



WORLD WATER DAY 2013 REPORT

Prepared by MTIASIC Project
March 2013



Focus Activity:

The National Environment and Planning Agency (NEPA) and the Mitigating the Threat of Invasive Alien Species (MTIASIC) Project hosted an Exhibition Booth and participated in a Speakers Forum in Observance of World Water Day 2013 Exposition, South Lawn, Devon House Complex, Kingston in support of the invasive alien species "Prevent the Spread" campaign.

Objective:

To share information and raise awareness among local and other stakeholders on invasives affecting water quality and quantity, encourage participation in Invasive Alien Species (IAS) identification and control; and, provide support to partner agencies mandated to the protection and management of Jamaica's water resources.

In addition to those entities and educational institutions invited by the Ministry of Water Land Environment and Climate Change; special invitations were extended to the University of the West Indies, Bodles Research and Development and Veterinary Services Divisions within the Ministry of Agriculture and Fisheries, Portmore Municipal Council, and Northern Caribbean University.

Background:

The National Environment and Planning Agency - NEPA, under the auspices of the Ministry of Water, Land, Environment and Climate Change and in collaboration with partner agencies, observed World Water Day on Friday March 22, 2013.

Through NEPA, the MTIASIC Project has identified and targeted several plant species identified as posing a direct threat to the protection of our water resources.

The focus of the MTIASIC projects on these invasive plant species is manifested in the project's pilot site located in the Black River Lower Morass in St. Elizabeth.

The importance of the Black River Lower Morass lies in its:

- Being recognized as the largest freshwater wetland in the English Speaking Caribbean
- Designation as a RAMSAR site.
- Support of important indigenous species and tree stands

NEPA/MTIASIC and Water Resource Preservation

The MTIASIC Project is presently investigating through research conducted by the University of the West Indies, effective methods of eradicating where possible and controlling invasive plant species impacting on our water resources. These are the:



MELALEUCA (*Melaleuca quinquenervia*)

- Commonly known as Bottlebrush or Paperbark Tree, an aggressive and highly invasive plant which depletes the wetlands of water and displaces local species.

WILD GINGER (*Alpinia allughas*)

- Originally from South East Asia is yet another invasive plant which is found throughout Jamaica and is impacting water quality and displacing local species.



WATER HYACINTH (*Eichhornia crassipes*)

- The Water hyacinth is a tropical/sub tropical water plant found in lakes, ponds, rivers and stream. It clogs waterways, changes water habitat and reduces species diversity by blocking sunlight, oxygen and nesting sites. The Water Hyacinth has proven expensive to control where it has proliferated.

The IAS Project has undertaken several interventions in the Black River Lower Morass. These include the continuing tracking of invasive species in the project pilot site, strategies of invasive control using eco-friendly or bio-control methods and, a range of public awareness activities within communities and schools where information on the importance of preserving **water resources** such as the Black River Lower Morass against the spread of invasive species is disseminated.



World Water Day – “International Year of Water Cooperation”

Theme: “Partnering for Sustainable Development.”

MTIASIC World Water Day Activities

In keeping with the theme partnering for sustainable development, the NEPA/MTIASIC Project joined with lead agencies under the Ministry of Water, Land, Environment and Climate Change to celebrate World Water Day 2013 on March 22 and 23 2013 at the Devon House complex in Kingston.

Information, Promotion and Awareness building

Speakers Forum:

The National Environment and Planning Agency facilitated three (3) of the main presentations at the World Water Day Speakers Forum, copies of which are at Annex 1.

This forum provided a platform to share information on the role of the MTIASIC Project in the identification of invasive alien species, research and data on interventions to date in the IAS Project sites and, methods of control being studied for implementation by the Project with an emphasis on bio-control.



Dr. Dwight Robinson, Department of Life Sciences, UWI, Mona, at the World Water day 2013 Speakers Forum

In his presentation titled, "The use of biological control agents in the Control of the spread of Invasive Alien Species", (Appendix 1a) Dr. Robinson highlighted the following points:

- The Institute of Jamaica records over 84 invasive alien species (IAS) in Jamaica
- The impact of IAS as a direct threat to native species and bio-diversity
- Reduction in steamflow and water availability

Biological Control was defined as the use of organism (natural enemy) to suppress the population of another (host).

The Pink Hibiscus Mealy Bug (*Maconnellicoccus hirsutus*) and the Christmas Bush or Jack in the Bush (*Chromolaena odorata*) were presented as case studies for which biological control was successfully introduced through the Wasp (*Anagyrus kamali*) and moths which attacks the Pink Mealy Bug and the Christmas Bush, respectively.



Dr. Kurt McLaren, Department of Life Sciences, UWI, Mona-presenting at the World Water Day Speakers Forum, 2013

Dr. McLaren's presentation (Appendix 1b) on: "Biological control of invasive plant species" highlighted the Water Hyacinth and the Melalueca/ Paper Bark Tree.

He indicated the most successful biocontrol of these invasive plants as being due to three weevils:

- *Neochetina eichhorniae* and *Neochetina Bruchi* for the Water Hyacinth
- These were not always successful for

example, in Australia and North America. South America and Africa had benefitted however from their being introduced.

The Melalucea Weevil was introduced in Florida as a control agent to the Paper Bark tree with some success as it reduced the flowering capacity of the plant by up to 90% thus helping to prevent the spread of this highly invasive plant.

Mrs. Lisa Kirkland gave a presentation (Appendix 1c) on general IAS highlighting those impacting water quality and quantity.



Lisa Kirkland, Coordinator , Ecosystems Management Branch, NEPA presenting on the MTIASIC activities in the preservation of Jamaica's important water resources at the World water Day Speakers Forum, Devon House, Kingston.



Awareness Building

The NEPA/MTIASIC Project mounted a display featuring educational material on several invasive species with an emphasis on those directly impacting on water quality. Brochures, posters and magnets were produced and distributed to patrons visiting the MTIASIC booth.

IAS Booth Activities



Patrons receiving tokens informing on IAS affecting biodiversity and water quality.



Promotion

In strengthening the MTIASIC Projects promotional efforts, a number of items carrying the "Prevent the Spread" IAS slogan were developed for use as tokens for World Water Day.

Persons visiting the IAS booth who engaged in discussions with IAS team members through questions comments or observations were presented with one of a number of attractive tokens (Appendix 2) as a reminder of the IAS message.

These were:

- Tote Bags
- Car Sun Shades
- Magnets
- Notebooks

These were very well received.



Tote Bags



Car Sun Shades



Informational Magnets

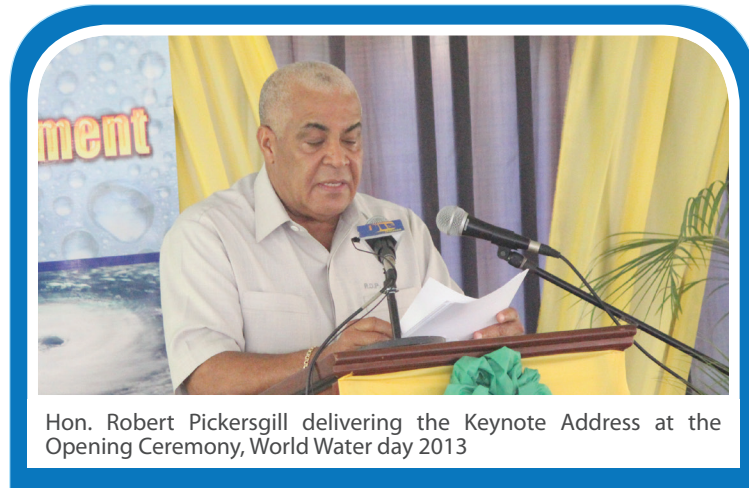


Note Books

Use of Media

One Newspaper Article titled: "Do your Part.....Prevent the Spread" was prepared and appeared in The Gleaner on Thursday, March 21, 2013 (Appendix 3). An advert promoting the "Prevent the Spread" IAS campaign was also carried in the Gleaner. (Appendix 4).

Members of NEPA's technical team were also interviewed during a live broadcast of the Hotline Programme on Radio Jamaica, in recognition of World Water Day 2013 and the agency's role in the preservation of water resources.



Hon. Robert Pickersgill delivering the Keynote Address at the Opening Ceremony, World Water day 2013

In his address at the Opening Ceremony of World Water Day 2013, the Minister of Water, Land, Environment and Climate Change, the Hon. Robert Pickersgill observed that in keeping with the theme for World Water Day 2013 –" Partnering for Sustainable Development", the day's Exposition reflected a true example of the importance of Public/Private partnerships and collaboration.

Pictorial of Days events



Conclusion

The MTIASIC Project under the auspices of NEPA used the opportunity of World Water Day and World Meteorological Day to present to a wide cross section of the public, partners and stakeholders, the message of the threat of IAS to our biodiversity. Approximately 250 patrons were impacted through direct conversation with Project Staff at the IAS Booth over the two day period (Appendix 6)

The Project shared in practical ways, identification, impact and safe methods of control of invasive alien species which impact on our water resources.

Date: March 25, 2013

WORLD WATER DAY 2013 APPENDIX 1A

THE USE OF BIOLOGICAL CONTROL AGENTS IN THE CONTROL OF THE SPREAD OF INVASIVE ALIEN SPECIES

The use of biological control agents in the control of the spread of Invasive Alien Species

Introduction

- Jamaica has been dealing with Invasive Alien Species (IAS) for decades
- The institute of Jamaica has records of over 84 IAS in Jamaica
- Most persons are familiar with the Indian Mongoose (*Herpestes javanicus*), that was brought in as a biological control agent

Impact of IAS

- Changes to trophic structures
- Loss of biological diversity
- Direct threat to native species
- Unsuitable habitats for native animal species
- Reduction in stream flow and available water
- Changes in soil nutrient status

Why are IAS so successful?

- Undisturbed ecosystems are usually balanced (homeostasis)
- In their new environment, the ecological associations that limit the dominance of IAS are usually absent
- This results in them dominating the ecosystem, thus creating an ecological imbalance

Restoring ecological balance

- Physical control
- Chemical control
- Biological control

Biological Control

- Use of one organism (natural enemy/biocontrol agent) to suppress the population of another (host)
- The form of biological control used in the control of IAS is termed classical biological control

WORLD WATER DAY 2013 APPENDIX 1A

THE USE OF BIOLOGICAL CONTROL AGENTS IN THE CONTROL OF THE SPREAD OF INVASIVE ALIEN SPECIES

Biological Control

- Classical biological control involves:
 - Identification of the geographical origin of the IAS
 - Exploration of the geographical origin to determine the natural enemies of the IAS
 - Introduction of the natural enemy into the new environment

Case Studies

- Pink Hibiscus Mealy Bug (*Maconellicoccus hirsutus*)
- "Christmas Bush" and "Jack-in-the-Bush" (*Chromolaena odorata*)

Pink Hibiscus Mealy Bug

- It was discovered in the Caribbean in 1994 (Grenada, St. Kitts, Nevis, Trinidad and Tobago)
- It was discovered in Jamaica in 2007

Pink Hibiscus Mealy Bug



Pink Hibiscus Mealy Bug

- Parasitoid
 - Wasp - *Anagyrus kamali*
- Predator
 - Ladybird Beetle - *Cryptolaemus montrouzieri*

Anagyrus kamali



WORLD WATER DAY 2013 APPENDIX 1A

THE USE OF BIOLOGICAL CONTROL AGENTS IN THE CONTROL OF THE SPREAD OF INVASIVE ALIEN SPECIES

Cryptolaemus montrouzieri



Chromolaena

- IAS in South Africa
- Thought to have been introduced from Jamaica

Chromolaena



Species	Family	Damage	Origin	Status
<i>Lixus aemulus</i>	Curculionidae	Stem borer	Brazil	Releases
<i>Dichrorampha odorata</i>	Tortricidae	Shoot borer	Jamaica	Application to DAFF
<i>Recchia parvula</i>	Cerambycidae	Crown borer	Argentina	Quarantine
<i>Carmenta chromolaenae</i>	Sesiidae	Shoot wilter	Venezuela	Shelved
<i>Melanagromyza eupatoriella</i>	Agromyzidae	Shoot wilter	Jamaica	Shelved
<i>Conotrachelus reticulatus</i>	Curculionidae	Stem galler	Venezuela	Shelved



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<i>Conotrachelus reticulatus</i>	Curculionidae	Stem galler	Venezuela	Shelved



Biological Control

- Proven to be the most effective means of controlling some IAS
- Requires proper research and monitoring prior and after introduction

WORLD WATER DAY 2013 APPENDIX 1B

BIOLOGICAL CONTROL (BIOCONTROL) OF INVASIVE PLANT SPECIES

Water hyacinth

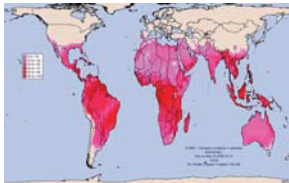
- Water hyacinth, *Eichhornia crassipes*.
- It is an aquatic plant native to the Amazon Basin

Biological control (biocontrol) of invasive plant species

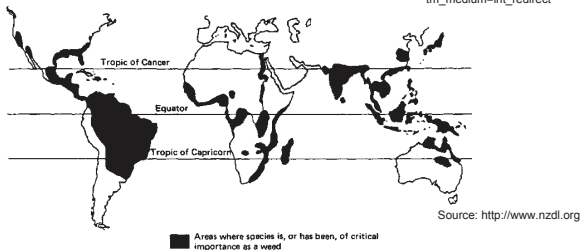
Presented by Dr Kurt McLaren
Department of Life Sciences, UWI



- It has been introduced to many parts of the world.



Source:
http://archives.eppo.int/MEETINGS/2008_conferences/clipex_course.htm?utm_source=archives.eppo.org&utm_medium=int_redirect



- It forms dense mats that interfere with navigation, recreation and irrigation.



Source:
<http://dnr.state.il.us/stewardship/cd/images/768x512/0002100.jpg>

- The mats also out-compete native aquatic plants.
- Low oxygen conditions develop under water hyacinth mats and the dense floating mats impede water flow and create good breeding conditions for vectors of human and animal diseases (CSIRO, 2011).

Biological Control

- Introduce a pest or pathogen that affects the species in its native range.
- Biocontrol of water hyacinth has been successful in some countries, but not in others.
- Most success to date are due to two weevils, *Neochetina eichhorniae*, and *Neochetina bruchi*.



WORLD WATER DAY 2013 APPENDIX 1B

BIOLOGICAL CONTROL (BIOCONTROL) OF INVASIVE PLANT SPECIES

Examples of successful biocontrol

- Sepik River lagoons in Papua New Guinea



Before



Three years after the introduction of the chevroned water hyacinth

Source: <http://www.csiro.au/Outcomes/Food-and-Agriculture/water-hyacinth-control.aspx>

Another example...

- Lake Victoria (specifically the three lake countries of Kenya, Uganda and Tanzania)



Source: <http://www.csiro.au/Outcomes/Food-and-Agriculture/water-hyacinth-control.aspx>

Biological Control

- Used successfully in other countries such as Benin, West Africa, South Africa and Thailand.

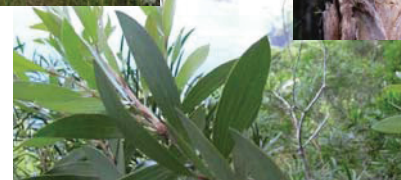


Source: <http://www.abc.net.au/science/slab/hyacinth/default.htm>

Melaleuca sp.

- An invasive woody plant that is native to Australia, New Guinea, and the Solomon Islands.
- Melaleuca is also known as the paper bark tree.
- Grows mainly in wetlands or sites with a high water table.
- Melaleuca threatens the integrity of freshwater ecosystem processes by altering soil chemistry, reducing decomposition rates and modifying hydrology and fire regime (ISSG, 2010).
- A stand of melaleuca may transpire (lose) more water than the sawgrass communities it replaces, thereby lowering the water table (ISSG, 2010).

- It has been introduced to a number of different countries, including Jamaica, mostly as an ornamental.



WORLD WATER DAY 2013 APPENDIX 1B

BIOLOGICAL CONTROL (BIOCONTROL) OF INVASIVE PLANT SPECIES

Biological control

- The *Melaleuca* weevil, which is native to Australia.
- This insect was released in Florida in 1997 after Australian field studies and laboratory testing demonstrated the weevil would reproduce only on *Melaleuca*.



Source: <https://edis.ifas.ufl.edu/in368>



Impact

- Reduced flowering (up to 90%) at several sites in south Florida where the weevil is established.
- This type of feeding damage will help to reduce seed production and prevent further spread of this highly invasive plant.

Unintended consequences of biocontrol!

Biocontrol without borders: the unintended spread of introduced weed biological control agents

PLoS One | 8: e76386

Abstract: An unintended consequence of classical biological control agents that intentionally introduced control agents will occur when the biological control agent propagates into non-target areas. A well-documented example of this is the release of the weevil *Oryza nitida* to control the invasive plant *Melaleuca* in Florida, USA. We describe the release and establishment of *Oryza nitida* and *Boreoryzaea melaleuca* in the United States and the unintended spread of *Oryza nitida* to 13 other states or countries where the weevil has not been intentionally introduced. We discuss the implications of the long-range dispersal of *O. nitida* and *B. melaleuca* beyond the herbivore's intended geographic range (Florida, Hawaii, or DRB) and the discovery of *B. melaleuca* within the sub-range of several *O. nitida* populations near San Jose, Puerto Rico. In 2007, *O. nitida* was observed on the island of New Providence in the Bahamas. An earlier herbivore was detected in nearby Grand Bahama or Andros Islands. In 2008, *B. melaleuca* was observed attacking *M. quinquenervia* in Los Angeles, California (USA). The herbivore has not been detected on other surveyed *M. quinquenervia* populations in Cuba, Bahamas, Texas (USA), Costa Rica, Brazil, Hawaii (USA), or South Africa. There is no evidence for dispersal from California to New Providence or Hawaii. Our findings indicate that the release of *O. nitida* to control *M. quinquenervia* may have unintended consequences. Biological control agents may disperse from DRB to >3500 km from their original release location (Florida) and to locations that have strong links via routes and trade as indicated by the routes of airline flights connecting with Florida with substantial new populations. Implications of this unintended spread are discussed in relation to the possibility of biogeographical barriers and risk assessment of biological control agents.

Keywords: Dispersal; Invasive pathways; *Oryza nitida*; *Boreoryzaea melaleuca*; *Melaleuca quinquenervia*.

Introduction: Development of a classical weed biological control program is a multistep process that includes extensive testing and evaluation with the introduction of control agents. Risk assessment involves, but is not limited to, quantifying a prospective biological control agent's host range to estimate the potential for direct feeding and damage to vulnerable non-target

Table 1. Adventive populations of the Australian tree *Melaleuca quinquenervia* and the years monitored for colonization by the biological control agents *Oryza nitida* and *Boreoryzaea melaleuca*.

Country/state	City/Island	GPS Coordinates of <i>M. quinquenervia</i> stands ^a	Nearest Airport (code)	Annual survey dates ^b	Distance (km)	Direct airline flight ^c
Bahamas	Andros	24.715, -77.799	ASD	2005–2009	267	599.0 (221.0)
	Grand Bahama	26.659, -78.009	IFPO	2005–2009	207	545.2 (82.2)
	New Providence	25.058, -77.453	NAS	2005–2009	295	1392.0 (582.1)
	Exuma	23.39, -75.48	GOT		538	1289.3 (41.0)
Cuba	Eleuthera	24.823, -76.336	GH8 + E1JH		408	1436.0 (78.8)
	Zapata Peninsula	22.30, -81.12	HAV	2007, 2011	530	1487.0 (54.2)
Dominican Republic	Santo Domingo	18.48, -69.95	SDQ		1310	2801.3 (54.2)
Puerto Rico	San Juan	18.395, -66.071	SJU	2005–2011	1665	5584.7 (140.1)
Hawaii	Maui	20.89, -156.21	OGG		7920	0.0 (0)
	Oahu	21.547, -158.076	HNL	2006, 2011	7600	0.0 (0)
	Molokai	21.157, -157.065	MCK		7510	0.0 (0)
	Kauai	22.02625, -159.671	LHM		7542	0.0 (0)
Hawaii	Hawaii	19.7, -155.05	ITO	2006, 2011	7400	0.0 (0)
Suriname	Albina	5.498, -54.081	PBM		3610	107.0 (10.1)
Canada	Hartford Village	12.1, -61.67	GND		2444	31.0 (1.0)
French Guiana	Kourou	5.17, -52.7	CAY		7331	3.0 (2.5)
Guyana	Rockett	5.8, -58.55	GEO		3191	61.7 (14.6)
Honduras	Zamorano	14.2389, -87.4082	TGU		1389	483.7 (25.5)
Costa Rica	San José	9.92, -84.07	SJO	2006, 2011	1716	2789.7 (230.4)
Panama	Colon	9.12, -79.69	PTY		1782	2383.3 (89.7)
Nicaragua	Managua	12.07, -86.18	MGA		1556	1101.0 (437.0)
Mexico	Zapopan	20.72207, -103.390	GDL		2273	1673.3 (13.0)
California (USA)	Los Angeles	34.010, -118.39	LAX	2007–2011	3565	3019.0 (198.6)
Jamaica	Kingston	18.05, -77.82	KIN	2011	407	3554.0 (242.9)
Colombia	Medellin	6.2440, -75.58	MDE		2171	4511.7 (26.7)
South Africa	Wolweley	-33.435, 19.144	CPT	2010	12384	0.0 (0)
Texas (USA)	La Feria	26.19, -97.837	CRP	2003, 2009	1567	3.7 (1.5)
Brazil	Mooca	-23.5733, -47.0893	GRU	2011	6580	1925.0 (93.4)
Montserrat	Gages	16.723, -62.192	MSN		2110	0.0 (0)

^a The linear distance from the herbivore's introduced range of Florida (USA) and the number of annual flights (averaged across 2005–2007) arriving from southern Florida airports are reported.

^b Reported in decimal degrees.

^c Surveys of *M. quinquenervia* stands were conducted once annually for the listed years.

^d Mean (SE), annual number of flights that originate from all south Florida international airports: Fort Lauderdale Hollywood International Airport, Miami International Airport, Palm Beach International Airport, Southwest Florida International Airport.

WORLD WATER DAY 2013 APPENDIX 1C

IAS IMPACTING OUR WATER RESOURCES: MTIASIC PROJECT PRESENTATION



EXPOSITION

Ministry of Water, Land, Environment & Climate Change



Devon House (East Lawn)

March 22, 2013

Facilitator:
Lisa Kirkland

Managing and protecting Jamaica's land, wood and water

Invasive Alien Species Impacting our Water Resources



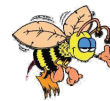
A presentation by the National Environment and Planning Agency (NEPA) and the Mitigating the Threat of Invasive Alien Species in the Insular Caribbean (MTIASIC) Project



About the MTIASIC Project

This is a Regional 4 year (2009-2013) project funded by the Global Environment Facility (GEF) and implemented by United Nations Environmental Programme (UNEP) and the Centre for Agriculture and Bioscience International (CABI).

The project is implemented in Jamaica by the National Environment and Planning Agency (NEPA).



About the MTIASIC Project, cont'd

Goals and Objectives

- To broaden the approach to dealing with invasive alien species
- Conserving globally important eco-systems, species and genetic diversity within the Caribbean
- Mitigating the threat to local diversity from invasive alien species in the Caribbean including: *terrestrial, freshwater and marine eco-systems*



MTIASIC Project Initiatives

Part of a national strategy to inform and develop policies, legislation, regulations and management of Invasive Alien Species (IAS)

- Establishing regional cooperation and strategies established through the Caribbean Invasive Alien Species Strategy –CIAS
- Establishing Pilot Projects to build capacity in detecting, responding and managing the impact of IAS
- Knowledge dissemination and awareness building



MTIASIC Pilot Projects

Control of IAS predators/competitors to the Jamaican Iguana

- Partners: UWI, Ja.Iguana Recovery Group, Urban Development Corporation (UDC)
- 2. Control of the Lionfish population in Jamaica
Partners: UWI Discovery Bay Marine Laboratory
 - 3. Protecting the Black River Lower Morass from plant and animal invasive alien species.
Partners: UWI



WORLD WATER DAY 2013 APPENDIX 1C

IAS IMPACTING OUR WATER RESOURCES: MTIASIC PROJECT PRESENTATION



What are Invasive Alien Species

- plants, animals or micro organisms which are introduced deliberately or unintentionally into areas where they do not belong, and whose introduction and spread threatens biological diversity.
- can be introduced intentionally by:
 - smuggling
 - species being used for biological control and
 - via the pet, agricultural or horticultural trades



Invasive Alien Species, Cont'd

- Movement within and between countries is by natural events such as flooding, hurricanes and sea currents as well as transportation by trains, planes, ships and packaging material
- Poses major threat to the biodiversity of Caribbean islands and to these countries social and economic realities



Alien Invasive Species targeted by the MTIASIC project



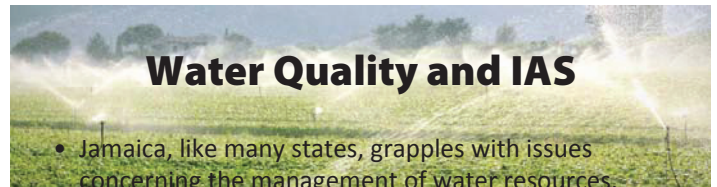
Water Hyacinth
(*Eichhornia crassipes*)



Wild Ginger
(*Alpinia allughas*)



Paperbark Tree
(*Melaleuca quinquenervia*)



Water Quality and IAS

- Jamaica, like many states, grapples with issues concerning the management of water resources.
- Critical sectors such as agriculture, irrigation, fishing, recreation and water transportation, rely on not just the quantity but the quality of water.
- Aquatic environment supports animal and plant species which contribute to bio-diversity and the social and economic viability of communities.



Water and IAS, cont'd

The MTIASIC Project has identified invasive species which impact on important ecosystems



MELALEUCA (*Melaleuca quinquenervia*)

- Commonly known as Bottlebrush or Paperbark Tree, is an aggressive and highly invasive plant.
- Originally from Australia, the Melaleuca or Paper Bark Tree typically grows up to 3- 6 feet per year and produces dense stands, thus displacing native plants.



Paperbark Tree (*Melaleuca quinquenervia*)



WORLD WATER DAY 2013 APPENDIX 1C

IAS IMPACTING OUR WATER RESOURCES: MTIASIC PROJECT PRESENTATION

Research activity in the Black River Lower Morass



The Black River Lower Morass



systems and structures. It actively competes with other plant species for water which affects the eco-balance of wetlands and

- (b) Reduces native species biodiversity
- by reducing water.



Invasive Alien Species (IAS) include:

Wild Ginger (*Alpinia allughas*)

The Wild Ginger which is originally from South East Asia is yet another invasive plant which is found throughout Jamaica and is impacting water quality in the Black River Lower Morass.

- It forms large thickets which spread quickly smothering other plants and out-competes native species.
- Its spread is enhanced by its use as a decorative plant and for landscaping as persons are attracted by its colorful blooms.



Wild Ginger (*Alpinia allughas*)



WATER HYACINTH (*Eichhornia crassipes*)

The Water Hyacinth is considered the scourge of waterways worldwide and is described as an “aquatic terrorist”.



Water Hyacinth

Water hyacinth reduces water quality by:

obstructing waterways- streams and rivers and hampers mechanical (boats, ski's) and non- mechanical (canoes, rafts) means of water transport.

- Lessening sunlight and oxygen supply in the water thus affecting plant and animals
- Blocks fish and other animals from access to food, plants, shelter and nesting areas
- Changes water eco-systems by pushing away and crushing native plants
- Changes water temperature thus affecting species habitat



WORLD WATER DAY 2013 APPENDIX 1C

IAS IMPACTING OUR WATER RESOURCES: MTIASIC PROJECT PRESENTATION



Water Hyacinth I Water Quality Impact

The Water Hyacinth is considered one of the worst problems experienced by tropical and subtropical countries.

It affects areas by:

- Inflicting damage to plants and wild life
- Incurs commercial costs for control and removal
- Demands a combination of strategies



Water Hyacinth and Water Quality, (cont'd)

Control Strategies include:

- Mechanical – use of harvesters which most developing countries cannot afford
- Manual – High cost of large labor force being employed periodically to remove 'mats'
- Chemical control – Use of herbicides which has its drawback especially for drinking water sources



Water Hyacinth Control strategies, (cont'd)

- Bio-control – considered the best method with the use of weevils (*neochefina eichhornia*) and moths (*Samodes alboguttalis*) especially in Africa and Latin America.



Do IAS impact Jamaica's water sources?

Anecdotal feedback from agencies such as the National Water Commission and the Water Resource Authority which manage our water resources indicates there is no major identifiable problem with the Water Hyacinth or other IAS.

Reference is however made to the canals and waste water channels in Portmore which are over run by the Water Hyacinth.



Water Hyacinth impact in Jamaica

There is no data available pointing to the Water Hyacinth being a major issue affecting our water ways, equipment and recreational activities.



Prevent the Spread!

It is committed to...
...ives aimed at preventing and re...
...e alien species

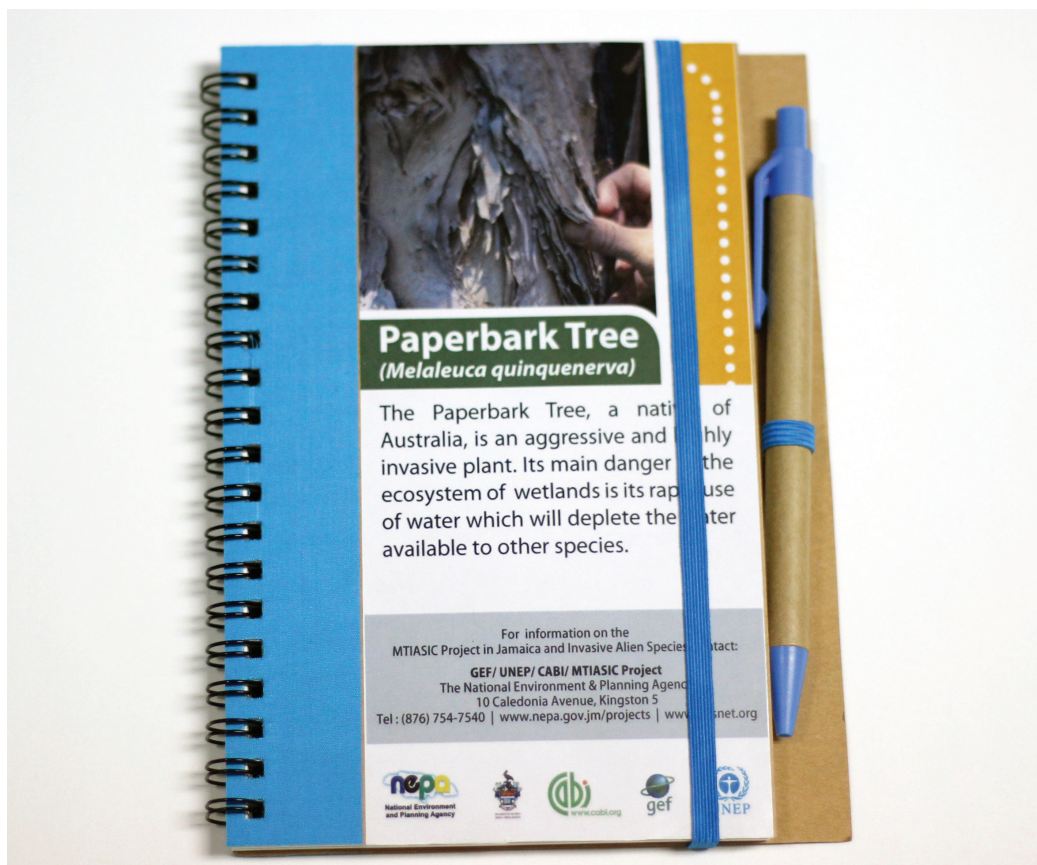


- The MTIASIC Project's Public Awareness programme informs persons on the impact of invasive species through various means including reading material, Public Service announcements, radio/T.V ads and community meetings
- Maintaining critical agency/
- organizational partnerships



WORLD WATER DAY 2013 APPENDIX 2

CAR SUN SHADE & NOTE BOOK



WORLD WATER DAY 2013 APPENDIX 2

TOTE BAG & INFORMATIONAL MAGNETS



Water Hyacinth
(*Eichhornia crassipes*)

This invasive is one of the fastest growing plants in the world and is known to double its size in six days. The Water Hyacinth clogs water-ways, streams and rivers, reduces oxygen and sunlight supply to other plant and animals in the water and displaces plants thus changing the eco-system.



Wild Ginger
(*Alpinia allughas*)

This invasive has been steadily spreading through-out the Lower Morass. Its spread is enhanced by its use as a decorative plant by persons unaware of its rapid growth; which displaces and smothers other plants.



Paperbark Tree
(*Melaleuca quinquenerva*)

The Paperbark Tree, a native of Australia, is an aggressive and highly invasive plant. Its main danger to the eco-system of the Black River Lower Morass is its rapid use of water which will deplete the water available to other species.

For information on the MTIASIC Project in Jamaica and Invasive Alien Species, contact:
GEF/ UNEP/ CABI/ MTIASIC Project
The National Environment & Planning Agency
10 Caledonia Avenue, Kingston 5
Tel: (876) 754-7540 | www.nepa.gov.jm/projects | www.ciasnet.org

For information on the MTIASIC Project in Jamaica and Invasive Alien Species, contact:
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WORLD WATER DAY 2013 APPENDIX 3

NEWSPAPER ARTICLE

THE NATIONAL Environment and Planning Agency (NEPA), under the auspices of the Ministry of Water, Land, Environment and Climate Change and in collaboration with partner agencies, will join the rest of the world in observing World Water Day on Friday, March 22.

Invasive alien species and our water resources

events are organised to highlight the importance of water to the environment, agriculture, health, sanitation, trade and recreation. Critical sectors such as agriculture, through irrigation, fishing

and water transportation rely on not just the quantity but the quality of the water. The aquatic environment, which is made up of rivers, streams, wetlands and ponds, supports important animal and plant species. This in turn contributes to Jamaica's biodiversity, i.e., the variety of species thriving within their habitats.



Do your part... Prevent the Spread!
Keep our water sources free of Invasive Alien Species!

Invasive Alien Species (IAS) are plants, animals or micro-organisms which are introduced deliberately or unintentionally into areas where they do not belong, and whose introduction and spread threatens biological diversity.

Mitigating the Threats of Invasive Alien Species in the Insular Caribbean (MTIASIC) Project has identified several invasive alien species which have a negative impact on Jamaica's water quality.



For information on the MTIASIC Project in Jamaica and Invasive Alien Species, contact:
GEF/ UNEP/ CARU/ MTIASIC Project
The National Environment & Planning Agency
10 Caledonia Avenue, Kingston 5
Tel: (876) 754-7540 | www.nepa.gov.jm/projects | www.danet.org



Water hyacinth (*Eichhornia crassipes*) in the Black River. Inset: close-up photo

The aquatic environment, which is made up of rivers, streams, wetlands and ponds, supports important animal and plant species. This in turn contributes to Jamaica's biodiversity, i.e., the variety of species thriving within their habitats.

IMPACT OF INVASIVE ALIEN SPECIES ON WATER QUALITY

The Mitigating the Threat of Invasive Alien Species in the Insular Caribbean (MTIASIC) project has identified several invasive alien species (IAS) which have had a negative impact on water quality in specific sites throughout the country. IAS are plants, animals or microorganisms which are introduced deliberately or unintentionally into areas where they do not belong, and whose introduction and spread threaten biodiversity. The MTIASIC project has identified three invasive alien species which can affect our water sources.

Six feet (up to 1.82 metres) per year and produces dense stands. The Black River lower morass in St. Elizabeth, which is the largest freshwater wetland ecosystem in Jamaica, is especially vulnerable to this invasive plant. The spread of the Paperbark leads to the degradation of ecosystems and structures as it actively competes with other plant species for water, which affects the ecological balance of wetlands. It reproduces easily by storing millions of seed pods which are shed at the slightest threat.

(1) PAPERBARK TREE (*Melaleuca quinquenervia*)



Paperbark tree (*Melaleuca quinquenervia*)

Commonly known as bottle-brush or paperbark tree, this aggressive and highly invasive plant is originally from Australia and typically grows up to three-

(2) WILD GINGER (*Alpinia allughas*)



Wild ginger (*alpinia allughas*)

The Wild Ginger, which is originally from South East Asia, is found throughout Jamaica. Though loved by housewives and landscape artists, this hardy invasive spreads rapidly, competes with other plants for space and is extremely hard to eradicate.

(3) WATER HYACINTH (*Eichhornia crassipes*)

The water hyacinth is a tropical/subtropical water plant found in lakes, ponds, rivers and streams. It grows faster than any tested plant and can double its population in as little as six days. The water hyacinth is considered the scourge of waterways worldwide and is described as an aquatic terrorist. Water hyacinth reduces water quality by clogging waterways, which hampers the movement of watercraft, lessens sunlight and oxygen supply in the water and blocks fish and other animals from access to food, shelter and nesting areas. Its invasion results in a reduction of native species and changes in water temperature, which impacts species habits.

PREVENT THE SPREAD

The MTIASIC project is currently conducting research to identify effective methods of controlling and destroying IAS plant species, namely the *melaleuca* (paperbark tree), wild ginger and water hyacinth.

HELP TO CONTROL THE SPREAD OF IAS

- The MTIASIC project's public awareness programme informs persons about the impact of invasive alien species through various means including awareness-raising publications, public service announcements, radio/TV ads and community meetings and events.
- Persons are encouraged to help in the control of invasive alien species by:
 - Learning what an IAS looks like, especially one(s) in your area
 - Learning about the damage they cause by attending awareness meetings on IAS
 - Preventing the further spread of an IAS by not taking them into the country or from one place to another
 - Telling your community members about the IAS in your area.

Article prepared by National Environment and Planning Agency.

WORLD WATER DAY 2013 APPENDIX 4

NEWSPAPER AD



Do your part... Prevent the Spread! Keep our water sources free of Invasive Alien Species!

Invasive Alien Species (IAS) are plants, animals or micro-organisms which are introduced deliberately or unintentionally into areas where they do not belong, and whose introduction and spread threatens biological diversity.

Mitigating the Threats of Invasive Alien Species in the Insular Caribbean (MTIASIC) Project has identified several invasive alien species which have a negative impact on Jamaica's water quality.



Water Hyacinth
(*Eichhornia crassipes*)



Wild Ginger
(*Alpinia allughas*)



Paperbark Tree
(*Melaleuca quinquenervia*)

For information on the MTIASIC Project in Jamaica and Invasive Alien Species, contact:

GEF/ UNEP/ CABI/ MTIASIC Project
The National Environment & Planning Agency
10 Caledonia Avenue, Kingston 5
Tel : (876) 754-7540 | www.nepa.gov.jm/projects | www.ciasnet.org



WORLD WATER DAY 2013 APPENDIX 5 POSTER



Invasive Alien Species Impacting Water Quality and Quantity



Water Hyacinth
(*Eichhornia crassipes*)

Wild Ginger
(*Alpinia allughas*)

Paperbark Tree
(*Melaleuca quinquenervia*)

Prevent The Spread!

The Mitigating the Threats of Invasive Alien Species in the Insular Caribbean (MTIASIC) Project is targeting invasive alien species which have had a negative impact on water quality and quantity in Jamaica.

Invasive Alien Species (IAS) are plants, animals or micro-organisms which are introduced deliberately or unintentionally into areas where they do not belong, and whose introduction and spread threatens biological diversity and socio-economic situation.

The MTIASIC Project supports continued research into areas of bio-control and identification of IAS through investigation of methods for controlling and eradicating where possible those which directly affect our water sources.

Water Hyacinth (*Eichhornia crassipes*)

- Can double its size in 6 days
- Clogs water-ways, reducing the supply of oxygen & sunlight
- Displaces other plants thus changing the ecosystem

Wild Ginger (*Alpinia allughas*)

- Should not be used as a decorative plant
- Displaces and smothers other plants
- Is steadily spreading through-out the wetlands

Paperbark Tree (*Melaleuca quinquenervia*)

- An aggressive and highly invasive plant
- It uses water rapidly which depletes the water available to other species.

For information on the
MTIASIC Project in Jamaica and Invasive Alien Species, contact:

GEF/ UNEP/ CABI/ MTIASIC Project

The National Environment & Planning Agency
10 Caledonia Avenue, Kingston 5

Tel : (876) 754-7540 | www.nepa.gov.jm/projects | www.ciasnet.org

WORLD WATER DAY 2013 APPENDIX 6

REGISTER

World Meteorological Day, Saturday, 23 Mar. 2013

World Meteorological

Name	Organization/Affiliation	Contact No.	Email Address	Comments
Fay Thomas	Private Citizen	944-4709		Interesting Very Informative +
G. Syrell	" "	944-4708		
Nicholas Ferguson		468-7481		
Nicholas Ferguson	Jessie Ripoll			
Shanelle Rankine	Jessie Ripoll			
Maurice Mighty	Jessie Ripoll			
Gary Cooper	Jessie Ripoll			
Andre Broderick	Jessie Ripoll			
Matthew Lewis	Jessie Ripoll			
Brianna Francis	Jessie Ripoll	426-7608	Kacryoung.5@gmail.com	
Shadmon Bennett	Jessie Ripoll	572-6787	Diamonpeefly@hotmail.com	
Jekara Bonner	Jessie Ripoll	883-2661	Windward way	
PASHION Law	PASHION			
Savannah Robinson				
Roshere Bellon				
Wayne Robinson				
Andrea Baker	ANDREA BAKER CONSULTING		amwil.com	
Rachel D Silva	CL E	587 5966	rachdsilva@gmail.com	Interesting
Veronica Thorpe	VINCI	387 7658	verthorpe@yahoo.com	
Evel Hamilton	P.C.	313 3598	woodshoplo@yahoo.com	Interesting
Kellie Wilbra		354 3761	Simpure006@hotmail.com	Informative & Interesting
Paula Pannuzzo		4707382	ppannuz30@gmail.com	Interesting
Robert March		362-9996	robmarch@hawaii.com	
Aralei March		8061783	araleimarch@gmail.com	
Doneique Smith	Merl Grove High School	845-3872	Doneiques@hotmail.com	
Kristen Carr	Merl Grove	368-2871	kristen_carr96@yahoo.com	
Majd Thomas	M.G.H.S	301-0600	Majdthomas@yahoo.com	
Shanel Richards	!	551-1880	Shanelrichards@yahoo.com	
Dania Danies	Met office	581-2748	D. Danies	
Kenisha Rose	Met office	879-8448	KRose	
Gabriel Todd	Cayman		G.todd@gmail.com	

WORLD WATER DAY 2013 APPENDIX 6

REGISTER

ld. Meteorological Day, Sat., 23 Mar. 2013 World Meteorological Day, S

Name	Organizational Affiliation	Contact No.	Email Address	Comments
Leslie Ann Charlton		5899887	leslie-ann.charlton@gmail.com	Very informative 😊
Al Williamson		544 9228	ato_williams@yahoo	
Sandra Lee Walker		827-8857	scorpioctaze@yahoo	
Nypha Smith	Allman Town	332-9220	bergilsmith56@yahoo	
Ramon Mitchell	Allman Town	333-7712	DionneLewis@ymail	
Toneitha Tate	Allman Town	376-6895		
Ahealy Reid	Allman Town	863-2763		
Just 4 U	St. Mary	316-5653	roorw2@yahoo.com	
Caron Rose	"	824-3492	cbernatrac@yahoo	
Arthur E. Ferguson	Kyngston	833-8118		SOLD ME VERY interesting
Rosemarie O'Connell	NWR.	351-9369		Very interesting/informative
Lorna Morgan		363-2160		Very informative, food for thought
Suzette Suite	WRA	294-8050	chen_engravers@twinkl.com	Very informative
Aneisha Samuels	WRA	294-8816	asamuels@wra	
Jeffery Spooner	MET Service	9605990		
Margaret Jones	MegChes		magnificentclass	Very informative
Anna May	Viscchio Canada	405-2037	@gmail.com	Very very educational, I
Kerrie Barnaby	MUWBC	9209117		Very interesting - much info. S
Lilith Barnaby				Interesting; well presented
Nicardo Wright	Clarendon	4934300	NicardoWright@yahoo.com	Interesting information
Berle Hylton	St James	4894843	hyltonmur@yahoo.com	
Dorina Spencer	UNEP	922-9267	ds@cep.unep.org	Interesting and informative
Shani Brown		504-7397	cattytoo@hotmail.com	interesting info
Tajara Simpson	St Catherine		tajarasimpson@yahoo	
Ch Brown	St Andrew	8649881	chbrown@speed.com	
Albert Stewart	Pottmore St. Geo.	7963798	JesusStewart@hotmail.com	Very interesting.
Abigail Meikle	St. Andrew			I learnt some interesting info
Audrey Meikle	St Andrew	2951779		interesting
Claudette Sebello-Mylie	Sheabar Portmore			So very informative
Janez Grant	TARRANT HILL	9262523		VERY INFORMATIVE
Abigail Gustafson	Peace Corps		AEAS1429@hotmail.com	
Laura Brown	P.C.	520-3137	LRBROWN@SYR.EDU	

WORLD WATER DAY 2013 APPENDIX 6

REGISTER

STRY OF WATER, LAND, ENVIRONMENT &
CLIMATE CHANGE
WORLD WATER DAY EXPO 2013.

NAME	ORGANIZATION/ AFFILIATION	CONTACT NO.	EMAIL ADDRESS	COMMENTS
Donald Watson	Forestry Dept			
Tasheka Drummond	Pondside Primary			
Faith Walker	NEPA			
L. McDonald	NIC			
Heather Francis	MWLECC			
KERRIE-ANNE DRYDEN	MWLECC			
CAROL MORRISSEY	E X E D.	401-3585		
Andrew Gooden	Marks man	891 6859		
Mark Edwards	Med Clinix	425 3577		
James Galbraith		8721055		
Cynthia Brown	PER	906-1748		
Paulette Westcott	EFFJ	989-0102		
Glenford Johnson	IBLC	906-7223		
Kemay Pearson		463-3123		
Dorothy Jones	M&D	927 1936		
Catherine Miles	Manifesto Jamaica	891-5075		
Ann Miles	Roburack of Newtgr	356-9167		
Anny Colleso	Life care	789 5974		
Suziel McLean	ci	389 5134		
Andrew Hinds	FF/EFS	589-0253	andrew.hinds@water.ail.com	
Splonnie Phay	EFF			
Sandra Buchan	MWLECC	926-1590		
Andrew Spencer	MWLECC	926 1590		
Kewsha Glave		361-7956		
Tanya Hoang	RWSL	865-6615	tanashay@hotmail.com	
SHARONETTE WALKER	ARDENNE PREP	2949739	sharonette.walker@yahoo.com	
Dulgette	Portmore	4479022		
Rose Perrygreen	MWLECC	9608389	rose.perrygreen@gmail.com	
Onjife Chiggin	Self	449-0305	ONTISE@HOTMAIL.COM	
theana will	SEDC	928-5161-5		
Hazel McKay	Self	306 5339		
Paulette Gardner	citizen	→		

Good info!

Good Info

keep informed.

Good talk by Smith Walker
The rest of the team
also display same level
of awareness of the
subject discussed
Well done by NEPA
stimulating + n

WORLD WATER DAY 2013 APPENDIX 6

REGISTER

WORLD WATER DAY & WORLD METEOROLOGICAL DAY EXPOSITION DEVON HOUSE (South Lawn) MARCH 22, 2013				WORLD WATER DAY & WORLD DAY EXPOS. DEVON HOUSE (South Lawn)
NAME	ORGANIZATION/ AFFILIATION	CONTACT NO.	EMAIL ADDRESS	COMMENTS
S Schwank L. Edwards	-	detae_jae@yahoo.com	glilithedwards@yahoo.com	Fishing sanctuary needs protection
M. Brown		851-1437	maxles99@yahoo.com	Need info on water hyacinth
P Henry	Ardenne Preparatory	3355025	henrypamela@yahoo.com	
P. Samuels	St. Francis Prim	847-7578	petty-ann@comcast.com	Educating children more
J Campbell		347-3498	IFCam2003@aol.com	Very informative & Educ
S. Mohamed		869-2212	Shahimosa0@comcast.com	Continue the good work & send me info.
A. Green	Ardenne Prep			
Pat Taylor	National Irrigation Com.	351-2148	patciapt@comcast.com	Excellent display, interesting info. Get the msg out to other
Greg Anderson				
Joseph	Hearttrust VIA	435-8729	kimpackard@yahoo.com	J'cans!
Nicholas Young		865-7280	nidgey2@bellsouth.com	The Rep was welcoming, never heard about the project was very enlighten.
				Good Presentation Very Informative
Peter Clarke	RWSC	75458485	clarkepe@rwsfjars.com	Very informative presentation
A. Henry Lewis	REB/CSC	926-9748-9	ahenry@reb.gov.jm	Very informative & helpful information - will pass on
Tricia Harris	REB/CSC	926-9748-9	tharris@reb.gov.jm	Very informative & helpful information - will pass on
Joan Miller		969-1269		Very informative
Romey Ann Hibbert	UWI SON, mona	868-8687	romeyann.hibbert@yahoo.com	Informative information
Sandra Miller	Min. TRANSP, WATER & HOUSING	386-4213	sandra@min.gov.jm	Very interesting & informative
M. Morris	Complete Marketing Solution	579-7010		
Leticia Bebeth	K/S Bee Farmers	855-3787	Letcore@yahoo.com	
Kwesi Palmer	MOA/Agriculture	4004-3264	kwesipalmer@yahoo.com	

WORLD WATER DAY 2013 APPENDIX 6

REGISTER

WWD
Friday, 22 Mar. 2013

WWD
Friday, 22 Mar

NAME	ORGANIZATION AFFILIATION	CONTACT NO.	EMAIL ADDRESS	COMMENTS
Claudette Simmonds	M.O.H.	538 8345	simmondsclaudette@ ^{you}	Very important project
Doug Wilson	RWSL	754 5485	dougswil@gn	
Faith Bertram		925-9539	FABSAMARCA@Hot	Very informative
Dominic McNaughton		829-6258		aliens are evil.
S Francis	NWLECC	569-0831	sharon.francis@nwlecc.gov.jm	Very informative
Richard Campbell	MOFP	932-5214	Richard.Campbell@moft.gov.jm	" "
M. Scott	PEB	277-6182	m.scott@peb.gov.jm	
Y. MITTOO	CONSULTANT	925-5390		Impressive as usual
Tamara Phang		398-9324	tai_mpa21@lyha	very informative
Claudia Gordon	NLA - Sand. Nat.	750-5263	Claudia.Gordon@nla.gov.jm	Excellent
James Spencer		597-2629	jaguspencer@jamaica.com	
Christopher Kirk			chrishinz102@gmail.com	
Aman O'Connor	Shortwood Practising	774-1153	-	Awesome and Informative
Natalie P. Wood		33-10-221		
Robert M. Ke	NIC	487-8965	krisann@nic.gov.jm	
M.A. McPhail	Self employed	890-1294	mcp@mail.moravia	Very informative never heard of the blue fish.
Gabby Wherwin	Student	414-0540	wherwin@gmail.com	quite informative
Matthew Burton	Student	891-4115	matthew25burton@gmail.com	very interesting
P. Russell-Born	PEY + Associate		pey-asso@hibrod.com	Thanks for the information.
Nicola Grant	Student	598-6182	nicola_grant@peb	very informative
Norma Puge		8430891		Very informative
Lillianne O'Connor	NWLECC	3894198		
Patric McDonald	Senior Life	589-3493	medon69@hotmail.com	Very Informative
Errol Gordon	NWC	5886637		
Leon BARNES	JAMAICA HIKING HERITAGE TOURS	89A-7990	MJLITAK@12091209@qc.com	Audience.
Phillipa Horvath		7704122		
Shirley Watson		402 0154		
Toni-Ann Reid	NEPA	446-2577		Continues to keep on the top of things
K. Brackshaw-Norris	NEPA			Too awesome!
J. Fanning	N.W.C.			Keep up the good work.
D. Thom	Govt			VERY INFORMATIVE.
JOAN Folkes	Govt	541-6023	Jmb.Folkes@gmail.com	Very interesting

WORLD WATER DAY 2013 APPENDIX 6 REGISTER

Friday WWD
22 March, 2013

Friday WWD
22 March 2013

NAME	ORGANIZATION AFFILIATION	CONTACT NO.	EMAIL ADDRESS	COMMENTS
W. CARL	Freelance Photographer	362-8858	WillsPhotos85@yahoo	
T. Brown	JOAN MTSCH	865-9873	Travis@BrownEMSA	Very interesting
F. Campbell	DONALD QUARRIE	420-8379	trishack107@yahoo	Very interesting
A. Thompson	Self Employed	449-4131	Mudreyauthentical	
Joan Sterling		454-5744	Jean Sterling-fa@yoduro.com	
Wilbert Foster	Self Employed	4696227		
Maxine Hall	Unemployed	505-4477	MaxineCampbell64@yahoo	Very informative
Patricia Kern	TAG	376-3143	kernpatricia@yahoo	Very Educational
Darcy Tomkinson	Met. Office	592-2820	detroyt@yahoo.com	Very informative
Donna Thomas	MWH/EC	820-1623	Heba.k@MWH.com	
Jacob E. Stephens	Rosemount PA & Junior High Sch	(985-2354) 434-9570	Jacob.stephens@unl.mona.edu.jm	
Janice Knight	NLA	295-8094	Janiceph2020@yahoo	

WORLD WATER DAY 2013 APPENDIX 6

REGISTER

World Meteorological Day, Sat. 23 Mar. 2013				World Meteorological Day,	
Name	Organization/Affiliation	Contact No.	Email Address	Comments	
J. Gill			private@stint	VERY GOOD	
J. Brown	Private			Very informative	
L. Brown	Cityzen			"	
Sabrina Boudeloh	Providence				
Shabana, Lindsay	Lyndhurst				
Maria Williams	Methodist Church				
Alexy Johnson	Chetolah Park				
Shanice Bantim	Primary				
Kenroy HARR	NFC			Very Informative	
C. Hudson					
E.H. Fishel				Great!	
Norma Price		8430891	Ligueron Sandy Park Rd		
Maibyne Boud		482-4441			
Magda Gutrie	St. Andrew High for girls Environmental Club	4233097			
K. Wood	Ligueron Prep Environment Club	3309822		Informative engaging	
Yochi Williams	Lightner Ecker Area	486-3761		informative great	
Socah Williams	Ligueron Prep				
Sophia Mitchell	NHF	872-1848	smitchell@nhf		
Norissa McKenzie		447-3818	Knowledge Improvement @ yahoo.com		
LAINE Zoussa	Min. of Education				
Joyall Kuntz		393-4873	J.kuntz@ht.ro		
Heidiann Williams		418-7580	jesussta@love@		
Ann-haye Campbell	UWI		annahaye.campbell@uwi		
PAM BOURZON & Kymani Rose	KINGSTON Hydrel Prep.	9334532 7051895	p9ourzong@gmail.com natalie.rose@msh.gov.jm	Informative and easily understood	
Natalie Burnett-Rose	MKWCC	4643155		Informative	
Jordan Rose	Hydel Prep	7051895			
Adrian Henry	St. Richard's Primary School	5676660	Henryadrian@yahoo.com		
MARCIA MULLER		861-3009	mmuller66@yahoo.com	Informative	