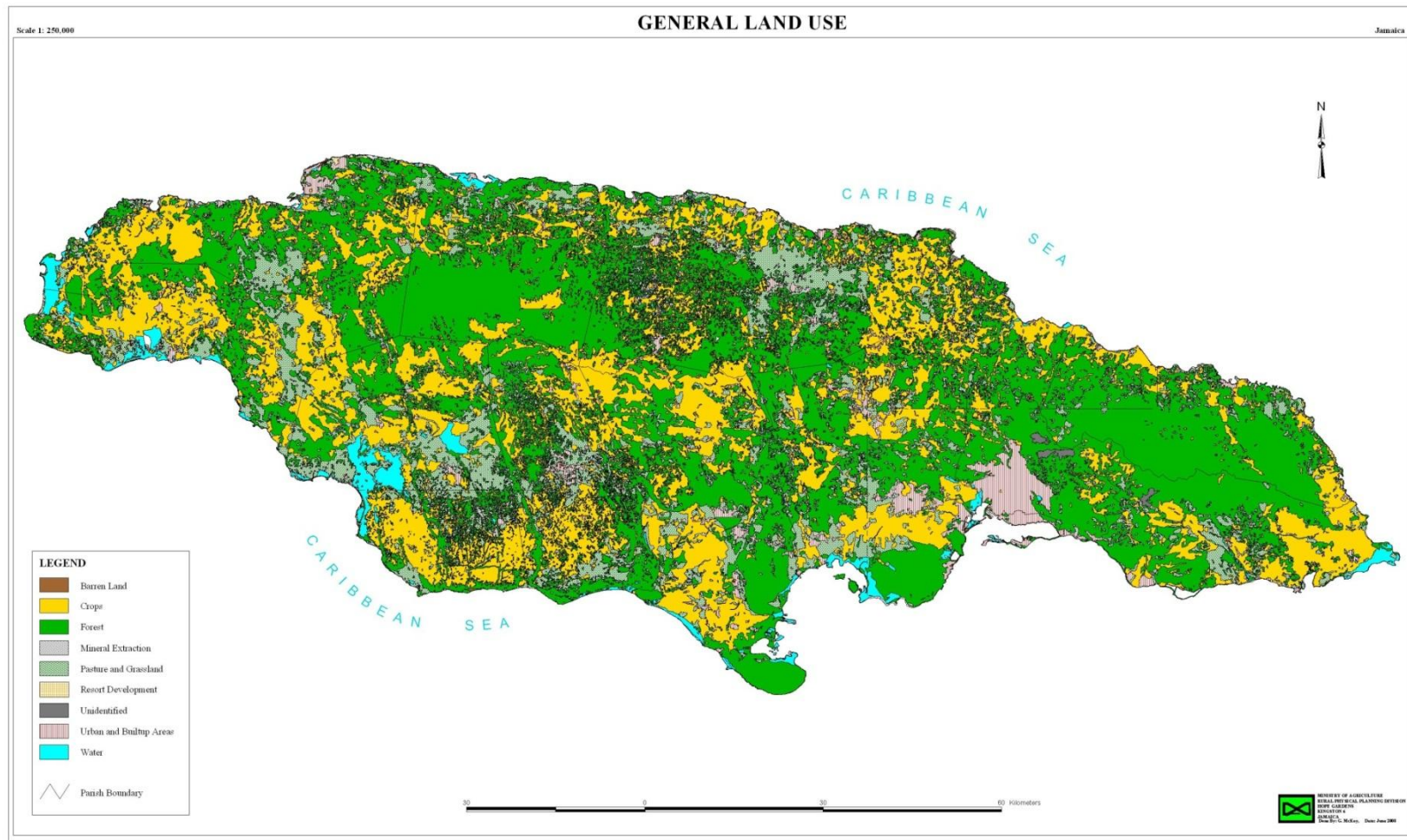


Figure 44: Map Showing Main Areas of Tourism in Jamaica (2013)





10. Energy

What is conventional energy? Conventional energy refers to the use of firewood and fossil fuels such as oil, coal and natural gas to produce energy for homes, commercial and industrial activity and to power the transport sector. Fossil fuels are finite. It is accepted by the United Nations and by most scientists that the burning of firewood and fossil fuels produces large amounts of carbon dioxide and other greenhouse gases, which accumulate in the earth's atmosphere to create the "Greenhouse Effect", which is causing global warming. Jamaica is highly dependent on conventional energy to generate electricity and power the transport sector.

What is energy security? The International Energy Agency (IEA) defines energy security as *"the uninterrupted availability of energy sources at an affordable price. Energy security has many aspects: long-term security mainly deals with timely investments to supply energy in line with economic developments and environmental needs. On the other hand, short-term energy security focuses on the ability of the energy system to react promptly to sudden changes in the supply-demand balance."*

What is renewable energy? This is energy that can be reproduced from natural processes that are replenished constantly, such as sunlight, wind, water, biomass, or geothermal resources (IEA).

What is alternative energy? This refers to energy from sources other than fossil fuels. This includes renewable energy and energy production processes that give off fewer GHG emissions such as the production of energy from bio-fuels, ethanol, solid waste (both agricultural and domestic waste), nuclear and hydrogen.



Why is alternative energy important? *Vision 2030 Jamaica* echoes the Rio+20 Outcome Document which emphasised the need to address the challenge of access to sustainable modern energy services for all [including through] increased use of renewable energy sources and lower emission technologies. Increasing the share of renewable energy in developing countries such as Jamaica is important in order to increase energy security, adapt to the effects of climate variability and change before the costs become too high, and reduce the negative effects on health and ecosystems – such as air pollution and decreases in water quality – caused by conventional power generation,. The introduction of renewable energy is often termed the 'greening' of the energy **sector** to promote the development of the **'green' economy**.

10.1 Background to the Energy Sector

The energy sector in Jamaica is covered by a number of Parliamentary Acts. These include the **Electric Lighting Act** (1890), the **Electricity Development Act** (1958) and the **Petroleum Act** (1979). Both Acts address the needs of Jamaica to generate energy using imported fossil fuels, which was founded on cheap oil prices. However, since the 1980s oil prices have grown, creating a network of oil-fired power stations that provide the vast majority of the country's electricity. Figure 45 at the end of this Chapter shows the geographical location of the country's oil-fired power stations.

The long-term development of the energy sector in Jamaica was first established in the **National Energy Policy (NEP) 2009-2030**. The NEP articulates the implementation of **Vision 2030 Jamaica**, in particular Outcome 10: "Energy Security and Safety" (under Goal 3). This outcome foresees the creation of a, *"modern, efficient diversified and environmentally sustainable energy sector, providing affordable and accessible energy supplies with long-term energy security that contributes to international competitiveness throughout all the productive sectors of the Jamaican economy."*

The Strategic Framework underpinning the NEP places priority attention on seven key areas of activity:

- 1) Security of energy supply through diversification of fuels as well as development of renewable energy sources;
- 2) Modernizing the country's energy infrastructure;
- 3) Development of renewable energy sources such as solar and hydropower. A major aim is to establish at least 20 percent of energy production from renewable sources;
- 4) Conservation and efficiency in use of energy;
- 5) Development of a comprehensive governance/regulatory framework for the energy sector
- 6) Enabling government ministries and agencies to be models/best practice for the rest of society in terms of energy management; and
- 7) Eco-efficiency is promoted to advance international competitiveness and build a green economy.

10.2 The Current State of the Energy Sector in Jamaica to 2013



At 2013 approximately 92% of the country's population has access to electricity (STATIN). Nevertheless, the vast majority of Jamaica's energy is produced from oil imports.

Table 66 below confirms that between 2010 and 2013 Jamaica was on average 95% dependent on imported oil for its energy production. Furthermore, due to high oil prices on the world market, the Ministry for Science, Technology, Energy and Mining (MSTEM) communicated in June 2013 that the cost of electricity

production had reached up to US\$0.42 per kilowatt, confirming that Jamaica had some of the highest energy production costs in the world in 2013.

Table 66 also confirms that renewable energy plays a small part in the country's total energy production, although the trend in the share of total energy production is increasing from 2.7 percent in 2010 to 3.8 percent in 2013.

Table 66: Primary Energy Supply by Source in One Thousand Barrels of Oil Equivalent (2010-2013)

Energy source	2010	2011	2012	2013**
1. Fossil Fuels				
Petroleum*	19,449	19,807	19,280	19,183
Coal	271	327	284	450
Total Fossil fuels	19,720	20,134	19,564	19,633
2. Renewable Energy				
Hydro-power	94	94	93	77
Wind	33	57	67	71
Bagasse	418	579	570	626
Total Renewable Energy	545	730	730	774
Grand Total	20,265	20,864	20,294	20,407

Source MSTEM; * does not include asphalt, lubricants, or petrochemicals ** Preliminary data only;

Note: No data available for wood fuel

Table 67 shows the main consumer categories of energy in Jamaica in the period 2011-2013. It confirms three sectors consume around 75% of the country's energy: electricity generation, road and rail transport and the bauxite/alumina industry. The table also indicates that energy consumption rates are decreasing in all subsectors, with the exception of the transport sector (road, rail and aviation), which has continued to increase its consumption, even despite the high price for petroleum products during the 2011-2013 period.

Table 67: Petroleum Consumption by User Category ('000 BOE) 2011-2013

User Category	2011	2012	2013
Road and rail transport	6,012	6,060	6,342
Shipping	1,635	1,405	1,370
Aviation	1,879	1,857	2,001
Cement manufacture	12	26	16
Electricity generation	6,529	6,114	5,719
Bauxite/alumina processing	3,753	3,317	3,253
Sugar manufacture	15	18	17
Cooking and Lighting	988	964	907
Petroleum Refinery	287	317	247
Other manufacturing	97	43	27
Other	82	122	199
Total	21,290	20,245	20,100

Source: MSTEM

MSTEM has also stated in 2013 that over 15% of the country's GDP was being spent on oil imports. Although this percentage is down in relation to 2007 (before the financial and economic crisis in 2008), the current status of the energy sector is summarised as follows:

- 1) Too much of the country's wealth is being spent on producing energy rather than on other important sectors related to socio-economic development and the sustainable use of natural resources. Indeed, the high cost of energy has to be passed on to consumers and

this reduces the level of competitiveness of most companies.

- 2) The diversification of the energy sector is slow suggesting the country is unlikely to meet its renewable energy target share of 20 percent of national energy production by 2030.
- 3) The high levels of fossil fuel use means Jamaica produces large amounts of GHG per capita, which means Jamaica's carbon footprint is high. This limits the opportunities to trade carbon credits under the principles of the United Nations Framework Convention on Climate Change (UNFCCC), to which Jamaica has been a party since 1995.¹⁰⁸

Table 68 provides details on the low world ranking of Jamaica for carbon dioxide emissions in the period 1992-2010 relating to the energy sector. It confirms Jamaica's international ranking for carbon dioxide emissions is currently on a downward trend.

Table 68: Carbon Dioxide Emissions from Energy Consumption in Jamaica (1992-2010)

Country	World Rank 1992	World Rank 2009	World Rank 2010	% change in emissions 1992-2010	Per person emissions in 2010, (MT)	2010 (MMT)
Jamaica	97	96	102	8	3.2	9.22

Source: US Energy Information Administration/The Guardian Newspaper, UK (12/06/2012)

10.2.1 Main Responses by the GoJ in the Period 2011-2013

The Energy Division of MSTEM has introduced a number of responses to reduce the country's energy dependency on oil. At the policy level the Ministry produced the **Draft National Renewable Energy Policy 2010-2030**, the **National Biofuels Policy 2010-2030** and the **Draft National Policy for Trading of Carbon Emissions** (2010) all of which have been operation since 2011.

In addition, MSTEM has been active in bringing about the following developments in the period 2011-2013:

- **Diversifying energy production to reduce dependency on oil:** GoJ has been exploring diversification of energy production to reduce dependency on oil, which has mainly concentrated on projects using gas, in particular the proposed commissioning of a 381 Mega Watt Combined Cycle Plant that converts natural gas into electricity;¹⁰⁹
- **Application of the Improvement in Energy Efficiency and Conservation programme (EEC):** this programme has been supported by the Inter-American Development Bank (IDB) in the amount of US\$ 20 million, and has mainly centred on retro-fitting public buildings to make them more energy efficient and cooler environments in which to work. This has included the installation of solar control film at 19 public sector buildings, the installation of cool roof solution at 11 public installations and installation of energy efficient air conditioning at four facilities, all of which have reported a significant drop in energy bills by the end of 2013. Other energy efficiency activities have included the installation energy efficient lighting and air conditioning and solar panels in public libraries, schools and healthcare centres.
- **Enhancing energy security and efficiency:** the Energy Security and Efficiency Enhancement

¹⁰⁸ The UNFCCC encourages all countries to reduce their emissions of GHG, although binding targets are only applicable to developed countries, known as Annex I Parties such as Canada, UK and USA. Jamaica is a Non-Annex party to the UNFCCC.

¹⁰⁹ Assuming an average "after diversity maximum demand" (ADMD) of 3 kW per home per day (with air conditioning) this plant could supply electricity to over 120,000 homes.

Project (ESEEP) supported with a loan from the World Bank and which represents a key initiative within the NEP, has centred on:

- Strengthening the regulatory and institutional framework of the energy sector. This has included the development of the **Electric Power Sector Policy** and a **draft Electricity Act** to replace the Electric Lighting Act of 1890 and also a draft legal and regulatory framework for the gas sector. The aim of the new policy is to facilitate greater private investment in cleaner energy production (such as liquefied natural gas and in renewable energy).
- **Promoting private investment and consumer education** in energy efficiency and renewable energy. This included implementation of the communication and public education programme and pre-feasibility studies to assess the potential of small hydro-power plants;
- **Implementation of the UNDP-funded project** Capacity Development for Energy Efficiency and Security in Jamaica has focused on reducing Jamaica's carbon footprint to establish a greener economy. This has included a study of the potential feasibility and viability of producing and distributing wind energy to promote and guide private investment in this renewable energy.
- **Promoting and facilitating competition in electricity production:** This has mainly focused on improving the way private companies can supply energy more efficiently to the national grid.
- **Increasing renewable energy (RE):** Full liberalisation of the RE market was established in 2012 with the aim of facilitating private investment in RE and reaching a government target of RE occupying at least 12.5% of the total energy by 2015. Some of the most important advances have been:
 - **Wind power:** The launching of a Request for Proposal (RFP) for the provision of 115MW of renewable energy, which resulted in the selection of two projects to supply wind power at Munro, St. Elizabeth (34MW) and Rose Hill, Manchester (24 MW). In addition, a National Wind Resource Assessment identified four sites where wind power is feasible and could produce up to 212 Giga Watt per year (Winchester in St. Thomas, Kemps Hill in Clarendon, Rose Hill and Top Lincoln in Manchester). It is estimated this RE could save approximately J\$ 1.27 billion.
 - **Solar energy:** Under the above-mentioned RFP Content Village in Clarendon was selected to provide solar energy (20MW).
 - **Hydro-electricity:** The launch of pre-feasibility studies into generating hydro-power (financed under the ESEEP) concluded four rivers have combined potential to produce more than 19 MW of hydro-energy (Rio Cobre in St. Catherine, Negro River in St. Thomas, Martha Brae in Trelawny and Spanish River in Portland). Feasibility studies are now in progress.
 - **Bio-fuels:** Implementation of the Biodiesel Pilot Project has continued since 2011 and the production parameters for biodiesel using castor and jatropha plants is now being designed. This project is implemented under the **National Biofuels Policy 2009-2030** and is executed by MoAF with support from PCJ;
- **RE in the hotel industry:** The launch of the Caribbean Hotel Energy Efficiency and Renewable Energy Action Advanced Programme, funded by IDB, GiZ and other donors aims at improving the competitiveness of small and medium-sized hotels (under 400 rooms) through the introduction of RE. Training of staff at the Jamaica Hotel and Tourist Association (JHTA) to support the project's implementation took place in 2013.

10.3 Conclusions and Recommendations

Jamaica maintains a very high level of dependence on oil imports to sustain the vast majority of its energy production, which in turn has helped rank Jamaica as a high producer of GHG per capita in the developing world. The rate of growth of RE has been small and current growth trends indicate the country will not reach its target of 12.5% of its total energy mix by 2015.

However, the launch of the **Climate Change Policy Framework and Action Plan** Green Paper in November 2013 represents an opportunity to bring the energy sector under an institutional mechanism that requires a coordinated and integrated approach to the way it reduces GHG emissions. This should contribute to meeting the country's obligations under the UNFCCC and the Kyoto Protocol (through greater energy efficiency) as well as in preparing to adapt to climate change through expansion into RE.

The full liberalisation of the RE market since late 2012 represents a positive move to facilitate quicker expansion into RE, using the private sector as the main driver. The conclusion of agreements in 2013 with the private sector to supply wind and solar power to the national grid has also been a positive step forward.

The following conclusions and recommendations are made in line with the findings in this Chapter and current policy framework:

- 1) The country is well behind in meeting its own targets for alternative energy.

Recommendations

- a) Strengthen legislation to support the production of renewable energy sources in line with targets to reduce the country's energy bill, promote a healthier environment and open new opportunities to access climate finance.
 - b) Establish an Advisory Group for RE that supports a multi-sector approach in order to promote an integrated approach to the development of the green economy in Jamaica, which includes the development of the National Grid into a Smart Grid.
 - c) Develop enabling policies and financial and fiscal instruments to support the development of the green economy in Jamaica. Specific attention should be given to:
 - Meeting the additional upfront costs for private companies to invest in RE;
 - Establishing energy efficient housing in line with current Housing policy and the provisions on energy saving in the Building Act currently under development (see also Chapter 10);
 - Installing efficient public lighting, especially street lighting by moving as soon as possible towards using latest technologies such as LED and solar powered lighting;
 - Developing stricter controls on the minimum energy efficiency and emission levels permitted for new cars and buses imported into Jamaica.
 - d) Strengthen the enforcement arm to ensure energy-saving investment meet national standards of public health and safety.
- 2) The growing problem of waste disposal capacity at some of the country's landfill sites (see also Chapter 8) requires an immediate response from GoJ that should include the waste-to-energy option.

Recommendations

- a) Fast track a study to establish a pilot waste-to-energy project as part of a strategy to establish a new landfill site (preferably at Riverton, which is at capacity and a risk to public health in the coming years).
 - b) Work closely with civil society on the options for local communities to benefit from the waste-to-energy project by way of jobs and linkages to the waste stream that will require the separation of waste at the home.
- 3) There is not an effective and regular communication campaign in place to promote the multiple benefits of RE and reduction of energy use.

Recommendations

- a) Establish a communication campaign that is cost effective and based on a catch phase in Patois.
 - b) Emphasise cost savings of RE in terms of:
 - Reduced economic and social costs associated with public health care;
 - Reduced operating costs over time;
 - Increased opportunities to exploit climate finance and reduce further the country's carbon footprint; and
 - Reduced waste generation.
 - c) Promote the establishment of eco-councils and stewards in schools, government departments and the private sector and promote their lessons learned and best practice in the media campaigns.
- 4) The planning of RE is not adequately integrated into the national planning system.

Recommendations

- a) Ensure RE development is coordinated with plans to promote growth centres to create sustainable towns and communities in Jamaica.
- b) Promote RE projects as contributions to urban renewal and developing affordable housing and places where Jamaicans are proud live
- c) Assess how RE projects can increase the economic competitiveness of sectors such as mining, agro-industry and tourism development.

Useful Links and References:

Jamaica's National Energy Policy 2009-2030: Securing Jamaica's Energy Future...Advancing Competitiveness...Promoting Sustainable Prosperity (MSTEM, 2009)

<http://mstem.gov.jm/sites/default/files/National%20Energy%20Policy.pdf>

Jamaica Sustainable Energy Roadmap: Pathways to an Affordable, Reliable, Low-Emission Electricity System (October 2013):

<http://www.worldwatch.org/system/files/Jamaica-Sustainable-Energy-Roadmap-112013.pdf>

Information on Bio-energy development in Jamaica:

http://www.globalbioenergy.org/fileadmin/user_upload/qbep/docs/2013_events/GBEP_Bioenergy_Week_Brasilia_18-23_March_2013/3.12_BANDY_LINDO.pdf

Maps:

Figure 45: Location of main power generation plants in Jamaica (2013)

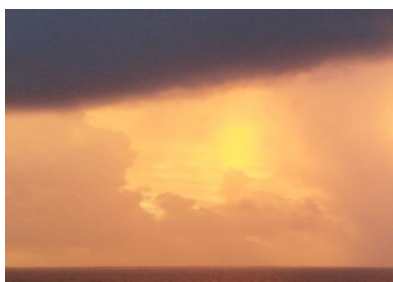
Figure 45: Locations of Main Power Generation Plants in Jamaica (2013)





Section 3:

Climate Change and Hazards

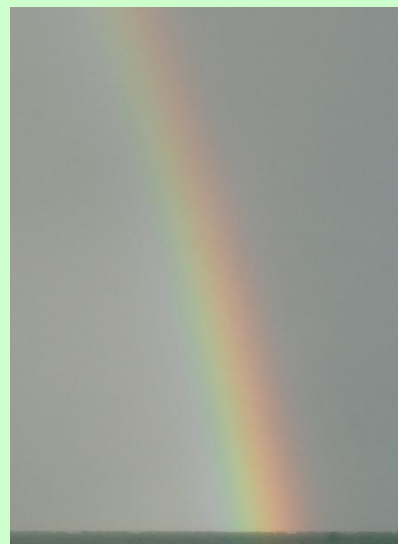


11. Climate Variability & Change

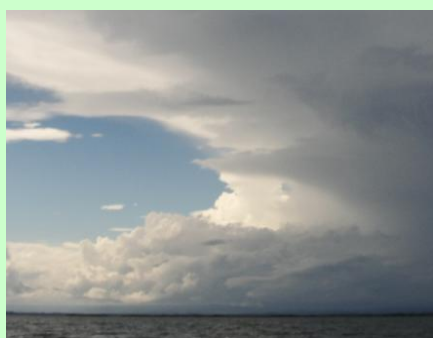
What is climate change? The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as, “a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to climate variability observed over comparable time periods.” The International Panel on Climate Change clarifies this statement by saying, “it refers to any change in climate over time, whether due to natural variability of as a result of human activity. According to the UNFCCC the rise in GHG has caused an estimated 0.74C rise in global temperature over the past 100 years.

What are greenhouse gases and the greenhouse effect?

According to the North American Space Agency (NASA) about 70% of the sun’s radiation gets through the Earth’s atmosphere. As it heats up the oceans, land and atmosphere infrared thermal radiation is emitted back into space through the atmosphere. This equilibrium of incoming and outgoing radiation makes the Earth habitable by regulating the temperature. The Earth’s atmosphere is mainly made up of nitrogen and oxygen. However, scientists believe it is the other gases in the atmosphere that are the main regulators of the earth’s climate, because they absorb and emit thermal radiation. These gases are known as greenhouse gases (GHGs) and include carbon dioxide, methane, nitrous oxide, ozone and water vapour. However, due to human activity, in particular, energy production from the burning of firewood and fossil fuels, the amount of GHGs in the earth’s lower atmosphere has been increasing dramatically over the last century. This accumulation of GHGs has sped up their capacity to trap the infrared thermal radiation in the same way glass does in a greenhouse. This is known as the greenhouse effect. This faster than normal warming of the earth’s climate is known as **global warming**.



Why is climate change important? The change in climate through even a small rise of temperature can upset the way life forms behave and cope. This can destabilize ecosystems, which in turn can undermine the global economy and affect livelihoods, especially of the most vulnerable. Hard coral is particularly vulnerable to temperature change, whereas some insects will increase their reproduction rates as temperature rises. Furthermore, climate change affects weather systems and patterns by making them more volatile. For example, the rise in sea temperature, which is resulting in an increase in the number of hazards like hurricanes and storms. This situation means there is a growing threat from **climate variability** and not just the gradual change in temperature. Jamaica is particularly at risk to climate variability, in particular the projection that storm and hurricanes are likely to be more intense and destructive.



11.1 Background to Climate Variability and Change in Jamaica

In January 1995, Jamaica became a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) which is dedicated to the reduction of greenhouse gases (GHGs), in particular carbon dioxide (CO₂), but also other damaging gases such as methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆)¹¹⁰. Between 2000 and 2005 inventories were compiled for the following sectors: Energy; Industrial Processes and Product Use; Agriculture, Forestry and Other Land Use and; Solid Waste. Initial GHG trends (see also Chapter 7) indicated that emissions of CO₂, CH₄ and N₂O increased with a minor drop in 2004. Concerning CO₂ the following trends were registered:

- CO₂ emissions increased consistently from 9,531 Gg in 2000 to 13,956 Gg in 2005.
- CO₂ emissions in the energy sector increased by 46% due to increases in fuel consumption in the manufacturing (bauxite and alumina industry) and transportation categories;. There was little change in the magnitudes of the sources and sinks for CO₂ in agriculture, forestry and other land use
- In the industrial processes and products use sector, the CO₂ emissions from the cement industry increased, whereas for lime manufacture they declined.
- CO₂ (and CH₄) emissions in the waste sector increased. The contribution from managed disposal sites decreased while that from unmanaged sites increased.

Vision 2030 Jamaica recognises that the effects of climate variability and change are likely to increase the incidence of natural disasters by causing extreme weather events to occur more often. For example, it mentions sea-level rise will help magnify storm surges and high waves in coastal areas resulting in greater erosion of beaches and the general shoreline. It will also contribute to changes in soil salinity and higher water temperatures which will increase human vulnerability to unsafe water.



11.2 The Current State of Adaptation to Climate Variability and Change

Vision 2030 Jamaica established Hazard Risk Reduction and Adaptation to Climate Change as one of the three expected outcomes (Outcome 14) to meet Goal 4 of **Vision 2030 Jamaica**: Jamaica has a healthy environment. The establishment of government capacity in climate variability and change has been low.

In response GoJ launched the State of the Jamaican Climate in 2011. The report assessed the effects of climate variability and change to 2012 and provided predictions on climate trends to 2100 using modelling software. The main conclusion from the report is that temperature is expected to increase by between 1.1 and 3.2°C by the end of the century. The negative impact this will have on Jamaica's population, biodiversity and ecosystems, on the natural and built environment as a whole and, therefore, on economic growth, is considered to be considerable for small island developing states (SIDS).

The main reason for concern is the speed at which temperature rise is expected to accelerate as

¹¹⁰ Also includes indirect GHGs such as non-methane volatile organic compounds (NMVOCs), carbon monoxide (CO), nitrogen oxides (NO_x) and sulphur dioxide (SO₂).

this will lead to significant changes in weather patterns (climate variability). For example, the above-mentioned report predicts a wide variation in rainfall patterns ranging from -44% to +18% by 2050 and -55% to +18% before 2090. This indicates longer drought periods and more intense rainfall. In part, this volatility will be aided by sea temperature, which is the major influence on weather patterns in the Caribbean. The report predicts that sea temperature will rise by between +0.9C to 2.7C before 2090.

The effects of climate variability and change are of major significance to Jamaica's population, economy and the future state of its natural environment. Major dangers (threats) include:¹¹¹

- **A rise in sea level** by between 0.18 and 0.59 m. to 2100. This will increase the vulnerability of low lying human settlements, ports and hotels located along Jamaica's coastline. Estimates are that this could affect as much as 82% of the population of Jamaica who live on or near the coastline of the island;
- **Increases in the frequency of storms** (and possibly hurricanes), which will increase the vulnerability of all Jamaicans, especially those living in low-lying areas around the coast, as well as affect agricultural production and the fisheries sector;
- **Increases in the severity of storm sand storm surges of the sea**, this will be aided by the removal of natural defences such as reefs, seagrass beds and mangroves around the coast and the loss of inland natural defences such as forests and riparian strips which help reduce soil erosion and extensive flooding.
- **Increases in prolonged periods of drought**, which will affect the quantity and quality of water resources, agriculture yields and fish stocks. It is also likely to increase insect populations (including the possible movement of alien insect species into the island).
- **Increases in the demand for emergency government funding**, which will reduce the GoJ's capacity to invest in its people and protect its natural and built up environments.
- **Increases in health epidemics**, in particular due to the transmission of vector-borne and water related diseases as a result of an increase in floods and removal of natural barriers such as mangroves and forests.

Table 69 summarises the number of climatic-related events from 2001-2013.

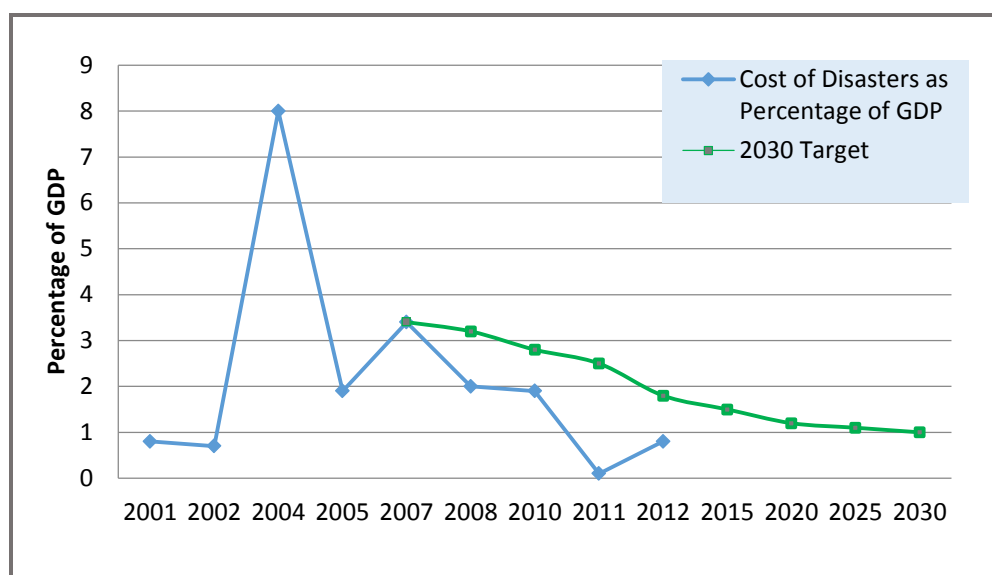
Table 69: Number of Hydro-Meteorological Events in Jamaica (2001 to 2013)

Hydro-meteorological Event	2001 to 2013 (No.)
Tropical storms	6
Hurricanes	5
Major flooding events	10
Total	21

Source: CCD

Table 69 confirms that there have been a total of 11 tropical storms and hurricanes over a period of 12 years, which, in historical terms, is a high number for Jamaica in just over a decade. The Planning Institute of Jamaica is responsible for coordinating the cost of disasters as a percentage of GDP. Figure 46 shows the costs of disasters as a percentage of the country's Gross Domestic Product (GDP) from 2000-2013 in graphic form.

¹¹¹ Based on data from UNDP/Caribsav

Figure 46: Cost of Disasters as a Percentage of GDP Against National Targets (2000-2013)

Source: Devinfo/PIOJ

The above graph shows that Jamaica has successfully remained inside its 2030 target line since 2007 when the target was first established in the aftermath of Hurricane Dean, which was the second most costly hurricane in terms of GDP in the 2001-2013 period (after Hurricane Ivan in 2004). The cost of Hurricane Sandy in October 2012 was put at J\$ 9.7 billion, which was equivalent to 0.8% of GDP in 2011, which proved less costly than Hurricane Ivan or Dean. This was achieved in part by improved preparedness prior to the arrival of the hurricane. Nevertheless, the financial cost of all disasters since 2001 is estimated at J\$ 122 billion (PIOJ).

11.2.1 Reducing the Effects of Climate Variability and Change

There are a number of challenges and pressures that Jamaica must confront if it is to meet the goals of the 2030 Vision national development plan, in particular the expected outcome of “adaptation to climate change” to meet Goal 4. The main challenge concerns mainstreaming adaptation to climate change into national and sector development planning as part of broader efforts to mainstream disaster risk reduction (DRR) and environmental conservation. This mainstreaming is crucial to reducing poverty and stimulating sustainable development.¹¹² In 2011, UNEP launched the, “Mainstreaming Climate Change Adaptation into Development Planning: A Guide for Practitioners” which encourages national governments to:

- 1) Find entry points and create awareness on the linkages between climate change and national development priorities in order to establish the case for adaptation mainstreaming;
- 2) Integrate adaptation issues into the on-going policy processes, supported by country specific evidence such as impact, vulnerability and adaptation assessments, socio-economic analysis and demonstration projects;
- 3) Meeting the implementation challenge by committing funds to adaptation actions in national budgets and finance as standard practice (and which may also attract donors to support such actions).

¹¹² In line with the Millennium Development Goals, in particular Goal 7: Ensure environmental sustainability

Mainstreaming of adaptation to climate change in sector development policy is particularly relevant in Jamaica taking into account the following pressures and issues, all of which offer important entry points for adaptation mainstreaming:

- **Poverty:** a large proportion of the country's population is poor and, therefore, particularly vulnerable to climate variability and change. Figure 2 in the introduction to this report indicates that the number of people who live below the poverty index in rural areas increased dramatically following the global economic and financial crisis between 2008 and 2009. Despite a small drop in 2012, rural poverty accounts for 21.3% of the population, which is comparable to the start of the new millennium (PIOJ). Furthermore, poverty is a major cause of environmental degradation from the clearing of forested areas in hilly areas for subsistence and charcoal production. This activity in turn increases the release of GHGs and increases human vulnerability to disasters such as landslides, floods and droughts. Therefore the mainstreaming of adaptation to climate variability and change must be promoted as a cross-cutting objective together with DRR and promoting environmental sustainability.
- **Population growth:** the fact that the population of Jamaica is projected to keep growing until around 2050 (see Chapter 9) while over the same period rainfall patterns are projected to decline and vary considerably, indicates that larger numbers of people will become increasingly vulnerable to climate variability and change. This situation could put increasing pressure on the country's natural resources and therefore, on the national economy unless more sustainable development approaches in which adaptation to climate variability and change is fully integrated (together with DRR and environmental sustainability) are adopted.
- **An energy sector that is over-dependent on oil imports:** Chapter 10 confirms that Jamaica spends too much of its wealth producing energy from oil. While oil prices remain high, there is a growing case to promote the greening of the Jamaican economy in which adaptation to climate change becomes a major driver of this change (in line with commitments under the UNFCCC).

11.2.2 Main Responses to These Challenges to 2013

The Pilot Programme for Climate Resilience (PPCR)¹¹³ funded by the Inter-American Development Bank (IDB) through its Climate Investment Funds has supported GoJ to develop the case for adaptation mainstreaming. For example, in the preliminary phase of the PPCR (2011), a number of studies and reports were produced including: a Knowledge, Attitude and Practice survey (KAP); a review of policies, strategies and plans to identify gaps where adaptation mainstreaming is needed; a handbook for Jamaica on how to conduct socio-economic impact assessments; State of the Jamaican Climate 2012 report; and a Climate Change Communications Strategy and Action Plan. In addition, the PPCR will support the development of climate relevant data acquisition, storage, analysis, access, transfer and dissemination.

In addition, the Caribsave Partnership, funded by UKAid and AusAid produced a Climate Change Risk Profile for Jamaica over a period of 18 months in 2011-2012 to mainly support the tourism sector prepare for climate variability and change. Similar profiles were produced for other countries in the region.

¹¹³Its main objective is to assist the Caribbean region increase its resilience to climate change by enhancing its adaptive capacity. The project is executed by the Mona Office of Research Innovation, UWI, in Jamaica.

In terms of specific policy development on climate change, the most significant has been the GoJ's adoption of the **Climate Change Policy Framework and Action Plan** as a Green Paper in November 2013. The policy was prepared with the support of the "Climate Change Adaptation and Disaster Risk Reduction Project" (CCADRRP) and funded by GoJ/EU/UNEP and other donors. It provides for the creation of an institutional mechanism that develops, coordinates and implements policies, strategies, sectoral plans, programmes and legislation that address the impacts of climate change in all sectors of the economy. The objectives of the policy are:

- To mainstream climate change considerations into sectoral and financial planning and build the capacity of sectors to develop and implement their own climate change adaptation and mitigation plans;
- To support the institutions at the national level which are responsible for research and the collection of data on climate change impact on Jamaica in order to improve decision-making and prioritisation of sectoral action planning; and
- To improve communication of climate change impact so that decision-makers and the general public will be better informed.

The implementation of the policy is entrusted to the CCD, which is required to conduct its work with the sectors through their designated focal points. Guidance and supervision of implementation is conferred to the establishment of the National Climate Change Advisory Committee (NCCAC) involving representatives from public and private sectors (includes a representative from the Ministry of Finance), from academia and NGOs.

One of the priorities in the Green Paper is for the NCCAC to identify flagship programmes, known as Special Initiatives (SI), which represent immediate multi-sectoral adaptation responses to the effects of climate change. The identification of these initiatives under the guidance of the NCCAC will be a major responsibility of the CCD in 2014-15. The policy recommends the SI focus on the following five priority areas:

- Low carbon development through expansion of RE and greater energy efficiency;
- Water resources management;
- Disaster risk reduction;
- Protection of ecosystems; and
- Land use planning to rationalise development processes and enact regulations for environmental impact assessments of proposed developments.

At the sector level, a number of government institutions have already made concerted efforts to integrate climate change into their policies, strategies and/or action plans. These include:

- The Disaster Preparedness and Emergency Management Act (1993), which through its National Disaster Plan establishes measures to promote disaster risk reduction from natural hazards which may be exacerbated by climate variability and change such as drought and flash floods.
- The draft National Water Sector Adaptation Strategy (2008) which looks at building resilience of the water sector against the effects of climate variability and change, especially droughts.
- The Jamaica Energy Policy 2009-2030, which places emphasis on energy efficiency and promoting RE.
- The draft National Carbon Emissions Trading Policy (2009) which commits Jamaica to participation in the Clean Development Mechanism and Kyoto Protocol regarding the reduction of GHGs.

- The National Building Code (2013) which requires buildings to be hurricane resistant, install improved drainage systems and be more energy efficient to save costs and reduce GHGs.
- The Forest Policy (2013), which, through the support of the CCADRRP, addresses climate change, carbon sequestration and carbon trading (includes REDD+) by reforestation, new forestry projects and greater forest protection. The CCADRRP has helped implement this policy by funding:
 - The rehabilitation of selected watersheds in coordination with the FD and NEPA. These projects have focused heavily on environmental education and awareness campaigns with a particular focus on strengthening Local Forest Management Committees.
 - Reviews of the draft Ocean and Coastal Resources Management Policy and the Jamaica Cays Management Policy as a way of fully integrating adaptation to climate change into these policies.
- The Ministry of Agriculture and Fisheries has started a review to develop a sector action plan to build resilience against climate change under the initiative “Enhancing the Resilience of the Agriculture Sector and Coastal Areas for Livelihoods Protection and Food Security” financed by the Adaptation Fund.¹¹⁴ Similar sector plans are to be developed in 2014-15 with other government institutions.
- MSTEM is in the preliminary stages of identifying a strategy to reduce GHG emissions with support from the Latin American Energy Organisation (OLADE). This work will facilitate efforts planned in 2014-15 to prepare a new inventory on GHG emissions for the UNFCCC (with support from UNDP).

Finally, concerning the funding of actions to build the country’s resilience to climate change, the GoJ established the **Adaptation Fund Programme** (US\$10 million) in 2013. The fund, which is managed by PIOJ, focuses on protecting livelihoods and food security among vulnerable communities by improving land and water management for the agriculture sector, strengthening coastal protection, and building institutional and local capacity for climate change adaptation. Activities that have already been financed by this fund include studies to design water supply systems for three vulnerable communities and build breakwater systems to protect beaches in Negril that have suffered from severe beach erosion (see section on beaches in Chapter 5). The studies commenced in 2012 and proposals were submitted to PIOJ in 2013.

11.3 Conclusions and Recommendations

The institutional framework to implement the Climate Change Policy Framework and Action Plan Green Paper from 2014 has some caveats that will need to be closely monitored to support the proposed mainstreaming of climate change into sector policy. The CCD has to rely heavily on networking with government institutions to promote the mainstreaming of climate change in policy.

Based on the findings in this report and current policy status the following conclusions and recommendations are made:

- 1) The CCD has a small number of staff assigned to it (three officers) which will need strengthening.

¹¹⁴ The Adaptation Fund was set up to support developing countries that are parties to the Kyoto Protocol reduce their GHG emissions. It is part financed by proceeds of Certified Emission Reductions (CERs) issued under the Protocol’s Clean Development Mechanism. The Government of Jamaica is required to also provide funds for its projects.

Recommendations

- a) Recruitment of a climate economist who can work closely with the Ministry of Finance to:
 - Coordinate valuation studies on the financial costs of the effects of climate variability and change on different development sectors and the economy as a whole (in coordination with PIOJ and specialists from academia);
 - Assess the role of insurance as a means of strengthening investment in environmentally friendly actions, rather than as a means of risk transfer;
 - Assess the potential for a new round of debt swap negotiations that facilitate climate change mainstreaming in the legal and policy framework as well as climate change adaptation measures on the ground, especially with local government, community based organisations and non-state actors.
- 2) The CCD needs to develop greater synergies with other key institutions such as the Meteorological Office of Jamaica, the Office of Disaster Preparedness and Emergency Management and NEPA in order to promote and intensify adaptation mainstreaming in key areas of central and local government (and within the private sector).

Recommendations

- a) Establish a fully coordinated response to DRR and adaptation to climate change with the land use and spatial planning system, building on lessons learned from the PPCR in the Caribbean region and any other relevant projects;
- b) Establish a centralised and standardised data collection and management facility on climate change indicators, in order to establish an effective annual reporting exercise as well support informed decision-making on:
 - Implementing climate change adaptation within key sectors (especially Energy, Agriculture, Construction, Mining and Tourism). For agriculture this must centre on the change to dry-zone crops where water stress levels in the watersheds are already at a critical level (see also Chapter 2);
 - Developing the Education Curriculum and extra-curricular actions linked to climate change adaptation;
 - The progress in meeting international commitments and targets.
- 3) The vulnerability assessments conducted to date in Negril, Manchioneal, Portland Cottage and Morant Bay do not provide a comprehensive picture (risk map) of the areas of Jamaica that are most vulnerable to the effects of climate change.

Recommendations

- a) CCD and ODPEM should coordinate efforts to develop an islandwide vulnerability assessment to determine the local communities and areas of the country that are most at risk from the effects of climate variability and change.
- b) Establish linkages between CCD, the Ministry of Health and the Ministry of Tourism on the health risks associated with climate variability and change, (such as dengue fever outbreaks and potential water borne diseases in flood waters).
- c) Establish an inventory on the health centres and hospitals to determine those that need to be updated/ improved so they will remain open and accessible in the event of

- a disaster.
 - d) Establish an inventory on sea defences to determine which ones are at risk from storm surges.
 - e) Increase the awareness of the private sector on the benefits of investing in adaptive measures, especially for the tourism sector.
- 4) There is a need to upgrade the communication strategy on climate variability and change to ensure that there is regular, island-wide information provided on how local communities and institutions can enhance their resilience to climate variability and change.

Recommendations

- a) Ensure the communication strategy is directed at different sectors of society, (households, vulnerable communities, private sector, local government, etc.) to develop awareness of the potential threats of climate variability and change and the types of support available to them, especially in relation to:
 - Water conservation and rainwater harvesting in drought-prone areas;
 - Set-backs and improving defences in areas prone to storm surges;
 - Climate-related diseases and how to prevent, detect and treat them.
 - Reducing the threats of fires, especially in forested areas that are prone to drought.
- b) Conduct a national assessment on the progress and achievements of mainstreaming climate change into the education curriculum, with a specific focus on teacher training and capacity to impart education on climate change in an effective, practical and interesting way.

Useful Links and References:

Jamaica's Climate Change Policy Framework and Action Plan (draft, November 2013):

http://www.japarliament.gov.jm/attachments/440_Climate%20Change.pdf

For a review of policy, plans, legislation and regulations for climate resilience in Jamaica visit:

<https://www.climateinvestmentfunds.org/cifnet/sites/default/files/Final%20Review%20of%20Policy,%20Plans,%20Legislation%20&%20Regulations%20for%20Climate.pdf>

Information on the Pilot Programme for Climate Resilience:

<http://www.climateinvestmentfunds.org/cif/node/4>

Information on the Climate Change Adaptation and Disaster Risk Reduction Project:

<http://www.qcca.eu/national-programmes/caribbean/qcca-jamaica>

Information on the Caribsave Climate Change Risk Atlas – Climate Change Risk Profile for Jamaica:

[file:///C:/Users/OLDING/Documents/201504%20Jamaica%20Environment%20Profile/SOE%20Final%20Draft/Maps%2021%20July/THE%20CARIBSAVE%20CLIMATE%20CHANGE%20RISK%20ATLAS%20\(CCCRA\)_Jamaica.pdf](file:///C:/Users/OLDING/Documents/201504%20Jamaica%20Environment%20Profile/SOE%20Final%20Draft/Maps%2021%20July/THE%20CARIBSAVE%20CLIMATE%20CHANGE%20RISK%20ATLAS%20(CCCRA)_Jamaica.pdf)

Maps:

See Chapter 12 for a selection of risk maps



12. Natural & Man-Made Hazards

What are hazards? The United Nations International Strategy for Disaster Reduction (UNISDR) defines hazards as: “a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.” Jamaica suffers from many natural and man-made hazards such as:

- **Biological hazards:** health-related pandemics (including influenza or dengue), plant or animal contagion, insect or other animal infestations and plagues;
- **Geological hazards:** includes earthquakes, landslides, mudflows and rockslides;
- **Hydro-meteorological hazards:** such as drought, floods, hurricanes, lightening and storm surges;
- **Oceanic hazards:** such as tidal waves, tsunamis and sea level rise;
- **Socio-natural hazards:** where poorly planned and managed human activity such as the clearing of land for agriculture raises the vulnerability of the land to natural hazards; and
- **Technological hazards:** such as industrial pollution, toxic wastes, transport accidents, fires, explosions and chemical spills.

What are disasters? They are a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceed the ability of affected communities or society to cope using its own resources (UNISDR).

Note: A disaster can destroy an investment of many years in just one day

What is disaster risk management? This is the systematic process of using administrative directives, organisations, and operational skills etc to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster (UNISDR) .

Why is disaster risk reduction (DRR) important? Learning to reduce disaster risk through systematic efforts to analyse and manage the causal factors of disasters is crucial to sustainable social and economic development. DRR focuses on reducing human (and natural) vulnerability to disasters. This can be done through improved land use and land management, preparing for adverse events and having an effective response capacity in place to reduce disaster impact. Effective DRR strengthens the coping capacity of humans and nature to withstand hazards. This is known as strengthening human or natural **resilience**.

Who is responsible for disaster risk reduction? In December 1999 the United Nations General Assembly adopted the International Strategy for Disaster Reduction (UNISDR) and established a secretariat to implement the Strategy. Since 2005 the UNISDR in collaboration relevant national, regional, international and other UN bodies, has been responsible for the implementation of the **Hyogo Framework for Action (HFA) 2005-2015**. Jamaica, in coordination with the Caribbean Disaster Emergency Management Agency (CDEMA) is responsible for implementing the HFA through the Office of Disaster Preparedness and Emergency Management.

12.1 Background to Disaster Risk Reduction in Jamaica



Since the establishment of the Office of Disaster Preparedness and Emergency Management in 1980 and the subsequent enactment of the **Disaster Preparedness and Emergency Management Act** in 1993 and the National Disaster Plan of 1983 (revised in 1997), the Office of Disaster Preparedness and Emergency Management (ODPEM) has been the government agency responsible for Disaster Risk Reduction and Emergency Management in Jamaica. The disaster management programme is administered by the ODPEM with policy oversight from the National Disaster Committee (NDC). The NDC has sub committees with responsibility for damage assessment, recovery, and rehabilitation, emergency operations, communications and transport. The ODPEM has five main divisions: Corporate Services, Information and Training, Mitigation, Planning and Research, Preparedness and Emergency Operations and Projects Implementation, Development and Monitoring.

ODPEM's activities are guided by the **Draft National Hazard-Risk Reduction Policy for Jamaica** (2005). The policy emphasises the importance of hazard-risk reduction (Disaster Risk Reduction – DRR) measures to sustain the development process. Its main aim is to fully integrate DRR into national, parish and community levels of development planning, in line with the **Strategy and Results Framework for Comprehensive Disaster Management** (CDM) adopted by the Caribbean Community (CARICOM) in 2001.

At the national level DRR has been integrated into the Vision 2030 NDP (Goal 4, Outcome 14). At the parish level, Parish Disaster Committees (PDC) operates within the local authorities and is responsible for responding to disasters and promoting education on DRR, which includes health-related issues. The policy places importance on securing the **active participation and partnership of local communities**, the public and private sectors, NGOs and international donors in the identification, design and implementation of hazard-risk reduction measures.

This has been achieved through the creation of National Zonal Programme in which a zone chairperson is responsible for monitoring potential disasters with the support of focal points that work at the local community level. This process of coordination is designed to support community-based early warning systems and an effective communication strategy in the event a disaster strikes. The programme recognises that community participation is a critical element in disaster management. Community participation is necessary to reverse the worldwide trend of increasing frequency of, and loss from, disasters; build a culture of safety and disaster resilient communities; and ensure sustainable economic development.

Jamaica has begun the process of developing its **Comprehensive Disaster Risk Management Policy** (CDRMP), which will guide DRR activities and emergency management under the framework of the CDM Governance Mechanism promoted by the Caribbean Disaster Emergency Management Agency (CDEMA) of CARICOM. The mechanism, which promotes a structured and harmonised approach to the development of CDM programming in Jamaica and other participating states in CDEMA, is primarily designed to facilitate cooperative financing and collaborative programming in support of DRR in the wider Caribbean region. The main goals behind this approach are to implement the disaster loss reduction agenda, mainstream DRR into sector programming and establish a programme based approach to the implementation of CDM.

12.2 Status of Nature-Related Hazards in Jamaica (2011-2013)



Geological hazards: the Earthquake Unit (EQU) at the University of the West Indies is responsible for monitoring seismic activities and provides seismic research. Here are the main developments since 2011:

- Installation of three permanent Global Positioning Systems (GPS) at Mona University, Pedro Cays and Morant Cays under the Continuously Operating Caribbean GPS Observational Network (COCONet), funded by UNAVCO (a university-governed consortium dedicated to geosciences research and education, part funded by National Aeronautics and Space Administration - NASA).
- Replacement of four analogue seismograph stations with four broadband seismic units within the seismic network. Figure 48 at the end of this chapter shows the current seismograph and accelerograph network in Jamaica.
- Realisation of the Seismic Microzonation of Kingston Harbour Study in 2013, which gathered data on ground acceleration /motion in the Harbour.
- The EQU participated in the sharing of data and information to support the development of a tsunami warning system in the Caribbean.
- Commencement of the Disaster Risk Profile for Jamaica funded by the Inter-American Development Bank (IDB), which is focusing on two hazards: earthquakes and hurricanes. The report will be finalised in 2014, but initial findings are that Jamaica would lose more than US\$2 billion in of public infrastructure should a major earthquake hit the country.

Table 70 summarises earthquake activity in 2012-2013. The majority of seismic activity was registered at the Blue Mountain Block (also in 2010 and 2011) followed by Rio Minho-Crawle River Fault Zone. Figure 49 shows the location of recorded earth tremors from 1998-2010.

Table 70: Earthquake Events Reported in Jamaica in 2012 and 2013

Month	Total Located Events (Local & Near)		Total Recorded Events (Local, Near, Regional, Distant & Blasts)		Felt Events	
	2012	2013	2012	2013	2012	2013
January	6	5	16	10	0	0
February	19	21	32	28	2	3
March	7	10	18	20	2	1
April	12	15	22	27	0	1
May	17	15	25	24	0	1
June	7	13	17	24	0	2
July	5	12	16	18	0	1
August	6	6	18	14	1	1
September	13	11	24	17	0	3
October	7	8	18	14	1	2
November	15	11	24	16	0	0
December	15	6	18	12	1	0
Total	129	133	260	224	7	15

Source: the Earthquake Unit/UWI



Source: National Hurricane Centre/NOAA (USA) applying the Saffir-Simpson Hurricane Wind Scale and showing the pathway and intensity of Hurricane Sandy in October 2012.

Hydro-meteorological hazards:

Hurricanes and tropical storms are highly dangerous hazards. They begin when the warm waters of the Atlantic Ocean evaporate in large quantities when it is warmest (August to November) known as the Peak Hurricane Season. As the water vapour rises it collects in the atmosphere creating a counter-clockwise wind (clockwise in the Southern Hemisphere). When the wind sucks up very large amounts of water vapour from the sea's surface it turns into a tropical storm, which often drift in a south-north direction. In some cases the tropical storm continues to grow and its wind force turns it into a hurricane.

The Saffir-Simpson Hurricane Wind Scale is used to rate a hurricane's wind speed to support emergency services in preparing in advance according to the risk level of the hurricane. The category levels are described in the following figure.

Figure 47: Saffir-Simpson Hurricane Wind Scale for Hurricanes

Hurricane Category	Average Wind Speed Range	Danger Level and Expected Damage
1	119-153 km/hour	Very dangerous: trees will be damaged and may fall; damage to roofs, gutters, aerials and other externalities expected; power lines brought down and power shortages expected
2	154-177 km/hour	Extremely dangerous: larger numbers of trees will fall; damage to buildings wooden buildings and shacks will be high; power disruption could last for several days; water shortages expected; road damage and blockages likely.
3	178-208 km/hour	Devastating damage will occur: well built houses will experience damage; greater numbers of trees will fall or be damaged; landslides and mudslides likely; Major disruption to electricity, water and other public services; emergency services will be affected.
4	209-251 km/hour	Catastrophic damage will occur: major damage and disruption expected in all areas for several weeks. Affected areas will be uninhabitable for many weeks
5	252+ km/hour	Catastrophic damage will occur: high numbers of framed houses will be destroyed; total roof failure; public services out for weeks to several months.

Source: National Hurricane Centre/NOAA (USA)

Table 71 summarises the main hydro-meteorological hazards that occurred in the period 2010-2013.

Table 71: Number of Major Storms and Their Estimated Cost (2010-2013)

Year	Event	Category	Estimated Cost (J\$B)	Impact (% GDP)
2010	Tropical Depression 16 & Tropical Storm Nicole	-	20.6	1.9
2011	No major events	-	-	-
2012	Hurricane Sandy	1	9.9	0.8
2013	No major events	-	-	-
Total Cost			30.5	-

Source: OPDEM/PIOJ

The above table confirms Hurricane Sandy was the major hurricane event between 2011 and 2013. On October 24, 2012, a category one hurricane with maximum sustained winds of 80mph made landfall in Jamaica directly impacting an estimated 4,000 persons. The main impact from the system was wind and storm surge concentrated mainly in the eastern region of the island. The total estimated loss across all sectors as a result of the passage of Hurricane Sandy was reported as J\$5 billion. The greatest losses were recorded in the Agriculture Sector (J\$1.5 billion), Infrastructure (J\$ 1.5 billion), Housing (J\$840 million estimated), Local Government Services – including infirmaries minor water supplies and debris management (J\$850 million), The Education Sector (J\$170 million) and Health (J\$159.5 million).

Figure 54 at the end of this chapter shows that the current level of category 3 to 5 hurricanes are projected to increase by 2080 as a result of climate change. The indications are there will be an increase in both the intensity and number of these highly dangerous hazards. The photo to the right shows the size of Hurricane Ivan in 2004; one of the few Category 5 hurricanes to make landfall. Its financial cost to Jamaica was very high at approximately 8% of GDP.



Floods: There are four main types of floods that affect Jamaica: **flash floods** (caused by too much rainfall coupled with inadequate drainage); **riverine floods** (when rivers burst their banks, which may be due to the rise in sediment from soil erosion on the river bed); **tidal floods** (caused by high tides and heavy rain, or seismic action on the sea bed); and **ponding** (the build-up of rainwater in sink holes, clay-based depressions, etc.). The photograph on the left shows flooding from storm surges associated with weather events in Jamaica.

Landslides, mudslides and rockslides: These are geological hazards that occur mainly in steep hilly areas where soils and/or rocks become saturated with water, and expand and cause land movement. Seismic activity can also trigger geological hazards. Major landslides and mudslides can bury a whole village or town, take many lives and cause permanent damage. From a development planning standpoint construction should not take place on (or below) land where the structural integrity of the bedrock is prone to movement. Landslides and other natural hazards are reported to the disaster management committees within local and national government and the information is also passed on to the United Nations International Strategy for Disaster Reduction

(UNISDR), which maintains an inventory of disasters and their effects. Figure 51 at the end of this Chapter shows the areas of the country that are vulnerable to landslide events (2011).

Droughts: This phenomenon is perceived differently by different sectors. For example, farmers perceive droughts over several growing seasons, whereas water supply shortages is perceived as a deficiency in precipitation over an extended period of time (normally over a season).¹¹⁵ The Meteorological Office did not declare a national drought in the period 2011 to 2013. Figure 52 at the end of this chapter shows the average annual distribution of rainfall in Jamaica. It confirms several areas of Jamaica have suffered localised droughts, some of which were more prolonged than usual. In many cases the impact of drought has been exacerbated by high water demand, poor water management, which includes high water loss in the water supply system due to leaks and burst pipes (see also Chapter 6 on non-revenue water).

Prolonged droughts have mainly affected the south and eastern parts of the island. The eastern part of the country has also suffered from the effects of drought because of the high dependency on surface water resulting from the geology of the island, such as in the Hope and Yallahs watersheds (see also Chapter 6).

12.2 Man-made Hazards and Environmental Incidents (2011-2013)



Fires: the Jamaica Fire Brigade (JFB) is responsible for attending to all types of fires in Jamaica. In 2013 it reported genuine fire calls amounted to 11,834, which was 1.1% down from 2012 figures. Forest fires were the most common (66%) and continue an upward trend in recent years. The JFB confirmed the parish with the highest incidence of fires in 2013 was St. Catherine (2,697). Table 72 summarises the major impact of fires in the period 2010-2013.

Table 72: Number of Deaths, Injuries and Homeless from Fires (2010-2013)

Impact	2010 (No.)	2011 (No.)	2012 (No.)	2013 (No.)
Deaths				
Adults	34	9	23	14
Children	12	11	11	5
Fire fighters	0	0	0	0
Injuries				
Adults	56	31	68	44
Children	2	10	3	9
Fire fighters	15	15	13	17
Rendered homeless				
Adults	1,188	1,402	1,549	1,232
Children	663	811	859	598
Fire fighters	0	0	0	0
Total Affected	1,970	2,289	2,526	1,919

Source: Jamaica Fire Brigade

¹¹⁵ ODPEM, Jamaica Country Document on Disaster Risk Reduction,

Table 73 provides a summary of human-induced technological hazards that have affected Jamaica in the period between 2010 and 2013.

Table 73: Number of Man-Made Hazards in Jamaica (2010-2013)

Type of Incident	2010	2011	2012	2013
Oil spills	6	4	12	16
Chemical spills	4	9	7	8
Fish kills	5	11	11	5
Gas releases (chlorine & ammonia)	3	2	5	2
Dust air pollution	7	6	1	4
Other Air pollution	0	5	20	38
Release of untreated effluent	12	1	6	8
Dunder/molasses spills	2	0	6	1
Marine pollution	3	1	1	0
Other	0	1	0	0
Total	42	40	69	82

Source: NEPA

An analysis of the data provided in the table above reveals the following developments:

- 1) The trend in the number of man-made hazards as a whole is on the increase to 2013.
- 2) The major man-made hazard relates to air pollution, which has increased considerably since 2010. The main hazard in this category relates to fires, in particular the illegal burning of rubbish. However, a growing hazard concerns unacceptable levels of sewage odour, which may correlate to the poor performance of a large number of sewage treatment plants (see section 8.4 in Chapter 8).
- 3) Oil spills have increased almost four fold since 2010. They mainly relate to tanker accidents at filling or delivery sites.
- 4) Fish kills using poisonous chemicals continue in Jamaica despite a drop in 2013. Fish kills arise from a number of causes including high biological oxygen demand or BOD (see also Chapter 6), discharges of toxic substances into rivers and coastal marine waters, or the use of poisons to catch prized species in fresh or salt waters (crayfish, lobster, grouper, etc.). According to the Oracabessa Bay Foundation and Fishermen's Group many perpetrators of the latter are repeat offenders who know the current fines in place do not act as a deterrent to carrying on the practice.

12.3 Challenges and Threats Associated with Hazards

Jamaica continues to face many challenges such as a rise in rural poverty; growth of informal development outside of the planning system without adequate law enforcement; population growth and concentrations in main centres (especially in the Kingston metropolitan area); and fire accidents and arson. The threats associated with climate variability and change (see also Chapter 11) represents one of the biggest challenges to Jamaica's development. Figure 54 shows the current and projected trend in hurricane tracks. It indicates that more intense hurricanes are likely

in warmer climate conditions in the future.

The loss of forest cover, especially in hilly areas and along rivers causes soil erosion and landslides, which are major contributors of flash and riverine flooding. This is exacerbated by an increase in more intense weather events, which are attributed to climate variability and change. These hazards have contributed to increasing the vulnerability of many Jamaicans. Figure 53 at the end of this chapter shows the latest geographical distribution of vulnerable communities to disasters in Jamaica (2011).

This challenge is exacerbated by ineffective land use and inadequate spatial planning. For example, there is currently no national risk map in circulation to guide national and regional development policy resulting in part from the delays in establishing the national spatial plan (see Chapter 8). Furthermore, there needs to be greater coordination between ODPEM; NEPA and WRA concerning flooding. Currently, WRA is responsible for Flood Plain Mapping, which is used to support the preparation and implementation of the Floodwater Control Master Plan.

However, it does not have a legal mandate for flood water control management (currently managed by the NWA). Furthermore, NEPA is responsible for flood impact assessments, which can also be conducted by ODPEM. This situation makes it more difficult to coordinate effective land use planning, resettlement programmes and DRR in critical areas, in particular the identification and implementation of early warning systems for priority areas.

Flash flooding in urban areas is also a growing hazard. Major causes are linked to increased paved areas, inadequate drainage and inappropriate solid waste disposal, in particular of plastic bottles, which often block drain grills and drainage ditches. Fires, particularly those due to inadequate management of solid waste disposal, which includes at the country's waste disposal sites and on the grounds of private dwellings, remain major threats to air quality and environmental wellbeing (see also Chapter 7).

One of the most significant responses by ODPEM in tackling these challenges and threats in the period 2011-2012 has been the launch of the **Disaster Risk Reduction Framework 2012-2015**. The framework aims at achieving four outcomes aligned to *Vision 2030 Jamaica* as follows:

- **Build community capacity** to cope with climate change and apply disaster risk reduction. By the end of 2013 ODPEM had supported the establishment of:
 - 14 Community Disaster Risk Management Groups
 - 9 Community Disaster Risk Management Plans
 - 12 Community Emergency Response Teams
- **Mainstreaming of disaster risk management** in national, sector and local policy and strategies: This included specific support to the Ministry of Tourism in areas such as:
 - Developing capacity in the establishment of Emergency Operation Centres for the public and private sectors.
 - Conducting Initial Damage Assessments.
 - Strengthening Basic Disaster Risk Management with hoteliers and other stakeholders.
 - Sensitising and training public officials from agriculture, education and health sectors on DRR.
 - Training of over 100 businesses in DRR.
 - Supporting faith-based organisations in emergency shelter development and management.

- **Community hazard mapping:** activities centred on:
 - Conducting the Annotto Bay multi-hazard assessment.
 - Seismic assessments and storm surge modelling for Falmouth and Trelawny;
 - A seismic assessment for Linstead, St. Catherine.
 - Realisation of a comprehensive vulnerability analysis of development assets in Negril (part-funded by the Adaptation Fund).
 - Conducting a Rapid Visual Screening of seismic vulnerability levels of 77 strategic public buildings (police buildings, JFB buildings and health centres). The conclusions were: 19% of police stations, 30% of health centres and 14% of fire stations would resist seismic events, confirming improvements are urgently needed to structures and/or foundations in all three sectors.
 - **Installation of early warning systems (EWS):** the main activities included:
 - Establishment of five community EWS
 - Creation of the National Alert and Mass Notification System designed to send flood alerts through a variety of channels, including mobile phone texts.

In addition, geospatial analysis was conducted to support disaster risk management and modelling of spatial trends. One of the most significant was the Risk and Vulnerability Assessment Methodology Programme (funded by CCADRRP), which used GIS and remote sensing to identify land use change in the South Negril-Orange River Watershed Management Unit in 1968, 1999 and 2009.

ODPEM also was responsible for leading the Hurricane Sandy Recovery Project. This included the mapping of damage to the agriculture sector, coastal development (by storm surge), public buildings (such as schools, health centres, police stations, etc.) and to housing.

Finally, phase I of the Disaster Management Geospatial Web Application was launched in 2013 by the National Works Agency. Once completed, the application is intended to collect, analyse and process data to determine if a disaster is likely to happen and, if positive, to allow for a rapid and early contingency¹¹⁶ response to be mobilised before it strikes.

12.4 Conclusions and Recommendations

Jamaica's geographical location makes it highly vulnerable to five main hazards: droughts, hurricanes, floods, landslides and earthquakes. Indications are that climate change is contributing to increasing the variability and intensity of these hazards.¹¹⁷ However, the GoJ has responded to this by fully recognising disaster risk reduction and adaptation to climate change under Goal 4 of ***Vision 2030 Jamaica***.

However, the current reality is that rural areas are becoming increasingly vulnerable to disasters as a result of the rise in socio-natural hazards that have developed in the absence of effective land use and spatial planning and its enforcement (see Chapter 9). This is likely to lead to further land degradation and erosion, which in turn will contribute to more flooding as soil sediment and debris mount up in the lower watershed and in estuaries. A weak natural resources base in many parishes is also likely to lead to water shortages and encourage rural to urban migration.

¹¹⁶ Contingency planning is a management exercise specifically designed to identify the response needs in advance of an imminent disaster.

¹¹⁷ Climate Studies Group, Mona-UWI, 2013.

The current institutional framework in place to deal with these challenges is substantial given that there are a number of specialised government agencies in place and OPDEM has established a national network of community cluster zones to support DRR and Early Warning Systems.

On the basis on the findings in this report, the following conclusions are made:

- 1) There is an inadequate level of inter-institutional coordination between the main stakeholders.

Recommendations

- a) Promote inter-institutional coordination and collaboration using opportunities such as risk mapping to identify public investment DRR priorities as a common interest.
 - b) Provide training and improve technological capacity to reduce inter-institutional barriers and lesson workload.
 - c) Establish a centralised digital database on indicators relating to hazards and disasters to ensure a systematic tracking of progress in meeting *Vision 2030 Jamaica* Goal 4 based on the collection of multi-sectoral data.
- 2) There are inadequate human and financial resources to ensure full integration of DRR in land use and spatial planning (in particular the development of land capability¹¹⁸ and risk maps).

Recommendations

- a) Identify different financial options to ensure the mainstreaming of DRR and adaptation to climate change can be undertaken and maintained.
 - b) Justify the need for more funds by communicating the potential investment benefits of DRR and climate change adaptation rather than focusing on their costs.
- 3) The application of environmental impact assessments has not always resulted in the desired application of its recommendations to reduce vulnerability.

Recommendations

- a) Carry out a study under NEPA to identify how EIA could be developed and amplified to establish DRR and climate change adaptation.
 - b) Assess the feasibility of establishing Strategic Environmental Assessment to help guide EIAs within NEPA/TCPA.
 - c) Develop capacity in ODPEM to promote participatory research into the causes behind disasters and identify lessons learned and best practices to guide the NSP and local planning authorities on promoting DRR within development strategies.
- 4) Informal development in highly vulnerable areas continues (flood-prone areas, on earthquake fault lines, on unstable bedrock, inside the setback regulations, etc.).

¹¹⁸ Land use capability maps identify potential uses of land according to their capability to sustain that use (soil and geology, slope and susceptibility to erosion, vegetation present, etc.). To prepare these maps remote sensing and ground truthing are usually required.

Recommendations

- a) Collect data and establish a national risk map within ODPEM to identify highly dangerous areas.
- b) The regulatory framework is strengthened to send a clearer message that incorrect practices in highly vulnerable areas will be prosecuted.

Useful Links and References:

Information on OPDEM situation reports and general information about its mandate:

<http://www.odpem.org.jm/News/SituationReport/tabid/486/Default.aspx>

Hazard-risk reduction policy

http://www.nepa.gov.jm/planning&development/vision_2030.pdf

Information on reports by the Earthquake Unit at the University of the West Indies (Mona):

<http://www.mona.uwi.edu/earthquake/publishnresearch.php>

<http://www.mona.uwi.edu/earthquake/files/UNAVCO-equ-web-info.pdf>

Country Document on Disaster Risk Reduction in Jamaica (2012):

http://www.preventionweb.net/files/39157_helpagefinalcountrydoc1.pdf

Information on UNISDR and the Hyogo Framework for Action 2005-2015:

<http://www.unisdr.org/who-we-are/mandate>

National progress report on the implementation of the Hyogo Framework for Action by ODPEM:

http://www.preventionweb.net/files/33409_jam_NationalHFAprogress_2011-13.pdf

Maps:

Figure 48: The current state of the Seismograph and Accelerograph Network of Jamaica (2013)

Figure 49: Recorded Earth Tremors by the EQU in Jamaica 1998-2010

Figure 50: The Location of Storm Surges Events in Jamaica (2005)

Figure 51: Landslide Vulnerable Areas Based on Geotechnical Engineering Categorization (2011)

Figure 52: Isohyetal Map of Jamaica Showing Areas of Extreme Rainfall and Drought for 50-Year Return Period to 2013

Figure 53: Informal Settlements and Vulnerable Communities in 2011 (ODPEM)

Figure 54: Modelled Category 4 and 5 Hurricane Tracks in the Caribbean Under Present and Warned Climatic Conditions (2010)

Figure 48: The current state of the Seismograph and Accelerograph Network of Jamaica (2013)

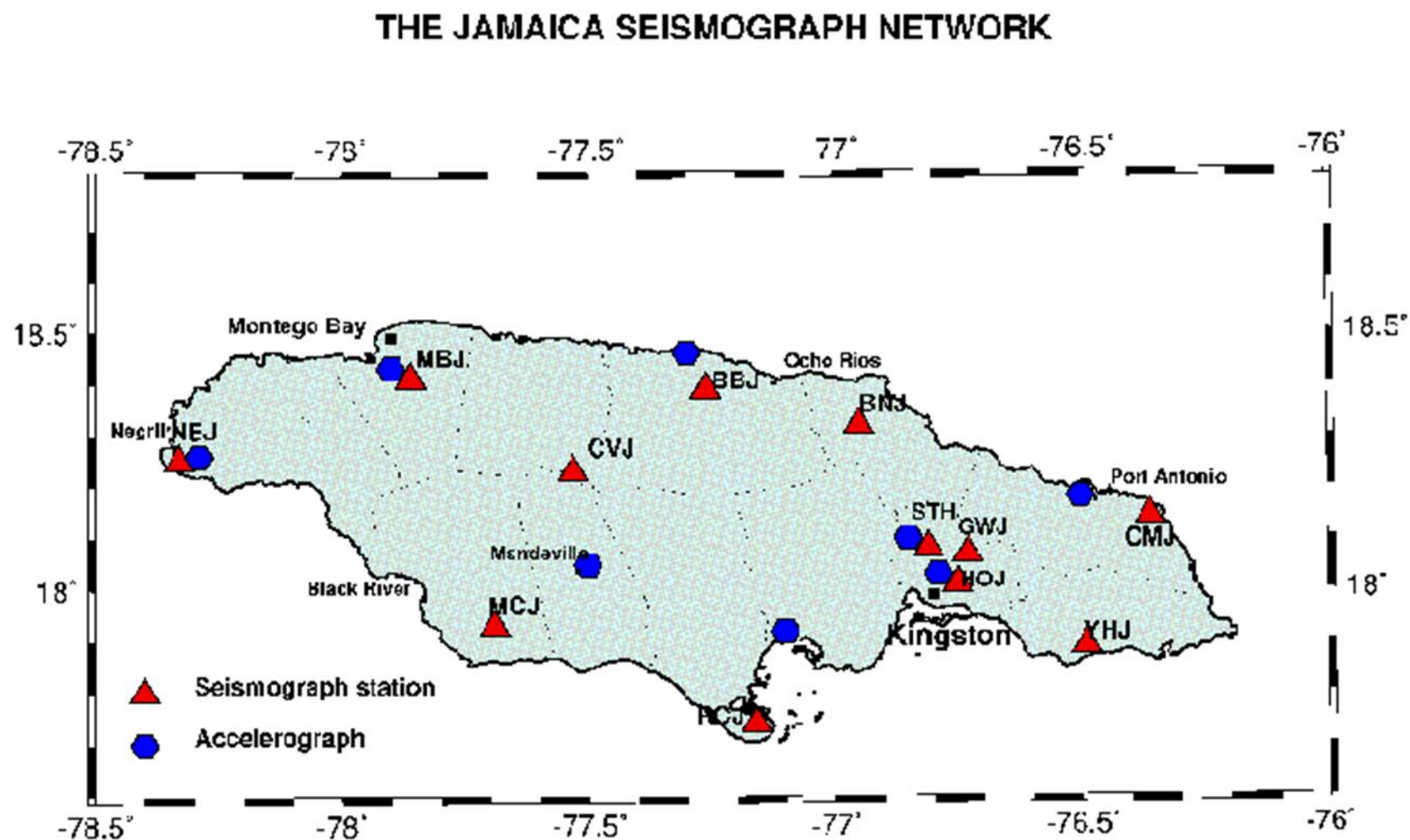


Figure 49: Recorded Earth Tremors by the EQU in Jamaica 1998-2010

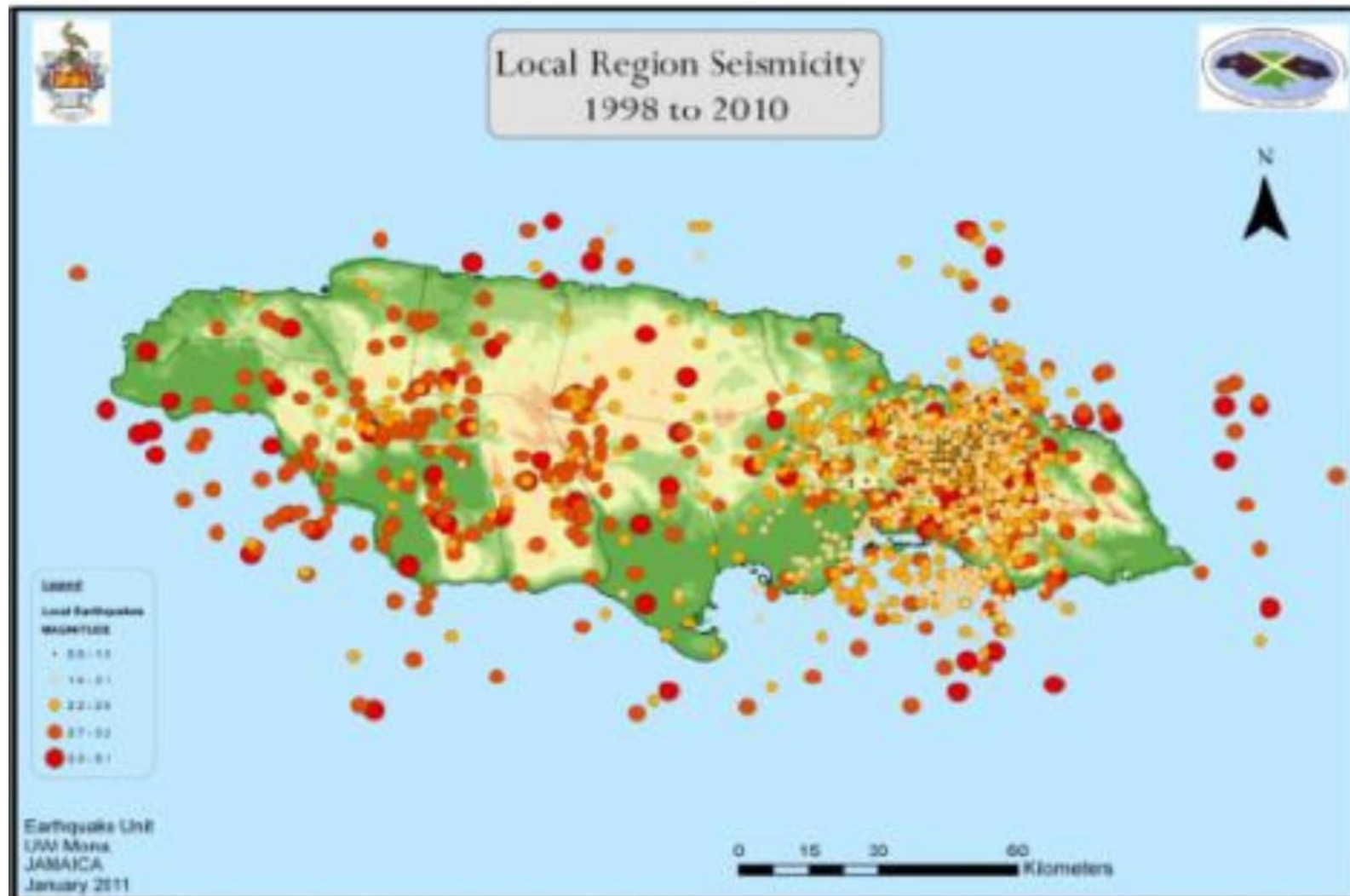


Figure 50: The Location of Storm Surges Events in Jamaica (2005)

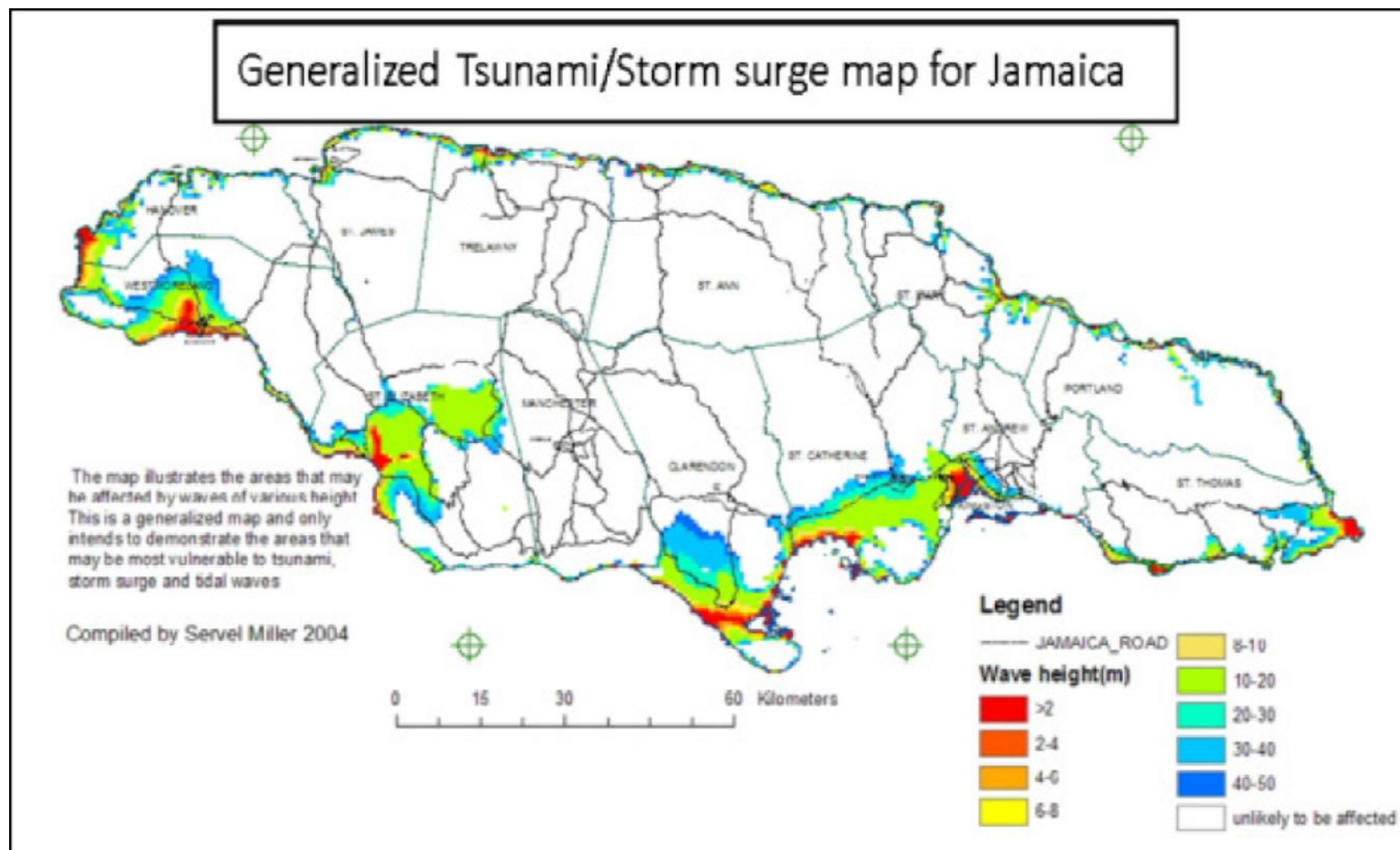


Figure 51: Landslide Vulnerable Areas Based on Geotechnical Engineering Categorization (2011)

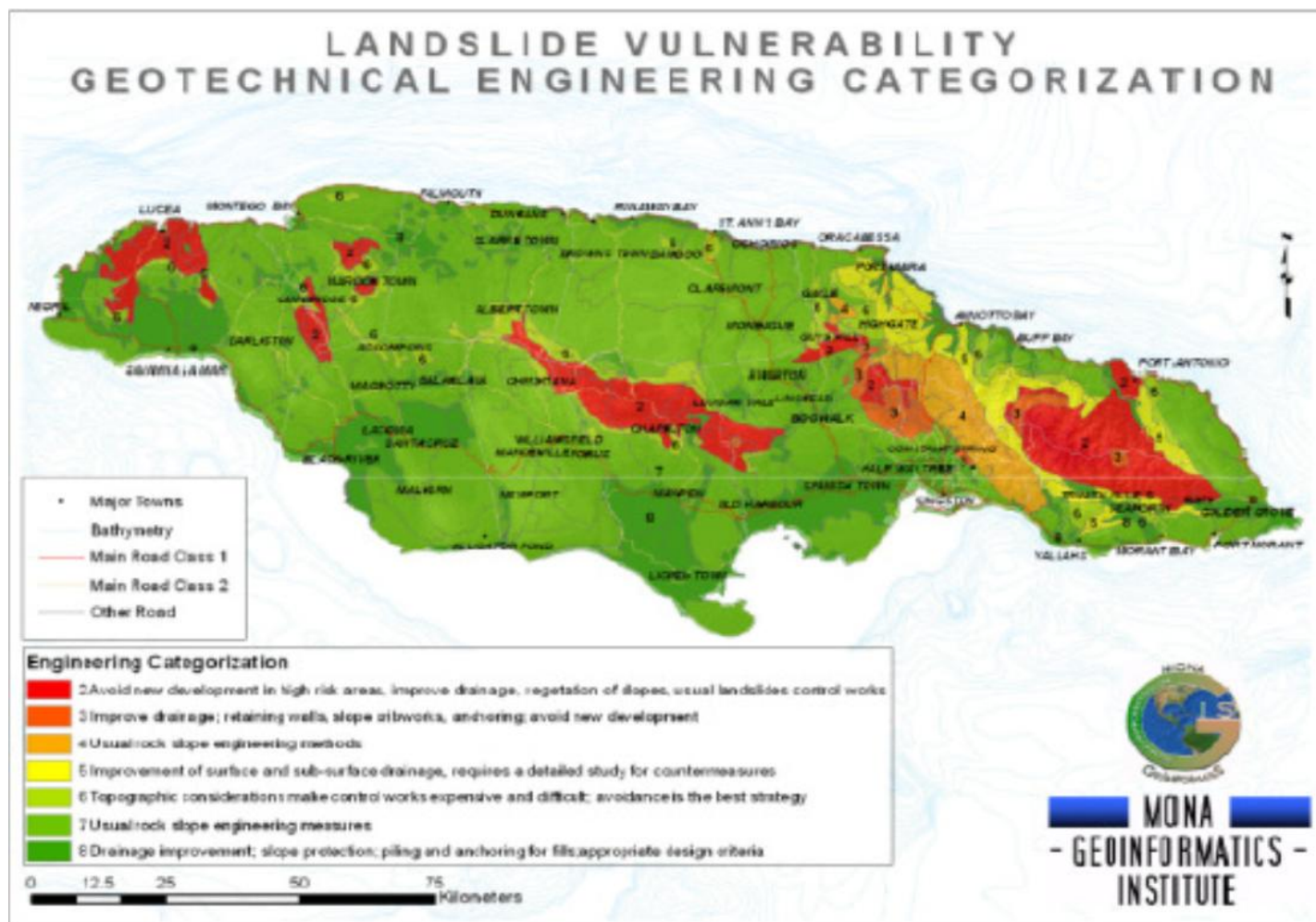


Figure 52: Isohyetal Map of Jamaica Showing Areas of Extreme Rainfall and Drought for 50-Year Return Period to 2013

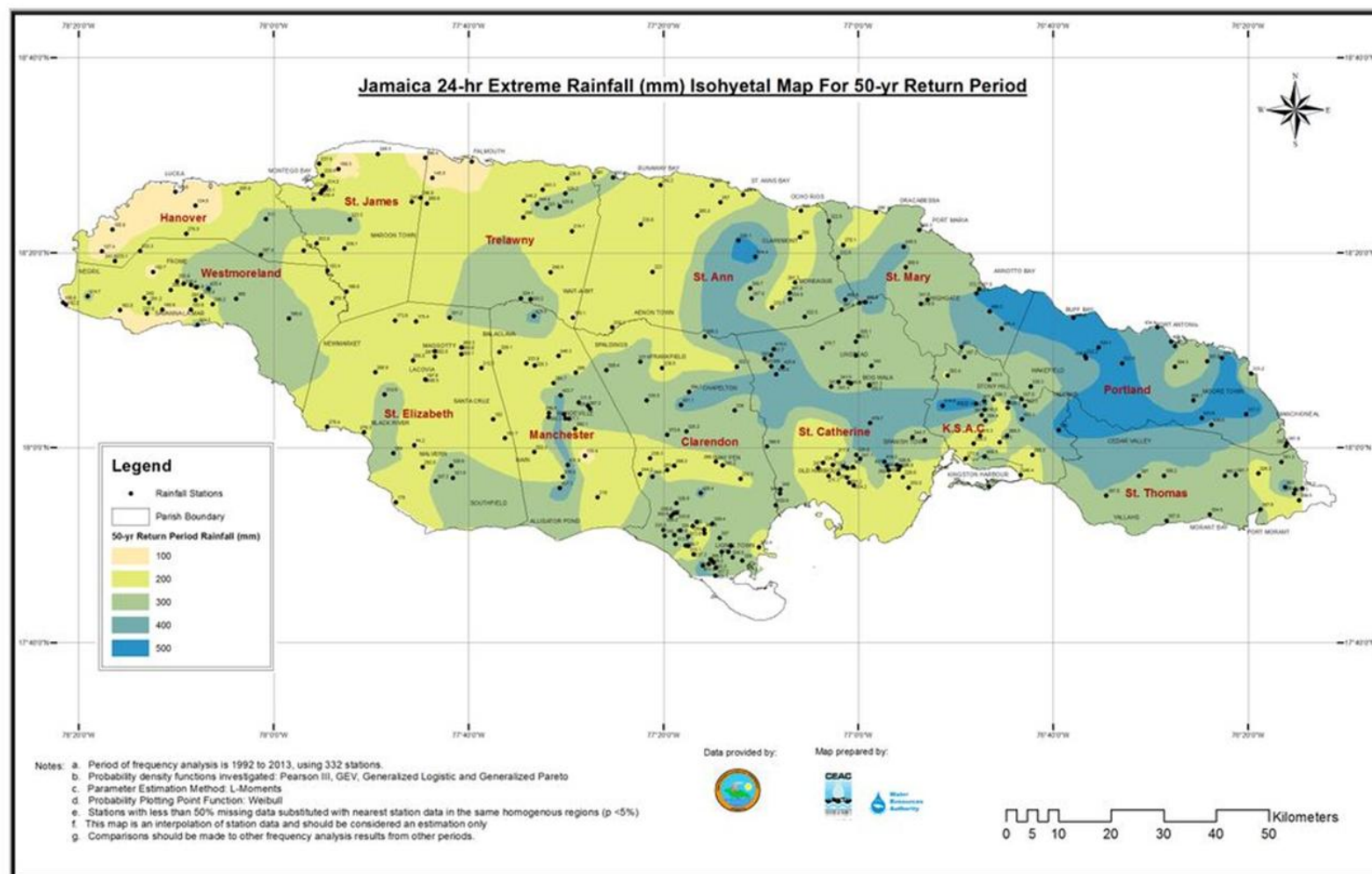


Figure 53: Informal Settlements and Vulnerable Communities in 2011 (ODPEM)

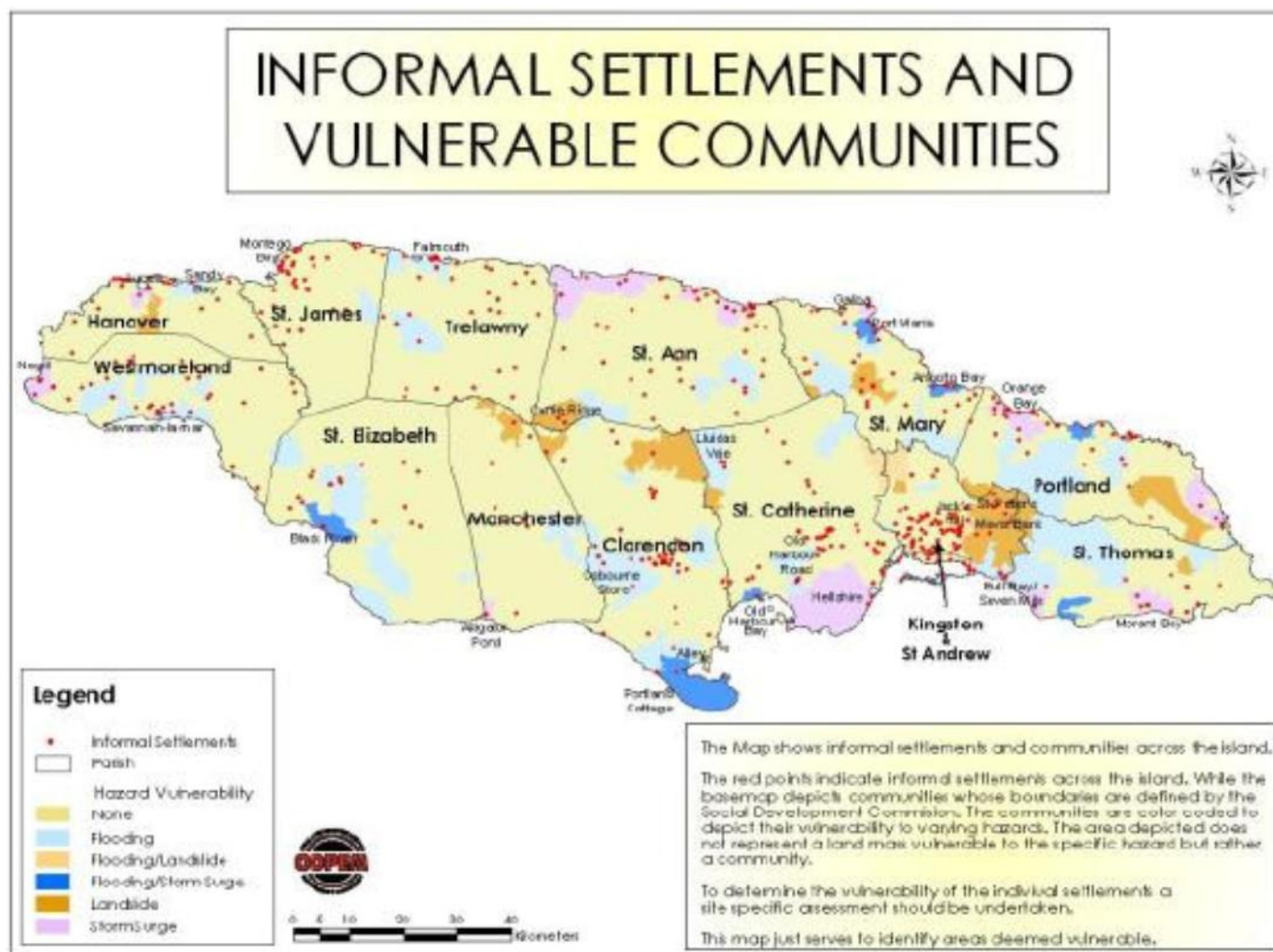
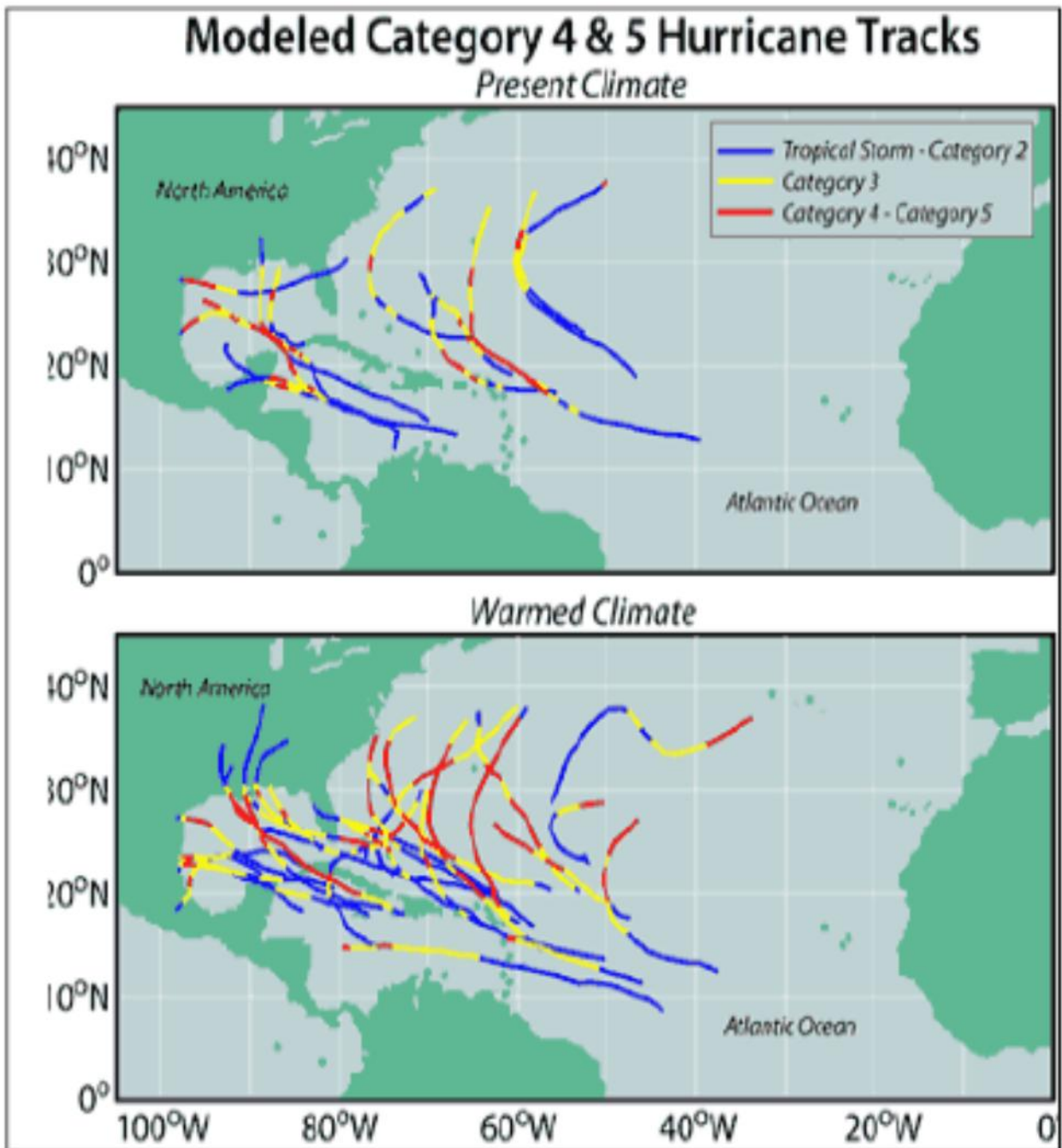


Figure 54: Modelled Category 4 and 5 Hurricane Tracks in the Caribbean Under Present and Warmed Climatic Conditions (2010)



Section 4:

Governance and Education



13. Governance & Education

What is governance? Governance is all about the process of decision-making and, once a decision has been made, how it is to be implemented (or not implemented).

What is good governance? The Good Governance Guide for Local Government (Australia) states good governance refers to taking decisions that are:

- Participatory (allows everyone to have their say)
- Consensus oriented (getting as many people as possible to agree willingly to a decision)
- Transparent (decisions are taken openly)
- Responsive (responds to people's needs and capacities)
- Inclusive (includes all people, regardless of social status, gender, race, etc.)
- Efficient and effective (decisions are taken in a timely manner and are implemented)
- Follows the rule of law (no cheats or corruption is allowed to sway the decision-making)

Why is good governance important for the environment? The growing effects of environmental degradation, climate variability and change and rural poverty increase the vulnerability of Jamaicans and risk becoming significant barriers to sustaining socio-economic growth. Establishing good governance over the way natural resources are planned, managed and monitored is essential to ensure these problems are effectively addressed and positive environmental outcomes secured for the benefit of all.

Why is local community participation important in governance? Ensuring local communities actively participate in environmental planning, its implementation and monitoring helps empower them to become the guardians of natural resources, which is crucial to their long-term conservation and sustainable use. Furthermore, local communities often represent the most cost effective way for the State to manage and maintain regular surveillance of forests, watersheds, coastal marine areas and so forth. In this sense community participation is essential if environmental legislation and multilateral environmental agreements such as CBD, CITES and the Hyogo Framework for Action on disaster risk reduction are to be implemented effectively and continuously.

Why is environmental education important? Informed decision-making relies on education and experience in order to optimise resources and establish effective monitoring of environmental outcomes. Education is therefore at the heart of good governance and crucial to empowering all stakeholders (especially those that cause environmental damage and/or bear the heaviest costs of environmental degradation) to take on new choices that lead to constructive change in attitudes, practices and values vis-à-vis the environment and development.

Why is transparency and accountability important in good environmental governance? Open and clear decision-making enhances trust and confidence in the implementation of the decisions taken. However, when decision-makers are not accountable for their decisions, or take them without adequate transparency, trust may be lost making positive environmental outcomes difficult to achieve.

13.1 Background to Environmental Governance and Education

Environmental governance: *Vision 2030 Jamaica* stresses the importance of achieving “Effective Governance” (Outcome 6) in order to achieve Goal 2: “Jamaican society is secure, cohesive and just”. Establishing effective environmental governance supports the achievement of this Goal as well as Goal 4: “Jamaica has a healthy natural environment.”

In Jamaica a number of government institutions have been given a mandate to apply environmental governance. One of the key elements of effective environmental governance is the application of regulatory powers to ensure that environmental legislation (Acts of Parliament) is enforced and that justice prevails. A list of environmental, planning and development legislation currently in operation and/or in the process of being drafted, and which supports the implementation of international agreements to which Jamaica is a party, can be found in Annex 1.

The following government institutions have important regulatory powers to support the protection, conservation and sustainable use of the country’s natural resources:

- 1) The Ministry of Water, Land, Environment and Climate Change
 - The Standards and Development Division
 - The Climate Change Division
 - The National Environment and Planning Agency, which has a specific Division dedicated to law enforcement to support the implementation of environmental legislation relating to the mandate of the Natural Resources Conservation Authority (NRCA), the Town Planning Department (TPD) and the Land Development and Utilization Commission (LDUC)¹¹⁹
 - The Forestry Department
 - The National Land Agency
 - The Water Resources Authority
- 2) The Ministry of Agriculture and Fisheries
 - The Fisheries Division
- 3) The Ministry of Health
 - The Standards and Regulation Division
- 4) The Ministry of Local Government and Community Development
 - The National Solid Waste Management Authority
- 5) The Ministry of Science, Technology, Energy and Mining
 - The Jamaica Bauxite Institute
 - The Jamaica National Heritage Trust

In addition, the Office of Disaster Preparedness and Emergency Management (OPDEM), under the Ministry of Local Government and Community Development, is responsible for ensuring that buildings comply with the National Building Code, which is in the process of formal approval by the GoJ (see also Chapter 12).

¹¹⁹NEPA continues to operate under multiple laws that relate to the three institutions which were placed under the agency’s mandate since April 2001: the NRCA, the TPD and LDUC. NEPA does not have its own environment and planning legislation.

The GoJ recognises that effective environmental law enforcement relies on the establishment of alliances between the government institutions named and local government authorities, law enforcement institutions (in particular the Jamaica Constabulary Force), civil society organisations (CSOs) and non-state actors (NSAs).

Some of the most prominent CSOs and NSAs currently involved in enhancing effective environmental good governance (and education) in Jamaica are:

- The Jamaica Environment Trust (JET), which promotes environmental governance in areas such as solid waste management, air and water quality, community participation in local planning and compliance of environmental laws;
- The Caribbean Coastal Area Management Foundation (C-CAM), which includes a co-management agreement with NEPA in the Portland Bight Protected Area;
- The Jamaica Conservation and Development Trust (JCDDT), which has a co-management agreement with NEPA to operate in the Blue and John Crow Mountains;
- The Negril Area Environmental Trust (NEPT), which has a co-management agreement with NEPA in administering the Negril Environmental Protection Area and Marine Park;
- The Montego Bay Marine Park Trust (MBMPT), which co-manages the Montego Bay Marine Park with NEPA; and
- The civil society organisations that support the management of the 12 Special Fisheries Conservation Areas (SFCAs) that have been officially recognised by the Fisheries Division of the Ministry of Agriculture and Fisheries to December 2013.

Environmental education: one of the key initiatives of the GoJ has been the implementation of the **National Environment Education Action Plan for Sustainable Development (1998-2010)**, which was identified by government and non-government actors and steered by the NRCA through the National Environmental Education Committee. The Action Plan responded to international agreements such as the Agenda 21 produced as a result of the 1992 UN Conference on Environment and Development in Rio de Janeiro in Brazil¹²⁰ and the UN Conference on Small Island Developing States (SIDS) in 1997. It states that education is a means to:

- e. Change values, behaviours and lifestyles that are needed to achieve sustainable development and ultimately, democracy, human security and peace;
- f. Disseminate the knowledge, know-how and skills that are needed to bring about sustainable production and consumption patterns and to improve the management of natural resources, agriculture, energy and industrial production; and
- g. Ensure an informed public that is prepared to support changes towards sustainability emerging from different sectors.

In relation to governance the Action Plan recognises the importance of having:

- Cross-sectoral approaches and linkages including partnership structures to handle interactions between groups in the public, private and NGO domains and inter-agency cooperation;
- Sustainability as a context for long term development of the economy and society;
- A focus on planning, with decision-making based on research and information;
- Centralized land use policy; decentralized planning and regulation.

¹²⁰Chapter 36 of Agenda 21

- Devolution of services to local areas and communities with accompanying capacity and resources;
- Monitoring and enforcement of laws;
- Incentives to encourage positive action, as well as deterrent legal sanctions;
- Efficient resource allocation and systems to regain environmental costs;
- Economic, political and social support for maintaining a wholesome environment;
- An integrated approach to the environment;
- Government support of 'green' and environmentally friendly products and technologies;
- Standards for environmentally-friendly products and packaging;
- Investment in science and technology; and
- Environmental and gender considerations integrated into government policies.

13.2 The Current State of Environmental Governance and Education

Annex 2a provides a summary of the most relevant international environmental agreements and conventions to which Jamaica is committed, while Annex 2b summarises important legislation and regulations that underpin the implementation of its international obligations and environmental governance in general.

Environmental permits and licences: An important element in applying effective environmental governance is the issuing of permits and licences. GoJ recognises that the permits and licences system facilitates the regulatory framework to control more effectively the private and non-government sectors that are contracted to support environmental management activities and services. Table 74 summarises the environmental permits and licences that were processed by NEPA from 2009-2013 in accordance with its mandate under the NRCA Act, the Beach Act, the Wild Life Protection Act (WLPA) and the Town and Country Planning Act (TCPA).

Table 74: Total Environmental Permits and Licences Issued and EIAs completed (2010-2013)

Type of licence or permit	2010-2011	2011-2012	2012-2013	Total
Air Quality Discharge Licences	3	0	0	3
Beach Licences	68	84	55	207
Environmental Licences	60	62	39	161
Environmental Permits	219	226	153	598
Parish Council Subdivision 9 Lots & Over	0	4	0	4
Planning applications (TCPA)	125	91	56	262
Planning permission (TCPA)	162	54	37	253
Subdivision 10 Lots & Over	81	70	38	189
Subdivision 9 Lots & Under	720	637	590	1,947
Tier 1 Subdivision 9 Lots & Under	25	6	0	31
Environ. Impact Assessments completed	2	4	1	7
Total	1,465	1,238	969	3,655

Source: NEPA; Note all years based on Jamaica's financial year from 01 April to 31 March

One of the main challenges in the country's environmental governance is the enforcement of environmental laws and regulations, both through the national enforcement institutions and local communities and their local governments. The following Table 75) provides a summary of the enforcement actions undertaken by NEPA in 2013.

Table 75: Environmental Enforcement by NEPA Under Its Respective Acts (2010-2013)

Type of Enforcement Action	2010-2011	2011-2012	2012-2013	Total
Enforcement notices	70	29	76	105
Cessation orders	13	10	12	35
Stop notices	13	2	27	42
Notice of intention to suspend licence/permit	2	10	18	30
Notice of intention to revoke licence/permit	0	1	0	1
Warning notice (WWSR/Air Quality Regulation)	0	0	0	0
On-site breach notices	307	496	385	1,188
Warning letters	60	51	102	213
Summons served	28	7	13	48
Bird shooting (Prosecutions)	15	0	5	20
Total	493	606	638	1,682

Source: NEPA (all years based on financial years 01 April to 31 March)

In the aftermath of Hurricane Sandy in October 2012, UNEP has called for the strengthening of education and environmental culture, coupled with activities designed to engage their active participation in environmental governance and justice. The establishment of co-management agreements in protected areas has been one response to developing greater community participation, which has proved successful in a number SFCAs such as in Oracabessa Bay and at Bluefields (see Chapter 4).

13.2.1 The Role of NEPA in Promoting Environmental Education

NEPA has a mandate to raise awareness and promote environmental education in areas such as environmental protection, the sustainable use of natural resources and supporting environmental law enforcement. This was coordinated under the National Environmental Education Action Plan for Sustainable Development in Jamaica (1998-2010) and which has been modified in order to meet the relevant goals and outcomes in the Vision 2030 Jamaica.

Key areas of activity by NEPA in the period 2011-2013

- Teacher training institutions and the Joint Board of Teacher Education: Presentations were made to teachers' colleges to sensitise teachers as to what resources are available at NEPA to support environmental education, how they can be accessed online and in person.
- The Jamaica Defence Force: Soldiers were trained in environmental awareness through the Human Employment and Resource Training Trust/ National Training Agency (HEART/NTA). The Island Special Constabulary Force and Jamaica Constabulary Force were also trained in environmental laws.

- Waste Water and Sludge Regulations 2013: Extensive training was provided to stakeholders in St. Ann, St. James, Clarendon and Kingston.
- Environmental wardens: NEPA supported the Jamaica Social Investment Fund and National Solid Waste Management Authority in training environmental wardens in inner-city communities in 2012.
- Environmental greening programmes: NEPA partnered with the Bank of Nova Scotia, RBC Royal Bank Jamaica and the National Housing Trust (NHT) in their environmental and greening programmes. In addition, the Agency continued outreach activities with schools, community groups and government partners. ;
- Environmental education in schools: In 2012, with funding from the Natural Resources Conservation Authority, NEPA partnered with the Jamaica Environmental Trust to implement the School Environment Programme covering 32 schools and approximately 15,000 students. The partnership was renewed again in 2013 where 33 schools were engaged. The programme engaged students on four focal areas – greening, solid waste management, strengthening the environment club and environmental research.
- Wildlife education: NEPA has participated in the Bird Sleuth Caribbean Programme,¹²¹ which trains teachers and government officials to increase the knowledge and interest of school children in birds and generally in nature and science.



13.2.2 The NGO Sector in Environmental Governance and Education to 2013

A number of NGOs participate actively in environmental governance in Jamaica. C-CAM is one NGO that is particularly active in Jamaica. The NGO sector supports NEPA in the co-management of many of the country's Protected Areas (see also Chapter 4). This includes the provision of co-management services in specific zones within the Portland Bight **PA** where a number of environmental education activities have been realised. Plans have been agreed to construct a Wetlands and Wildlife Interpretation Centre at Salt River, Clarendon (see Figure 55 below). The centre is planned for opening in 2015 to promote environmental education in many areas.

For example, there are plans to operate the centre with solar energy, supply water through rainwater harvesting, treat liquid waste using a bio-digester and produce crops using fertigation (fertilisation

¹²¹ The programme is based on an inquiry-based science curriculum developed by the Cornell Lab of Ornithology. It was launched in 2012 involving three pilot countries: Jamaica, Antigua and Barbuda and the Bahamas to engage school children in scientific study and real data collection on birds.

through irrigation) supplied from the bio-digester. The centre's main aim is to promote ecotourism and wildlife conservation by providing visitors with: :

- Awareness of Environmental conservation, sustainable living and adaptation to climate change;
- Knowledge about the animals and plants that live in Jamaican wetlands;
- Boardwalk and/or do boat rides through mangrove forest;
- Bird watching from an observation shelter;
- The opportunity to observe aquatic life in a turtle pond;
- Seeing conservation agriculture established at the nursery;
- The studying of samples of biodiversity under a microscope;
- A firsthand look at the conducting of research; and
- Educational experiences especially for school groups from basic school to university.

The centre is also intended to generate income for C-CAM and the local community from the eco-tourism activities. The project is being financed by a number of stakeholders including the Ministry of Agriculture and Fisheries (\$18.8 million), Alcoa Foundation (US\$65,000), Seacology (US\$18,000), the Critical Ecosystems Partnership Fund (US\$270,000), among others.

Figure 55: Wetlands and Wildlife Interpretation Centre at Salt River, Clarendon (2015¹²²)



The NGO JCDT, which is responsible for co-management of the Blue and John Crow Mountains National Park, has also been active in promoting environmental education in 2011-2013. In 2011 it established (with NEPA) a Management Plan for 2011-2016 in which specific chapters are dedicated to an Enforcement and Compliance Programme and Education and Public Involvement. Both programmes look at the problems of illegal activity in the park including the illegal logging of precious woods like the Blue Mahoe. The programmes also examine strategies to reduce cultural acceptance of these illegal activities.

These strategies focus on promoting alternative income generating activities, increasing the network of enforcement officers, community patrolling and promoting environmental education about illegal practices and the legal consequences of such actions. Other activities identified for action include:

¹²² The image was taken during a field visit during the preparation of this R report.

- Improving fire management, especially in relation to the burning of domestic garbage or land clearing in the buffer-zone areas;
- Reducing river poisoning, especially in the upper Rio Grande River, done to catch crayfish and fish;
- Strengthening disaster preparedness and risk reduction among local communities; and
- Capacity building within local communities to become the guardians of natural resources.

The Jamaica Environment Trust (JET) is another NGO that has been active in promoting environmental education, conservation of natural resources and in enhancing environmental governance through the development and application of environmental laws in Jamaica. Their activities between 2011 and 2013 included environmental education in schools through the Schools' Environment Programme (SEP). JET has participated in many clean-up campaigns which will be scaled up in 2014 (see also Chapter 8) and promoted school field trips to PAs. It also provides information and links to the Environmental Democracy Index, which is the world's first interactive public platform that tracks progress in establishing national laws to promote transparency, accountability and citizen engagement in environmental decision-making.

13.3 Conclusions and Recommendations

The following conclusions and recommendations are made in the light of the findings in this report and the current policy framework governing environmental governance and education.

- 1) The implementation of environmental education has generally been conducted through fragmented actions that are not part of a regular programme of actions that have no time conditions attached

Recommendations

- a) Concentrate resources on developing environmental education with a multi-sectoral approach whereby different government agencies cover some of the expenses involved, but in a coordinated way.
 - b) Provide training to selected government agencies on how their key activities can include environmental education as a cross-cutting objective in line with the provisions in ***Vision 2030 Jamaica*** for the education sector.
- 2) The mainstreaming of environmental policy and management within sector policy developments has improved since the launch of the vision plan, but there is inadequate emphasis on establishing appropriate mechanisms to implement effective environmental governance at the local level.

Recommendations

- a) Identify mechanisms that are practical and sustainable to deliver sustainable management of Jamaica's natural resources, based on environmental education and training that is results focused.

- b) Establish an effective reporting system that develops awareness and dialogue on the mechanisms deployed.
 - c) Coordinate efforts with the Ministry of Local Government and Community Development, which is in the process of reforming how Local Government authorities under a new Local Governance Act, that will repeal a number of outdated laws and ensure Local Government becomes more autonomous and responsive to its local communities.
- 3) There is an inadequate level of enforcement of environmental legislation and regulations, because of limited resources.

Recommendations

- a) Identify a suitable and sustainable funding mechanism to finance enforcement of environmental laws, permits and licences
- b) Create a national programme designed to empower local communities to establish themselves as the guardians of their natural resources, including those in PAs.

Case study 8: Oracabessa Bay Foundation and the Oracabessa Bay Fisherman's Group



The **Oracabessa Bay** Foundation and the Oracabessa Fisherman's Group is a civil society organisation designed to co-manage the Special Fishery Conservation Area (SFCA) which was officially recognized by the GoJ in 2010. The joint initiative of the Foundation and Fishermen's Group represents a positive example of how civil society can take an active part in the conservation and sustainable use of the Jamaica's natural resources. As reported in Chapter 5 this is helping to help replenish fish stocks and hard coral and other coastal marine life, as well as sensitise the local community on the benefits of developing sustainable fishing practices.



Why are they obtaining positive results?

- 1) Building the capacity of fishers to have their own organisation empowers them.
- 2) Trained, committed and hard-working wardens operating 16 hours per day enforcement.
- 3) Ensuring full participation and transparency in all decision-making.
- 4) Forging stronger relationships with the police builds trust in the law being applied.
- 5) Including the local community in management builds a sense of ownership.

- 6) Community engagement in events and promotions communicates the benefits.
- 7) Oracabessa Bay Special Fishery Conservation Area (Fish Sanctuary) receives public funding and grants because it works.
- 8) The organisation works closely with the Boscobel SFCA, which has private sector support from the Sandals Foundation and the Turtle Rescue Programme in Oracabessa to promote environmental education on turtles and nesting sites.
- 9) Fisherfolk share the results of their efforts.

What still needs to be done?

- Fish Sanctuaries should not be left on their own to forge relationships with authorities..
- Each sanctuary is different and needs a specific approach and support package.
- Establish 24 hour law enforcement capacity of wardens and police.
- Monitoring as a partnership with NEPA needs to be strengthened .
- Data collection methods and parameters need to be standardised to facilitate information exchange.
- Secure core long-term funding is needed so managers do not spend too much time on fund raising.
- Research into plankton movements/fish feeding grounds would support the location of new sanctuaries.

Useful Links and References:

Information on UNEP's environmental education activities in Jamaica:

<http://www.unep.org/disastersandconflicts/UNandGovernmentofJamaica/tabid/79195/Default.aspx>

Information on C-CAM's environmental education and governance activities:

<http://www.ccam.org.jm/pbpa/activities>

Information on the JCDT Management plan for the Blue and John Crow Mountains:

<http://parkscaribbean.net/wp-content/uploads/2014/09/Blue-and-John-Crown-Mountains-National-Park-Jamaica-Management-Plan-2011-2016.pdf>

Information on the environmental education activities of the NGO JET:

<http://www.jamentrust.org/education.html>

Information on the Global Environmental Governance Project (UNEP/Jamaica)

<http://environmentalgovernance.org/featured/2013/10/unep-and-jamaica-host-second-global-conference-on-land-ocean-connections-gloc-2/>

Information on the BirdSleuth Caribbean Programme:

<http://www.birdscaribbean.org/birdsleuth-caribbean/>

MAPS: None for this Chapter

Annexes

Annex 1: Progress in meeting the CBD Commitments and Aichi Targets 2011-2020

Table 1: Level of Progress in Meeting the CBD Commitments to 2013

CBD Commitments	Level of Progress in Meeting the CBD Commitments to 2013
Put in place measures to develop or maintain the necessary legislative and/or regulatory provisions for the protection of threatened species and populations	So far this measure has not been fully achieved because there is no protected areas system in place to ensure the country's endemic species are protected.
Take legislative, administrative or policy measures to facilitate access to genetic resources (seeds) by national legislation.	Access has been facilitated but there is no legislative framework that covers all species.
Regulate and manage the collection of biological resources from natural habitats for <i>ex-situ</i> conservation purposes.	The NHMJ has very limited resources to manage biological resources from natural habitats for <i>ex-situ</i> conservation purposes. The Ministry of Agriculture and Fisheries maintains field banks (including botanical gardens and private collections). The present storage facility for the seed bank remains limited. The active field banks of MAF are maintained at Bodles, Orange River and Top Mountain Research Stations. Two <i>in vitro</i> collections are maintained by the Scientific Research Council and the Biotechnology Centre.
Establish national legislation that respects, preserves and maintains local knowledge, innovations and practices of local communities relevant for the conservation and sustainable use of biodiversity.	To date there is no legislation that specifically recognises the value of local community knowledge, innovations and practices. However, the Windsor Research Centre and UTECH are currently researching local knowledge relating to medicinal plants and their conservation.
Introduce, as far as possible, appropriate procedures to apply environmental impact assessments to proposed projects that may produce significant adverse effects on biodiversity and promote public participation as far as possible.	EIAs are required when a project is scoped and deemed to have a significant negative impact. Plans to expand the application of EIA are currently being assessed. Enforcement of EIA mitigation measures remains a problem as a result of limited human and financial resources.
Introduce adequate legislative, administrative or policy measures to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology (such as genetically modified organisms - GMOs) and ensure there is fair and equitable sharing of the benefits arising from the commercial utilisation of genetic resources.	There is inadequate legislation and policy in place to manage the use and release of LMOs. Arising from a lack of resources the National Biosafety Council does not meet regularly to support policy development in this area.

Table 2: Level of Progress Achieved in Meeting the Aichi Targets in Jamaica (2011-13)

Aichi Biodiversity Targets (2011-2020)	Progress in Achieving the Targets (2011-2013)
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	
<p>Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.</p>	<ul style="list-style-type: none"> • Public education programme on the value of biodiversity continued in Government as well as Private Sector and NGO community. • Valuation of the biodiversity in protected areas declared under the Various Acts (Cockpit Country). • Incorporation of Biodiversity Valuation within the EIA process (NEPA).
<p>Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.</p>	<ul style="list-style-type: none"> • Declaration of additional fish sanctuaries and management of existing ones as well as installation of artificial reefs (Bluefields). These actions will increase the commercial fish stock. • Utilization of the underutilized and unutilized species (Lionfish).
<p>Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts. At the same time, positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio-economic conditions.</p>	<ul style="list-style-type: none"> • Continued tax amnesty for preservation of privately owned forests. (The hope is for this to be expanded beyond forests.) • Continued promotion of the extraction and use of invasive alien species.
<p>Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve, or have implemented, plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.</p>	<ul style="list-style-type: none"> • Continued promotion of sustainable livelihoods (through projects and public education).
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	
<p>Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible, brought close to zero, and degradation and fragmentation is significantly reduced.</p>	<ul style="list-style-type: none"> • Strategic designation of Protected Areas (as recommended by NEGAR/PASMP) • Rehabilitation of degraded areas (Hope/Yahallas River and Drivers River)

Aichi Biodiversity Targets (2011-2020)	Progress in Achieving the Targets (2011-2013)
	watersheds).
<p>Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally. Ecosystem-based approaches are applied, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems, and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits</p>	<ul style="list-style-type: none"> • • Determine catch quotas for all CITES species and emerging commercial species, such as, conch and lobsters. (Sea Cucumbers being looked at by Scientific Authority). • Modernization of the Fisheries Division and the enactment of a new Fishing Industry Act and management plan – an ongoing activity of the Ministry of Agriculture and Fisheries. • The establishment of fish sanctuaries has grown from 2 in 2006 to 12 in 2013 and more are planned.
<p>Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.</p>	<ul style="list-style-type: none"> • Implementation of the Watershed Policy. • Planned expansion of the WWAM (St. Mary, St. Andrew, St. Thomas, St. James, St. Elizabeth, Westmoreland, Hanover, St. Catherine, Portland and St. Ann). • Revision of the Watershed Act. • Full implementation of the management plan 2011-2016 for the Blue and John Crow Mountains National Park JCDT). • Identification of freshwater species suitable for aquaculture. (Fisheries Division).
<p>Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.</p>	<ul style="list-style-type: none"> • Enactment and enforcement of the Wastewater and Sludge Regulations.
<p>Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.</p>	<ul style="list-style-type: none"> • Continued work on development of a National Invasive Species Strategy and Action Plan. • Control of Lionfish in the marine environment (Eat it to beat it campaign). • Control of Jamaican Iguana predators. • Control of aquatic invasive in the Black River Lower Morass • Implementation of the National Invasive

Aichi Biodiversity Targets (2011-2020)	Progress in Achieving the Targets (2011-2013)
	<p>Species Strategy and Action Plan.</p> <ul style="list-style-type: none"> • Maintain a national database on invasive alien species (IOJ) • Control of identified invasive species in key biodiversity areas of Forest Reserves, Blue and John Crow Mountains National Park (JCDT).
<p>Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.</p>	<ul style="list-style-type: none"> • Establishment of a Climate Change Division of the Ministry of Water Land Environment and Climate Change.
<p>Strategic Goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity</p>	
<p>Target 11: By 2020, at least 17 percent of terrestrial and inland water, and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.</p>	<ul style="list-style-type: none"> • Finalization of the Protected Areas Master Plan • Strengthening of financial planning and revenue generation for PAs through Preparation of business plan and establishment of a Trust Fund) • Rationalizing the National Protected Area System (new protected areas – Pedro Cay and Bank, Black River to be declared) and preparation of the National Protected Areas legislation. • Increasing protected areas management effectiveness. • Preparation and implementation of management plans and identification of alternative livelihood projects. • Participation in the Caribbean Challenge Initiative for coastal and marine areas (20% by 2020). • Approximately 18 percent of Jamaica's land and 15 percent of the country's archipelagic waters were protected in 2013, which is in line with target 11. • There are more than 350 declared protected areas in the country, but there is no Protected

Aichi Biodiversity Targets (2011-2020)	Progress in Achieving the Targets (2011-2013)
	Areas System in place to manage and coordinate this high number of PAs.
Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	<ul style="list-style-type: none"> • Work continues to identify threatened species under risk of extinction and introduce habitat protection, captive breeding and artificial propagation programmes.
Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	<ul style="list-style-type: none"> • Work continues on a draft Biosafety Policy • Drafting Instructions are being prepared for Biosafety regulations.
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem service	
Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	<ul style="list-style-type: none"> • Implementation of the Watershed Policy. • Planned expansion of the WWAM (St. Mary, St. Andrew, St. Thomas, St. James, St. Elizabeth, Westmoreland, Hanover, St. Catherine, Portland and St. Ann). • Full implementation of the management plan 2011-2016 for the Blue and John Crow Mountains National Park (JCDT) • Overarching policy on the protected areas system is being finalised. A finalise version of the Protected Areas System Master Plan has been completed and submitted to GoJ.
Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 percent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	<p>Strategies implemented include:</p> <ul style="list-style-type: none"> • Mangrove replanting • Seagrass replanting • Coral reef propagation and replanting • Installation of data loggers • Dune rehabilitation • Coastal vegetation nursery • Artificial reefs • No net loss for environmental Permits, for mangrove and seagrass
Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	<ul style="list-style-type: none"> • Signed the Nagoya Protocol • Advancing strategies to Accede to the Protocol (Dialogue between Focal Point ((NEPA)) and Attorney General re readiness for accession) • Preparing a roadmap for accession.
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building	
Target 17: By 2015 each Party has developed, adopted as a	<ul style="list-style-type: none"> • Implementation of activities for Revision of

Aichi Biodiversity Targets (2011-2020)	Progress in Achieving the Targets (2011-2013)
policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	Jamaican's National Strategy and Action Plan on Biological Diversity, July 2003 (completing project requirements).
Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected. This is subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	<ul style="list-style-type: none"> • Preparation for Accession to the ABS Protocol and associated legislation. • Hosted a regional Workshop on ABS (outcomes incorporated into drafting roadmap to accession).
Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	<ul style="list-style-type: none"> • The Incorporation of Biodiversity Valuation within the EIA process (NEPA).
Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilisation, should increase substantially from the current levels. This target will be subject to changes contingent on resource needs assessments to be developed and reported by Parties.	<ul style="list-style-type: none"> • Continue to rally support at the international, regional and national levels for biodiversity conservation (Participation/ advocating in the various fora; GRULAC, SIDS etc.). • GoJ intends to access national funding currently available under GEF-6 to support the implementation of the PASMP. The use of GEF-6 Funds to support the effective management of the PAS and by establishing a Trust Fund for the PAS is also foreseen. Use of public resources for biodiversity conservation will be limited due to national debt servicing (equivalent to 135% of GDP according to the Bank of Jamaica) and energy production costs based heavily on oil imports (approximately costing 15% of GDP) .

Annex 2a: International Treaties and Agreements Related to the Environment, of Which Jamaica is a Signatory

International Agreement, date entered into force and main UN institution involved	Main Objectives/Area of Action	Date of Accession for Jamaica	Date of Entry into force for Jamaica
Millennium Development Goals (Goal 7), 08/09/2000 (UNDP)	<p>7A) Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources, in particular forests which are recognised as a “safety net” for the poor.</p> <p>7B) Reduce biodiversity loss, achieving a significant reduction in the rate of loss by 2010.</p> <p>7C) Halve the proportion of the population without sustainable access to safe drinking water and basic sanitation by 2015.</p> <p>7D) Achieve a significant improvement in the lives of at least 100 million slum dwellers by 2020.</p>	8 Sept. 2000	8 Sept. 2000
Convention on Biological Diversity, 29/12/1993 (UNEP)	<p>a) Ensure the conservation of biological diversity.</p> <p>b) Ensure the sustainable use of the components of biological diversity.</p> <p>c) Ensure the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.</p> <p>Supplementary agreements to CBD include:</p> <ul style="list-style-type: none"> - The Cartagena Protocol (entered into force on 11/09/2003). It governs the movements, from one country to another, of living modified organisms (LMOs) also known as Genetically Modified Organisms resulting from modern biotechnology. To help do this a Biosafety Clearing-House (BCH) was established to facilitate the exchange of information on LMOs and assist the Parties to better comply with their obligations under the Protocol. - The Nagoya Protocol (Entered into force on 12/10/2014). Jamaica has not yet ratified this protocol. The Protocol aims at helping the parties implement the fair and equitable sharing of benefits arising from the utilization of genetic resources (in particular when it concerns indigenous people’s knowledge of biodiversity). 	4 Jun. 2001	25. Sept. 2012
Convention on International Plant Protection, 02/10/2005 (IPPC Secretariat in FAO)	Protect plant resources from harmful pests (and weeds) which may be introduced through international trade.	24 Nov. 1969	24 Nov. 1969

International Agreement, date entered into force and main UN institution involved	Main Objectives/Area of Action	Date of Accession for Jamaica	Date of Entry into force for Jamaica
International Treaty on Plant Genetic Resources for Food and Agriculture, 29/06/2004 (FAO)	The Treaty aims at: a) recognizing the enormous contribution of farmers to the diversity of crops that feed the world-; b) establishing a global system to provide farmers, plant breeders and scientists with access to plant genetic materials; and c) ensuring that recipients share benefits they derive from the use of these genetic materials with the countries where they have been originated.	14 Mar. 2006	-
Convention of Wetlands of International Importance especially as Waterfowl Habitat (RAMSAR Convention), 21/12/1975, (UNESCO)	a) Work towards the wise use of all wetlands; Designate suitable wetlands for the list of Wetlands of International Importance (Ramsar list) and ensure their effective management; c) Cooperate internationally on trans-boundary wetlands, shared wetland systems and shared species. b)	07 Feb. 1998	-
Convention on Migratory Species (Bonn Convention),	Conserve terrestrial, marine and avian migratory species, their habitats and their migration routes. The Convention maintains lists of threatened migratory species and those which could significantly benefit from agreements to protect them and their habitats.	under consideration	-
Convention on the Illegal Trade in Endangered Species of Wild Fauna and Flora (CITES) 01/07/1975 (UNEP)	Convention on International Trade in Endangered Species of Wild Fauna and Flora aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	23. April 1997	22. Jul 1997
Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) 11/10/1986 (UNEP)	Legally binding environment treaty on the protection and development of the marine environment of the wider Caribbean Region. There are three Protocols: 1) Oil Spills Protocol (entered into force in 1986) and ratified by Jamaica on 01/04/87; 2) Specially Protected Areas and Wildlife Protocol (SPAW) (entered into force in 2000) but not yet ratified by Jamaica; 3) Land-based Sources of Marine Pollution Protocol (entered into force in 2010), Jamaica is expected to accede to this Protocol in March 2014.	24. Mar 1983	1. April 1987

International Agreement, date entered into force and main UN institution involved	Main Objectives/Area of Action	Date of Accession for Jamaica	Date of Entry into force for Jamaica
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989 (UNEP)	Control of trans-boundary transport of hazardous wastes and their disposal.	23 Jan. 2003	
Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, 1998 (UNEP)	a) Control the international trade of hazardous chemicals (mainly banned pesticides and industrial chemicals) to protect human health and the environment; b) to contribute to the environmentally sound use of those hazardous chemicals, through information exchange and establishing a national decision-making process on their import and export .	20 Aug. 2002	24. Feb 2004
Stockholm Convention on Persistent Organic Pollutants, 17/05/2004 (UNEP/FAO)	Protect human health and the environment from o Persistent Organic Pollutants (POPs) that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on human health or on the environment.	23. May 2001	1. Jun 2007
United Nations Convention to Combat Desertification, 26/12/1996, (Secretary General of the UN)	Forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability.	12 Nov.1997	10. Mar 1998
United Nations Framework Convention on Climate Change, 21/03/94, (Secretary General of the UN)	Stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The treaty requires all countries to establish GHG inventories. Binding agreements are established in international treaties called protocols: a) Kyoto Protocol (ratified by Jamaica on 28/06/1999) sets legally binding obligations for developed countries to reduce their greenhouse gas emissions.	06 Jan. 1995	5. April 1995

International Agreement, date entered into force and main UN institution involved	Main Objectives/Area of Action	Date of Accession for Jamaica	Date of Entry into force for Jamaica
United Nations International Strategy for Disaster Reduction 20/12/1999 (UNISDR)	Coordination of disaster risk reduction and implementation of the Hyogo Framework for Action 2005-2015 supported by the creation of national platforms. Main objective: build resilience of nations and communities to disasters.	2000	(no national platform in place to date)
Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972 (UNESCO)	a) Protect cultural heritage of global interest: monuments, buildings and sites that are of outstanding universal value from the archaeological, historical, ethnological or anthropological point of view. b) Protect natural heritage of global interest: natural features, geological and physiographical formations which are habitats of threatened species of animals or plants that are of global interest to science or conservation and natural sites of global interest to science, conservation or for their natural beauty.	14. Jun 1983	14 Jun. 1983
Convention on the Law of the Sea 16/11/1994 (Secretary General of the UN)	Defines the rights and responsibilities of nations with respect to their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources.	1. Oct. 1965	30. October 1962
Convention on the High Seas (1958) Superseded by the United Nations Convention on the Law of the Sea (UNCLOS) , signed in Montego Bay, Jamaica on 10 Dec. 1982 and effective from 16 Nov. 1994	Defines the rights and responsibilities of nations with respect to their use of the world's oceans.	(8 Oct. 1965) 10 Dec. 1982	(1965) 21 Mar. 1983
Convention on the territorial Sea and Contiguous Zone (1958) Superseded by UNCLOS	Defines the rights and responsibilities of nations with respect to their use of the world's oceans.	(8 Oct. 1965) 10 Dec. 1982	(21 Mar 1983) 21 Mar. 1983
Convention on the Continental Shelf (1958) Superseded by UNCLOS	Defines the rights and responsibilities of nations with respect to their use of the world's oceans.	(8 Oct. 1965) 10 Dec. 1982	(1965) 21 Mar. 1983

International Agreement, date entered into force and main UN institution involved	Main Objectives/Area of Action	Date of Accession for Jamaica	Date of Entry into force for Jamaica
Convention on Fishing and Conservation of the Living Resources of the High Seas	Defines the rights and responsibilities of nations with respect to their use of the world's oceans.	(20 Mar. 1966) 10 Dec. 1982	(1965) 21 Mar. 1983
Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, 1963	Prohibits nuclear weapon tests except at underground sites.	13. Aug. 1963	22. Nov 1991
Convention on Civil Liability for Bunker Oil Pollution Damage, 2001	Provides provisions for civil liability for bunker oil pollution damage.	28. Jul 2003	21. Nov 2008
International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990	Provides guidance on how to prepare, respond and cooperate in the event of major oil spills.	30 Jan. 2001	
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), 30/08/1972, (IMO)	International control and prevention of marine pollution by prohibiting the dumping of certain hazardous materials. It covers the deliberate disposal at sea of wastes or other matter from vessels, aircraft, and platforms, but does not cover discharges from land-based sources such as pipes and outfalls. Protocol 1996 (24/03/2006): prohibits all dumping at sea, except acceptable wastes on the so-called "reverse list", contained in an annex to the Protocol (includes sewage sludge, fish waste and dredged material).	-	22 Mar. 1991
Convention on the Prevention of Pollution from Ships (MARPOL Convention), absorbed by the MARPOL Protocol 02/10/1985 (IMO)	Provides regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations.	13 Jun 1991	13. Jun 1991

International Agreement, date entered into force and main UN institution involved	Main Objectives/Area of Action	Date of Accession for Jamaica	Date of Entry into force for Jamaica
Vienna Convention for the Protection of the Ozone Layer (22/09/1988)	Promotes the protection of the Earth's Ozone layer from hydro-fluorocarbons and chlorofluorocarbons (CFCs) and other contaminants found in refrigerants that create holes in the Ozone layer. Legally binding targets on the reduction and eventual elimination of CFCs are set out in the Montreal Protocol on Substances that Deplete the Ozone Layer (01/01/1989).	22. Mar 1985	1993

Annex 2b: National Legislation Relating to the Environment in Jamaica

Legislation (Acts of Parliament)	Date Enacted
The Country Fires Act	1942
The Wildlife Protection Act	1945
The Beach Control Act	1956
The Beach Control (Hotel, Commercial and Public Recreational Beaches) Regulations	1957
The Beach Control Act Rules and Regulations (Beach Safety Measures)	-
The Flood Water Control Act	1958
The Watersheds Protection Act	1963
The Clean Air Act	1964
Air Quality Regulations	-
The Jamaica National Heritage Trust Act	1985
The Land Development and Utilisation Act	1966
The Fishing Industry Act	1975
The Fishing Industry Regulations	1976
The Quarries Control Act	1984
The Public Health Act	1985
The Pesticides Act	1987
The National Solid Waste Management (Public Cleanliness) Regulations	2003
The Natural Resources Conservation Authority Act	1991
The Natural Resources (Marine Park) Regulations	1992
The Wildlife Protection (Game Bird Hunting Limit) Regulations	1992
The Natural Resources (National Park) Regulations	1993
The Public Health (Nuisance) Regulations	1995
The Water resources Act	1995
The Forest Act	1996
The Maritime Areas Act	1996
The Natural Resources (Permit and Licences) Regulations	1996
The Wildlife Protection (Amendment) Act Order	1998
The Aquaculture, Inland and Marine Products and By-products (Inspection, Licensing and Export) Act	1999
The Aquaculture, Inland and Marine Products and By-products (Inspection, Licensing and Export) Regulations	2000
The Endangered Species (Protection, Conservation and Regulation of Trade) Act	2000
The Fishing Industry (Conservation of Conch (Genus Strombus), Regulations	2000
The Forest Regulations	2001
The National Solid Waste Management Act	2001
The Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations	2001
Waste Water and Sludge Regulations (of the NRCA Act)	2005
Natural Resources Conservation (Wastewater and Sludge) Regulations (under the NRCA Act).	2013
The Aquaculture, Inland and Marine Products and By-Products (Inspection, Licensing and Export) Act, 1999	1999
Aquaculture, Inland and Marine Products and By-Products (Inspection, Licensing and Export) Regulations 2000	2000

Aquaculture, Inland and Marine Products and By-Products (Inspection, Licensing and Export) list of Production Areas	2000
Aquaculture, Inland and Marine Products and By-Products (Inspection, Licensing and Export) (Amendment) Regulations	2002
Aquaculture] Inspection and Certification of Fishery Facilities (Prescribed Forms) Regulations	2002
Beach Control Act	1956
Beach Control (Protected Area) (Ocho Rios) Order,	1956
Beach Control (Protected Area) (Port Royal) Order 1967 (similar to the provision contained in the Ocho Rios Order)	1967
Beach Control (Protected Area) (Montego Bay) Order 1974 (similar to the provision contained in the Ocho Rios Order)	1974
Beach Control (Protected Area) (Black Coral) Order	1979
Beach Control (Crown Licences) Regulations	1956
Beach Control (Safety Measures) Regulations	1957
Beach Control Authority (Licensing) Regulations	1956
Beach Control Authority (Licensing) (Amendment) Regulations	1999
Beach Control (Hotel, Commercial and Public Recreational Beaches) Regulations	1978
Black River (Upper Morass) Reclamation Act List of Regulations	-
The Clean Air Act	1964
Endangered Species (Protection, Conservation and Regulation of Trade) Act,	2000
Endangered Species (Protection, Conservation and Regulation of Trade) (Designation of Management Authority Order	2000
Endangered Species (Protection, Conservation and Regulation of Trade) Regulations	2000
Endangered Species (Protection, Conservation and Regulation of Trade) (Amendment) Regulations	2000
Endangered Species (Protection, Conservation and Regulation of Trade) Act (Appointed Day) Notice	2000
Endangered Species (Protection, Conservation and Regulation of Trade) Establishment of National Export Quota (Conch, Strumbus gigas) Regulations	2000
Endangered Species (Protection, Conservation and Regulation of Trade) (Conch, Strumbus Gigas) Regulations	2000
Endangered Species (Protection, Conservation and Regulation of Trade) Establishment of National Export Quota (Conch, Strumbus Gigas) Regulations	2001
Endangered Species (Protection, Conservation and Regulation of Trade) (Amendment) Regulations	2002
Endangered Species (Protection, Conservation and Regulation of Trade) Establishment of Individual Export Quota (Conch, Strumbus Gigas) Regulations	2002
Endangered Species (Protection, Conservation and Regulation of Trade) Establishment of National Export Quota (Conch, Strumbus Gigas) Regulations	2003
Exclusive Economic Zone Act	1991
Fishing Industry Act	1976
Fishing Industry Act List of Regulations	-
Fishing Industry (Exemption) Order	1976
Fishing Industry Regulations	1976
Fishing Industry (Amendment of Schedule) Order	2000

Fishing Industry (Conservation of Conch, Strumbus Gigas) Regulations	2000
Fishing Industry (Fishery Management Areas) Order	2000
Forest Act	1996
Forest Act - Authorization	-
Forest Act - Regulations	2001
Forest Act - List of Regulations	-
Forest (Removal of Timber and Property marks) Regulations	1938
Map of Protected Areas	-
Maritime Areas Act	1996
Morant and Pedro Cays Act	1907
National Solid Waste Management Act	2001
National Solid Waste Management (Public Cleanliness) Regulations	2003
Natural Resources Conservation Authority Act	1991
Natural Resources Conservation Authority Act List of Regulations	-
Natural Resources Conservation Authority Appeals Tribunal Rules 1997	1997
Natural Resources (Marine Parks) Regulations 1992	1992
Natural Resources Conservation (Marine Parks) (Amendment) Regulations	2003
Natural Resources (National Parks) Regulations	1993
Natural Resources (National Parks) (Amendment) Regulations	2003
Natural Resources (Blue and John Crow Mountains National Park) (User Fees) Regulations	2003
Natural Resources Conservation (Permits and Licences) Regulations	1996
Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order	1996
Natural Resources Conservation (Ambient Air Quality Standards) Regulations	1996
Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations	2002
Natural Resources Conservation (Coral Spring -Mountain Spring Protected Area) Order	1998
Natural Resources Conservation (Palisadoes – Port Royal Protected Area) Order	1998
Natural Resources Conservation (Portland Bight Protected Area) Order	1999
Natural Resources (Ocho Rios Marine Park Protected Area) Order	-
Natural Resources Negril Environmental Protection Area Order	1997
Natural Resources Conservation (Negril Marine Park) (Declaration) Order	1998
Natural Resources (Montego Bay Marine Park) Order	1992
Natural Resources Conservation (Blue and John Crow Mountains National Park) Declaration Order	1993
Trade Act	1955
Trade (Restriction on Importation) (Chlorofluorocarbons) Order	1999
Trade (Restriction on Importation) (Chlorofluorocarbons) (Amendment) Order	2002
Trade (Prohibition of Importation) (Equipment containing Chlorofluorocarbons) Order	1998
Trade (Prohibition of Importation) (Equipment containing Chlorofluorocarbons) (Amendment) Order	1998
Trade (Prohibition of Importation) (Equipment containing Chlorofluorocarbons) (Amendment) Order 2002	2002
Trade (Imports Licensing) (Amendment) Order 2002	2002
Trade (Prohibition on Exportation) (Halon) (Revocation) Order 2003	2003
Water Resources Authority Act 1995	1995

Watersheds Protection Act 1945	1945
Watersheds Protection Act List of Orders	-
Watersheds Protection (Rio Minho, Cane River and Rio Nuevo Watersheds Areas) Order 1964	1964
Wild Life Protection Act 1945	1945
Wild Life Protection Act List of Regulations	-
Wild Life Protection Act (Amendment) Order 1998	1998
Wild Life Protection Regulations 1945	1945
Wild Life Protection Act (Amendment of First Schedule) Order	1997
Wild Life Protection Act (Amendment of First Schedule) Order	1998
Wild Life Protection Act (Amendment of First Schedule) Order	1999
Wild Life Protection Act (Amendment of First Schedule)(No.2) Order	1999
Wild Life Protection Act (Amendment of Third Schedule) Regulations	2001
Wild Life Protection Act (Amendment of Second Schedule) Regulations	2002
Wild Life Protection (Protective Zone) Regulations	1998
Wild Life Protection (Hunters' Licences) Regulations	1973
Wild Life Protection (Hunters' Returns) Regulations	1999
Wild Life Protection (Hunters' Returns) (Amendment) Regulations	2002
Wild Life Protection (Hunters' Licences) (Amendment) Regulations	2003
Wild Life Protection (Shooting Season) Order	2003
Wildlife Protection (Game Bird Hunting Limit) Regulations	2990
Wildlife Protection (Game Bird Hunting Limit) Regulations	2000

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* Underwater camera provided courtesy of NEPT

