Forestry Department

Protecting our Forests; Sustaining Lives

JAMAICA

NATIONAL FOREST MANAGEMENT AND CONSERVATION PLAN

FORESTRY DEPARTMENT

1/20/2017

Foreword

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Acknowledgements

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Stakeholders Consulted

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Abbreviations and Acronyms

AOSIS	Alliance of Small Island States
CIF	Climate Investment Fund
CSGM	Climate Studies Group, Mona
COP	Conference of the Parties
CPC	Chief Parliamentary Council
DBJ	Development Bank of Jamaica
EFJ	Environmental Foundation of Jamaica
FAO	Food and Agricultural Organisation
FI	Forest Instrument
FD	Forestry Department
FCF	Forest Conservation Fund
GoJ	Government of Jamaica
GDP	Gross Domestic Product
GEF SGP	Global Environment Facility, Small Grants Programme
GHG	Greenhouse Gases
IDB	Inter-American Development Bank
IOJ	Institute of Jamaica
IPCC	Intergovernmental Panel on Climate Change
LFMCs	Local Forest Management Committees
LFMPs	Local Forest Management Plans
LMOs	Living Modified Organisms
JNHT	Jamaica National Heritage Trust
JCDT	Jamaica Conservation Development Trust
NAP	National Action Plan
NBSAP	National Biodiversity Strategy and Action Plan
NEPA	National Environment and Planning Agency
NFAP	National Forest Action Plan

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NFMCP	National Forest Management and Conservation Plan
NGOs	Non-Governmental Organisations
NLA	National Land Agency
M&E	Monitoring and Evaluation
MfDR	Management for Development Results
MEGJC	Ministry of Economic Growth and Job Creation
MTM	Ministry of Transport and Mining
ODPEM	Office of Disaster Preparedness and Emergency Management
PASMP	Protected Areas System Master Plan
PDCA	Plan, Do, Check, Act
PES	Payment for Ecosystem Services
PIOJ	Planning Institute of Jamaica
PPCR	Pilot Program for Climate Resilience
RBM	Results Based Management
RCP	Representative Concentration Pathways
SFMP	Strategic Forest Management Plan
SDGs	Sustainable Development Goals
SLR	Sea Level Rise
TEF	Tourism Enhancement Fund
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNREDD	Reducing Emissions from Deforestation and Forest Degradation
UWI	University of the West Indies

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SECTION A

Contextual Setting/Framework

1.0 Background

1.1.1 The Historical Development of the Forest Sector in Jamaica

Jamaica, the third largest island in the Caribbean, is situated about 145 kilometres south of the island of Cuba, with a total landmass of 10,991 square kilometres and a population of approximately 2.7 million people. The country has several rugged mountain ranges, with the highest point, the Blue Mountain Peak, rising over 2,256 metres (7,402 feet). More than 120 rivers flow from the mountains to the coast.

Approximately 60% of the island's bedrock is white limestone; 25% is volcanic and cretaceous; 10% alluvial; and 5% yellow limestone. Jamaica's climate is mainly tropical, with the most important climatic influences being the Northeast Trade Winds and the island's orographic features, that is, mainly the central ridge of mountains and hills.[1]

The island was called "the land of wood and water" on its discovery by Christopher Columbus in May 1494. By 1655 the English had colonized the country, gradually developing the agricultural sector firstly through the large-scale cultivation of sugar cane to be followed by coffee. The English accomplished this by alienating much of the low-lying lands and by the end of the eighteenth century, due to the necessity of the production of ground provision for the expanding enslaved population, the higher lands were applied for and apportioned.[2] This approach to land use and distribution meant that most of the country's land, apart from the cockpit lands of Trelawny and St James, passed out of the control of the Government.

The development pattern pursued by the English resulted in significant loss of forest cover, which was accompanied by a general change in climate over several years. By 1879 the "land of wood and water" experienced five years of continuous drought that adversely affected the mainly agrarian economy. This resulted in severe declines in sugar exports. By 1885 Maxwell Hall, the country's meteorologist, in a public lecture discussing the drought situation stated:

> It is now many years since the reciprocal influences operating between the existence of forest in a country and the climate of that country have been accepted to being directly related the one to the other . . . we have direct proofs afforded to us that in older countries where forests have been largely or entirely cleared there have followed certain conditions which can scarcely be otherwise regarded as direct effects; these are briefly: the diminution of rivers, the drying up of streams and springs, the recurrence of destructive floods, of unseasonable and prolonged droughts, the raising of temperature of both air and soil, excessive drainage, aridity of soil, and uncertainty in the growth of crops.
>
> (Hall cited in Hooper 1886, 7)

It is against this background, that E.M. Hooper was asked by the Government of the day to provide some recommendations for the recovery of the country's forest in a clear recognition of the importance of forests to national welfare and economic development. At that time the country was experiencing forest loss in the order of 30,000 acres each year due to clearing and burning. Hooper noted that such a rate of

[1] Planning Institute of Jamaica, The State of the Climate Report (Kingston: PIOJ, 2012).
[2] E.D. Hooper, *Report Upon the Forests of Jamaica* (London: Waterlou and sons, 1886).

loss was unsustainable and recommended the reservation of highlands for conservation and protection purposes and the reforestation of denuded lands in key limestone forests. His recommendations are summarized as follows.[3]

1) Reserve the highlands of the Blue Mountains, arranging to escheat, acquire or obtain amicable surrender of private lands where necessary.
2) Demarcate and survey the Reserve so formed and protect it against fire, theft and trespass.
3) Retain as forest reserves all blocks of Crown Lands on the limestone formations that exceed 2,000 acres in extent. Restrict cultivation of ground provisions in them wherever possible or expedient.
4) Protect the Reserves against the felling of valuable timbers and generally conserve them. Enforce rigidly all conditions in the Cinchona leases, etc.

He also suggested the formation of the Forest Department and later legislation for the management of the forests as marked by the passage of the Mountain and River Reserves Law of 1889 and the Amending Law of 1892.

Approximately 40 years later, A. Wimbush, the then Chief Conservator of Forests for Madras India, was invited by the Colonial Office to visit Jamaica to deal with problems related to deforestation, protection of existing forests lands and reforestation. The Chief Conservator found that while some efforts to manage forests had borne fruit, for example the passage in 1927 of the "Law to regulate Afforestation", in general the state of affairs was unsatisfactory. This was largely due, firstly to the demand for forest resources mainly wood to construct railway sleepers, secondly to the destruction of forest due to fires that were lit to clear land and finally in Wimbush's words, "inadequately controlled shifting cultivation has been allowed and encouraged by Government on Crown Lands, and since these are the only areas which carry any Government Forest, we have arrived at one of the main reasons for the unsatisfactory state of affairs as regards forestry in Jamaica" (Wimbush 1935). He noted that the only area spared from deforestation was the Cockpit Country, mainly because of its inaccessibility, and thus it still contained valuable tropical forests — a large extent of which still pertains today. Wimbush recommended a series of actions involving a significant programme of protection for several forest types along with reforestation; both he found were required for a sustainably managed forest sector.[4]

This brief review of the history of the management of forests shows that the challenges of land use are not dissimilar over the period and reaffirms the importance of forests to Jamaica's national development. As far back as one hundred and thirty years ago it was recognized that forests were valuable for mitigating the effects of climate change, the sustainable provision of water supply, the protection of the country's infrastructure as well as indirectly linked to the success of the agricultural sector. Ironically, agriculture was one of the land utilization activities, which still today contributes to forest degradation and deforestation and there is a delicate balance that must be maintained between agricultural production and sustainable forest management practices. The early recommendations, that is, the establishment of forest reserves, legislation and staff to administer forest estates are strategies that remain relevant in the postmodern forest sector in Jamaica.

[3] A. Wimbush, *Report on Forest Problems in Jamaica* (1935).
[4] Ibid.

1.1.2 Why a Forest Plan[5]

Against the background of the recommendations of Hooper and Wimbush, the Forestry Department (FD) had its early beginnings in 1937 with the passage of the Forest Act. This led to the creation of the Forest Branch in the Lands Department. By 1942 the Branch had evolved into the Forestry Department located in the Ministry of Agriculture. Since its inception, the Forestry Department has undertaken reforestation projects. Arguably one of the most notable projects took place from 1974 to 1979 when over 3,000 hectares of plantation were established. However, by 1988, Hurricane Gilbert destroyed most of the mature and immature pine plantations, and reforestation efforts were temporarily abandoned. The disaster of 1988 highlighted the urgent need for a more structured framework within which to sustainably manage Jamaica's forests. It became clear that the formation of the Forestry Department and the passage of legislation did not halt deforestation and forest degradation as forest estates continued to diminish because of population growth pressures, agricultural expansion, shifting cultivation, mining, land clearing for housing and extraction of forest resources. Despite these actions, the challenges of how to manage the forest resource in such a manner that the benefits of ecosystem services, prevention or reduction of disasters due to flooding and landslides, maintenance of soil fertility and microclimates, provision of livelihoods, mitigation of climate change and protection of our cultural and aesthetic values remained. The Government recognized that the actions of the past were not sufficient to address the complex, perplexing and competing demands that placed increasing pressures related to land utilization on waning levels of forest resources. It was further acknowledged that what was needed was a more strategic approach to the management of forest estates. The development of a forest action plan was determined to be the most appropriate framework through which to sustainably manage the forest sector. In 1990 with the support of the United Nations Development Programme (UNDP) the first National Forest Action Plan (NFAP) was developed.

1.1.3 The Accomplishments of Previous Forest Management Plans

The 1990 NFAP supported the implementation of three important activities: (i) the compilation of data on the composition and condition of the forest resource; (ii) the development of a Forest Policy; and (iii) the passage of new legislation — the Forest Act of 1996, which expanded the powers and responsibilities of the Forestry Department. The new legislation enshrined (given its critical importance) the requirement for the Conservator of Forests to prepare a National Forest Management and Conservation Plan (NFMCP)[6] in consultation with government departments, key stakeholders and interested parties.

The first NFMCP was approved by both houses of Parliament in 2001. Its development was guided by the following key principles: (i) sustainability of forest development, (ii) holistic and inter-sectoral approach towards forest values and resources, (iii) consistency with national development policies and the socio-economic environment, (iv) partnership, participation and transparency, (v) national policy commitment, (vi) international commitment, (vii) raising awareness, and (viii) a long-term iterative process.

[5] National Forest Management and Conservation Plan (March 2001).
[6] Forest Act, 1996, Section 16.

The 2001–2010 NFMCP contained several strategic pillars. These are:

- community participation;
- public education;
- forestry research;
- Local Forest Management Plans;
- cooperative management agreements;
- forest protection;
- forest production programmes;
- investment and incentives;
- role of the Forestry Department;
- role of the Private Sector; and
- Coordination and monitoring.

There was also the development of the Strategic Forest Management Plan 2010–2014[7] in which the Forestry Department (Agency) articulated the status of the forestry sector, outlined five strategic objectives and established targets by which it could monitor its progress.

In 2015, a gap assessment on the accomplishment of the 2001 Plan was undertaken with the view to inform the development of a new Plan.[8] The 2001 Plan contained a total of 11 strategies, many of which required that resources be secured by the Agency either from within or outside of the Agency. The gap assessment report acknowledged that this first NFMCP was very ambitious particularly given the resource constraints faced by the organisations with the responsibility to execute various aspects of the plan and the degree of interagency coordination, which would be required for its execution. In light of those considerations, the report found that indeed in several instances numerous actions were not undertaken, mainly because the required resources were not available and this included the support of sister government entities and private landowners. Thus, in implementing the 2001 NFMCP the Agency had focused its resources on the high priority actions, which were under their direct control. However, it must be acknowledged that the accomplishments of the plan were mainly, but not entirely, an Agency effort and some degree of support was forthcoming from other entities; although the level of the support affected the completion of some actions during the implementation period under review. This finding from the assessment, that is, the need for effective interagency collaboration given the cross-cutting nature of the forest sector, was a significant lesson and correcting this shortfall is one of the key actions in the 2016–2026 plan. The overall results of the assessment are highlighted in Figure 1.

The gap assessment found that during the 2001 to 2015 period the Agency and its partners were fairly successful in building the capacity of the Agency by strengthening its monitoring framework, improving information systems and biophysical inventory that informs its forest management decisions, establishing and upgrading nursery facilities, re-establishing the Forest Research Branch and investing in the training of community forest specialists. In respect of private forests and community participation there have been some accomplishments with the establishment of Local Forest Management

[7] Forestry Department Strategic Forest Management Plan 2010–2014.
[8] Forestry Department, National Forest Management and Conservation Plan, 2001 Gap Summary (April 2015).

Committees (LFMCs), the development of incentive programmes for private landowners and socio-economic studies of forest communities. In addition, the public awareness programme grew extensively through targeted public relations programmes, conducting perception surveys, design of educational materials and collaboration with the Ministry of Education regarding environmental educational materials.

	Strategy Objective	Number of Actions	Number Met	Number Partially Met	Number with Gaps	% fully met	% Gaps
A	Build FD	17	5	6	6	29.4	35.3
B	Private Forests and Participation	3	1	2	0	33.3	0
C	Public Awareness	12	10	2	0	83.3	0
D	Forest Management Plans	27	5	6	16	18.5	59.3
E	Restore Forest Cover	14	2	1	11	14.3	78.6
F	CC Adaptation	12	0	6	6	0.0	50.0
G	Forest Management	16	5	8	3	31.3	19.00
H	Forest Benefits	6	0	0	6	0.0	100

Key:

	70% or more fully or partially met
	50% or more fully or partially met
	Less than 50% fully or partially met

Figure 1 Summary of Accomplishments linked to Forest Strategy Objectives

Despite these successes there were actions in which stated intent was not accomplished to the degree anticipated. This occurred in areas of forest management particularly with regards to issues related to land tenure, squatting and the development and implementation of Local Forest Management Plans (LFMPs). With respect to forest cover, the reforestation targets were not achieved and approximately 954 hectares were replanted from 2007 to 2015. In the main, climate change mitigation activities were not implemented as little was accomplished with respect to joint implementation of carbon sequestration projects. This outcome was equally true for the forest benefit activities as to date no values have been placed on the various components and resources within the forest estates.

1.1.4 The Role of Forests in National Economic Development, Lessons Learnt and Responding to New Exigencies

The benefits of Jamaica's forests and its contribution to the country's economic development have not been extensively studied. This places Jamaica's forest sector at a disadvantage in the 'race' for scarce government resources. Nevertheless, even in the absence of hard empirical data the experiential and traditional knowledge of the contribution of forests to national development is undeniable. The country's forests and forest resources contribute to food production, timber, provision of fuel wood and other forest resources, livelihoods, biodiversity and ecosystems services and there is no doubt about the contribution that well managed forests can make to climate change adaptation and mitigation.

Globally, it has been agreed that forests will play a significant role in climate change mitigation and it is posited that maintaining nature's capacity to buffer the impacts of climate change will be less costly and more efficient than the utilization of heavy infrastructural technology. This justifies the recommendation for investment in ecosystems (forests) as an attractive economic alternative.[9] The potentially adverse impact of climate change on Jamaica's economic development has been extensively discussed and documented.[10] An examination of the agricultural sector in Jamaica reveals that it accounts for 6.7% of GDP, employs 18.2% of the labour force and has over 200,000 farmers. In recent years, floods, cyclones, drought and forest fires have contributed to a slowdown in the sector, resulting in growing concerns about food security. In terms of disasters, in 2011, the Planning Institute of Jamaica (PIOJ) provided an assessment of the costs of disasters on Jamaica's infrastructure. The PIOJ's assessment of the period from 2001 to 2010 revealed that natural disasters cost the country approximately 111 billion Jamaican dollars[11] and that one of the main contributing factors was identified as environmental conditions.

Even if the impact of these natural disasters on agriculture and infrastructure can only be determined by proxy figures, in the absence of more direct data on the benefits of forests to Jamaica's economic development, the information is sufficient to demonstrate the importance of sustainable forest management to national economic development. Considering that analysis, the importance of an effectively implemented and adequately resourced NFMCP to national development is significant and has been recognized in the preparation of the NFMCP 2016–2026.

The learning derived from the implementation of the 2001 NFMCP provided several valuable lessons, which informed the development of the 2016 NFMCP. One of the most important lessons was the recognition of the extent to which the forest sector impacts several areas of the country's social fabric; including its heritage, the economy and the daily lives of its people. Given the cross-cutting nature of the sector and the demonstrated value of forests, the development of a holistic plan to guide the forest sector is a national imperative. The second lesson is that given its scope and the number of organisations involved in its execution, there is need for a shared vision and effective collaboration for its successful implementation. The final lesson is the need for the NFMCP to be properly resourced from its inception if the outcomes are to be achieved.

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[9] Bruno Locatelli and Emilia Pramova, Forests and Adaptation to Climate Change: What is at Stake? (Center for International Forestry Research, Indonesia, World Resource Institute).

[10] Climate Studies Group, Mona (CSGM), State of the Jamaican Climate 2012 (produced for the Planning Institute of Jamaica).

[11] PIOJ, Assessing the Costs of Disasters on Jamaica's Infrastructure: Evidence from the Damage and Loss Assessment (Kingston: PIOJ, 2013).

In summary, any gaps in the accomplishment of the 2001 NFMCP are related to several equally important and interrelated issues. These are: insufficient recognition at the highest levels of the decision-making pyramid of the complex relationship between sustainable forest management and national economic development; the existence of 'silos', which resulted in insufficient effective collaboration on key activities beyond the direct remit of the Agency; and the relative under-resourcing of the Plan. However, despite the gaps in the accomplishments in the 2001 to 2015 period, what was accomplished has established a relatively sound platform from which to launch an even more ambitious forestry programme.

Table 1 Impact on Jamaica's Gross Domestic Product (GDP) from some Selected Natural Disasters[12]

Selected natural disasters in Jamaica and their impact event	Year	Category	Cost($J)	Impact (% GDP)
Hurricane Michelle	2001	4	2.52	0.8
May/June Flood Rains	2002	-	2.47	0.7
Hurricane Charley	2004	4	0.44	0.02
Hurricane Ivan	2004	3	36.9	8.0
Hurricanes Dennis &Emily	2005	4	5.98	1.2
Hurricane Wilma	2005	5	3.6	0.7
Hurricane Dean	2007	4	23.8	3.4
Tropical Storm Gustav	2008		15.5	2.0
Tropical Storm Nicole	2010		20.6	1.9
Total			111.81	

Additionally, State of the Jamaican Climate 2012 Report[13] and the later updated report of January 2016[14] provides detailed information of the impact of climate change on the country's temperatures, rainfall, sea levels and cyclones, and supports the necessity of a well-resourced NFMCP to help build climate resilience within the country. Further, several eminent scientific studies have predicted that Jamaica is one of the countries that will experience the full impact of climate change sooner rather than later.

[12] PIOJ, Assessing the Costs of Disasters on Jamaica's Infrastructure: Evidence from the Damage and Loss Assessment.
[13] CSGM, State of the Jamaican Climate 2012.
[14] Climate Studies Group, Mona, Draft Report – Jamaica: Future Climate Changes (University of the West Indies, January 2016).

Scientists refer to this phenomenon as 'climate departure'; it is defined as "the moment when average temperatures, either in a specific location or worldwide, become so impacted by climate change that the old climate is left behind." It can be thought of as a tipping point. A city or country experiences 'climate departure' when the average temperature of its coolest year from then on is projected to be warmer than the average temperature of its hottest year between 1960 and 2005.

A study published in the prestigious peer-reviewed scientific journal *Nature*,[15] predicts that the Earth as a whole will reach 'climate departure' in 2047. In addition, the study projects the climate departure dates for each country based on the Global Circulations Models (GCMs), Representative Concentration Pathways (RCPs) 8.5 and 4.5. The authors project bad news for many of the world's most vulnerable countries, noting that these countries will be impacted the earliest and the Caribbean is among the group of such countries. In the case of Kingston, Jamaica the climate departure date predictions in the RCP 8.5 and RCP 4.5 are 2023 and 2028, respectively.

Given these new exigencies that the country faces increasing and more severe impacts from climate change and considering the policy objectives laid out in Vision 2030 Jamaica for the Forest Sector, these considerations have significantly influenced the preparation of the 2016 NFMCP.

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[15] C. Mora, A.L. Frazier, and R.J. Longman, et al., 'The projected timing of climate departure from recent variabilities', *Nature* 502 (2013): 183–87.

2.0 The Issues Informing the 2016–2026 NFMCP Development

2.1 National Policies

The 2016–2026 NFMCP has been developed to ensure alignment to three key national policies geared at achieving national sustainable development objectives. In addition, its development comes against the background of Jamaica's international obligations for which the Forestry Sector plays a significant role. These policies and multilateral agreements are briefly described below.

2.1.1 The Forest Policy

The revised Forest Policy[16] for Jamaica, 2015 has considered the experiences of developing the sector over the past several years and is aligned with the national sustainable development goals of Vision 2030 Jamaica. It also builds on the Strategic Forest Management Plan (SFMP) 2010–2015, which was developed as a framework for increasing the Agency's capacity to manage state-owned forests by "increasing the participation of the private sector, community based organizations, and Non-Governmental Organizations (NGOs) in the sustainable management and conservation of Jamaica's forests".[17]

At the heart of the Policy is a commitment to engage the Jamaican people in the protection, conservation and management of Jamaica's forests. Perhaps best expressed in the words of a retired Forester,

> The task that now faces Jamaica is a steep one: we must put back the trees on the land. It is not a job that should be left to the Forestry Department alone. It is the responsibility of each and every able-bodied Jamaican to join in this national effort to recapture the fast disappearing beauty of our country and thus ensure the stability of our remaining rivers.
>
> (Norman Bertram Vickers, Forestry Department 1968)

2.1.2 The Climate Change Policy Framework

Building resilience to the impacts of climate change has been articulated as one of the GoJ's highest priorities. The Government has acknowledged the cross-cutting nature of climate change and the need to develop an integrated approach in order to effectively build resilience at all levels and to have the required enabling policies in place.

It is against that background that the Climate Change Policy Framework (2015) was prepared under the Government of Jamaica/ European Union/United Nations Environment Programme Climate Change Adaptation and Disaster Risk Reduction (CCADRR) Project through a number of consultations, using as a

[16] Forestry Department, Forest Policy for Jamaica (2015).
[17] Ibid.

basis, the Vision 2030 Jamaica – National Development Plan (2009) and Jamaica's Second National Communications on Climate Change (2011), presented to the United Nations Framework Convention on Climate Change.[18]

The general objective of the Policy Framework is to create a sustainable institutional mechanism to facilitate the development, coordination and implementation of policies, sectoral plans, programmes, strategies and legislation to address the impacts of climate change. These sectors, which have so far been identified, are: water, energy, agriculture, fisheries, forestry, coastal and marine resources, health, mining, tourism, transportation, solid waste management, planning and disaster risk reduction and response management.[19]

The Climate Change Policy Framework's five objectives are: (i) to mainstream climate change considerations into national policies and all types and levels of development planning, and to build the country's capacity to develop and implement climate change adaptation and mitigation activities; (ii) to support the institutions responsible for research, data collection, analysis and projections at the national level on climate change, its impacts, and appropriate adaptation and mitigation measures, to facilitate informed decision-making and strategic actions at all levels; (iii) to facilitate and coordinate the national response to the impacts of climate change and promote low carbon development; (iv) to improve communication at all levels on climate change impacts and also adaptation and mitigation related opportunities so that decision makers and the general public will be better informed; and (v) to mobilize climate financing for adaptation and mitigation initiatives.

Further, the Policy Framework and Action Plan (2015) outlines the strategies that the country will utilize in order to mainstream climate change into all facets of the country's life. The guiding principles that are directing the implementation of the Climate Change Policy are:

- Sustainable use of natural resources;
- Multi-sectoral approach to climate change;
- Public Participation and Collaboration;
- The Precautionary Approach;
- Transparency and accountability;
- Best science;
- Polluter Pays Principle; and
- Inter- and intra-generational equity.

These principles as well as the overall strategic framework outlined in the policy have guided the development of the NFMCP.

2.1.3 Vision 2030 Jamaica – National Development Plan

Vision 2030 Jamaica is the Government of Jamaica's (GoJ's) National Development Plan (2009) and outlines the Government's stated policy intent for achieving a better future for the country. Vision 2030

[18] Green Paper No. 1/2013 Climate Change Policy Framework and Action Plan.
[19] Ibid.

Jamaica provides a common and clear planning framework for all sectors in the society to work towards making "Jamaica the place of choice to live, work, raise families and do business."

The actions outlined in the Vision 2030 Jamaica document are informed by four mutually reinforcing and interlinked goals, which are detailed below:

- Goal 1: Jamaicans are empowered to achieve their fullest potential
- Goal 2: The Jamaican society is secure, cohesive and just
- Goal 3: Jamaica's economy is prosperous
- Goal 4: Jamaica has a healthy natural environment

Each goal has clearly articulated national outcomes, many of which hinge on the forest sector. However, it is Goal 4 that has guided to a large extent the development of the 2016 NFMCP.

Table 2 Goal 4 – Jamaica has a Healthy Natural Environment

National Goal 4	National Outcomes
Jamaica has a healthy natural environment	• 13 – Sustainable management and use of environmental and natural resources • 14 – Hazard Risk Reduction and Adaptation to Climate Change • 15 – Sustainable urban and rural development

Goal 4 identifies the importance of the natural environment, environmental sustainability and conservation of the country's natural resources and acknowledges that a productive and protective environment, sound social systems and a healthy economy are key pillars of sustainable development and the welfare of the nation's citizens. The Vision 2030 Jamaica document reports that deteriorating air and water quality; loss of biodiversity; watershed degradation; net loss of forest cover; and increasing incidence of forest fires being experienced within the country are threatening a sustainable future. Considering those findings, the GoJ acknowledges that effective management of ecosystems such as terrestrial forests and wetland forests provide essential services such as flood control, recharging ground water and carbon sinks that are of paramount importance to economic development. In this regard, the forest sector has much to contribute to ensuring the integrity of the nation's ecosystem services.

2.1.4 Medium Term Socio-economic Policy Framework

Jamaica faces persistent economic, social, and national security challenges, pressures on the natural environment, and the increasing impacts of global climate change. The national development plan is the country's first long-term strategic development plan and is being implemented through a series of

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three-year Medium Term Socio-Economic Policy Frameworks (MTFs),[20] which is directly linked to Vision 2030 Jamaica – National Development Plan, and guides the implementation of the Plan through the identification of the priority outcomes, strategies, and actions for each three-year interval from 2009 to 2030.

The 2016 NFMCP builds on the achievements of the previous MTFs and has been developed with due consideration to the 2015–2018 MTF and in particular National Outcome #13 — Sustainable Management and Use of Environmental and Natural Resources, and National Outcome #14 — Hazard Risk Reduction and Adaptation to Climate Change.

In terms of Outcome #13, the priorities are related to improving the state of the natural environment, thereby contributing to reduced vulnerabilities, and advancing socio-economic development. The NFMCP is linked to Sustainable Development Goals (SDGs) # 6, 12, 13, 14 and 15, that is, to:

- ensure availability and sustainable management of water and sanitation for all; and
- protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation, and halt biodiversity loss.

In the case of National Outcome #14 — Hazard Risk Reduction and Adaptation to Climate Change the NFMCP is aligned to SDGs Goals # 13 and 15 to:

- take urgent action to combat climate change and its impacts; and
- protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation, and halt biodiversity loss.

2.2 Multilateral Agreements

Jamaica is a signatory to several international agreements, chief among these are the United Nations Forum on Forests (UNFF); the United Nations Framework Convention on Climate Change (UNFCCC); the United Nations Convention on Biological Diversity (UNCBD); and the United Nations Ramsar Convention.

2.2.1 UNFF

Member States to the UNFF are committed to the principles outlined in the Forest Instrument (FI), to the four Global objectives on forests[21] outlined below.

Global objective 1 - Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation, and reforestation, and increase efforts to prevent forest degradation;

[20] Planning Institute of Jamaica, GOJ Medium Term Socio-Economic Policy Framework 2015–2018 (Kingston: PIOJ).
[21] United Nations General Assembly Non-legally binding instrument on all types of forests (October 2007).

Global objective 2 - Enhance forest-based economic, social and environmental benefits, including by improving the livelihoods of forest-dependent people;

Global objective 3 - Increase significantly the area of protected forests worldwide and other areas of sustainably managed forests, as well as the proportion of forest products derived from sustainably managed forests;

Global objective 4 - Reverse the decline in official development assistance for sustainable forest management and mobilize significantly increased, new and additional financial resources from all sources for the implementation of sustainable forest management.

In addition, the Forest Instrument outlines several national polices and measures by which these objectives can be achieved. These range from updating strategies for sustainable forest management to creating enabling environments to encourage private sector investment in the forest sector. Where it was relevant and within the capacity and capability of the GoJ, the NFMCP has aligned itself within the Jamaican context to the measures in the action plan.

The Agency is Jamaica's Focal Point for the UNFF. The country is one of six pilot countries preparing a National Action Plan guided by the global objectives and the twenty-five national policies and measures specified in the Forest Instrument. In light of this, coupled with the GoJ's commitment to the UNFF, the development of the NFMCP followed protocols outlined by the UNFF Secretariat in order to assure alignment with the Forest Instrument. To achieve this alignment, several activities were undertaken, the first of which was the conduct of a situational analysis of the forest sector,[22] which provided supporting documentation for stakeholder consultations. The second activity was the staging of a series of stakeholder consultations to ensure that 'voice' was given to the diverse group of participants in the sector and to help the Agency determine priority national policy areas and to identify suitable actions. The stakeholder consultations were supported by an expert from the UNFF Secretariat and its participants were drawn from the public sector, local forest management community groups, academia, private planters and other interested parties. These facilitated discussions that proposed the following priority policy areas, which along with the global objectives, have been further distilled, refined and incorporated in the NFMCP:

- strengthen the contribution of science and research to advancing sustainable forest management by incorporating scientific expertise into forest policies and programmes;
- identify and implement measures to enhance cooperation and cross-sectoral policy and programme coordination among sectors affecting and affected by forest policies and management, with a view to integrating the forest sector into national decision-making processes and promoting sustainable forest management, including by addressing the underlying causes of deforestation and forest degradation, and by promoting forest conservation;
- analyse the causes of and address threats to forest health and vitality from natural disasters and human activities, including threats from fire, pollution pests, disease and invasive alien species;

[22] Una May Gordon, Formulation of a National Action Plan (NAP) for implementing the Forest Instrument in Jamaica (A Situational Analysis, commissioned by the United Nations Forum on Forests Secretariat).

- develop financing strategies that outline the short-, medium- and long-term financial planning for achieving sustainable forest management, taking into account domestic, private sector and foreign funding sources;

- develop and implement policies that encourage the sustainable management of forests to provide a wide range of goods and services, and that also contribute to poverty reduction and the development of rural communities;
- promote and strengthen public understanding of the importance of and the benefits provided by forests and sustainable forest management, including through public awareness programmes and education;
- establish or strengthen partnerships, including public–private partnerships, and joint programmes with stakeholders to advance implementation of sustainable forest management;
- support the protection and use of traditional forest-related knowledge and practices in sustainable forest management with the approval and involvement of the holders of such knowledge, and promote fair and equitable sharing of benefits from their utilization, according to national legislation and relevant international agreements;
- promote the use of management tools to assess the impact on the environment of projects that may significantly affect forests, and promote good environmental practices for such projects; and
- Create enabling environments to encourage private sector investment, as well as investment by and involvement of local and indigenous communities, other forest users and forest owners and other relevant stakeholders, in sustainable forest management, through a framework of policies, incentives and regulations.

2.2.2 UNFCCC

A historic agreement regarding the global response to climate was reached in Paris at the 21st meeting of the Conference of the Parties (COP) in December 2015. The agreement came into effect on November 4, 2016 after more than 55 Parties representing 55% of global emissions have signed the agreement. In Paris, the Parties agreed to hold average global temperature rise, this century, to below 2°C above pre-industrial levels and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. Further, the agreement calls for the Parties to pursue efforts “to limit the temperature increase to 1.5 degrees Celsius above pre-industrial levels, thereby significantly reducing the risks and impacts of climate change”, a position that Jamaica strongly supported as a member of the Alliance of Small Island States (AOSIS).

Of some significance for the forest sector in Jamaica, the climate change agreement — adopted by 195 countries — raised the profile of forests in ways never experienced before. At the Conference, Heads of Government from major forest countries and partner countries endorsed forests as a key climate solution and committed to providing strong, collective and urgent action to promote equitable rural economic development, reversing deforestation and massively increasing forest

restoration. In a joint statement the leaders said, "we, leaders, today in Paris on November 30th 2015, recognize the essential role forests play in the long-term health of our planet, in contributing to sustainable development, and in meeting our shared goal of avoiding dangerous climate change. We are committed to intensifying efforts to protect forests, to significantly restore degraded forest, peat and agricultural lands, and to promote low carbon rural development." The commitment of the Heads of Government was outlined in Article 5 of the agreement that "requires Parties to take action to conserve and enhance sinks and reservoirs of greenhouse gases, including forests. It also encourages parties to implement and support activities to reduce emissions from deforestation and forest degradation, and highlights the role of conservation, sustainable management of forests and enhancement of forest carbon".[23]

Further, the Paris Agreement's central aim is to strengthen the ability of countries to deal with the impacts of climate change. Considering the decisions of the COP, Jamaica, as a Party to the Convention, should put in place programmes for adaptation but perhaps more importantly to build climate resilience in communities and the country at large. In short, to align its obligations to the Paris Agreement, Jamaica must develop mitigative strategies.

Jamaica's forests offer the country an opportunity to put forward its best efforts through 'nationally determined contributions' (NDCs) via the enhancement of forest carbon stocks. This matter has been given priority in the 2016 NFMCP through the development of climate change adaptation and mitigation actions with a focus on the implementation of the United Nations Programme Reducing Emissions from Deforestation and Forest Degradation (UNREDD). Further, the Plan recognizes the importance of adaptation to climate change. The NFMCP will be the programme by which the country intends to address the climate change issues within and through the forest sector.

2.2.3 UNCBD

Jamaica has a very rich and varied biodiversity because plants, animals and other living organisms have adapted to the many different environmental conditions that exist on and/or around the island. Almost without full realisation of its impact, the country's rich biological resources have supported families and communities for generations and continue to foster economic growth and stability by supporting agriculture, tourism, fishing, craft manufacturing and a host of other activities.

Jamaica has been a party to the Convention for Biological Diversity (CBD) since 1995. The Convention commits the Government of Jamaica (GoJ) to achieving the following three goals.

1) The conservation of biological diversity.

2) The sustainable use of the components of biological diversity.

3) The fair and equitable sharing of the benefits arising from the use of genetic resources.

[23] United Nations / Framework Convention on Climate Change (2015) Adoption of the Paris Agreement, 21st Conference of the Parties (Paris: United Nations).

In response to their obligation under UNCBD the GoJ developed a National Biodiversity Strategy and Action Plan (NBSAP),[24] the goals of which are as follows:[25] (i) conserve Jamaica's biodiversity; (ii) promote sustainable use of biological resources; (iii) facilitate access to biological resources to promote developments in biotechnology and to ensure benefit sharing; (iv) ensure safe transfer, handling and use of Living Modified Organisms (LMOs); (v) enhance resource management capacity; (vi) promote public awareness and education, and community empowerment; and (vii) promote regional and international cooperation and collaboration in support of the implementation of the CBD.

The *2013 State of the Environment Report* published by the National Environment and Planning Agency (NEPA)[26] reported that much of Jamaica's biodiversity is found in forest ecosystems. These are:

1) **Wet limestone forests**, found in the John Crow Mountains, central and western Jamaica;

2) The **predominantly shale forests** of the Blue Mountains and Port Royal Mountains;

3) **Dry limestone forests**, found almost exclusively in the south of the island in the Hellshire Hills in St. Catherine and Portland Ridge in Clarendon;

4) **Alluvial and wetland forests**, found in the coastal plains. Wetlands account for only around 2% of total land cover, but they support high amounts of terrestrial and coastal marine biodiversity. For example, mangroves and seagrass beds act as essential, early nurseries for many commercial fish such as grunts and snappers;

5) **Anthropogenic forests**, which have been created by man, such as Caribbean Pine plantations.

The forest sector therefore has a significant role in conserving and protecting the country's biodiversity by protecting and conserving its forests. The NFMCP will therefore be a significant contributor to meeting the country's obligation under the UNCBD.

2.2.4 Ramsar Convention

The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Convention defines wetlands to include all lakes and rivers, underground aquifers, swamps and marshes, wet grasslands, peatlands, oases, estuaries, deltas and tidal flats, mangroves and other coastal areas, coral reefs, and all human-made sites such as fish ponds, rice paddies, reservoirs and salt pans.

The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world."[27]

The Parties to the Convention are committed to:

[24] The Natural Resources Conservation Authority, the National Environment Planning Agency, and Ministry of Land and Environment, National Biodiversity Strategy and Action Plan (2003).
[25] Ibid.
[26] National Environment and Planning Agency, *State of Environment Report 2013* (Kingston: NEPA, December 2015).
[27] www.ramsar.org

- work towards the wise use of all their wetlands;
- designate suitable wetlands for the list of Wetlands of International Importance (the 'Ramsar List') and ensure their effective management;
- cooperate internationally on transboundary wetlands, shared wetland systems and shared species.

Wetlands are among the most diverse and productive ecosystems. They provide essential services but are continually under threat. Wetland forests do not only provide vital ecosystem services to the country but also significant shoreline protection against storm surge and wind events, and significantly increase the buffering capacity against flooding and wind damage in the instances of natural disasters.

In Jamaica, the wetlands comprise mainly mangrove forests. Mangrove forests provide several economic benefits to communities, which in many cases are extracted at unsustainable rates, for example, timber for construction, yam sticks, artisanal fish pots, small-scale farming, charcoal production and use as firewood. As a result, mangroves are threatened by over exploitation of their resources, permitted coastal development projects, housing solutions, and hotels and tourist attractions. The National Environment and Planning Authority (NEPA), in an effort to protect the country's wetlands, has declared four Ramsar sites. These are the Black River Lower Morass in 1997, Palisadoes–Port Royal Protected Area 2005, the Portland Bight Wetlands and Cays, 2006 and Mason River Protected Area, 2011.[28]

2.2.5 UNESCO World Heritage Sites

The protection of cultural heritage is the mandate of United Nations Educational, Scientific and Cultural Organization's (UNESCO's) Convention concerning the Protection of the World Cultural and Natural Heritage. Parties to the Convention recognize their duty — "ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage".[29] In July 2015, the Blue and John Crow Mountains was inscribed on the World Heritage List. The listing potentially will provide the site with greater protection while at the same time achieving the delicate balance of promoting sustainable livelihoods and ecotourism within the forest reserve. The NFMCP has outlined a programme under sustainable forest utilization, which addresses the issue of protecting Jamaica's cultural and natural heritage with a focus on building community involvement and resilience.

[28] The National Environment and Planning Agency, Status of Jamaican Mangroves (2014).
[29] UNESCO's Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972 Article 4.

3.0 Mainstreaming Climate Change in the Forest Sector

3.1 The Global Outlook on Climate Change

There is increasing evidence from around the world that the Earth's climate is changing and that human activity is the most likely cause.[30] The changes in climate are most noticeable in terms of increasing average temperatures and rising sea levels. Since the 1850s, average temperatures have been increasing, and this is particularly noticeable in the last three decades, which have been successively warmer. The average change in temperature around the world between 1880 and 2012 is 0.85°C.

The change in climate is mainly caused by human activity as is evidenced through the greenhouse effect, that is, the increasing emissions of greenhouse gases (GHGs) including carbon dioxide, methane and nitrous oxide, creating a greenhouse effect. That is, a blanket of gases in the earth's atmosphere which retains the sun rays and warms the planet. It must be noted that the greenhouse effect is a natural phenomenon. Carbon dioxide and a few other gases in the atmosphere keep the solar rays that hit the earth's surface from reflecting back into outer space, resulting in a heating of the earth's atmosphere. This in principle is a good thing, as otherwise the planet would be too cold for us to survive. However, the increased levels in greenhouse gases due to increasing industrialization fuelled mainly by fossil fuels has led to 'imbalance', resulting in an increase in the 'warming potential' of the atmosphere. GHGs are warming the climate system, with the largest contribution coming from atmospheric concentration of carbon dioxide (CO_2) resulting in the changes to the climate, which are increasingly being observed and experienced.

The change in climate has profound implications for everyday life and the Intergovernmental Panel on Climate Change (IPCC) has produced several scenarios on what future climate could look like. These scenarios, named Representative Concentration Pathways (RCP), are based on GHG emissions until 2100 and describe the possible ways in which emissions could fluctuate in the future. The RCP 8.5 scenario presents a continuous growth of emissions, RCP 6 and RCP 4.5 scenarios present intermediate situations, and the RCP 2.6 scenario presents a scenario of sharp emission reductions. The projections for change in temperature are shown in Figure 2.[31]

[30] Intergovernmental Panel on Climate Change (IPCC) 2015 AR5 Summary Report.
[31] IPCC 2013.

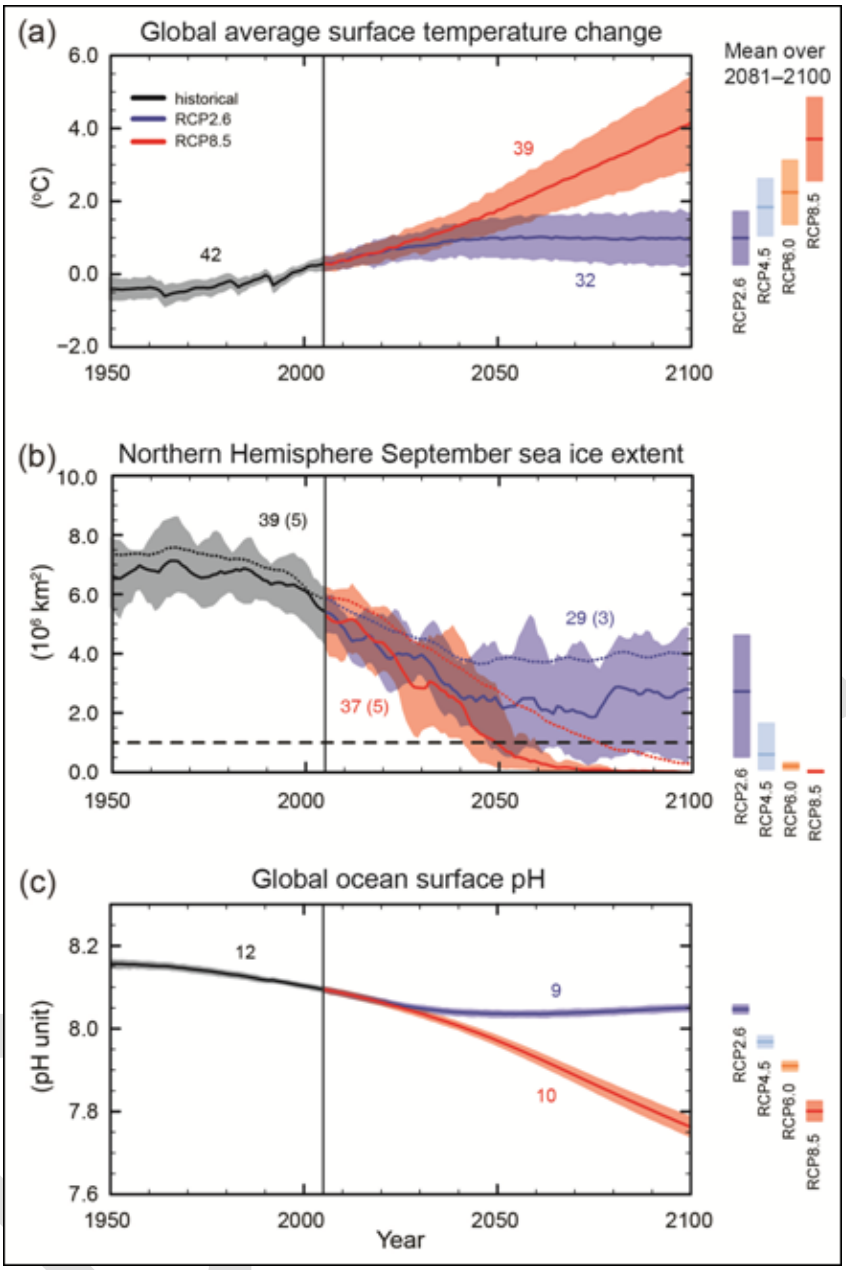

Figure 2 Simulated Time Series from 1950 to 2100

These projections are useful for informing decisions related to the future climate and are important considerations for national development planning, which along with Jamaica's downscaled climate data is essential for developing appropriate national responses and for building the country's climate resilience.

The following section provides a summary of the status of climate in Jamaica, which has informed the development of the NFMCP and will direct efforts in mainstreaming climate change in the forest sector.

3.2 Overview – State of Jamaica's Climate: Challenges and Opportunities

In 2012, the Planning Institute of Jamaica (PIOJ) published a report describing the state of the Jamaican climate[32] in order to understand and address the emerging challenges of climate change, adaptation and mitigation actions that will be needed across all sectors of Jamaica's economy.

The 2012 report was an initial reference point for a description of Jamaica's climate, its variability, trends and future projections. The report will be used by key sectors and stakeholders engaging in climate change adaptation work and by those who need to define the climate state being adapted to as well as providing information on how key sectors in the country may be impacted by climate change. In 2016 the CSGM updated the 2012 report[33] and the following section of the document outlines their major findings.

3.3 Projections

The climate scenarios for Jamaica were developed from several data sources and the report focused on future scenarios based on sub-island scale data provided in 26 grid boxes (see Figure 3).[34]

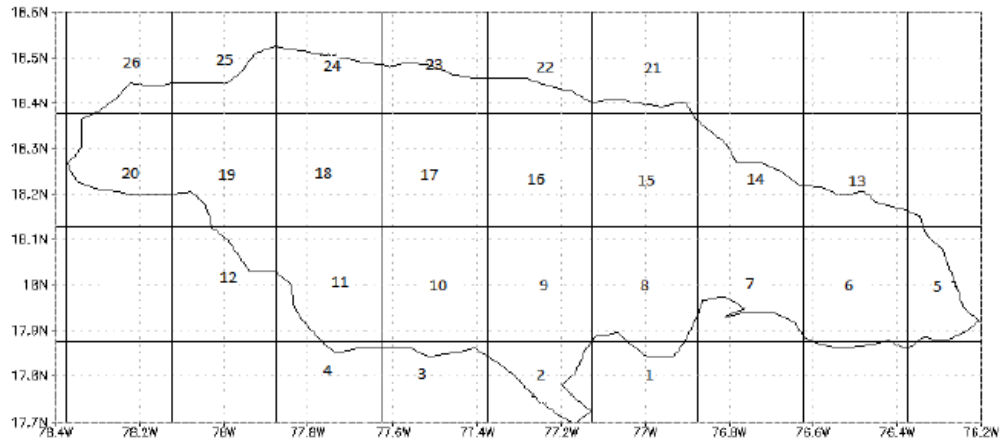

Figure 1: PRECIS 25-km grid box representation over the island of Jamaica.

Figure 3 PRECIS 25 km Grid Box Representation over the Island of Jamaica

[32] Climate Studies Group, Mona (CSGM), State of Jamaican Climate 2012, produced for the Planning Institute of Jamaica.
[33] Climate Studies Group, Mona, Draft Report – Jamaica: Future Climate Changes (Kingston: University of the West Indies, January 2016).
[34] Ibid.

3.3.1 Temperatures Projections

The temperature climatology across Jamaica is unimodal, with peak temperatures in the summer months June to September and cooler temperatures from December to March. Monthly temperatures range from 24°C to 28°C, with a mean maximum temperature of 33°C in the warmer months and a mean minimum temperature of 19^0C during the cooler months.

Globally, the mean surface temperatures have increased by 0.85°C from 1880 to 2012. In the case of the Caribbean, increases have been in a similar range of 0.5°C from 1900 to 1995. In Jamaica, the warming trend for minimum, maximum and mean temperatures is illustrated in Figure 4.[35] However, based on the calculations over the period 1950–2014, minimum temperatures are increasing at a faster rate than maximum temperatures, that is, 0.27°C /decade compared with 0.06°C /decade. In general, Jamaica's estimated temperature increases align with the global projections.

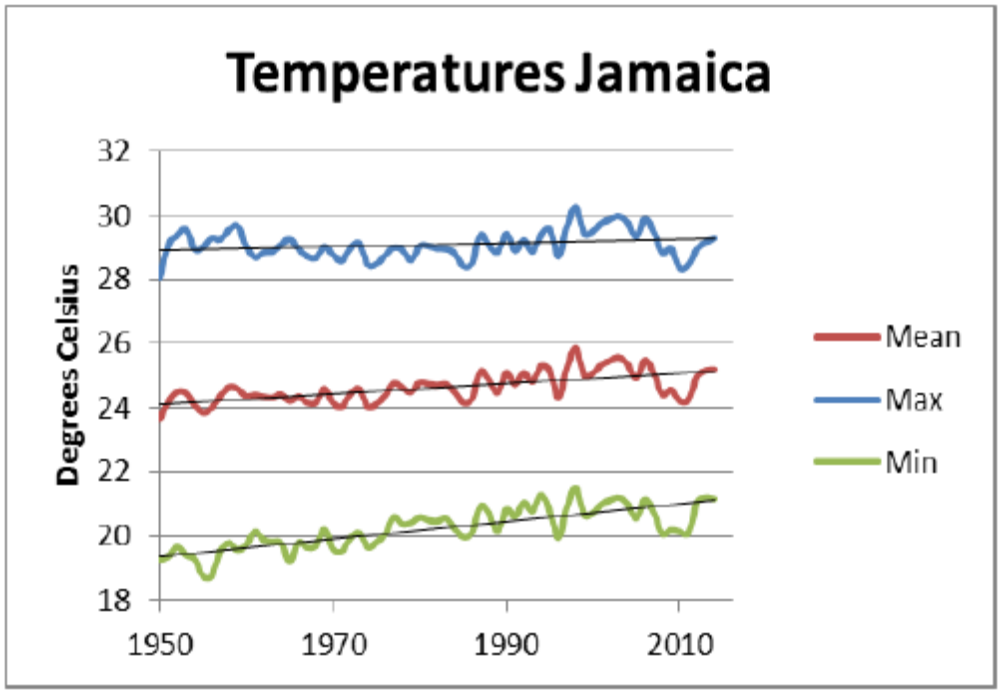

Figure 4 Mean, Average and Minimum Temperature Projections for Jamaica

In summary, the major CSGM findings for Jamaica are as follows.

- Mean annual temperatures are projected to increase regardless of the scenario through to the end of the century.

[35] Ibid.

The Regional Climate Models (RCMs) suggest increases of up to 4.0°C for the A1B scenario for the sub-island regions by the end of the century. This is in general higher than the values projected by the Global Climate Models (GCMs).

- There is some spatial variation (across the country and even within Blocks) with coastal regions generally showing slightly smaller increases in temperature variables than interior regions.
- The months of August–October have slightly higher values of temperature change than other times of the year.

3.3.2 Rainfall

Within Jamaica, the annual rainfall pattern is bi-modal, resulting in a rainy season from April to November and a dry season from December to March. During the rainy season, there is a mid-summer dry season occurring from July through August and rainfall peaks from May to June and September to November. Historically, the annual rainfall in Jamaica reflects a similar pattern, with most of the island's rainfall occurring in October and the driest month of the year being February (Figure 5).[36] This usually reliable pattern of rainfall has ordered the way in which major activities take place in several sectors. For forestry, the bimodal pattern affects the planting cycles.

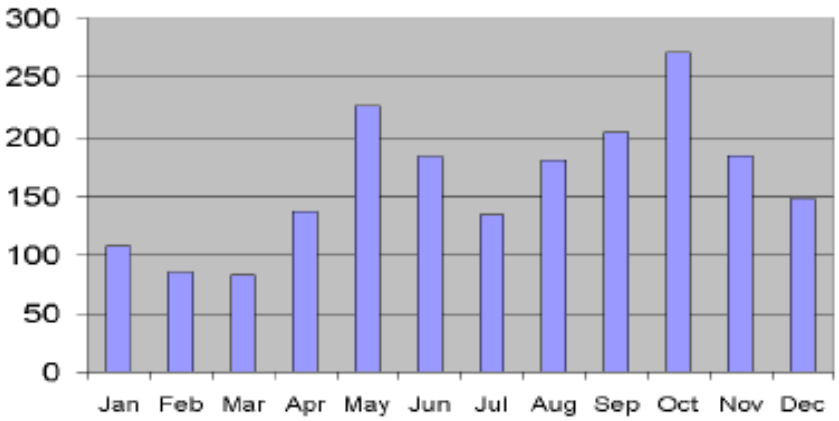

Figure 5 Jamaica's Rainfall Climatology in mm Averaging (1951–1980)

In terms of the distribution of rainfall across the island there are variations. The interior mountainous areas experience more rainfall annually; the coastal areas are drier, with the southern coastal plains being the driest, experiencing approximately 1,000 mm of rainfall or less annually. The maximum rainfall is experienced on the eastern and western ends of the island (Figure 6).[37]

[36] Ibid.
[37] Ibid.

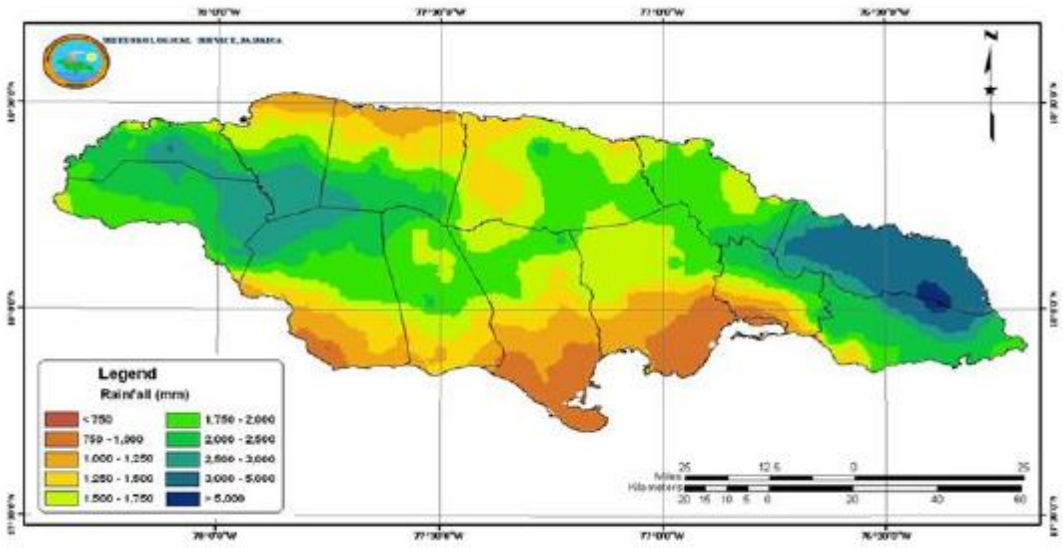

Figure 6 Distribution of Mean Annual Rainfall for Jamaica (in mm). Averaging period, 1951–1980

Historically, rainfall trends for the island unlike temperature experience interannual variability, that is, year-to-year and decadal variations which in part are explained by the El Nino/La Nina phenomenon. El Nino has been observed since the 1970s and lasts from 3 to 5 years, with increasing frequency and intensity. The El Nino phenomena produces drier and hotter than usual means (rainfall and temperature), resulting in the meteorological droughts experienced in the Caribbean in 2010 and 2014. In the early rainfall period following an El Nino event, the May to July period tends to be wetter. Generally, La Nina produces the opposite effects, that is, a wetter rainy season.

Considering these findings, the CSGM has the following major projections for rainfall in Jamaica to the end of the century.

- Dry season rainfall generally shows small increases or no change. Mean Increases are consistently between 1% and 4% across all time series examined. Given the small amounts of rainfall received at this time, the increases are not enough to offset the overall drying pattern.
- Regional Climate Model predicts the onset of a drying trend from the mid-2030s continuing into the 2050s and through the end of the century. The percentage decreases (over the grid boxes) for annual rainfall in the defined Blocks are as summarized in Table 3.[38]
- There is some spatial variation (across the country and even within Blocks), with the south and east showing greater decreases than the north and west for each time slice.

[38] Ibid.

Table 3 Range of Percentage Annual Rainfall Change across Grid Boxes comprising Four Rainfall Zones

	2020s	2030s	2050s	End of Century (2081-2100)
West	2.44 – 4.50	-10.11 – 34.37	-5.70 – 9.95	-13.23 – 6.09
East	-4.17 - -1.77	-13.91 - -8.82	-19.38 - -14.73	-28.09 - -22.91
Interior	-4.64 – 2.58	-24.84 - -3.89	-25.25 - -2.16	-37.03 - -9.70
Coasts	-18.44 - -6.97	-29.86 - -5.00	-31.24 - -1.26	-43.28 - -4.34

3.3.3 Sea Levels

Globally, mean sea levels have been increasing since the 1900s in the region of 0.19 ± 0.02 metres and are predicted to continue into the 21st century. This trend in sea level rise (SLR) is accelerating across the globe, although not uniformly, and there are large regional differences. In the Caribbean, there is a dearth of tide gauge data — currently there are only seven tidal measuring gauges across the region, which limits data collection and has implications for the precision of the predictive models. Despite this deficiency, there is sufficient data to support a prediction of an upward trend in SLR from 1950 to 2010 ranging from 1.3 mm to 2.5 mm/year.[39]

In Jamaica's case, over a period of approximately 18 years, sea level data measured at Port Royal shows an estimated increase of 1.66 mm/year. Additionally, satellite altimetry data across the country confirms a substantial rise in sea levels since the 1950s.

In summary, the future sea level rise within the Caribbean will not differ significantly from the global projections (Table 4).[40]

Table 4 Projected Increases in Global Mean Sea Level rise (m). Projections relative to 1986–2005

	2046 – 2065		2081– 2100	
Scenario	Mean	Likely range	Mean	Likely range
RCP2.6	0.24	0.17 – 0.32	0.40	0.26 – 0.55
RCP4.5	0.26	0.19 – 0.33	0.47	0.32 – 0.63
RCP6.0	0.25	0.18 – 0.32	0.48	0.33 – 0.63
RCP8.5	0.30	0.22 – 0.38	0.63	0.45 – 0.82

[39] Ibid., page 63, Table 32.
[40] Ibid.

For Jamaica, the projected sea level rise from RCMs for the north coast is 0.43 m to 0.67 m by the end of the 21st century, with a maximum of 1.05 m. The predictions are similar for the south coast.

3.3.4 Cyclones

The historical trends of Atlantic hurricane activity show significant increases in intensity, duration and frequency since the early 1980s. Between 1950 and 2014 Jamaica has been affected by 11 cyclones. These systems ranged from category 3-5 and between 2000 to 2010 there were 6 such cyclones demonstrating the increasing frequency and severity. The Intergovernmental Panel on Climate Change (IPCC) Special 2012 Report on Extremes offers five summary statements on cyclones.[41] These are:

Conclusion 1: There is low confidence in projections of changes in tropical cyclone genesis, location, tracks, duration, or areas of impact.

Conclusion 2: Based on the level of consistency among models, and physical reasoning, it is likely that tropical cyclone related rainfall rates will increase with greenhouse warming.

Conclusion 3: It is likely that the global frequency of tropical cyclones will either decrease or remain essentially unchanged.

Conclusion 4: An increase in mean tropical cyclone maximum wind speed is likely, although increases may not occur in all tropical regions.

Conclusion 5: While it is likely that overall global frequency will either decrease, or remain essentially unchanged, it is more likely than not that the frequency of the most intense storms will increase substantially in some ocean basins.

While there is a great deal of uncertainty with regards to the predictions for hurricane frequency, intensity and duration, Conclusion 5 indicates that "at the very least Jamaica should contemplate a future where tropical storm/hurricane genesis, frequency and tracks are similar to what has been experienced in the very recent past (last two decades) but intensities (rainfall rates and wind speeds) are increased."[42]

To a large extent, Jamaica's downscaled climate data is aligned with the global trends. However, the data is invaluable as it provides decision makers and practitioners with more specific rather than generalized data, which is essential for the planning and actions required to build Jamaica's climate resilience. The NFMCP has incorporated in its action plan activities that will investigate the effect of climate change on the country's forests, with a view to developing adaptation strategies. In addition, the plan recognizes the importance of forests to mitigating the impacts of climate change.

[41] Ibid.
[42] Ibid., page 75.

3.4 Co-benefits of Adaptation and Mitigation Actions in Building Climate Resilience

3.4.1 The Case for Adaptation

In August 2008, three hundred and thirty researchers, managers and decision makers from 50 countries gathered in Umeå, Sweden at a conference entitled 'Adaptation of Forests and Forest Management to Changing Climate with Emphasis on Forest Health: A Review of Science, Policies and Practices'. One of the key outcomes of the conference was an acknowledgement that "forest adaptation to future environmental or social conditions resulting from climate change may significantly alter how and why forestry is practised in many parts of the globe. With the climate, and as a result the environment, undergoing perceptible changes within the life span of trees, achieving sustainable forest management will increasingly resemble aiming at a moving target" (cited in Bernier and Schoene 2008).[43] In short, the participants underscored the need to incorporate adaptation to climate change in current forest management practices.

The rationale for this conclusion was clear. On the one hand, the researchers acknowledged that forests, the people, societies and economic activities that depend on them are sensitive to climate change. Additionally, forests contribute to human well-being through a range of services. In this regard, it was highlighted that wetland (mangrove forests and swamp forests) and tropical moist forests are likely to be affected by climate change. On the other, they agreed that forests also impact climate change as carbon sinks when they grow or expand. Against this background, the international scientists supported the proposal that forests in developing countries be considered a prime tool for climate change mitigation. Currently, activities addressing these issues include reducing emissions from deforestation and forest degradation in developing countries (REDD+) and conservation and enhancement of carbon stocks through sustainable forest management.

It is against this background that there is global agreement on the importance of adaptation of forests to climate change, while also recognizing that sustainable forest management will influence carbon sequestration by trees, conserve biodiversity and provide valuable ecosystems. That is, adaptation and mitigation are inextricably linked and the country should embrace the opportunity of developing strong adaptation and mitigation programmes. These conclusions are integral to Jamaica's NFMCP.

Jamaica faces three options for adapting forests to climate change: no intervention, reactive adaptation and planned adaptation. Given the country's vulnerability, no active intervention or business as usual — with management targets and practices based on the premise that the forest will adapt as it did in the past — is not an option. However, planned adaptation is challenging and involves redefining forestry goals and practices in advance in view of climate change-related risks and uncertainties. This would mean:[44]

- Identifying Sensitivities

[43] P. Bernier, and D. Schoene, 'Adapting forests and their management to climate change: an overview' (paper presented at the international conference on Adaptation of Forests and Forest Management to Changing Climate with Emphasis on Forest Health, Umeå, Sweden, August 2008. An FAO Publication).
[44] Michael Taylor, 3 Things About Climate Change and Jamaica (Kingston: CSGM).

- Species & climate thresholds, reserve locations, topography, infrastructure & access, etc.

- Determining what changes are as a result of a changing climate regime e.g. extinction, invasive species, more frequent destruction, wildfires, water quantity and quality, external threats from migration & urbanization, need for new livelihoods, etc.

- Identifying Priorities
  - Preservation, diversification, protection, restoration, targeted expansion, monitoring, etc.
- Identifying needs to pursue actions (mindful of what gaps exist)
  - Data & research, equipment, climate services, personnel, policy, training, strong links with other sectors, etc.

3.4.2 The Case for Mitigation

Prior to the Age of Industrialization there were 5.9 billion hectares of forests. Today globally, forests cover about 4 billion hectares or 31% of the world's land surface. Forests are carbon stores and most forests are found in the tropics. The different forest types as well as other biomass contain varying amounts of carbon. Globally, tropical forests contain the largest carbon stock (547.8 million tonnes) in tropical and subtropical forests.[45] Additionally, in tropical areas, mangrove forests and swamp forests contain particularly high levels of biomass in their vegetation cover and soils.

Given that forests contain substantial stores of carbon, their degradation and or conversion to other types of land use causes the release of some of the carbon stored within them. The level of emissions depends on the amount of carbon stored in the forest, the extent to which the vegetation covers and soil structure are damaged or destroyed, as well as what happens to the land afterwards. For example, high levels of emission will result if the vegetation is destroyed as is often observed in slash and burn agricultural practices.

The links between forests and the carbon cycle demonstrate that the forest sector can have a large positive impact on the removal of GHGs. The total amount of carbon dioxide in the atmosphere can be reduced by decreasing emissions from both deforestation and forest degradation. Maintaining standing forests can preserve their role as the terrestrial carbon sink and reforestation can increase the sequestration of carbon, thereby decreasing the overall levels of carbon dioxide in the atmosphere.

In Jamaica, forest restoration, through reforestation, afforestation and halting degradation, along with some degree of forest/tree cover is interspersed in areas with other land use types including urban spaces and small-scale agriculture — will all contribute to forest/tree cover acting as a carbon sink that directly contributing to the removal of carbon dioxide globally.

The IPCC reports that due to the combined action of natural land and ocean sinks of carbon dioxide, an average 55% of the total anthropogenic emissions were removed every year during the period 1958–2011.[46] This is a significant contribution to mitigating the impact of climate change, which is of great

[45] REDD+ Academy – Journal 1 Forest, Carbon Sequestration and Climate Change.
[46] IPCC 2013, AR5 WGI.

importance to Jamaica as a small island state. The current state of Jamaica's forests and the challenges and opportunities this presents to the management of the sector are outlined in the following section.

Against this background, the following sections of the NFMCP describe the status of land use in the country and discuss the potential impacts on the forest sector and how the NFMCP seeks to address these issues in and through the action plan.

3.5 Jamaica's Forest Cover

3.5.1 Land Use Assessment[47]

The land use/l change assessment in the 2001 NFMCP was conducted by the Agency in 1999 with the support of the Canadian International Development Agency (CIDA). That study reported an annual deforestation rate of 0.1% for the period 1989 to 1998. A more recent study, published in 2015, has benefited from improvements in technology in terms of high resolution satellite imagery and imagery analysis software and therefore provides more detailed and accurate classification of the forest types.

The 2015 study shows that 40% or 439,937.8 hectares of Jamaica's land is covered by forest.[48] This compares with 30% in 1998, an increase in forest cover for the country over the intervening sixteen years and is attributed mainly to the increase of secondary (ruinate) forest cover and to the improvement in technology and higher resolution satellite images which has resulted in more accurate assessments.

Of Jamaica's total forest cover, 59% is classified as broadleaf forest, which comprised closed broadleaf (19%) and disturbed broadleaf (40%) forests. Secondary (ruinate) forest experiencing even greater disturbance accounts for 28% of forest cover. Open dry tall limestone forest makes up 8%, mangrove forests and swamp forests contribute 3% and plantation forest accounts for 2% of forest cover (Figure 7).[49]

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[47] Forestry Department, Jamaica's Land Use Cover Assessment: A comparative assessment of Forest Change between 1998 & 2013 (Forest Resource Information Management Branch, GIS Unit, 2015).
[48] Does not include bamboo, which is now classified as a non-forest land use category.
[49] Ibid.

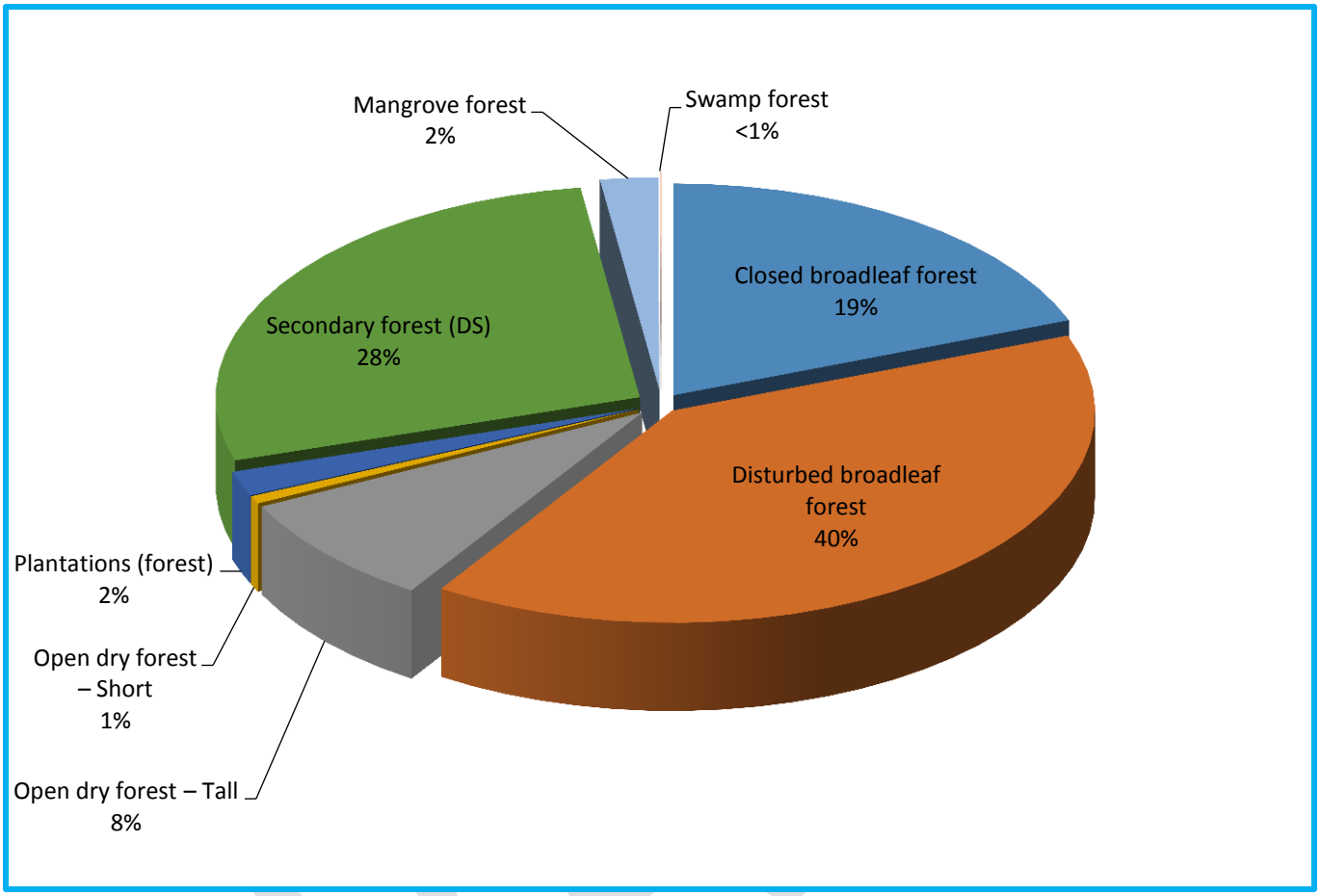

Figure 7 Forest Classifications (2013) at the National Level

For the period 1998–2013, there has been a 0.41% gain in forest, which has been attributed to gains in secondary and to a lesser extent plantation forests. This data is of great significance and even more so with respect to building Jamaica's climate resilience is the data regarding forest loss (Table 5).[50]

Wetlands, comprising mangrove forest and swamp, experienced a loss of approximately 95% or 2,100 hectares. This was largely due to agricultural activity, herbaceous wetland and infrastructure including buildings and roadways. Nine thousand five hundred (9,500) hectares of short dry forest were lost, and in the main these areas have been converted to bare land.

[50] Forestry Department, Jamaica's Land Use Cover Assessment: A comparative assessment of Forest Change between 1998 & 2013 (Forest Resource Information Management Branch, GIS Unit, 2015).

Table 5 National Land Use Change Assessment

Land Use/Cover Change in Jamaica: 1988 and 2013 (hectares)				
Forest Land Use /Cover >75% **Land Use/Cover Classification**	**1988 LU (hectares)**	**2013 LU (hectares)**	**Difference (hectares)**	**Per Cent Loss/Gain**
Forest Land-use / cover >75%				
Closed broadleaf forest[1]	88,230.5	84,636.6	-3,594.0	-4.1
Disturbed broadleaf forest	174,724.6	175,590.6	866.0	0.5
Open dry forest – Tall	41,998.5	37,559.7	-4,438.8	-10.6
Open dry forest – Short	12,104.0	2,615.1	-9,488.9	-78.4
Plantation	8,186.9	8,319.0	132.1	1.6
Secondary forest*[2]		40,436.9	40,436.9	
Mangrove forest	9,731.4	9,732.8	1.4	0.0
Swamp forest	2,247.0	122.9	-2,124.1	-94.5
Sub-total	**337,223.0**	**359,013.5**	**21,790.5**	**6.5**
Annual deforestation rate				0.4
Secondary forest*		80873.8		
Total Forest Cover		**439,887.3**		

The loss of tall open dry forest was 4,500 hectares, resulting in a cumulative reduction of 26% in open dry forest (refer to Figures 8 and 9). This is of significant concern to Jamaica as tropical dry forests are considered globally as the most threatened ecosystem when compared with moist forests. Additionally, there is limited understanding of their resilience to disturbance, which is critical to the development of conservation and management strategies[51] — a key consideration in the adaptation actions outlined in the NFMCP. In the broadleaf forest category, a 2.5% reduction was recorded in the reporting period.

[51] M. Nino, K.P. McLaren, and H. Meilby, et al., 'Long term changes in above ground biomass in a neotropical dry forest, Hellshire Hills Jamaica', *Plant Ecology* (2014).

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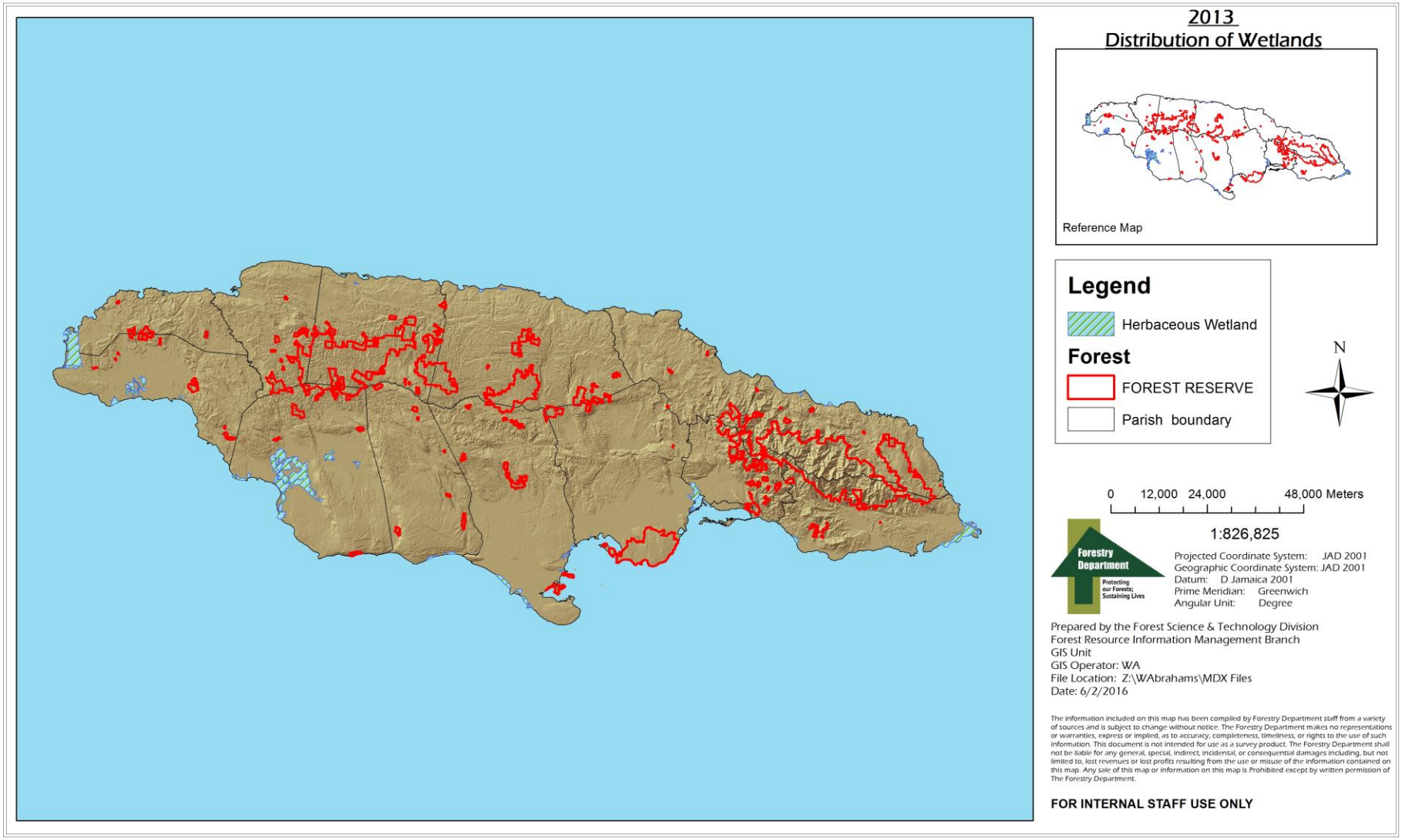

Figure 8 Distribution of Wetlands (Mangrove Forests and Swamp Forests)

The report also provides information on the location by parish of the various forest categories. Table 6[52] shows that 51% of the country's most valuable forest — broadleaf forest — is located across four parishes.

Table 6 Location of Majority of Broadleaf Forest by Parish

Forest Category	Portland (ha)	St James (ha)	St Thomas (ha)	Trelawny (ha)
Closed broadleaf forest	19,799.40	7,200.09	9,870.35	30,056.98
Disturbed broadleaf forest	14,713.02	20,260.9	10,349.33	20,977.67
Total	34,512.42	27,460.99	20,219.68	51,034.65
Percentage (%)	13.26	10.55	7.77	19.61

With regard to wetlands, swamp forests are now only found in the parish of Hanover and St Thomas and in the case of mangrove forest, 82% is found along the southern coast of the island.

The rate of deforestation within each parish is described and this information, coupled with the downscaled climate data provided in the CSGM January 2016 report, will continue to be invaluable in the planning and execution of mitigation actions.

Table 7 shows that St Ann, Hanover, Clarendon and Kingston experienced the greatest rate of deforestation, ranging from -1.16% to -0.02%. Of importance is not only the rate of loss but the category of forest types that have been reduced (Table 7).[53]

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[52] Ibid.
[53] Ibid.

Table 7 Annual Rate of Loss of Forests by Parish

	Forest Cover (Ha)				
PARISH	1998	2013	Difference (ha)	Deforestation Rate	Annual rate
St Ann	32,154.49	28,826.03	-3,328.46	-10.35	-0.65
Hanover	14,057.09	13,022.44	-1,034.66	-7.36	-0.46
Clarendon	35,379.62	32,858.66	-2,520.96	-7.13	-0.45
Kingston	221.71	221.04	-0.68	-0.30	-0.02
Trelawny	54,262.60	55,933.21	1,670.61	3.08	0.19
Portland	37,088.41	40,389.19	3,300.79	8.90	0.56
St James	26,452.71	28,770.56	2,317.85	8.76	0.55
St Andrew	9,187.08	10,596.27	1,409.19	15.34	0.96
St Elizabeth	23,618.98	26,155.34	2,536.35	10.74	0.67
Westmoreland	15,855.49	18,179.97	2,324.48	14.66	0.92
St Catherine	36,413.55	41,878.27	5,464.72	15.01	0.94
Manchester	17,364.70	19,208.22	1,843.52	10.62	0.66
St Thomas	23,543.49	29,087.09	5,543.60	23.55	1.47
St Mary	10,640.42	13,397.37	2,756.95	25.91	1.62
Total	336,240.33	358,523.64	22,283.31	6.63	0.41

The following section of the document explores how the predicted climate scenarios will affect the country's forest and how this information has been used to define the challenges and opportunities for the forest sector in the country's adaptation and mitigation actions.

3.5.2 Implications of Climate Change Projections for Forest Cover

Sea Level Rise

The projections supplied by CSGM show that there will be an increase in the sea level in the region of 0.24 m to 0.30 m (refer to Table 4) during the period 2046–2065. The map (Figure 9) shows the

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movement of the sea on the north and south coasts; but particularly on the southern coastline. Mangrove forests and swamp forests have been recommended as the more effective method of shoreline protection.[54]

The Land Use Cover Assessment Report shows that only 2% of the country's land cover is mangrove forest and that the country has lost 94.53% of its swamp forest.[55] Based on these data, the NFMCP has incorporated in its actions, adaptation plans to restore mangrove forest cover. While the change in sea level rise will be gradual, the projections suggest that significant impact will not be felt before 2040. This information, given the relatively slow rate of forest growth, provides the country with a twenty-year timeframe to take action, starting now, for the timely restoration of the country's mangroves as outlined in the NFMCP.

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[54] Bruno Locatelli and Emilia Pramova, Forests and Adaptation to Climate Change: What is at Stake? (Center for International Forestry Research, Indonesia, World Resource Institute).

[55] Forestry Department, Jamaica's Land Use Cover Assessment: A comparative assessment of forest change between 1998 &2013 (2015), page 13, Table 1.

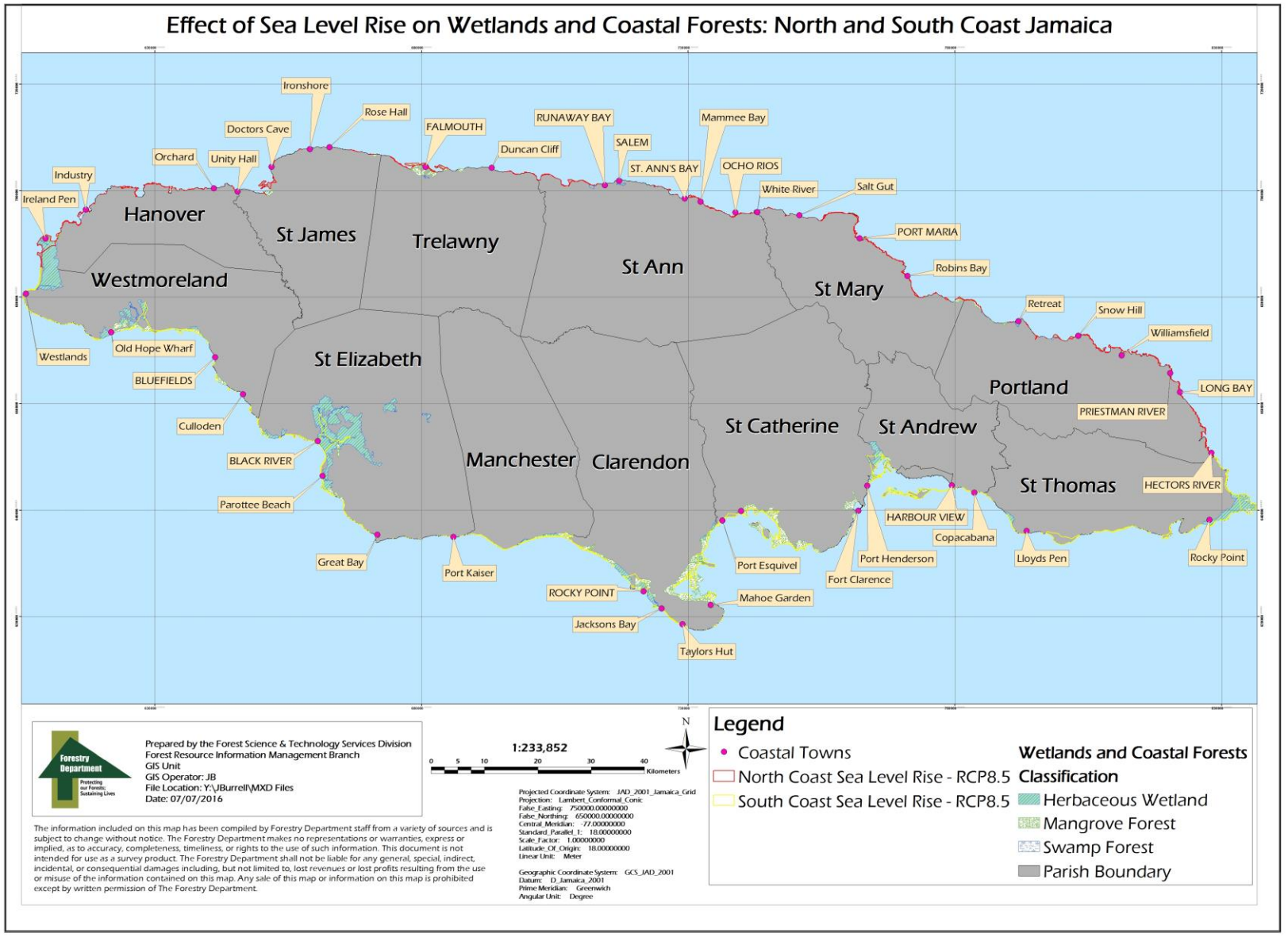

Figure 9 Sea Level Rise Prediction: Jamaica's Southern and Northern Coastline (RCP 8.5)

Rainfall and Temperature

The climate change projections show that there will be increases in temperatures and a drying effect. Of interest to the forest sector is that the increases in temperatures are most likely in the interior region where the country's forest reserves are located. There will also be less rainfall, particularly in the south east. Further, the southern coastline, which has significant areas of mangrove forests and swamp forests, will experience less precipitation. The maps (Figure 10 and Figure 11) show the projection in changes in mean temperature and rainfall across the country's forest reserves.

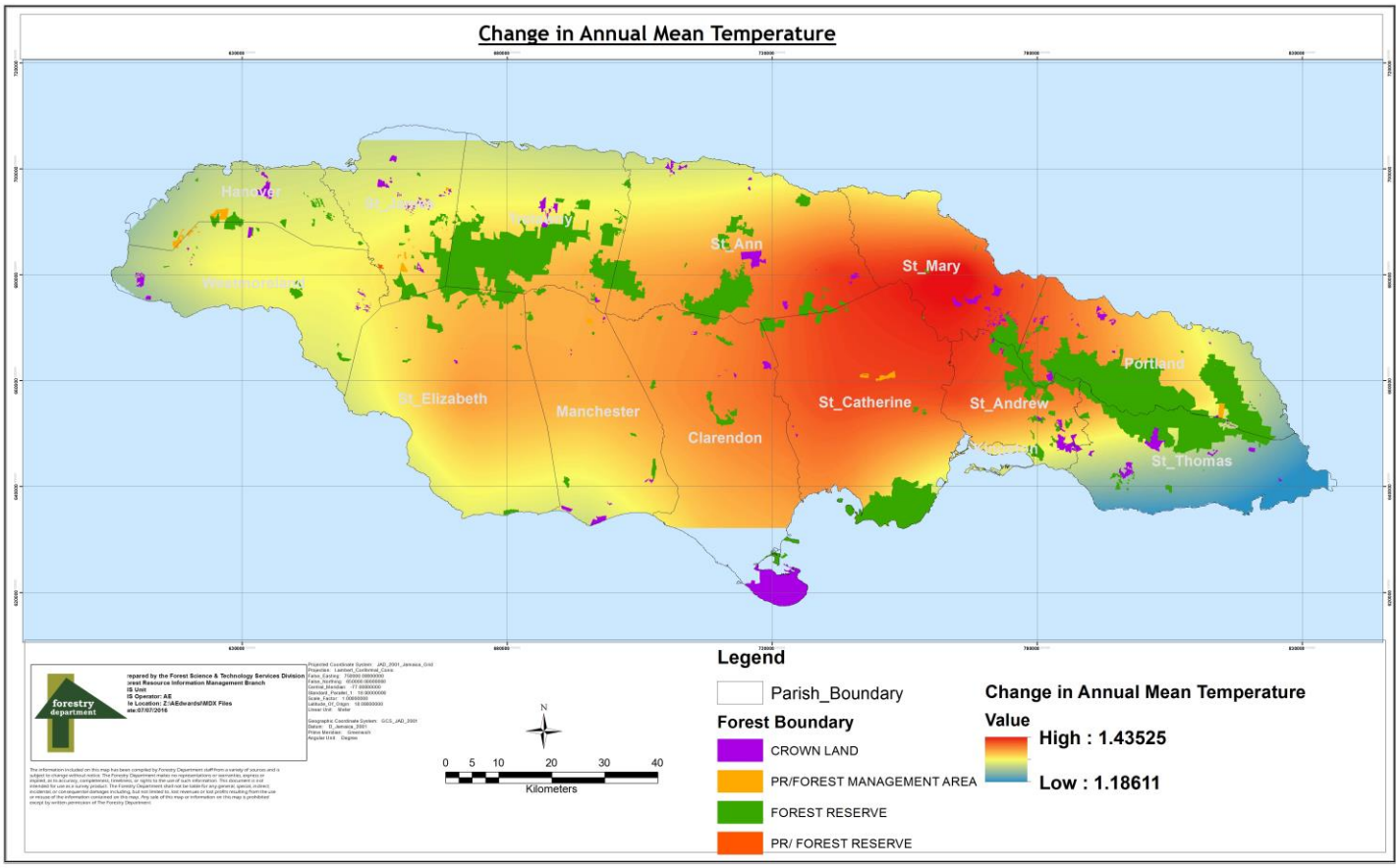

Figure 10 Climate Prediction Change in Annual Mean Precipitation

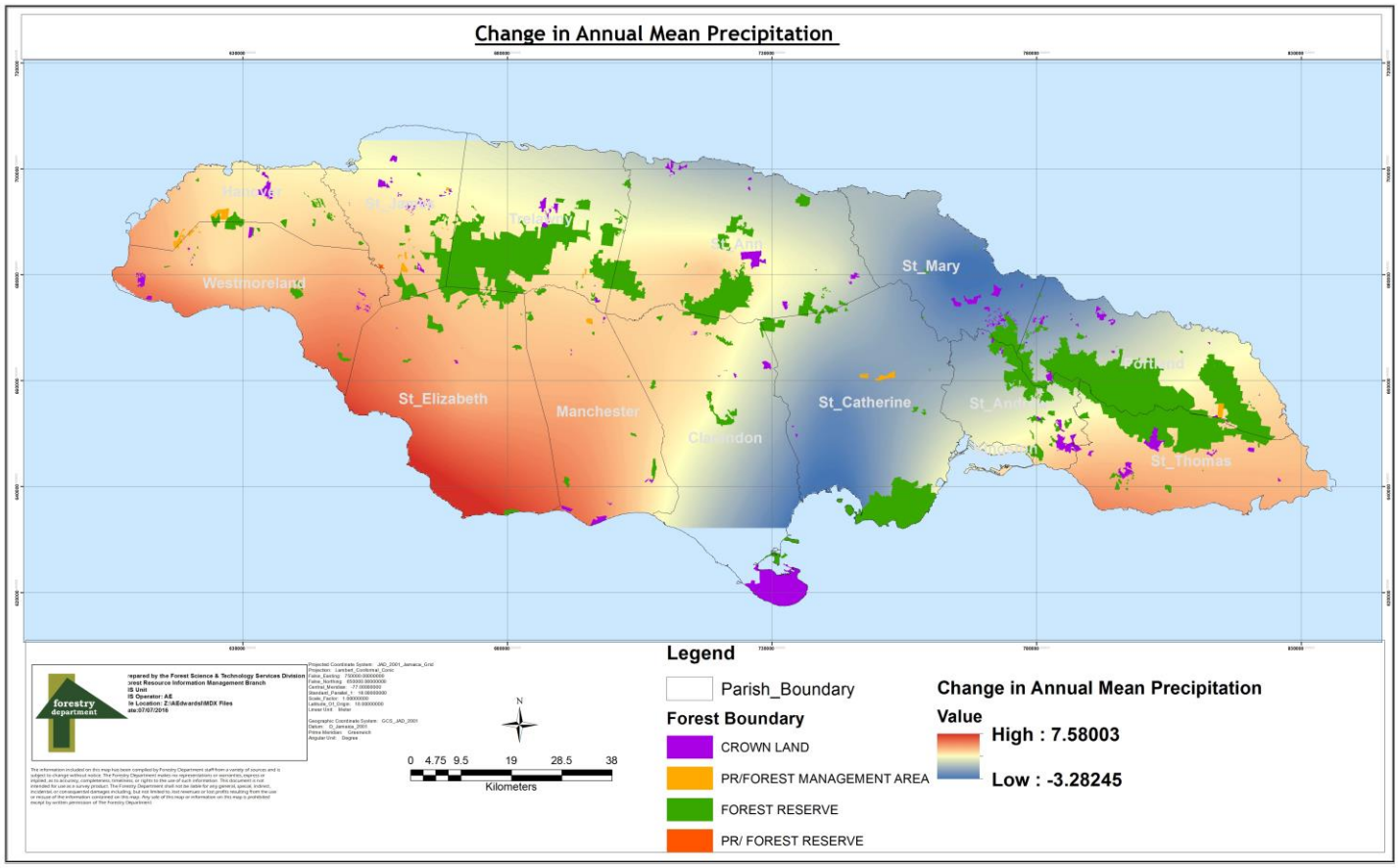

Figure 11 Climate Projection Mean Annual Precipitation

Given the importance of forests to the country's efforts to mitigate climate change and its ability to build climate resilience, the climate prediction models are of tremendous significance. On the one hand, the models confirm that our forests will be impacted. One the other hand, the models provide useful information for the Agency as it develops its plans for forest restoration. Climate models therefore will be an increasingly important planning tool during the implementation of the NFMCP.

The following sections of the document outline the principles which guide the execution of the plan, its management framework, and monitoring and evaluation and financial strategies.

4.0 The Guiding Principles of the Plan's Development

4.1 Guiding Principles

Given the complex and cross-cutting nature of sustainably managing forests, along with the many stakeholders and interested parties involved the process, the Agency has developed several guiding principles by which the Plan will be implemented. These are as follows:

Enhancing partnerships and encouraging authentic dialogue and participation among all stakeholders – This is a key consideration particularly as it relates to engaging private landowners, forest communities, NGOs and government agencies in a united vision on the sustainable management of forests.

Combating climate change – recognizing the impact of climate change on forests and sustainable forest management and contributing to climate change adaptation and mitigation strategies.

Implementing sustainable forest management including giving due consideration to emerging thinking on landscape restoration.

Forest finance – diversifying financing mechanisms for the management and conservation of the forest sector.

Increasing public education and awareness – abiding by its mantra, "It is the responsibility of each able-bodied Jamaican to join in this national effort to recapture the fast disappearing beauty of our country." This will only be possible through a vigorous and sustained effort to educate the various publics.

Enhancing the decision-making capability – through investments in developing staff capability, and expanding and supporting forest research.

Ensuring the alignment to Vision 2030 Jamaica – the National Development Plan.

Embracing relevant National Plan – taking into consideration, during the execution of work, the policies and guidelines set out in both the Protected Areas System Master Plan (PASMP) and National Biological Diversity Strategic Action Plan (NBSAP) among others.

Meeting International Obligations and Commitments – ensuring the Forest Sector supports the county's commitment to various multilateral agreements.

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4.2 The Management Framework

4.2.1 Adaptive Management

The need to align all the required elements of the plan with the required resources within specified time frames, while being able to respond to changes within the task environment makes the successful implementation of the NFMCP a complex undertaking. Given these considerations and the dynamic nature of the implementation process, an adaptive management approach has been adopted. Against this background, the management framework being used for the execution, monitoring and evaluation, and continuing improvement of the NFMCP is derived from a tried and proven management practice, which had its early beginnings from the Shewhart cycle and the Deming cycle;[56] both of which were developed from evaluation of management practices and the quality circle. Its four components are Plan, Do, Check and Act (PDCA refer to Figure 12).

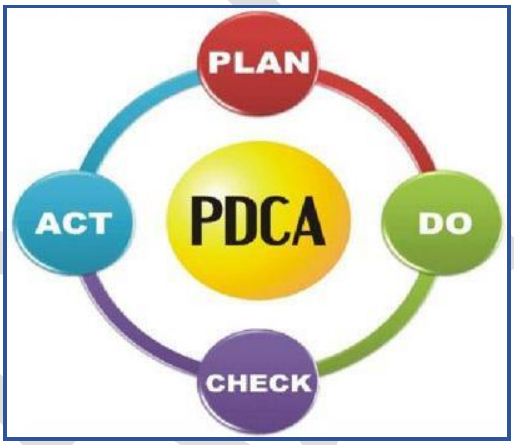

Figure 12 Representation of the PDCA Management Framework

In the plan phase (P), goals have been identified, the strategic pillars established and actions developed. In the Do (D) stage the actions are operationalized. For the NFMCP this has been achieved through work plans developed by each of the lead organisations. The operational work plans are linked to the SDGs, Vision 2030 Jamaica (2009) and the Medium Term Socio-Economic Framework. In the check phase (C) the outputs and outcomes of the plan will be monitored through key performance indicators (KPIs) in order to facilitate ongoing evaluation of the progress in implementing the NFMCP, its successes, problems or activities, which may need rethinking and revision. The final stage of this iterative management framework entitled Act, will integrate the learning from the implementation process into elements of the plan in order to strengthening ongoing activities and to facilitate an adaptive management approach. The PDCA cycle approach will guide the overall implementation of the NFMCP

[56] C.N. Johnson, 'The Benefits of PDCA', *Quality Progress* (2002). Accessed January 2016, www.qualityprogress.com.

by all the collaborating organisations. Table 8 provides a list of the lead organisations and their mandates.

Table 8 List of Lead Organisations and their Mandates

Entity	Mandate
Forestry Department (FD)	The Agency is the lead government entity responsible for the management of forests located on Crown lands. The goal of the Agency is to "Manage and conserve the forest resources of Jamaica for the benefit of present and future generations". The law mandates the Agency to establish rules on directing and controlling the exploitation of forest resources, promoting reforestation, conducting research, developing and implementing public education and awareness programmes, and developing recreational initiatives in forests.
National Environment and Planning Agency (NEPA)	NEPA was founded to carry out the technical (functional) and administrative mandate of three statutory bodies "the Natural Resources & Conservation, Authority (NRCA), the Town & Country Planning Authority (TCPA), and the Land Development & Utilisation Commission (LDUC)". Its mission is to promote sustainable development by ensuring protection of the environment and orderly development in Jamaica through highly motivated staff performing at the highest standard.
National Land Agency (NLA)	NLA was established to create a modern national land (spatial) information system to support sustainable development. Its mission is to ensure that Jamaica has an efficient and transparent land titling system, a national land valuation database, optimal use of government-owned land, and to develop the basic infrastructure to build a modern spatial information system, designed to support sustainable development.
Office of Disaster Preparedness and Emergency Management (ODPEM)	ODPEM provides the disaster management functions in Jamaica. Its operations are designed towards: developing and implementing policies and programmes for the purpose of achieving and maintaining an appropriate state of national preparedness for natural disasters and other emergency events; encouraging and supporting disaster preparedness and mitigation measures; providing early warning, emergency response, relief and recovery operations in emergency situations; advocating and supporting risk reduction measures; providing training in all areas of disaster management; promoting a greater national awareness for disaster management issues through public education and awareness; and conducting hazard identification and risk assessments.
Meteorological Service of Jamaica (MSD)	The Meteorological Service of Jamaica is a scientific division of the MEGJC and handles the business of meteorology. Its mission is to take full advantage of man's present knowledge of weather and climate; to take steps to improve significantly that knowledge; and to foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity.
Ministry of Economic Growth and Job Creation	MEGJC is the portfolio ministry for FD, NEPA, NLA and MSD; it provides policy direction for its agencies and has the primary responsibility of advancing the achievement of the country's prosperity through partnership, economic growth and sustainable development.
Ministry of Transport and Mining	The Ministry's primary responsibility continues to be the country's land, marine and air transport and the management of the mining sector.
University of the West Indies Mona – Department of Life Sciences	UWI Life Sciences Department is involved in research aimed at creating new knowledge to help solve the challenges facing our nation. Its research encompasses work on coastal forest nursery propagation to generate best practice manuals for nursery set up and management and the production of "head-started" coastal forest species for planting islandwide.
University of the West Indies Mona – Climate Studies Group	Formed in 1994, the Climate Studies Group, Mona (CSGM) is within the Physics Department of the UWI. There, physicists use the disciplines of equations of motion, thermodynamics, hydrodynamics, radiation and cloud physics to understand climate processes and engage in climate studies.

4.2.2 Establishment of a Collaborative Implementation Framework

The development of the Draft NFMCP was pursued in a consultative manner, giving due consideration to all parties who have a role in the execution of the Plan. The Agency is the lead organisation in its execution and has the responsibility for coordination and overall reporting. However, while being ultimately responsible for the Plan's implementation, the Agency is among several executing entities. Many key actions are the responsibility of other agencies, private landowners, NGOs and community groups and academia.

The effective implementation of the NFMCP is a complex undertaking with many actors involved from a range of sectors. Consideration must also be given to the many challenges for implementation ranging from financial resources and other resource constraints; conflicts related to land use; political considerations; often differing positions from interested parties; failure to communicate effectively; and frequent changes in the ground rules in the search for solutions.[57] In management literature, the implementation of the NFMCP would be classified as a Type 3 'wicked problem'[58] for which three possible approaches are posited. These are authoritative, competitive and collaborative.

Considering the cross-cutting nature of the NFMCP and the diversity and number of stakeholders that will play critical roles in its implementation, a collaborative management framework will be adopted. This is based on a belief that joint collective effort can accomplish more than independent action, resulting in a win-win scenario for all in solving the problem.[59] The GoJ is aware that collaborative strategies are associated with an increase in transaction costs: more people, more meetings and more time. There are also difficulties agreeing on operational procedures and the ability to achieve synergy with the working groups. Nevertheless, under the leadership of the Ministry of Economic Growth and Job Creation (MEGJC) over the period of implementation the necessary tools and experience will be developed during the plan's implementation to introduce a more effective participatory approach to decision-making and problem solving. This will require building the capacity across the entities to achieve effective collaboration, which is regarded as a key success factor in the plan's implementation.

The implementers of the NFMCP are aware of these issues and the groundwork for the development of this collaborative framework through the Technical Advisory Committee (TAC) which guided the development of the NFMCP is already in place. The enhancement of the framework is regarded as a key success factor for the implementation of the action plan and the MEGJC supported by the Agency will oversee the process. The Agency is charged with the responsibility of developing this framework and monitoring its effectiveness.

[57] N. Roberts, 'Wicked problems and network approaches to resolution', *International Public Management Review* 1, no. 1 (2001): 1–19.
[58] B.W. Head, and J. Alford, 'Wicked Problems: Implications for Public Policy Management', *Administration & Society* 46, no. 6 (2015): 711–39.
[59] D. Forrest, Extract, Doctoral thesis, University of Liverpool (unpublished – in progress, 2016).

4.2.3 Cross-Cutting Issues – Public Education and Capacity Building

The development of capacity of the lead organisations and participating stakeholders is a continuous thread through all the strategic pillars of the plan. The same is true for public education and outreach activities. Although the two issues have not been dealt with separately but are in fact integrated in all components of the plan, this approach does not diminish the importance of these areas, which are being given the highest priority. Representatives from these areas within the lead organisations will be incorporated in the development of work plans and take active and critical action during the implementation of the plan as part of a collaborative approach across the entities.

4.3 Monitoring and Evaluation

Monitoring and evaluation (M&E) is the C component of the PDCA management framework, which shapes the implementation of the NFMCP. A detailed report on the M&E framework is an annex to this document.[60] The key elements of the M&E programme are described below.

The NFMCP's M&E plan ensures that the lead organisations and targeted stakeholders can systematically generate, capture, utilize, and disseminate data and knowledge to strengthen the impact and effectiveness of the plan. The M&E Framework is designed to measure progress made towards the attainment of the NFMCP strategic objectives and evaluate related expected results and impacts for Jamaica's forest sector.

The M&E Framework is aligned to Vision 2030 Jamaica (2009), the MTF, as well as the UNFF Forest Instrument and the SDGs, and will operate with the following guiding principles.

- Consistency with Managing for Development Results (MfDR) and Results Based Management (RBM) principles.
- Balanced emphasis on learning, adaptive management and accountability.
- Practical and cost-effective processes.

A logical approach of output, outcome and impact indicators to ensure ongoing monitoring and evaluation of the goal, objectives and other strategic elements of the NFMCP has been used in the development of the framework, which is found below.

In the overall M&E plan,[61] a total of 97 indicators have been identified. The indicators are both quantitative and qualitative in nature and in keeping with the requirements of the NFMCP, are disaggregated along various considerations including gender, age and geographic location. Table 9 details the distribution of indicators across strategic and operational levels.

[60] Draft Monitoring and Evaluation Plan for the National Management and Conservation Plan, 2016–2026.
[61] Ibid.

Table 9 Distribution of Indicators at the Strategic and Operational Levels

Level of results	Number of indicators
Strategic	
Impact	4
Outcomes	18
Sub-Total	*22*
Operational	
Outputs	75
Total	**97**

Data sources to help measure the performance of the NFMCP will come from routine administrative data systems of the relevant entities, survey findings, research records, satellite data, special studies, public policies, external institutional reports and project reports. Various methods will be used for data collection including:

- document review of data sources and surveys;
- Interviews and focus group discussions with a wide variety of stakeholders in the forest sector;
- bio-physical survey data, including field surveys and satellite data; and
- public surveys.

While monitoring will be ongoing, and will inform and influence on the ground implementation and incremental changes, a midterm evaluation of the NFMCP will be a key tool used to evaluate progress and to institute any significant changes if required.

The detailed M&E Framework is attached as an annex to the NFMCP.

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Alignment			**Sustainable Development Goals (SDGs)** **Forest Policy**		**UN Forest Instrument**		**Vision 2030 Jamaica/MTF2015–2018 (National Outcomes #13 and 14)**	
								
GOAL			**Sustainably manage, protect, conserve, restore and utilize Jamaica's forest resources to enhance social and economic development and the building of climate resilience for current and future generations**					
NFMCP OBJECTIVES			**SO1:** Reverse the loss of forest cover in specialized types of forests by strengthening the legislative, policy, institutional and regulatory framework of the sector **SO2:** Reverse the loss of forest types at high risk for deforestation and degradation **SO3:** Increase forest cover through conservation and sustainable forest management practices **SO4:** Enhance forest-based economic, social and environmental benefits by contributing to the improvement of livelihoods in forest communities **SO5:** Build capacity of stakeholders of forests to protect, conserve and manage forest estates **SO6:** Increase public education and outreach to protect, restore, reforest and prevent forest degradation					
IMPACT			**JAMAICA FORESTS ARE SUSTAINABLY MANAGED, PROTECTED, HEALTHY, ECONOMICALLY VIABLE AND SOCIALLY BENEFICIAL TO ALL**					
STRATEGIC PILLARS	**Pillar 1: Forest Protection & Governance**	**Pillar 2: Adaptation to Climate Change**	**Pillar 3: Mitigation of Climate Change through forests**			**Pillar 4: Sustainable Development of the Forest Sector**		
OUTCOMES	**Outcome 1:** Strengthened governance, policy, legislative and regulatory framework to ensure protection of the forestry sector	**Outcome 2:** Increased resilience to climate change	**Outcome 3:** Biodiversity of forest ecosystems protected *(Forest Conservation)*	**Outcome 4:** Strengthened capacity for sustainable forest management to restore cover and improve forest health and vitality	**Outcome 5:** Increased contribution of forest resources and services to economic and social development *(Forest Utilization)*	**Outcome 6:** Improved coordination capacity among relevant stakeholders for forest research	**Outcome 7:** Strengthened institutional capacities for Measuring, Reporting and Verifying (MRV) deforestation and forest degradation	**Outcome 7:** Strengthened institutional capacities for Measuring, Reporting and Verifying (MRV) deforestation and forest degradation
OUTPUTS	**Output 1.1:** Forest Act amended **Output 1.2** Regulations developed for special recreational use permits, research permits, licence, and/or lease programmes **Output 1.3:** Forestry Department's input towards the revision and amendment of the Mining Act provided to the Ministry of Transport and Mining	**Output 2.1:** List of invasive plant and animal species in forested areas developed, maintained **Output 2.2** Invasive species control (management) plan designed and implemented **Output 2.3** Forest monitoring system using Permanent Sample Plots (PSPs) established **Output 2.4** Mangrove and swamp	**Output 3.1:** Species (pilot) conservation plans developed **Output 3.2:** Targeted species (giant swallowtail, yellow-and-black-billed parrot, water mahoe, and bitter wood) surveyed, mapped **Output 3.3:** Potential target species most relevant to the forestry sector for future	**Output 4.1:** Various types of forest fire assessments conducted **Output 4.2:** Fire-related public awareness and education programme designed, implemented **Output 4.3:** Fire suppression teams trained; established in high priority/high risk areas **Output 4.4:** Watershed vulnerability assessment conducted	**Output 5.1**: Improved availability of data for driving the growth and investment in the forest sector (the database includes information regarding growth and yield curves for primary commercial species and the related return on investment (ROI) **Output 5.2:** Sustainable	**Output 6.1** Working group established for research on management knowledge of mangrove forests, swamps and short limestone forests and on the impact of climate change on all forest types established **Output 6.2:** Research programme on non-timber	**Output 7.1:** REDD+ readiness Strategy completed **Output 7.2:** Activity 1 REDD+ readiness completed **Output 7.3:** Activity 2 REDD+ completed **Output 7.4:** Activity 3 REDD+ completed	**Output 7.1:** REDD+ readiness Strategy completed **Output 7.2:** Activity 1 REDD+ readiness completed **Output 7.3:** Activity 2 REDD+ completed **Output 7.4:** Activity 3 REDD+ completed **Output 7.5:** Activity 4 REDD+ completed

	Output 1.4: Database of private forest landowners created and maintained **Output 1.5:** Incentives programme reviewed/evaluated **Output 1.6:** Support for the development of Parish Development Orders provided **Output 1.7** Boundary verification programme implemented **Output 1.8:** Outreach programme for private farmers developed and evaluated on an ongoing basis **Output 1.9:** Crown lands transferred by Commissioner of Lands to the Forestry Department for sustainable management **Output 1.10:** Recommendations implemented on the Review of the role and function of Local Forest Management Committees study **Output 1.11:** Cross sectoral mechanism established for integrating the Forest Sector into relevant national decision-making processes	forest assessed, mapped **Output 2.5:** Mangrove and swamp forest management plan developed; implemented **Output 2.6:** Gap analysis conducted identifying spatial data and other information to better map risks and vulnerabilities of forests and communities to climate change and related hazards (e.g. fire, floods, landslides)	conservation efforts identified **Output 3.4:** Spatial representation of disturbance within broadleaf category developed **Output 3.5:** Plan to protect disturbed broadleaf on FD lands with the most potential to regenerate over the long term developed and implemented **Output 3.6:** Education programme developed to strengthen the public's understanding of the benefits of forests and its resources, the importance of sustainable forest management and conservation practices	**Output 4.5:** Watershed restoration plan developed,[62] implemented **Output 4.6:** Best management practices for riparian forests along rivers and streams within forest estates developed **Output 4.7:** Nursery programme implemented; evaluated **Output 4.8:** Reforestation programme to include forest estates and privately-owned lands implemented **Output 4.9:** Lands verified and mapped in the private lands reforestation programme **Output 4.10:** Cluster Forest Management Plans (FMP) developed **Output 4.11:** Existing forest inventory approach reviewed and revised to support Carbon Stock Monitoring (CSM) and potential carbon trading agreements **Output 4.12:** Training in silviculture conducted **Output 4.13:** Weather stations placed in strategic locations within forested areas in order to garner additional data to support sustainable forest management practices **Output 4.14:** Impact assessment of mining and other permitted activity on forest goods, services, and values over time conducted **Output 4.15:** Training programmes for natural resource/ecosystem valuations (NRVs) for all types of forests conducted **Output 4.16:** Programme developed for payment of ecosystem services within forested areas **Output 4.17:** Appropriate guidelines developed for the establishment and maintenance of trees in urban settings; for cultural, aesthetics and shade purposes	harvesting programme developed **Output 5.3:** Market surveys conducted to identify producers and consumers of non-timber products **Output 5.4:** Economically viable non-timber market opportunities developed **Output 5.5:** Information about economically viable and resilient wood product species disseminated **Output 5.6:** Recreation sites rehabilitated **Output 5.7:** Recreational trails identified and mapped **Output 5.8:** Feasibility studies conducted to identify and establish new recreational sites and trails **Output 5.9:** Cultural and heritage sites on forest reserves and FMAs identified **Output 5.10:** Guidelines for the use of cultural and heritage sites developed **Output 5.11:** Alternative livelihoods in forest communities promoted **Output 5.12:** Access to funding to LFMCs and CBOs facilitated for the development of alternative livelihoods **Output 5.13:** School education and awareness programme designed and implemented	forest resources developed	**Output 7.5:** Activity 4 REDD+ completed	

[62] Following the conduct of vulnerability assessment.

From													
Cross-cutting			**Public Education & Outreach**		**Capacity Strengthening**		**Coordination and harmonization among stakeholders**				**Resource Mobilization**		

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4.4 Financing Strategy

4.4.1 Key considerations

Forests are one of the most important natural resources spread across the globe and more than a billion people, often the poorest and mostly living in the tropics, depend upon it for food, fuel and housing. This is certainly the case in the Jamaican experience, and yet despite the contribution of forests to livelihoods, the generation of goods and services, and ecosystem services, according to the Food and Agricultural Organisation (FAO) the investments in forests globally has been disappointing.[63] The reasons for this persistent problem were revealed in a policy study carried out with the support of the FAO. The researcher concluded:

> where forests do not fetch adequate financial value or an opportunity cost that satisfies the forest landowners or important stakeholders they tend to disappear. The central issue that faces forestry in general and sustainable forestry in particular is that earnings from existing forests are not competitive with other services produced by forests.
>
> (van Dijk and Savenije 2009)

More recently, through the work of the UNFF, who in 2007 decided to mobilize resources to support the implementation of sustainable forest management, an Ad Hoc Expert Group on Forest Financing for implementing SFM in all types of forests was established. Additionally, UNFCCC through its REDD+ programme is developing financial mechanisms, as too are the UNCCD and UNCBD. There are also opportunities through the Green Climate Fund. Locally, the TEF, the Forest Conservation Fund (FCF), other foundations and the Global Environment Facility Small Grants Programme (GEF SGP), along with bilateral donors are also potential sources of funding for the forest sector.

The Agency is aware of these funding opportunities and the NFMCP has developed financing strategies for the sector based on a consideration of the following key success factors.

- **Role and policy prescriptions of the GoJ and its relevant entities –** based on a commitment to optimize the production of forestry goods and services, providing equitable benefits to all stakeholders while ensuring the value of the forests are enhanced rather than diminished in economic and ecological terms. In this regard, the GoJ has committed through the strategic pillar of Governance and Protection to create a well-coordinated, effective policy framework through the passage of the Forest Policy (2016) and the strengthening of laws within the FD and related institutions.

- **Safeguarding the interests of rural communities –** through the strengthening of LFMC by improving protection of the forest, addressing land tenure issues and diversifying income earning opportunities through the development of non-timber resources, recreation activities and ecotourism. The LFMCs are important partners in the protection of the forests but it is expected that these rural communities earn a regular and decent income as a supplement to

[63] P. Kant, and S. Appanah, 'Guidelines for Formulating National Forest Financing Strategies' (FAO Regional Office for Asia and the Pacific, 2013).

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their other incomes and in this respect, seek government help in raising and or identifying finances for expanding forest utilization in a sustainable way.

- **Incorporating Payment for Ecological Services in forest financing strategies –** this is a complex and multidimensional undertaking incorporating Payment for Environmental Services through the ecological benefits of well-managed forests — biodiversity conservation, water regulation and quality, soil conservation, and ecotourism which entails, among other considerations, developing capacities for natural resource valuation, a key activity in the plan. Additionally, the Payment for Ecological Services schemes aim at taking advantage of the new marketplaces emerging or services such as carbon sequestration, biodiversity conservation, watershed protection and landscape value, which are addressed in the actions under the strategic pillar Sustainable Development of the Forest Sector.

- **Private investment as a component of national forest financing –** most of the country's forests are privately owned and as such there is an acknowledgement in the plan of the importance of the private sector as a player in national forest financing. This is an embryonic area in the management of the forest sector in Jamaica but going forward is viewed as a key requirement for sustaining healthy forests.

Considering these issues the following strategies will be undertaken to secure sustainable financing for the forest sector.

Promoting forestry investments as attractive for the economy

- ✓ Initiate actions to bring forests under intensive management by assisted natural regeneration, soil and moisture conservation measures, protection against fire, weeds, pests and disease, forest infrastructure, ecotourism, research and monitoring. These activities generate jobs while being ecologically desirable and lead towards Sustainable Forest Management.
- ✓ Give high priority to climate change mitigation and adaptation action in the forestry sector as an avenue for attracting finance, technology and management skills.
- ✓ Train forest staff and forest stakeholder communities in these activities.
- ✓ Raise awareness of the need to manage the forests sustainably and in harmony with the local economy.
- ✓ Make a good assessment of the conservation status of fauna and flora through capable organisations, put it through a public stakeholder process and then decide on the extent of public forest lands that are required to be placed under strict conservation.
- ✓ Assess the need for forestry professionals and encourage universities and specialized forest and forest-related institutions to initiate new educational and vocational courses in the locally relevant fields.

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Ensure forest investments and programmes are compatible with REDD+ and other international mechanisms

- ✓ Access the actual and promised funds under REDD+ for adaptation to climate change, enhancing renewable energy production and access to it, protecting biodiversity, combating desertification and in meeting their SFM objectives.
- ✓ Explore the possibility of insuring forests against fires and disease outbreaks under provisions of financial and technical assistance in international agreements for REDD+, adaptation to climate change, desertification control and biodiversity conservation, etc.

Promote non-timber forest products as economically attractive for investors in forestry

- ✓ Regulate access to forests estates for sustainable harvesting of non-timber products.
- ✓ Develop viable mechanisms for collection and dissemination of information regarding prices, import, export and domestic trade of non-timber products.

Integrating PES in the economics of forestry

- ✓ Initiate stakeholder consultations in partnership with other entities around the concept of payment for ecosystem goods and services across various ecosystems and communities.
- ✓ Develop valuation tools for ecological services through extensive research, and a wide stakeholder consultation process, to enhance their quality and market acceptability.
- ✓ Involve trusted and neutral intermediaries to bring sellers and buyers together in agreeing on environmental services targeted, the level of payments, and contract terms for the successful development of PES schemes.

Sourcing energy funds

- ✓ Align NFMCP with GoJ renewable biomass-based energy policy and identify wood resources for this purpose spread across the rural areas without harming the important task of biodiversity conservation.
- ✓ Seek assistance from the International Energy Agency (IEA) for this purpose if own resources are insufficient.

Harmonizing laws and policies

- ✓ Identify formal laws, rules, and bureaucratic practices that discourage investments in tree planting through a committee of cross-sectoral experts and seek to reform where applicable.

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Addressing the issue of the long gestation of forestry investments

- ✓ Develop a long-term vision for forestry through a bipartisan political approach at the national and rural levels, and link forest-related policies to this long-term vision.

4.4.2 Identification of Sources of Financing

It is estimated that financing the NFMCP requires …million United States dollars. In this regard, several funding sources both local and international have been identified.[64] These can be broken down as: (i) government funding, (ii) official development assistance (ODA) through bilateral and multilateral donors, (iii) Green Climate Fund, (iv) the Adaptation Fund, (v) payment for environmental services, (vi) private sector investment, and (vii) foundations.

Under each of the four strategic pillars sources for funding have been identified for the NFMCP.

A. Governance and Legislation

Government	ODA/Donors	Local Interests
•Budget Allocations relevant entities	•UNFF •USAID •UNDP •JCCC	•Private Owners •DBJ

B. Adaptation to Climate Change

Government	ODA/Donors	Local Interests
•Budget Allocations relevant entities	•World Bank/IDB • Adaptation Fund •GEF/UNCBD	• Forest Conservation Fund •DBJ

C. Mitigation of Climate Change

[64] Peter Gondo, Ad Hoc Expert Meeting on Forest Financing, 'Financing Forestry in Africa', African Forest Forum, January 14–18, 2013.

Government	ODA/Donors	Local Interests
•Budget Allocations relevant entities	•World Bank/IDB/CDB • UNFCCCGreen Climate Fund •UNFF/UNCCD/FAO •PES	• Forest Conservation Fund/Other Foundations •TEF •Private Sector

D. Sustainable Development Forest Sector

Government	ODA/Donors	Local Interests
•Budget Allocations relevant entities	•UNFCCC/UNREDD REDD+ •World Bank/IDB • UNFCCC Green Climate Fund •UNFF/UNCBD/UNCCD	• Environmental Foundation of Jamaica/Other Foundations •Private Sector

The detailed financing strategy is attached in the annex to this document.

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SECTION B

Protection of the Forest Sector

5.0 Governance and Legislation

5.1 Policy and Legislative Framework

The strengthening of forest law enforcement and monitoring will be a key activity that is central to achieving the results which are projected in the NFMCP. The forest sector already has several key policy and legal instruments for management including:

- The Forest Act 1996
- The Forest Regulations 2001
- The Forest Policy (2016)

Nevertheless, given the complexity of the Action Plan, the number of hectares of forest, which are privately owned and the number of other pieces of legislation that influence and impinge on the execution of the NFMCP, the issue of the quantity of forests owned by private interests will require substantial effort and has been identified as critical for the success and implementation of the plan. There will also be need to strengthen the enforcement activities in forest estates through more precise mapping of boundaries and the control of squatting.

In addition to the strengthening of the legislative framework, a key strategy for achieving protection of the country's forests will be the development of a programme of incentives for private landowners whose lands are in forests. The role of LFMCs will also be critical to the successful protection of forests as these communities have vested interest in their sustainable management. In this regard, efforts will continue to improve the governance framework of these committees in order to enhance their overall effectiveness.

Further, the protection of the forest will require inputs at the highest level of decision-making in national development. A key NFMCP action to be implemented, in close collaboration with the MEGJC, PIOJ and the Vision 2030 Jamaica structures and processes, will be the development of mechanisms for better coordination with cross-sectoral policies and programmes. These will facilitate consideration of the NFMCP in all decisions that may affect the forest sector as well as alignment between other relevant policies, programmes and plans, and the NFMCP.

The section below details the proposed actions regarding protection of forests that will be undertaken from 2016 to 2026.

5.2 Actions and Responsible Agencies

The actions will focus on identifying private forest landowners and developing programmes to incentivize investment in forests by the private sector. Forest boundaries of state-owned lands will be determined and enforcement strengthened. Several laws will be amended to expand the Agency's and its partners' ability to protect forests and encourage landscape management.

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While the Agency will have overall responsibility for the execution of these actions, the lead Ministry will be the Ministry of Economic Growth and Job Creation (MEGJC). All the entities with a lead or supporting role — FD, NEPA, NLA — report to the MEGJC, with the exception of the Ministry of Transport and Mining (MTM).

The actions are detailed in Table 10.

Table 10 Actions for Protection

Action #	Action	Start and End Date	Responsibility	KPI Link	Key Risks/Assumptions
PROTECTION					
1	Amend the Forest Act and its regulations along with related legislation to ensure harmonisation in order to: (i) fill existing gaps in the current act; (ii) add additional offences; and (iii) improve the Agency's ability to protect, and regulate the forested areas.		**MEGJC and FD**, CPC, TCPA (NEPA), Cabinet Office	Amended Forest Act approved, promulgated	**RISK**: Length of time taken to revise legislation. Final process outside Agency control
2	Develop regulations that permit and license activities such as: special recreational use, research and lease programme, and permit the use of performance bonds.	2018-2019	**MEGJC**, **FD,** NEPA, Cabinet Office	Number of regulations for special recreational use permit, research permits, licence, and/or lease programmes	**RISK**: Untimely & unfavourable response from the Minister
3	Collaborate with Ministry of Transport and Mining to provide input to the revision and amendment of the Mining Act as it relates to the forest sector.	TBD	**MTM,** FD, MGD	Mining Act amended	
4	Create and maintain a database of private forest landowners; to facilitate effective communication regarding the management and availability of incentive programmes for broadleaf, mangrove, swamp and open short dry forest types.	2017-2020	**FD**, NLA	Number of identified private forest landowners whose profiles are included in database	**Risk:** Failure of Agency's ICT hardware. Corruption of data. Unreliability and unavailability of corroborating data from NLA

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5	Review the administrative procedures and evaluate the financial and non-financial offerings for the incentives programme and utilization of findings to strengthen the programme, improve the attractiveness of the incentives and generally improve its efficiency and effectiveness.	2016-2020	**FD**, MOFP, NEPA, Parish Councils and PDCs	Review of incentive programme conducted (*Yes/No*). Number of incentives (new or revised) available to private landowners	**Risk:** Activity started in FY 2016 with development of SOP. Inability to determine suitable incentives. Lack of funding for financial incentives. Rejection of proposed incentives by the target group
6	Collaborate with NEPA in the preparation, revision and updating of the Parish Development Orders, giving due consideration and placing high priority on forest resources.	TBD	**NRCA Forward Planning Committee (NEPA)**, FD, Parish Councils and PDCs	Number of Parish Development Orders updated	
7	Expand and accelerate the boundary verification programme for forest estates.	2016-2020	**FD**	Number/percentage of forest estates or regions covered in the boundary verification programme	RISKS: Activity needs to be projectized to be completed. Funding a major constraint.
8	Develop outreach programme for private forestry programme participants and evaluate the programme on an ongoing basis.	2017-2026	**FD**	Number of private farmers participating in outreach programme. Status of implementation of private farmer outreach programme	Support for programme not sufficient
9	Transfer by the Commissioner of Lands, crown lands to the Forestry Department for the management of mangrove forest and swamp.	TBD	**NLA,** FD	Existence of signed mechanism permitting Agency's management of mangrove forest and swamp on crown lands (*Yes/No*)	

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10	Implement the recommendations of the 'Review of the role and function of Local Forest Management Committees' study commissioned in 2015 to strengthen the governance and decision-making processes as it relates to LFMCs.	2017-2018		Number of recommendations from the 'Review of the role and function of Local Forest Management Committees' implemented	**RISKS:** Delays with submission from consultant. Report which was due from 2015 has not yet been received
11	Implement in collaboration with the National Development Plan process and linked to the Medium-Term Framework, a cross-sectoral mechanism for integrating the Forest Sector into relevant national decision-making processes that support sustainable forest management, the building of the country's climate resilience, and the implementation of the NFMCP.			Existence of cross sectoral mechanism (including NDP mechanisms) for integrating the Forest Sector into relevant national decision-making processes (*Yes/No*)	

5.3 Monitoring Framework and Financial Strategies

The details of these components are found in the annex to this document.

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SECTION C

Forests and Adaptation to Climate Change

6.0 Adaptation to Climate Change

6.1 Overview

The Agency and other stakeholders recognize the importance of and co-benefits of both adaptation and mitigation actions for building the country's climate resilience (refer to Section 3.5). However, for the purposes of structure, the adaptation and mitigation actions have been presented in different sections of the document.

Many of the considerations for adaptation will require new and refocused forest research and will be discussed in Chapter 8 of the NFMCP, which deals with the sustainable development of the forest sector.

Additionally, Jamaica's forests have experienced higher temperatures and decreased rainfall (refer Section 3.4.2) and this trend will continue. Sea levels are projected to rise from a mean of 0.24 to 0.30 metres according to the various RCP models (refer to Table 4) resulting in raising water salinity in mangroves and other coastal forested wetlands. Against this background, the NFMCP adaptation actions, where adaptation is defined as a "recognition of the inevitability of present and upcoming change and advocates pursuing options to facilitate resilience and sustainability despite the changed climate",[65] has focused on conserving wetlands, mainly mangrove forests and conserving short dry limestone forests.

6.2 The Actions and Responsibilities

Adaptation actions are aligned to UNFF's global objectives; of which the overarching objective is to "reverse the loss of forest types at high risk for deforestation and degradation due to the impact of climate change and other factors."

The action items are detailed in Table 11 and subsequent segments of the chapter will provide information on the monitoring and evaluation, and financing of the activities over the next ten years.

The adaptation activities are focused on the identification and management of invasive species; identification, restoration and management of mangrove forests and swamp forests; adaptation of tree species to climate change; and conservation of dry lime stone forests.

In respect of mangrove forests and swamps, it is generally agreed in the scientific community that natural systems are the most cost-effective method of shoreline defence. Mangroves and swamps are

[65] Ibid.

part of nature-based solutions for protecting shorelines from storms and floodplains from absorbing excess water runoff.[66] These natural services performed by mangrove forests as part of the 'living shoreline' have an infrastructure-like function. Given that shoreline protection services of mangrove and coral ecosystems are particularly valuable, during extreme weather events such as cyclones, the action plan is to a large degree focused on protection and restoration of these forest types as a key part of the strategy to adapt to climate change. The matter is urgent as seen in Figure 9, which shows the impact of sea level rise on the country's coastline due to the proportion of the country's population and infrastructure that is located in coastal areas.

Invasive species will be investigated with a view to finding means of better control or eradication. Additionally, adaptation of tree species to climate change will be investigated as well as the impact of sea level rise on the mangrove forests and swamp forests.

Successful implementation of these actions will require coordination and collaboration between the key actors, that is, the AGENCY, University of the West Indies (UWI) Life Sciences Department, NEPA and the IOJ. The need for additional research in this area is acknowledged and further discussed under the strategic pillar of Forest Research.

6.3 Monitoring Framework and Financial Strategies

The details of these components are found in the annex to this document.

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[66] IUCN, https://www.iucn.org/content/building-climate-change-resilience-through-water-management-and-ecosystems

Table 11 Actions for Adaptation

Action #	Action	Start and End date	Responsibility	KPI Link	Key Risks/Assumptions
ADAPTATION TO CLIMATE CHANGE					
1	Develop and maintain list of invasive plant and animal species in forested area and design and implement a plan for control of these species.	2017-2018	**FD,** NEPA, IOJ, UWI	Up-to-date invasive species list in place (*Yes/No*)	**RISK:** Unfavourable weather conditions can significantly delay completion of activity
2	Establish a forest monitoring system using Permanent Sample Plots (PSPs) to investigate and determine how the forested ecosystems are being impacted by climate change and develop adaptation strategies over time.	2016-2019	**FD,** UWI Academia	Existence of forest monitoring system using PSPs to investigate and determine how climate change impacts the forested ecosystems *(Yes/No)* Number of climate change adaptation strategies with respect to forested ecosystems developed	**RISK**: Unavailability of funds. Loss of PSPs due to unforeseen changes in Land use
3	Assess and map mangrove forests and swamp forests, rate the condition of the areas and identify and map other areas likely to provide suitable habitats for these species in the likelihood of sea level rise.	2017	**UWI,** NEPA, FD and NGOs managing protected areas	Number of mangrove forests and swamps that are mapped	**RISK**: Length of time taken to revise legislation. Final process outside Agency control

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4	Collaborate in the development of a mangrove forest and swamp management plan.	TBD	**NEPA, FD**, **UDC** MEGJC- ERMD, UWI, IOJ, NGOs	Number of mangrove forest and swamp management plans developed. Rate of implementation of mangrove forest and swamp management plan (0) *Not Applicable or not addressed;* (1) *Highly Unsatisfactory: Less than 25% of the recommendations implemented;* (2) *Unsatisfactory: Between 25% and 50% of the recommendations implemented;* (3) *Satisfactory: Between 50% and 75% of the recommendations implemented;* (4) *Highly Satisfactory: More than 75% of the recommendations implemented*	

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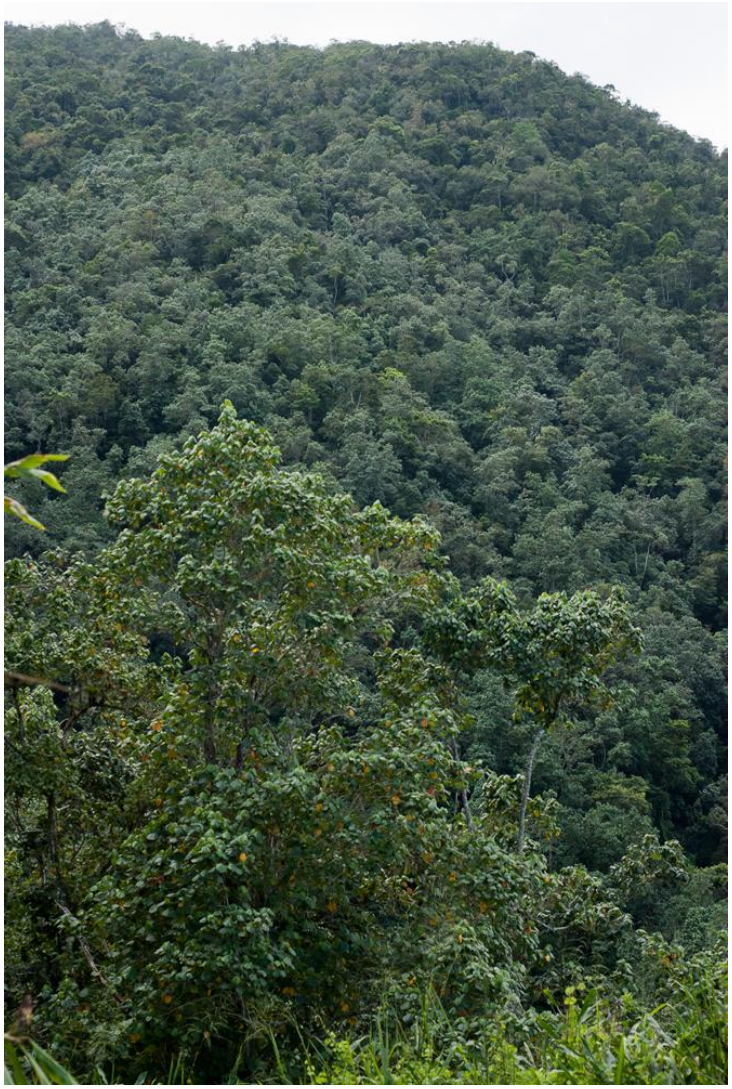
SECTION D

Forests and Mitigation of Climate Change



7.0 Conservation, Sustainable Forest Management and Forest Utilization

7.1 Overview

The worldwide concern about the global effects of climate change has drawn attention to tropical forests, both as sources of atmospheric heat-trapping gases when they are degraded or destroyed and as sinks for these same gases when they are well-managed or restored.[67] Improved forest management is considered by international policymakers as a way to mitigate climate change and this consideration is shared by the decision makers in Jamaica.

As part of an approach to preserving forest cover there is also a concern for conserving the country's biodiversity. Jamaica's forests are vital for conserving the country's rich biological heritage. Loss of forest cover or the degradation of forests will threaten the country's biodiversity due to loss of habitats. Additionally, in the future, biodiversity loss will likely be exacerbated by the impact of changing climatic conditions, which result in further losses of habitats, especially in highly fragmented landscapes that prevent species migration. These issues are addressed under the strategic pillar of forests and mitigation of climate change as outlined in the chapter.

In this regard, the main areas of focus within the NFMCP will be, improving sustainable forest management, reducing deforestation, reducing forest degradation particularly through the control of forest fires, and increasing sustainable forest utilization. These actions will simultaneously contribute to protecting biodiversity, preserving ecosystem services and enhancing social welfare.

Against this background, the Agency will strengthen its current sustainable forest and landscape management approach. In the first instance, the Agency will work to improve its silvicultural capacity and approach, which is arguably the most important step towards sustainable forest management — and the most effective way to retain carbon in managed stands even as a large reforestation programme is undertaken. Furthermore, in building the nation's climate resilience, forest fire management will be key. Failure to control fires results in large quantities of carbon dioxide being released into the atmosphere. So, controlling forest fires is a critical activity in achieving the sustainable management of forests. The result of a successful forest fire prevention and containment programme will be the preservation of forest cover, while simultaneously preserving biodiversity, protecting stocks of timber and other forest products while avoiding the many health problems associated with smoke. In the NFMCP, the Agency will focus on developing risk profiles for forest fires in forest estates and training and equipping local communities as first responders.

The Agency will also be diversifying the current scope of forest utilization activities within its forest estates, the activities will primarily focus on engaging LFMCs but will not be limited to these entities. In this regard, greater emphasis will be placed on the utilization of forest resources for recreation and community ecotourism. During the period 2016–2026, more recreational trails will be established and

[67] Forest and Climate Change: adaptation and mitigation, *European Tropical Forest Research*, Issue 50 (November 2009).

recreation facilities of varying functionality will be built. The following sections outline the actions to be undertaken.

7.2 Actions and Responsibilities

The following tables details the actions to be taken and the responsible entities.

Table 12 Actions for Conservation

Action #	Action	Start and End Date	Responsibility	KPI Link	Key Risks/Assumptions
CONSERVATION					
1	Develop initial (pilot) species conservation plans and survey and map the distribution of targeted species — giant swallowtail, yellow-and-black-billed parrot, water mahoe, and bitterwood.	2016	**NEPA, FD**, IOJ	Number of species conservation plans developed. Status of implementation of species conservation plans	
2	Identify other potential target species most relevant to the forestry sector for future conservation efforts.	2017	**NEPA, FD**, IOJ	Number of species identified for future conservation efforts	
3	Develop spatial representation of disturbance within broad leaf category and use assessment to target protection efforts.	2017	**FD**	Number of initiatives developed to protect broadleaf categories	
4	Design an education programme to strengthen the public's understanding of the benefits of forests and their resources, the importance of sustainable forest management and conservation practices.	2017-ongoing (this would run throughout the life of the Plan)	**FD,** in collaboration with other agencies	Number of public education/awareness sessions delivered (by type)	**RISK:** Inadequate resources to execute programme; Competing/Conflicting Public Education Messages

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Table 13 Actions for Sustainable Forest Management

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	Action	Start and End Date	Responsibility	KPI Link	Key Risks/Assumptions
SUSTAINABLE FOREST MANAGEMENT					
1	Conduct forest fire vulnerability assessment and fire damage assessments including the effectiveness of post fire restoration treatment and map the areas.	2017-2022	**FD**, ODPEM, NSDMD- MEGJC, RADA, SDC, NERGIS	Number of forest fire assessments (by type) conducted	**RISK:** Unfavourable climate conditions. Lack of coordination between partners to source data. Human capacity, lack of sufficient implementation.
2	Design and implement a public awareness and education programme on sustainable forest management, the related risks of forests and its impact on forest health and preventative methods in relation to forest fires.	2016	**FD**, RADA	Number of fire awareness and education programmes conducted. Number of persons participating in fire awareness and education programmes	
3	Establish, train and equip fire suppression teams in the following high priority/high risk areas: (i) Petersfield FR, (ii) Bellevue Heights FR, (ii) Bull Head FR and (iv) Stephney Johns-Vale FR.	2018-2019	**FD,** JFB, LFMCs	Number of fire suppression personnel trained in high priority/high risk areas. Number of high priority/high risk areas in which fire suppression teams are established	**RISK:** Lack of equipment to conduct training. Low participation of community members.
4	Conduct watershed vulnerability assessment and use the findings to develop and implement a watershed restoration plan(s).	TDB/2017	**ODPEM, NEPA, FD, WRA, UWI, NSDMD- MEGJC,** local groups	Number of watershed plans implemented (NEPA - WAMM)	
5	Develop best management practices for riparian forests along rivers and streams within forest estates.	2018-2019	**FD**, NEPA, WRA.	Number of best management practices developed for riparian forests along rivers and streams within forest estates	**RISK:** Unavailability of spatial data for riparian forests. Unfavourable climatic conditions. Insufficient data

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6	Evaluate and strengthen the Agency's nursery operations and determine efficiency levels and costs.	2016-2019	**FD**	Proportion of seedlings produced that are distributed. Status of implementation of recommendations from nursery programme evaluation: (0) *Not Applicable or not addressed;* (1) *Highly Unsatisfactory: Less than 25% of the recommendations implemented;* (2) *Unsatisfactory: Between 25% and 50% of the recommendations implemented;* (3) *Satisfactory: Between 50% and 75% of the recommendations implemented;* (4) *Highly Satisfactory: More than 75% of the recommendations implemented*	Data availability, accuracy and efficiency
7	Develop a comprehensive reforestation programme for forest estates.	2017-2019	**FD**	Availability of a procedure for identifying or prioritizing lands for reforestation within LFMPs (*Yes/No*)	**RISK:** Insufficient data. Inaccuracy of data.
8	Verify and map private lands in the reforestation programme.	2017-2019	**FD**	Hectares verified in private land reforestation programme. Hectares mapped in private land reforestation programme	
9	Develop three (3) Cluster Forest Management Plans.	2017-2019	**FD**	Number of Cluster FMPs developed	**RISK:** Insufficient data. Lack of capacity

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10	Review the existing forest inventory approach and revise where necessary in order to meet the needs of Carbon Stock Monitoring (CSM) and potential carbon trading agreements.	2017-2019	**FD, MSET,** UWI, CCD	Forest inventory approach revised (*Yes/No)*	**RISK:** Lack of human and technical capacity
11	Increase silvicultural capacity within the Agency.	2017-2019	**FD**	Number of persons trained in silviculture	**RISK:** Limited qualified personnel available to provide silviculture skill sets
12	Collaborate with the Meteorological Service's climate data collection network to place weather stations in strategic locations within forested areas in order to garner additional data to support sustainable forest management practices.	2016	**MSD**, FD, MEGJC	Number of weather stations placed in strategic locations by Met Service climate data collection network	
13	Collaborate with Ministry of Transport and Mining, and the Mines and Geology Division (MGD) to assess impacts of mining and other permitted activity on forest resources, services, and value over time.	2017-2018	**FD**, MGD, MTM, NEPA, UNDP	Number of impact assessments conducted	**RISK:** Lack of collaborative efforts from key partners
14	Build the capacity of the Agency and its partner organisations to conduct natural resource/ecosystems valuations for all types of forests.	2018-2021	**FD**, PIOJ, UWI, UTECH, NEPA	Number of individuals trained to conduct NRVs	**Risk:** Inability to identify suitable consultant to conduct trainings
15	Develop programme for payment of ecosystem services within forested areas.	2022-2026	**FD,** NEPA, WRA	Existence of programme for payment of ecosystem services in forested areas (*Yes/No*)	**RISK:** Insufficient information sharing among partners. Inability to identify suitable consultants to conduct trainings

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16	Collaborate with support agencies to develop appropriate guidelines for the establishment and maintenance of trees in urban settings; for use in cultural, aesthetics and shade purposes.	2019-2022	**FD, NSWMA, PSOJ, MLGC**	Number of guidelines developed for the establishment and maintenance of trees in urban settings and for use in cultural, aesthetics and shade purposes.	**RISK:** A key assumption is that there would be an established urban forestry programme. A risk identified is the absence of a precedent on urban forestry programmes.
17	Conduct gap analysis and identify spatial data and other information to better describe risks and vulnerabilities of forests and communities to climate change and related hazards (e.g., fire, floods, landslides)	TBD	**ODPEM,** FD, SDC, NSDMD- MEGJC	Availability of data (spatial and other information) to better describe risks and vulnerabilities of forests and communities to climate change and related hazards — e.g., fire, floods, landslides (*Yes/No*)	

Table 14 Actions for Forest Utilization

Action #	Action	Start and End Date	Responsibility	KPI Link	Key Risks/Assumptions
FOREST UTILIZATION					
1	Improve the availability of data for driving growth and investment in the forest sector. Include in the database information regarding growth and yield curves for primary commercial species and the related return on investment (ROI).	2018-2023	**FD**	Availability of data for driving growth and investment in the forest sector (including information on growth and yield curves for primary commercial species and the related return on investment) (*Yes/No*)	**RISK:** Lack of human and technical capacity. Insufficient data
2	Develop sustainable harvesting plan utilizing data on sustainable annual cuts for the Forest Management Plan Areas (FMP).	2017- 2026 (ongoing for the life of the plan)	**FD**	Number of harvesting plans developed	**Risk**: Poor data management. Synergies within the Agency at all divisional levels needed.

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3	Conduct market surveys in order to identify producers and consumers of non-timber products, for example, fuelwood, charcoal, yam sticks, natural fibres, medicinal products, biomass from treatments and thinning, and other goods and establish the feasibility for further developing markets for these products.	2018-2019		Number of market surveys conducted	**Risks:** Lack of understanding about forestry sector among market research firms; inadequate resources (funding). **Assumptions:** That capable market researchers are identified to conduct the research
4	Based on the results of market feasibility studies, develop and expand economically viable non-timber market opportunities.	2020-ongoing (throughout the life of the plan)	**FD**, Petroleum Corporation of Jamaica, BSJ (Bureau of Standards of Jamaica)	Number of investment profiles for non-timber products prepared	**Assumptions:** that the identification and documented information and processing methods detailed are completed for the dissemination to begin in 2020. Conflicting priorities among responsible entities
5	Identify, document and disseminate information on the economic viability of wood product species and recommend appropriate timber processing methods for these species.	2020-2026	**Collaboration: FD,** JBDC, SRC, UTech, UWI, NCU, and private sector	Availability of information on economically viable and resilient wood product species (*Yes/No*)	**Risk:** Absence of human capacity with wood science skill sets
6	Rehabilitate recreation sites (e.g. Gourie, Clydesdale).	2018-2026	**FD**, TPDCO, JCDT	Number of recreational sites and trails rehabilitated	**Risk**: Unavailability of funding. Absence of business plan for sites
7	Map existing recreational trails, and identify and map other potential recreational trails.	2017-2026 (ongoing for the life of the plan)	**FD, JNHT,** Ministry of Tourism, NGOs, NLA	Number of new recreational trails identified. Number of recreational trails mapped (existing, newly identified)	**Risks**: Human capacity to conduct trail assessments
8	Identify, conduct feasibility studies and establish new recreation sites and trails of varying design and functionality in forested areas.	2018-2026	FD, TEF, TPDCO, JNHT, Ministry of Tourism, NGOs	Number of new recreational trails identified	**Risk:** Inability to source funding for consultants to do feasibility studies.

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9	Collaborate with relevant stakeholders to identify cultural and heritage sites on forest reserves and FMAs, and develop guidelines for the use of these sites.	TBD	**JNHT**, FD	Number of cultural and heritage sites on forest reserves and FMAs identified. Availability of guidelines for the use of cultural and heritage sites on Forest Reserves and FMAs (*Yes/No*)	
10	Promote alternative livelihoods in forest communities through the development of ecotourism; honey production; and farming using sustainable land management practices on private land and other feasible alternatives.	2018-2026		Number of LFMCs and CBOs benefiting from project development support initiatives	**Risks:** No control of private lands. Assumptions: Incentives would need to be developed
11	Facilitate access to funding to LFMCs and CBOs by providing support for the development of alternative livelihoods, community development, and conservation projects.	2017-2026	**FD**, SDC, NGOs	Number of LFMCs and CBOs benefiting from project development support initiatives	**Risk**: Unavailable funding
13	Evaluate and update the school education and awareness programme, including, where applicable, the school curricula and ensure that the programme highlights the benefits and value of healthy forests, and explains the importance of forests to building climate change resilience.	2017-ongoing (throughout the life of the Plan)	**FD,** NEPA, MOE, CCD	Number of participants in revised school awareness programme (disaggregated by schools, parish, age and sex of children)	**Risks:** Inadequate resources to execute programme; competing public education messages

7. 3 Monitoring Framework and Financial Strategies

The details of these components are found in the annex to this document.

SECTION E

Sustaining the Development of the Forest Sector

8.0 Maintaining and Sustaining Healthy Forests

The future of the country's forests rests with increasing its capabilities, capacities and resources to manage the forests. Important too is the conduct of forest-related research to enhance understanding of the ecological, economic and social aspects of forests and trees, in order to strengthen the scientific knowledge that informs the action of the policymakers, practitioners and other stakeholders. The NFMCP recognizes that these issues are vital for sustaining healthy forests. Against this background, the Agency will focus on REDD+ readiness and implementation while building the forest research capability through various alliances over the next 10 years. These two actions, working in concert, are of strategic importance regarding the sustainable development of the country's forests.

The following sections provide the context and outline the proposed actions.

8.1 Reducing Emissions from Deforestation and Forest Degradation (REDD+)

8.1.1 Its History

The UNFCCC Conference of the Parties (COP) has unanimously agreed on the potential for mitigation of greenhouse gas emissions (GHG) as a forest sector contribution. Each ensuing COP has been supporting REDD+; coupled with the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries. REDD+ is an effort to provide positive incentives to developing countries to contribute to climate change mitigation through activities in the forestry and land-use sectors.[68]

The idea for REDD+ emerged in 2005 at COP 11 when the Governments of Costa Rica and Papua New Guinea submitted a proposal to include the effort to Reduce Emissions from Deforestation (RED) in the climate negotiations agenda. Since that time, the idea of establishing a global mechanism to reduce emissions from deforestation and forest degradation (UNREDD) in developing countries, gained traction in the deliberations of the UNFCCC COP. Up until that time, tropical deforestation had for the most part been excluded from the scope of the Kyoto Protocol's Clean Development Mechanism (CDM), which provides Certified Emission Reduction units that may be traded in emissions trading schemes.

Guided by Article 4 of the UNFCCC Convention and supported by several decisions, UNREDD+ has evolved over the last fifteen years through successive rounds of negotiations (refer Table 15). The decisions adopted by the Conference of the Parties at each of these meetings have provided the architecture for the global REDD+ mechanism. The UNFCCC COP established rules and provided methodological guidance for the operationalization of REDD+. The development of methodological guidance for REDD+ was concluded in June 2015.

[68] REDD+ Programme

Table 15 UNFCCC Conference of the Parties Agreement re REDD+

Agreement	Summary
The UNFCCC: Text of the Convention (1992), Article 4: Commitments:	Parties will publish and make available national inventories of anthropogenic sources and removals by sinks, using similar methods.
The Bali Action Plan (2007)	All parties are encouraged to reduce their GHG emissions in ways that are measurable, reportable and verifiable. Capacity building should be supported, and reporting using the latest IPCC guidelines encouraged.
Copenhagen (2009)	Emissions from forests should be reduced according to the latest IPCC guidelines and national forest monitoring systems should be established using consistent methodologies.
Cancun (2010)	A National forest monitoring system is one of the four key elements of REDD+ and it should be developed through a phased approach.
Warsaw (2013)	Formalizes earlier guidance into decisions, describes the quality of national forest monitoring systems required for measurement of REDD+ results, and the methods of reporting and verification.

8.1.2 The REDD+ Philosophy

The guiding principles of REDD+ is that through more sustainable forest management practices, it is possible to:

- Reduce GHG emissions produced by the forest sector; and
- Enhance the capacity of the forest sector to act as a carbon sink, by storing and enhancing carbon in the five carbon pools (i.e. aboveground biomass, belowground biomass, soil organic carbon, litter and dead wood).

Figure 13 illustrates, the central principle of REDD+

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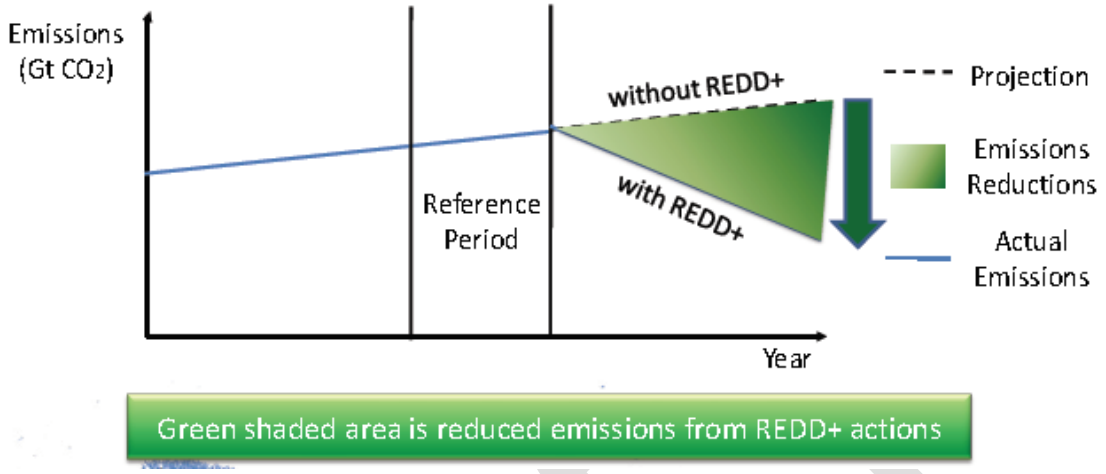

Figure 13 REDD+ AND GHG EMISSIONS (source: UN-REDD Programme)

8.1.3 REDD+ Implementation

Jamaica's REDD+ initiatives will follow global processes but implementation will be defined within the national context and is considered a pivotal forest action contributing to Jamaica's growth agenda. In undertaking the REDD+ programme as the key activity in Jamaica's development agenda for the forest sector, the GoJ through the Agency is guided by the leadership and expertise within the UNREDD Programme:

> *In order to be effective and lasting, REDD+ was originally conceived as a mechanism with a nation-wide scope, anchored to national-level policies, national implementation measures and public/private transformational investments. Such national scope would foster, achieve and demonstrate sustainable development with a social and environmental performance of magnitude. The national scope of the REDD+ mechanism is thus not arbitrary – it lays the basis for mainstreaming, impact and permanence.*
>
> (Josep Garí from the UN-REDD Programme)

The UNFCCC, REDD+ programme seeks to achieve five central outcomes:

- reduced emissions from deforestation;
- reduced emission from degradation;
- forest carbon stock enhancement;
- sustainable management of forests; and
- forest carbon stock conservation.

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These outcomes are well aligned to maintaining healthy forests in addition to mainstreaming climate change in the forest sector. Climate change mainstreaming is being undertaken through three critical mitigation strategies: reduction of emissions; enhancement of the rate of sequestration; and maintenance of existing forest carbon reservoirs.

Further, the benefits of implementing REDD+ activities to the country's growth and development are far reaching and extend beyond building a climate resilient nation. Other benefits for the forest sector, which will significantly contribute to the sector's sustainability include: (i) support to design and implement Policies and Measures (PAMs) in the forest and other sectors that have an impact on REDD+ efforts; (ii) payments per ton of carbon emissions reduced or removed; (iii) international recognition for mitigation results; (iv) biodiversity conservation; (v) poverty alleviation; and (vi) contribution as one of the catalysts for developing a green economy integrating forestry, agriculture, energy and finance.

The implementation of REDD+ activities is a phased iterative process as shown in Figure 14.

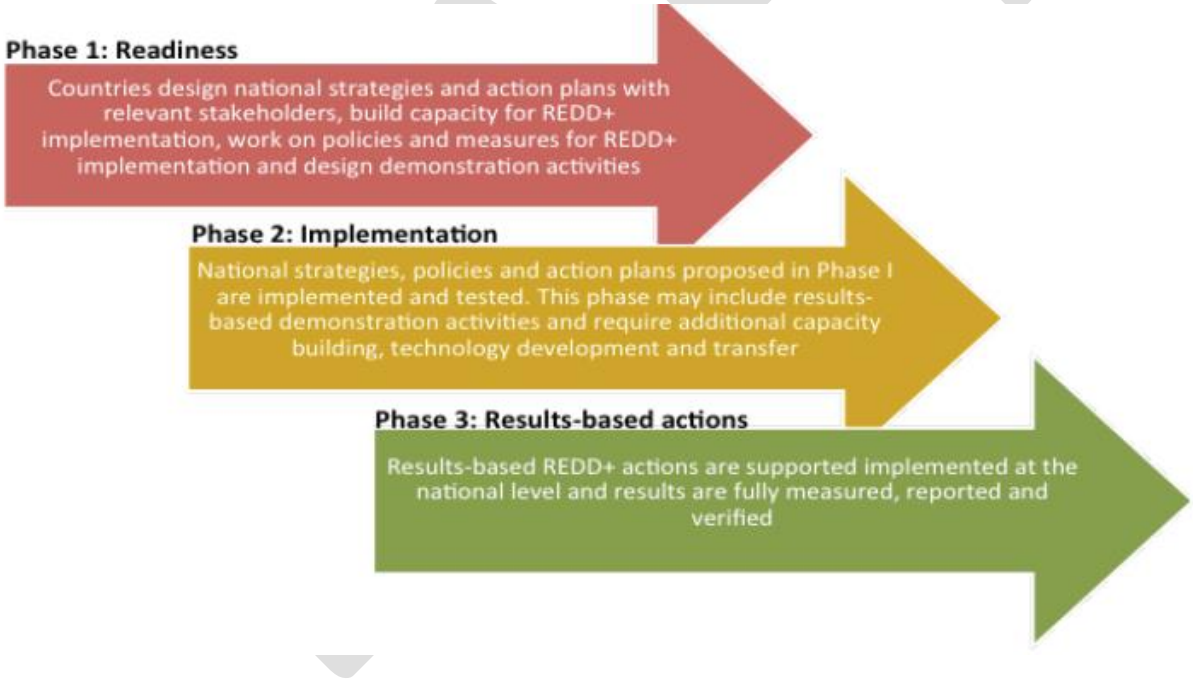

Figure 14 Phased approach to REDD+ implementation[69]

As a key NFMCP action, the GoJ will embark on Phase 1 – the UNREDD+ readiness programme from 2016 to 2021, which will focus on developing capabilities, among other things. The activities in the

[69] UNREDD Programme

readiness phase are outlined in Table 16. The actions will be reviewed during the mid-term review of the NFMCP, at which time future actions will be determined.

The implementation of REDD+ is a complex undertaking and the Agency will be mindful of issues that have been identified by the UNREDD programme as technical challenges, which have hindered full-scale and impactful implementation of the programme.[70] These are:

Permanence: how to ensure that reductions in emissions from deforestation are not eventually reversed by later activities;

Displacement: how to ensure that actions are not otherwise negated by increases in deforestation activities elsewhere;

Finance: ensuring meaningful sources of finance and adequate private sector engagement;

Conflicting interests: powerful political and economic interests may favour continued deforestation and degradation;

Institutional arrangements: implementation must be coordinated across various government levels and agencies – e.g. Ministries of Environment and Forest should successfully coordinate with Ministries of Finance and Planning;

Benefit sharing: if benefits are to be distributed, effectiveness, efficiency and equity need to be balanced; tenure insecurity and safeguards must be genuinely addressed; and transparent institutions put in place; and

Technical complexity: measuring emissions from forestry and establishing reference levels can be a technical challenge.

8.1.4 Actions and Responsibilities

Table 16 details the actions to be undertaken in the first five years of the implementation of the NFMCP the main focus of which will be achieving REDD+ readiness.

[70] UNREDD Programme

Table 16 Actions for REDD+ Readiness

Action #	Action	Start and End Date	Responsibility	KPI Link	Key Risks/Assumptions
SUSTAINABLE DEVELOPMENT OF FOREST SECTOR					
1	Facilitate consultations and support activities for preparation of project document to fund REDD+ readiness	2017-ongoing (throughout the life of the Plan)	**FD**, CCD, (MEGJC) UNEP	Rate of implementation of REDD+ *[*(0) *Not Applicable or not addressed;* (1) *Highly Unsatisfactory: Less than 25% of the REDD+ initiatives implemented;* (2) *Unsatisfactory: Between 25 and 50% of the REDD+ initiatives implemented;* (3) *Satisfactory: Between 50 and 75% of the REDD+ initiatives implemented;* (4) *Highly Satisfactory: More than 75% of the REDD+ initiatives implemented]*	**Risks**: Lack of technical capacity and funding
2	Activity 1 REDD+ readiness – analyse the drivers for deforestation/forest degradation	2017-2019	**FD**, CCD, (MEGJC), UNEP		**Risks:** Lack of technical capacity and funding
3	Activity 2 REDD+ preparedness – strengthen forest monitoring systems	2019-2022	**FD**, CCD, (MEGJC), UNEP		**Risks**: Lack of technical capacity and funding
4	Activity 3 REDD+ establish Forest Reference Emission Level (contribution to INDC	2019-2022	**FD**, CCD, (MEGJC), UNEP		Risks: Lack of technical capacity and funding
5	Activity 4 REDD+ preparedness – develop information system, environment and social safeguards	2020-2022	**FD**, CCD, (MEGJC), UNEP		**Risks**: Lack of technical capacity and funding

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8.2 Forest Research

8.2.1 Overview

There is an acknowledgement that in general, forest research in developing countries has been unable to provide adequate information and responses to the challenges of sustainable forest development in a rapidly changing world.[71] Forest researchers[72] have argued that this places developing countries at a significant disadvantage because of insufficient understanding of the link between the strong national forestry research capacity and resolution of the boarder development issues. To a large degree, the main barriers to forest research in developing countries, of which Jamaica is no exception, is the inadequacy and somewhat ad hoc nature of political and financial support and insufficient research management capacities.

Further, for countries like Jamaica located in the tropical zone, the higher biodiversity of the forests coupled with the complexity of the ecosystems and the changes that will be brought about by climate change create a tremendous challenge in developing sustainable forest management practices.

One of the intents of the NFMCP is to begin to dismantle the barriers to forest research and to develop through collaboration with academia and other interested parties, research working groups in the areas deemed most important at this stage of the sector's history. These areas are: (i) management of mangrove forests, swamp forests and short limestone forests; (ii) improving knowledge on the impact of climate change on all forest types; and (iii) non-timber forest resources.

8.2.2 Actions and Responsibilities

Table 17 details the actions to be undertaken in the area of forest research. The chief collaborators will be the FD, UWI and other interested parties.

Table 17 Actions for Forest Research

[71] Krishna P. Acharya, The Challenges of Forestry Research in Developing Countries, the case of Nepal (Ministry of Forest and Soil Conservation, Forest Research Division).
[72] Ibid.

Action #	Action	Start and End Date	Responsibility	KPI Link	Key Risks/Assumptions
FOREST RESEARCH					
1	Establish a working group in collaboration with UWI Life Sciences and other interested partners locally and overseas focused on research that improves knowledge regarding the management of mangrove forests, swamps and short limestone forests.			Existence of functional working group focused on research to improve knowledge on management of mangrove forests, swamps and short limestone forests established (*Yes/No*)	
2	Establish a working group in collaboration with UWI CSG and other interested parties focused on improving knowledge on the impact of climate change on all forest types.			Existence of functional working group focused on improving knowledge on the impact of climate change on all forest types established (*Yes/No*)	
3	Develop a research programme for non-timber forest resources focused on producing marketable products in the support of diversifying options for sustainable forest utilisation and the development of forest communities.	**2019-2026**		Existence of research programme for non-timber forest resources (*Yes/No*) Number of research outputs (by type) generated by research programme for non-timber forest resources as planned	**Risk**: Change in market demands

8.3 Monitoring Framework and Financial Strategies

The details of these components are found in the annex to this document.

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