Technical Progress Report
IABIN INVASIVE SPECIES THEMATIC NETWORK CONTENT BUILDING PROJECT IMPLEMENT, UPDATE AND MAINTAIN AN I3N IAS DATABASE IN JAMAICA
For the period May 19, 2006 -November 16, 2006

Submitted by

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EXECUTIVE SUMMARY

The IABIN Content-Building project for I3N Jamaica is the second IABIN project being administered and spearheaded by the Natural History Division (NHD) of the Institute of Jamaica. The project facilitates the improvement of the current database on invasive alien species found in Jamaica. The development of posters and brochures are additional components of the project that seek to increase the awareness of the general public on the presence and effects of alien invasives in Jamaica. These new materials will compliment the existing brochure that was produced in the pilot project in 2002. In addition, the educational materials to be produced would serve to better inform decision makers on matters concerning invasive alien species.

Using the current standards and protocols developed by IABIN-I3N, the database contains to date, 24 species of which 23 are validated and 70 occurrences of which all are validated. Difficulties have included obtaining the raw data used to develop the original database. The main challenge is finding information on the impacts that invasives have on local biodiversity as well as obtaining specific details of introductions. The process of obtaining and inputting of data is becoming less challenging with increased usage of the database.

Two posters and two brochures are being conceptualized with advice from the local Alien Invasive Species Working Group and are in draft format

INTRODUCTION

In 2001 Jamaica participated in a pilot project (I3N) initiated by the United States Geological Survey (USGS/BIO) where information on invasive alien species was gathered and exchanged among participating countries of the Americas. On completion of the project, some of the deliverables included the development of four databases namely:

i. Invasive alien species
ii. Experts involved in invasive species research and management
iii. Invasive species projects
iv. Available invasive species datasets.

There was also the creation of a brochure on Jamaica's invasive species.

Since then, I3N has become one of the five IABIN Thematic Networks which aim to provide online data and information on invasive alien species in all IABIN participating countries thereby addressing the need for a regional network. The Institute of Jamaica, in it's capacity as the coordinating institution (C.I.) for the Jamaican I3N database, answered the call to develop a project to increase update the content of pilot project's database in compliance with the protocols and standards developed by IABIN.

The project commenced in May 2006 and with an approved budget of US$ $26,610 (amended budget) of which US$10,000 funded by IABIN-I3N, and US $ 16,610 of matching funds contributed by the Institute of Jamaica. The project has the main focus of creating a national database on Invasive Alien Species. Using updated I3N standards, this would incorporate the existing database housed at the Institute of Jamaica as well as new information from various governmental and non-governmental organizations including the University of the West Indies. Information obtained would fill the current gaps that exist and this is vital for the proper management of Jamaican biodiversity, protected areas and other sensitive habitats.

PROJECT OBJECTIVES

Using standards developed by the IABIN-I3N thematic network, the project is aimed at providing high quality data on invasive alien species in all habitat types in Jamaica. The Institute of Jamaica, by means of its informatics facilities, will make the information gathered through the project freely available through the Jamaican I3N-IAS website hosted by the Jamaica Clearing House Mechanism. The main deliverables include the development of a comprehensive list of all known invasive species in Jamaica and the development of educational materials (posters and brochures.)

EXPECTED OUTPUTS AND OUTCOMES

Following the first six months of the project implementation, it is expected that the database would be provided based on I3N standards in digital form, be submitted. This should include at least 20 invasive species with at least 40 validated records by subject experts, and draft versions of 2 posters and 2 brochures. It is also expected that published documents for educational and other purposes must recognize the role of IABIN and I3N and should include the respective logos.

The participants of the project will also liaise on a regular basis with the local I3N lead, the members of the established local steering committee, IABIN-I3N Coordinating Institution and the IABIN National Focal Point. The project administrators will also communicate with local experts on invasive species, community groups and organizations involved in the research, control and management of invasive species. Participating in local invasive alien species workshops and meetings will also ensure that information relating to the IABIN-I3N project is communicated.

METHODS EMPLOYED AND ACTIVITIES CARRIED OUT

Following the initial disbursement of funds, computer hardware (1 desktop and 1 laptop) to be used for data entry and field research, were purchased. This was followed by the hiring of a research assistant in September 2006.

The research assistant is in the process of gathering metadata relating to invasive species in Jamaica guided by Schedule 7 of the Jamaica Wildlife and Protected Areas Act compiled by the Alien Invasive Working Group (AIWG). Subject experts and relevant literature from NHD and the University of the West Indies provided the initial metadata on selected species from schedule 7. This included re-entering the information from the previous database (pilot project 2002) as well as any new information acquired.

A two-day workshop funded by the Institute of Jamaica was conducted in order to share information and experiences relating to invasive alien species and subsequent management practices. The workshop was facilitated by Dr. Silvia Ziller and Dr. Sergio Zalba, developers of the new I3N database with members of the local AIWG in attendance (See Appendices 1 and 2). The workshop included presentations of Case studies specific to Jamaica.

A meeting that was geared towards the use and development of the I3N database and web interface followed. In attendance were members of the Alien Invasive Working Group secretariat, the Information Technology Staff of the Institute of Jamaica, staff of the Jamaica-CHM and IABIN focal point. It was well attended and there was positive feedback from the facilitators as well all those in attendance.

TABLE 1: PROPOSED MATRIX FOR THE JAMAICA IABIN-I3N CONTENT BUILDING PROJECT

Activity vs. Month	1	2	3	4	5	6
Gap Analysis	*					
Identification of Information Sources		*				
Visits to institutions islandwide to acquire all information related to the IAS		*	*	*	*	
Formatting of data for IABIN and upload			*	*	*	*
Production for Pub. Ed. Materials on IAS in Jamaica						
Plan and host end of project workshop						
Prepare and Submit quarterly technical and financial reports			*			*

RESULTS

To date, at least 24 species with 70 occurrences have been entered into the database (See Appendix 3). The target of 20 species with at least 40 occurrences has been exceeded and steps are being taken to acquire information from other organizations. Special effort is being made to incorporate some 30 invasive alien species not found in the original database. Summary of which is shown below (Table 2).

TABLE 2: HABITS (LIFE FORMS) OF IAS DATABASE INPUTS

FAUNA		FLORA	
Habit	Number	Habit	Number
Mammal	1	Tree	3
Bird	1	Grass	9
Fish	4	Shrub	1
Mollusc	4		
Crustacean	1		

Draft copies of two posters and two brochures have been produced as stipulated (See Appendix 4). The first poster would highlight attractive flora and fauna and illustrations on the dangers they cause. Five plants and five animals have been identified. Information will include the scientific and common name, location of invasion and the impact that they have. Two Images per species will be used. The first would showcase the attractiveness of the species and the second would be used to visualize the impact of these species on various habitats. The species chosen are those that do not appear on any other material being produced by other organization in order to increase the amount of information that will be available to the public. The second poster will show the ecological, social and economic impacts of invasives.

One brochure will highlight feral invasives found in Jamaica. This will show the effects of animals that have escaped captivity and the impacts they have on the environment and human life. The second will show the economic benefit that some of these invasives have provided many people.

The project participants participated in a workshop hosted by Rural Agricultural Development Authority (RADA) on Integrated Pest where IABIN- I3N database was presented as well as background information and activities of IABIN. This was done to introduce the database to the agricultural sector in the hope that the Caribbean initiative and Ministry will collaborate with IABIN-I3N in achieving its goals. Project participants also attended a meeting of the local alien invasive species working group comprising members from various government and non-government organizations. It was agreed that the I3N educational material to be produced will be supported by group members

through comments and recommendations and will be distributed throughout various sectors such as agriculture, tourism and schools.

LESSONS LEARNED PROBLEMS AND POSSIBLE SOLUTIONS.

- During the development of the database the information obtained reinforces the importance of a regional initiative in collating and sharing information on invasive species. This is largely due to the commonality of occurrences of adventive species across of the Caribbean and Latin America.

- One of the major challenges encountered is the difficulty in sourcing specific information on Jamaican IAS as it relates to details of introduction and associated impacts. This may be remedied by increasing the contribution of subject experts.

- Efforts should be placed into creating an extensive taxonomic list of invasives across the region as this would decrease the likelihood of related typographic errors by use of a standardized drop down listing.

- The issue of natural invasives needs to be addressed as it seem to be controversial. There is discussion surrounding whether naturally introduced species can be termed invasive.

- There are currently other regional initiatives such the Caribbean Invasive Working Group that appears to have the same objectives as does I3N. Therefore, there seems to be a duplication of effort in regards to the development of a regional database.

FINANCIAL REPORT

IABIN I3N PROJECT

EXPENDITURE ANALYSIS

5/18/2006 - 11/16/2006

Receipt			**$6,900.00**
Available Funds (USD)			**$6,900.00**
Date	**Supplier**	**Particulars**	**Cost**
Jun-06	Dell USA	Laptop Computer	**$ 2,373.63**
Jun-06	P.C. Consultancy	Computer System	$ 892.30
Sep-06	Aisha Bailey	Part Time Salary Research Assistant/Consultant	$ 383.80
Sep-06	Dennis Buddo	I3N Meeting	$ 101.50
Oct-06	Aisha Bailey	Part Time Salary Research Assistant/Consultant	$ 383.80
Nov-06	Aisha Bailey	Part Time Salary Research Assistant/Consultant	$ 383.80
TOTAL			**$ 4,518.83**
Surplus/(Deficit)			**$ 2,381.17**

Parallel Financing Reporting Form

May 2006 -November

PLEASE PROVIDE INFORMATION ABOUT THE ACTIVITIES AND COSTS THAT YOUR INSTITUTION HAS FUNDED RELATED TO IABIN ACTIVITIES (DO NOT INCLUDE FUNDS PROVIDED BY IABIN)

INFORMATION OF FINANCIER (SOURCE)

	Academic ( )	NGO ( )	Government ( )	Multilateral Agencies ( )	Other (√)

INSTITUTION / ORGANIZATION NAME	INSTITUTE OF JAMAICA
COUNTRY	JAMAICA, WEST INDIES
DEPARTMENT/OFFICE/OTHER	NATURAL HISTORY DIVISION
AUTHORIZED PERSON NAME	TRACY COMMOCK
DATE	November 16, 2006

IMPORTANT: The information reported in this form is the Institution/Organizations' responsibility, which will be filled together with the background documentation during project implementation, and are required that their records are available for review

02-Data Content Creation

Support multilingual training, and provide technical leadership to IABIN countries as they develop data for access within the IABIN network (i) Consultants' Services to work on the catalogue and the six Thematic Networks (Specimens, Species, Ecosystems, Invasive Species, Pollinators and Protected Areas), (ii) Participation in Seminars and Workshops related to Component I (iii) Operating expenses

Units of Parallel Financing	**ACTUAL**				**Description**
	# of Units	Cost per hour	Actual Semester	Period of the Project	
Technical Personnel Hours - Senior Level	80	$50	$4,000.00	6 months	
Technical Personnel Hours - Junior Level	80	$25	$2,000.00	6 months	2 IT officers using 20% work hours
Equipment and supplies	6 months	$2.50/month	$15.00	6 months	Internet Access
Physical Infrastructure					
Documents	xx	xx	$1,181.84	6 months	Report, stationary, printing,
Number of professionals in Seminar n (cost/day)+(travel cost)	30 persons	$10/person	$300.00		Meals for workshop participants
Others (please detail)					
Total			$7,496.84 **$0**	**$0**	

APPENDIX 1

IABIN INVASIVE SPECIES INFORMATION (I3N) INVASIVE ALIEN SPECIES (IAS) WORKSHOP 2006

Name	*Organisation and Department*	*Email Address*
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APPENDIX 2

I3N IAS WORKSHOP PROGRAMME

INSTITUTE OF JAMAICA/NATURAL HISTORY DIVISION
&

iabin
Inter-American Biodiversity Information Network
Invasives Information Network (I3N)

INVASIVE ALIEN SPECIES WORKSHOP

SEPTEMBER 13TH - 15TH, 2006

MINISTRY OF LOCAL GOVERNMENT AND ENVIRONMENT CONFERENCE

nepa

Programme, Day One, September 13, 2006

Chairperson: Mrs. Tracy Commock, *Director of Natural History Division,*

9:00 - 9:30 am	**Greetings**	**Mr. Vivian Crawford** Executive Director *Institute of Jamaica* **Ms. Joy Anderson** Director of Integrated Planning & Environment *National Environmental & Planning Agency* **Mrs. Donna Blake** CBD National Focal Point **Mrs. Dionne Newell** IABIN National Focal Point
	Introduction of Dr. Sergio Zalba and Dr. Silvia Ziller	**Mr. Dayne Buddo Chair AIWG Jamaica**
9:30 - 11:00 am	**Introduction of Biological Invasions - Concepts and Definitions**	**Dr. Sergio Zalba & Dr. Silvia Ziller**
11:00 - 11:15 am	**Coffee Break**	
11:15 - 12:30 pm	**Characteristics of Invasive Alien Species and of Invasion Processes**	**Dr. Sergio Zalba & Dr. Silvia Ziller**
12:30 - 2:00 pm	**Lunch**	
2:00 - 4:00 pm	**Invasibility and Facilitation of Invasions**	**Dr. Sergio Zalba & Dr. Silvia Ziller**
4:00 - 4:15 pm	**Coffee Break**	
4:15 - 6:00 pm	**Dispersal and Expansion of Invasions - Vectors and Pathways**	**Dr. Sergio Zalba & Dr. Silvia Ziller**

Programme, Day Two, September 14, 2006

9:00 - 11:00 am	**Managing Invasions - Prevention and Eradication**	**Dr. Sergio Zalba & Dr. Silvia Ziller**
11:00 - 11:15 am	**Coffee Break**	
11:15 - 12:30 am	**Managing Invasions - Control and Management**	**Dr. Sergio Zalba & Dr. Silvia Ziller**
12:30 - 2:00 pm	**Lunch**	
2:00 - 4:00 pm	**Case Studies** *Perna viridis*	**Mr. Dayne Buddo**
	Pittosporum undulatum & *Hedychium spp.*	**Ms. Shauna Lee Chai**
	Hypostomus plecostomus & *Callichthys callichthys*	**Ms. Aisha Bailey**
	Chromolaena odorata	**Ms. Marsha Robinson**
	Dicranopteris pectinata	**Mr. Keron Campbell**
4:00 - 4:15 pm	**Coffee Break**	
4:15 - 4:45 pm	**DVD Film- 'Working for Water Program'**	
4:45 - 5:00 pm	**Closing Ceremony**	

Programme, Day Three, September 15, 2006

9:00 - 11:00 am	**Presentation of Database Use and Structure, Exporting Data in XML, Web Access and Web-Based Management**	**Dr. Sergio Zalba & Dr. Silvia Ziller**
11:00 - 11:15 am	**Coffee Break**	
11:15 - 12:30 pm	**Exercise: Registering Data and Using the Database**	**Dr. Sergio Zalba & Dr. Silvia Ziller**
12:30 - 2:00 pm	**Lunch**	
2:00 - 4:00 pm	**Contributing with Data and Searching for Information via the Web**	**Dr. Sergio Zalba & Dr. Silvia Ziller**
4:00 - 4:15 pm	**Coffee Break**	
4:15 - 4: 30 pm	**Closing Thought**	**Mr. Sean Townsend** IABIN I3N Lead

APPENDIX 3

I3N IAS DATABASE REPORT

Latin name: Passer domesticus

Kingdom: Animalia
Phylum: Chordata
Class: Aves
Order: Passeriformes
Family: Passeridae

Common name:
House sparrow

Language:
English

Description of species:
The House Sparrow is a stout, stocky sparrow, with shorter legs and a thicker bill than indigenous American sparrows. Members of both sexes are brown backed with black streaks throughout this area. Its underside is pale buff. Males have white cheeks and a black bib, while females do not. The tail is usually three-quarters the length of the wing.

Reproduction:
Sexual

Biological form:
Bird

Diet:
Omnivore

Introduction:
Possible arrived to Jamaica on passenger cargo and ships.

Cause of introduction:	***Means:***	***Place:***	***Date:***
	Accidental		1903

Economic use:
Science
The House Sparrow has proven well-suited for studies of general biological problems, such as evolutionary mechanisms, temperature metabolism, and pest control.

Ecological impacts:
Due to its preference for human-modified habitats, the House Sparrow is considered a nuisance species, a competitor of native birds, and an agricultural pest. Large aggregations around buildings produce annoying noise and large quantities of feces.

Economic impacts:
Is considered an agricultural pest.

Mechanical control:
Use of Gilbertson PVC boxes. Multi-bird trapping.

Biological control:
Plugging the entrance hole. Eliminating feeding areas, roosting and nesting sites.

Native range:
Eurasia and North Africa.

Natural habitat:
Like areas that have been modified by humans, including farms, residential, and urban areas. They are absent from uninhabited woodlands, deserts, forests, and grasslands.

Preferred habitats for invasion:
Disturbed areas, Urban.

Date: ***11/16/2006***

Latin name: Canis lupus familiaris

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Carnivora
Family: Canidae

Canis lupus familiaris L.

Common name:	***Language:***
Domestic Dog	English
Dog	English

Description of species:
Come in a variety of shape and sizes. They are selectivley bred by humans. They exhibit sexual dimorphism where the male is larger than the female. Dogs are predators and scavengers with strong jaws, sharp teeth for holding and tearing food.

Dispersal:
Direct development (no planctonic larvae)

Pathways:
People sharing resources
Acclimatization societies
Transportation of domesticated animals
Self-propelled

Vectors:
Human

Reproduction:
Sexual

Biological form:
Mammal

Diet:
Carnivore
Omnivore

Economic use:
Agriculture

Native range:
East Asia

Natural habitat:
Terrestrial biomes mainly associatd with humans.

Preferred habitats for invasion:
Unknown

Date: ***11/16/2006***

Latin name: Perna viridis

Kingdom: Animalia
Phylum: Mollusca
Class: Bivalvia
Order: Mytiloida
Family: Mytilidae

Perna viridis L.

Common name:	*Language:*
Asian Green Mussel	English
Green Mussel	English
Green Lipped Mussel	English

Description of species:
Perna viridis are bivalve molluscs that are characteristically brown and green lipped (adults) or predominanatly green (juveniles). The adults show a predominant brown colour with green margins. Internally a dark stripe outlines the exhalent siphon and the inner surfaces of the inhalent siphon. The retractor muscle has two scars on the inside of the shell on dissection, a posterior and an anterior scar. They attach to substrate using byssal threads. They are filter feeders with a planktonic larval stage. They show a wide tolerance range for environmental conditions and can survive periods of unfavourable conditions.

Dispersal:
Indirect development (with planctonic larvae)

Pathways:
Ship/boat hull fouling
Shipping
Translocation of vessels

Vectors:
Ship - ballast water
Ship - ballast tanks

Reproduction:
Sexual

Biological form:
Mollusc

Diet:
Planctivore

Introduction:
Due to accidental introduction it is difficult to determine the actual date of intriduction. However the first record of P. viridis in the Kingston Harbour was Feburary 1998.

Cause of introduction:	*Means:*	*Place:*	*Date:*
In association with international commerce	Accidental	Kingston Harbour	

Economic use:

Aquaculture, Handicrafts, Science, Bait, Wearing apparel.
Due to high population densities and rapid growth and reproductive rate P. viridis has become useful to local fishers for sale on the local market on a small scale, as well as use as fish bait.

Ecological impacts:
Compete with Sponges, tunicates, oysters and other mangrove root species for food and space.

Economic impacts:
Colonies of P. virdis clog the pipelines and drains of industrial companies along the Kingston Harbour. This results in increasing cost of maintainance for these companies. The hulls of boats and other vessels become fouled more often and need to be cleaned more regularly, and attract additonal maintenance costs.

Impacts on health:
Stomach content analysis shows P. viridis to feed on toxic microalgae. The gut contents and cavity water has shown high levels of coliforms due to the water conditions on Kingston Harbour. There is therefore a risk to human health.

Social and cultural impacts:
Minimal negative impacts were expereinced during the early years of the invasion as the number of oysters were reduced by the green mussel in the mangrove areas. This soon became and opportunity as persons started exploiting the green mussel to sell on the local market. Fishers also realized that this species can be used for fish bait.

Organism affected:	*Common name:*	*Family:*
Crassostrea	Oyster	
Isognomon alatus	Oyster	

Prevention measures:
Elimination of relocation of live mussels to new harbours by persons. Reintroduction of mussels by ballast water release (in progress).

Native range:
Along the Indian Coast and throughout the Indo-Pacific

Natural habitat:
Estuarine and marine environments

Preferred habitats for invasion:
Rocky coast, Coast, Waterways, Estuarine, Coastal waters, Coastal vegetation.
P. viridis will attach to a wide range of substrates found in sea water. These include wharf/jetty pilings (wooden and metallic), rocks, mangrove prop roots, seagrass and sandy beds, rubber tyres, ropes, plastic buckets, pier walls.

Places where the species is invasive:

Invaded habitat:
Mangrove

Local reference:
Old Airport Runway

City/District - State/Province:
PORT ROYAL / KINGSTON

Populational level:
Invasive

Description of invasion:
Mussels found on mangrove prop roots.

Places where the species is invasive:
Invaded habitat:
Mangrove

Local reference:
Palisadoes Strip

City/District - State/Province:
PORT ROYAL / KINGSTON

Populational level:
Invasive

Description of invasion:
Mussels found on magrove prop roots.

Places where the species is invasive:
Invaded habitat:
Mangrove

Local reference:
Goodbody's Channel (Port Royal Mangroves)

City/District - State/Province:
PORT ROYAL / KINGSTON

Populational level:
Invasive

Description of invasion:
Marine diversity under significant threat due to the invasiveness of P. viridis on mangrove prop roots.

Places where the species is invasive:
Invaded habitat:
Vertical Habitat - Epibenthic

Local reference:
Old Coal Wharf

City/District - State/Province:
PORT ROYAL / KINGSTON

Populational level:
Invasive

Description of invasion:
Mussels found on wharf pilings.

Places where the species is invasive:
Invaded habitat:
Vertical Habitat - Epibenthic

Local reference:
Greenwich farm Fishing Beach

City/District - State/Province:
PORT ROYAL / KINGSTON

Populational level:
Invasive

Description of invasion:
Mussels found on concrete pilings.

Places where the species is invasive:
Invaded habitat:
Horizontal Habitat - seagrass

Local reference:
MS

City/District - State/Province:
PORT ROYAL / KINGSTON

Populational level:
Invasive

Description of invasion:
Mussels established on shoals and forms dense communities.

Places where the species is invasive:
Invaded habitat:
Mangrove

Local reference:
Refuge Cay (Greater Port Royal Mangroves)

City/District - State/Province:
PORT ROYAL / KINGSTON

Populational level:
Invasive

Description of invasion:
Mussels also found on dislodged prop roots on the sea floor close to mangroves.
Places where the species is invasive:
Invaded habitat:
Vertical Habitat - Epibenthic

Local reference:
University of the West Indies Port Royal Marine Lab

City/District - State/Province:
PORT ROYAL / KINGSTON

Populational level:
Invasive

Description of invasion:
Mussels found on concrete wharf pilings.

Places where the species is invasive:
Invaded habitat:
Vertical Habitat - Epibenthic

Local reference:
Downtown Kingston

City/District - State/Province:
WEST DOWN TOWN / KINGSTON

Populational level:
Invasive

Description of invasion:
Mussels found on sea wall.

Places where the species is invasive:
Invaded habitat:
Vertical Habitat - Epibenthic

Local reference:
Gympsum Quarry Office

City/District - State/Province:
WEST DOWN TOWN / KINGSTON

Populational level:
Invasive

Description of invasion:
Mussels found on wall of small pier.

Places where the species is invasive:
Invaded habitat:
Mangrove

Local reference:
Great Salt Pond

City/District - State/Province:
HELLSHIRE / ST. CATHERINE

Populational level:
Detected in natural habitat

Places where the species is invasive:
Invaded habitat:
Vertical Habitat - Epibenthic

Local reference:
Jamaica Public Service Company Power Barge (Hunt's Bay)

City/District - State/Province:
HELLSHIRE / ST. CATHERINE

Populational level:
Invasive

Description of invasion:
Mussels found on large cylindrical concrete pilings.

Places where the species is invasive:
Invaded habitat:
Vertical Habitat - Epibenthic

Local reference:
Hunt's Bay Power Station

City/District - State/Province:
HELLSHIRE / ST. CATHERINE

Populational level:
Established

Description of invasion:
Found on pilings of concrete wharf.

Places where the species is invasive:

Invaded habitat:

Vertical Habitat - Epibenthic

Local reference:

Green Bay

City/District - State/Province:

HELLSHIRE / ST. CATHERINE

Populational level:

Established

Description of invasion:

Wharf pilings

Places where the species is invasive:

Invaded habitat:

Vertical Habitat - Epibenthic

Local reference:

Fort Augusta Correctional Facility

City/District - State/Province:

PORTMORE / ST. CATHERINE

Populational level:

Invasive

Description of invasion:

Wharf Pilings and surrounding seabed grasses.

Places where the species is invasive:

Invaded habitat:

Rocky coast

Local reference:

Forum Hotel Jetty

City/District - State/Province:

PORTMORE / ST. CATHERINE

Populational level:

Invasive

Date: ***11/16/2006***

Latin name: Thiara granifera

Kingdom: Animalia
Phylum: Mollusca
Class: Gastropoda
Order: Neotaenioglossa
Family: Thiaridae

Thiara granifera Lamark 1822.

Synonyms:	***Author:***	***Date:***
Papaver somniferum var. setigerum	auct. non (DC.) Corb.	

Common name:	***Language:***
Quilted Melania	English
Snail	English

Description of species:
The shell of T. granifera is generally brown with prominent nodules that overlap suture. The whorl is elongated and prominent spiral rigdges are present on the base of the last node.

Dispersal:
Direct development (no planctonic larvae)

Pathways:
Aquaculture
Aquarium trade
Transportation of habitat material
For ornamental use
Ignorant possession
Floating vegetation/debris
Translocation of aquatic structures

Vectors:
Human

Reproduction:
Parthenogenesis

Biological form:
Mollusc

Diet:
Detritivore
Herbivore

Introduction:
T. granifera was introduced to Florida between 1940 and 1947; and since then the spread of the gastropod has been noted in the Caribbean islands. The exact date of introduction into Jamaica is unknown. Studies conducted on Jamaican rivers in 1986 and 1993 makes no mention of this species. It is therefore suggested that either this species was overlooked during these studies or

they were introduced into the island in the late
1980's or ealry 1990's. In 1996 the species were noted to be quite abundant and widespread. The species could have introduced accidentallt through aquatic plants, through aquaculture or the aquarium trade. It is widely introduced in the Caribbean so it is fairly easy for this species to be introduced here.

Cause of introduction:	*Means:*	*Place:*	*Date:*
	Unknown		

Economic use:

Ecological impacts:
The abundant numbers of this species lead to increased competition for food and space with planorbids and the native H. lineolatus and N. punctulata in Jamaican freswater systems.

Economic impacts:
Bussu is economically important as food in Jamaica. So increased competition from T. granifera may cause reductions of naturally occuring bussu and hence have significant economic implications (Bussu Festival, tourism).

Impacts on health:
T. garnifera acts as an intermediate host for a variety of trematode parasites such as the oriental lung fluke but there are no records of the snail transporting any parasites in Jamaica.

Organism affected:	*Common name:*	*Family:*
Hemisinus lineolatus	Snail	Thiaridae
Neritina punctulata	Bussu	Neritidae

Native range:
India, Ceylon, Phillipine and Hawaiian Islands, small islands south of Japan, south to Society.

Natural habitat:
Variety of freshwater habitats (rivers, streams, riffles etc.).

Preferred habitats for invasion:
Pond, Freshwater, Waterways, Freshwater reservoir, River.

Places where the species is invasive:

Invaded habitat:
Freshwater

Local reference:
Rio Cobre

City/District - State/Province:
BOG WALK / ST. CATHERINE

Populational level:
Invasive

Description of invasion:

At this location the populations of T. granifera are quite large. They show densities of 411 individuals m2 in the Rio Cobre.

Places where the species is invasive:
Invaded habitat:
Lake / Lagoon

Local reference:
Moneague Lake

City/District - State/Province:
EWARTON / ST. CATHERINE

Populational level:
Invasive

Description of invasion:
Specimens collected form this site attain greater than normal size.

Places where the species is invasive:
Invaded habitat:
River

Local reference:
Black River

City/District - State/Province:
SANTA CRUZ / ST. ELIZABETH

Populational level:
Invasive

River basin:
Black River

Places where the species is invasive:
Invaded habitat:
River

Local reference:
Wag Water

City/District - State/Province:
ANNOTTO BAY / ST. MARY

Populational level:
Invasive

Description of invasion:
Species quite abundant.

Date: ***11/16/2006***

Latin name: Melanoides tuberculata

Kingdom: Animalia
Phylum: Mollusca
Class: Gastropoda
Order: Neotaenioglossa
Family: Thiaridae

Melanoides tuberculata Muller 1779.

Description of species:

M. tuberculata is a small gastropod housed in a small light brown shell with red melania rim. The shell is usually mottles with red coloured spots. The shell is elongated and conical in shape with regularly increasing whorls. Vertical and weakly curved ribs with fine spiral striations cover the shell. They burrow in the substrate of freswaters for most of the day and then at night the emerge and feed.

Dispersal:

Indirect development (with planctonic larvae)

Pathways:

Aquarium trade
Biological Control
Self-propelled
Level channels
Floodgate channels
Irrigation channels

Vectors:

Water
Aquatic currents
Domestic aquariums and shops
Public aquarium

Reproduction:

Parthenogenesis

Biological form:

Mollusc

Diet:

Carnivore
Detritivore

Introduction:

This species was first noted in the Caribbean in Puerto Rico between 1964 and 1966. It has spread to various islands since then, however no exact date of introduction to Jamaica is known. It is believed however that it may have been introduced to the Island in the late 1980's or early 1990's since no records have ever been made of it
before.

Cause of introduction:	*Means:*	*Place:*	*Date:*
	Unknown		

Economic use:
Pet

Native range:
Eastern and southern Africa, south-east Asia, China, islands of the Indo-Pacific

Natural habitat:
Freshwater (rivers and streams)

Preferred habitats for invasion:
Freshwater, Freshwater reservoir.

Date: ***11/16/2006***

Latin name: Planorbella duryi

Kingdom: Animalia
Phylum: Mollusca
Class: Gastropoda
Order: Basommatophora
Family: Planorbidae

Planorbella duryi Wetherby 1879.

Synonyms:	***Author:***	***Date:***
Papaver pseudoorientale	(Fedde) Medv.	

Common name:	***Language:***
Snail	English

Dispersal:
Indirect development (with planctonic larvae)

Pathways:
Biological Control
For ornamental use
Ignorant possession

Vectors:
Water
Aquatic currents
Plant vector

Reproduction:
Parthenogenesis

Biological form:
Mollusc

Diet:
Detritivore

Introduction:
The species were first observed in Jamaica in 1996 in artificial ponds in Kingston. It is likely that the species was directly intoduced to Jamaica or in accidentally with aquatic plants. The snail may have also been introduced at other parts of the island as a biological control to Biomphalara a schistosome host.

Cause of introduction:	***Means:***	***Place:***	***Date:***
	Unknown		

Economic use:
Pet

Ecological impacts:
P. duryi is not particularly abundant in Jamaica freshwater systems. However were they are found they are considerably larger in size than indigenous planorbid fauna.

Native range:
Florida
Natural habitat:
Freswater
Preferred habitats for invasion:
Freshwater, Freshwater reservoir.

Places where the species is invasive:
Invaded habitat:
Freshwater
Local reference:
Fresh River
City/District - State/Province:
SPANISH TOWN / ST. CATHERINE
Populational level:
Detected in natural habitat
Description of invasion:
The species are not abundant but they are quite large in size relative to native planorbids.

Date: ***11/16/2006***

Latin name: Pterygoplichthys sp.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Siluriformes
Family: Loricariidae

Pterygoplichthys sp. Hancock.

Common name:	***Language:***
Suckermouth Catfish	English
Radiated Ptero	English
Sailfin Catfish	English

Description of species:
These are large dark brown or grey coloured loricariids with longitudinal scutes (not scales) that cover the upper regions of the head and the body. The ventral surface of the head and body is naked with dark and light spots or vermiculations. The head is broad and dorsally flattened. The mouth is ventral and forms a sucker. It also has one pair of subterminal barbels. This loricariid also has a large dorsal fin having 10+ fin rays. These species have auxillary air breathing organs and as such are able in extreme environmental conditions and even outside of water for long periods of time.

Dispersal:
Direct development (no planctonic larvae)

Pathways:
Aquaculture
Aquarium trade
For ornamental use

Vectors:
Human
Domestic aquariums and shops
Public aquarium

Reproduction:
Sexual

Biological form:
Fish

Diet:
Detritivore
Herbivore

Introduction:
It is likely that Ptergoplichthys sp. was introduced into Jamaican freswater systems accidentally however this is not confirmed. This is a very popular species in the aquarium trade and its intruduction here is likely associated with this trade.

Cause of introduction:	***Means:***	***Place:***	***Date:***
In association with the aquarium trade	Unknown		

Economic use:
Pet, Aquaculture, Other food use.
Recently these species have been used as food in Jamaica although it is still quite an

Ecological impacts:
The population of sailfin catfishes has become quite prolific in the Black River system in a matter of a few years. They are the largest fish species in the systems although they are not particularly aggressive. Their burrowing habit may cause increased phosphate turnover rates that may contribute to eutrophication. Sedimentation may also choke periphyton and macrophytes hence affecting the primary productivity of the system. The fish may compete with other detritivores/herbivores for food and space. It is also possible that the large numbers of catfish may affect the brood patches of tilapiine fish that is found on the substrate hence affecting the fecundity of these species.

Economic impacts:
Tilapia, which represent the main source of protein, are being displaced and the catch of fishermen is dominated by Pterygoplichthys. This therefore has significant implications on the livelihood of fishermen and there families in surrounding communities. The catfish with their bony scutes become tangled in the nests often times destorying the nets.

Impacts on health:
Fishermen discard of the scores of catfish they catch in their nets by the river banks. Their rotting flesh may attract pathogens which may affect the health.

Social and cultural impacts:
Due to the reduction in tilapia catch the viability of fishing as a main source of income is being jeprodized.

Organism affected:	*Common name:*	*Family:*
Oreochromis niloticus	Silver Perch	Cichlidae
Oreochromis mossambicus	Black Perch	Cichlidae
Callichthys callichthys	Amoured Plated Catfish	Callichthydae

Mechanical control:
Fishermen generally discard of the catfish on the river banks whenever they are obtained in nets and fish pots.

Native range:
Venezuela

Natural habitat:
Freshwater; large and small water systems, floodplains, swamps, sluggish streams, lakes, marshes

Preferred habitats for invasion:
Pond, Freshwater, Demersal, Lake / Lagoon, Freshwater reservoir, River.
Pterygoplichthys species are well adapted to hypoxic and pollutted freshwater systems and will survive well in areas where other species find it difficult to survive. These species will invade a variety of freshwater habitats.

Places where the species is invasive:

Invaded habitat:
River

Local reference:
Black River, Upper Morass

City/District - State/Province:
SANTA CRUZ / ST. ELIZABETH

Populational level:
Invasive

Description of invasion:
These fish are extremely abundant in the Upper Morass of the Black River. 100 individuals can be easily obtained in one fish pot or net. They are evidently growing in numbers and other species appear to have reducing popluations.

River basin:
Black River

References:

Aiken, K.A., Morris, D., Hanley, F.C., Manning, R., Aquaculture in Jamaica, 25, World Fish Quarterly, 2002

Fugi, R., Agostinho, A.A., Hann, N.S., Trophic Morphology of Five Benthic Feeding Fish Species of a Tropical Floodplain, 61, Revista Brasileira de Biologia, 2001

Date: ***11/16/2006***

Latin name: Callichthys callichthys

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Siluriformes
Family: Callichthydae

Callichthys callichthys L.

Common name:
Armoured-plated Catfish

Language:
English

Description of species:
C. callichthys are greyinsh' olive green catfish with a compressed fusiform body. They have two rows of overlappign longitudinal scutes that run the length of the body. It has a rounded tail and two pairs of long prominent subterminal maxillary barbels. They are dermersal fishes that dwell on or near the bottom of freshwater systems and are able to respire using tehre intestine. They are well adapted to anoxic waters.

Dispersal:
Direct development (no planctonic larvae)

Pathways:
Aquaculture
Aquarium trade
For ornamental use

Vectors:
Human
Domestic aquariums and shops
Public aquarium

Reproduction:
Sexual

Biological form:
Fish

Diet:
Omnivore

Introduction:
The exact date and type of intorduction is unknown. However these fish are associated with the aquarium trade and it is believed that there introduction was associated with ornamental use.

Cause of introduction: ***Means:*** ***Place:*** ***Date:***
In association with the aquarium trade Unknown

Economic use:
Pet, Aquaculture, Other food use. These species have no economic use in Jamaica. However in Trinidad they are eaten and is associated with a folklore.

Ecological impacts:
The carnivorous nature of C. callichthys may result in increased competion for

macroinvertebrates with especially the juveniles of tilapia in streams.

Economic impacts:

Increased competition with the juveniles of tilapia may result in stunting rendering the tilapia stock unfavorable among consumers.

Impacts on health:

When C. callichthys is caught by fishermen they are discarded on the river banks; such careless disposal may pose a serious threat to human health.

Social and cultural impacts:

Reduction in tilapia can cause loss of work for fishermen who sell these species in order to earn a living.

Organism affected:	*Common name:*	*Family:*
Oreochromis mossambicus	Black Perch	Cichlidae
Oreochromis niloticu niloticus	Silver Perch	Cichlidae

Mechanical control:

Direct removal from the river using nets and fish posts.

Native range:

South America mainly Cis-Andean River drainages

Natural habitat:

Freshwater; rivers, costal plains

Preferred habitats for invasion:

River

Places where the species is invasive:

Invaded habitat:

River

Local reference:

Black River, Upper Morass

City/District - State/Province:

SANTA CRUZ / ST. ELIZABETH

Populational level:

Detected in natural habitat

Description of invasion:

It does not appear that these species have established themselves in the Black River because individuals are occasionally caught by fishermen. However these species are very difficult to catch especially during rainy seasons. This may may indicate that they are not abundant in the system.

River basin:

Black River

References:

Aiken, K.A., Morris, D., Hanley, F.C., Manning, R., Aquaculture in Jamaica, 25, World Fish

Quarterly, 2002

Fugi, R., Agostinho, A.A., Hann, N.S., Trophic Morphology of Five Benthic Feeding Fish Species of a Tropical Floodplain, 61, Revista Brasileira de Biologia, 2001

Date: ***11/16/2006***

Latin name: Oreochromis niloticus niloticus

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Cichlidae

Oreochromis niloticus niloticus L.

Common name:	***Language:***
Silver Perch	English
Nile Tilapia	English

Description of species:
O. niloticus is the most widely cultured tilapia harvested outside of Africa. It is a freshwater species although it can be cultured in estuarine and marine environments. It has a rounded fusiform body with 7-12 vertical bands or stripes through the depth of the caudal fin. It has an oval cross section and has 1 interrupted lateral line. The fish is grey or olive green in colour.

Dispersal:
Direct development (no planctonic larvae)

Pathways:
Aquaculture
Aquarium trade
Fishing

Vectors:
Human

Reproduction:
Sexual

Biological form:
Fish

Diet:
Omnivore

Introduction:
O. niloticus was introduced to replace *O. mossmabicus* that was previously introduced since the latter was not
a popular protein choice by consumers. It was introduced solely for the purposes of inland aquaculture.

Cause of introduction:	***Means:***	***Place:***	***Date:***
Introduced for food	Voluntary		1975

Economic use:
Aquaculture, Fishing.
Tilapia is one of the most important freshwater food fish in Jamaican aquaculture. Fishermen in several freshwater fishing communities depend heavily on the populations of these fish.

Ecological impacts:

O. niloticus like most other tilapia have the capability of breeding quickly and establishing populations in the wild in short periods of time. This may have resulted in quick invasions of natural freshwater systems that may have resulted in the displacement of many native fish species. Also because *O. niloticus* is benthopelagic there may have disruptions of benthic communities.

Native range:

Africa

Natural habitat:

Freshwater; lakes, rivers, water courses, wetlands

Preferred habitats for invasion:

Pond, Freshwater, Freshwater reservoir, River.
Tilapia inhabit a variety of freshwater habitats especially those with still or slow flowing waters.

Places where the species is invasive:

Invaded habitat:

River

Local reference:

Black River

City/District - State/Province:

SANTA CRUZ / ST. ELIZABETH

Populational level:

Invasive

Description of invasion:

The numbers in Black River have been reduced due to the invasion of catfish in the Black River.

River basin:

Black River

References:

Aiken, K.A., Morris, D., Hanley, F.C., Manning, R., Aquaculture in Jamaica, 25, World Fish Quarterly, 2002

Chakalall, B. (compiler), Species cultured in insular Caribbean countries, Belize, French Guiana, Guyana, Suriname., Caribbean Technical Co-operation Netwrok in Artisanal Fisheries and Aquaculture. FAO Regional Office for Latin America and the Caribbean., 1993

Date: ***11/16/2006***

Latin name: Oreochromis mossambicus

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Cichlidae

Oreochromis mossambicus Peters.

Common name:	***Language:***
Black Perch	English
Mozambique Tilapia	English

Description of species:
O. mossambicus individuals are dominantly black or dark grayish in colour with no or remnant (adult females) stripe bands through the depth of the caudal fin. There are 2 interrupted lateral lines. The body has a compressed cross-section. The dorsal and caudal fin may be outlined with red coloration.

Dispersal:
Direct development (no planctonic larvae)

Pathways:
Aquaculture
Aquarium trade
Self-propelled
Fishing

Vectors:
Human

Reproduction:
Sexual

Biological form:
Fish

Diet:
Detritivore
Omnivore

Introduction:
This was the first introduction of tilapia for fisheries in Jamaica- a joint project between Inland Fisheries Development Project of USAID and the Government of Jamaica. They became established in the wild through unassisted reproduction. It was introduced from St. Lucia and repetitive introductions occurred between 1950 and 1975.

Cause of introduction:	***Means:***	***Place:***	***Date:***
Introduced for food	Voluntary		1950

Economic use:

Pet, Other food use, Fishing. O. mossambicus is a significant commodity in Jamaican aquaculture. However it is a less preferred fish in Jamaica due to its slow breeding rate.

Ecological impacts:
May compete with native fauna fpr food and space.

Native range:
Africa

Natural habitat:
Estuaries, lakes, marine environments, water course, wetlands

Preferred habitats for invasion:
Pond, Freshwater, Wetlands, Waterways, Estuarine, Lake / Lagoon, Freshwater reservoir, River.

Places where the species is invasive:

Invaded habitat:
River

Local reference:
Black River, Upper Morass

City/District - State/Province:
SANTA CRUZ / ST. ELIZABETH

Populational level:
Invasive

Description of invasion:
The population of O. mossambicus is quite reduced in Black River which is likely due to the introduction of catfish in the system.

River basin:
Black River

References:

Aiken, K.A., Morris, D., Hanley, F.C., Manning, R., Aquaculture in Jamaica, 25, World Fish Quarterly, 2002

Chakalall, B. (compiler), Species cultured in insular Caribbean countries, Belize, French Guiana, Guyana, Suriname., Caribbean Technical Co-operation Netwrok in Artisanal Fisheries and Aquaculture. FAO Regional Office for Latin America and the Caribbean., 1993

Date: ***11/16/2006***

Latin name: Cherax quadricarinatus

Kingdom: Animalia
Phylum: Arthropoda
Class: Crustacea
Order: Decapoda
Family: Parastacidae

Cherax quadricarinatus Von Martens 1868.

Common name:	***Language:***
Shrimp	English
Australian Red Claw	English

Description of species:
The body of Australian red claw is dominantly blue-green with a brown green carapace. The carapace is generally mottles with paler spots and the claws tend to be a deep green colour. A red patch on the outer margins of the fixed finger of the male claw is the characterizing feature of C. quadricainatus and hence the common name red claw. These species have wide tolerance ranges being able to survive in low oxygenated and moderately polluted waters.

Dispersal:
Indirect development (with planctonic larvae)

Pathways:
Aquaculture
Self-propelled

Vectors:
Water
Human

Reproduction:
Sexual

Biological form:
Crustacean

Diet:
Detritivore

Introduction:
C. quadricarinatus was introduced to Jamaica for aqua cultural purposes. In 1999 the first specimen was
collected from the wild in Black River.

Cause of introduction:	***Means:***	***Place:***	***Date:***
Introduced for food	Voluntary	Farms in Jamaica	1993

Economic use:
Aquaculture, Other food use. C. quadricarinatus had now become a popular freshwater prawn

sold by local fishermen.

Ecological impacts:

These species; due to their wide tolerance range and remarkable fecundity, they are known for competing with existing crustacean fauna and native species. In Black River they apparently have displaced native Machrobrachium from most of the river.

Economic impacts:

Macrobrachium sp. Were economically important to local fishermen and hence the financial returns on these species have been reduced. However the increase in numbers of the Australian red claw does illicit so economic gain to the surrounding communities.

Organism affected:	***Common name:***	***Family:***
Macrobrachium sp.	Shrimp	Palamonidae

Native range:

Nothern Australia

Natural habitat:

Freshwater: streams and rivers

Preferred habitats for invasion:

Freshwater, Freshwater reservoir, River.

Places where the species is invasive:

Invaded habitat:

River

Local reference:

Rio Cobre

City/District - State/Province:

BOG WALK / ST. CATHERINE

Populational level:

Established

River basin:

Rio Cobre

Places where the species is invasive:

Invaded habitat:

River

Local reference:

Black River, Upper and Lower Morass

City/District - State/Province:

SANTA CRUZ / ST. ELIZABETH

Populational level:

Invasive

Description of invasion:

C. quadricarinatus is now the most abundant freshwater prawn in the Black River.

River basin:

Black River

References:

Hunte, W., The Distribution of freshwater shrimps (Atyidae and Palaemonidae) in Jamaica, 64,

Jones, D.S., Morgan, G.J., A field guide to crustaceans of Australian waters, Reed/Western Australian Museum, 1994

Shoa, L., Wang, X., Zhu, J., Preliminary study on the morphological features and behavious of Cherax quadricarinatus., 15 (3), J. Zhejiang Coll. Fish., 1996

Williams Jr., E.W., Bunkley-Williams, L. Lilyestrom, C.G., Oritiz-Corps, 2001, A review of recent introductions of aquatic invertebrates in Puerto Rico and implications for the management of nonindigenous species, 37(3-4), Caribbean Journal of Science

Date: ***11/16/2006***

Latin name: Schinus terebinthifolia

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Magnoliopsida
Order: Burserales
Family: Anacardiaceae

Schinus terebinthifolia Raddi.

Common name:
Brazilian Pepper Tree

Language:
English

Description of species:
The Brazilian Pepper Tree is an evergreen shrub that grows to about 10m. It has a short trunk that is often concealed in dense intertwined branches. The plant is commonly found on the streets or in gardens. The seedling cotyledon is simple with an obtuse apex and base. The first true leaves and the later leaves are toothed and compound respectively. The mature plant has leathery green leaves with 3-13 sessile sinely toothed leaflets. The white flower has twice as many stamens as it does petals. The pericarp is fleshy and the endocarp of the drupe bony. The plant has separate male and female flowers and each sex
grow in clusters on separate plants. The young fruit is glossy, green and juicy which upon ripening becomes red and with a papery sheath-like skin around the seed. The fruits grow in clusters.

Dispersal:
Birds

Pathways:
Mud on birds
For ornamental use

Vectors:
Animal vector

Reproduction:
Seeds

Biological form:
Tree

Introduction:
S. terebinthifolia is a common ornamental plant that was introduced to Florida between 1842 and 1849. The plant escaped cultivated lands and has spread aggressively in natural habitats in Florida. It is likely that the introduction of Brazilian Pepper Tree to Jamaica has followed suit.

Cause of introduction: ***Means:*** ***Place:*** ***Date:***
Unknown

Economic use:
Horticulture, Construction materials, Chemical, Shade or wind-break.
The Brazilian Pepper Tree does not serve any significant economic uses in Jamaica except those

related to small scale horticulture.

Ecological impacts:

The tree produces shaded areas that prevent the colonization of native trees and may interfere with the growth of trees that are already established in the area. The tree may invade natural ecosystems such as mangrove swamps and mature forests; habitats that are quite sensitive in Jamaica. In forests or shrub lands the Brazilian tree populations may interfere with nesting sites. Ingestion by birds and grazing animals may result in paralyzing effects.

Economic impacts:

Unknown.

Impacts on health:

The high concentrations of alleopathic chemicals such as volatile monoterpenes may cause allergic reactions, flu-like symptoms, sneezing, sinus congestion, head pains and acute headaches.

Risk assessment:

It is believed that the ecology and economic stability of Pacific islands are at serious risk due to the spread of S. terebinthifolia. The same may be likely for our islands especially in disturbed areas and mangrove swamps.

Prevention measures:

Open habitats encourage the invasion and spread of S. terebinthifolia (such as deforestation). Hence disturbed areas can be carefully monitored and managed in order to prevent the establishment of Brazilian pepper tree.

Biological control:

There are a variety of biological control agents: Brazilian pepper thrip (Pseudophilothrips ichini), Brazillian pepper leafroller (Episimus utilis), Brazilian pepper sawfly (Heteroperreyia hubrichi and fungal pathogens.

Native range:

Brazil, Paraguay and Argentina

Natural habitat:

Tropical and subtropical habitats: agricultural areas, coastland, natural forests, range, grasslands

Preferred habitats for invasion:

To be determined, Disturbed areas.
S. terebinthifolia invaded a wide variety of soil types and habitats from mesic areas to lowland environments. It prefers shaded areas to fully lit habitats.

Places where the species is invasive:

Invaded habitat:

Rain forest

Local reference:

Hills of St. Andrew

City/District - State/Province:

HOPE PASTURES / ST. ANDREW

Populational level:

Invasive

References:

Adams, C.D., Flowering Plants of Jamaica, University of the West Indies, 1972, Univeristy Press, Glasgow

Invasive Species Specialist Group (ISSG), Schinus terebinthifolia (tree), 2006, http://www.issg.org/database/species/ecology.asp?si=22&fr=1&sts=sss

Date: ***11/16/2006***

Latin name: Spathodea campanulata

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Magnoliopsida
Order: Salanales
Family: Bignoniaceae

Spathodea campanulata Beauv. (1805).

Common name:
African Tulip Tree

Language:
English

Description of species:
The African Tulip Tree is a shrub that can grow to 25m in height. It is an evergreen deciduous tree with a grey bark and stout, tapering trunk and thick branches. The leaves are generally opposite with one of the leaf pairs less developed than the other. The odd terminal leaflet is ovate, elliptical, acuminate and unequal at the base with a large gland or few smaller glands. The racemes are terminal and the calyx 5-7 cm long and distinctly ribbed with short tomentose. The corolla is dominantly red with a yellow base. The follicles
are broad and replum leathery. The seeds are broad with transparent lateral wings.

Pathways:
For ornamental use

Vectors:
Wind

Reproduction:
Seeds

Biological form:
Tree

Introduction:
S. campanulata is a common ornamental and street tree introduced into tropical and sub-tropical areas. It is
likely that its presence in Jamaica is consequent of these uses. It is now quite common across the island and
is a useful ornamental tree.

Cause of introduction: ***Means:*** ***Place:*** ***Date:***
Unknown

Economic use:
Horticulture, Construction materials, Medicine, Other food use, Recreation.
In Jamaica S. campanulata serves mainly as an ornamental plant.

Ecological impacts:
S. campanulata invades agricultural and forest areas affecting the natural biodiversity as it smothers prevailing trees and crops.

Risk assessment:
In Hawaii the risk assessment renders S. campanulata is likely to cause significant ecological and economic damage in tropical and subtropical areas.

Biological control:
Pinus spp. And sugar cane appears to strongly compete with the young stands of African Tulip tree.

Native range:
West Africa

Natural habitat:
Moist, sheltered tropical areas, natural forests

Preferred habitats for invasion:
Agriculture, Disturbed areas, Forest.

Places where the species is invasive:

Invaded habitat:
Grasslands

Local reference:
Marshall's Pen: 2.25 miles due northwest of Mandeville

City/District - State/Province:
MANDEVILLE / MANCHESTER

Populational level:
Established

Description of invasion:
The specimen was seen at the edge of a pasture. It was naturalized and 20m tall.

Places where the species is invasive:

Invaded habitat:
River

Local reference:
Rio Grande

City/District - State/Province:
BUFF BAY / PORTLAND

Populational level:
Invasive

Description of invasion:
Found on the banks of the Rio Grande

River basin:
Rio Grande

Places where the species is invasive:

Invaded habitat:
Periurban

Local reference:
Norbrook Road

City/District - State/Province:
NORBROOK / ST. ANDREW

Populational level:
Established

Description of invasion:
The community was present along the roadside.

References:

Adams, C.D., Flowering Plants of Jamaica, University of the West Indies, 1972, University Press, Glasgow

Invasive Species Specialist Group (ISSG), Spathodea campanulata (tree), 2006, http://www.issg.org/database/species/ecology.asp?si=75&fr=1&sts=sss

Streets, R.J., Exotic Forest Trees in the British Commonwealth, Oxford, 1962, Clarendon Press

Date: ***11/16/2006***

Latin name: Casuarina equisetifolia

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Magnoliopsida
Order: Casuarinales
Family: Casuarinaceae

Casuarina equisetifolia Forst..

Common name:	***Language:***
Casuarina	English
Willow	English
Whistiling Pine	English

Description of species:
C. equisetifolia is a moderately sized tree with a distinctive appearance reaching over 100 ft. in height. The trunk is slender and the pendulous branchlets form a spreading crown. The wood is hardy which may have splits and cracks. The first seasons branches are long, grooved, slender and drooping. The flowers are monoecious and the male flower are found in terminal spikes. This species is fast growing and produces thousands of seeds per square inch of plant yearly.

Pathways:
People sharing resources
For ornamental use

Vectors:
Water
Wind

Reproduction:
Seeds

Biological form:
Tree

Introduction:
The plant was first introduced in the Americas in the 1800's and subsequently quickly spread to 'remote'
islands. It was introduced to Jamaica on the H. East, Esq.

Cause of introduction:	***Means:***	***Place:***	***Date:***
For landscape "improvement"	Voluntary		1793

Economic use:
Fuel, Construction materials, Medicine, Chemical, Shade or wind-break.
C. equisetifolia serves no significant economic use in Jamaica.

Ecological impacts:
C. equisetifolia is a fast growing tree. The shed leaves and fruits often form dense blankets on the ground beneath the tree. This may displace dune and beach flora and fauna. Changes in the

physical and chemical features of these areas may prevent other species from colonizing such areas; rendering the areas ecologically sterile. The tree has shallow roots which may increase beach and dune erosions, nesting of turtles and American crocodiles.

Economic impacts:
In Jamaica where the coasts is important to tourism; further invasions by this species may negatively affect the biodiversity and stability of the beaches and dunes which will have negative economic effects.

Impacts on health:
The pollen of C. equisetifolia is a source of respiratory irritation.

Native range:
North-east and north Australasia, the Pacific Islands, the Malay Archipelago and Penninsula

Natural habitat:
Sandy Coastal Areas, coasts, beaches, sand dunes

Preferred habitats for invasion:
Coast, Beach.

Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:
1 Mile by the road north of Cumberland

City/District - State/Province:
HAYES / CLARENDON

Populational level:
Invasive

Description of invasion:
c. 3000ft, roadside habitat, planted tree.

Places where the species is invasive:
Invaded habitat:
Coastal vegetation

Local reference:
Lime Cay

City/District - State/Province:
PORT ROYAL / KINGSTON

Populational level:
Invasive

Description of invasion:
Introduced tall tress on sand cay, many dead.

Places where the species is invasive:

Invaded habitat:

Coastal vegetation

Local reference:

Lime Cay

City/District - State/Province:

PORT ROYAL / KINGSTON

Populational level:

Invasive

Places where the species is invasive:

Invaded habitat:

Coastal vegetation

Local reference:

Treasure Beach Hotel

City/District - State/Province:

SANTA CRUZ / ST. ELIZABETH

Geographic reference:	***Datum:***	***Zone:***	***Coordinates X:***	***Y:***
	SAD 1969		17 53 6	77 46 6

Populational level:

Established

Description of invasion:

5m.

River basin:

Black River

Places where the species is invasive:

Invaded habitat:

Coastal vegetation

Local reference:

Morant Cays: Northeast Cays

City/District - State/Province:

MORANT BAY / ST. THOMAS

Populational level:

Invasive

Description of invasion:

Single juvenile.

References:

Adams, C.D., Flowering Plants of Jamaica, University of the West Indies, 1972, Univeristy Press, Glasgow

Streets, R.J., Exotic Forest Trees in the British Commonwealth, Oxford, 1962, Clarendon Press

Powell, Dulcie, The Botanic Gardens, Liguanea, Netherlands, 1972

Invasive Species Specialist Group (ISSG), Casuarina equisetifolia (tree), 2006, http://www.issg.org/database/species/ecology.asp?si=365&fr=1&sts=sss

Date: ***11/16/2006***

Latin name: Bambusa vulgaris

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae

Bambusa vulgaris Schred. (1789).

Common name:	***Language:***
Bamboo	English
Wild Cane	English

Description of species:

B. vulgaris is a woody grass with arborescent reaching 10ft and more in height. It is highly branching and mature culms form arches. The diameter of mature culms 10-12 cm. The leaves are lanceolate with smooth edges.

Pathways:

Landscape/fauna "improvement"
People sharing resources
For ornamental use

Vectors:

Soil

Reproduction:

Seeds
Rhizomes

Biological form:

Grass

Introduction:

The exact date of introduction purposes and since then the species have become quite widespread in forest and periurban areas.

Cause of introduction:	***Means:***	***Place:***	***Date:***
	Unknown		

Economic use:

Accessories, Handicrafts, Science, Horticulture, Construction materials, Medicine, Fishing, In Jamaica B. vulgaris along with other species of bamboo is essential construction tool especially in rural areas. They are also used to make decorative items that are sold in markets and shops island wide. B. vulgaris is also important in river rafting which is an important tourism attraction in Jamaica. In many rural fishing communities bamboo is used to make fishing poles.

Ecological impacts:

B. vulagris like many other types of bamboo are fast growing and reproducing quickly. This may result in increases competition for space with other plants or increase in cover of the forest may result in a reduction of the productivity of other plants. It is also suggested that shed of bamboo leaves in Jamaica river systems is changing the transfer of energy among macroinvertebrates.

Mechanical control:

The removal of plants and shoots via cutting and mowing is an inexpensive method of controlling bamboo growth and spread. This is consistently done until the energy reserve in

Chemical control:

EVERY CONTROL ACTION MUST BE PERFORMED WITH ADEQUATE SAFETY EQUIPMENT. WHEN USING CHEMICAL PRODUCTS, FOLLOW LABEL INSTRUCTIONS AND CARE NOT TO GENERATE PARALLEL IMPACTS ON THE ENVIRONMENT.

Foliar Spray, Glyphosphate and cut stump method are the main chemical methods used to contol B. vulgaris.

Native range:

Asia

Natural habitat:

Variety of terrestrial habitats; warm temperate and tropical forests.

Preferred habitats for invasion:

Forest, Riparian forest.

Places where the species is invasive:

Invaded habitat:

Disturbed areas

Local reference:

Reynold's mine area near Lydford P.O.

City/District - State/Province:

ALEXANDRIA / ST. ANN

Populational level:

Invasive

Description of invasion:

Study o vegetation on bauxite and related areas. B. vulgaris forms tall clumps up to 60 feet tall in various pasture areas.

Date: ***11/16/2006***

Latin name: Brachiaria decumbens

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae

Brachiaria decumbens Griseb..

Synonyms:	***Author:***	***Date:***
Fumaria officinalis	auct. non L.	

Description of species:
B. decumbens is a low growing erect perennial grass that has bright green hairy leaves. The leaves are 7-20 mm wide amd 5-25 cm l;omg. The leaves are lanceolate with racemes almost at right angles to the axis. The plant has elliptical spikelets which are borne in 2 rows on flattened (winged) rachis.

Pathways:
Agriculture
Landscape/fauna "improvement"
Transportation of domesticated animals

Reproduction:
Seeds

Biological form:
Grass

Introduction:

Cause of introduction:	***Means:***	***Place:***	***Date:***
	Unknown		

Economic use:
Conservation, Forage, Other food use.

Native range:
Central and East Africa

Preferred habitats for invasion:
Disturbed areas
B. ducumbens have become an environmental weed and vigourously colonise disturbed areas. It colonized and covers soil rapidly.

Date: ***11/16/2006***

Latin name: Coix lacryma-jobi

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae

Coix lacryma-jobi L. (1753).

Common name:	***Language:***
Job's Tears	English
Adlay	English

Economic use:

Native range:
Asia

Preferred habitats for invasion:

Places where the species is invasive:
Invaded habitat:
River

Local reference:
2 miles southeast of Crooked River P.O.

City/District - State/Province:
AENON TOWN / CLARENDON

Populational level:
Established

Description of invasion:
Altitude: 700 feet. Found on gravelly shore of the Rio Minho.

Places where the species is invasive:
Invaded habitat:
Swamp

Local reference:
Brea Head District

City/District - State/Province:
AENON TOWN / CLARENDON

Populational level:
Invasive

Description of invasion:
Located on wet soil near open bog.

Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:
Lucea

City/District - State/Province:
LUCEA / HANOVER

Populational level:
Established

Description of invasion:
Found along roadside.

Places where the species is invasive:
Invaded habitat:
River

Local reference:
Lenox

City/District - State/Province:
BUFF BAY / PORTLAND

Populational level:
Established

Description of invasion:
Located along the banks of a stream.

Places where the species is invasive:
Invaded habitat:
Freshwater reservoir

Local reference:
Hermitage Dam

City/District - State/Province:
AUGUST TOWN / ST. ANDREW

Populational level:
Established

Description of invasion:
Population in moist soil near reservoir.

Places where the species is invasive:
Invaded habitat:
River

Local reference:
Middle Bonnett, 2 miles southwest of Benbow P.O.

City/District - State/Province:
ABOVE ROCKS / ST. CATHERINE

Populational level:
Established

Description of invasion:
Located on the bank of stream.

Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:
Lluidas Vale

City/District - State/Province:
LLUIDAS VALE / ST. CATHERINE

Populational level:
Established

Description of invasion:
Growing on roadside near a stream.

Places where the species is invasive:
Invaded habitat:
Disturbed areas

Local reference:
Silver Spring

City/District - State/Province:
BETHEL TOWN / WESTMORELAND

Populational level:
Established

Description of invasion:
Located along a drainage ditch in partial shade.

Places where the species is invasive:
Invaded habitat:
River

Local reference:
Near Marchmont, on bank of Great River

City/District - State/Province:
BETHEL TOWN / WESTMORELAND

Populational level:

Established

Description of invasion:

River Bank.

Date: ***11/16/2006***

Latin name: Melinis minutiflora

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae

Melinis minutiflora Beauv. (1812).

Synonyms:	***Author:***	***Date:***
Fumaria officinalis var. wirtgenii	(W.D.J. Koch) Hausskn.	

Common name:	***Language:***
Wynne Grass	English
Molasses Grass	English

Native range:
Tropical Africa

Preferred habitats for invasion:

Places where the species is invasive:
Invaded habitat:
Forest

Local reference:
Retford Pen, 3 miles northwest of Hatfield P.O.

City/District - State/Province:
ALLIGATOR POND / MANCHESTER

Populational level:
Established

Description of invasion:
Altitude: 2400 feet.

Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:
Cold Spring, above Newcastle

City/District - State/Province:
ARCADIA / ST. ANDREW

Populational level:
Established

Description of invasion:
Trailside Bank.

Places where the species is invasive:

Invaded habitat:

Periurban

Local reference:

Newcastle

City/District - State/Province:

ARCADIA / ST. ANDREW

Populational level:

Established

Description of invasion:

Altitude: 3800 ft.

Date: ***11/16/2006***

Latin name: Panicum maximum

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae

Panicum maximum Jacq. (1787).

Common name:
Guinea Grass

Language:
English

Native range:
Africa

Preferred habitats for invasion:

Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:
Chapelton

City/District - State/Province:
CHAPELTON / CLARENDON

Populational level:
Established

Description of invasion:
Altitude: 900 ft.

Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:
Along Newcastle Roaad, 3/4 miles north of Cooperage

City/District - State/Province:
ARCADIA / ST. ANDREW

Populational level:
Established

Description of invasion:
Along roaside bank.

Places where the species is invasive:
Invaded habitat:

Urban

Local reference:
Near Gordon Town

City/District - State/Province:
GORDON TOWN / ST. ANDREW

Populational level:
Established

Description of invasion:
Altitude: 1200-1500 feet.

Places where the species is invasive:
Invaded habitat:
Disturbed areas

Local reference:
Mona

City/District - State/Province:
MONA HEIGHTS / ST. ANDREW

Populational level:
Established

Description of invasion:
Located by a waste land.

Places where the species is invasive:
Invaded habitat:
Dry forest

Local reference:
Gore's Road, Hellshire Hills

City/District - State/Province:
HELLSHIRE / ST. CATHERINE

Populational level:
Invasive

Description of invasion:
Located in woodlands, grasses reached heights above 3 feet.

Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:
Near Ipswich

City/District - State/Province:
BALACLAVA / ST. ELIZABETH

Populational level:
Established

Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:
Sheerwood Content

City/District - State/Province:
ALBERT TOWN / TRELAWNY

Populational level:
Established

Description of invasion:
Altitude: 750 ft.

Date: ***11/16/2006***

Latin name: Sacciolepis indica

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae

Sacciolepis indica L..

Synonyms:	***Author:***	***Date:***
Hypecoum grandiflorum	Benth.	

Native range:
Tropical Asia, Malaysia, Australasia, Polynesia

Preferred habitats for invasion:

Places where the species is invasive:
Invaded habitat:
Disturbed areas

Local reference:
Mason River Field Station

City/District - State/Province:
KELLITS / CLARENDON

Populational level:
Detected in natural habitat

Date: ***11/16/2006***

Latin name: Paspalum botteri

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae

Paspalum botteri L..

Synonyms:	***Author:***	***Date:***
Corydalis lutea	(L.) DC.	

Native range:
Southern Mexico, Central America to Costa Rica

Preferred habitats for invasion:

Places where the species is invasive:
Invaded habitat:
Disturbed areas

Local reference:
University of the West Indies, Waste Land near the Botany Department

City/District - State/Province:
MONA COMMONS / ST. ANDREW

Populational level:
Detected in natural habitat

Description of invasion:
Found in open waste land. The perennial weed was noted to be persisting.
Date: ***11/16/2006***

Latin name: Tregus racemosus

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae

Tregus racemosus L..

Native range:
Southern Europe eastward through Asia Minor to Iran and Afganistan.

Preferred habitats for invasion:

Places where the species is invasive:
Invaded habitat:
Urban

Local reference:
East of Cane River

City/District - State/Province:
ARCADIA / ST. ANDREW

Populational level:
Detected in natural habitat

Description of invasion:
Located above the coastal highway bridge.

Places where the species is invasive:
Invaded habitat:
River

Local reference:
Hope River

City/District - State/Province:
ARCADIA / ST. ANDREW

Populational level:
Detected in natural habitat

Description of invasion:
Located near the mouth of Hope River.

Places where the species is invasive:
Invaded habitat:
River

Local reference:
Rio Cobre, south of Central Village

City/District - State/Province:
SPANISH TOWN / ST. CATHERINE

Populational level:
Detected in natural habitat

Date: ***11/16/2006***

Latin name: Themeda arguens

Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae

Themeda arguens L..

Common name:	***Language:***
Piano Grass	English
Christmas Grass	English

Native range:
Asia

Preferred habitats for invasion:

Places where the species is invasive:
Invaded habitat:
Shrubland

Local reference:
Peckham District, 1 mile southeast of Tweeside P.O.

City/District - State/Province:
AENON TOWN / CLARENDON

Populational level:
Invasive

Description of invasion:
Habitat was a cultivated hillside where T. arguens is a common weed.

Places where the species is invasive:
Invaded habitat:
Urban

Local reference:
Shortwood College

City/District - State/Province:
GRANTS PEN / ST. ANDREW

Populational level:
Established
Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:

Sweetwater, near Mocho

City/District - State/Province:
ADELPHI / ST. JAMES

Populational level:
Established

Description of invasion:
Altitude: 1900 ft.

Places where the species is invasive:
Invaded habitat:
Periurban

Local reference:
Albert Town

City/District - State/Province:
ALBERT TOWN / TRELAWNY

Populational level:
Established

Description of invasion:
Altitude: 1850 ft.

Date: ***11/16/2006***

Latin name: Hydrilla verticillata

Kingdom: Plantae
Phylum: Magnoliophyta
Series: djfaldk
Class: Magnoliales
Order: Butomales
Family: Hydrocharitaceae

Hydrilla verticillata Thunb. (1798).

Common name:
Hydrilla

Language:
English

Places where the species is invasive:
Invaded habitat:
Pond

Local reference:
Vicinity of Free People, north of railway track.

City/District - State/Province:
AENON TOWN / CLARENDON

Populational level:
Invasive

Description of invasion:
Abundant in a shallow pond. Altitude: 250 ft.

Places where the species is invasive:
Invaded habitat:
Pond

Local reference:
Williamsfield, near railway station.

City/District - State/Province:
WILLIAMSFIELD / MANCHESTER

Populational level:
Established

Description of invasion:
Sterile plants naturalised in artificial pond. Sumberged. Altitude: 1200 ft.

Places where the species is invasive:
Invaded habitat:
River

Local reference:
Near head of Fresh River, 1.3 miles due N.N.W. of Caymanas Factory

City/District - State/Province:

ABOVE ROCKS / ST. CATHERINE

Populational level:
Invasive

Description of invasion:
Located in slow-flowing brackish stream and dense growths of sterile plants persists.

Places where the species is invasive:
Invaded habitat:
River

Local reference:
Rio Cobre, South of Central Village

City/District - State/Province:
SPANISH TOWN / ST. CATHERINE

Populational level:
Invasive

Description of invasion:
Submerged in river and locally abundant.

Places where the species is invasive:
Invaded habitat:
Pond

Local reference:
Yallahs at Thai Farm

City/District - State/Province:
YALLAHS / ST. THOMAS

Populational level:
Invasive

Description of invasion:
Plants found floating in inland fish pond fed by stream.

Date: ***11/16/2006***

APPENDIX 4

LAYOUT OF POSTERS AND BROCHURES

1. **<u>Poster 1: Invasive Species in Jamaica</u>**

   - 5 examples of flora
   - 5 examples of fauna
   - Information on scientific name, common name, native range and date of introduction given
   - Examples are as follows

     - Name: *Bambusa vulgaris*
       Alias: Bamboo, Wild Cane
       Native to: Old World Tropics
       Date of Introduction: Unknown
     - Name: *Spathodea campuanulata*
     - Name: *Syzygium jambos*
     - Name: *Hedychium coronarium*
     - Name: *Angiopteris erecta*
     - Name: *Odocoileus virginianus*
     - Name: *Sturnus vulgaris*
     - Name: *Trachemys scripta*
     - Name: *Cyprinus carpio*
     - Name: *Dysdercus spp*.

2. **Poster 2: Impacts of Jamaican Invasive Species**

- **Ecological Impacts**

    a. Disruption of the physio-chemical features of an ecosystem: examples; *Cyprinus carpio* (Common Carp) in Black River, *Schinus terebinthifolia* (Brazillean Pepper Tree), *Eucalyptus spp*.

    b. Increased Competiton for Food and/or Space: examples; *Bambusa vulgaris* (Bamboo), *Perna viridis* in Kingston Harbour.

    c. Interference of Reproduction: examples; *Molothurs bonariensis* (Glossy/Shiny Cowbird), *Herpestes javanicus* (Small Indian Mongoose).

    NB: The above factors may ultimately lead to the displacement of native or naturalized flora and fauna in an ecosystem.

- **Economic Impacts**

    a. Displacement or Reduction of Economically Important Flora and Fauna: examples; *Hypothenemus hampei* (Coffee Berry Borer), *Pterygoplichthys sp.* (Suckermouth Catfish), *Phytophthora cinnamomi* (Phytophthora Root Rot).

    b. Restoration of Ecosystem, Eradication and Control: examples; *Hedychium gardneranum* (Ginger Lily), *Pittosporum undulatum* (Mock Orange).

- **Social/Health Impacts**

    a. Loss of Jobs and Cultural and/or Heritage Icons: examples; *Callichthys callichthys* (Armoured-plated Catfish), *Aleurocanthus woglumi* (Citrus Blackfly), *Thiara granifera* (snail)

    b. Transfer of Pathogens and Increase in Health Problems: examples; *Perna viridis*, *Acacia mearnsii*, *Mus musculus* (House Mouse), *Rattus rattus* (Roof Rat) .

Presentation of Database Use and Structure, Exporting Data in

3. **Brochure 1: Invasive Gone Wild (Feral Animals)**

   - Examples of domesticated animals that escape into the wild

     - *Canis familiaris* (Dog)
     - *Capra hircus* (Goat)
     - *Felis catus* (Cat)
     - *Odocoileus virginianus* (White-tailed Deer)
     - *Sus scrofa* (Pig)

   - Features of Feral Animals

   - Impacts on Natural Biodiversity

   - Recommendations

4. **Brochure 2: Useful Jamaican Invasive Species**

   - Highlight that some invasive species have become useful and essential to human development.

   - Uses

   - Implications for control and management of such invasive species

   - Examples

     - *Canis familiaris* (Dog)
     - *Sus scrofa* (Pig)
     - *Trachemys scripta* (Red-eared Slider)
     - *Oreochromis niloticus niloticus* (Nile Tilapia)
     - *Cherax quadricarinatus* (Red-Claw Lobster)
     - *Bambusa vulgaris* (Bamboo)
     - *Alpinia allughas* (White Ginger Lily)