

**CARIBBEAN DEVELOPMENT BANK**



**TECHNICAL ASSISTANCE – ESTABLISHMENT OF A COMPREHENSIVE BUSH FIRE  
WARNING INDEX FOR EFFECTIVE BUSH FIRE MANAGEMENT  
JAMAICA**

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Considered at the Two Hundred and Seventy-Fifth Meeting of  
the Board of Directors on March 16, 2017

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**CARIBBEAN DEVELOPMENT BANK**

**TWO HUNDRED AND SEVENTY-FIFTH MEETING OF THE BOARD OF DIRECTORS  
TO BE HELD IN BARBADOS  
MARCH 16, 2017**

**PAPER BD 4/17**

**TECHNICAL ASSISTANCE – ESTABLISHMENT OF A COMPREHENSIVE BUSH FIRE  
WARNING INDEX FOR EFFECTIVE BUSH FIRE MANAGEMENT - JAMAICA**

**1. BACKGROUND**

1.01 The African Caribbean Pacific-European Union-Caribbean Development Bank Natural Disaster Risk Management (ACP-EU-CDB NDRM) programme in the CARIFORUM Countries (Paper BD 80/13) aims at reducing the vulnerability to long-term impacts of natural hazards, including the potential impacts of climate change (CC), thereby achieving regional and national sustainable development and poverty reduction goals in the CARIFORUM Countries<sup>1</sup>. The Contribution Agreement between CDB and the EU was signed in July 2014. The programme is being managed by three implementing partners: CDB, Caribbean Disaster Emergency Management Agency and the Ministry of the Presidency of the Dominican Republic. Among the expected results of the Programme (Result 2) is Local, National, and Regional Resilience Enhanced through Strengthened Early Warning, National Risk Profiling and Community-Based Disaster Risk Reduction (DRR). CDB has responsibility for the achievement of this result.

1.02 Most bush fires occur naturally and play a role in the evolution of the landscape, soil fertility and biodiversity. Bush fires can spread rapidly and become uncontrolled when weather, vegetation and topography conditions are favourable and conducive to fire. Over the last five years, an increase in the incidence of bush fires has been observed during the dry season (especially January-March) and especially during periods of severe drought in Jamaica<sup>2</sup>. An increase in the risk of droughts has been predicted with the occurring of global warming<sup>3</sup> resulting from human activities that contribute to increasing concentrations of greenhouse gases in the atmosphere. Thus, it can be inferred that climate variability and CC will likely result in an ever-increasing number of drought-induced bush fires in Jamaica.

1.03 Bush fires have caused significant negative socio-economic impacts particularly on property and the agriculture and forestry sectors in Jamaica. Between 1996 and 2005, damage and losses in agriculture due to bush fires were estimated at USD0.7 million (mn) over the years<sup>4</sup>. In 2014, the Rural Agricultural Development Authority (RADA) reported over 1,600 hectares of land valued at over USD8.33mn were lost or damaged due to drought and fires and affected over 16,000 farmers<sup>5</sup>. In 2015, 7,261 of such fires occurred. In May 2015, a bush fire event in rural St. Andrew, destroyed approximately 367 hectares of

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<sup>1</sup> [https://ec.europa.eu/europeaid/sites/devco/files/aap-acp-action-fiche-20131010\\_en.pdf](https://ec.europa.eu/europeaid/sites/devco/files/aap-acp-action-fiche-20131010_en.pdf)

<sup>2</sup> Jamaica Fire Brigade (JFB) reported a total of 37,314 bush fires between 2011 and 2015 i.e an average of 7,463 bush fires/year. However, it is difficult to distinguish between naturally induced fires and those set deliberately by humans.

<sup>3</sup> Intergovernmental Panel on Climate Change (IPCC), 2014. CC 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the IPCC [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

<sup>4</sup> Selvaraju, Ramasamy, et al. CC and agriculture in Jamaica: Agricultural sector support analysis. Food and Agriculture Organization of the United Nation, 2013.

<sup>5</sup> <http://jis.gov.jm/statement-drought-conditions-impact-agricultural-sector>.

forest cover<sup>6</sup>, contributing to an increase in air pollution with adverse impact on human health, as well as the removal of key carbon sinks. Currently, bush fires account for 63%<sup>7</sup> of the total number of emergency calls to the JFB.

1.04 JFB was established in 1998 with the passing of the Fire Brigade Act with responsibility for protecting life and property from fire within Jamaica. The legislation seeks to consolidate what were once 13 parochial fire entities to establish a national fire service. The JFB capital development and operations have been affected by inadequate resources for capital expenditure on buildings, firefighting infrastructure such as hydrants and equipment to effectively support its operations including its capacity to adequately respond and fight potential bush fires. Currently, the network of 33 fire stations of JFB is insufficient in number and poorly equipped to provide effective fire and rescue service in Jamaica. The Disaster Vulnerability Reduction Project, funded by the World Bank, is financing the construction of three fire stations in Port Maria, Montego Bay and Yallahs and acquisition of some equipment to facilitate JFB operations<sup>8</sup>. However, further investment is required to make JFB fully operational in order to fulfil its mandate.

1.05 Currently most of JFB information management system has not been converted to an electronic format and bush fire incidents are still recorded in hand-written logs, making it less accessible and reducing the country's ability to better analyse, plan and take action for both strategic and tactical needs. In this manual format, bush fire information is not easily accessible for sharing among key partners including Meteorological Service Jamaica (MSJ), Office of Disaster Preparedness and Emergency Management (ODPEM), RADA, and Forestry Department. Converting the existing information into a computerised format will involve a time-consuming process of mining each bush fire record from the logs. However, this is important to facilitate exchanges of bush fire information among partners and the use of the information for planning adequate prevention and mitigation measures.

1.06 MSJ, in collaboration with the International Research Institute for Climate and Society (IRI) and the Caribbean Institute for Meteorology and Hydrology (CIMH), have worked to develop a one-to-five-day forecast tool which attempts to predict likely outbreaks of bush fires. This is done via the use of the Keetch-Byram Drought Index (KBDI), which was developed by John Keetch and George Byram in 1968 to specifically assess forest fire potential. This drought index represents the net effect of evapotranspiration and precipitation in producing loss in moisture content of the upper level of the soil including organic matter. The KBDI is computed from annual precipitation, daily precipitation and daily maximum temperature. The values of the KBDI ranges from 0-800, with higher values indicating drier conditions and higher risk of fire.

1.07 Although the KBDI is useful for fire potential assessment, its application as an early warning tool and decision-making aid for fire management is limited as the index lacks a customisation to local conditions and does not include other key parameters of fire behaviour such as vegetation (sometimes termed as fuel loading) and topography. For instance, while weather conditions mainly influence the start of a bush fire, it is the vegetation and topography that dictate the maintenance and spread of fire. Under similar weather conditions, two zones with a different vegetation (e.g. grass versus trees) will not experience the same bush fire behaviour. Generally grasslands are more conducive to fires than forests as the latter is coarser and slower to combust. When weather conditions and vegetation are similar, zones with differing gradient (e.g. flat land versus sloping) will not exhibit the same bush fire behaviour. Fires will tend to spread faster on a slope than on flat ground. Therefore, integrating weather, vegetation and topography in the determination of the bush fire index will increase its accuracy.

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<sup>6</sup> <http://jis.gov.jm/bush-fires-have-destroyed-hundreds-of-acres>.

<sup>7</sup> Average between 2007 and 2014 – Auditor General's Department Performance Audit Report of the JFB.

<sup>8</sup> World Bank, 2016. Disaster Vulnerability Reduction Project. <http://documents.worldbank.org/curated/en/282911467999736588/pdf/PAD1233-R2016-0008-1-Box394844B-OUO-9.pdf>.

1.08 The development of a robust model aside, a common alerting protocol (CAP) and public education and awareness are critical to ensure timely preparation and effective response to bush fires. Following a series of devastating fires in 2015 that affected farms in Mavis Bank, St Andrew, and Nain in St Elizabeth, Jamaica, JFB launched a Community Bush Fire Management Education Programme, which has shown great success. At October 2016, no incident of fire was observed in Mavis Bank, where fires had destroyed hectares of farmland in the previous year. A key element of this success is due to local community involvement in the programme.

1.09 The Government of Jamaica (GOJ) through the MSJ will develop a comprehensive Jamaican Bush Fire Warning Index to determine critical thresholds for outbreaks under different conditions for effective bush fire management. This work requires an interdisciplinary approach and inter-agency coordinated effort. Key partners of the Project will include JFB, Forestry Department, RADA, ODPEM, National Environmental and Planning Agency (NEPA), School of Building and Land Management (SBLM) at University of Technology Jamaica (UTECH), Social Development Commission (SDC), CIMH and IRI. MSJ will collaborate and engage these partners along with local communities at the initial stages of the Project as their involvement is critical to ensure Project ownership and sustainability.

1.10 MSJ, a scientific division of GOJ, is responsible for monitoring weather conditions over the island and its territorial waters and for issuing reliable and timely weather and climate services relevant to the needs of respective client groups for the preservation of life and property. Jamaica is a member of the World Meteorological Organisation (WMO), and the Director of MSJ is usually appointed Jamaica's Permanent Representative to WMO. MSJ is also an active member of the Caribbean Meteorological Organisation (CMO), which is a specialised agency of the Caribbean Community (CARICOM) that coordinates the joint scientific and technical activities in weather, climate, and water-related sciences in its sixteen Member States<sup>9</sup>. MSJ is the training arm of the CMO.

1.11 MSJ is organised into three branches, namely Administrative, Weather and Climate, and comprises a staff of 74 persons. The Administrative Branch is responsible for administration and support services of the Division and provides efficient and effective operations regarding human resource management, office management, accounting services, a registry and library facilities. The Weather Branch is primarily concerned with current weather information and synoptic weather forecasting for the local public, press, radio, television aviation and shipping. The Climate Branch manages an island-wide network of climatological stations, rain-gauges and automatic weather stations. The Branch analyses the data generated with a view to monitoring and assessing the climate of the island and for processing a wide variety of user-oriented request which include crop water requirements, design criteria for hydrologists and engineers, and climatological information for resolving legal and insurance problems. The organisational structure of MSJ is shown at Appendix 1.

1.12 MSJ has solely and collaboratively implemented a number of projects including: (a) the Pilot Programme for Climate Resilience, where MSJ is responsible for implementing components of Investment Project 1 of the Strategic Programme for Climate Resilience financed at USD4 mn, (b) The Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance's Jamaica Rural Economy and Ecosystems Adapting to Climate Change, where the MSJ will jointly install and manage a network of weather equipment estimated to cost USD144,000, and the GOJ-EU-United Nations Environment Programme Climate Change Adaptation and Disaster Risk Reduction Project financed at USD750,000.

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<sup>9</sup> CMO Member States include all Borrowing Member Countries except Bahamas, Haiti and Suriname.

## 2. **PROPOSAL**

2.01 It is proposed that CDB provides a grant to GOJ in an amount not exceeding the equivalent of three hundred and twenty-seven thousand, nine hundred and twenty-five Euros (EUR327,925) from CDB Special Funds Resources (SFR) under the ACP-EU-CDB NDRM programme to assist with financing the development of an index and services to enhance bush fire management in Jamaica. This index will weigh the influence of the KBDI factor as well as topography and vegetation factors in the occurrence of bush fires to establish with more accuracy, critical thresholds for fire outbreaks; thereby allowing Jamaican authorities and the communities at risks to prepare and respond adequately and in a timely manner. The grant will provide resources to:

- (a) Develop a multi-criteria model for bush fire predictions including:
  - (i) review of JFB data collection record, data collection and analysis, and model development and testing; and
  - (ii) training of MSJ in Geographic Information System (GIS) and acquisition of satellite imagery and equipment to facilitate the model development.
- (b) Conduct two pilot sites<sup>10</sup> monitoring and capacity development including:
  - (i) equipment installation;
  - (ii) data collection and analysis on weather and soil conditions;
  - (iii) capacity building of JFB and pilot communities for more effective response to bush fires<sup>11</sup>, data record-keeping and management in a computerised format;
  - (iii) bushing and fencing of selected sites; and
  - (iv) public education, awareness and outreach.
- (c) Develop a CAP including:
  - (i) recruitment of consulting services;
  - (ii) stakeholder consultation workshops; and
  - (iii) launch of bush fire warning protocol.
- (d) Increase public education, awareness and outreach about bush fires in a gender-sensitive and socially inclusive way including:
  - (i) consulting services for conducting public awareness survey; and
  - (ii) designing and implementing a communications campaign.

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<sup>10</sup> The two pilot sites will be selected in bush fire prone areas based on historical data on bush fire incidents. Data to be collected at the two sites will be used to calibrate and increase the confidence of the model in predicting bush fire outbreaks.

<sup>11</sup> Basic equipment such as backpack sprayers will be provided to allow firefighters to go on foot in the local communities to fight bush fires where there is no accessibility for the fire truck.

2.02 The draft Terms of References (TORs) for the Project Coordinator (PC) and the consultancy services assignments are presented at Appendices 2A to 2F.

### **3. OUTCOME**

3.01 The expected outcomes are:

- (a) improved monitoring and prediction of critical thresholds of bush fire outbreaks; and
- (b) increased public awareness about bush fires.

3.02 The design and monitoring framework of the proposal is provided at Appendix 3, and the Project Implementation Schedule at Appendix 4.

### **4. JUSTIFICATION**

4.01 In Jamaica, frequent bush fires have resulted in significant damage to property, and the agriculture and forestry sectors. The increasing level of risks of bush fires has prompted several key departments to seek to work collaboratively to devise an initiative to identify and analyse the risks and to establish and implement an efficient and accurate bush fire risk management process. This will include adequate protocols for alerting those risks as well as to generally improve public education and awareness about the hazard.

4.02 The ability to predict bush fire outbreaks can help to substantially reduce their impacts, but this requires a number of input parameters to develop and operate robust models. A multi-criteria model that integrates KBDI, vegetation and topography factors will increase the level of confidence in predicting potential bush fire outbreaks in Jamaica. Such a predictive tool is very important for providing early warning information for timely decisions and effective responses. For instance, it will provide information to JFB to assign resources to the most needed areas based on warning indicators, help limit the impacts of potential fire events, as well as alert communities at risks.

4.03 The proposed multi-criteria bush fire model will be developed using historical bush fire data, topography and vegetation type and variability to determine risk in bush fire prone areas. Detailed record-keeping of bush fire data in a computerised format is required to ensure timeliness and ease of transfer of data between JFB and MSJ.

4.04 In addition to developing a robust multi-criteria model for bush fire prediction, it is important to have electronic means for registering, storing, updating and reporting the risk information and to establish a formal protocol to alert communities at risk. The development of policy and procedures to effectively manage bushfire emergencies should be developed in consultation with relevant authorities such as the JFB, Forestry Department and ODPEM to ensure synchronisation of policies and procedures for a CAP in the event of an emergency.

4.05 Improved communication to communities about bush fire risk and general public education and awareness on the issue are critical factors that will help to shape behaviours and contribute to the resilience of affected communities. The proposed initiative therefore includes a component to design and implement effective emergency alerts. The key collaborating partner agencies will determine alert levels, roles and responsibilities and the protocols for public warnings and information dissemination. A two component public education, awareness and outreach (PEAO) programme has been included. The first component includes a public awareness survey, the results of which will be used to guide the development of the

programme and to later gauge its effectiveness. It will also focus on delivering key messages on bush fires directly to targeted communities through training workshops in the two pilot monitoring sites. The second component of the PEAO will expand the delivery of key messages on bush fires to a larger audience through the use of television, radio, brochures, and adverts on buses and bus shelters. It will employ a previously successful JFB Community Bush Fire Management Education Programme, which had been implemented by JFB in the communities of Nain and Mavis Bank via a British High Commission funded project.

4.06 Local communities in bush fire prone areas will benefit enormously from this Technical Assistance (TA) as it will contribute to the reduction of the impacts of bush fires to property and the agriculture and forestry sectors. Public education and awareness as well as communication activities will pay particular attention to including vulnerable groups like women, youth, the elderly and persons with disabilities.

4.07 Based on CDB Performance Assessment Rating System, the Project has been assessed as satisfactory with an overall score of 3. A summary of the Project Performance Assessment Score is shown in Table 1, and Appendix 5 shows the details of the rating system.

**TABLE 1: PROJECT PERFORMANCE ASSESSMENT SCORE SUMMARY**

Criteria	Relevance	Effectiveness	Efficiency	Sustainability	Overall Score Highly Satisfactory
Score	3	3	3	3	3

4.08 Based on CDB Gender Marker, the proposed Project is assessed as marginally mainstreamed (MM) having limited potential to contribute to gender equality with an overall score of 2.0. The Project includes a component on public education and awareness campaign for residents, especially the most vulnerable groups, in bush fire prone areas. Increasing the accuracy of predictions of critical thresholds for bush fires will help reduce their effects and thus can potentially help women and men build and protect their assets and improve their quality of life. The Gender Marker summary is shown in Table 2, and the details are reported at Appendix 6.

**TABLE 2: GENDER MARKER SUMMARY**

Gender Marker	Analysis	Design	Implementation	Monitoring and Evaluation	Score	Code
	0	1.0	0.5	0.5	2.0	MM

4.09 The proposed Project is consistent with the ACP-EU-CDB Result Areas 2: Improved local, national and regional resilience through strengthened early warning, national risk profiling DRR and climate change adaptation (CCA). It is also consistent with:

- (a) CDB Strategic Objectives of: (i) supporting environmental sustainability and DRR; and (ii) promoting good governance, regional cooperation and integration; and
- (b) CDB Corporate Priorities of: (i) promoting disaster risk management and CC mitigation and adaptation; and (ii) improved protection and sustainable management of natural resources.



## 5. EXECUTION

5.01 The Project will be executed by the GOJ through the Climate Branch of MSJ. MSJ will assign a senior staff member of the Climate Branch as PC who will be responsible for coordinating the execution of all Project activities, ensuring Project technical supervision and quality of deliverables. A TOR detailing the Scope of Work to be performed by the PC is presented at Appendix 2A. The qualifications and experience of the PC and of any person subsequently assigned to the position of PC shall be acceptable to CDB.

5.02 The Climate Branch of MSJ will be responsible for technical implementation of the Project including:

- (a) overseeing multi-criteria bush fire development, data collection and analysis, stakeholder consultations and public awareness campaign;
- (b) coordinating the selection of the two pilot sites;
- (c) coordinating the process of engagement of consultants; and
- (d) managing Project financial resources.

5.03 A Project Steering Committee (PSC) will be formed to provide technical guidance for Project implementation, ensuring the delivery of the outputs and the attainment of the outcomes. PSC will comprise the following key partners whose contributions are also shown:

- (a) JFB - data and institutional expertise in fire management;
- (b) Forest Department of Jamaica - data and institutional expertise in forest fire risk and management;
- (c) RADA - educational opportunities to farmers via field officers' extension services;
- (d) ODPEM - data and institutional expertise in disaster risk management and public awareness and communication;
- (e) NEPA - TA on developing alerting protocol;
- (f) SBLM/UTECH - expertise in developing local bush fire warning model;
- (g) MSJ - expertise and supervision of model development and pilot monitoring;
- (h) SDC- expertise in public education, gender equality and social interactions in the communities; and
- (i) IRI - expertise and supervision of model development and pilot monitoring.

5.04. Under the direction of the PC, two Technical Assistants and a Data Management Consultant will be engaged to provide services to (a) collect, compile and analyse data on bush fire occurrences across Jamaica; (b) determine weights for environmental factors involved in the bush fire environment and to model such factors accordingly; and (c) review and assess the data collection and management practices of

the JFB. A Consultant will also be used to assist in designing the CAP including the policy, standards and platform to govern the system; and a consulting firm will be engaged to design and roll out a communication campaign to raise public awareness about bush fires.

## 6. RISK ASSESSMENT AND MITIGATION

6.01 The identified risks have been classified according to their relevance to the implementation and operational phase of the Project. Table 3 summarises these risks and potential mitigation measures to address them.

**TABLE 3: POTENTIAL RISKS AND MITIGATION MEASURES**

<b>Type of Risk</b>	<b>Description of Risk</b>	<b>Mitigation Measures</b>
<b>Implementation</b>	Existing historical bush fire data not readily useful.	Consult with JFB and other partners in the initial Project stages to assess the existing historical bush fire data and establish a data mining plan.
	Low participation/engagement of some key partners.	MSJ has already engaged with and garnered support of all the key partners from the initial stages of the Project's design to discuss the expectations, and to define and agree on their roles and responsibilities.
<b>Operation</b>	Bush fire index not consistently updated.	MSJ will continue to collect field data to feed the model as part of its routine work.

## 7. COST AND FINANCING

7.01 The total cost of the Project is estimated at four hundred and seven thousand and ninety-eight Euros (EUR407,098). The Financing Plan is summarised in Table 4 and the detailed budget is shown at Appendix 7.

**TABLE 4: SUMMARY OF FINANCING PLAN**

<b>Contributors</b>	<b>EUR</b>	<b>%</b>
CDB	327,925	81
GOJ	79,173	19
<b>TOTAL</b>	<b>407,098</b>	<b>100</b>

## 8. FUNDING SOURCE

8.01 CDB grant to GOJ of an amount in the equivalent of EUR327,925 is eligible for financing from CDB SFR allocated from resources provided under the ACP-EU-CDB NDRM in the CARIFORUM Countries Programme. Funds are available within existing resources.

## 9. PROCUREMENT

9.01 Procurement shall be in accordance with the CDB Guidelines for Procurement (January 2006) for goods, works and non-consultancy services, and the CDB Guidelines for the Selection and Engagement of Consultants (October 2011) for consultancy services. Financing shall be provided under the ACP-EU-CDB NDRM in CARIFORUM Countries Agreement and thus, in accordance with that Agreement eligibility

shall be extended to countries which are eligible for procurement under EU-funded projects, which are not CDB member countries, in accordance with the EU Eligibility Rules set out in Appendix 8.

9.02 MSJ oversees an existing network of automatic weather stations (AWS), which were supplied and supported by an American company. These stations conform to WMO requirements and their cost reflects the prevailing market rate for such offerings. The AWS equipment required under the Project will expand and enhance the existing network of weather stations and therefore, given the need for the standardisation of the new equipment with that which is already in place, it is intended to procure it under the direct contracting procurement method, as allowed for under paragraph 3.07 (b) of the above-mentioned Guidelines for Procurement (January 2006), from the American company.

9.03 The American company manufactures the required AWS equipment in the United States of America. Therefore, a waiver of CDB Guidelines for Procurement (2006) is sought to further extend eligibility for the supplier of the AWS equipment and the origin and source of the equipment beyond that allowed with reference to the funding source (see paragraph 9.01) to additionally include the United States of America for this Project. The EU has confirmed in writing that the required extension of eligibility can be undertaken in accordance with CDB's procedures. The value of the waiver is estimated at EUR15,288.

9.04 CDB's usual practice is to allow for the allocation of up to a maximum of 30% of the resources provided for TA for the procurement of goods such as equipment and related items. In this Project the equipment required to be purchased is critical to facilitate data collection to feed the multi-criteria model and to strengthen JFB capacity to respond to bush fire events and record the data in a computerised format and thus it is proposed that 32% of the financing provided by CDB be utilised for equipment procurement.

9.05 The Procurement Plan is provided at Appendix 9. Any revisions to the Procurement Plan would require CDB prior approval in writing.

## **10. REPORTING**

10.01 GOJ will be required to submit to CDB, in form and substance acceptable to CDB, the reports described at Appendix 2A.

## **11. RECOMMENDATION**

11.01 It is recommended that CDB make a grant to GOJ of an amount not exceeding the equivalent of three hundred and twenty-seven thousand, nine hundred and twenty-five Euros (EUR327,925) (the Grant), from CDB SFR, to assist GOJ in financing consultancy services and procurement of goods and services for "Developing a Comprehensive Bush Fire Warning Index for Effective Bush Fire Management" (the Project), on CDB standard terms and conditions, and on the following terms and conditions:

### **(1) Disbursement:**

Except as CDB may otherwise agree, and subject to paragraph (b) below, payment of the Grant shall be made as follows:

(a) an amount not exceeding the equivalent of ninety-eight thousand, three hundred and seventy-seven Euros (EUR98,377) of the Grant shall be paid as an advance (the Advance) on account of expenditures in respect of the Project, following receipt by CDB of:

(i) a request in writing from GOJ for such funds; and

- (ii) evidence acceptable to CDB, that the condition precedent to first disbursement of the Grant set out in sub-paragraph (3) below has been satisfied; and
- (b) the balance of the Grant shall be paid periodically, by way of further advances (each, a subsequent advance), on account of expenditure in respect of the Project, following receipt by CDB of an account and documentation satisfactory to CDB with respect to each preceding advance, provided however, that CDB shall not be under any obligation to make:
  - (i) the first such subsequent advance until CDB shall have received an account and documentation satisfactory to CDB, in support of expenditures incurred by GOJ with respect to the Advance;
  - (ii) any subsequent advance until CDB shall have received the requisite number of copies of the reports, in form and substance acceptable to CDB, to be furnished for the time being by GOJ and the PC, in accordance with the TOR set out at Appendix 2A; and
  - (iii) payments exceeding the equivalent of two hundred and ninety-five thousand, one hundred and thirty-two Euros (EUR295,132) representing ninety percent (90%) of the Grant, until CDB shall have received the requisite number of copies of the final report in form and substance acceptable to CDB, required to be furnished by GOJ and the PC in accordance with the TOR set out at Appendix 2A and a certified statement of the expenditures incurred in respect of, and in connection with, the Project.

(2) **Period of Disbursement:**

The first payment of the Grant shall be made by May 15, 2017, and the Grant shall be fully disbursed by January 31, 2019 or such later dates as CDB may specify in writing.

(3) **Condition Precedent to First Disbursement of the Grant:**

The PC referred to in sub-paragraph (5)(b)(i) below shall have been assigned.

(4) **Procurement:**

- (a) Except as provided in sub-paragraph (b) below, procurement shall be in accordance with the procedures set out and/or referred to in the Grant Agreement between CDB and GOJ or such other procedures as CDB may from time to time specify in writing. The Procurement Plan approved by CDB is set out at Appendix 9. Any revisions to the Procurement Plan shall require CDB's prior approval in writing.
- (b) In order to comply with the requirements of the ACP-EU-CDB NDRM in CARIFORUM Countries contribution agreement, country eligibility shall be extended to countries which are eligible for procurement under EU-funded projects, which are not CDB member countries.

(5) **Other Conditions:**

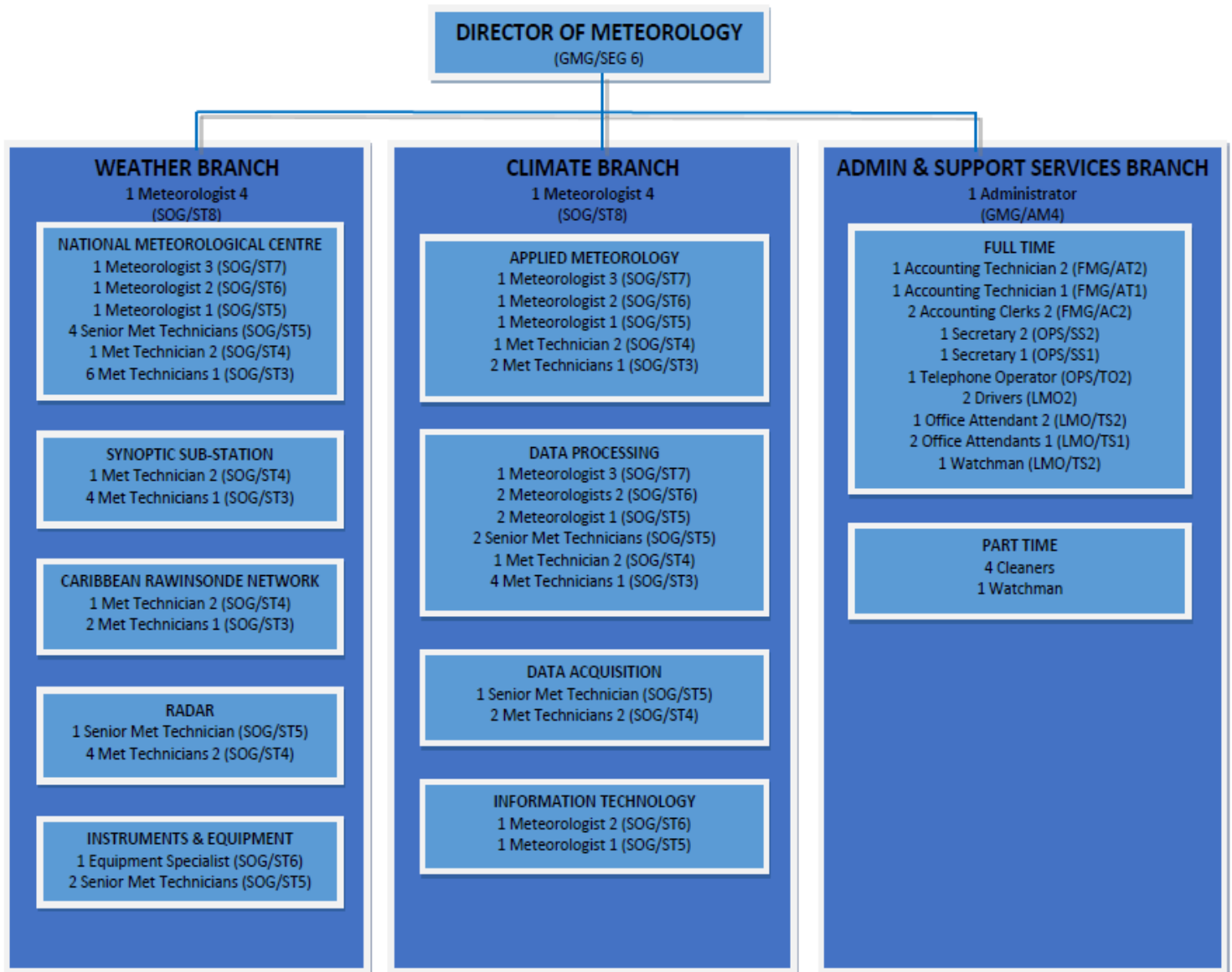
- (a) Except as CDB may otherwise agree, the Grant shall be implemented through the Climate Branch of MSJ.
- (b) MSJ shall assign a senior member of its staff as PC who shall be responsible for coordinating the implementation of the Project, including the carrying out of the functions described in the TOR set out at Appendix 2A. The qualifications and experience of any person subsequently appointed as PC shall be acceptable to CDB;
- (c) GOJ shall:
  - (i) Establish, and for the duration of the Project maintain, a PSC which shall have the responsibility, functions and composition as described in paragraph 5.03 of this Paper;
  - (ii) in accordance with the procurement procedures applicable to the Grant select and engage consultants to carry out the services set out in the TORs at Appendices 2B to 2F;
  - (iii) in all relevant workshops, publications, correspondence, advertisements and promotions associated with the Grant, openly acknowledge the financial support from the EU in the framework of the ACP-EU-CDB NDRM in CARIFORUM Countries and CDB's contribution to the Project, and display the EU, ACP and CDB's logos; and
  - (iv) submit to CDB, in form and substance acceptable to CDB, the reports set out in Appendix 2A to this Paper within the periods stipulated therein.
- (d) Except as CDB may otherwise agree, GOJ shall:
  - (i) meet, or cause to be met:
    - (aa) the cost of the items designated for financing by GOJ in the Budget;
    - (bb) any amount by which the cost of the Grant exceeds the estimated costs set out in the Budget; and
    - (cc) the cost of any other items needed for the purpose of, or in connection with, the Grant; and
  - (ii) provide all other inputs required for the punctual and efficient carrying out of the Grant not being financed by CDB.

- (e) CDB shall be entitled to suspend, cancel or require a refund of the Grant, or any part thereof, if there shall have been a failure by the donors, to provide the whole or any part of their contribution, except that GOJ shall not be required to refund any amount of the Grant already expended by GOJ in connection with the Grant and not recoverable by it.

**SUPPORTING DOCUMENTATION**

- Appendix 1 - Organisational Structure
- Appendix 2A - TOR - Project Coordinator
- Appendix 2B - TOR - Data Collection Assistants
- Appendix 2C - TOR - GIS Modelling Assistant
- Appendix 2D - TOR - Data Management Consultant
- Appendix 2E - TOR - CAP Consultant
- Appendix 2F - TOR - Public Education, Awareness and Outreach Campaign Consulting Firm
- Appendix 3 - Design and Monitoring Framework
- Appendix 4 - Project Implementation Schedule
- Appendix 5 - Performance Assessment Score
- Appendix 6 - Gender Marker Analysis
- Appendix 7 - Budget
- Appendix 8 - EU Eligibility Rules
- Appendix 9 - Procurement Plan

**ORGANISATIONAL STRUCTURE – METEOROLOGICAL SERVICE OF JAMAICA**



DEVELOPING A COMPREHENSIVE BUSH FIRE WARNING INDEX FOR  
EFFECTIVE BUSH FIRE MANAGEMENT – JAMAICA

DRAFT TERMS OF REFERENCE  
PROJECT COORDINATOR

**1. BACKGROUND**

1.01. The African Caribbean Pacific–European Union–Caribbean Development Bank Natural Disaster Risk Management (ACP-EU-CDB NDRM) programme is a part of the Caribbean component of the 10th European Development Fund Intra-ACP Cooperation Strategy (2008-2013) in which the ACP Group and the EU recognised the need to increase efforts with regard to *ex ante* Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). The ACP-EU-CDB NDRM programme aims at reducing the vulnerability to long-term impacts of natural hazards, including the potential impacts of climate change (CC), thereby achieving regional and national sustainable development and poverty reduction goals in the CARIFORUM Countries. The programme comprises four Result Areas (RAs) being managed by three implementing partners, the Caribbean Disaster Emergency Management Agency (CDEMA) (RA 1); CDB (RA 2 and RA 3); and the Ministry of the Presidency of the Dominican Republic (RA 4). CDB's components focus on strengthening regional, national and community level capacities for mitigation, preparedness, management and coordinated response to natural hazards and the effects of CC. The four RAs are:

- (a) **RA 1** - Capacity of National Disaster Management Offices and CDEMA Coordinating Unit Strengthened for Implementation of Comprehensive Disaster Management.
- (b) **RA 2** - National, Local and Regional Resilience Enhanced through Strengthened Early Warning, National Risk Profiling and Community-based DRR.
- (c) **RA 3** - Sector Resilience Strengthened in Key Public Sectors, through DRR and CCA Mainstreaming.
- (d) **RA 4** - Capacity building and the Establishment of Common Policies, Strategies, Programmes and Sub-programmes Undertaken as a Contribution.

1.02 Bush fires occur naturally and play a role in the evolution of the landscape, soil fertility and biodiversity. Over the last two decades, an increase has been observed in the incidence of bush fires during the dry season (especially January-March) and especially during periods of severe drought in Jamaica. An increase in the risk of droughts has been predicted with the occurring global warning<sup>1</sup> resulting from human activities that contribute to increasing concentrations of greenhouse gases in the atmosphere. Thus, it can be inferred that climate variability and CC will likely result in an ever-increasing number of drought-induced bush fires in Jamaica.

1.03 Bush fires have caused significant negative socio-economic impacts particularly on property and the agriculture and forestry sectors in Jamaica. Between 1996 and 2005, damage and losses in agriculture

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due to bush fires were estimated at USD0.7 million (mn) over the years<sup>2</sup>. In 2014, the Rural Agricultural Development Authority reported over 1,600 hectares of land valued at over USD8.33 mn was lost or damaged due to drought and fires and affected over 16,000 farmers<sup>3</sup>. In 2015, 7,261 of such fires occurred. In May 2015, a bush fire event in rural St. Andrew, destroyed approximately 367 hectares of forest cover<sup>4</sup>, contributing to an increase in air pollution with adverse impact on human health, as well as the removal of key carbon sinks. Currently, bush fires account for 63%<sup>5</sup> of the total number of emergency calls to the Jamaica Fire Brigade (JFB).

1.04 The Meteorological Services of Jamaica (MSJ) in collaboration with the International Research Institute for Climate and Society and the Caribbean Institute for Meteorology and Hydrology have worked to develop a one-to-five-day forecast tool which attempts to predict likely outbreaks of bush fires. This is done via the use of the Keetch-Byram Drought Index (KBDI), which was developed by John Keetch and George Byram in 1968 to specifically assess forest fire potential. This drought index represents the net effect of evapotranspiration and precipitation in producing loss in moisture content of the upper level of the soil including organic matter. The KBDI is computed from annual precipitation, daily precipitation and daily maximum temperature. The values of the KBDI ranges from 0-800, with higher values indicating drier conditions and higher risk of fire.

1.05 Although KBDI is useful for fire potential assessment, its application as an early warning tool and decision-making aid for fire management is limited as the index lacks customisation to local conditions and does not include other key factors of fire behaviour such as vegetation (sometimes termed as fuel loading) and topography. For instance, while weather conditions mainly influence the start of a bush fire, it is the vegetation and topography that dictate the maintenance and spread of fire. Under similar weather conditions, two zones with a different vegetation (e.g. grass versus trees) will experience a different bush fire behaviour. Generally grasslands are more conducive to fires than forests as the latter is coarser and slower to combust. When weather conditions and vegetation are similar, zones with differing gradient (e.g. flat land versus sloping) will not exhibit the same bush fire behaviour. Fires will tend to spread faster on a slope than on flat ground. Therefore, integrating weather, vegetation and topography in the determination of the bush fire index will increase its accuracy.

1.06 The development of a robust model aside, a common alerting protocol (CAP) and public education and awareness are critical to ensure timely preparation and effective response to bush fires. Following a series of devastating fires that affected farms in Mavis Bank, St. Andrew, and Nain in St. Elizabeth, Jamaica in 2015, JFB launched a Community Bush Fire Management Education Programme, which has shown great success. At October 2016, no incident of fire was observed in Mavis Bank, where fires destroyed acres of farmland last year. A key element of this success is due to local community involvement in the programme.

1.07 The Government of Jamaica through the MSJ is proposing to develop a comprehensive Jamaican Bush Fire Warning Index to determine critical thresholds for outbreaks under different conditions for effective bush fire management. The current proposal include four components: (a) development of a multi-criteria model weighing KBDI as well as topography and vegetation factors; (b) pilot sites monitoring; (c) development of alerting protocol; and (d) public education and awareness campaign. This work requires an interdisciplinary approach and inter-agency coordinated effort.

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<sup>3</sup> <http://jis.gov.jm/statement-drought-conditions-impact-agricultural-sector>.

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<sup>5</sup> Average between 2007 and 2014 – Auditor General’s Department Performance Audit Report of the JFB.

**2 OBJECTIVES**

2.01 The primary objective of this position is to coordinate the development of the multi-criteria bush fire index, CAP, and the public education and awareness campaign.

**3 SCOPE OF WORK**

3.01 The Project Coordinator (PC) will be directly responsible for coordinating the execution of all Project activities and ensuring Project technical supervision and the quality of deliverables.

3.02 Specific duties and responsibilities of the PC will include, but not be limited to:

- (a) coordinating the development of the multi-criteria bush fire including pilot sites selection and monitoring, data collection and analysis, and reporting;
- (b) coordinating CAP development;
- (c) facilitating public education and awareness campaign and stakeholder consultations;
- (d) ensuring that stakeholder consultations and public education and awareness campaigns include vulnerable groups such as women, youth, the elderly and persons with disabilities,
- (e) as well as reporting on how they are included and being targeted;
- (f) managing the selection and engagement of consultants and contractors, and the procurement of materials, goods and services;
- (g) ensuring timely and quality deliverables;
- (h) liaising with CDB's Project Management Unit on all technical, administrative and financial aspects of the Project;
- (i) managing Project financial resources;
- (j) preparing and submitting progress reports to CDB; and
- (k) executing any other tasks as assigned by MSJ to facilitate the successful completion of the Project.

**4 QUALIFICATIONS AND EXPERIENCE**

4.01 The Consultant must have recognised credentials (Master's degree or higher) in Meteorology, Climatology, Forestry, Environmental Sciences, Soil Sciences, Climate Science, or related field, and proven experience (at least seven years) in:

- (a) climate modelling;
- (b) environmental modelling; and
- (c) statistical analysis.

4.02 The Consultant shall also possess:

- (a) excellent research, analytical, organisational and communication skills;
- (b) specific experience in the Caribbean region; and
- (c) good understanding of the environmental challenges in Small Island Developing States.

**5 REPORTING REQUIREMENTS AND DELIVERABLES**

5.01 The PC will be required to provide the following reports and deliverables to CDB:

- (a) Inception Report within two weeks of the signing of the Grant Agreement and a revised implementation schedule;
- (b) Quarterly Reports on the progress of implementation activities under the Project following the signing of the Grant Agreement until implementation of the Project is completed; and
- (c) Final Project Report at the end of 19 months following the start of the assignment.

**6 DURATION**

6.01 The duration of this assignment is 19 months.

**DEVELOPING A COMPREHENSIVE BUSH FIRE WARNING INDEX FOR  
EFFECTIVE BUSH FIRE MANAGEMENT – JAMAICA**

**DRAFT TERMS OF REFERENCE  
DATA COLLECTION ASSISTANT**

**1. BACKGROUND**

1.01 The African Caribbean Pacific–European Union–Caribbean Development Bank Natural Disaster Risk Management (ACP-EU-CDB NDRM) programme is a part of the Caribbean component of the 10<sup>th</sup> European Development Fund Intra-ACP Cooperation Strategy (2008-2013) in which the ACP Group and the EU recognised the need to increase efforts with regard to *ex ante* Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). The ACP-EU-CDB NDRM programme aims at reducing the vulnerability to long-term impacts of natural hazards, including the potential impacts of climate change (CC), thereby achieving regional and national sustainable development and poverty reduction goals in the CARIFORUM Countries. The programme comprises four Result Areas (RAs) being managed by three implementing partners, the Caribbean Disaster Emergency Management Agency (CDEMA) (RA 1); CDB (RA 2 and RA 3); and the Ministry of the Presidency of the Dominican Republic (RA 4). CDB's components focus on strengthening regional, national and community level capacities for mitigation, preparedness, management and coordinated response to natural hazards and the effects of CC. The four RAs are:

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- (b) **RA 2** - National, Local and Regional Resilience Enhanced through Strengthened Early Warning, National Risk Profiling and Community-based DRR.
- (c) **RA 3** - Sector Resilience Strengthened in Key Public Sectors, through DRR and CCA Mainstreaming.
- (d) **RA 4** - Capacity building and the Establishment of Common Policies, Strategies, Programmes and Sub-programmes Undertaken as a Contribution.

1.02 Bush fires occur naturally and play a role in the evolution of the landscape, soil fertility and biodiversity. Over the last two decades, an increase has been observed in the incidence of bush fires during the dry season (especially January-March) and especially during periods of severe drought in Jamaica. An increase in the risk of droughts has been predicted with the occurring global warning<sup>1</sup> resulting from human activities that contribute to increasing concentrations of greenhouse gases in the atmosphere. Thus, it can be inferred that climate variability and CC will likely result in an ever-increasing number of drought-induced bush fires in Jamaica.

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1.04 The Meteorological Services of Jamaica (MSJ) in collaboration with the International Research Institute for Climate and Society and the Caribbean Institute for Meteorology and Hydrology have worked to develop a one-to-five-day forecast tool which attempts to predict likely outbreaks of bush fires. This is done via the use of the Keetch-Byram Drought Index (KBDI), which was developed by John Keetch and George Byram in 1968 to specifically assess forest fire potential. This drought index represents the net effect of evapotranspiration and precipitation in producing loss in moisture content of the upper level of the soil including organic matter. The KBDI is computed from annual precipitation, daily precipitation and daily maximum temperature. The values of the KBDI ranges from 0-800, with higher values indicating drier conditions and higher risk of fire.

1.05 Although KBDI is useful for fire potential assessment, its application as an early warning tool and decision-making aid for fire management is limited as the index lacks customisation to local conditions and does not include other key factors of fire behaviour such as vegetation (sometimes termed as fuel loading) and topography. For instance, while weather conditions mainly influence the start of a bush fire, it is the vegetation and topography that dictate the maintenance and spread of fire. Under similar weather conditions, two zones with a different vegetation (e.g. grass versus trees) will experience a different bush fire behaviour. Generally grasslands are more conducive to fires than forests as the latter is coarser and slower to combust. When weather conditions and vegetation are similar, zones with differing gradient (e.g. flat land versus sloping) will not exhibit the same bush fire behaviour. Fires will tend to spread faster on a slope than on flat ground. Therefore, integrating weather, vegetation and topography in the determination of the bush fire index will increase its accuracy.

1.06 The development of a robust model aside, a common alerting protocol and public education and awareness are critical to ensure timely preparation and effective response to bush fires. Following a series of devastating fires that affected farms in Mavis Bank, St. Andrew, and Nain in St. Elizabeth, Jamaica in 2015, JFB launched a Community Bush Fire Management Education Programme, which has shown great success. At October 2016, no incident of fire was observed in Mavis Bank, where fires destroyed acres of farmland last year. A key element of this success is due to local community involvement in the programme.

1.07 The Government of Jamaica through the MSJ is proposing to develop a comprehensive Jamaican Bush Fire Warning Index to determine critical thresholds for outbreaks under different conditions for effective bush fire management. The current proposal include four components: (a) development of a multi-criteria model weighing KBDI as well as topography and vegetation factors; (b) pilot sites monitoring; (c) development of alerting protocol; and (d) public education and awareness campaign. This work requires an interdisciplinary approach and inter-agency coordinated effort.

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<sup>4</sup> <http://jis.gov.jm/bush-fires-have-destroyed-hundreds-of-acres>.

<sup>5</sup> Average between 2007 and 2014 – AGD Performance Audit Report of the JFB.

1.08 The consultancy is directed at assisting with bush fire data collection and analysis process to build the multi-criteria bush fire index in Jamaica.

**2. OBJECTIVES**

2.01 The primary objective of this position is to collect, compile and analyse data on bush fire occurrences across Jamaica to be used in the development of a multi-criteria model for bush fire behaviour.

**3. SCOPE OF WORK**

3.01 The scope of services is understood to cover all activities necessary to accomplish the objectives of the consultancy, whether or not a specific activity is cited in these Terms of Reference (TOR). The draft TOR will be finalised based on discussions with the Data Collection Assistant. A participatory and consultative approach is to be encouraged in the conduct of the services, which will contribute to their completion in as timely a manner as possible.

3.02 Specific duties and responsibilities of the Data Collection Assistant include:

- (a) collecting and compiling data on bush fires;
- (b) presenting data in Geographic Information System (GIS) mapping software; and
- (c) assisting in the development of an electronic surface for bush fire data entry and management.

**4. QUALIFICATIONS AND EXPERIENCE**

4.01 The Data Collection Assistant is required to have completed at least two years of undergraduate study, preferably in GIS, Geography, Environmental Sciences, or related disciplines. The Consultant shall also possess:

- (a) good research, and organisational skills;
- (b) specific experience in GIS software and Microsoft Office Suite; and
- (c) good communication skills.

**5. REPORTING REQUIREMENTS AND DELIVERABLES**

5.01 The Data Collection Assistant will be required to collaboratively map incidences of bush fire on a GIS platform.

**6. DURATION**

6.01 The duration of this assignment is two months.

DEVELOPING A COMPREHENSIVE BUSH FIRE WARNING INDEX FOR  
EFFECTIVE BUSH FIRE MANAGEMENT – JAMAICA

DRAFT TERMS OF REFERENCE  
GEOGRAPHIC INFORMATION SYSTEM MODELING ASSISTANT

**1. BACKGROUND**

1.01 The African Caribbean Pacific–European Union–Caribbean Development Bank Natural Disaster Risk Management (ACP-EU-CDB NDRM) programme is a part of the Caribbean component of the 10<sup>th</sup> European Development Fund Intra-ACP Cooperation Strategy (2008-2013) in which the ACP Group and the EU recognised the need to increase efforts with regard to *ex ante* Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). The ACP-EU-CDB NDRM programme aims at reducing the vulnerability to long-term impacts of natural hazards, including the potential impacts of climate change (CC), thereby achieving regional and national sustainable development and poverty reduction goals in the CARIFORUM Countries. The programme comprises four Result Areas (RAs) being managed by three implementing partners, the Caribbean Disaster Emergency Management Agency (CDEMA) (RA 1); CDB (RA 2 and RA 3); and the Ministry of the Presidency of the Dominican Republic (RA 4). CDB’s components focus on strengthening regional, national and community level capacities for mitigation, preparedness, management and coordinated response to natural hazards and the effects of CC. The four RAs are:

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- (c) **RA 3** - Sector Resilience Strengthened in Key Public Sectors, through DRR and CCA Mainstreaming.
- (d) **RA 4** - Capacity building and the Establishment of Common Policies, Strategies, Programmes and Sub-programmes Undertaken as a Contribution.

1.02 Bush fires occur naturally and play a role in the evolution of the landscape, soil fertility and biodiversity. Over the last two decades, an increase has been observed in the incidence of bush fires during the dry season (especially January-March) and especially during periods of severe drought in Jamaica. An increase in the risk of droughts has been predicted with the occurring global warning<sup>1</sup> resulting from human activities that contribute to increasing concentrations of greenhouse gases in the atmosphere. Thus, it can be inferred that climate variability and climate change will likely result in an ever-increasing number of drought-induced bush fires in Jamaica.

1.03 Bush fires have caused significant negative socio-economic impacts particularly on property and the agriculture and forestry sectors in Jamaica. Between 1996 and 2005, damage and losses in agriculture due to bush fires were estimated at USD0.7 million (mn) over the years<sup>2</sup>. In 2014, the Rural Agricultural

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Development Authority reported over 1,600 hectares of land valued at over USD8.33 mn was lost or damaged due to drought and fires and affected over 16,000 farmers<sup>3</sup>. In 2015, 7,261 of such fires occurred. In May 2015, a bush fire event in rural St. Andrew, destroyed approximately 367 hectares of forest cover<sup>4</sup>, contributing to an increase in air pollution with adverse impact on human health, as well as the removal of key carbon sinks. Currently, bush fires account for 63%<sup>5</sup> of the total number of emergency calls to the Jamaica Fire Brigade (JFB).

1.04 The Meteorological Services of Jamaica (MSJ) in collaboration with the International Research Institute for Climate and Society and the Caribbean Institute for Meteorology and Hydrology have worked to develop a one-to-five-day forecast tool which attempts to predict likely outbreaks of bush fires. This is done via the use of the Keetch-Byram Drought Index (KBDI), which was developed by John Keetch and George Byram in 1968 to specifically assess forest fire potential. This drought index represents the net effect of evapotranspiration and precipitation in producing loss in moisture content of the upper level of the soil including organic matter. The KBDI is computed from annual precipitation, daily precipitation and daily maximum temperature. The values of the KBDI ranges from 0-800, with higher values indicating drier conditions and higher risk of fire.

1.05 Although KBDI is useful for fire potential assessment, its application as an early warning tool and decision-making aid for fire management is limited as the index lacks customisation to local conditions and does not include other key factors of fire behaviour such as vegetation (sometimes termed as fuel loading) and topography. For instance, while weather conditions mainly influence the start of a bush fire, it is the vegetation and topography that dictate the maintenance and spread of fire. Under similar weather conditions, two zones with a different vegetation (e.g. grass versus trees) will experience a different bush fire behaviour. Generally grasslands are more conducive to fires than forests as the latter is coarser and slower to combust. When weather conditions and vegetation are similar, zones with differing gradient (e.g. flat land versus sloping) will not exhibit the same bush fire behaviour. Fires will tend to spread faster on a slope than on flat ground. Therefore, integrating weather, vegetation and topography in the determination of the bush fire index will increase its accuracy.

1.06 The development of a robust model aside, a common alerting protocol and public education and awareness are critical to ensure timely preparation and effective response to bush fires. Following a series of devastating fires that affected farms in Mavis Bank, St. Andrew, and Nain in St. Elizabeth, Jamaica in 2015, JFB launched a Community Bush Fire Management Education Programme, which has shown great success. At October 2016, no incident of fire was observed in Mavis Bank, where fires destroyed acres of farmland last year. A key element of this success is due to local community involvement in the programme.

1.07 The Government of Jamaica through the MSJ is proposing to develop a comprehensive Jamaican Bush Fire Warning Index to determine critical thresholds for outbreaks under different conditions for effective bush fire management. The current proposal include four components: (a) development of a multi-criteria model weighing KBDI as well as topography and vegetation factors; (b) pilot sites monitoring; (c) development of alerting protocol; and (d) public education and awareness campaign. This work requires an interdisciplinary approach and inter-agency coordinated effort.

1.08 The consultancy is directed at assisting with bush fire data collection and analysis process to build the multi-criteria bush fire index in Jamaica.

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<sup>5</sup> Average between 2007 and 2014 – Auditor General’s Department Performance Audit Report of the JFB.



**2. OBJECTIVE**

2.01 The primary objective of this position is to assist in weighting the influence of environmental factors on bush fires and account for these factors in the model.

**3. SCOPE OF WORK**

3.01 The scope of services is understood to cover all activities necessary to accomplish the objectives of the consultancy, whether or not a specific activity is cited in these Terms of Reference (TOR). The draft TOR will be finalised based on discussions with the Geographic Information System (GIS) Modelling Assistant. A participatory and consultative approach is to be encouraged in the conduct of the services, which will contribute to their completion in as timely a manner as possible.

3.02 Specific duties and responsibilities of the GIS Modelling Assistant include *inter alia*:

- (a) determining specific weighting of factors in order to develop a bush fire warning model; and
- (b) using the developed model to determine pilot sites for monitoring bush fires.

**4. QUALIFICATIONS AND EXPERIENCE**

4.01 The GIS Modelling Assistant is required to have completed at least three years of undergraduate study, preferably in GIS, Geography, Environmental Sciences, or related disciplines. The GIS Modelling Assistant shall also possess:

- (a) good research, and organisational skills;
- (b) specific experience in GIS software and Microsoft Office Suite; and
- (c) good communication skills.

**5. REPORTING REQUIREMENTS AND DELIVERABLES**

5.01 The GIS Modelling Assistant will be required to collaboratively map incidences of bush fire on a GIS platform.

**6. DURATION**

6.01 The duration of this assignment is five months.

DEVELOPING A COMPREHENSIVE BUSH FIRE WARNING INDEX FOR  
EFFECTIVE BUSH FIRE MANAGEMENT - JAMAICA

DRAFT TERMS OF REFERENCE  
DATA MANAGEMENT CONSULTANT

**1. BACKGROUND**

1.01 The African Caribbean Pacific–European Union–Caribbean Development Bank Natural Disaster Risk Management (ACP-EU-CDB NDRM) programme is a part of the Caribbean component of the 10<sup>th</sup> European Development Fund Intra-ACP Cooperation Strategy (2008-2013) in which the ACP Group and the EU recognised the need to increase efforts with regard to *ex ante* Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). The ACP-EU-CDB NDRM programme aims at reducing the vulnerability to long-term impacts of natural hazards, including the potential impacts of climate change (CC), thereby achieving regional and national sustainable development and poverty reduction goals in the CARIFORUM Countries. The programme comprises four Result Areas (RAs) being managed by three implementing partners, the Caribbean Disaster Emergency Management Agency (CDEMA) (RA 1); CDB (RA 2 and RA 3); and the Ministry of the Presidency of the Dominican Republic (RA 4). CDB's components focus on strengthening regional, national and community level capacities for mitigation, preparedness, management and coordinated response to natural hazards and the effects of CC. The four RAs are:

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1.08 The consultancy is directed at assessing data collection and management practices of the JFB and building their capacity for recording, managing and exchanging bush fire data effectively.

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<sup>5</sup> Average between 2007 and 2014 – Auditor General’s Department Performance Audit Report of the JFB.

**2. OBJECTIVES**

2.01 The primary objective of the consultancy is to review and assess the data collection and management practices of JFB in order to identify gaps and opportunities for improvement.

**3. SCOPE OF WORK**

3.01 The scope of services is understood to cover all activities necessary to accomplish the objectives of the consultancy, whether or not a specific activity is cited in these Terms of Reference (TOR). The draft TOR will be finalised based on discussions with the Consultant. A participatory and consultative approach is to be encouraged in the conduct of the services, which will contribute to their completion in as timely a manner as possible.

3.02 Specific duties and responsibilities of the Consultant include:

- (a) determining how bush fire data is collected, stored, retrieved and communicated;
- (b) determining appropriateness and weaknesses of current measures of collecting bush fire data;
- (c) specifying the methodology and infrastructure required for future transfer of bush fire data between JFB and MSJ and other partners;
- (d) designing and developing a suitable and user friendly interface for JFB to facilitate bush fire data management including the capture and reporting of data; and
- (e) developing a manual and providing training to JFB personnel on data entry and management towards the implementation of the new JFB data management system.

**4. QUALIFICATIONS AND EXPERIENCE**

4.01 The Consultant is required to have recognised credentials (Master's degree plus five years of experience, or Bachelor's degree plus seven years of experience) in Data Management, Database Development, Computer Science or related fields.

4.02 The Consultant shall also possess:

- (a) good research, analytical and organisational skills;
- (b) good oral and written communication skills; and
- (c) working experience in scientific data collection and reporting.

**5. REPORTING REQUIREMENTS AND DELIVERABLES**

5.01 The Consultant will be required to provide the following reports and deliverables:

- (a) an electronic interface for bush fire data entry and management by JFB;
- (b) training on the use of the interface for 50 persons of JFB; and

- (c) a technical report of data management practices at JFB and an implementation plan for the modernisation of data management practices at JFB.

**6. DURATION**

- 6.01 This assignment will require a level of effort of 15 days over a period of three months.

**DEVELOPING A COMPREHENSIVE BUSH FIRE WARNING INDEX FOR EFFECTIVE  
BUSH FIRE MANAGEMENT – JAMAICA**

**DRAFT TERMS OF REFERENCE  
COMMON ALERTING PROTOCOL CONSULANT**

**1. BACKGROUND**

1.01 The African Caribbean Pacific–European Union–Caribbean Development Bank Natural Disaster Risk Management (ACP-EU-CDB NDRM) programme is a part of the Caribbean component of the 10<sup>th</sup> European Development Fund Intra-ACP Cooperation Strategy (2008-2013) in which the ACP Group and the EU recognised the need to increase efforts with regard to *ex ante* Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). The ACP-EU-CDB NDRM programme aims at reducing the vulnerability to long-term impacts of natural hazards, including the potential impacts of climate change (CC), thereby achieving regional and national sustainable development and poverty reduction goals in the CARIFORUM Countries. The programme comprises four Result Areas (RAs) being managed by three implementing partners, the Caribbean Disaster Emergency Management Agency (CDEMA) (RA 1); CDB (RA 2 and RA 3); and the Ministry of the Presidency of the Dominican Republic (RA 4). CDB’s components focus on strengthening regional, national and community level capacities for mitigation, preparedness, management and coordinated response to natural hazards and the effects of CC. The four RAs are:

- (a) **RA 1** - Capacity of National Disaster Management Offices and CDEMA Coordinating Unit Strengthened for Implementation of Comprehensive Disaster Management.
- (b) **RA 2** - National, Local and Regional Resilience Enhanced through Strengthened Early Warning, National Risk Profiling and Community-based DRR.
- (c) **RA 3** - Sector Resilience Strengthened in Key Public Sectors, through DRR and CCA Mainstreaming.
- (d) **RA 4** - Capacity building and the Establishment of Common Policies, Strategies, Programmes and Sub-programmes Undertaken as a Contribution.

1.02 Bush fires occur naturally and play a role in the evolution of the landscape, soil fertility and biodiversity. Over the last two decades, an increase has been observed in the incidence of bush fires during the dry season (especially January-March) and especially during periods of severe drought in Jamaica. An increase in the risk of droughts has been predicted with the occurring global warning<sup>1</sup> resulting from human activities that contribute to increasing concentrations of greenhouse gases in the atmosphere. Thus, it can be inferred that climate variability and climate change will likely result in an ever-increasing number of drought-induced bush fires in Jamaica.

1.03 Bush fires have caused significant negative socio-economic impacts particularly on property and the agriculture and forestry sectors in Jamaica. Between 1996 and 2005, damage and losses in agriculture due to bush fires were estimated at USD0.7 million (mn) over the years<sup>2</sup>. In 2014, the Rural Agricultural

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<sup>1</sup> Intergovernmental Panel on Climate Change (IPCC), 2014. CC 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the IPCC [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

<sup>2</sup> Selvaraju, Ramasamy, et al. CC and agriculture in Jamaica: Agricultural sector support analysis. Food and Agriculture Organization of the United Nations, 2013.

Development Authority reported over 1,600 hectares of land valued at over USD8.33 mn was lost or damaged due to drought and fires and affected over 16,000 farmers<sup>3</sup>. In 2015, 7,261 of such fires occurred. In May 2015, a bush fire event in rural St. Andrew, destroyed approximately 367 hectares of forest cover<sup>4</sup>, contributing to an increase in air pollution with adverse impact on human health, as well as the removal of key carbon sinks. Currently, bush fires account for 63%<sup>5</sup> of the total number of emergency calls to the Jamaica Fire Brigade (JFB).

1.04 The Meteorological Services of Jamaica (MSJ) in collaboration with the International Research Institute for Climate and Society and the Caribbean Institute for Meteorology and Hydrology have worked to develop a one-to-five-day forecast tool which attempts to predict likely outbreaks of bush fires. This is done via the use of the Keetch-Byram Drought Index (KBDI), which was developed by John Keetch and George Byram in 1968 to specifically assess forest fire potential. This drought index represents the net effect of evapotranspiration and precipitation in producing loss in moisture content of the upper level of the soil including organic matter. The KBDI is computed from annual precipitation, daily precipitation and daily maximum temperature. The values of the KBDI ranges from 0-800, with higher values indicating drier conditions and higher risk of fire.

1.05 Although KBDI is useful for fire potential assessment, its application as an early warning tool and decision-making aid for fire management is limited as the index lacks customisation to local conditions and does not include other key factors of fire behaviour such as vegetation (sometimes termed as fuel loading) and topography. For instance, while weather conditions mainly influence the start of a bush fire, it is the vegetation and topography that dictate the maintenance and spread of fire. Under similar weather conditions, two zones with a different vegetation (e.g. grass versus trees) will experience a different bush fire behaviour. Generally grasslands are more conducive to fires than forests as the latter is coarser and slower to combust. When weather conditions and vegetation are similar, zones with differing gradient (e.g. flat land versus sloping) will not exhibit the same bush fire behaviour. Fires will tend to spread faster on a slope than on flat ground. Therefore, integrating weather, vegetation and topography in the determination of the bush fire index will increase its accuracy.

1.06 The development of a robust model aside, a common alerting protocol and public education and awareness are critical to ensure timely preparation and effective response to bush fires. Following a series of devastating fires that affected farms in Mavis Bank, St. Andrew, and Nain in St. Elizabeth, Jamaica in 2015, JFB launched a Community Bush Fire Management Education Programme, which has shown great success. At October 2016, no incident of fire was observed in Mavis Bank, where fires destroyed acres of farmland last year. A key element of this success is due to local community involvement in the programme.

1.07 The Government of Jamaica through the MSJ is proposed to develop a comprehensive Jamaican Bush Fire Warning Index to determine critical thresholds for outbreaks under different conditions for effective bush fire management. The current proposal include four components: (a) development of a multi-criteria model weighing KBDI as well as topography and vegetation factors; (b) pilot sites monitoring; (c) development of alerting protocol; and (d) public education and awareness campaign. This work requires an interdisciplinary approach and inter-agency coordinated effort.

1.08 The consultancy is directed at developing an operational and effective common alerting protocol (CAP) system for bush fires.

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<sup>3</sup> <http://jis.gov.jm/statement-drought-conditions-impact-agricultural-sector>.

<sup>4</sup> <http://jis.gov.jm/bush-fires-have-destroyed-hundreds-of-acres>.

<sup>5</sup> Average between 2007 and 2014 – Auditor General’s Department Performance Audit Report of the JFB.

**2. OBJECTIVES**

2.01 The primary objective of the consultancy is to assist MSJ in developing a CAP system along with the policy, standards and platform to govern the system.

**3. SCOPE OF WORK**

3.01 The scope of services is understood to cover all activities necessary to accomplish the objectives of the consultancy, whether or not a specific activity is cited in these Terms of Reference (TOR). The draft TOR will be finalised based on discussions with the Consultant. A participatory and consultative approach is to be encouraged in the conduct of the services, which will contribute to their completion in as timely a manner as possible.

3.02 Specific duties and responsibilities of the Consultant include:

- (a) reviewing the literature for existing CAP for bush fires and other hazards;
- (b) developing the standards to accompany the delivery of CAP as a service at MSJ;
- (c) advising on the policy direction and relationships with partnering agencies for the delivery of bush fire warnings via CAP; and
- (d) designing an implementation plan for the delivery of MSJ warnings via CAP.

**4. QUALIFICATIONS AND EXPERIENCE**

4.01 The Consultant is required to have recognised credentials (Master's degree and five years' experience, or Bachelor's degree and seven years' experience) in Disaster Risk Management, Communication and Public Relationship, Environmental Studies, or related fields.

4.02 The Consultant shall also possess:

- (a) sound knowledge of the CAP Standard (ITU-T X.1303);
- (b) working experience in strategic planning;
- (c) good research, analytical and project management skills; and
- (d) good oral and written communication skills.

**5. REPORTING REQUIREMENTS AND DELIVERABLES**

5.01 The Consultant will be required to provide the following reports and deliverables:

- (a) a Policy and Standards document of the proposed CAP service for bush fires, and
- (b) a Detailed Plan for the implementation of the CAP service for bush fires.



**6. DURATION**

6.01 This assignment will require a level of effort of 12.5 days over a period of two months.

**DEVELOPING A COMPREHENSIVE BUSH FIRE WARNING INDEX FOR  
EFFECTIVE BUSH FIRE MANAGEMENT – JAMAICA**

**DRAFT TERMS OF REFERENCE  
PUBLIC EDUCATION, AWARENESS AND OUTREACH CAMPAIGN CONSULTING FIRM**

**1. BACKGROUND**

1.01 The African Caribbean Pacific–European Union–Caribbean Development Bank Natural Disaster Risk Management (ACP-EU-CDB NDRM) programme is a part of the Caribbean component of the 10<sup>th</sup> European Development Fund Intra-ACP Cooperation Strategy (2008-2013) in which the ACP Group and the EU recognised the need to increase efforts with regard to *ex ante* Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). The ACP-EU-CDB NDRM programme aims at reducing the vulnerability to long-term impacts of natural hazards, including the potential impacts of climate change (CC), thereby achieving regional and national sustainable development and poverty reduction goals in the CARIFORUM Countries. The programme comprises four Result Areas (RAs) being managed by three implementing partners, the Caribbean Disaster Emergency Management Agency (CDEMA) (RA 1); CDB (RA 2 and RA 3); and the Ministry of the Presidency of the Dominican Republic (RA 4). CDB’s components focus on strengthening regional, national and community level capacities for mitigation, preparedness, management and coordinated response to natural hazards and the effects of CC. The four RAs are:

- (a) **RA 1** - Capacity of National Disaster Management Offices and CDEMA Coordinating Unit Strengthened for Implementation of Comprehensive Disaster Management.
- (b) **RA 2** - National, Local and Regional Resilience Enhanced through Strengthened Early Warning, National Risk Profiling and Community-based DRR.
- (c) **RA 3** - Sector Resilience Strengthened in Key Public Sectors, through DRR and CCA Mainstreaming.
- (d) **RA 4** - Capacity building and the Establishment of Common Policies, Strategies, Programmes and Sub-programmes Undertaken as a Contribution.

1.02 Bush fires occur naturally and play a role in the evolution of the landscape, soil fertility and biodiversity. Over the last two decades, an increase has been observed in the incidence of bush fires during the dry season (especially January-March) and especially during periods of severe drought in Jamaica. An increase in the risk of droughts has been predicted with the occurring global warning<sup>1</sup> resulting from human activities that contribute to increasing concentrations of greenhouse gases in the atmosphere. Thus, it can be inferred that climate variability and climate change will likely result in an ever-increasing number of drought-induced bush fires in Jamaica.

1.03 Bush fires have caused significant negative socio-economic impacts particularly on property and the agriculture and forestry sectors in Jamaica. Between 1996 and 2005, damage and losses in agriculture due to bush fires were estimated at USD0.7 million (mn) over the years<sup>2</sup>. In 2014, the Rural Agricultural Development Authority reported over 1,600 hectares of land valued at over USD8.33 mn was lost or

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<sup>1</sup> Intergovernmental Panel on Climate Change (IPCC), 2014. CC 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the IPCC [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

<sup>2</sup> Selvaraju, Ramasamy, et al. CC and agriculture in Jamaica: Agricultural sector support analysis. Food and Agriculture Organization of the United Nation, 2013.

damaged due to drought and fires and affected over 16,000 farmers<sup>3</sup>. In 2015, 7,261 of such fires occurred. In May 2015, a bush fire event in rural St. Andrew, destroyed approximately 367 hectares of forest cover<sup>4</sup>, contributing to an increase in air pollution with adverse impact on human health, as well as the removal of key carbon sinks. Currently, bush fires account for 63%<sup>5</sup> of the total number of emergency calls to the Jamaica Fire Brigade (JFB).

1.04 The Meteorological Services of Jamaica (MSJ) in collaboration with the International Research Institute for Climate and Society and the Caribbean Institute for Meteorology and Hydrology have worked to develop a one-to-five-day forecast tool which attempts to predict likely outbreaks of bush fires. This is done via the use of the Keetch-Byram Drought Index (KBDI), which was developed by John Keetch and George Byram in 1968 to specifically assess forest fire potential. This drought index represents the net effect of evapotranspiration and precipitation in producing loss in moisture content of the upper level of the soil including organic matter. The KBDI is computed from annual precipitation, daily precipitation and daily maximum temperature. The values of the KBDI ranges from 0-800, with higher values indicating drier conditions and higher risk of fire.

1.05 Although KBDI is useful for fire potential assessment, its application as an early warning tool and decision-making aid for fire management is limited as the index lacks customisation to local conditions and does not include other key factors of fire behaviour such as vegetation (sometimes termed as fuel loading) and topography. For instance, while weather conditions mainly influence the start of a bush fire, it is the vegetation and topography that dictate the maintenance and spread of fire. Under similar weather conditions, two zones with a different vegetation (e.g. grass versus trees) will experience a different bush fire behaviour. Generally grasslands are more conducive to fires than forests as the latter is coarser and slower to combust. When weather conditions and vegetation are similar, zones with differing gradient (e.g. flat land versus sloping) will not exhibit the same bush fire behaviour. Fires will tend to spread faster on a slope than on flat ground. Therefore, integrating weather, vegetation and topography in the determination of the bush fire index will increase its accuracy.

1.06 The development of a robust model aside, a common alerting protocol and public education and awareness are critical to ensure timely preparation and effective response to bush fires. Following a series of devastating fires that affected farms in Mavis Bank, St. Andrew, and Nain in St. Elizabeth, Jamaica in 2015, JFB launched a Community Bush Fire Management Education Programme, which has shown great success. At October 2016, no incident of fire was observed in Mavis Bank, where fires destroyed acres of farmland last year. A key element of this success is due to local community involvement in the programme.

1.07 The Government of Jamaica through the MSJ is proposing to develop a comprehensive Jamaican Bush Fire Warning Index to determine critical thresholds for outbreaks under different conditions for effective bush fire management. The current proposal include four components: (a) development of a multi-criteria model weighing KBDI, including topography and vegetation factors; (b) pilot sites monitoring; (c) development of an alerting protocol; and (d) public education and awareness campaign. This work requires an interdisciplinary approach and inter-agency coordinated effort. The consultancy will assess the current level of public awareness to bush fires and design an effective communication campaign building upon the previously successful JFB's Community Bush Fire Management Education Programme.

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<sup>3</sup> <http://jis.gov.jm/statement-drought-conditions-impact-agricultural-sector>.

<sup>4</sup> <http://jis.gov.jm/bush-fires-have-destroyed-hundreds-of-acres>.

<sup>5</sup> Average between 2007 and 2014 – AGD Performance Audit Report of the JFB.

**2. OBJECTIVES**

2.01 The primary objective of the consultancy is to assist MSJ in developing and implementing a gender-sensitive and socially inclusive communication campaign to improve public education and awareness about bush fires in Jamaica.

**3. SCOPE OF WORK**

3.01 The scope of services is understood to cover all activities necessary to accomplish the objectives, whether or not a specific activity is cited in these Terms of Reference (TOR). The draft TOR will be finalised based on discussions between MSJ and the Consulting Firm. A participatory and consultative approach is encouraged in carrying out the services.

3.02 Specific duties and responsibilities of the Consulting Firm include:

- (a) conducting surveys on the level of population awareness on bushfires including vulnerable groups like women, youth, the elderly and persons with disabilities;
- (b) designing spots and other media elements and advertising materials for public education and awareness on bush fires targeting different population groups including vulnerable ones like women, youth, the elderly and persons with disabilities;
- (c) conducting gender and socially inclusive training workshops to targeted communities in the two pilot monitoring sites to heighten awareness of the Bush Fire Warning Index and its alerting methods;
- (d) educating the pilot communities and the public in general on the dangerous practice of setting fire to crops and trash; and
- (e) educating the public on how to prevent and respond to bush fires taking into account the different roles of different population groups, men, women, youth, the elderly and persons with disabilities.

**4. QUALIFICATIONS AND EXPERIENCE**

4.01 The Consulting Firm is required to include persons that have recognised credentials (Master's degree and five years' experience, or Bachelor's degree and seven years' experience) in Communication and Public Relationship, Disaster Risk Management, Environmental Studies, or related fields.

4.02 The team shall also possess:

- (a) working experience of at least two jobs successfully implemented to bring awareness to an environmental issue;
- (b) excellent oral and written communication skills; and
- (c) good research and analytical skills.

**5. REPORTING REQUIREMENTS AND DELIVERABLES**

5.01 The Consulting Firm will be required to provide the following reports and deliverables:

- (a) a strategy for an advertising campaign with the following minimum media elements:
  - (i) one 30-second Public Service Announcement for radio;
  - (ii) two 10-second time signals for radio;
  - (iii) one 5-minute television (TV) feature within a TV programme;
  - (iv) two half page newspaper advertisements;
  - (v) two variations of (iv) above for web advertisements; and
  - (vi) brochure, flyer, billboard, bus stops and bus wraps.
- (b) three periodic survey reports.

**6. DURATION**

6.01 The duration of the consultancy is 20 days over a period of six months.

## DESIGN AND MONITORING FRAMEWORK

DESIGN SUMMARY	PERFORMANCE TARGETS/ INDICATORS	DATA SOURCES / MEANS OF VERIFICATION	ASSUMPTIONS
<p><b>Impact:</b> Enhanced resilience to bush fire hazards to reduce their negative impacts to economic activities and livelihoods, infrastructure, and human welfare and life.</p>	Reduced losses of USD1mn from bush fires by December 2020.	JFB annual report.	Key partners/beneficiaries fully participate in the Project.
<p><b>Outcome:</b></p> <p>(a) Improved monitoring and predictions of critical thresholds of bush fire outbreaks.</p> <p>(b) Increased public awareness on bush fires.</p>	<p>(a) GOJ will commence the dissemination of more accurate Bush Fire Warnings by November 2018.</p> <p>(b) Local communities follow and respond appropriately to bush fire warning by January 2019.</p> <p>(c) 50% increase in sensitised persons in prone bush fire areas by November 2018. Baseline: to be determined from baseline survey conducted by August 2018.</p> <p>(d) 50% decrease in the number of bush fires in pilot communities per year. Baseline 2016.</p>	<p>(a) Project progress reports.</p> <p>(b) JFB annual report.</p>	<p>(a) All Project phases to create a final Bush Fire Warning Index are successfully completed.</p> <p>(b) Decisions are finalised by key stakeholders on a common alerting protocol.</p>
<p><b>Outputs:</b></p> <p>(a) Jamaica multi-criteria Bush Fire model developed, tested and finalised.</p> <p>(b) Pilot monitoring sites completed.</p> <p>(c) Alerting protocol for bush fire operationalised.</p> <p>(d) Public awareness campaign developed and launched.</p>	<p>(a) Multi-criteria Model approved by January 2018.</p> <p>(b) Instruments and equipment installed in two monitoring sites by September 2017.</p> <p>(c) Alerting protocol, including alerting levels, warning dissemination and roles and responsibilities of key actors finalised by August 2018.</p> <p>(d) Communication strategy, baseline survey and public awareness campaign implemented by December 2018.</p>	<p>(a) Project progress reports.</p> <p>(b) Feedback from key stakeholders.</p>	<p>(a) Collaboration with SBLM and IRI is effective.</p> <p>(b) No undue delay in procurement of instruments.</p> <p>(c) Coordination and cooperation with key stakeholders are successful.</p> <p>(d) Absence of extreme climate events increasing precipitations and skewing data conclusions.</p>

**DESIGN AND MONITORING FRAMEWORK**

<b>CONTRIBUTIONS</b>	
<b>CDB</b>	<b>327,925</b>
<b>GOJ</b>	<b>79,173</b>
<b>TOTAL</b>	<b>407,098</b>







**PERFORMANCE ASSESSMENT SCORE**

<b>Criteria</b>	<b>Score</b>	<b>Justification</b>
Relevance	3	The proposed TA is consistent with the ACP-EU-CDB RA 2: Improved local, national and regional resilience through strengthened early warning, national risk profiling and community-based DRR and CCA. This TA is also consistent with CDB's Strategic Objectives for (a) supporting environmental sustainability and DRR, and (b) promoting good governance, regional cooperation and integration; and CDB's Corporate Priorities for (a) promoting disaster risk management and CC mitigation and adaptation, and (b) improved protection and sustainable management of natural resources.
Effectiveness	3	The proposed Project will help reduce the negative impacts of bush fires in Jamaica and build local and national resilience to these hazards. Therefore, it is expected that the Project will contribute to the achievements of the ACP-EU-CDB RA 2. Mitigation measures are considered to address potential risks during Project implementation and operation.
Efficiency	3	In the absence of a robust model to predict with accuracy critical thresholds for bush fire outbreaks, it is difficult to respond in a timely manner. A robust model coupled with sound CAP and effective public education awareness are essential for reducing the impacts of bush fires in Jamaica. The Project will use a sound approach and its expected cost and timelines are considered reasonable.
Sustainability	3	The Project will promote ownership of key GOJ entities involved in bush fire management. Particularly, the Project will build MSJ and JBF institutional capacities. These entities will continue to properly record bush fire incidents, collect field data and maintain the equipment beyond the life of the Project.
<b>Overall Score</b>	<b>3</b>	<b>Satisfactory</b>

**GENDER MARKER ANALYSIS**

<b>PROJECT STAGE</b>	<b>CRITERIA</b>	<b>SCORE</b>
<b>Analysis:</b> Introduction/ Background/ Preparation	Consultations with women/girls/men/boys and relevant gender-related or sector-related public or private organisations have taken place.	0
	Social analysis identifies gender issues and priorities.	0
	Macroeconomic analysis identifies gender issues and priorities.	0
<b>Design:</b> Project Proposal/ Definition/ Objective/ Description	To address the needs of women/girls and men/boys concrete interventions to reduce existing gender disparities have been designed. Effect on Project outcome is direct.	0.5
	Project objective/outcome includes gender equality.	0.5
<b>Implementation:</b> Execution	Implementation arrangements (gender mainstreaming capacity building or gender expertise in implementing agency) to enhance the gender capacity of the implementing agency. Effect on Project outcome is indirect.	0
	TOR of Project Coordinating Unit/Project Management Unit include responsibilities of gender mainstreaming, especially at the levels of the Project Coordinator/Director and the Monitoring and Evaluation (M&E) officer.	0.5
<b>Monitoring and Evaluation:</b> Results-Monitoring- Framework (RMF)	Collection of sex-disaggregated data required for M&E (stated and budgeted in Project).	0.5
	At least one gender-specific indicator at the outcome and/or output level in the RMF.	0
<b>Overall Score</b>		<b>2.0</b>
<b>Gender specific (GS):</b> if 3.75 points to 4 points <b>Gender mainstreamed (GM):</b> if 3 points to 3.5 points <b>Marginally mainstreamed (MM):</b> if 1.5 to 2.75 points. <b>NO:</b> if projects score zero or 1; if NO please give a justification why		

**DEVELOPING A COMPREHENSIVE BUSH FIRE WARNING INDEX FOR EFFECTIVE  
BUSH FIRE MANAGEMENT**

**BUDGET**  
**(EUR)**

<b>CONTRIBUTIONS</b>	
<b>CDB</b>	<b>327,925</b>
<b>GOJ</b>	<b>79,173</b>
<b>TOTAL</b>	<b>407,098</b>

**EUROPEAN UNION ELIGIBILITY RULES**  
**AFRICAN CARIBBEAN PACIFIC – EUROPEAN UNION**  
**NATURAL DISASTER RISK MANAGEMENT**

**PARTICIPATION IN PROCEDURES FOR THE AWARDING OF**  
**PROCUREMENT CONTRACTS OR GRANT CONTRACTS**

1. Participation in procedures for the award of procurement contracts financed under the EU Contribution Agreement for the Implementation for the Action entitled: “Africa Caribbean Pacific – European – Caribbean Development Bank (ACP-EU-CDB) Natural Disaster Risk Management in CARIFORUM Countries” (ACP – EU NDRM Resources)”, is open to international organisations and all natural persons who are nationals of, or legal persons who are established in, an eligible country.

2. Eligible countries<sup>1</sup> are deemed to be:

(a) Caribbean Development Bank member countries:

Anguilla, Antigua and Barbuda, Barbados, Belize, Brazil, British Virgin Islands, Canada, Cayman Islands, China, Columbia, Dominica, Germany, Grenada, Guyana, Haiti, Jamaica, Italy, Mexico, Montserrat, St Kitts and Nevis, Saint Lucia, St Vincent and the Grenadines, Suriname, The Bahamas, Trinidad and Tobago, Turks and Caicos Islands, the United Kingdom and Venezuela.

(b) Members of the “African, Caribbean and Pacific (ACP) Group of States”<sup>2</sup>:

**Africa:**

South Africa<sup>3</sup>, Angola, Benin, Botswana, Burkina Faso, Burundi, Central African Republic, Cameroon, Cape Verde, Chad, Comoros Islands, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Equatorial Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Mauritania, Mozambique, Namibia, Niger, Nigeria, Uganda, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Swaziland, Tanzania, Togo, Zambia and Zimbabwe.

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<sup>1</sup> Note some countries may be eligible by virtue of more than one category

<sup>2</sup> Cotonou Partnership Agreement of 23 June 2000 (as amended by the provisional application of Decision No 1/2000 of the ACP-EC Council of Ministers of 27 July 2000, Decision No 1/2000 of the ACP-EC customs cooperation committee of 18 October 2000, Decision No 1/2001 of the ACP-EC customs cooperation committee of 20 April 2001, Decision No 2/2001 of the ACP-EC customs cooperation committee of 20 April 2001, Decision No 3/2001 of the ACP-EC customs cooperation committee of 10 May 2001, Decision No 4/2001 of the ACP-EC customs cooperation committee of 27 June 2001, Decision No 5/2001 of the ACP-EC customs cooperation committee of 7 December 2001, Decision No 2/2002 of the ACP-EC customs cooperation committee of 28 October 2002, Decision No 1/2003 of the ACP-EC Council of Ministers of 16 May 2003, Council Decision (EC) of 19 December 2002, Decision No 1/2004 of the ACP-EC Council of Ministers of 6 May 2004, Decision No 2/2004 of the ACP - EC customs cooperation committee of 30 June 2004 and Decision No 4/2005 of the ACP-EC customs cooperation committee of 13 April 2005).

<sup>3</sup> Natural and legal South African persons are eligible to participate in contracts financed by the 10th/11th EDF. However, the 10th/11th EDF does not finance contracts in South Africa.

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**Pacific:**

Cook Islands, East Timor, Fiji, Kiribati, Marshall Islands, Micronesia, Nauru, Niue, Palau, Papua New Guinea, the Solomon Islands, Western Samoa, Tonga, Tuvalu, Vanuatu.

**Overseas Countries and Territories:**

Anguilla, Antarctic, Netherlands Antilles, Aruba, British Indian Ocean Territory, British Virgin Islands, Cayman Islands, Falkland Islands (Malvinas), French Polynesia, French Southern Territories, Greenland, Mayotte, Montserrat, New Caledonia, Pitcairn, Saint Helena, Saint Pierre and Miquelon, South Georgia and South Sandwich Islands, Turks and Caicos, Wallis and Futuna Islands.

(c) A Member State of the European Union:

Austria, Belgium, Bulgaria, Croatia, Czech republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

**An official candidate country of the European Union:**

The Former Yugoslav Republic of Macedonia, Turkey, Iceland, Montenegro.

**A Member State of the European Economic Area:** Iceland, Lichtenstein, Norway.

(d) All natural persons who are nationals of, or legal persons who are established in, a Least Developed Country as defined by the United Nations:

Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Dem. Rep. Congo, Equatorial Guinea, Eritrea, Ethiopia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao PDR, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Djibouti, Solomon Islands, Somalia, South Sudan, Sudan, Tanzania, The Gambia, Timor-Leste, Togo, Tuvalu, Uganda, Vanuatu, Yemen, Rep. and Zambia.

(e) Participation in procedures for the award of procurement contracts or grants financed from the Facility shall be open to all natural persons who are nationals of, or legal persons established in, *any country other than those referred to in paragraph 1, where reciprocal access to external assistance has been established*. Reciprocal access in the Least Developed Countries as defined by the United Nations (UN) shall be automatically granted to the OECD/DAC members: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.

3. Services under a contract financed from the Facility may be provided by experts of any nationality, without prejudice to the qualitative and financial requirements set out in the Bank's procurement rules.

4. Supplies and materials purchased under a contract financed from the Facility must originate in a State that is eligible under paragraph 1. In this context, the definition of the concept of 'originating products' shall be assessed by reference to the Bank's prevailing procurement guidelines/procedures, and

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products' shall be assessed by reference to the Bank's prevailing procurement guidelines/procedures, and supplies originating in the EU shall include supplies originating in the Overseas Countries and Territories.

5. Whenever the Facility finances an operation implemented through an international organisation, participation in procedures for the award of procurement contracts or grants shall be open to all natural and legal persons who are eligible under paragraphs 1, care being taken to ensure equal treatment of all donors. The same rules apply for supplies and materials.

6. Whenever the Facility finances an operation implemented as part of a regional initiative, participation in procedures for the award of procurement contracts or grants shall be open to all natural and legal persons who are eligible under paragraph 1, and to all natural and legal persons from a country participating in the relevant initiative. The same rules apply for supplies and materials.

7. Whenever the Facility finances an operation co-financed with a third entity, participation in procedures for the award of procurement contracts or grants shall be open to all natural and legal persons eligible under paragraph 1, and to all persons eligible under the rules of the third entity. The same rules shall apply to supplies and materials.

**Caveat:** The Bank and EU eligibility requirements are subject to change by the Bank and the EU. The applicant is responsible for checking whether there have been any updates on the eligibility requirements, as well as the UN's list of Least Developed Countries.



**PROCUREMENT PLAN**

**I. General**

**1. Project Information:**

Country: Jamaica

Grant Recipient: Government of Jamaica (GOJ)

Project Name: Developing a Comprehensive Bush Fire Warning Index for Effective Bush Fire Management - Jamaica

Project Executing Agency: GOJ

**2. Bank's Approval Date of the Procurement Plan:** March 16, 2017

**3. Period Covered By This Procurement Plan:** March 2017 to January 2019

**II. Goods and Works and Non-Consulting Services**

**1. Prior Review Threshold:** Procurement decision subject to prior review by the Bank as stated in Appendix 2 to the Guidelines for Procurement.

	<b>Procurement Method</b>	<b>Prior Review Threshold (EUR)</b>	<b>Comments</b>
1.	DC Goods/Non-Consulting Services	██████████	
2.	Shopping/Non-Consulting Services	██████████	

This information is withheld in accordance with one or more of the exceptions to disclosure under the Bank's Information Disclosure Policy.



2. **Prequalification:** N/A
3. **Reference to (if any) Project Operational/Procurement Manual:** Guidelines for Procurement (2006)
4. **Any Other Special Procurement Arrangements:** To comply with the requirements of the ACP-EU Finance Agreement the following is required:
  - (a) Financing shall be provided under ACP-EU-CDB NDRM in CARIFORUM Countries and thus eligibility shall be extended to CARIFORUM member countries and countries which are eligible for procurement under EU-funded projects, which are not CDB member countries, in accordance with the EU Eligibility Rules.
  - (b) MSJ oversees an existing network of AWS, which were supplied and supported by an American company. These stations conform to WMO requirements and their cost reflects the prevailing market rate for such offerings. The AWS equipment required under the Project will expand and enhance the existing network of weather stations and therefore, given the need for the standardisation of the new equipment with that which is already in place, it is intended to procure it under the direct contracting procurement method, as allowed for under paragraph 3.07 (b) of the above-mentioned Guidelines for Procurement (January 2006), from the American company.
  - (c) The required AWS equipment is manufactured in the United States of America. Therefore, a waiver of CDB Guidelines for Procurement (2006) is required to further extend eligibility for the supplier of the AWS equipment and origin and source of the equipment beyond that allowed under 4 (a) above to include the United States of America. The value of the waiver is estimated to EUR15,288.

5. Procurement Packages with Methods and Time Schedule:

1	2	3	4	5	6	7	8
Ref No.	Contract (Description)	Estimated Cost (EUR)	Procurement Method	Prequal. (Yes/No)	Review by Bank (Prior/Post)	Expected Bid-Opening Date	Comments
1.	<b>Development of Multi-Criteria Model</b>						
	Satellite Imagery	██████	DC	No	Prior	April 2017	One provider available
	GIS Computer Hardware	██████	Shopping	No	Post	April 2017	
	GIS Training/MJS Capacity Building	██████	Shopping	No	Post	April 2017	
2.	<b>Pilot Site Monitoring</b>						
	Equipment (Weather, Soil Moisture/Temperature Stations)	██████	DC	No	Prior	June 2017	
	Desktop Computers	██████	LIB	No	Prior	June 2017	
	Fire Ranger Unit	██████	Shopping	No	Prior	June 2017	
	Water Backpack Sprayer	██████	Shopping	No	Post	June 2017	
	GPS Unit	██████	LIB	No	Prior	June 2017	
	Bushing and Fencing Services	██████	Shopping	No	Post	June 2017	
	PEAO I and Stakeholder Engagement - Venue, Services, Catering and Memorabilia	██████	Shopping	No	Post	July 2017	
3.	<b>Development of a CAP</b>						
	CAP Consultant Airfare and Accommodation	██████	Shopping	No	Post	October 2017	

1	2	3	4	5	6	7	8
Ref No.	Contract (Description)	Estimated Cost (EUR)	Procurement Method	Prequal. (Yes/No)	Review by Bank (Prior/Post)	Expected Bid-Opening Date	Comments
	CAP Meeting - Venue and Catering	██████	Shopping	No	Post	October 2017	
	Bush Fire Warning Launch – Venue, Services, Catering and Materials	██████	Shopping	No	Post	January 2018	
	Technical Workshop – Venue, Catering and Workshop Material	██████	Shopping	No	Post	January 2018	
4.	<b>PEAO II Campaign</b>						
	Print Advertising	██████	Shopping	No	Post	July 2017	
	PEAO II Training Workshops for Communities in Pilot Monitoring Sites	██████	Shopping	No	Post	July 2017	
	PEAO II via TV	██████	Shopping	No	Prior	July 2017	
	PEAO II via Radio	██████	Shopping	No	Prior	July 2017	
	PEAO II via Print	██████	Shopping	No	Post	July 2017	
	PEAO II via Web	██████	Shopping	No	Post	July 2017	
	PEAO II via other Branding	██████	Shopping	No	Prior	July 2017	

This information is withheld in accordance with one or more of the exceptions to disclosure under the Bank's Information Disclosure Policy.

**III. Consulting Services**

1. **Prior Review Threshold:** Procurement decision subject to prior review by the Bank as stated in Appendix 1 to the Guidelines for the Selection and Engagement of Consultants.

No.	Selection Method	Prior Review Threshold (EUR)	Comments
1	Individual Consultant Selection	██████████	

2. **Reference to (if any) Project Operational/Procurement Manual:** Guidelines for Selection and Engagement of Consultants (October 2011).

3. **Any Other Special Procurement Arrangements:** To comply with the requirements of the ACP-EU Finance Agreement the following is required:

- (a) Financing shall be provided under ACP-EU-CDB NDRM in CARIFORUM Countries and thus eligibility be extended to CARIFORUM member countries and countries which are eligible for procurement under EU-funded projects, which are not CDB member countries, in accordance with the EU Eligibility Rules.

4. **Procurement Packages with Methods and Time Schedule:**

1	2	3	4	5	6	7
No.	Assignment (Description)	Estimated Cost (EUR)	Selection Method	Review by Bank (Prior/Post)	Expected Proposal Submission Date	Comments
1.	Data Collection and GIS Modelling Assistants	██████████	ICS	Post	February 2017	
2.	Data Management Consultant	██████████	ICS	Post	February 2017	
3.	CAP Consultant	██████████	ICS	Post	October 2017	
4.	PEAO Consultant	██████████	ICS	Post	June 2017	

This information is withheld in accordance with one or more of the exceptions to disclosure under the Bank's Information Disclosure Policy.

**IV. Implementing Agency Procurement Capacity Building Activities with Time Schedule**

1. In this section the agreed Capacity Building Activities are listed with time schedule.

<b>No.</b>	<b>Expected Outcome/ Activity Description</b>	<b>Estimated Cost</b>	<b>Estimated Duration</b>	<b>Start Date</b>	<b>Comments</b>
1.	Project launch virtual meeting with CDB and Implementing Agency to increase the capacity of Implementing Agency to follow CDB's procurement procedures	0	1 day	May 2017	
2.	Increased capacity of Implementing Agency to undertake procurement in accordance with CDB's Procurement Procedures through CDB's Online Procurement Training.	0	1 day	May 2017	

**V. Summary of Proposed Procurement Arrangements**

Project Component	ACP-EU-CDB (EUR)									NBF (EUR)	Total Cost (EUR)
	Primary	Secondary			Other						
	ICB	NCB	RCB	LIB	Shopping	DC	FA	QCBS	ICS	Country	
1. Development of a Multi-Criteria Model	-	-	-	-			-	-		-	
2. Pilot Site Monitoring	-	-	-				-	-		-	
3. Development of a CAP	-	-	-	-			-	-		-	
4. PEAO II Campaign	-	-	-	-			-	-		-	
<b>Sub-Total</b>											
Contingency	-	-	-	-	-	-	-	-	-	-	
<b>Total</b>	-	-	-	-	-	-	-	-	-	-	

This information is withheld in accordance with one or more of the exceptions to disclosure under the Bank’s Information Disclosure Policy.

CQS	-	Consultant Quality Selection	LIB	-	Limited International Bidding
DC	-	Direct Contracting	NCB	-	National Competitive Bidding
FA	-	Force Account	NBF	-	Non-Bank Financed
FBS	-	Fixed Budget Selection	QCBS	-	Quality and Cost-Based Selection
ICB	-	International Competitive Bidding	RCB	-	Regional Competitive Bidding
			ICS	-	Individual Consultant Selection