Low Emission Development Strategy (LEDS) for Jamaica:

Pre-Scoping Report

EC-LEDS Jamaica Scoping Team

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The points of view expressed in this publication do not necessarily reflect those of the United States Agency for International Development or the Government of the United States.

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Acronyms

Agriculture and Land Use	ALU
Agriculture Forestry and Other Land Use	AFOLU
Canadian International Development Agency	CIDA
Caribbean Community Climate Change Center	CCCC
Centre of Excellence for Renewable Energy	CERE
Climate & Development Knowledge Network	CDKN
Climate Studies Group in Mona	CSGM
Compressed Natural Gas	CNG
Department for International Development	DFID
Energy Efficiency	EE
Energy Service Companies	ESCOs
Enhancing Capacity for Low Emission Development Strategies	EC-LEDS
Environmental Foundation of Jamaica	EFJ
Environmental Protection Agency	USEPA
European Union	EU
First National Communication	NC1
Food and Agriculture Organization	FAO
Forest Carbon Partnership Facility	FCPF
Forest Conservation Fund	FCF
German Development Bank	GIZ
Global Environment Fund	GEF
Government of Jamaica	GOJ
Greenhouse Gas	GHG
Gross Domestic Product	GDP
High Occupancy Vehicle	HOV
Independent Power Producer	IPPU
Industrial Processes and Product Use	IPPU
Inland Revenue Department	IRD
International Standard of Industrial Classification	ISIC
Island Traffic Authority	ITA
Jamaica Aluminum	JAMALCO
Jamaica Conservation and Development Trust	JCDT
Jamaica Energy Partners	JEP
Jamaica Information System	JIS
Jamaica Institute of Engineers	JIE
Jamaica National Environment Action Plan	JANEAP
Jamaica Private Power Company	JPCC
Jamaica Public Service Company Limited	JPSCo
Jamaica Social Investment Fund	JSIF
Jamaica Urban Transit Company	JUTC
Kingston and St. Andrew Corporation	KSAC

Latin America and Caribbean Regional Platform	LACRP
Liquefied Natural Gas	LNG
Local Sustainable Development Plans	LSDPs
Long Range Energy Alternative Planning System	LEAP
Low Emissions Development Strategy	LEDS
Metropolitan Management Transport Holdings, Inc.	MMTH
Ministry of Energy, Mining and Transportation	MEMT
Ministry of Finance	MOF
Ministry of Science, Technology, Energy and Mining	MSTEM
Ministry of Transport and Works	MTW
Ministry of Water, Land, Environment and Climate Change	MWLECC
Monitoring and Evaluation	M&E
Montego Bay Metro Limited	MBM
National Energy Policy	NEP
National Environment Action Plan	NEAP
National Environment Planning Agency	NEPA
National Environmental Societies Trust	NEST
National Road Operating and Construction Company	NROCC
National Solid Waste Management Authority	NSWMA
National Works Agency	NWA
Natural Resources Conservation Authority	NRCA
Non-Methane Volatile Organic Compounds	NMVOC
Office of the Prime Minister	OPM
Office of Disaster Preparedness and Emergency Management	ODPEM
Office of Utilities Regulation	OUR
Petroleum Corporation of Jamaica	PCJ
Pilot Program for Climate Resilience	PPCR
Planning Institute of Jamaica	PIOJ
Quality Assurance/Quality Control	QA/QCC
Reducing Emissions from Deforestation and Forest Degradation	REDD
Renewable Energy	RE
Renewable Energy and Energy Efficiency Partnership	REEEP
Road Maintenance Fund Board	RMFB
Rural Agricultural Development Authority	RADA
Second National Communication	NC2
Statistical Institute of Jamaica	STATIN
The Nature Conservancy	TNC
The World Bank	WB
Transparency, Accuracy, Completeness, Comparability, and Consistency	TACCC
Transport Authority	TA
United Nations Development Program	UNDP
United Nations Framework Convention on Climate Change	UNFCCC
United States Government	USG

University of the West Indies	UWI
Urban Development Corporation	UDC
Wigton Wind Farm	WWF

1. Introduction and Background

1.1 Low Emissions Development Strategy

A Low Emission Development Strategy (LEDS) is a strategic framework that articulates concrete actions, policies, programs and implementation plans to advance economic growth, improve environmental management and meet development objectives. This framework provides a foundation for achieving long-term, measurable greenhouse gas emission reductions as compared to a business-as-usual development pathway.

The following elements form a general framework that illustrates the U.S. perspective on LEDS:

- A country's integrated development goals and objectives, national greenhouse gas (GHG) inventory and economic and resource data
- Long-term projections of business-as-usual economic growth and greenhouse gas emission pathways
- Alternative development scenarios that achieve economic and development goals, slow the growth rate of GHG emissions and support climate change resilience
- A set of prioritized policies, programs and measures – identified through broad stakeholder engagement – that are necessary to achieve the low emission development pathway
- Domestic implementation plans that include strategies for attracting private sector investment and channeling international support from a range of sources and appropriate partners necessary to facilitate implementation.

1.2 Enhancing Capacity for Low Emission Development Strategies

Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) is a U.S. Government (USG) initiative to support developing countries' efforts to pursue long-term, transformative development and accelerate sustainable, climate-resilient economic growth while slowing the growth of greenhouse gas emissions. The initiative aims to build capacities in partner countries, provide targeted technical assistance and build a shared global knowledge base on LEDS. This program is country-driven; support for creating and implementing a LEDS will be tailored to each country's unique capacity, technical, analytical and policy needs.

Jamaica was selected as a priority country for engagement under the EC-LEDS initiative. In order to engage the Government of Jamaica (GOJ), a scoping mission is being planned for the fall of 2012 with the overall goal of creating a document that will guide future collaboration on LEDS in Jamaica. The scoping team will be comprised of representatives from various USG agencies (Department of State, US Agency for International Development, Department of Energy, US Forest Service, etc.) to ensure broad technical coverage. This pre-scoping report will serve as a reference document to the individuals participating in the scoping missions and a primer on climate change and low emission development work in Jamaica. The information presented within this work is by no means exhaustive.

2. Country Overview

2.1 General Country Context

Jamaica is a small island developing state, gaining full independence from Britain in 1962. Since independence, Jamaica's natural resource base has been critical to the country's economic development. Traditionally, the island's major economic sectors were mining and agriculture. However, since independence, the economy has been transformed from one based mainly on the export of primary agricultural products and mineral commodities, to a service economy in which tourism is now the principal earner of foreign exchange.[1]

Deteriorating economic conditions during the 1970s led to recurrent violence as rival gangs affiliated with the major political parties evolved into powerful organized crime networks involved in international drug smuggling and money laundering. Violent crime, drug trafficking, and poverty pose significant challenges to the government today. Nonetheless, many rural and resort areas remain relatively safe and contribute substantially to the economy.

Jamaica is a constitutional parliamentary democracy and part of the Commonwealth, and the legal system is a common law system based on the English model. The country is further divided into 14 parishes. The current government of Prime Minister Portia Simpson-Miller of the People's National Party (PNP) took office on January 5th, 2012.[2] The Simpson-Miller administration faces the difficult prospect of having to achieve fiscal discipline in order to maintain debt payments, while simultaneously attacking a serious crime problem that is hampering economic growth. High unemployment exacerbates the crime problem, including gang violence that is fueled by the drug trade.[3]

The Human Development Index for Jamaica is .0727, ranking 79 out of 177 countries in 2011.[4] The index value reflects the fact that Jamaica is characterized by weak economic development, high debt load, high unemployment, weak export performance and energy independence, but also relatively strong social indicators. Jamaica's population is estimated to be 2,889,187, with a growth rate of .7% annually. Approximately 52% of the population is urban, with an urbanization rate of 0.6% annually. Kingston is the capital and the major city on the island. The official language of Jamaica is English, and the country has a literacy rate of 87.9%. Unemployment continues to burden the country, with at 12.7% overall rate and a youth

1 National Environment and Planning Agency, http://www.nrca.org/projects/ncsa/NCSAPROJECTDOCUMENT.pdf

2 CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/jm.html

3 CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/jm.html

4 International Human Development Indicators, UNDP, http://hdrstats.undp.org/en/countries/profiles/JAM.html

unemployment of over 27%, (20th in the world). Moreover, the country faces large-scale unemployment and underemployment.[5]

With an area of 10,911 square kilometers, Jamaica is the largest island of the Commonwealth Caribbean. Two types of climate are found on Jamaica. An upland tropical climate prevails on the windward side of the mountains, whereas a semiarid climate predominates on the leeward side. Warm trade winds from the east and northeast bring rainfall throughout the year. Since the southwestern half of the island lies in the rain shadow of the mountains, it has a semiarid climate and receives fewer than 762 millimeters of rainfall annually.[6]

The Jamaican economy is heavily dependent on services, which now account for nearly 65% of GDP. The country continues to derive most of its foreign exchange from tourism, remittances, and bauxite/alumina. Remittances account for nearly 15% of GDP and exports of bauxite and alumina make up about 10%. The bauxite/alumina sector was most affected by the global downturn while the tourism industry was resilient. Tourism revenues account for roughly 10% of GDP, and both arrivals and revenues grew in 2010, up 4% and 6% respectively. The primary agriculture products are sugarcane, bananas, coffee, citrus, yams, ackees, vegetables; poultry, goats, milk, and shellfish. The primary industries are tourism, bauxite/alumina, agro processing, light manufactures, rum, cement, metal, paper, chemical products, and telecommunications.[7] Jamaica's economy faces many challenges to growth: high crime and corruption, large-scale unemployment and underemployment, and a debt-to-GDP ratio of more than 120%. Jamaica's onerous public debt burden is the result of government bailouts to ailing sectors of the economy, most notably to the financial sector in the mid-to-late 1990s. In early 2010, the Jamaican government created the Jamaica Debt Exchange in order to retire high-priced domestic bonds and significantly reduce annual debt servicing. Despite the improvement, debt servicing costs still hinder the government's ability to spend on infrastructure and social programs, particularly as job losses rise in a shrinking economy.[8]

Jamaica is highly vulnerable to the impacts of climate change, and a high level of interdependence exists between the environment and economic and social systems in the country.[9] Over the last two decades, natural hazards have had significant impact on economic activities, property, human welfare and natural resources. Between 1991 and 2005, six major events resulted in losses estimated at J$53.03 billion, an average of J$ 8.8 billion per event. Disasters have potentially significant implications for public finance, increasing expenditure, reducing domestic revenue and in turn resulting in increased domestic and external borrowing. As a result, the National Hazard Risk Reduction Policy has been developed and approved by Cabinet. This policy, available in draft[10], needs to be complemented by an action plan.[11] I believe this is called the National Hazard Risk Reduction Policy, but on the ODPEM website you can only download the draft. I don't know if it's in force yet.

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5 CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/jm.html

6 Country Studies, http://countrystudies.us/caribbean-islands/20.htm

7 CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/jm.html

8 Ibid.

9 Vision 2030, Sector Plan for Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change

10 http://www.odpem.org.jm/Portals/0/Mitigation_Preparedness/Hazard%20Mitigation%20Planning/National%20Hazard%20Risk%20Reduction%20Policy%20for%20Jamaica.pdf

11 Vision 2030, Sector Plan for Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change

2.2 Country Context for LEDS

Jamaica, as a small island developing state, is responsible for only about .04 percent of global greenhouse gas emissions according to the United Nations, but is vulnerable to a number of climate change impacts. Moreover, the concerns with the economy highlighted in the section above and the debt burden have led to a scarcity of resources to fund environmental initiatives when compared to matters of security and other social sector services. [12]

The Climate Studies Group in Mona (CSGM) in the Physics Department at the University of the West Indies (UWI) has outlined the most probable climate change impacts for Jamaica. Expected changes include shifts in precipitation patterns, with more intense storms and longer dry spells (especially between June and August), increased temperatures, an increase in hurricane intensity, and sea-level rise. These trends are already apparent in Jamaica. Additionally, deficiencies in the existing risk information framework, inadequate climate data and data management systems, unplanned settlement patterns, inadequate level of knowledge and/or awareness of the impacts of climate change, weak physical planning system and land use practices, inconsistent enforcement of planning and land use regulations, and the degradation of terrestrial and coastal and marine resources decrease Jamaica's ability to effectively respond to climate change.[13]

National climate change mitigation activities in Jamaica have centered on issues of energy efficiency, which are viewed as a cost saving measure for the Government highly dependent on fossil fuel resources. Renewable energy is still a minor element, while adaptation issues are increasingly viewed as important, particularly because of the high susceptibility to natural disasters.[14]

In recent years, Jamaica has made progress with regard to the establishment of institutions, the development of policy and legislation. The country has initiated various policy responses to address environmental and planning issues – new policies, strategies and action plans, laws and regulations, and become party to several multilateral and regional environmental agreements. Notwithstanding, much of the problems hindering progress in the environment and sustainable development arena relate to the inadequate policy, legislative and institutional capacity in critical areas of the system. In addition to a number of general outdated legislation, a critical issue is the inadequate enforcement of existing legislation. Another issue is that relevant institutions involved in environmental management lack the capacity (financial, human, physical) to effectively execute their mandates and are unable to deal with the complex nature of current problems.[15]

Jamaica ranked 54 out of 147 countries in the 2008 Environmental Performance Index, outperforming many developed countries and is among the leaders in the Caribbean with respect

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12 National Environment Planning Agency, http://www.nrca.org/projects/ncsa/NCSAPROJECTDOCUMENT.pdf

13 USAID Vulnerability Assessment, 2011

14 The Global Environment Fund, http://www.thegef.org/gef/sites/thegef.org/files/documents/GEF_Jamaica_CPS_Volume_One.pdf

15 Vision 2030, Sector Plan for Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change

to environmental protection and sustainability.[16] The Government recently launched a year-long communication and public education campaign to increase Jamaicans' awareness about climate change and its effects. The campaign, undertaken by the Climate Change Adaptation and Disaster Risk Reduction Project[17], funded by the EU/UNEP is providing the public with up to date and accurate information on climate change. [18]

2.3 Summary of Existing Strategic Plans and Legal Framework

Since the 1970s, Jamaica has passed a range of legislative documents that relate in some way to the environment, development and climate change. Responsibility for climate change is vested with the Meteorological Service of the Office of the Prime Minister, though various ministries and agencies have some role to play in enacting plans and policies.

Key policies and plans are outlined below; a comprehensive list of the environment and planning laws of Jamaica are available here: **http://www.nepa.gov.jm/symposia_03/Laws/Laws.htm**

2.3.1 Enacted Policies and Plans

The Jamaica National Environment Action Plan (JANEAP) was first drafted in 1995 and has been updated in 1999/2000, 2006 and 2009. It has several strategies, including environmental education, national parks, watershed management and forestry reserves. This included National Environment Planning Agency (NEPA) 'Ridge to Reef' policy for watershed management, which started in the Great River and Rio Grande watersheds.[19] The JANEAP is the main planning instrument for environmental conservation and sustainable development in the country.

Vision 2030[20] provides the overarching context within which Jamaica's mitigation activities will take place. It includes two national strategies – *Develop measures to adapt to climate change* and *Contribute to the effort to reduce the global rate of climate change* – that specifically speak to the strategies and actions that Jamaica will employ to reduce its GHG emissions to 2030.

The Pilot Program for Climate Resilience (PPCR)[21], approved in November 2008, was the first program developed and operational under the Strategic Climate Fund (SCF), which is one of two funds within the design of the Climate Investment Funds (CIF). The PPCR aims to pilot and demonstrate ways in which climate risk and resilience may be integrated into core development planning and implementation. In this way, the PPCR provides incentives for scaled-up action and initiates transformational change. The pilot programs and projects implemented under the PPCR are country-led, build on National Adaptation Programs of Action (NAPA) and other relevant country studies and strategies. They are strategically aligned with other donor funded activities to

16 United Nations Development Programme, http://www.jm.undp.org/files/Strengthening%20the%20Protected%20Are%20System%20Jamaica%20(PIMS%203832)%20Project%20Document.pdf

17 http://eeas.europa.eu/delegations/jamaica/documents/eu_jamaica/climate_change_adaption_en.pdf

18 Prevention Web, http://www.preventionweb.net/english/professional/news/v.php?id=25967

19 The Global Environment Fund, http://www.thegef.org/gef/sites/thegef.org/files/documents/GEF_Jamaica_CPS_Volume_One.pdf

20 http://www.vision2030.gov.jm/

21 Open EI: http://en.openei.org/wiki/Jamaica-Pilot_Program_for_Climate_Resilience_(PPCR)

provide financing for projects that will produce experience and knowledge useful to designing scaled-up adaptation measures.

The Strategic Programme for Climate Resilience (SPCR) was developed by the Planning Institute of Jamaica under the PPCR, and is one of the current initiatives which will assist in climate-proofing the country's development. Designed within the context of Vision 2030, there are several components to the program - improving climate change information and data management; mainstreaming climate change policies, plans and legislation; implementing integrated adaptation strategies in targeted river basin planning and management; and establishing financing mechanisms for climate change adaptation by the public and private sectors, and community-based organizations.[22]

The Policy for the National System of Protected Areas (1991), which is contained in Section 5 of the Natural Resources Conservation Authority Act, describes Jamaica's protected areas system as having a common underlying foundation of environmental protection purposes, and a standardized approach to planning and management. The goals of the protected areas system are expressed as economic development and environmental conservation. Efforts have been made to update the System Plan and begin implementation, including quality control and standards. However, the financial sustainability of protected areas remains an issue of concern.[23]

The National Industrial Policy of 1995 commits the Government to establish an Environment and Sustainable Development Unit within the Planning Institute of Jamaica (PIOJ), to ensure the integration of social, economic and environmental policy. The PIOJ (part of the Ministry of Finance) is the main agency responsible for economic and social planning in Jamaica, and is mandated with steering Jamaica towards a sustainable future, communicating a vision to the people of Jamaica, articulating the principles and precepts of good governance, and developing and communicating strategic policies to the nation. Although proposed in 1995, the Sustainable Development Unit of the PIOJ was only officially launched in 2002.[24]

The Watershed Protection Act (1963) provides for the protection of watersheds and adjacent areas, and the preservation of promotion of water resources. It makes provision for watershed conservation through improved soil conservation practices.[25]

The Land Development and Utilisation Act (1966) is also administered by the NEPA and designates the Land Development and Utilisation Commission as the responsible Agency for land development. Development Plans for designated areas are written under this Act.[26]

The Natural Resources Conservation Authority (NRCA) Act (1991) provides for the management, conservation and protection of Jamaica's physical environment through the Natural Resources Conservation Authority. Section 9 provides for the declaration of „Prescribed Areas" in which specified activities require a permit, for which applicants are obliged to provide an Environmental Impact Assessment. The Natural Resources (Prescribed Areas) (Prohibition of

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22 Jamaica Information Service http://www.jis.gov.jm/news/104-headlines/29913?src=media.webstreams

23 The Global Environment Fund, http://www.thegef.org/gef/sites/thegef.org/files/documents/GEF_Jamaica_CPS_Volume_One.pdf

24 National Environment Planning Agency, http://www.nrca.org/projects/ncsa/NCSAPROJECTDOCUMENT.pdf

25 The Global Environment Fund, http://www.thegef.org/gef/sites/thegef.org/files/documents/GEF_Jamaica_CPS_Volume_One.pdf

26 Ibid.

Categories of Enterprise, Construction and Development) Order of 1996 declares the entire island Prescribed and lists the categories of enterprise, construction or development that require a permit. The Act also addresses sewage and trade effluent discharges. The 1991 Act requires subsequent environmental regulations to incorporate the 'polluter pays' principle. Although NRCA responsibilities were transferred to NEPA in 2001, the Act remains the primary instrument of environmental and planning legislation pending the passing of a NEPA Act. [27]

The Forest Act (1996) and its Regulations (2001) address the sustainable management of forests on lands in the possession of the crown and vests management responsibility in the Conservator of Forests. The Act provides for the establishment of forests reserves, the establishment of protected areas, the promotion of forestry research areas, reforestation initiatives and the preparation of a Forestry Management Plan.[28]

The Petroleum Act, 1979, the main energy legislation, formed the Petroleum Corporation of Jamaica as a statutory corporation to develop and manage Jamaica's petroleum resources and, where directed by the Minister, national renewable energy resources.[29]

The Framework for Local Sustainable Development Planning in Jamaica which provides opportunities for 'greening' both government and private sector environmental performance. This framework was published in 2006 by the Statistical Institute of Jamaica, which acts as the technical clearing house for environmental management systems.[30]

NEPA and the Statistical Institute of Jamaica (STATIN) published "Jamaica Environment 2001 - Environmental Statistics and the State of the Environment" in 2001, which lead to **Local Sustainable Development Plans** (LSDPs) produced with aid from the Canadian International Development Agency, under its Environmental Action (ENACT) project. Some of these LSDPs were later formally adopted by Parish Development Committees.[31]

Threshold 21 (T21) Jamaica[32] is the qualitative systems dynamics model that supports comprehensive and integrated planning. More information about the T21 model is available here: http://unpan1.un.org/intradoc/groups/public/documents/un/unpan028220.pdf

2.3.2 Pending Legislation

The National Environment and Planning Agency Act (NEPA) draft legislation is intended to combine the various environment and planning laws administered by the National Environment and Planning Agency into one act.

The Wetlands Policy Natural Resources Conservation Authority (Draft) sets out a management strategy for the protection of wetlands. It identifies five goals that are aimed at the

27 The Global Environment Fund, http://www.thegef.org/gef/sites/thegef.org/files/documents/GEF_Jamaica_CPS_Volume_One.pdf

28 Ibid.

29 Ibid.

30 Ibid.

31 Ibid.

32 Ibid.

sustainable use of wetlands, including the development of guidelines for any development of wetlands and the preservation of biological diversity.

Updates to the **Forest Policy** are also planned for 2012.

The Coastal Resources Policy, a **National Cays Management Policy** as well as review the **National Oceans and Coastal Zone Management Policy**, 2001, is currently underway and being synchronized with one another.
MWLECC aims to have a **Policy Framework for Climate Change** in the form of a Green Paper to go to Cabinet by end 2012. USAID will support this.

Additionally, MSTEM has several pending policies, including a **National Policy for the Trading of Carbon Credits** and a **National Renewable Energy Policy.** A full list is available at: http://www.mem.gov.jm/policy_develop.htm

2.3.3 Key Government Ministries and Agencies[33]

The Planning Institute of Jamaica (PIOJ) initiates and coordinates the plans, programs and policies for the economic, financial, social, cultural and physical development of Jamaica, provides technical support to Cabinet, and is the main interface with international funding agencies and donors.

The Statistical Institute of Jamaica (STATIN) collects, compiles, analyses, and publishes statistical information in relation to commercial, industrial, social, economic and other activities, including the organization of the National Census. Such information provides the information necessary to identify changing pressures of settlements and industry on the environment.

Office of the Prime Minister, Environment Unit promotes sustainable development for Jamaica by managing its environment and natural resources through strategic planning, policy formulation and implementation, and the utilization of appropriate technology. The Office of the Prime Minister (OPM) is responsible for the environment overall. Among the agencies reporting to OPM are the National Environment and Planning Agency, National Solid Waste Management Authority (NSWMA), the Statistical Institute of Jamaica , the Planning Institute of Jamaica, and the Meteorological Service.

Ministry Water Land Environment & Climate Change (MWLECC) was recently formed from the former Ministry of Water and Housing. The Ministry is working to establish a Climate Change Department, with the assistance of UNDP and USAID by the end of 2012. The Department will have a staff of 20-30 persons.

The Climate Change Advisory Board, is a multi-sectoral group of experts set up by Government in 2012 charged with a number of responsibilities, including: to establish a Climate Change Department; to prepare a climate change policy; to educate and build public awareness on climate change; and to seek additional bilateral and multi-lateral support for climate change projects.

33 The Global Environment Fund, http://www.thegef.org/gef/sites/thegef.org/files/documents/GEF_Jamaica_CPS_Volume_One.pdf

The National Environment and Planning Agency (NEPA) is an executive agency responsible for environment management, land use planning, natural resources conservation and development control services. It was formed in keeping with the recommendations of the National Land Policy tabled in 1996 and is a merger of the Town Planning Department, Natural Resources Conservation Authority, and the Land Development and Utilization Commission.

The National Land Agency is an executive agency that delivers land-related information and systems essential to all public sector users engaged in land management activities, including surveys, mapping and land valuation.

The National Meteorological Service maintains a continuous Hurricane Watch during the hurricane season and is responsible for the issuance of severe weather warnings. The service also operates an island-wide network of rainfall and climate stations and processes the data recovered for a wide variety of needs. It houses the focal point for the Climate Change Convention (UNFCCC).

The Water Resources Authority, under MWLECC, has statutory responsibility for the management, protection, and controlled allocation and of Jamaica's surface and ground water resources. Its duties include hydrologic data collection, compilation, and analysis; water resources investigation, assessment, and planning; water resources allocation; and environmental monitoring and impact assessment. The Authority processes applications for the permitting of well drilling and testing and for the licensing of surface and ground water abstraction.

Ministry of Science, Technology, Energy and Mining (MSTEM) provides the policy framework and strategic direction for the energy sector in Jamaica including the promulgation and amendment of legislation and regulations. The Energy Division of the Ministry oversees the functioning of the energy sector. It monitors energy supplies and the identification alternative energy sources, as well as energy conservation.

The Petroleum Corporation of Jamaica (PCJ) mandated by the Petroleum Act of 1979 undertakes the development and promotion of Jamaica's energy resources, including national renewable energy resources. The Corporation will seek, where necessary, business partners through joint ventures with the private sector.

The Jamaica Public Service Company Limited (JPSCo) is the major light and power company in Jamaica and has been so for over 85 years. It started life in private hands but became state owned in the 1970s and was privatized again in 2001.

Jamaica Information System (JIS) mission is to inform the public about the policies, programs and institutions of the Government of Jamaica, so as to increase awareness, understanding and support for these policies, programs and institutions.

Ministry of Transport,Works and Housing is the primary agency for regulating and managing Jamaica’s transport sector.

Forestry Department is an executive agency tasked with managing forests on a sustainable basis to maintain and increase the environmental services and economic benefits they provide.

The Mines and Geology Division is the geological research and development arm of Government and is charged with developing a comprehensive understanding of the geology of Jamaica and directing the orderly development of mineral resources, in accordance with mining and environmental legislation. It has a modern analytical laboratory and a library, and is the sole distributor of blasting licenses.

The Council on Ocean and Coastal Zone Management provides a formal mechanism for integrated coastal zone management. Participants include representatives from local government, private sector, shipping, fishing, marine interests, marine park management entities, and selected international/regional agencies involved in marine and ocean management.

Ministry of Agriculture and Fisheries (MOAF) works to advance the development of a modern, efficient and internationally competitive agricultural sector and the sustainable management of the country's fisheries in order to promote food security and food safety.

Ministry of Finance, Planning and the Public Service (MOF) has overall responsibility for developing the Government's fiscal and economic policy framework; collecting and allocating public revenues and playing an important role in the socio-economic development of the country in creating a society in which each citizen has every prospect of a better quality of life.

Office of Disaster Preparedness and Emergency Management (ODPEM) is responsible for natural disaster preparedness in Jamaica, and provides disaster management for the country.

Ministry of Tourism and Entertainment has been active in promoting climate change adaptation, especially with regards to disaster preparedness.

2.3.4 Civil Society, Academia, and the International Donor Community

Climate Studies Group, University of the West Indies, Mona, Jamaica Publishes reports and holds workshops on climate change, renewable energy, and climate resilience. [34]

The Global Environment Fund (GEF) of the World Bank has a large climate change portfolio, including support of an enabling/capacity development nature at the national and regional level for both mitigation and adaptation. The mitigation work is particularly focused on renewable energy and energy efficiency. An early Enabling Activity assisted the Ministry of Water and Housing to assess greenhouse gas (GHG) emissions from forestry, industrial processes, land use change and the energy and transport sectors.[35]

34 http://myspot.mona.uwi.edu/physics/csgm/about

35 The Global Environment Fund, http://www.thegef.org/gef/CPS%20Jamaica

Caribbean Community Climate Change Center (CCCCC) is a clearing house for regional climate change information and data, and provides climate change-related policy advice and guidelines to the Caribbean Community (CARICOM) members, and is recognized as the focal point for climate change issues in the Caribbean.[36]

United Nations Development Programme (UNDP) works with Jamaica in its implementation, monitoring and reporting as one of the Parties to the UN Framework Convention on Climate Change (UNFCCC), and facilitates financing of climate change mitigation and adaptation measures.[37]

National Environmental Societies Trust (NEST) was established in 1989 to act as an umbrella organization and network for Jamaican environmental non-governmental organizations and community organizations engaged in conservation, sustainable community development and environmental education.[38]

Jamaica Conservation and Development Trust (JCDT) is an NGO that works promote environmental conservation and sustainable development, with particular emphasis on the Blue and John Crow Mountains National Park, for the benefit of Jamaica and our people.[39]

Environmental Foundation of Jamaica (EFJ) was established through a bilateral debt reduction agreement between Jamaica and the United States to facilitate the promotion and implementation of activities which will conserve and manage the natural resources and environment of Jamaica and improve and positively impact child development.

The World Bank (WB) through the **Climate Investment Funds** is funding the Pilot Program for Climate Resilience (PPCR), approved in 2008 (updated in 2011) and aims to pilot and demonstrate ways in which climate risk can be integrated into core development planning and implementation.[40]

German Development Bank (GIZ) and **Worldwatch** Institute are collaborating on the "Low-Carbon Development Strategies for the Caribbean" project that partner with local governments, business leaders, academia, and civil society groups to develop low-carbon energy roadmaps. The project is working in the Dominican Republic, Haiti and Jamaica. The project will include renewable resource mapping, technical and economic assessments, and a full-scope policy analysis of potential renewable energy sites and energy efficiency projects.[41]

Department for International Development (DFID) of the UK supports regional programs to help the Caribbean prepare for and reduce the risk from climate change disasters.[42]

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36 Caribbean Community Climate Change Center, http://www.caribbeanclimate.bz/

37 United Nations Development Program, http://www.jm.undp.org/

38National Environment and Planning Agency http://www.nrca.org/ngo_links/national_environmental_societies.htm

39 Jamaica Conservation and Development Trust, http://www.jcdt.org.jm/

40 Climate Investment Funds, http://www.climateinvestmentfunds.org/cif/ppcr

41 http://en.openei.org/wiki/GIZ-Jamaica-Low-Carbon_Energy_Roadmaps_for_the_Greater_Antilles

42 DFID, http://www.dfid.gov.uk/Where-we-work/Caribbean/Jamaica/

Climate & Development Knowledge Network (CDKN) and **DFID** have partnered with the **Caribbean Community Climate Change Center** to develop a Regional Framework for Achieving Development Resilient Climate Change.

The Latin America and Caribbean Regional Platform (LACRP) is part of the LEDS Global Partnership. It seeks to promote low emissions development in Latin America through learning and information exchange, sharing best practices, and providing enhanced opportunities for coordination and collaboration on the development and implementation of LEDS.[43]

The Nature Conservancy (TNC) is working with the Jamaican Conservation Development Trust and the Government of Jamaica, established the country's first national park and brokered a Debt for Nature Swap. Current activities support forest conservation efforts.[44]

Forest Conservation Fund (FCF) created under the Tropical Forest Conservation Act offers Jamaica to relieve official debt owed to the United States while generating funds to support local tropical forest conservation initiatives. The Forest Conservation and Debt Swap Agreements were signed in 2004 by the Government of Jamaica, the United States, the Nature Conservancy, and the Jamaica Protected Areas Trust, which paved the way for the creation of the FCF.[45]

3. National Greenhouse Gas Inventories

3.1 Overview of current emissions profile

The Government of Jamaica (GOJ) developed a GHG inventory as part of the Second National Communication (NC2)[46] using the 2006 IPCC Inventory Guidelines. NC2 was submitted to United Nations Framework Convention on Climate Change (UNFCCC) in June 2011. The national GHG inventory was prepared for the years 2000-2005 using 2000 as the base year.[47] The inventory includes estimates for both direct and indirect GHG emissions. The direct GHGs reported in the inventory include estimates for carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and hydrofluorocarbons (HFCs). The indirect GHG emissions include estimates for non-methane volatile organic compounds (NMVOCs), carbon monoxide (CO), nitrogen oxides (NO_x), and sulfur dioxide (SO_2). These indirect GHG emissions were not included in the total GHG emissions estimate, per UNFCCC guidelines.

Emissions were estimated from the Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU), Waste, and "other" sectors.[48] Table 1 provides a summary of GHG emissions for the year 2000 by sector. Figure 1 presents the percent share contribution of each sector to total emissions.

43LEDS Global Partnership Latin America and Caribbean Regional Platform, http://en.openei.org/wiki/Latin_America_and_Caribbean_Regional_Platform

44 The Nature Conservancy, http://www.nature.org/ourinitiatives/regions/caribbean/jamaica/placesweprotect/index.htm

45 http://www.jpat-jm.com/netcentr/fcfund/fcfund.html

46 GOJ (2011). The Second National Communication of Jamaica to the UNFCCC. June 2011.

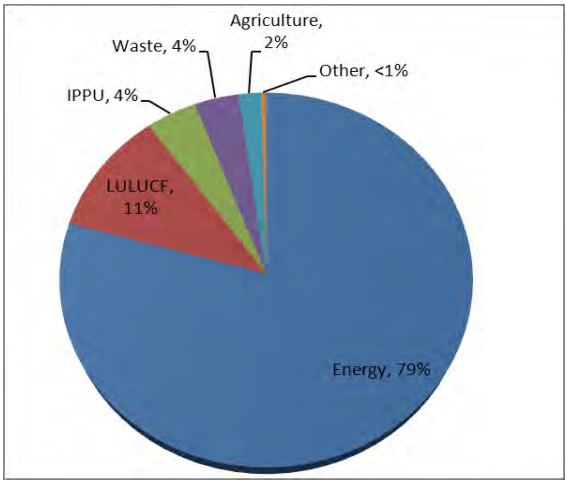
47 According to the UNFCCC, the inventory year for NC2 is the year 2000. Jamaica's NC2 provides detailed information about estimates for the year 2000, hence the remainder of this report discusses emission estimates for that year.

48 Emissions from the "other" sector included indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3.

Table 1: GHG Emissions by Sector, 2000[49]

Sector	Emissions (million tCO_2e)	Percentage of Total
Energy	10,526	79%
IPPU	541	4%
AFOLU	1,665	13%
Agriculture	*244*	*2%*
LULUCF[50]	*1,421*	*11%*
Waste	476	4%
Other	51	<1%
Total	**13,260**	**100%**

Figure 1: Contribution of GHG Emissions by Sector, 2000[51],[52]



3.2 Assessment of key emissions drivers and trends

As demonstrated in Table 1 and Figure 1 above, the Energy sector was the largest contributor to total GHG emissions in 2000, representing 79 percent of total emissions. The Energy sector was followed by LULUCF (11 percent), IPPU (4 percent), Waste (4 percent), Agriculture (2 percent), and other (<1%).

49 The NC2 estimated emissions using the 2006 IPCC guidelines, which groups agriculture, forestry, and land use into the AFOLU sector. Emissions from AFOLU were disaggregated into emissions from Agriculture and LULUCF sectors to provide a better understanding of emissions from these sources/sinks.

50 LULUCF represents a net value accounting for both emissions and sinks of GHGs for this sector. Jamaica emitted approximately 2,530 MTCO2e from the LULUCF sector and removed an estimated 1,108 MTCO2e.

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52 Agriculture and LULUCF are presented in Jamaica's NC2 as subcomponents of the AFOLU sector. The two sources are disaggregated here to more accurately display sources of emissions.

Changes in Jamaica's GHG emissions from 2000 to 2005 are presented, by gas, in Figure 2 below. Emission trends were also provided for each sector presented in NC2; across all sectors, emissions are generally increasing from 2000-2005, with a slight decrease in emissions in 2004.

Figure 2: GHG Emissions by Gas, 2000-2005[53]

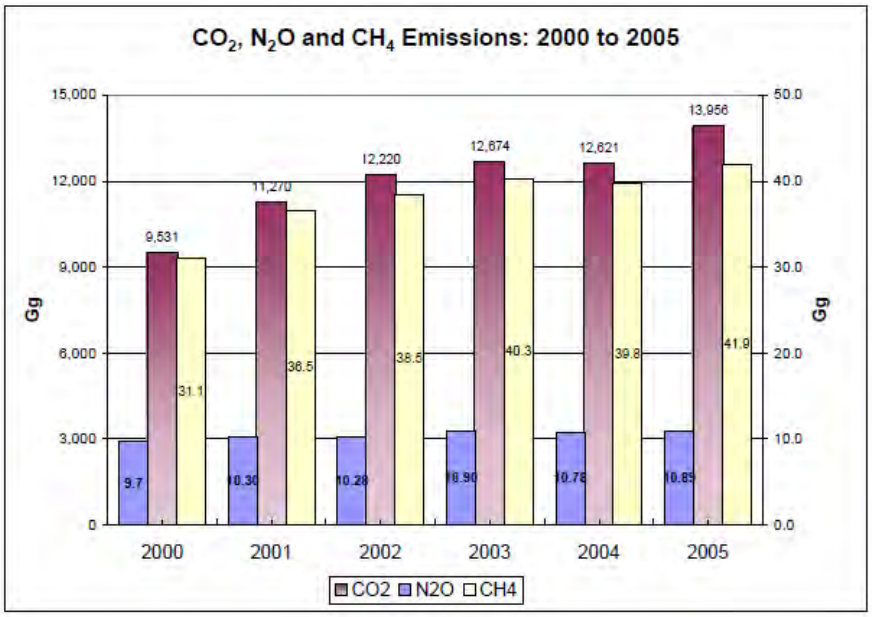
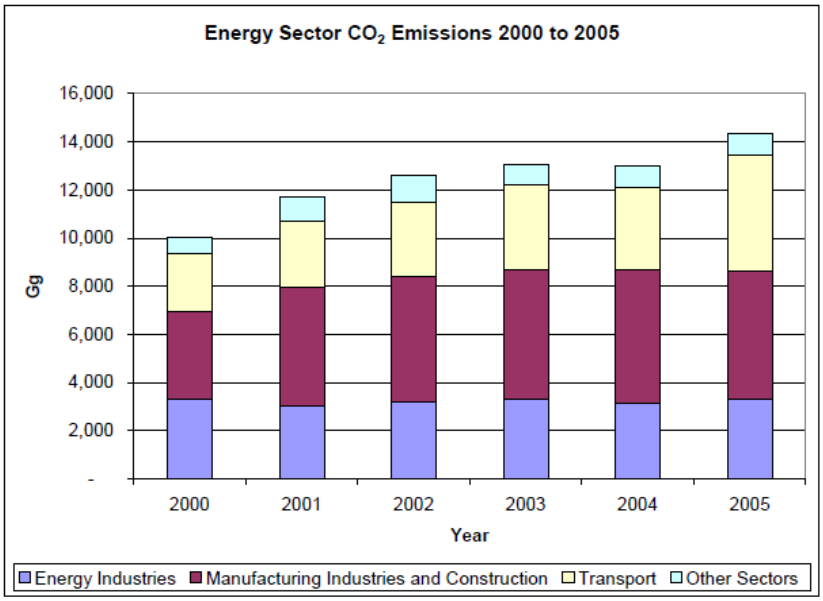


Figure 3: Energy Sector CO_2 Emissions, 2000-200553



53 GOJ (2011). The Second National Communication of Jamaica to the UNFCCC. June 2011.

Figure 4: IPPU Sector CO_2 Emissions, 2000- 200553

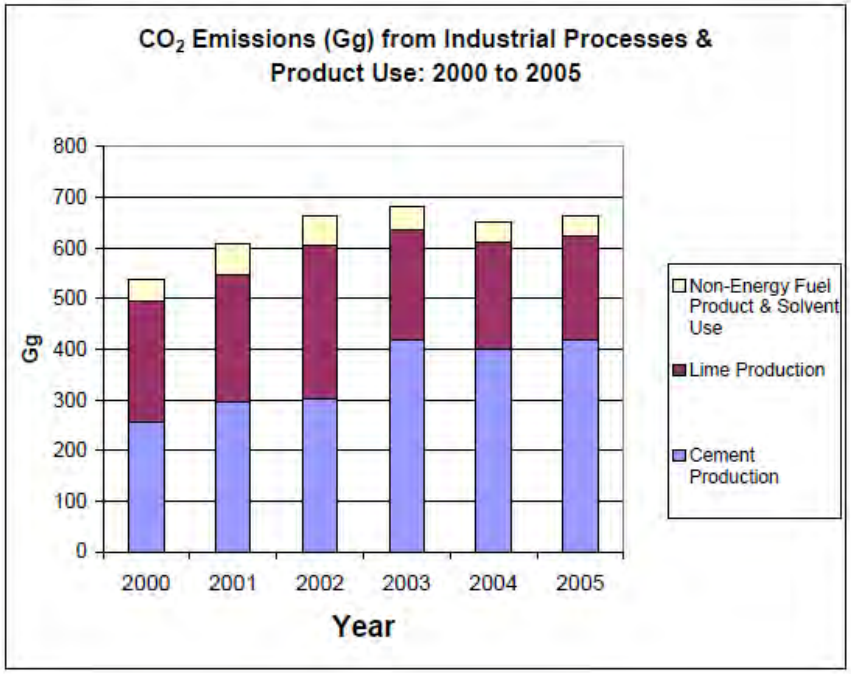
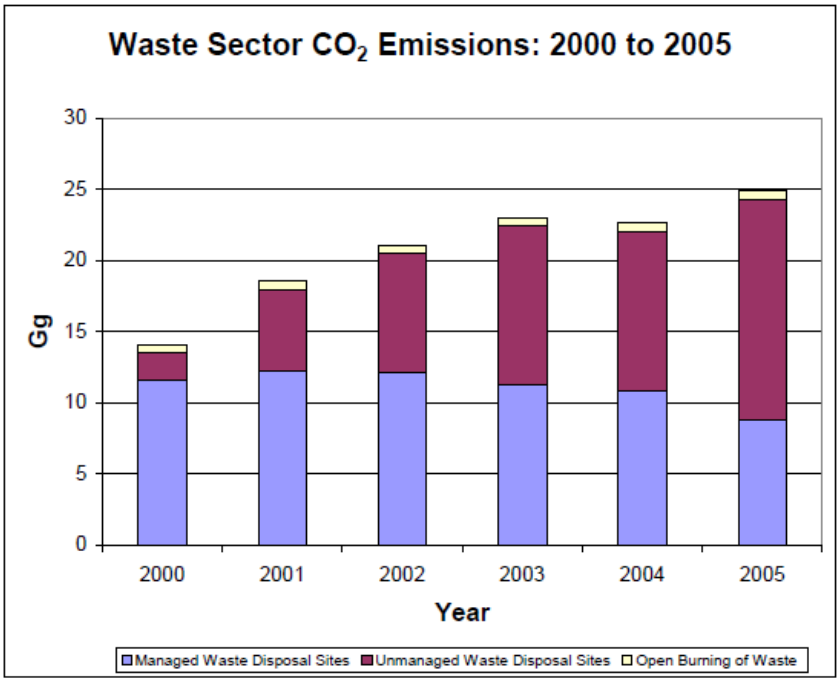


Figure 5: Waste Sector CO_2 Emissions, 2000-200553

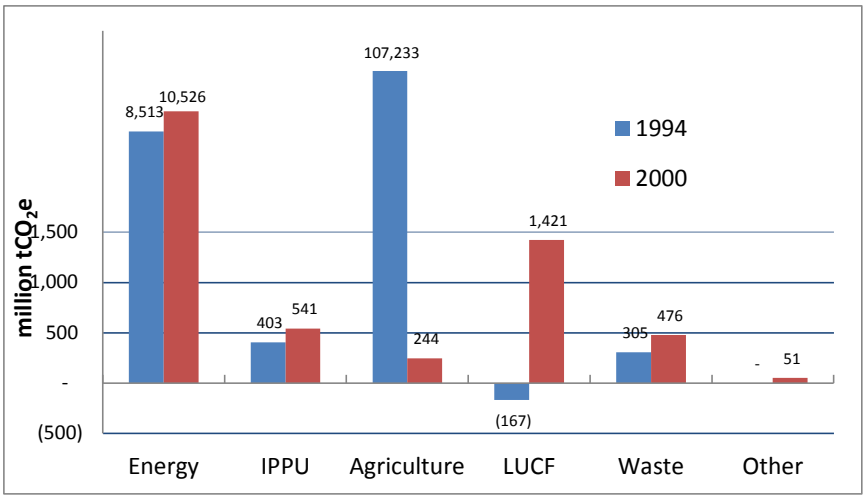


The emission estimates from initial national communication (NC1) and NC2 are shown in Figure 6 below. Different methodologies were used to estimate emissions for both reports—NC1 estimated emissions for 1994 using the 1996 IPCC Revised Guidelines while NC2 estimated

emission for 2000 using the 2006 IPPC Guidelines. Because the methodologies and activity data used in the two reports differ, a direct comparison to evaluate trends may not be a reliable indication of actual trends in emissions from Jamaica; however, such a comparison may be broadly instructive to begin to evaluate growth or reduction in sector emissions over the time period and identify improvements in the NC2. Across all sectors other than Agriculture, comparing the two reports indicate growth in emissions over the time period. Figure 6 shows significant differences in emission estimates for Agriculture and LULUCF sectors in both years.

The NC2 highlights the apparent anomalies in the NC1 estimates for CO_2 sink in the Forestry sector and CH_4 emissions from Agriculture soils. The NC2 notes that due to poor data availability, recalculating the 1994 emissions using the 2006 IPCC Guidelines was impossible. NC2 also notes that "fairly good" forestry data was available for forestry and land use sectors in Jamaica for the 2000 inventory and estimates were based on a systematic data gathering process. Data on land use/land cover changes for NC2 was also derived based on a matrix for land use/cover changes reported for the year 1989-90, which may not be representative of the land use conversions occurring during the 2000 time period.[54] Jamaica began reporting estimates for HFC emissions in NC2. Estimates for HFC emissions were from the refrigeration, air conditioning, mobile air conditioning, and solvent applications.

Figure 6: Comparison of Reported Emissions between NC1 (1994)[55] and NC2 (2000)[56]



The NC2 does not include a key category analysis (KCA) to determine the most significant sources of GHG emissions.

54 As cited in NC2: Evelyn, O. and Camirand, R., (2003). Forest cover and deforestation in Jamaica: An analysis of forest cover estimates over time. International Forestry Review 5(4): 354-363.

55 GOJ (2000). The Initial National Communication of Jamaica to the UNFCCC. unfccc.int/resource/docs/natc/jamnc1.pdf

56 Agriculture and LULUCF are presented in Jamaica's NC2 as subcomponents of the AFOLU sector. The two sources are disaggregated here to more accurately display sources of emissions.

3.3 Review of existing GHG inventory system and institutional structure

Based on a review of UNDP/GEF funding documents[57] the Planning Institute of Jamaica (PIOJ) was the Executing Agency for NC2 funding received from GEF and UNDP[58], and the Meteorological Service of Jamaica was the Implementing Agency (also the national focal point for UNFCCC). NC2 was undertaken by the Environment and Disaster Management Unit of the Ministry of Local Government on behalf of the Meteorological Service of Jamaica. A full time project manager (Jeffery Spooner) was hired for two years and based in the UNDP Country Office for NC2. The project manager utilized the skills of international and local consultants and several national experts to prepare NC2. The persons listed below contributed to the development of the GHG Inventory.[59]

- Dr. Claude Davis; Claude Davis & Associates
- Dr. Leslie Simpson; Caribbean Agriculture Research Development Institute
- Dr. Sergio Gonzales; Consultant
- Mr. Earl Greene; Consultant

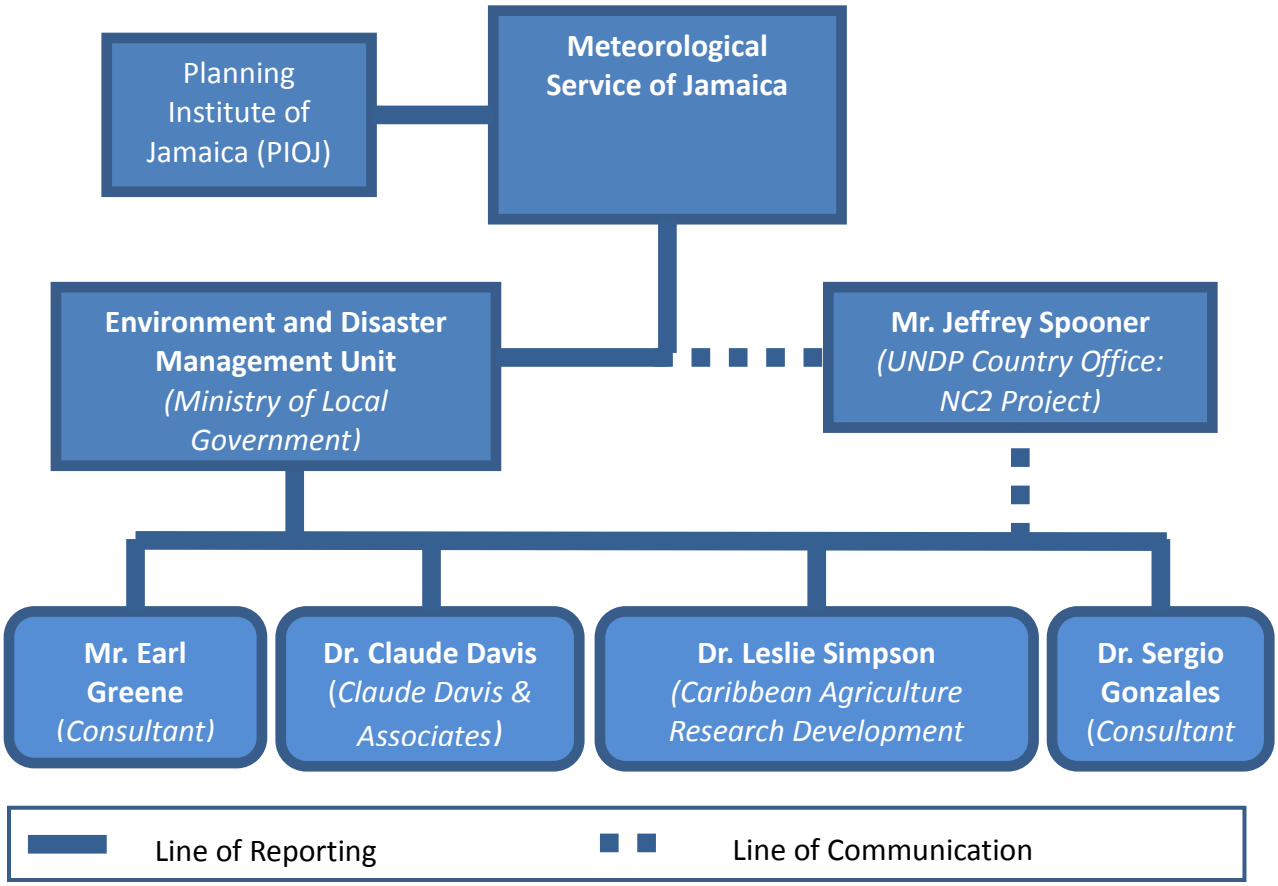
NC2 does not describe any specific teaming/staffing arrangements among various government agencies or ministries for GHG inventory development apart from the abovementioned details. Figure 7 below presents the institutional structure for the inventory development process based on the assessment of NC2.

57 UNDP Project Document (2009). Enabling Activities for the Preparation of Jamaica's Second National Communication to the UNFCCC http://www.jm.undp.org/files/UNFF%202.pdf

58 Jamaican government received approximately USD 405,000 from GEF and USD 57, 800 from UNDP for NC2. Jamaican government counterpart funding was USD 70,000 (in-kind).

59 UNDP Project Document (2009). Enabling Activities for the Preparation of Jamaica's Second National Communication to the UNFCCC http://www.jm.undp.org/files/UNFF%202.pdf

Figure 7: Institutional Arrangements for 2000 GHG Inventory



3.3.1 Quality of country-specific emission factors

No country-specific emission factors were used in the NC2 inventory. Emission estimates for the years 2000-2005 were based on IPCC default emission factors for all sources.

3.3.2 Quality of sectoral methodologies

The inventory was developed using the following IPCC guidance documents: 2006 IPCC Guidelines, Good Practice Guidance for Land Use, Land Use Change and Forestry 2003, Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories 2000. This section assesses the quality of sectoral methodologies according to IPCC Good Practice Guidance, i.e. Transparency, Accuracy, Completeness, Comparability, and Consistency (TACCC) principles.

Emissions from most categories were estimated using IPCC Tier 1 methodologies; emissions from some categories in the Waste and AFOLU sectors were estimated using Tier 2 methodologies.[60] The inventory in NC2 is transparent as it includes a detailed description of the activity data and emission factors used to estimate emissions for each category along with sources of data, and complete references for data sources. The inventory is also complete in its coverage of all sources and sinks in Jamaica. However, it does not include a KCA and includes

60 Estimates for the following source categories were developed using Tier 2 methodologies: forest land remaining forest land, land converted to forest land, CH4 from domestic wastewater, CH4 from industrial wastewater, solid waste disposal, and open burning of waste.

incomplete results for the uncertainty analysis. As noted earlier, consistency of emission estimates in NC2 as compared to estimates in NC1 was not assessed in NC2 due to lack of complete data for NC1. However, NC2 uses consistent methodologies and data to estimate emissions for the years 2000-2005. This is a significant improvement over NC1. Estimates for NC2 are generally comparable with NC2 GHG inventory estimates from other countries that used the 2000 and 2003 Good Practice Guidance Reports and/or the 2006 IPCC Guidelines.

Comparison with NC2 estimates from countries using 1996 IPCC guidelines is slightly difficult as the methods and activity data requirements between these versions of the IPCC Guidance are often quite different. Additionally, the IPPU sector estimates will have to be broken down to emissions from Industrial Processes and emissions from Solvents and Other Product Uses; and AFOLU sector estimates will have to be broken into Agriculture and LUUCF sector estimates. Additionally, comparison of results from uncertainty analysis for each category with inventories from other countries is not possible as complete results were not provided. Accuracy of estimates can be assessed using the uncertainty associated with these estimates and robustness of data sources and improvements in emission factors. The NC2 included complete documentation of activity data and relied on country reports with mostly national aggregated data, in some cases facility specific data was used (e.g. cement manufacturing). This is a significant improvement over NC1. Uncertainty estimates were not comprehensive enough to assess accuracy of emission estimates for all categories.

Energy Sector: Emission estimates for all categories in this sector were developed using Tier 1 methodologies. Activity data was obtained primarily from MEMT, along with some data from Civil Aviation Authority, and Jamaican Bauxite Institute. The NC2 notes that fuel consumption and other activity data in the sector should be compiled using the International Standard of Industrial Classification (ISIC) codes. These codes provide a way for governments and international bodies to standardize data collection and promote international comparability. Discrepancies in the vehicle fleet database used to develop the energy sector estimates in the NC2 will need to be addressed by using appropriate QA/QC methods to avoid data collection and data entry errors. Data on diesel consumption is currently not clearly distinguished between on-road and off-road transportation and fuel consumption data for mining activities and lime production is not captured. These two issues should be improved for future inventories. Additionally, Jamaica's NC2 did not include emission estimates for CO_2 from the Energy sector using the reference approach.

IPPU Sector: Emission estimates for all categories in this sector were developed using Tier 1 methodologies. The NC2 clearly describes sources for activity data and emission factors. Activity data was primarily obtained from economic surveys by STATIN, MEMT reports, and import data. NC2 notes that HFCs were used in foam blowing applications starting the year 2005, hence emissions form this source will need to be accounted for in future inventories. The inventory does not include HFC emissions from the fire protection sector due to insufficient data. The inventory notes that import data on HFCs was not comprehensive.

AFOLU Sector: The discussion below is organized by what were previously defined as the Agriculture and LULUCF sectors in past versions of the IPCC Guidance in order to help clarify the discussion.

Agriculture: According to the 1994 emission estimate from the NC1, the Agriculture sector was reported as the largest contributor, representing over 90 percent of the total country GWP-weighted emissions; for the NC2, 2000 Agriculture sector emissions contributed just 2% of total national GWP weighted emissions. The reason for this change is not entirely clear, though it was likely an error in calculating the emissions for the NC1 as the value far exceeds the emissions normally expected from a country the size of Jamaica. The NC2 also reports that lack of complete archive of data for the year 1994 hindered the investigation of the high level of emissions reported from the Agriculture sector and the large CO_2 sink in the Forestry sector in the NC1. For the Agriculture sector, NC2 uses 1996 Agriculture Census data that is quite outdated as it uses 1996 data to estimate emissions for 2000-2005.

LULUCF: By contrast, the NC2 reports that "fairly good" [though quite outdated] country specific data are available for the forests and land-use sectors in Jamaica. Following a critical analysis of the previous land use/cover and land classifications systems which was completed by the Forestry Department in 2003,[61] a land use/cover type hierarchical classification system was developed for use with both satellite imagery and aerial photograph interpretation; guidelines are also available for interpretation of the various land use types on aerial photographs.[62] An updated system for interpreting satellite imagery data and ground-based surveys and sample plots will significantly improve the accuracy of Jamaica's NIRs as well as inform land-use policies and forestry management. The most recent land use/cover study uses 1989 and 1998 LANDSAT™ imagery and estimated a deforestation (i.e., loss in forest cover) rate in Jamaica of 0.1 percent. A supervised classification system was used and over 100 locations island-wide were visited for "ground truthing" purposes (and photographed) and the coordinates taken by GPS for verification purposes. Aerial photographs (1991–1992 1:15 000 color and 1999 1:40 000 black & white) were also used to verify seven large blocks which were very difficult to interpret because of clouds and shadows.54,[61] The 1998 land use/cover color map was published in the *National Forest Management and Conservation Plan for Jamaica.*[62]

The required reporting on the six land-use categories per the 2006 IPCC Guidelines are similar to Jamaica's national land-use classes. For the National Forest Inventory Report 2003[61], the island's land uses were determined using 1992 color aerial photographs following the procedures outlined in the Forestry Department Aerial Interpretation Manual.[62] These classes of land use were then mapped to the six IPCC land use categories. The inventory also presented annual change in carbon stocks resulting from land use conversions. The land use conversion matrix, presented in Table 2 below, was derived from land use/cover changes reported for the years 1989-90.54 Given that the dataset on which this table is based is quite old (10 years prior to the 2000 base year), it is unlikely that it represents the land use conversions accurately for the year 2000. Additionally, the data presented should probably be questioned as it is very unlikely, for example, that there was no conversion of forestland to cropland, as would be indicated by the matrix below.

Table 2: Annual land use conversion by land use class (in hectare)[53]

61 *As cited in NC2:* Camirand, R. and Evelyn, O.B. (2003). Ecological land classification for forest management and conservation in Jamaica. Jamaica-Canada Trees for Tomorrow Project Phase II, Forestry Department and Tecsult International, Kingston, Jamaica. 40 p.

62 *As cited in NC2:* Forestry Department (2001). National forest management and conservation plan. Ministry of Agriculture, Kingston, Jamaica. 100 p. and appendices.

From → / To ↓	Forest Land	Crop Land	Grass Land	Wet Land	Settlement	Other Lands	Total
Forest Land		25.2	26.2	7.5	0.03	33.1	92.43
Crop Land			13.7	0.3			14.0
Grass Land	205.8	73.0				123.4	402.2
Wet Land		5.2					5.2
Settlement	26.6		5.5			7.1	39.2
Other Lands	346.8		223.7	5.3	0.10		575.9
Total	579.2	103.4	269.5	13.1	0.13	163.6	1128.93

Waste Sector: Activity data was obtained from STATIN, National Water Commission, PIOJ, and the National Solid Waste Management Association (NSWMA). The NC2 notes that reliable data on types and quantities of industrial waste generation and disposal were not available. NC2 mentions that some data for municipal waste is being compiled by the NSWMA and will be useful for future inventories. Enactment of waste sector regulations under the NEPA is expected to improve data availability. NC2 also highlights the need for data on population according to income groups and degree of utilization of sewage treatment systems by rural and urban areas that can be collected by STATIN and PIOJ.

Uncertainty Analysis: A discussion on uncertainty was included in NC2 for each sector, which presents uncertainty estimates for emission factors and activity data for each category. In some cases combined uncertainty associated with the emission estimate for the category was calculated and reported for each sector. However for the Energy sector and Agriculture sector, uncertainty estimates were only provided for activity data and emission factors separately. Table 3 below presents uncertainty estimates from NC2 for categories where combined uncertainty was estimated for emissions (after combining uncertainty associated with activity data and emission factors). These estimates were primarily based on IPCC default uncertainty ranges.

Table 3: Summary of uncertainty analysis by sources/sinks53

	Sources/Sinks	Uncertainty
IPPU	Cement Manufacturing	5%
	Lime Manufacturing	8%
	Sulphuric Acid Production	51%
	HFCs	N/A

	Lubricant and Paraffin Wax Use	±120%
	Solvent Use Paints	60%
	Asphalt/Bitumen	-50% to +100%
	Personal Care Products	±200%
Forestry	Forest Land remaining Forest Land	35%
	Cropland remaining Cropland	90-100%
	Grassland remaining Grassland	90-100%
Waste	CH_4 from Domestic Waste Water	200%
	CH4 from Industrial Wastewater	135%
	N_2O Emissions from Waste Water	161%
	CH_4 from Biodigesters	-121% to +920%
	CH_4 from Solid Waste Disposal Sites	225%
	CH_4 from Medical and Industrial/Private Sector Waste Incineration	170%
	CO_2 from Medical and Industrial/Private Sector Waste Incineration	N/A
	N_2O from Medical and Industrial/Private Sector Waste Incineration	170%
	CH_4 from Incineration by Open Burning of Waste	120%
	CO_2 from Incineration by Open Burning of Waste	N/A
	N2O from Incineration by Open Burning of Waste	120

NC2 does not present compiled results for total uncertainty for the overall uncertainty analysis. However, NC2 states that uncertainties in the overall GHG inventory for emission factors and activity data were calculated using the 2006 IPCC Guidelines for both level and trends without specifying whether Tier 1 or Tier 2 approach was adopted. Detailed uncertainty results were presented only for the Forestry sector, which used a Tier 1 approach (propagation of error). Based on uncertainty calculations presented for forestry sector in NC2, it is assumed that Tier 1 approach was also adopted for other sectors and for the overall uncertainty analysis.

The level uncertainty for the overall inventory, and the uncertainty for individual sources, was estimated for the year 2000. The overall level uncertainty in the 2000 was about 10%. The trend uncertainty analysis was prepared for the 2005 inventory using 2000 as the base year and the trend uncertainty was estimated to be 16%.

Table 4: Results for Overall Uncertainty Analysis from NC253

Overall Uncertainty Analysis	Year	Uncertainty Estimate
Level Analysis	2000	10%
Trend Analysis	2005 (with 2000 as the base year)	16%

The majority of CO_2 emissions came from fuel combustion (mainly in industrial activities and to a smaller extent from transportation categories) that had low uncertainties. This resulted in lower uncertainty estimate associated with CO_2 emissions from the Energy sector. NC2 also noted that the uncertainty in emissions from cement manufacture was low, as facility-specific data was available.

Gaps and Improvements Identified in NC2: NC2 specifically identifies data gaps and suggests improvements for the national GHG inventory as part of the future national communications for all sectors. These proposed improvements focus on improved methods for collection of activity data to enable use of higher tier methodologies. Key proposed improvements are summarized below:

- Improved data collection by PIOJ and Statistical Institute of Jamaica (STATIN).
- Improved data availability for the Waste sector through reporting under Air Quality Regulations (2006) under the Natural Resources Conservation Act[63] and enactment of Pollutant Release and Transfer Regulations.
- For the Energy sector, NC2 emphasizes the need for improved data collection on fuel consumption and vehicle and aircraft fleet but does not recommend any specific steps.
- For the Forestry sector, NC2 identifies the need for updated satellite imagery data, suitable ground based surveys, and permanent sample plots to measure suitable growth rates to improve the quality of land use change data.
- Currently, agricultural census data are compiled every 10 years and NC2 identifies the need for compiling estimates for the intervening years to improve the accuracy of estimates.

3.3.3 Data storage and processing

As discussed in NC2, availability of reliable data is a significant challenge. Primary sources of data were government institutions, e.g., the STATIN, Ministry of Energy, Mining and Transportation (MEMT), Forest Department, the PIOJ and—to a smaller extent—individual power/industrial plants, e.g., cement production and lime production. Data was mainly available at the national level, which makes it a challenge for inventory preparers to move to higher tier methodologies.

NC2 does not include a description of any specific QA/QC procedures that were followed for inventory estimates.

As previously mentioned, NC2 reported that "fairly good" country-specific data were available for the forests and land use sectors in Jamaica. The Forestry Department started a systematic data gathering process in 2000 that was completed after a critical analysis of the existing land

63 GOJ, NEPA Website. http://nepa.gov.jm/legal/nrca_act_Ipart1.htm. Accessed on Aug 27, 2012.

use/cover and land classification systems.54 A standardized broad classification system was developed for use with satellite imagery and aerial photograph interpretation. An aerial photo interpretation manual was also prepared which provides guidelines for interpretation of the various land use types on aerial photographs.[62] Country-specific land use areas were reported by Holdridge Life Zones[60] that were converted to GHG inventory ecological zones per 2006 IPCC classification. Therefore, robust methods and documentation are in place for interpreting Landstat™ satellite imagery and aerial photographs (and subsequent ground truthing). However, as the NC2 notes, the assignments of land use and changes in land use categories are based on outdated satellite imagery.

3.3.4 Other important aspects as determined by EPA inventory experts

Existing and Planned Donor Support

Funding for both of Jamaica's national GHG inventories in NC1 and NC2 came primarily from the GEF. Jamaican government received approximately $350,000 USD and $400,000 USD for NC1 and NC2 respectively.[64] UNDP provided $57,800 USD and the GOJ also provided counterpart financing of $70,000 USD for the NC2.[65] Twenty percent of the NC2 budget was allocated for inventory development while other financing was directed towards project management (29 percent) climate change adaptation measures (20 percent), climate change mitigation measures (7 percent), and monitoring and reporting (7 percent) among other components of NC2 development.[66]

After NC1 was submitted, GOJ requested additional funds from GEF to conduct new enabling activities and build GHG inventory capacity in order to continue to fulfill its obligations under the UNFCCC. Jamaica's goals included extending current knowledge, facilitating the emergence of national networks, promoting the integration of climate change concerns into development planning dialogue, identifying technology needs, and supporting the government's GHG Inventory capacity building activities.[67] This project was approved in 2003 and Jamaica was awarded $100,000 USD for interim measures for capacity building in priority areas related to climate change.

Jamaica is also engaging in other capacity building projects with donors such as USAID, Canadian International Development Agency (CIDA), the World Bank (WB), and the European Union (EU). These capacity building projects address a variety of issues including climate change impacts and adaptation, natural resource management, transportation, disease control, education, tourism, and Jamaica's economic infrastructure.

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64 GEF Website. Projects details: Enabling Jamaica to Prepare its First National Communication in Response to its Commitments to UNFCCC. http://www.thegef.org/gef/project_detail?projID=439 Accessed on August 21, 2012.

65UNDP Project Document (2009). Enabling Activities for the Preparation of Jamaica's Second National Communication to the UNFCCC http://www.jm.undp.org/files/UNFF%202.pdf

66 Mahlung, Clifford. NC2 Workshop for the Caribbean Region; Presentation on Jamaica's Second National Communication. Meteorological Service of Jamaica. April 8-11, 2008, Barbados. http://ncsp.undp.org/sites/default/files/832.pdf

67 GEF Website. Project Details: Climate Change Enabling Activity (Additional Financing for Capacity Building in Priority Areas). http://www.thegef.org/gef/project_detail?projID=1882 Accessed on August 21, 2012

3.4 Implications for USG programming

Based on the review of NC2 and some additional materials including Jamaica's Strategic Programme for Climate Resiliance (SPCR), the following areas have been identified for potential collaboration between the USG and various departments of the Jamaican government. The SPCR suggest areas of support related to those proposed below, such as 1) Strengthening institutional arrangements to ensure the effective mainstreaming of climate change, and 2) Building capacity for climate data management, forecasting and planning. However, the focus of the SPCR is related more to adaption and mitigation, rather than the specific GHG inventory focus of the following:

- **National Inventory Management System**: The Meteorological Services of Jamaica carried out most of the inventory development work for NC1 and NC2 with support from external consultants. The inventories for both NC1 and NC2 were developed on a project basis. Thus, there is a need to establish a National Inventory Management System to establish institutional arrangements, document methodologies and data, and conduct other inventory activities. As Ministry of Water, Land and Environment has now expanded to include climate change activities (now Ministry of Water, Land, Environment and Climate Change), the GHG inventory will be developed by this ministry. It will be important to ensure that any staff new to the inventory development process are sufficiently trained. There will also be a need to ensure that effective oversight is provided by the ministry to the responsible agencies within the government (e.g., line ministries providing sectoral data) and to external consultants (that support inventory development).

  There is need for development of tools and procedures for documenting methodologies, creation of databases of emission factors and activity data for all sources/sinks that add up to generate the national GHG emission profiles across each year. The USEPA in collaboration with USAID and UNFCCC has been conducting GHG capacity building activities in several countries focusing on building sustainable national inventory systems. Some of the tools and trainings developed under the USEPA program could be helpful here. For example, USEPA works with national inventory compilers to document their national inventory systems using pre-defined templates that reflect key components of the inventory management process. Application of the "Developing a National GHG Inventory System" template workbook could help institutionalize national inventory development systems, including institutional arrangements for data collection, methods and data for emission estimation, quality assurance/quality control procedures, archiving procedures and planned improvements. USEPA could expand capacity building activities to help Jamaica establish processes and procedures to support a sustainable national inventory system, which facilitates the transition from the current project-based approach to programmatic approach for GHG inventory development, or development of inventories on a more regular basis.

- **Data Availability and Collection**: There is a strong need for improved coordination, quality, and gathering of data/statistics to support inventory development. Currently, most data is only available at the national level. There is a need to obtain more disaggregated data to enable use of higher tier methodologies. The USG could collaborate and provide technical assistance/guidance regarding efficient ways of data collection and management. USEPA could offer inventory compilers training to help assess availability and document data sources for each category.

Specifically, the USG could provide training on using the Agriculture and Land Use (ALU) National GHG Inventory software tool, a data management tool that can greatly assist a country in estimating emissions and removals from the Agriculture and Forestry sectors (AFOLU). This tool and the associated worksheets guides an inventory compiler through the process of estimating GHG emissions and removals related to agricultural and forestry activities. The software simplifies the process of conducting the inventory by dividing the inventory analysis into steps to facilitate the compilation of activity data, assignment of emission factors and completion of the calculations. The software also has internal checks to ensure data integrity.

- **QA/QC Measures**: Since NC2 does not mention any specific QA/QC procedures, there may not be an established QA/QC plan or system. The USG could work with the inventory team to discuss QA/QC procedures and help them develop a QA/QC plan. The template workbook on "Developing a National GHG Inventory System" that USEPA utilizes in its capacity building work includes guidance on this.
- **Improved Sectoral Methodologies**: Emissions for most of the sources are estimated using Tier 1 methodologies; there is a need for improved data collection to bridge data gaps, especially for high-emitting categories where emissions are still being estimated using Tier 1 method. The USG could collaborate and provide technical assistance/guidance regarding data needs and use of higher tier methodologies.
- **Improved Emission Factors**: Emission estimates in NC2 were entirely based on IPCC default emission factors. Due to resource, data quality, and inventory system limitations, country-specific emission factors have not been developed. Country-specific emission factors could improve inventory estimates for high-emitting categories. Categories considered for this effort should 1) account for a significant portion of the total emissions, 2) have low variability in emission rates across sites/facilities, and 3) be able to be characterized cost-effectively. For example, country-specific emission factors for emissions from fuel combustion in energy industries and manufacturing industries could help improve emission estimates considerably as these are significant sources of emissions within the Energy sector. Emissions from fuel combustion in manufacturing industries were reported to increase consistently between 2000-05 (Figure 3). Additionally, country-specific emission could also be developed for process emissions from cement and lime industries, as facility-specific activity data is already available. However, emissions form IPPU sector constitute only 4 percent of the total GHG emissions.
- **Uncertainty Analysis**: NC2 includes uncertainty estimates for each source category and overall uncertainty analysis–level and trend– using IPCC default uncertainty ranges. However the results for the overall uncertainty analysis were not presented in the inventory chapter. A thorough uncertainty assessment is helpful in identifying the degree of uncertainty associated with the high emitting sectors or sources that are rapidly increasing and can further help focus resources towards improving those estimates. The USG could conduct trainings to also include assessment of the uncertainty associated with activity data and emission factors using at least a Tier 1 approach that uses the error propagation method and then eventually move to a Tier 2 approach that uses the Monte Carlo method.
- **Land Use Maps**: According to NC2, the assignments of land use and changes in land use categories are based on outdated satellite imagery. Updated satellite imagery data

complemented by suitable ground based surveys (ground-truthing) and permanent sample plots to measure growth rates are needed in order to improve the quality of the land-use change data, and to develop country-specific growth rates. This information will significantly improve the accuracy of the inventories as well as inform land-use policies and forestry management. The USG could provide support in development of more up-to-date land-use maps using more recent satellite data (and aerial photographs) and establishing a sustainable system for producing the required land-use maps on an on-going periodic basis to improve emission estimates for LULUCF sector.

4. LEDS Inputs Analysis

4.1 Energy Sector

4.1.1 Sector Overview

Energy supply

Imported oil accounts for approximately 91% of the energy mix in Jamaica making the country highly vulnerable to fluctuating oil prices. In 2002 and 2007 extreme price shocks had negative impacts on the economy.[68] Since 1999 demand for oil has decreased on average by 1% per year in relation to deployment of energy efficiency and renewable energy technologies, however, fluctuating oil prices have caused import costs to increase.[69] In 2010, 87% of the GOJ's foreign exchange surplus was used to purchase imported oil.[70]

According to the Renewable Energy and Energy Efficiency Partnership (REEEP), Jamaica's total installed electricity capacity in 2010 was 1161 MW with the supply mix as follows: oil - 90%, hydroelectricity - 2.2%, biomass -1.4%, with the remaining generated from other sources identified by REEEP, including coal.[71] Approximately 90% of the country was electrified in 2006 and the Rural Electrification Program (REP) seeks to provide electricity to the whole country. [72] Much of the electricity generation infrastructure in Jamaica is over 30 years old and transmission and distribution system losses are approximately 23% of total output. [73]

GOJ is working to diversify the energy supply in a number of ways including support for importation of liquefied natural gas (LNG). In 2004 the Government Trinidad and Tobago signed a Memorandum of Understanding (MOU) with the GOJ to import 1.15 million tons of LNG per year for twenty years to the Jamaica Public Service Company and the Jamaica Aluminum Company. [74] Investments are needed to develop the infrastructure for large-scale LNG operations, such as construction of regasification plants.

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68 Ministry of Energy and Mining. (2009). "National Energy Policy". http://ocs.mona.uwi.edu/public/conferences/12/schedConfs/11/energyPolicyOctober212009.pdf.

69 REEEP. (2012). "Policy Database Details – Jamaica." http://www.reeep.org/index.php?id=9353&text=policy-database&special=viewitem&cid=25.

70 Ministry of Energy and Mining. (2009). "National Energy Policy". http://ocs.mona.uwi.edu/public/conferences/12/schedConfs/11/energyPolicyOctober212009.pdf.

71 REEEP. (2012). "Policy Database Details – Jamaica." http://www.reeep.org/index.php?id=9353&text=policy-database&special=viewitem&cid=25.

72 Ministry of Energy and Mining. (2009). "National Energy Policy". http://ocs.mona.uwi.edu/public/conferences/12/schedConfs/11/energyPolicyOctober212009.pdf.

73 REEEP. (2012). "Policy Database Details – Jamaica." http://www.reeep.org/index.php?id=9353&text=policy-database&special=viewitem&cid=25

74 Ibid.

There is significant renewable energy potential in Jamaica. The National Energy Policy (NEP), developed by the Ministry of Energy and Mining, provides a plan to incorporate a greater amount of RE in the country's energy supply mix. According to the Renewable Energy and Energy Efficiency Partnership (REEEP), "Strategic analyses of renewable energy potentials on the island have identified a pipeline of projects for the electricity and transport sectors, which have the potential to reduce petroleum imports by over 10% by the year 2010."[75]

Key renewable energy resources in Jamaica include hydro, solar, wind and biomass. Hydropower provides 24 MW of Jamaica's base load capacity[76], 4% of total generation, and there is estimated to be an additional 80 MW of installed hydropower potential.[77] Solar is another abundant resource and studies have shown solar radiation of approximately 5kWh/m^2 per day that could be harnessed through photovoltaic, concentrated solar power, solar water heater, and crop drying applications. Wind resources are being harnessed at a 20.7 MW wind farm in Wigton and an 18 MW expansion is currently underway. Biomass in the sugar cane industry is currently being used for power and fuel. Bagasse is used for biomass cogeneration[78] and Petrojam, the government owned refinery, is working with the Brazilian company Coimex Group to develop a sugar cane biofuel industry through rehabilitating a 40-million gallon ethanol plant. Capturing landfill gas for energy is another area of interest. Several landfill gas CDM proposals have been submitted, but further assessment of landfill gas potential is needed.

Energy demand

The transport sector is the greatest consumer of petroleum accounting for 37% of consumption (2008) with demand increasing at a rate of approximately 4.3% each year. Bauxite/alumina sector is another significant consumer of petroleum at 34% of consumption followed by electricity at 23%, and cooking and lighting at 3%.[79]

Inefficiency in the energy sector is a major concern in the country as the energy intensity index is four times greater than the world average. The main sectors contributing to this issue are alumina/bauxite, electricity, manufacturing and other productive sectors. Efforts have been made to address energy efficiency issues on the demand side including a public education program to promote energy efficiency funded by the Petrol Corporation of Jamaica and a Public Sector Energy Efficiency project to implement energy efficiency audits and measure in schools and hospitals. [80] Other energy efficiency programs and projects are noted in the policy and donor sections and in Annex 2.

The Long Range Energy Alternatives Planning System (LEAP) was used to project energy demand and associated GHG emissions from 2009 to 2035 under business as usual and other scenarios. The business as usual scenario used GDP and population projections aligned with Vision 2030 without introducing RE and EE measures while the other scenarios introduced RE

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75 Ibid.

76 Many of the plants are currently being refurbished.

77 Loy, D.; Coviello, M. (2005). "Renewable Energies Potential in Jamaica." Ministry of Commerce, Science & Technology, Government of Jamaica. http://www.eclac.org/publicaciones/xml/3/24583/jamaica.pdf.

78 Approximately 1.2 million barrels fuel oil equivalent (bfoe)

79 Ministry of Energy and Mining. (2009). "National Energy Policy". http://ocs.mona.uwi.edu/public/conferences/12/schedConfs/11/energyPolicyOctober212009.pdf.

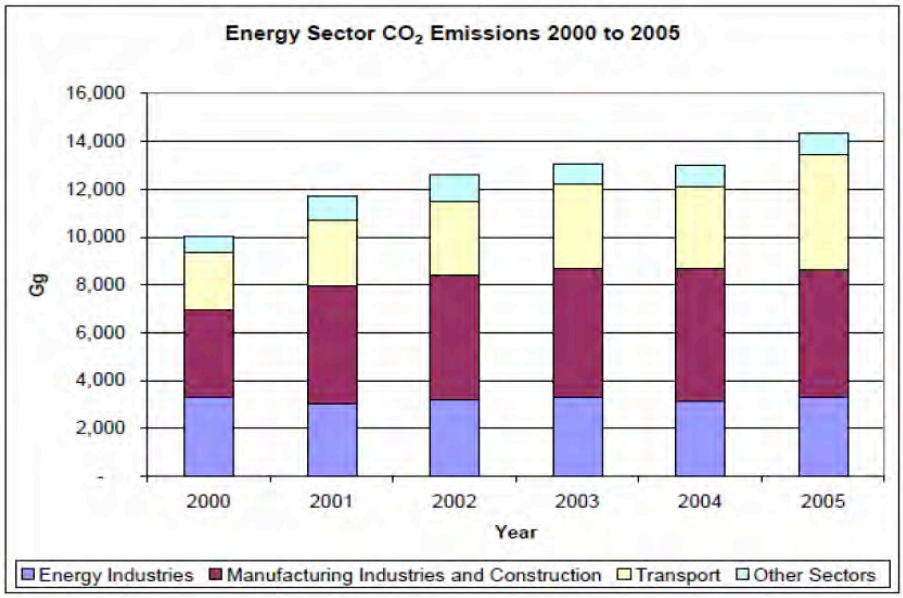
80 Ibid.

and EE measures proposed in the National Energy Policy. The analysis found that "Under business as usual (assuming the price of oil at US$ 100/barrel in 2008 dollars), the cost of imported energy is projected to increase from US$ 2.7 billion in 2008 to US$ 4.6 billion by 2020. The implementation of an effective efficiency improvement and conservation program is projected to reduce the energy demand by two million barrels of oil equivalent (boe) in 2015 and by 6 million boe in 2020. The resulting reduction in the energy import bill is projected at US$129 million in 2015 rising to US$555 million by 2020. The introduction of a national diversification program is projected to increase the annual savings by US$711 million in 2015 and US$1.7 billion by 2020. Investments in these programs are considered cost-efficient." [81]

GHG emissions in the energy sector

According to the Second National Communication, the energy sector accounted for 86% of CO_2 emissions in 2000, a decrease from 97% in 1994. In this year, manufacturing and construction (including bauxite/alumina industry) contributed 37.5% of emissions, energy industries (electricity generation and petroleum refining) 33.1%, and transport 24.2%. A large increase in CO_2 emissions (46%) between 2000 and 2005 was associated with increased fuel consumption in the bauxite/alumina industry and the transportation sector. CO_2 emissions in the cement industry also increased from 2000-2005. The following graph shows energy sector CO_2 emissions from 2000 to 2005.[82]

Figure 8: Energy Sector C02 Emissions 2000-2005



4.1.2 Goals, policies and programs at national and local levels

81 Ibid.

82 GOJ (2011). The Second National Communication of Jamaica to the UNFCCC. June 2011.

Vision 2030: National Development Plan – Jamaica's Vision 2030 lays out sectoral development objectives to help the country achieve developed country status by 2030. Energy security and efficiency are noted as key objectives to achieve economic prosperity. During the USAID and GOJ workshop "Towards the Development of a Policy Framework for Jamaica" it was noted that the Vision 2030 does not consider interdependencies across sectors and objectives. One goal of the workshop was to encourage discussion on these interactions. For more information on outcomes from the workshop please see Appendix 1.

National Energy Policy 2009-2030 - This policy document developed by the Ministry of Energy and Mining, with input from various other Ministries, seeks to ensure that by 2030 Jamaica "achieves a modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behaviour on energy issues and an appropriate policy, regulatory and institutional framework." The policy document supports implementation of Vision 2030 through promoting energy security and efficiency and builds on the previous Energy Policy Green Paper 2005-2020 based on wide stakeholder consultations. Figure 2 below presents the goals of the National Energy Policy and Figure 3 notes the renewable energy targets included in the policy document. [83]

Figure 9: Vision of Jamaica's Energy Sector

83 Ministry of Energy and Mining. (2009). "National Energy Policy". http://ocs.mona.uwi.edu/public/conferences/12/schedConfs/11/energyPolicyOctober212009.pdf.

Figure 10: Jamaica's Energy Mix

Indicator	2009	2012	2015	2030
Percentage of renewables in energy mix	9%	11%	12.5%	20%
Percentage diversification of energy supply	9%	11%	33%	70%

National Renewable Energy Policy (2010-2030) – This draft policy provides a framework to support renewable energy development in the country and align with the Vision 2030 objective to support energy security and efficiency.

National Energy-from-Waste Policy (2010 – 2030) – This draft policy seeks to establish Jamaica as a regional leader in waste-to energy project development.

National Energy Conservation and Efficiency Policy (2010 – 2030) – This draft policy supports reduction of energy consumption in Jamaica through providing a framework to coordinate and facilitate energy efficiency action by stakeholders across all sectors of the economy.

National Biofuels Policy – This draft policy is designed to support the development of a biofuels industry in Jamaica that is environmentally sustainable, efficient, modern, diversified and contributes to the Vision 2030 objective to support energy security and efficiency.
Trading of Carbon Credits Policy – This draft policy provides the foundation for development of a carbon credit trading system in Jamaica.

Energy Efficiency Building Code –This code was developed by the Bureau of Standards and the Jamaica Institute of Engineers (JIE) in 1996 and is being advocated by the GOJ. Adherence to the code is currently voluntary. To become legally enforceable, the new Building Act will need to be passed into legislation. The National Energy Policy states the need to "update, apply and enforce the National Energy Efficiency Building Codes to support efficient use of energy in buildings". [84]

Regulation Policy for the Addition of New Generating Capacity to the Public Electric System – This regulation sets rules for the addition of capacity at the least economic cost. The Least Cost Expansion Plan (LECP) presents plans for capacity expansion beyond 15 MW. [85]

Net Billing Regulation – This regulation allow JPS to provide Standard Offer Contracts to small power producers for the addition of 100 KW capacity to the electricity system. Issues related to the net billing system are noted in the opportunities section. [86]

All Island Electric License – This license allows for addition of generating capacity to the national grid through a competitive process.[87]

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84 Loy, D.; Coviello, M. (2005). "Renewable Energies Potential in Jamaica." Ministry of Commerce, Science & Technology, Government of Jamaica. http://www.eclac.org/publicaciones/xml/3/24583/jamaica.pdf.

85 Ibid.

86 Ibid.

4.1.3 Sectoral structure and institutional capacities

Key Entities

The Ministry of Science, Technology, Energy and Mining (MSTEM) is responsible for development of the energy sector in Jamaica. Key roles of the Ministry are to provide the policy framework and strategic pathway for all Ministry agencies, to develop and amend energy sector legislation and regulation to allocate financial resources, and to establish priorities. The Ministry also measures impact of energy activities, promotes public awareness related to energy use, and performs economic analysis and develops energy forecasts for the electricity and transport sectors. The Energy Division of the Ministry designs and implements policies, programs and projects to support the National Energy Policy.

The primary implementing agency of MSTEM is the Petroleum Corporation of Jamaica (PCJ) that focuses on energy security, availability and cost-effectiveness of petroleum products and fuel diversification. The Centre of Excellence for Renewable Energy (CERE) was established in 2006 as a division of the PCJ and assists with development of renewable energy policies, programs and projects.

Petrojam Limited is a petroleum refinery and supplier of various petroleum products jointly owned by PDVCaribe, a subsidiary of Petróleos de Venezuela (PDVSA) and PCJ. Petrojam Ethanol Limited is a subsidiary of Petrojam Limited that produces fuel grade ethanol.

The Jamaica Public Service Company, Ltd. (JPS) is the vertically integrated National Electric Grid Operator and is 20% owned by the GOJ and 80% owned by US investors. JPS is the sole provider of electricity transmission and distribution services. Electricity generation was fully liberalized in 2004 and a number of independent power producers (IPP) supply 40% of electricity (to the grid and for off-grid uses) with JPS making up the other 60% of electricity supply. JPS and PCJ work closely with the Energy Division.

The Rural Electrification Program is responsible for providing electricity to rural areas of the country. As previously noted, over 90% of the country is currently electrified.

The Office of Utilities Regulation (OUR) is an independent regulatory entity for the electricity sector developed in 1995. OUR processes all utility service applications and makes recommendations to the Ministry of Energy. OUR regulates the final price of electricity, but does not regulate transmission and distribution (T&D) charges. [88]

Institutional capacity

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87 Ibid.

88 Ministry of Energy and Mining. (2009). "National Energy Policy". http://ocs.mona.uwi.edu/public/conferences/12/schedConfs/11/energyPolicyOctober212009.pdf.

As noted in the previous section, a number of policies have been developed to support renewable energy and energy efficiency. However, in many cases, implementation of these policies has proven difficult. Barriers to implementation include lack of commitment by the GOJ to enact policies, inconsistencies in legislation related to the energy sector, and overlapping roles and responsibilities of energy sector actors that make it challenging for one entity to take responsibility for implementation.[89]

The National Energy Policy notes the following strengths and weaknesses in the energy sector.

Strengths:

- Jamaica has a well developed power supply and distribution system with more than 90% of the population having access to electricity
- Jamaica is endowed with a very high potential for the use of renewables in the form of solar, wind and biomass production
- There are diverse opportunities for co-generation

Weaknesses:

- High dependence on imported petroleum
- Lack of known indigenous fossil fuel sources
- High energy import bill
- High cost of electricity
- Old/aging electricity generation plant - Over 40% of the power generation system is old and in need of replacement/retirement
- Aged technology of the local petroleum refinery
- Lack of detailed and up-to-date data for determining renewable energy projects
- Slow development of renewable energy resources
- Low levels of public action on energy conservation
- Weak enforcement powers of regulatory agencies

4.1.4 Donor and private sector engagement; access to finance

Donor activities

A number of donors are engaged in energy sector activities in Jamaica. Some of the key programs are included in the table below. The Caribbean Information Platform on Renewable Energy has developed a comprehensive database of energy sector programs which can be accessed for further information - http://cipore.org/info-centre/projectsdatabase/?type=project&country_rep=110&search=&pg=1. Information on past energy efficiency initiatives is provided in Appendix 2.

Table 6: Energy Sector Donor Programs

Program or project	Implementing agency and partners	Funding agency	Overview

89 Mason, M. (2009). "Renewable Energy Development in Jamaica." Lund University. - http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=1512582&fileOId=1512589.

Data Collection			
Wind and Solar Study	PCJ/ UWI/ Wigton Wind Farm	IDB	US$1 million study, (750K - IDB grant, 230K – PCJ, 26K - UWI) Projects: wind resource assessment; assessment and improvement of WWF variable energy power system, feasibility study of 1 megawatt solar facility in Portmore, St. Catherine
Country-wide solar assessment	WWI and 3Tier		Assessment not yet published but initial results received by WWI
Solar Radiation And Intensity Mapping	N/A	Government of Jamaica, PCJ and UWI	Financial support is expected from PetroCaribe, initial discussions are still being held with partners and stakeholders
Analysis and Modeling			
Sustainable Energy Roadmap	WWI	Ministry of Energy	Roadmap will include solar, wind, biomass, hydro, energy efficiency, and grid assessments; socio-economic modeling; as well as recommendations for regulatory, policy, governance and finance reform - first draft presented at workshops in Jamaica in fall 2012 and published in early 2013
Policy Development and Implementation			
Technical Assistance For Biofuels Development And Policy Support In Jamaica	Ministry of Energy and Ministry of Agriculture	OAS	Technical Assistance to support development and implementation of Jamaica's Biofuels Policy
Energy Security and Efficiency Enhancement Project	Ministry of Energy and Mining	World Bank and IDB	Assistance program to support implementation of the National Energy Policy (2010-2030). The program seeks to build capacity in public institutions, strengthen regulatory framework, support LNG and RE development through providing international best practices, promote investment in EE technologies for

			SMEs and residential consumers, and reduce GHG emissions.
Capacity Development for Energy Efficiency and Security in Jamaica		UNDP	This program seeks to build capacity in the public sector to implement energy efficiency measures, technical assistance for small scale RE development (wind mapping feasibility study and implementation), develop a platform for public and private sector dialogue on RE and EE issues. http://www.jm.undp.org/node/563
Energy Audits for SMEs	Scotiabank/ IDB	Scotiabank/ IDB	Energy audits with SMEs in the manufacturing, agro-processing, tourism and other productive sectors to identify EE opportunities.

Private sector

As noted above, independent power producers provide 40% of the electricity supply in Jamaica. Some of the key entities are included below.

Wigton Wind Farm (WWF) – WWF, located in Wigton, Manchester, is a subsidiary of PCJ and contributes 2.5% to Jamaica's electricity mix or 20 MW of installed capacity.[90] Wigton is currently expanding to add another 18 MW. WWF sells electricity to the grid at a fixed price negotiated with JPS under a power purchase agreement (PPA). WWF also conducts data analysis and feasibility assessments for other possible wind sites in the country and negotiates the sale of associated Clean Development Mechanism (CDM) credits. WWF recently developed a Resource Center that they hope to transform into a high tech training facility to train renewable energy technology professionals.[91]

Jamaica Energy Partners (JEP) – JEP is an IPP that uses petroleum to generate 124 MW of electricity. They operate and own a baseload/cycling power generation facility and sell bulk electricity to the grid.

Jamaica Private Power Company (JPPC) – JPPC is an IPP that supplies 60MW of installed capacity to the grid using slow speed diesel generation technology.

90 To support RE development, OUR has reserved a block of electricity capacity for additional RE integration and WWF has been given the right to expand renewable energy generation (from all sources).

91 CIPORE. "Renewable Energy Project: Wigton Windfarm." http://cipore.org/info-centre/projects-database/wigton-windfarm-resource-centre/. Accessed August 2012.

Jamaica Aluminum (JAMALCO) – The bauxite company JAMALCO produces electricity for its own use and sells the excess (approximately 11 MW) to the grid.[92]

Finance mechanisms[93]

Energy Fund – This fund was established in 2008 and provides a funding mechanism for energy projects, particularly energy efficiency and small-scale renewable energy. The fund is focused on energy users in the commercial and industrial sectors, Energy Service Companies (ESCOs), and manufacturers of energy efficiency technologies. The Development Bank of Jamaica oversees the fund that is retailed by certain financial institutions at a 12.5% annual interest rate. Contributors to the fund included the National Housing trust, PCJ, and the PetroCaribe Development Fund. In 2010, however, only about 14% of the 6 million USD fund had been accessed. According to the Development Bank of Jamaica, businesses are skeptical that the investment in energy retrofits and renewable energy technologies will result in financial savings.[94] The Fund is seeking to raise another 25 million USD by 2015.

PetroCaribe Development Fund – The 2005 PetroCaribe Cooperation Agreement between Jamaica, Venezuela and twelve other Caribbean countries resulted in the PetroCaribe Development Fund that manages deferred payment proceeds for oil from Venezuela. The Fund supports renewable energy and energy efficiency projects as well as other economic development and social infrastructure projects. Jamaica has accessed approximately 65 million USD for energy related activities including Energy Fund projects, expansion of Wigton Wind Farm and an oil refinery upgrade project.

ALBA CARIBE Fund for Social and Economic Development – This fund was created for Caribbean countries to access finance for social and economic development projects. Venezuela has contributed 50 million USD to the fund and GOJ has contributed 5 million USD. Venezuela also contributes set amounts in relation to oil exported to the region.

GOJ Incentives – The GOJ has developed a number of financial incentives to support renewable energy and energy efficiency including individual and corporate tax credits for investment in RE, sales tax exemptions for purchase of RE technologies, variable property tax exemptions, special loans, production tax credits, and grants for RE demonstration projects. The GOJ has also developed fiscal incentives including tax exemptions, depreciation incentives, customs concessions, and tax subsidies for ethanol. Tax credits are also offered for energy audits, Energy Conservation Opportunities (ECOs) implementation, net metering services, recycling of waste for production, and research and development of energy technologies.

4.1.5 Gaps and potential opportunities

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92 REEEP. (2012). "Policy Database Details – Jamaica." http://www.reeep.org/index.php?id=9353&text=policy-database&special=viewitem&cid=25.

93 Binger, A. (2011). "Energy Efficiency Potential in Jamaica: Challenges, Opportunities and Strategies for Implementation." Ministry of Energy and Mining, Government of Jamaica. http://www.eclac.cl/publicaciones/xml/1/43261/Lcw394i.pdf.

94 "$500,000 Energy Fund Fails to Electrify Investors". (2011, July 17). *The Gleaner*. http://jamaica-gleaner.com/gleaner/20110717/business/business3.html. Accessed September 2012.

There are a number of opportunities to support low emissions development in the Jamaican energy sector. The opportunities below are based on energy sector needs identified in the National Energy Policy and the Second National Communication, as well as information collected at the recent USAID Climate Change workshop in Jamaica (see Annex 1).

- **Technical assistance to design, implement, or update renewable energy and energy efficiency policies and standards that support the goals of the National Energy Policy**
    - **Building codes** – While building codes have been developed, as noted in the NEP, there is a need to "update, apply and enforce the National Energy Efficiency Building Codes to support efficient use of energy in buildings" (GOJ, 2010). This was also noted as a significant need during the USAID Climate Change workshop and the idea was also raised to implement energy efficiency and climate resiliency building codes as a package.
    - **Waste-to-energy** – As outlined in the National Energy-from-Waste Policy and the SNC2, there are opportunities to reduce GHG emissions through converting landfill and other waste methane to energy. At the workshop support for waste to energy development was also raised as an area of need a number of times. Jamaica could become engaged with EPA's Global Methane Initiative and possibly receive more targeted technical support to implement the National Energy-from-Waste Policy and waste to energy projects.
    - **Feed-in-tariffs** – Various reports and participants at the USAID workshop noted that the current Feed-in-Tariffs (FiT) for renewable energy should be revised to send price signals that attract further investment in renewable energy.
    - **Net metering** – Jamaica currently uses a net billing system to allow consumers to sell excess renewable energy to the grid. The price at which the excess is purchased by the utility is seen by many as too low and does not provide enough of an incentive to support renewable energy expansion. A net metering system has been proposed as a more efficient alternative, however further analysis is needed on this subject.[95]

- **Support discussions between the government and the bauxite industry on options to reduce energy use**: The bauxite-alumina industry is one of the greatest contributors to GHG emissions in Jamaica.[96] The Second National Communication noted the need for "Creation of relevant legislation to support investments in efficiency in energy-intensive sectors such as transport and bauxite" and "Mechanisms… for public and private sector entities to collaborate on energy related projects". Support for discussions between the public sector and the bauxite industry could provide a forum to consider partnership opportunities and inform possible legislation to reduce energy use.

- **Review of previous and existing demand side management programs for performance, strengths and lessons learned** (text from SNC2): GOJ has pursued various demand side management programs, many of which are noted in Annex 2. The SNC2 specifically notes the need to review these programs in relation to performance, strengths, and lessons learned. Support could be provided to review these programs and recommend additional DSM actions

95 Loy, D.; Coviello, M. (2005). "Renewable Energies Potential in Jamaica." Ministry of Commerce, Science & Technology, Government of Jamaica. http://www.eclac.org/publicaciones/xml/3/24583/jamaica.pdf. Accessed August 2012.

96 GOJ (2011). The Second National Communication of Jamaica to the UNFCCC. June 2011.

in the residential and commercial sectors.

- **Build capacity to evaluate and implement energy efficiency technologies in the tourism sector –** The SNC2 noted the need for the creation of "programmes designed to influence market behaviour towards more efficient use in energy across all sectors". Tourism is a key economic sector in Jamaica and growth in the sector could increase energy demand and have a negative impact on GHG emissions. Supporting evaluation and implementation of energy efficient technologies in the sector could help to address these issues.

- **Collaboration with the Wigton Wind Farm Resource Center –** WWF recently established a Resource Center and would like to develop the Center into a technical laboratory to provide training for various renewable energy professions (analysts, engineers, technicians, etc.). There could be opportunities to support development of this Center and the associated training program.

- **Collaboration with the Ministry of Energy to implement the forthcoming Energy Sector Roadmap** (produced by WWI) – A workshop will be held this fall to present initial findings from the roadmap assessment. An EC-LEDS representative could attend the workshop to explore opportunities for collaboration.

- **Support for development of Energy Service Companies (ESCOs)** – At the USAID workshop a Ministry of Energy representative noted the need to develop ESCOs in Jamaica, which are companies that "carry out performance contracts to implement financed energy efficiency and renewable energy projects in a facility on a guaranteed savings basis" (NREL, 2005). USG has supported ESCO market development in Mexico and other countries and could follow a similar model of support with Jamaica.

- **Technical assistance to reduce GHG Emissions in the cement sector** – Industrial cement production is a considerable contributor of GHG emissions in Jamaica.[97] An industrial efficiency tool called BEST (applied to the Chinese cement sector) could possibly be adapted and applied in Jamaica to support reduction of GHG emissions in the sector.

4.2 Forestry and Land Use Change

4.2.1 Sector Overview

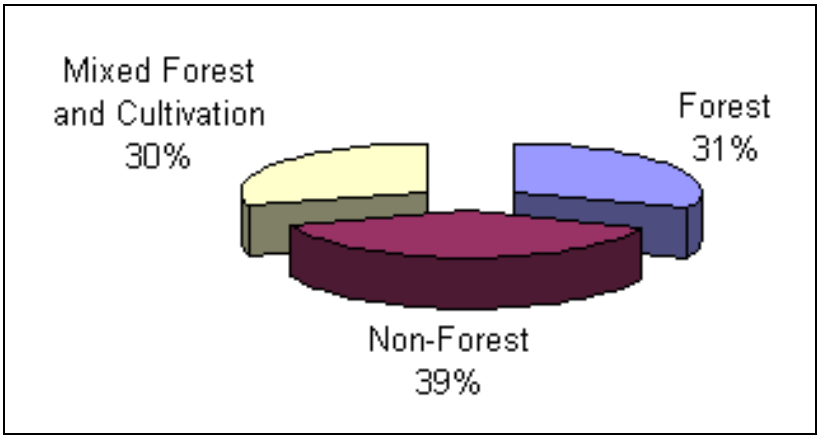
Originally described as "land of wood and water", Jamaica still derives important benefits from its forests. Originally, Jamaica was almost entirely covered with forest. However, natural forests now remain only in the less accessible areas. In a relatively small area the island has an array of coastal and terrestrial resources, including tropical ecosystems, forests, dry limestone forests, scrub, and coastal wetlands, many of which have been degraded.[98] With approximately

97 Ibid.

98 Vision 2030, Sector Plan for Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change

31 percent of Jamaica classified as forests, and 30 percent as forests and cultivation, the sector has key implications for the development of a low emissions development strategy.[99]

Figure 11: Jamaica's Forest Mix



Deforestation in Jamaica is occurring at about 0.1 percent annually over the past 10 years, adding up to about 3,063 hectares. Deforestation occurs most frequently at sites used for bauxite mining which represent the largest increase in land use over the past 10 years, amounting to an increase of 4,989 hectares. Much of the damage to forests occurs in the limestone areas adjacent to bauxite deposits and disturbed by pit access development. [100] The Jamaica Forestry Department has stated that bauxite mining is the single largest cause of deforestation in Jamaica. In 50 years of operation, the industry has stripped 5,099 hectares of trees, including some 3,218 hectares of forest.[101] This is particularly problematic, because whereas reclamation of pits is legally required, reclamation of roads is not required and is often socially impractical. The high quality roads built by the bauxite mining industry are frequently perceived as a social benefit but they provide public access into previously inaccessible forest, resulting in further forest degradation. Still, while recognizing that the destruction of forest in the mining process is in some cases unavoidable, the Forest Department has stated that the bauxite mining industry should compensate the loss by reforesting an equivalent area elsewhere, and requiring notification and additional consultation for road locations.[102]

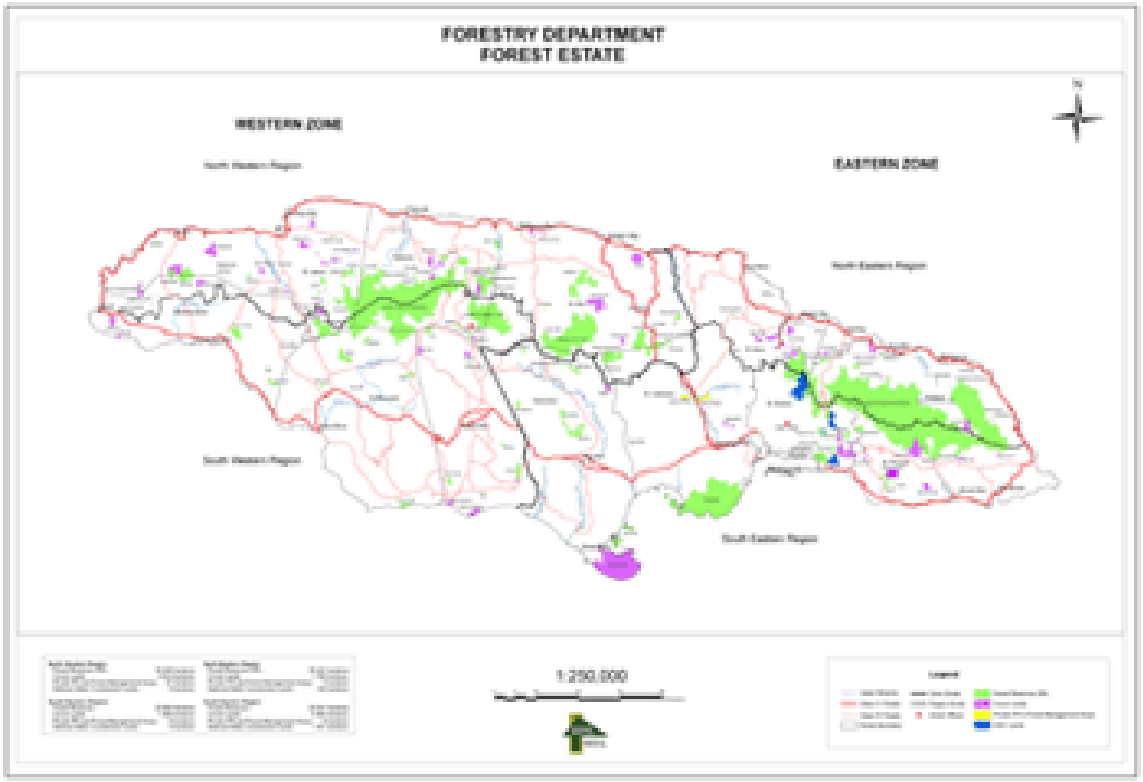
Figure 12: Forest Estate Map

99 FAO, http://www.fao.org/docrep/003/x6769e/X6769E01.htm#2939

100 National Forest Management and Conservation Plan (Forest Plan), http://www.forestry.gov.jm/PDF_files/ForestPlan.pdf

101 Forest Plan

102 Forest Plan



In addition to mining, Jamaica's forest cover has been under serious pressure for the production of yam sticks, charcoal, resort and residential development, timber extraction, grazing, and cropping.[103] Charcoal and fuel wood are used primarily in the residential sector as fuel for cooking. There is also commercial use of charcoal for cooking especially in roadside establishments. Fuel wood (bamboo and acacia, leucaenea) has been used at one sugar factory and also at one lime kiln. Except for fuel wood use in the sugar industry, the estimates of fuel wood and charcoal use are subject to large uncertainties.[104] The lack of soil and water conservation measures has led to high rates of soil erosion, loss of nutrients, and reduction of water retention capacity in watersheds. Improper road construction and logging operations, both legal and illegal, in pine plantations, have also contributed to the problem.[105]

At the same time, wood products derived from Jamaica's forest resources provide several economic and social benefits. At the local level, wood-products provide wood fuel requirements for large number of people in both rural and urban areas; Provide income-generating activities in wood harvesting and transport, and small-scale wood processing activities. At the national level, wood-products: Provide opportunities for development of a range of wood-base industries; Provide a source of renewable energy; Provide for the creation of employment opportunities in

103 Vision 2030

104 Second National Communication, http://www.forestry.gov.jm/PDF_files/ForestPlan.pdf

105 Vision 2030

the various phases of the production and marketing chain and for earning export revenue to improve the balance of payment.[106]

Jamaica's Vision 2030 recognizes that the economic and social well-being of the country is directly linked to the state of its natural resources and the quality of the environment. It also notes that, in spite of the interdependence between the Jamaican economy and the natural environment, there is evidence of a tendency to undervalue natural capital. The result is lack of sustainable use of resources leading to resource depletion and environmental degradation. [107]

Figure 13: Ecosystem Goods and Services

ECOSYSTEM	GOODS	SERVICES
Agro-ecosystem	• Food Crops • Genetic resources	• Habitat • Build Soil Organic Matter • Carbon Sequestration • Employment
Coastal and Marine Ecosystem	• Fish & Shell Fish • Genetic resources	• Storm Moderation (mangroves) • Wildlife Habitat • Biodiversity Maintenance • Aesthetic enjoyment & recreation • Employment
Forest Ecosystems	• Timber • Fuelwood • Genetic resources • Drinking & Irrigation Water • Non-timber Products	• Pollution control, Oxygen Emission • Watershed Maintenance • Carbon Sequestration • Biodiversity Maintenance • Soil Production • Habitat • Employment • Aesthetic enjoyment & recreation
Freshwater Ecosystem	• Drinking & Irrigation Water • Food • Genetic resources	• Waste Assimilation • Habitat • Cycle nutrients • Transport corridor • Carbon Sequestration • Aesthetic enjoyment and recreation

Vision 2030 also highlights the threats to Jamaica's forestry sector, including watershed degradation, net loss of forest cover and increasing incidence of forest fires. Of the 30 percent of land classified as forest, 64 percent is unprotected. Of the forested land, most of it is classified as "managed forest" following the IPCC Guidelines. This is because anthropogenic activities, such as extraction of wood and non-wood forest products, are taking place in almost all the forests of Jamaica. About 114,300 ha of this area has been designated as Forest Reserves and other protected areas, and therefore is under continuous management as stipulated by the Forest Act, 1996 (Section 8 (1) and the Natural Resources Conservation Authority Act, 1991.[108] Moreover, at least 94 percent of Jamaica's forests are classified as "disturbed", even in the reserves, more than 33 percent of all combined forest and other protected areas have been significantly disturbed. Overall, only about 8 percent of the land is considered to have little human activities.[109]

Deforestation and forest degradation, including reduced tree and vegetative cover through conversion of land for agriculture, cutting for fuel wood and charcoal production, and aggravated

106 FAO, http://www.fao.org/docrep/003/x6769e/X6769E01.htm#2939

107 Vision 2030

108 Second National Communication

109 Vision 2030

by forest fires that occur during drought periods all negatively affect Jamaica's 26 watersheds.[110] The extraction and utilization of forest resources have resulted in deforestation, habitat destruction and soil erosion. Many natural and plantation forests are usually located within the upper reaches of watersheds. The removal of trees has been affecting low lying areas, resulting in increased flooding, sedimentation and reduction in aquifer recharge.[111]

Jamaica is fringed with mangroves around its entire coast. While there are no permanent human settlements in mangrove areas, they are traditionally used for charcoal production and minor commercial activity including the use of mangrove stakes for oyster racks, garden poles, and beach hut construction. Substantial areas have also been cleared for urban development and the backs of others reclaimed for agriculture.[112] It is estimated that Jamaica has lost approximately 30 percent of the island's mangrove forests, and damage is continuing with uncontrolled. While currently more than 6,000 ha of mangroves are in protected areas, mangroves are increasingly threatened by infrastructure development and conversion from natural habitat to other uses, including agriculture and commercial ventures.[113]

While the last assessment of forest cover in Jamaica was undertaken in 1998,[114] the Second National Communication considers Agriculture, Forestry and Other Land-Use to be a C02 sink.

4.2.2 Goals, Policies and Programs at National and Local Levels

Jamaica does have policies and plans in place to support sustainable management of its forest resources. The main policy is the **National Forest Management and Conservation Plan (Forest Plan)**, which recognizes the economic benefits of forests to society, including timber and non-timber products, employment, energy, and recreation and tourism.[115] The **Watershed Protection Act** provides a framework for management of watershed in Jamaica, and declared the 26 Watersheds in Jamaica, which also impacts the management of Jamaica's forests. However, no overarching and coherent policy framework exists for wetland management. A mangrove and coastal wetlands protection policy was drafted by NRCA from as far back as 1996, but still remains in draft and awaiting completion. Wetland management in Jamaica is complicated by the fact that most wetlands are on private lands and the constitution allows private landowners great latitude in the use and disposal of their property.[116]

The Forest Act

The Forest Act of 1996 provides the legal basis for the organization and functions of the Forestry Department. It also called for the Forestry Department to develop a Forest Plan.

Forest Plan

The purpose of the Forest Plan is to promote and improve the conservation and sustainable use of the forest resources of the country to meet local and national needs through protecting, managing

110 Vision 2030

111 Ibid.

112 FAO, Global Forest Resources Assessment 2005, Thematic Study on Mangroves, Jamaica Country Profile

113 Vision 2030

114 Ibid.

115 Forest Plan

116 Ibid.

and restoring the resource for the benefit of present and future generations. The Forest Plan outlines several key goals for Jamaica's forestry sector, including:[117]

- Protect the forest resource;
- Restore tree cover;
- Conserve biodiversity;
- Improve the economic contribution of forests to the well-being of the Jamaican people;
- Produce fuelwood on a sustainable basis;
- Maintain the visual quality of forests; and
- Enhance the use of forests for recreation and tourism.

As part of the Forest Plan, a forestry research program will be prepared. The program's focus will be to provide data, information and guidelines for efficient forest management practices and conservation strategies, reforestation planning and development, agroforestry practices and social/participatory forestry initiatives.[118]

Also part of the Forest Plan, Local Forest Management Plans (LFMPs) will be prepared for forest reserves, forested Crown lands and other protected areas. An LFMP is under development for the Buff Bay/Pencar pilot area; eight additional local plans will be completed during the five year planning period. The plans, which will include biophysical and socio-economic information, will be the basis for management and sustainable use of forest resources. The Forestry Department and the LFMCs will be responsible for the preparation and implementation of the local plans.[119]

In developing the Forest Plan, a number of higher order national policies were taken into consideration and reference is made to the following:

- National Industrial Policy (1996)
- National Land Policy (1996)

Developments or changes to these higher order plans will be reflected as necessary in amendments and implementation of the Forest Plan. Other national policies and plans having a bearing on the Forest Plan were consulted to ensure the highest possible degree of harmonization include:

- Policy for Jamaica's System of Protected Areas (1997)
- Watershed Policy (draft) (1999)
- Jamaica National Environmental Action Plan (first prepared in 1995)
- National Environmental Education Action Plan for Sustainable Development (1998)
-

Two other programs that will have a bearing on Forestry Department activities are presently under development: the National Biodiversity Strategy and Action Plan Project and the National Integrated Watershed Management Programme (NIWMP). As the Forestry Department's role in these programs become known, appropriate revisions to this Forest Plan will be made.[120]

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117 Forest Plan

118 Ibid.

119 Ibid.

120 Ibid.

Vision 2030
Vision 2030 also includes in its strategic plans efforts to improve the sustainable management of Jamaica's forests. Activities in the plan address Support for the implementation of forestry management initiatives, including:

- Develop and implement the forest conservation and management plan
- Maintain and restore forest cover
- Increase participation of the private sector and non-governmental organizations in forestry management initiatives
- Build the capacity of NGOs and private land owners to manage forestry and conservation projects
- Establish local watershed/forestry management communities
- Implementation of effective patrolling and policing of transported timber and enforcement laws

Additionally, Vision 2030 calls for a plan to encourage and expand research and ground monitoring to provide and improved understanding of the rate and extent of degradation within remaining natural broadleaf forests and to develop improved approaches for measuring and reversing degradation. It also calls for the country to prepare a complete inventory of forest ecosystems.

Reducing Emissions from Deforestation and Forest Degradation (REDD)
Jamaica has begun to engage in the REDD process, submitting an Expression of Interest in joining the Forest Carbon Partnership Facility (FCPF) in 2011. In the application, Jamaica indicated that REDD+ activities will be led by the Forestry Department in collaboration with the Ministry of Water, Land, Environment and Climate Change, and the Climate Change Advisory Board.[121]

Forest Policy
Jamaica's national forest policy dates back to 1886, with recommendation in a report calling on the island to "reserve, demarcate, survey, and protect against fire, theft and trespass" its forests. In 1996, Parliament approved the *Forest Land Use Policy*, which contains a statement relating to forest policy and goals for:

- Conservation and Protection of Forests
- Management of Forested Watersheds
- Management of Forest Lands
- Promotion and Regulation of Forest Industries
- Forest Research
- Public Awareness and Environmental Education
- Forest Education and Training

The Forest Department has said that the Forest Policy will be updated in 2012, in part supported by the FAO.

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121 Forest Carbon Partnership Facility, Supplement to Expression of Interest in Joining the FCPF, January 31,2012 http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/PDF/Jan2012/FCPF%20questionnaire%20with%20Forest%20Dept%20Jan%2031%2C%202012.%20final.pdf

4.2.3 Sectoral Structure and Institutional Capacities

The Forestry Department

The Forestry Department is an Executive Agency of the MWLECC and is the lead agency responsible for the management and conservation of Jamaica's forests. Its functions are mandated by the Forest Act, 1996, but the Forest Department only came into existence as an Executive Agency in 2010. Its policies are aimed at managing forests on a sustainable basis to maintain and increase the environmental services and economic benefits that forests provide. The Forest Plan, among other things, describe the Department's policy and legal framework, forest management constraints, forest values, the current state of Jamaica's forests and establish goals and a wide range of implementation forest management strategies and activities.[122] Jamaica is in the process of amending the Forest Act and updating the Forest Policy to include related forest and climate change issues, including adaptation and mitigation measures, which will be implemented.

The Forestry Department's Forest Plan will enable it to fulfill its mission to manage, protect and conserve the country's forest resources. The Plan specifically refers to the mandate to maintain and measure the role of forests as carbon sinks as part of Jamaica's commitments under the UNFCCC.[123]

However, the capacity of the Forestry Department, particularly as it relates to detecting land use and land use changes, is lacking. For the SNC, the assignments of land use and changes in land use categories are based on outdated satellite imagery. Information on the wood conversion (removals for various purposes e.g., fuel wood, timber, agricultural purposes) on privately owned lands is lacking.[124]

Fairly good (if outdated) country-specific data are available for the forests and land use sectors in Jamaica. A standardized broad classification system was developed for use with satellite imagery and aerial photograph interpretation. An aerial photo interpretation manual was also prepared which provides guidelines for interpretation of the various land use types on aerial photographs.[125] To address the outdated data needs the Forestry Department has embarked on a management inventory of areas scheduled for detailed forest management planning. The key elements of the management inventory are:

- Detailed photo-interpretation and stratification of vegetation into classes, groups, formations, communities and further subdivisions using 1:15 000 scale color photography;
- Map transfer of photo-interpretation, preferably to digital orthophoto base maps combining planimetric and topographic features with geographically corrected aerial photography at a production scale of 1:15 000;

122 SNC

123 Ibid.

124 Ibid.

125 Ibid.

- Update, at least once every five years, maps and photo-interpretation using aerial photography and/or satellite imagery;
- Systematic stratified ground sampling to obtain data on vegetation, terrain features, soils, and fauna; and
- Production of spatial and attribute databases.

The sequence and priorities for this level of inventory will be based on the schedule and priorities for Local Forest Management Plans.[126]

Additionally, a Monitoring and Evaluation (M&E) Unit is being established within the Forestry Department. The Unit will utilize data generated from this program to monitor and evaluate evolution and change in the forests of Jamaica and provide analysis to aid in decision making.[127]

The Forest Plan recognizes several constraints to sound forest management, which unless addressed will impede the ability of the Forestry Department to achieve the goals outlined above. Constraints include:

- Lack of public awareness, need to change public behavior which includes an indifference to forest degradation, and illegal occupation/use of forest land
- Lack of demonstrated commitment and accountability by senior levels of government to enforce the laws, policies and plans related to forestry development
- Insufficient number of trained, motivated and properly supported personnel to implement the Forest Plan
- Barriers to the long-term commitment and heavy investment required to successfully establish and maintain a forest plantation, with both public and private investors facing conflicting needs and limited budgets. Particularly, pubic allocations are often diverted to address more immediate crises
- Overlapping responsibilities, with at least 14 government offices, ministries, departments, authorities, commissions or boards with statutory and sometimes conflicting interests in forest management.
- Lack of meaningful information/information sharing on land use alternatives among stakeholders, including
    - Lack of basic and consistent forest inventory information
    - Information gas in forecasting the costs and benefits of forest conservation measures and the financial returns and risks for forestry investment
    - Ability to deliver information and messages to participants, who may not have ready access or be functionally literate

These weaknesses are addressed in Part III of the Forest Plan to reduce the impact of the constraints on the forestry sector's goals.

Additionally, the **Land Development and Utilization Act** has the potential to thwart any real investment by the private sector in engaging with the Forest Plan because of the somewhat haphazard wording, which can result in land being classified as idle by the State. The possibility of this arises where it appears that the occupier of any agricultural lands greater than 10 acres in

126 Forest Plan

127 Ibid.

size is not fulfilling his or her responsibility to farm any agricultural land. Private land owners, especially those with existing stand of trees on their property, are therefore slightly wary of utilizing their land in this manner, so as to avoid it being declared idle lands.[128]

4.2.4 Donor and Private Sector Engagement

A number of donors and non-governmental organizations are engaged in climate change-related forestry sector projects in Jamaica. Key programs are identified in the table below.

Title	Objectives and Brief Description	Lead Agency (Jamaica)	Funding Agency	Total Cost
Capacity Building for Sustainable Land Management in Jamaica	Enhance sustainable land management (SLM) by building capacities for SLM in appropriate government and civil society institutions and user groups and mainstreaming SLM into government planning and strategy development.	Forestry Department	GEF, UNDP, JCDT	US$989 890 (GEF= US$500 000)
Climate Change Adaptation and Disaster Risk Reduction	Rehabilitate and improve management of selected watersheds to reduce downstream run-off and associated pollution and health risks; Restore and protect coastal ecosystems to enhance natural buffers and increase resilience; Integrate climate change mitigation and adaptation into relevant national policies and plans; enhance institutional (human and technical) capacity and facilitate awareness building amongst Jamaica's population to better adapt to climate change.	Forestry Department (other project components are being implemented by NEPA and PIOJ)	EU	€4.5m (the forestry dept gets part of this total funding)
Reducing Climate Change-Driven Erosion and Landslide Risks through Sustainable Agriculture for Safer Slopes	The project objective is to increase the capacity of the targeted farming communities on the slopes of the Blue Mountains to adapt to climate change. The outcomes expected are: (1)Increased agro-technical capacity for applying soil conservation techniques that are necessary in steep slope environments. (2)Alternative livelihood practices promoted. (3)Forest and tree cover (with appropriate species) promoted on slopes that are vulnerable to climate-driven increases in erosion and landslide risks.	JCDT	CBA Fund - GEF/SGP Office	US$0.05m

128 FAO, The Role of Private Landowners in the Jamaican Forest Industry, http://www.fao.org/docrep/ARTICLE/WFC/XII/0536-C2.HTM#P10_167

Communicating climate change and biodiversity	The objective of this project is to sensitize key stakeholders in vulnerable sectors and communities as to the emerging research and data on climate change and biodiversity issues, and help to create sustainable conservation and preservation of marine and forest ecosystems.	Mocho Community Development Association	EFJ	J$0.730m
Climate Change and Disaster Risk Reduction			EFJ	US$85,000
Water Harvesting Systems and Community Water Systems			EFJ	US$115,000

EFJ has also support several climate change related projects over the last years. About US$200,000 in FY11: FY11 Grants for Climate Change and Disaster Risk Reduction projects ($85,000) and Water Harvesting Systems and Community Water Systems ($115,000).

In addition, several projects are also financed through the Forest Conservation Fund (FCF), established under the United States Tropical Forest Conservation Act of 1998 which offers eligible developing countries to relieve official debt owed to the United States while at the same time generating funds to support local tropical forest conservation initiatives. The Forest Conservation and Debt Swap Agreements were signed in September of 2004 by the Governments of Jamaica and the U.S., the Nature Conservancy, and the Jamaica Protected Areas Trust, which paved the way for the creation of the FCF. The GOJ will deposit US$16 million into the FCF over a period of 19 years, and the funds are to be used only for purposes outlined in the Agreement. Active projects from FCF funds are outlined in Appendix 4.

4.2.5 Gaps and Potential Opportunities

There are a number of opportunities, as identified through the Forest Plan and the Second National Communication, as well as Vision 2030 to support low emissions development in the Jamaican forestry sector. In general and for the forestry sector specifically, while policies and plans exist, inadequate institutional coordination, lack of implementation of policy, and ill-defined roles and responsibilities hinder the full implementation of a Jamaica low emissions development strategy.

Government Policy and Planning:[129]

- Indifference to forest degradation, destruction and theft of forest resources, illegal occupation of forest land, non-sustainable land use practices and uncontrolled grazing of livestock are public attitudes and behaviors which must be changed.

129 Forest Plan

- The Forestry Department in particular, and the forestry sector in general, lack sufficient numbers of trained, motivated and properly supported personnel to implement the Forest Plan.
- The high cost of investing in forestry and the required long-term commitment are disincentives to private investment. In addition, budget allocations of public funds are inadequate to support forestry investment programs.
- At least 14 Government offices have statutory interest and often conflicting interest in forest land. Although a good deal of co-operation exists between agencies, a number of crucial institutional arrangements are lacking, notably:
    - agreement on a common and comprehensive system of land use zoning;
    - formal co-operative management arrangements between implementing agencies
    - effective participation in forest planning at a senior level of Government having sufficient authority to resolve differences between the management agencies.

Forest Monitoring:[130]

Lack of basic and consistent forest inventory information (and associated information management systems) on forest resources facilitating identification of rates of deforestation and degradation, values at risk, development opportunities, and sites requiring or justifying interventions. Using the expertise of the USG/USFS, opportunities exist to engage with GOJ to address current gaps in forest monitoring, including :

- **The assignments of land use and changes in land use categories are based on outdated satellite imagery and lack of ground-based surveys.** Updated satellite imagery data complemented by suitable ground based surveys and permanent sample plots to measure growth rates are needed in order to improve the quality of the land use change data and to develop country–specific growth rates. This information will significantly improve the accuracy of the inventories for as well as inform land use policies and forestry management. The design of suitable, viable solutions to obtain such data is challenging but options that should be considered include trainings on designing a national forest inventory or other periodic surveys, as well as appropriate legislation.
- **Information on the wood conversion (i.e., removals for various purposes such as fuel wood, timber, and agriculture) on privately owned lands is lacking.** The design of suitable, viable solutions to obtain such data is challenging but options that should be considered include legislation and well designed, periodic surveys.
- **Weaknesses in data collection system for inventory of wood products,** including high level of illegal logging, private landowners do not require permits for cutting or removal of trees on private lands, check points are non-existent, records are not kept by sawmillers and licensees, and Forest Department staff capacity decline due to decline in budget.[131]

Information Management[132]

The Forest Plan identified constraints in developing an integrated and participatory decision-making process using meaningful information on land use alternatives: and an attempt is being made to address these in the current planning process:

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130 Second National Communication

131 FAO, Jamaica Inventory of Wood Products

132 Forest Plan

- information gaps in forecasting the costs and benefits of forest conservation measures, and financial returns and risks for forestry investments; and
- delivery of information and messages to targeted participants, who may not be readily accessible or functionally literate.

Increasing Forest Cover through Private Sector[133]

More than 60 percent of Jamaica's forests are held privately. Given the right incentives, the private sector has a much greater capacity to meet national reforestation requirements than any Government agency. The availability and general productivity of private land offers much greater potential for reforestation than does Crown land, and Jamaica enjoys very high site productivity relative to many timber-producing countries.

- Of the 69,244 hectares of forested or partially forested land identified with reforestation potential, only 2,190 hectares are within forest reserves. The majority is on private land.

- More land is becoming marginal or idle for agricultural use as farmers struggle with global competition and other problems. Growing trees can provide farmers an alternative viable use for such lands.

- As the Forestry Department focuses its resources on public liaison, extension, and regulation, there will be increased opportunities for the private sector in seedling supply and nursery production. Incentives and co-management arrangements for the participation of the private sector in both forest protection and production have been outlined in the Forest Plan, but will need the financing and strong policy to implement.

However, discussion of incentives without a plan to provide financing or realize financial gain is not sufficient to encourage the potential investors who would include but not be limited to small, medium and large scale farmers, persons holding interests in land (including absentee owners), the bauxite and tourism industry, pension funds or other such long-term investors. There is also a lack of reliable data to provide a basis for economic projections for reforestation versus foregoing other activities.[134]

REDD+[135]

A goal of the Forest Plan is to manage forest lands for CO2 sequestration. Jamaica's Forestry Department recognizes the potential role of the forestry sector as a carbon sink, noting in the Forest Plan that Jamaica's forests can be sources, sinks or reservoirs of carbon dioxide. Appropriate forestry activities include the protection of the dwindling closed broadleaf forest and biodiversity, reforestation of forest reserves, watersheds and privately owned forest land, energy plantations and the consolidation of Jamaica's system of parks and protected areas.[136]

Jamaica has begun to engage in the REDD process, submitting an Expression of Interest in joining the Forest Carbon Partnership Facility (FCPF) in 2011. The Planning Institute of

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133 Ibid.

134 FAO, The Role of Private Landowners in the Jamaica Forest Industry, http://www.fao.org/docrep/ARTICLE/WFC/XII/0536-C2.HTM#P10_167

135 Forest Carbon Partnership Facility, Supplement to Expression of Interest in Joining the FCPF, January 31,2012 http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/PDF/Jan2012/FCPF%20questionnaire%20with%20Forest%20Dept%20Jan%2031%2C%202012.%20final.pdf

136 Forest Plan

Jamaica led the submission efforts, requesting participation with full financial support for REDD+ Readiness preparation. Key gaps in preparedness include:

- Limited capacity to undertake baseline assessments
- Limited financing to undertake baseline assessment
- Comprehensive public awareness program to raise awareness of private land owners, who control 66 percent of Jamaica's forests, to get them to buy in to the sustainable forest management strategy and a national REDD+ strategy

Jamaica has begun to engage in the REDD process, submitting an Expression of Interest in joining the FCPF in 2011. In the application, Jamaica indicated that REDD+ activities will be led by the Forestry Department in collaboration with the Ministry of Water, Land, Environment and Climate Change, and the Climate Change Advisory Board. Opportunities to engage include a focus on joint implementation of carbon sequestration projects and encouraging the involvement of the local private forestry sector and foreign companies.

4.3 Agriculture

4.3.1 Agricultural Sector Overview

The Jamaican agricultural sector contributes 5.6 percent to GDP and accounts for 20.6 percent of the employed labor force (Statistical Institute of Jamaica). Real value added for agriculture, forestry, and fishing grew by 12.1 percent in 2009. Trends show that urban migration is increasing with over 48 percent of the total population living in the Kingston Metropolitan Area (KMA) coupled with a 1.75 percent annual decrease in the agricultural labor force from 2006-2011. The arable and permanent crop land have also seen a combined decrease of 3.3% annually from 2004-2009; current land use statistics have arable and permanent crop land at 20.3% of total land use.[137]

The major agricultural sub-sectors in Jamaica are: poultry and livestock, traditional export crops (coffee, cocoa, and sugar), non-traditional export crops (spices and tubers), domestic crops (fruits and vegetables), and fisheries. Currently, the poultry industry attracts the largest consistent flow of investments; however, in recent years, the aquaculture (inland fisheries and marine), swine, and dairy industries have attracted increasing investments.

In recent years, the combination of past trade liberalization policies, competition and low productivity, and effects from natural disasters, particularly hurricanes, have led to a sustained increase in demand for imports on food-related consumer goods and raw materials while creating a deficit on its agricultural trade.[138] Despite these challenges the agricultural sector continues to be the third largest source of employment in the country.[139] The Jamaican Ministry of Agriculture have committed in its 2010-2013 Corporate Plan, the Vision 2030 National

137 FAOSTAT Jamaica Country Report, Food and Agricultural Organization of the United Nations

138 Planning Institute of Jamaica

139 Corporate Plan 2010-2013, Jamaican Ministry of Agriculture, Pp. 2

Development and Agricultural Sector Development Plans (2005-2008) to improving the agricultural sector through a diverse portfolio of policy and implementation initiatives for the coming years.

Agricultural Sector GHG Emissions Profile Overview

The agricultural data used to determine greenhouse gas emissions prior to 2000 was stated, in both a report sanctioned by the Jamaican Meteorological Service and the second communication of Jamaica to the UNFCCC as being, "unfeasible, incomplete, and not in line with newer methodologies for acquiring data."[140] As such, this report focuses primarily on emissions for the period from 2000-2005. But even the data on agricultural emissions in Jamaica for 2000 – 2005 can be confusing, as the Second Communication of Jamaica to the UNFCCC provides conflicting numbers that are often difficult to interpret.

On page 3 of the executive summary, the report states that the primary sources of GHG emissions from the agricultural sector are N20 emissions from fertilizer applications and CH4 emissions from enteric fermentation and manure management from livestock (CO2 emissions in agriculture are a net negative – in other words it is considered to be a CO2 sink).

Regarding N20 emissions, the report states, "*Nitrous oxide emissions fell from 344 Gg in 1994 to 11.7 Gg in 2000. The reason for the large discrepancy between the 1994 and 2000 estimates could not be determined since raw data used in the calculations for 1994 were not available. Managed soils (fertilizer applications) accounted for 80 percent of the nitrous oxide emissions*" If 11.7 Gg were the correct N20 emissions for the year 2000, this would be quite significant because nitrous oxide has a global warming potential of approximately 310 times that of C02, so fertilizer applications would account for 3,627 C02 equivalents, or about the same as 38% of the net carbon dioxide emissions for the whole country in 2000. However, on page 126 of the same report, it states that direct N20 "*emissions from crop residues…was by far the highest source of emissions*", and provides a table of data to support this claim with N20 emission in different units (kg N yr-1), so it is unclear what the Gg units would be, much less the C02 equivalents. In sum, it is unclear what the N20 emissions are for the 2000 – 2005 time period and what source they are primarily coming from.

The data with respect to CH4 emissions are also confounding. On page 3 of the Executive Summary it states that CH4 emissions from enteric fermentation and manure management were estimated to be 36 Gg and 7 Gg, respectively for the year 2000. Since CH4 has a global warming potential of approximately 21 times that of C02, this would mean that enteric fermentation and manure management accounted for a total of 903 in C02 equivalents, or the about the same as 9.5% of net CO2 emissions in 2000. However, a close look at the data provided in Table 2.69 on page 121 reveals that methane emissions from enteric fermentation was only 8.17 Gg in the year 2000, and that manure management was only 0.645 Gg of emissions in that year. This is much less than the estimates provided in the Executive Summary and would imply different policy implications for a LEDS.

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140 Claude Davis & Associates, Final Report, Jamaica's Greenhouse Gas Emissions 2000-2005, Pp. 2 (http://www.metservice.gov.jm/Climate%20Change/Exec%20Summary%20GHG%20Jamaica%20SNC%20Final%20Version[1].pdf)

According to the table provided on enteric fermentation (and provided below), dairy cows and other cattle account for 4.83 Gg in 2005 while goats produced 2.25 Gg of CH4 in 2005. Cattle numbers generally decreased overall due to the threat of mad cow disease and other bovine-related food borne illnesses, while goat numbers increased considerably in the five year period. Manure management emissions did increase from 2000 to 2005 from 0.0645 Gg to 0.848 Gg in 2005[141]; however, manure is a relatively smaller source of CH4 emissions because manures are not stored under anaerobic conditions in Jamaica.

Livestock categories	*Annual methane emissions from enteric fermentation (Gg CH_4)*					
	2000	2001	2002	2003	2004	*2005*
Dairy cows	1.24	1.23	1.21	1.20	1.16	*1.09*
Other cattle	4.86	4.65	4.43	4.22	4.01	*3.74*
Sheep	0.03	0.03	0.03	0.03	0.03	*0.03*
Goats	1.50	1.65	1.82	2.00	2.13	*2.25*
Horses	0.33	0.33	0.34	0.35	0.35	*0.35*
Mules & asses	0.10	0.10	0.10	0.09	0.09	*0.09*
Swine	0.11	0.12	0.13	0.14	0.16	*0.18*
Total	*8.17*	*8.11*	*8.06*	*8.03*	*7.93*	*7.73*

Other more minor sources of agricultural emission mentioned in the report include CO2 emissions from lime and urea application, and greenhouse gases from sugar cane harvesting and biomass burning (industrial processing of sugarcane as an energy source is not considered in this section). Liming remained the same during the five year period at 0.6 Gg while Urea application dropped by two thirds from 2000 to 2005 from 1.56 Gg to 0.57 Gg. Sugar Cane harvesting and burning, which consist of emissions from CO2, CH4, and N20, were estimated from reliable data, but the emissions were provided in different units and therefore the total amount of emissions could not easily be compared to other sources of agricultural emissions.

4.3.2 Goals, Policies, and Programs at the Local and National Level

The 2010-2013 Corporate Plan outlined by the Jamaican Ministry of Agriculture and Fisheries (MOAF) seeks to employ,

> "…strategies [that will] modernize the sector, expand the extension services, introduce or expand the application of technology, farmer education, improved production and productivity through targeted and focused intervention in specific crops production, infrastructural development, value chain development, greater use of market intelligence as well as a renewed emphasis on research and development."[142]

The 2010-2013 Corporate Plan is "anchored in the Agricultural Sector and the Vision 2030 National Development Plans [that] seek to establish a sustainable programme of transforming the agricultural sector and place it in a position to achieve higher levels of production and productivity as well [as] increasing its contribution to GDP in the long term."[143]
Financing for programs at the local and national level are limited. Jamaica is currently

> "focused [on] boosting local agriculture production to depend less on foreign markets and increase exports. Jamaica's fiscal position does not afford the ability to provide farm and export subsidies. Domestic support is generally confined to extension, research, and other

141 Second Communication of Jamaica to UNFCCC, 2011, PP. 123 (http://unfccc.int/resource/docs/natc/jamnc2.pdf)

142 Ibid, Pp. 2

143 Ibid, Pp. 1

> essential technical services. The Government of Jamaica provides a relatively small consumption subsidy to vulnerable consumer groups as part of its social safety net."[144]

The goals, policies, and emissions reports developed by the Jamaican government point to some opportunities to create additional climate change based programming as well as re-orientating existing programs to be climate-smart. The GOJ has expressed, in Goals 6 and 7 of the Corporate Plan, that they are committed to the development of an 'Environmentally Sustainable Sector' and the improvement of 'National Food Security'. They intend to achieve these goals, according to the Corporate Plan, through a number of initiatives that involve Plant and Animal Health (as part of a larger Sanitary and Phytosanitary strategy), Public Gardens, Research and Development, and Rural Development.

The USAID-USFS Vulnerability Assessment identified a range of gaps and needs broken into four sectors: information, field activities and best practices, capacity building, and governance. Many of the agricultural gaps identified were focused on reducing vulnerability and building adaptive capacity to confront the effects of climate change. For example, increasing the capacity to obtain information, analysis, and research of climate data and technology (e.g. climate change impacts on crops and pests) in addition to an improved approach to watershed management, coastal resources, public awareness of climate change issues, and developing the capacity of farmers and their organizations to implement adaptive practices. Addressing these gaps, especially with respect to building the capacity of farmers to implement adaptive practices, could also have mitigation benefits where they lead to an increase in soil carbon or reduced need for inorganic fertilizer.

4.3.3 Sector Structures and Institutional Capacity

There are four major strategic platforms that correspond to each of the four Directorates within the JMOA (see graphic below). Contained within the Corporate Plan is a Strategic Analysis, identical to a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats), that breaks out the current assets and challenges facing the Ministry's current goals. The conclusion identifies some of the persistent issues facing the JMOA, which are primarily of a financial nature:

> "While the Ministry has the basic institutional capacity to provide these [support] services [to operators], budgetary constraints have limited its capacity to maintain and improve these services. These services therefore require strengthening and in some cases development if growth in the sector is to proceed apace. The Ministry has over the past two years undertaken a restructuring programme which seeks to reposition several of its departments and agencies to better deliver a higher level of service to the sector."[145]

Much of the Agricultural Development Strategy presupposes sufficient levels of initial funding to start the programs aimed at achieving the goals listed in the Corporate Plan. Some of the threats identified also emphasize the need to develop improved agricultural practices, such as climate-smart agriculture, that limit the environmental impact and degradation of arable landscapes.

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144 Jamaica 2012 USDA Foreign Agricultural Service Country Strategy Statement

145 Corporate Plan 2010-2013, Jamaican Ministry of Agriculture, Pp. 14

The sector structure of the MOAF is broken into four separate platforms, which are illustrated below. Many of the goals that will be addressed through the four strategic platforms are focused on production research, institutional capacity building, and sustainability. Some of these have benefits for increased exports, but much of the different initiatives are focused on increasing baseline agricultural production. In addition to the four platforms, there are a number of Statutory Bodies that support Ministerial initiatives as well as private sector counterparts. The relevant Statutory Bodies are also listed below.

Statutory Bodies

- Rural Agricultural Development Authority
- Coffee Industry Board
- 4H Clubs
- Sugar Industry Authority
- Agricultural Credit Board
- Sugar Industry Authority
- Banana Board
- Jamaica Agricultural Society
- National Rums of Jamaica Ltd.
- Coconut Industry Board

4.3.4 Donor and Private Sector Engagement

USAID/Jamaica currently has programs related to "[a]daptation programming [that] is focused on reducing vulnerability to climate change within the agriculture sector…to improve farm income and food security, expand small scale agro-processing and other supporting rural enterprises, and protect fragile environments."[146] There has been an additional focus on

146 USAID-USFS Jamaica Vulnerability Assessment and Adaptation Prioritization, Pp. 6

agriculture and tourism, as mentioned at the August 10-11 stakeholder's meeting, as they pertain to climate change adaptation work. These foci are structured around the USAID Jamaica Country Strategy and a recent USAID-U.S Forest Service Vulnerability Assessment, which highlight the key issues, approaches, phases, and environmental impacts that affect Jamaica at present as well as avenues of exploration for different sectors and how they could pertain to climate change adaptation programming.

Climate change related programming from other donors and private sector partners has been a bit limited in recent years but the time could be ripe for engagement. In February, 2012 the UNDP Resident Jamaica Representative stated,

> "three important reasons why private sector counterparts would be interested in generating public-private partnerships to address Climate Change issues in Jamaica: 1) Private sector interest is being catalyzed by the realization that consumers are becoming increasingly aware that they do not just purchase products but are also buying into supply chains; 2) Supply chain procurement processes are also taking into consideration as to how to maximize local development opportunities and mitigate known social and environmental risks; 3) The potential market for insurance in developing economies is estimated to be between $1.5 and $3 billion [which demonstrates a] significant demand for a range of insurance products from health and life, agricultural, property, and catastrophe cover (this is in line with Art. 4.8 UNFCCC, Art. 3.14 Kyoto Protocol, which propose actions, including insurance, to meet the specific needs and concerns of developing countries in adapting to Climate Change."[147]

Most donor and private sector related programs are part of a larger Caribbean regional climate change effort. There has been a substantial amount of regional policy frameworks, written papers, climate change related databases, and other resources developed by a variety of different donors such as the Inter-American Development Bank (IADB), the Caribbean Community Climate Change Centre (CCCCC), the United Nations Development Programme (UNDP), and the Food and Agriculture Organization of the United Nations (FAO) that capture country-specific data, impacts, and strategies for creating synergy between climate specific concerns that relate to Jamaica and current governmental policy objectives.

Other private sector opportunities mentioned in the Corporate Plan that may have mitigation benefits include organic farming, and biofuel or ethanol production from sugar cane residues; however, as stated in the Vulnerability Assessment, one of the needs under 'governance' is to "improve coordination between agencies, donors, the private sector, and other stakeholders." There should be an initial phase to help coordinate interested parties and to present climate smart opportunities to public and private stakeholders prior to programmatic engagement.

4.3.5 Gaps and Potential Opportunities

One of the major challenges in identifying priorities related to low emission development in the agricultural sector is the lack of reliable information on both GHG inventories and field data. A number of these same gaps were also identified in the USAID-USFS Vulnerability Assessment,

147 Post-Durban Press Stakeholder Debriefing, UNDP Jamaica, February 16, 2012 (http://www.jm.undp.org/files/Speeches_Statements/RR's_Remarks_CC_Debriefing_160212.pdf)

including information gathering and the consistency in the sharing of lessons learned. An initial needs assessment within the Ministry of Agriculture could examine some of the root causes and attempt to address them through training or other types of capacity building activities. A scientific exchange on emission modeling, statistical analysis, and greenhouse gas emission inventories could be a potential cost-effective opportunity.

Additional gaps and recommendations in the Vulnerability Assessment were: insufficient understanding of how climate change will impact the agricultural sector and a lack of capacity to plan and implement adaptation strategies; disjointed research efforts, uncoordinated data management, and a lack of transfer of information to farmers. Depending on how these needs are addressed, there is an opportunity to design "win-win" solutions for farmers to learn about and implement adaptation strategies that can increase agricultural profits while mitigating future greenhouse gas emissions. Such activities may include precision fertilizer use, conservation agriculture (e.g. – no-till, leaving residue in the soil, and crop rotations), agroforestry, and using sugarcane residues rather than burning it on the fields. Organic farming in particular was emphasized as a primary interest on the part of the Ministry in the Corporate Plan and if done strategically it could have growth potential both as an income generating source, a climate mitigation strategy, and also serve to increase agricultural production. Once "win-win" strategies are identified, such techniques could be rolled out through an agricultural extension system.

To ensure sustainability, it will be key to engage with private sector stakeholders on potential cost savings or income generating possibilities on climate sensitive practices for commercial agriculture, specifically sugarcane harvesting, post-harvest waste, biofuel production, and alternatives to biomass burning. The Second Communication mentioned "the adoption of clean and energy efficient technologies is a priority."[148] Producing sustainable biofuels from biomass residues could have multiple climate benefits, but this would require careful strategic planning and feasibility studies (e.g. life cycle assessments of the particular feedstock and energy conversion pathway).

In sum, there are many gaps in information and financing to achieve low emissions development in agriculture in Jamaica, but the most effective opportunities would be those that both address adaptive capacity and increase profits for farmers while mitigating future greenhouse gas emissions.

4.4 Transportation

4.4.1 Sector Overview

Key GHG Emissions Drivers and Trends

In 2000, the transport sector produced the majority of Jamaica's carbon monoxide emissions and 24.2% of its carbon dioxide emissions. In 2008, on-road fleet traffic consumed 23% of

148 Second Communication of Jamaica to UNFCCC, 2011, PP. 222 (http://unfccc.int/resource/docs/natc/jamnc2.pdf)

Jamaica's total energy consumption, hence transportation is a major emissions source category, especially the road transport sub-sector[149].

The transport sector is also the largest consumer of petroleum in the Jamaican economy, accounting for 42 percent of the nation's oil imports in 2008. Road and rail transport consumed 21 percent of the economy's total petroleum imports alone, which is comparative to the total amount consumed by Jamaica Public Service Company (JPS) for the electric grid, not counting self generation by the bauxite and sugar industries[150]. Although annual oil imports have decreased slightly from 1999 to 2009, demand for petroleum, especially from the road sector's cars, buses and trucks, is increasing at a rate of 4.3% per year[151], as is private vehicle ownership. However, a recent survey found that three quarters of Jamaican households do not own a motor vehicle[152], which stresses the importance of access for Jamaicans to a more efficient and reliable public transit system.

Biofuels development and deployment has a major potential impact on transport-related emissions reductions in Jamaica. A natural gas storage terminal will soon be constructed that will enable the use of LNG and CNG for transportation on the island. Prices will likely be cheaper than gasoline. However, vehicles that can run on natural gas are not currently readily available in Jamaica. A 40 million gallon sugar ethanol plant is also being commissioned that could enable both domestic consumption and exportation[153].

4.4.2 Goals, Policies and Programs at the National and Local Level

Development Goals and Priorities

Jamaica's National Development Plan – Vision 2030 Jamaica – includes an important Transport Sector Plan that was completed in 2009[154]. The plan's strategic vision is to improve the domestic transport infrastructure and services in such a manner as to develop Jamaica into an attractive regional hub for transport and logistics. The sector's development is seen as fundamental to developing all of Jamaica's economic sectors. The planned development of the transport sector includes various LEDS approaches.

Although specific targets were not set, the Transport Sector Plan sets explicit goals that includes elements of low emissions development:

- A sustainable road transport system that serves the economic and social needs of the country – outcomes include efficient and well maintained road network, efficient public transit systems, and accommodations for non-motorized transportation

149 *The Second National Communication of Jamaica to the United Nations Framework Convention on Climate Change*. June 2011.

150 *Energy Efficiency Potential in Jamaica*: *Challenges, Opportunities and Strategies for Implementation*. Economic Commission for Latin America and the Caribbean. April 2011.

151 *The National Energy Conservation and Efficiency Policy*. Government of Jamaica - Ministry of Energy and Mining. 2010.

152 *Energy Efficiency Potential in Jamaica*: *Challenges, Opportunities and Strategies for Implementation*. Economic Commission for Latin America and the Caribbean. April 2011.

153 *The Second National Communication of Jamaica to the United Nations Framework Convention on Climate Change*. June 2011.

154 Vision 2030 Jamaica – Transport Sector Plan. 2009. http://www.mtw.gov.jm/general_information/reports/Vision%202030%20Jamaica%20-%20Final%20Draft%20Transport%20Sector%20Plan%20_Jul.pdf

- A viable railway system that supports economic and social development – outcomes include the revival of railway travel on critical paths for passengers and cargo

- Environmentally sustainable transport sector – outcomes include sustainable transport infrastructure and services, and conservation and efficiency throughout the sector[155]

In addition, the National Transport Policy of 2007 includes various measures designed to encourage biofuel and CNG development and use, as well as fuel conservation measures such as:

- Traffic management (carpooling, park and ride, etc.)

- Tele-work policies

- Efficient public urban mass transit systems

- Vehicle maintenance programs

- Alternative transport mode assessments (barges or rail for cargo)

Finally, the Petroleum Quality Act of 1992 defined the required standards of liquid fuels, including standards for biodiesel and ethanol blends. E10 fuel was introduced in 2008 and by May 2009 had been phased in across the country[156].

Key Policies and Implementation Plans

The National Energy Conservation and Efficiency Policy, 2010-2030 drafted by the Ministry of Energy and Mining in 2010 specifically sets out goals for the transport sector. In general, the policy encourages use of more fuel-efficient vehicles and Biofuels[157]. One goal is it to stimulate and demonstrate national energy conservation by better managing the efficiency of GOJ's fleet. Although targets were not provided, the policy also promotes the following strategies:

- Establish tax on petrol at levels to encourage conservation and higher utilization of and development of public transport

- Facilitate the importation and use of more fuel-efficient and alternative fuel vehicles in the transport sector as well as the use of diesel, bio-fuels and CNG when it becomes available

- Promote carpooling opportunities (preferential tolls, HOV lanes)

- Carry out study of urban transport needs and mass transit options

- Align retail distribution system for transport fuel with development of land transport network

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155 Vision 2030 Jamaica – Transport Sector Plan. 2009. http://www.mtw.gov.jm/general_information/reports/Vision%202030%20Jamaica%20-%20Final%20Draft%20Transport%20Sector%20Plan%20_Jul.pdf

156 *Energy Efficiency Potential in Jamaica*: *Challenges, Opportunities and Strategies for Implementation*. Economic Commission for Latin America and the Caribbean. April 2011.

157 *The National Energy Conservation and Efficiency Policy*. Government of Jamaica - Ministry of Energy and Mining. 2010.

The National Biofuels Policy, 2010-2030 was adopted in October 2010 by the Ministry of Energy and Mining. Like the National Energy Conservation and Efficiency Policy, it also supports the implementation of the National Energy Policy and the National Renewable Energy Policy. It considered not only an important policy for displacing emissions sourced from petroleum consumption in the transport sector, but to aid in increasing energy security and potentially generate revenue as well for exportation of sugar ethanol[158].

Goals of the policy include developing the regulatory, planning, deployment, and usage capacity for Biofuels. The policy also sets forth addressing concerns for potential environmental impacts of the development of the sugar ethanol industry[159]. Strategies and actions include: developing a systems approach to all steps in feedstock production, assessment of biodiesel feedstocks, knowledge sharing between foreign experts and domestic entrepreneurs for best practices in feedstock production, and implementing an outreach program to garner support for Biofuels. Policy implementation will be coordinated between MSTEM, MTWH, the Min of Agriculture and other ministries, the private sector, local universities and NGOs. Specific Biofuels targets were not yet set.

Finally, in July 2004, the national import policy for used vehicles became more strict – a three year maximum age limit for cars[160]. A minimum emissions or fuel economy standard for vehicle importation should also be adopted.

4.4.3 Sectoral Structure and Institutional Capacities

The Ministry of Transport, Works and Housing (MTWH) is the primary agency for regulating and managing Jamaica's transport sector. There are several organizations directly tasked by the MTWH to regulate road transportation, including:

- Island Traffic Authority (ITA) – tests vehicles
- Jamaica Urban Transit Company (JUTC)
- Montego Bay Metro Limited (MBM)
- Toll Authority and the Transport Authority (TA) – monitors bus routes and taxi regulation, and licenses drivers and vehicles
- Jamaica Ultimate Tyre Company
- National Road Operating and Constructing Company (NROCC)
- National Works Agency (NWA)
- Road Maintenance Fund Board (RMFB) – manages a fund that receives portions of a fuel consumption tax to be used towards road maintenance.

158 *The National Biofuels Policy*. Government of Jamaica - Ministry of Energy and Mining. 2010.

159 *The National Biofuels Policy*. Government of Jamaica - Ministry of Energy and Mining. 2010.

160 *Energy Efficiency Potential in Jamaica*: *Challenges, Opportunities and Strategies for Implementation*. Economic Commission for Latin America and the Caribbean. April 2011.

ITA, JUTC, MBM and the TA are key organizations for public transit development, maintenance and operation. The Metropolitan Management Transport Holdings, Ltd. (MMTH) was established in 1995 to own buses and infrastructure for the Kingston area, while the JUTC was set up in 1998 to operate public transportation in Kingston.

Road construction, planning and maintenance is covered by the RMFB, NROCC and the NWA. Planning, financial, and other organizations that also play a role in road transport development, but are outside of the MTWH's purview, including the Jamaica Social Investment Fund (JSIF), Urban Development Corporation (UDC), Rural Agricultural Development Authority (RADA) – oversees farm roads which are generally in a state of disrepair, causing disruption of agricultural development, Trade Board Limited, Inland Revenue Department (IRD) – collects licensing fees, Parish Councils and the Kingston and St. Andrew Corporation (KSAC)[161].

The Jamaica Railway Corporation is an agency of the Ministry of Transport and Works and was founded in 1960 to provide and manage passenger rail transport on the island. However, that service had largely ended by 1992, only to be successfully revived in 2011[162]. Although passenger service is currently limited, and lines connecting the country to Kingston would need to be substantially rehabilitated, the bauxite industry still maintains some rail lines for its activities. Also, the costs of reestablishing lines may not be feasible, especially given the current extensive bus and taxi services offered across the nation.

MSTEM is responsible for implementation of the National Energy Conservation and Efficiency Policy and National Biofuels Policy. Obviously, the MTWH is involved in close coordination with MSTEM.

Key organizations for the National Energy Conservation and Efficiency Policy include the Ministry of Finance and the Public Service, The Office of the Prime Minister – Environmental Management Division, and the Scientific Research Council. The University of Technology, Jamaica and University of the West Indies would also be involved.

Key institutions involved in the implementation of the National Biofuels Policy besides MSTEM and MTWH, include: the Ministry of Agriculture and Fisheries and Ministry of Finance and the Public Service, the Sugar Industry Research Institute, which is researching strategies to increase sugar cane production and testing various cane varieties while minimizing the environmental impact, the Environmental Management Division and National Environment and Planning Agency (NEPA), which are responsible for advising biofuel production programs to minimize environmental impact, and the Ministry of Finance and Planning, which is responsible for establishing financial measures to support biofuel development.

MSTEM also is responsible for reporting fuel use data.

4.4.4 Donor and Private Sector Engagement

Civil Society Engagement

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161 Vision 2030 Jamaica – Transport Sector Plan. 2009. http://www.mtw.gov.jm/general_information/reports/Vision%202030%20Jamaica%20-%20Final%20Draft%20Transport%20Sector%20Plan%20_Jul.pdf

162 "Jamaica Railway Corporation Earns Millions."*The Gleaner.* http://jamaica-gleaner.com/gleaner/20110716/lead/lead8.html. July 2011.

MSTEM's Centre of Excellence for Renewable Energy (CERE) is leading the research and development of the domestic biodiesel industry in Jamaica.

Private Sector Engagement

Domestic sugar estates will be crucial to the implementation of the National Biofuels Policy. Engagement with vehicle manufacturers and importers will be necessary to ensure availability of alternative fuel and/or high efficiency vehicles in Jamaica.

Donor Engagement

ECLAC, CARICOM, OAS, the government of Brazil, and the US Embassy have all offered technical assistance in developing Jamaica's Biofuels sector[163].

Most other donor engagement (especially the IDB) supports road safety and development and recovery from storms without focus on emissions reduction potential.

4.4.5 Gaps and Potential Opportunities

- *Technical gaps*

  Lack of fueling infrastructure and storage for alternative fuels and lack of availability of alternative fuel vehicles.

- *Analytical gaps*

  Lack of modeling to understand the true costs and impacts of expanding public rail service on emissions and economy. Lack of modeling to understand the emissions and financial impacts of producing ethanol via the island's sugar industry. Lack of modeling to understand the impact of running domestic vehicles and especially buses and taxis on domestically produced ethanol and biodiesel fuel in order to vastly decrease the nation's dependence on petroleum imports and decrease emissions.

  According to the document, *Energy Efficiency Potential in Jamaica*, the government has not conducted a qualitative or quantitative assessment to determine the degree to which tax subsidies for the production and use of Biofuels, such as excise tax exemption, blenders' tax credit, or production tax credit, might spur the development of such an industry in Jamaica[164].

- *Data gaps*

  Lack of ability to set and review specific targets for Transport Sector Plan in the Vision 2030 National Development Plan through data analysis, although data collection and availability

163 *The National Biofuels Policy*. Government of Jamaica - Ministry of Energy and Mining. 2010.

164 *Energy Efficiency Potential in Jamaica*: *Challenges, Opportunities and Strategies for Implementation*. Economic Commission for Latin America and the Caribbean. April 2011.

does not seem to be a barrier as the capacity of the Statistical Institute of Jamaica is deemed reliable (according to the plan's writers)[165].

- *Sectoral gaps*.

According to the SNC, [166] further consideration and analysis for mass transit and especially light rail systems may be necessary. No broader national/local plan for mass transit development currently exists in Kingston.

- *Capacity gaps*.

Weak enforcement powers of regulatory agencies. The heavy influence of the Petroleum Corporation of Jamaica being the "main implementing agency" of MSTEM may provide some resistance to LEDS adoption, especially with implementation of the National Biofuels Policy[167].

- *Institutional gaps*.

The MTWH will require much support in order to sufficient implement the Vision 2030 Transport Sector Plan. Relevant regulations to support investments in fuel use efficiency in the transport sector will also be necessary.

Implications for USG Programming

The excellent strategic proposals made in the *Energy Efficiency Potential in Jamaica* document (pages 54-57) for transport sector development would help to secure low emissions development. The USG could especially aid in supporting capacity-building within Jamaica to calculate and estimate vehicle emissions standards, driver incentive schemes to encourage conservation practices, plan the roadmap alternative fuel deployment for public and private vehicles, and measure the impacts of mode shifting cargo from road to rail systems[168]. A cost-benefit analysis that could measure viability of rehabilitating certain rail lines on the island for public service for comparison with current bus/taxi transport services could also be helpful. Impacts on emissions, costs, and employment (for taxi and bus operators) would also need to be measured.

The development of a roadmap for alternative fuel and advanced vehicle deployment, could include training and knowledge sharing for GOJ officials to conduct financial analyses evaluating various incentive policies such as biofuel tax subsidies. The process of optimally evaluating pricing regimes for sugar ethanol to ensure maximum incentive for increased production and domestic use could also be shared.

Share best practices and develop guidance document for fleet management that would increase vehicle and driver efficiencies in GOJ fleet vehicles as a demonstration for other large Jamaican fleets and private vehicles.

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165 Vision 2030 Jamaica – Transport Sector Plan. 2009. http://www.mtw.gov.jm/general_information/reports/Vision%202030%20Jamaica%20-%20Final%20Draft%20Transport%20Sector%20Plan%20_Jul.pdf

166 *The Second National Communication of Jamaica to the United Nations Framework Convention on Climate Change*. June 2011.

167 *The National Biofuels Policy*. Government of Jamaica - Ministry of Energy and Mining. 2010.

168 *Energy Efficiency Potential in Jamaica*: *Challenges, Opportunities and Strategies for Implementation*. Economic Commission for Latin America and the Caribbean. April 2011.

There is also a stated need from the GOJ for assistance in developing models to set specific targets for Transport Sector Plan in Vision 2030 National Development Plan. An example model could be developed that calculates the expense of retrofitting service stations to provide Biofuels, and help strategize the location of that infrastructure.

Appendix 1: Energy Efficiency-Related Initiatives in Jamaica

ENERGY EFFICIENCY-RELATED INITIATIVES IN JAMAICA IN THE LAST 3 DECADES

Programme	Financed by	Period	Main Priorities	Achievements
Project for Energy Conservation and Efficiency in the Public Sector	IDB and GOJ	2010 - 2011	To evaluate energy consumption in the public sector and develop plans to implement corrective measures	Assessment of energy costs and patterns are in progress
Programme of Environmental Management in Hospitals and Schools	UNDP and GOJ	2006	To "kick-start" energy conservation activities in the public sector, particularly hospitals and schools	Energy audits showed potential annual savings of about USD 1.8 million at investment costs of roughly USD 3.6 million
Household CFL Distribution Programme	Republic of Cuba and GOJ	2006 - 2007	Providing "state-led" intervention in energy efficiency measures at the household level	Estimated load reduction in 80 MW of demand or 48,500 MWh of electricity, as well as large-scale acceptance of the product and its benefits by the general public
Jamaica Demand Side Management Programme, JDSMP	World Bank/ GEF and GOJ	1994 - 1998	Demonstrating a broad-based utility DSM program	Reduction of the electric load by almost 1.7 MW and electric savings of approximately 5,350 MWh per year
Least Cost (Electricity) Expansion Plans, LCEP	JPS OUR	2004 2007	Establishes a balance between capital investments that flow into the electricity sector and the price to the consumer	
Energy Audits for Sustainable Tourism, EAST	USAID and GOJ	1997 - 2002	Demonstrating the benefits of environmental management systems to the hotel sector	Reduction in water consumption by 50 million gallons and energy use by over 1.6 million KWh
Energy Sector Management Assistance Programme, ESMAP	UNDP/ World Bank and GOJ	1990 - 1991	To ensure that proposed investments in the energy sector represented the most efficient use of domestic and external resources	Energy Efficiency Building Code (EEBC); Appliance Testing and Labeling (ATL) programme; and other technical assistance
Energy Sector Assistance Programme, ESAP	USAID and GOJ	Late 70s – late 80s	To provide technical assistance and funding for energy conservation and alternative energy requirements of the public and private sectors	Energy audits and retrofitting that resulted in energy savings between 10 and 25 per cent

Source: Data gathered by the Author.

Appendix 2: Government of Jamaica and USAID Climate Change Workshop

(July 26 to July 27, 2012)

This draft report was prepared by NREL and provides information and outcomes from the GOJ and USAID "Towards the Development of a Policy Framework for Jamaica" workshop that could inform EC-LEDS activities with the Government of Jamaica.

Highlights from the workshop

- High level participation by the Government of Jamaica including the Ministers of Agriculture, Finance, State and Foreign Affairs, Local Government and Community Development, and Water, Land, Environment, and Climate Change,
- Productive discussion on interaction between sectors in relation to climate change adaptation and mitigation, including a collective recognition that energy is not only an important sector on its own, but also a key input to all sectors of the economy. It was recognized that many sectors do not exist in silos, but feed into each other, which is an important consideration for Vision 2030, Jamaica's development plan
- Further collection of information on sectoral climate change activities in the country to inform ongoing and future efforts
- Commitment by the Government of Jamaica (GOJ) to continue this discussion and use the outcomes of the workshop to inform the policy framework for climate change

Overview

NREL participated in a Climate Change workshop "Towards the Development of a Policy Framework for Jamaica" co-sponsored by USAID/Kingston and the Government of Jamaica. The event brought together leaders and staff from across the government, including the Ministry of Water, Land, Environment and Climate Change, Ministry of Finance, Ministry of Agriculture, Ministry of State and Foreign Affairs and the National Planning Department, among others. The purpose of the event was to hold interactive discussions to inform development of a policy framework for climate change. The event focused on adaptation to climate change, but was also used as a forum to begin discussions on mitigation to inform the EC-LEDS program.

The workshop was organized around objectives and sectors identified in Jamaica's Vision 2030, the country's national development plan. Vision 2030 does not consider interdependencies across sectors and objectives, and one goal of the workshop was to encourage discussion on these interactions and to emphasize climate resilience as a common theme.

USAID, ICF, NREL, and others facilitated discussions at the sectoral level to identify key inputs to sectors, climate and non-climate related risks and constraints, actions, policies and resources to address risks/constraints, and key stakeholders to implement these actions and policies. NREL (Sadie Cox) facilitated discussions related to the energy sector. It was clear from the discussions within the energy and other groups that energy was not only a sector to consider on its own, but also a key input to nearly every other sector of the Jamaican economy.

The GOJ seeks to align the future of the energy sector with the vision 2030 objective to achieve greater energy security and efficiency. Key inputs, identified by the group, to the energy sector included fuels and technologies (oil, RE, LNG, etc.), data and information (energy demand and

supply, GIS and land use data), labor (skilled and trainers), infrastructure (transmission and distribution, LNG infrastructure such as regasification plants), water, and land. The group chose to focus on technologies and fuels when looking at risks. Key risks and constraints identified included prices, water availability, tropical storms and other natural disasters, population, rising temperatures, consumer behavior, and political barriers to policy implementation. The group identified prices as the biggest risk and concluded that diversification of the energy supply was the most important action moving forward.

The group agreed on some concluding thoughts from this activity. As noted above, they found that energy is a key input to all sectors of the economy and thus reliable and low cost supply options are necessary to ensure economic development. Currently Jamaica imports oil for over 90% of its energy supply for electricity. Fluctuating oil prices have significantly impacted the economy and this was seen as a key threat to the energy sector and all other sectors utilizing oil for electricity or fuel. In addition future climate conditions that could impact hydro resources also represent a significant risk for the sectors reliant on electricity. Thus the group identified diversifying electricity resources beyond oil and hydro as a key action moving forward (and, again, one that would also have positive impacts across the economy). To support this action group members noted that the current feed-in tariffs should be revised to ensure increased investment in renewable energy. In addition, development of infrastructure to support liquefied natural gas (LNG) imports was seen as a necessary investment to address oil dependence.

Possible energy activities that could be supported by EC-LEDS

- **Feed-in Tariffs (FiT)** – The group noted as a key action item that the current FiT should be revised to send price signals that attract further investment in renewable energy. EC-LEDS and particularly the National Labs could provide technical assistance to support revision of the FiT.
- **Net metering** – Jamaica currently uses a net billing system to allow consumers to sell excess renewable energy to the grid. The price at which the excess is purchased by the utility is seen by many as too low and does not provide enough of an incentive to support renewable energy expansion. A net metering system has been proposed as a more efficient alternative, however further analysis is needed on this subject (GOJ, 2011a). The National Labs could provide support for this type of analysis and incentive design.
- **Energy Service Companies (ESCOs)** – The Ministry of Energy noted the need to develop ESCOs in Jamaica, which are companies that "carry out performance contracts to implement financed energy efficiency and renewable energy projects in a facility on a guaranteed savings basis" (NREL, 2005). NREL has supported ESCO market development in Mexico and other countries and could follow a similar model of support with Jamaica.
- **Waste-to-energy** – Support for development of waste to energy projects was raised as an area of need a number of times. Jamaica could become engaged with EPA's Global Methane Initiative and possibly receive more targeted technical support.
- **Industrial efficiency** – Industrial cement production is a considerable contributor of GHG emissions in Jamaica. (GOJ, 2011b) LBNL has worked with China to reduce GHG emissions from cement production using an industrial efficiency tool called BEST. This tool could possibly be adapted and applied in Jamaica with support from LBNL.
- **Building codes** – The group noted that building codes are required to reduce energy demand. While building codes have been developed, as noted in the National Energy Policy, there is a need to "update, apply and enforce the National Energy Efficiency Building Codes to support efficient use of energy in buildings" (GOJ, 2010). The National Labs could support

analysis needed to update the building codes. The idea was also raised to develop energy efficiency and climate resiliency building codes as a package.

- **Electricity infrastructure efficiency** – The electricity system in Jamaica is inefficient and requires upgrades to reduce energy loss and mitigate associated GHG emissions (GOJ, 2011a). National Labs and particularly PNNL could support development of policies and dialogue with utilities to design and implement policies to address this issue.
- **Water infrastructure efficiency** – Inefficiency of electrical pumps and other water infrastructure technologies lead to considerable energy losses in Jamaica (GOJ, 2011a). The National Laboratories could support an energy audit of water infrastructure and facilities to inform subsequent actions to address inefficiencies, building on progress made on energy audits and energy efficiency actions in the public sector.
- **Bauxite-alumina industry** – The bauxite-alumina industry is one of the greatest contributors to GHG emissions in Jamaica (GOJ, 2011b). EC-LEDS could support discussions between the government and the bauxite industry on options to reduce emissions in the sector.
- **Renewable Energy Center by the Caribbean Maritime Institute –** This center was recently launched to provide education to communities on renewable energy and climate change and to train engineers to implement renewable energy projects. There could be opportunities to partner with this organization on EC-LEDS activities.

Next steps

- Report to be developed by ICF with input from the Government of Jamaica, USAID, and other workshop participants
- USAID proposed that a newsletter could be developed to ensure that the workshop participants are made aware of how the discussions from the event will feed into a climate change policy framework
- Further scoping of possible EC-LEDS activities with the Government of Jamaica

Sources

1. Government of Jamaica, Ministry of Energy and Mining, UN ECLAC, BMU, GIZ, "Energy Efficiency Potential in Jamaica: Challenges, Opportunities and Strategies for Implementation", 2011a.
2. Government of Jamaica, "National Energy Conservation and Efficiency Policy – 2010-2030", 2010.
3. Government of Jamaica, "Second National Communication of Jamaica to the UNFCCC", 2011b.

Appendix 3: Diagram of Land Use/Cover Types Hierarchical Classification in Jamaica

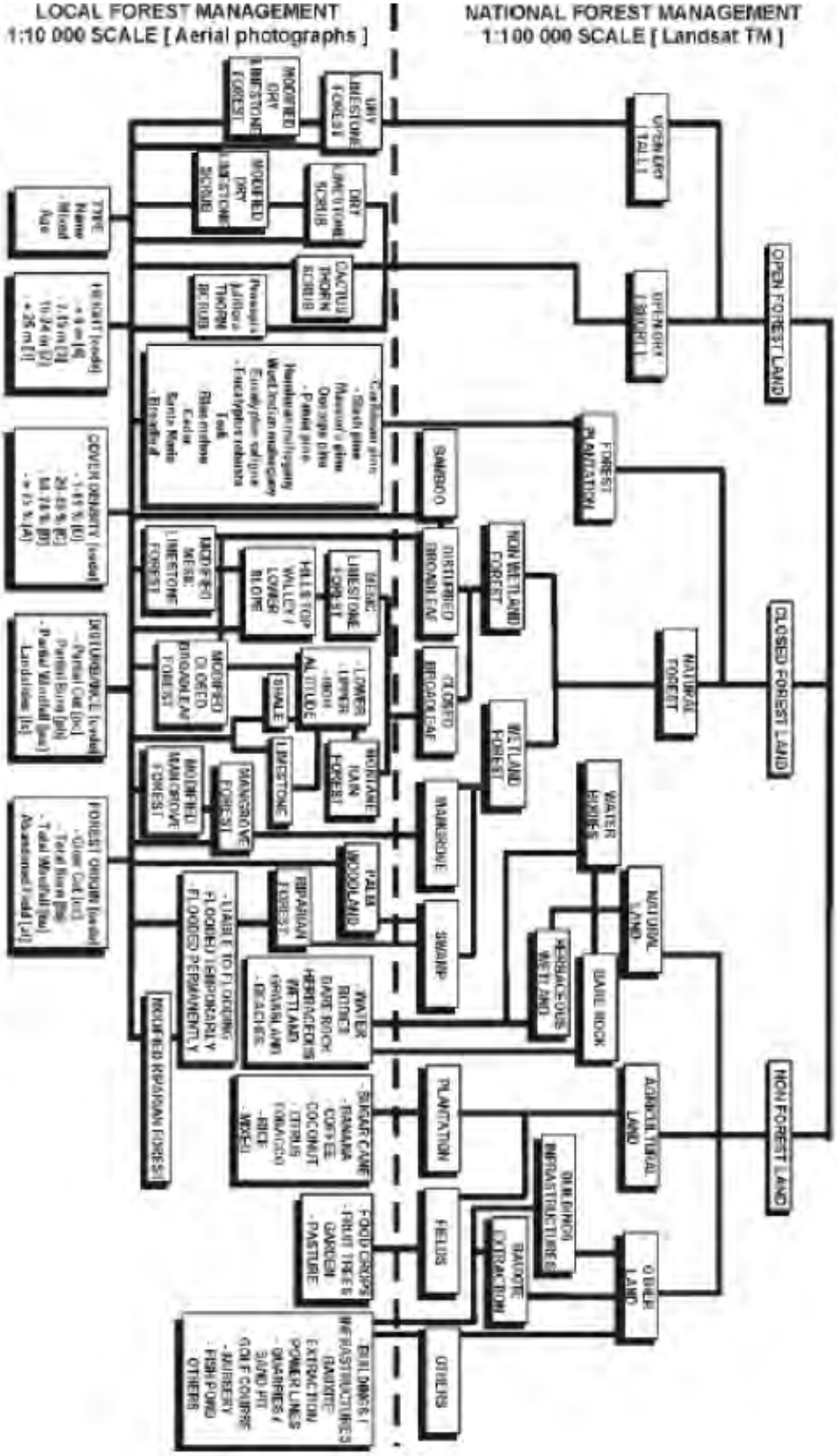

Figure 2.16: Diagram of Land Use/Cover Types Hierarchical Classification in Jamaica[14]

[14] Source Evelyn and Camirand (2003)

Appendix 4: Forest Conservation Fund Projects

Title	Objectives and Brief Description	Lead Agency (Jamaica)	Total Cost
Identification, propagation and dissemination of native forest species	To develop propagation protocols on various tree species. Thirteen trees being considered. Collect seeds and develop most successful protocols. Work with LFMCs to issue seedlings to establish small plots for improving biodiversity	Biotechnology Center, UWI	J$14m
Nursery propagation of coastal forest land	To develop two nurseries, a wet one for mangrove species and a dry one for sand dune species.	Port Royal Marine Lab, UWI	J$5.22M
St Thomas Bee Farmers Association Reforestation and Alternative Livelihood Project	To contribute to the sustainable reforestation and preservation of biodiversity in the foothills of the Blue and John Crow Mountains by encouraging forest conservation through beekeeping as a sustainable livelihood.	St. Thomas Bee Farmers Association	J$16.4m
Dolphin Head Reforestation, Agroforestry and Livelihood Development Project.	Promote awareness and conservation in the Dolphin Head mountain through education, provision of alternative livelihoods, training, reforestation and creation of eco-tourism site.	Dolphin Head Local Forest Management Committee (LFMC	J$17.9m
Reforestation and Promotion of Best Farming Practices to mitigate the effects of landslides in Somerset, St. Thomas	To enhance the environmental health and living conditions in the Somerset community by addressing the problem of erosion, landslides and flood risks through mixed reforestation on erosion-prone areas of Somerset and the installation of slope stabilization mechanisms. To provide local farmers with training in best farming practices most suitable for hilly areas, as well as building the capacity of the community to carry out proper environmental stewardship.	Women's Resource and Outreach Centre	J$20.4m
Mixed Agro-Forestry to Achieve Slope Stability	To reduce the frequency of landslides in the Shirley Castle area of Portland through slope stability, by applying soil conservation measures including the establishment and production of forest trees, food crops and ornamental plants.	Portland Environ. Protection Assoc.	J$7.4m
Morant Watershed Restoration, Conservation and Community Development Project	To protect and restore 25 ha of forest reserve; provide public awareness, education and training towards the protection, enhancement, enjoyment and sustainable use of our forest by 2013	St. Thomas Environment Protection Association Benevolent Society	J$15.2m
Reforestation of degraded forest reserve.	Planting of 12 Hectares of new Seedlings of and Maintenance of a Total of 48 Hectares of Forest Reserve in the Wallenford/Silver Hill area	Lions Club of Mona	J$21.1m
Reforestation of 25 Hectares of degraded forest reserve at cinchona in the Yallahs watershed	To reforest 25 hectares of degraded forest reserve in the Cinchona area of the Yallahs Watershed	Lions Club of Mona	J$13.5m

Planting of 12 ha. of new seedlings and maintenance of a total of 48 ha. in Wallenford		Lions Club of Mona	J$21M
Buff Bay Agro-forestry project	To enable the BBLFMC to develop an agro-forestry program among farmers, schools and forest reserves in the Buff Bay Watershed	Buff Bay LFMC	J$6.6m
Expansion of the Buff Bay Agro-forestry project		Buff Bay LFMC	J$17.8M
Forest Conservation in the Blue Mountains	To rehabilitate 28 hectares of park/forest reserve land within the upper Yallahs watershed using a combination of controlling invasive alien plant species and replanting with native forest tree species.	Jamaica Conservation and Development Trust (JCDT)	J$13.1m
Dallas Forest Conservation Project	Slope Stabilization incorporating terracing and reforestation with fruit and timber species and installation of gabion baskets	Dallas Castle Community Development Council	J$3.5m
Content Gap Forest Conservation	To strengthen, train and equip farmers with the right skills to be better able to protect the environment and their livelihoods, thus improve the standard of living for the farmers and the wider community. This enhanced community development will be achieved through sustainable land management practices.	Content Gap JAS Farmers Group	J$2.2m