



THE BAHAMAS NATIONAL INVASIVE SPECIES STRATEGY 2013

An output of the project - Mitigating the Threats of Invasive Alien
Species in the Insular Caribbean (MTIASIC)



The Bahamas National Invasive Species Strategy 2013

Published by: The Department of Marine Resources, Ministry of Agriculture, Marine Resources and Local Government, Nassau, The Bahamas

Copyright: 2013 Department of Marine Resources

Reproduction of this publication for educational or other non-commercial purposes is authorized without prior permission from the copyright holder provided the source is fully acknowledged.

Reproduction for resale or other commercial purposes is prohibited without the prior written permission of the copyright holder.

Citation: Moultrie, S. (2013). *The Bahamas National Invasive Species Strategy 2013*. Nassau: Department of Marine Resources.

Available from: Department of Marine Resources, Ministry of Agriculture, Marine Resources and Local Government
East Bay Street
P.O. Box N 3028
Nassau, The Bahamas
Tel: 242-393-1777
Fax: 242-393-0238
Email: michaelbraynen@bahamas.gov.bs

Cover design and layout by: Stacey Moultrie, HD Wells Professional Planning Services



Contents

Foreward by the Permanent Secretary of the Environment and Housing.....	5
Acknowledgements.....	6
Acronyms.....	5
Glossary of Terms.....	9
1.0 Introduction.....	12
2.0 Impacts of Invasive Alien Species.....	13
2.1 <i>Environmental Impacts of Invasives</i>	14
2.2 <i>Economic Impacts of Invasives</i>	15
2.3 <i>Socio-cultural Impacts of Invasives</i>	17
Table 1: Invasive Species Pathways and Disease Outbreaks.....	17
Box 1: The Lionfish Invasion	18
3.0 Mechanisms to Manage and Control Invasive Species.....	19
3.1 <i>Prevention</i>	19
3.2 <i>Early Detection and Response</i>	20
3.3 <i>Control, Eradication and Mitigation</i>	20
Box 2: Evolution of Customs for IAS Management.....	22
4.0 Management Objectives of the NISS.....	23
Table 2 – 2013 NISS Management Objectives.....	23
5.0 Barriers to Implementation of the NISS	25
6.0 NISS Implementation Strategy	27
Diagram 1: Invasion Zones and Stakeholders	27
6.1 <i>Legislation</i>	28
6.2 <i>Institutional framework</i>	28
6.3 <i>Inter-agency coordination</i>	28
6.4 <i>Capacity</i>	28
6.5 <i>Research</i>	28
6.6 <i>Economic tools</i>	29
6.7 <i>Risk assessment</i>	29
6.8 <i>Information management</i>	30
6.9 <i>Education and Awareness</i>	30
6.10 <i>Species-specific management plans</i>	30
6.11 <i>International and regional obligations and cooperation</i>	31
Table 3: International Organizations and IAS Management	32

Box 3 – The WTO and Invasive Species Management	34
Diagram 2 – NISS Institutional Framework	35
Table 4 – NISS Institutional Framework: Agency Responsibilities	36
Table 5 – NISS Implementation Strategy	38
References	46
Appendices.....	48
I. List of Known Invasive Alien Species in The Bahamas.....	48
II. Plant and Animal Species Recommended for Eradication.....	51
III. Plant and Animal Species Recommended for Control.....	51
IV. National Invasive Species Policy	52
V. Code of Conduct for Government.....	55
VI. Guiding Principles for Invasive Species Management	56

FOREWARD

The first National Invasive Species Strategy (NISS) was developed in 2002 and published in 2003. Ten years later, the need for a new updated document was imperative. The Bahamas was afforded the opportunity to update this document through the Global Environment Facility (GEF) funded project, Mitigating the Threats of Invasive Alien Species in the Insular Caribbean (MTIASIC), led by the Department of Marine Resources.

In the recent years, The Bahamas has become more vulnerable to invasions such as the Lionfish and most recently the Cane Toad. Both species are aggressive invaders threatening important species such as the Nassau Grouper and native frog species. The grouper is not only an important ecosystem species, but also one of economic importance.

As one of the world's unique biodiversity hotspots, it is extremely important to protect the natural biodiversity from unwanted flora and fauna as well as microbial invasions. These introductions can lead to negative environmental impacts that are potentially irreversible by threatening species abundance and diversity. This NISS focuses on the prevention of introduction as well as management and eradication of invasive species if necessary. This serves as a protection of the environment, genetic diversity of flora and fauna, as well as ecosystem services and quality of life.

The success of the strategy not only depends on Government abiding by its code of conduct, but also the everyday citizen helping in its implementation.

Permanent Secretary Camille Johnson
Ministry of the Environment and Housing
The Commonwealth of The Bahamas

Acknowledgements

The revised National Invasive Species Strategy (NISS) is a product of the collaborative efforts of HD Wells and the Department of Marine Resources (DMR). Stacey Moultrie, Managing Consultant for HD Wells, served as the lead on the project. Michael Braynen and Frederick Arnett II of the DMR provided keen insight and valuable contributions.

The existence of this document is also due in part to the input of key stakeholders, the National Steering Committee (NSC) and the Project Management Unit (PMU). The following persons deserve special thanks for their notable commentary: LaKeshia Anderson, Stacy Lubin-Gray, Charlene Carey, Sandra Buckner, Janeen Bullard and Dr. Ulrike Krauss.

The 2013 NISS was funded by the Global Environment Facility (GEF) through the United Nations Environment Programme (UNEP) and the Centre for Agricultural Bioscience International (CABI) under the Mitigating the Threats of Invasive Alien Species in the Insular Caribbean (MTIASIC) Project.

*Frederick E. Arnett II
Assistant Fisheries Officer &
National Project Coordinator
For the MTIASIC Project
Department of Marine Resources*

Nassau, September 2013

Acronyms

BEST	Bahamas Environment, Science and Technology Commission
BMA	Bahamas Maritime Authority
BNT	Bahamas National Trust
BREEF	Bahamas Reef Environment and Educational Foundation
CABI	Centre for Agricultural Bioscience International
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna & Flora
DEHS	Department of Environmental Health Services
DMR	Department of Marine Resources
FAO	United Nations Food and Agriculture Organization
FCO	Foreign and Commonwealth Office
GEF	Global Environment Facility
GISP	Global Invasive Species Programme
I3N	IABIN Invasives Information Network
IABIN	Inter-American Biodiversity Information Network
IATA	International Airline Transport Association
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
IPPC	International Plant Protection Convention
ISSG	Invasive Species Specialist Group
IUCN	International Union for the Conservation of Nature
MEA	Multilateral Environmental Agreement
MTIASC	Mitigating the Threats of Invasive Alien Species in the Insular Caribbean
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Non-Governmental Organization
NISS	National Invasive Species Strategy
NISP	National Implementation Support Programme
OIE	Office International des Epizooties/World Organization for Animal Health
Ramsar	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971)
RBDF	Royal Bahamas Defence Force
SIDS	Small Island Developing States
SPS	Agreement on the Application of Sanitary and Phytosanitary Measures
TNC	The Nature Conservancy
UNCLOS	United Nations Convention on Law of the Sea (Montego Bay, 1982)
UNCED	United Nations Conference on Environment and Development (Rio de Janeiro, 1992)
UNFCCC	United Nations Framework Convention on Climate Change
USFWS	United States Fish and Wildlife Service
UNWTO	World Tourism Organization
WCO	World Customs Organization
WHO	World Health Organization
WTO	World Trade Organization

Glossary of Terms

Aggressive species – Those species (plants, animals, micro-organisms) that overwhelm the landscape whether they are native or introduced.

Alien species – non-native, non-indigenous, foreign, exotic species occurring outside of their natural range and dispersal potential, and includes any part, such as seeds and larvae, that might survive and subsequently reproduce.

Ballast water – Fresh or salt water, sometimes containing sediments, held in tanks and cargo holds of ships to increase stability and maneuverability during transit.

Biodiversity – The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. Short for biological diversity.

Biosecurity – Procedures intended to protect humans or animals against disease or harmful biological agents.

Conservation of biodiversity - The management of human interactions with genes, species, and ecosystems so as to provide the maximum benefit to the present generation while maintaining their potential to meet the needs and aspirations of future generations; encompasses elements of saving, studying, and using biodiversity.

Control – Measures to eliminate or reduce the effects of invasive species, including eradicating infestations, reducing populations of invasive species, preventing their spread and mitigating their impact on the economy.

Detection – Surveillance for the existence and location of an invasive species that may have been introduced

Domesticated or cultivated species - Species in which the evolutionary process has been influenced by humans to meet their needs.

Ecology - A branch of science concerned with the interrelationship of organisms and their environment.

Ecosystem - A dynamic complex of plant, animal, fungal, and microorganism communities and their associated non- living environment interacting as an ecological unit.

Endemic species – A species restricted to a specified region or locality.

Exotic species - Plant or animal species introduced into an area where they do not occur naturally, non-native species.

Harmful or dangerous – Plants and animals that sting, prickle, cause allergies, are poisonous to humans or other organisms or exclude other organisms from an ecosystem or habitat.

Feral animals – Animals that are untamed or wild.

Historic – Those plants and animals that were introduced long ago but now are accepted by most persons as “native”.

Information management – Activities to facilitate access to and exchange of information on invasive species, including information on distribution of invasive species. Information management includes storage of data, providing access to invasive species databases and other forms of information.

Intentional introduction – An introduction made deliberately by humans, involving the purposeful movement of a species outside of its natural range and dispersal potential. Such introductions may be done legally or illegally.

Introduction – The movement by human agency of a species, subspecies or lower taxon outside its natural range. This movement can be either within a country or between countries.

Invasive alien species - Alien species that become established in a new environment, then proliferate and spread in ways that are destructive to native ecosystems, human health, and ultimately human welfare.

Monitoring – Ongoing research and surveys to track the presence and status of invasive species over time and at varying geographic locations to evaluate their impact on ecosystems and to evaluate the effectiveness of prevention and control activities.

Native species – A species occurring within its natural range and dispersal potential, i.e. within the range it occupies naturally or could occupy without direct or indirect introduction or by care of humans. Those plants and animals that occurred when Columbus arrived.

Naturalized – Plants and animals that have been introduced and now propagate on their own.

Prevention – Activities to prevent the introduction of invasive species. Includes monitoring the international and domestic movement of invasive species, evaluating individual species for invasiveness prior to introduction, and identifying and interdicting pathways for introduction.

Research – Developing scientific knowledge, methods and technologies to prevent, detect, control and monitor invasive species or to restore native species and habitats.

Sanitary or phytosanitary measure – Any measure applied:

- To protect animal or plant life or health within a country from the risks arising from the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms;

- To protect human or animal life or health within a country from risks arising from additives, contaminants, toxins or disease-causing organisms in foods, beverages or feedstuffs;
- To protect human life or health within a country from the risks arising from diseases carried by animals, plants or their products or from the entry, establishment or spread of pests; or
- To prevent or limit other damage within a country from the entry, establishment or spread of pests.

SPS measures include all relevant laws, regulations, requirements and procedures; processes and production methods; testing, inspection, certification and approval procedures; quarantine treatments; risk assessment measures; and packaging and labeling requirements related to food safety.

Unintentional introduction – An unintended introduction made as a result of a species utilizing humans or human delivery systems as vectors for dispersal outside its natural range.

1.0 Introduction

The first National Invasive Species Strategy (NISS) for The Bahamas was developed and approved in 2003. This first NISS was developed through stakeholder collaboration and led by the BEST Commission with support from international agencies focused on invasives, like the Global Invasive Species Programme (GISP), Invasive Species Specialist Group (ISSG) and the Islands Initiative. The work was funded by The Bahamas Government and the Environment Project Fund of the Foreign and Commonwealth Office (FCO) of the British Government.

The first NISS built on initial work completed under the Inter-American Biodiversity Information Network Invasives Information Network (I3N) Project in which databases on invasives species, expertise and programmes were developed and made accessible on the Worldwide Web.

This Revised NISS continues the trend of stakeholder collaboration and was led by the Department of Marine Resources (DMR). The work has been funded by The Bahamas Government and the Global Environment Facility (GEF) under the regional project, *Mitigating the Threats of Invasive Alien Species in the Insular Caribbean* (MTIASC). The regional MTIASC project was coordinated by the Centre for Agricultural Bioscience International (CABI) in conjunction with the United Nations Environment Programme (UNEP).

2.0 Impacts of Invasive Alien Species

Invasive alien species may be defined as:

Alien species that become established in a new environment, then proliferate and spread in ways that are destructive to native ecosystems, human health, and ultimately human welfare.

Invasive species spread because the natural controls that keep them in check in their native homelands, such as disease and predators, do not exist when they introduced into a new habitat.

Invasive species occur globally and are represented in every taxonomic group. They can be:

- micro-organisms, such as bacteria and plankton;
- plants, such as trees, shrubs and vines; or
- animals, such as insects, reptiles, amphibians and mammals

Invasive species have negative economic and environmental impacts. Some of these negative impacts include:

- loss of genetic diversity, i.e. they dilute the gene pool through hybridization;
- competition with native species, resulting in their loss or displacement;
- parasitism and predation as drivers of extinctions;
- introduction of diseases; and
- change in the physical properties of the environment, e.g. decrease amount of dissolved oxygen in water, decrease the amount of sunlight reaching an area.

Increasing globalization of markets and rises in global trade, transport, travel and tourism mean that more and more species from all parts of the world are moving to new habitats, enhancing the possibility of invasion in all ecosystems all over the world.

The invasion pathway along with the vector that transports the invader are important links in an invasion. If a vector can be intercepted, then the potential invasion can be prevented. Most vectors are human-assisted transport mechanisms (e.g. planes and ships) that move organisms across their natural barriers. Live fish and shellfish importers, aquaculture facilities and pet stores regularly transport, rear and sell non-native species as a part of their business. Sometimes, animals can escape or be improperly disposed of. Even the packaging, soil and water used to transport living organisms may serve as vectors for invaders.

Examples of vectors that transport organisms unintentionally include shipments of food, household goods, wood and wood products, construction materials (including lumber and sand), new or used tires, ballast water, pallets, heavy equipment (particularly earth-moving machinery), internal packaging materials and humans (including their various pathogens and disease agents, such as bacteria and viruses).

Ships carry ballast water to maintain stability and structural integrity. It is estimated that 7,000 species are carried in ships' ballast tanks around the world. Fouling of ship hulls by various marine organisms has also been an invasion pathway.

As an archipelagic nation, The Bahamas has multiple borders and therefore multiple pathways for invasion. The diversity of vectors following multiple pathways yields an extraordinarily complex matrix, requiring equally complex management.

The degradation of natural habitats globally has made it easier for alien species to establish and become invasive. Global climate change is also a factor assisting the spread and establishment of invasive alien species. For example, increased temperatures may enable alien, disease-carrying mosquitoes to extend their range.

There are three categories of activities that can result in alien species becoming invasive:

1. Intentional introduction of species for use in biological production systems, i.e. agriculture, forestry, fisheries and landscaping, as well as recreational and ornamental purposes and for biological control of pests;
2. Intentional introduction of species as a commodity for uses where there is a known risk of escape or release to the wild, i.e. zoos, aquaculture, mariculture, aquariums, horticulture, pet trade, etc.; and
3. Unintentional introduction of species through pathways involving transport, trade, travel or tourism.

With unintentional introductions, alien species can be present in bilge and ballast water of ships, airplane wheel wells, tourists' shoes, as well as gut and hooves of imported livestock. Absent bioterrorism, the spread of disease by international travelers or freight is also an unintentional introduction, e.g., West Nile virus.

Studies have shown that islands, like those of The Bahamas, are especially vulnerable to invasions. Island species often have small populations and are unique when compared to continental species due to the isolation of islands throughout prehistoric times. This isolation has been provided by the natural barriers of oceans, mountains, rivers and deserts that have enabled these unique species and ecosystems to evolve. Most island species are ill-equipped to defend against aggressive invading species and fare poorly in the face of competitors, predators, pathogens and parasites from other areas.

While the isolation of islands has proved to be a weakness in the ability of island species and ecosystems to be resilient against biological invasion, it can be used as an advantage by improvement of the capacity of governments of Island States to prevent the arrival of invasive alien species with better knowledge, improved legislation and greater management capacity, supported by quarantine and customs systems that are capable of identifying and intercepting invasive alien species.

2.1 Environmental Impacts of Invasives

The major environmental impact of invasive alien species is loss of native biodiversity. This can occur due to:

- Preying upon native species
- Decreased habitat availability for native species
- Additional competition

- Parasites and disease
- Smothering and overgrowth
- Hybridization, causing genetic dilution

Other environmental impacts include changes to ecosystem function, changes in nutrient cycles and decreased water quality.

Environmental impacts of invasives may be exacerbated by climate change. Potential impacts of climate change include alterations in species distributions and species abundance. Changes in climate may also produce more conducive conditions for the establishment and spread of invasive species, particularly tropical diseases.

The greatest impact of climate change on invasive species may arise from changes in the frequency and intensity of extreme climatic events that disturb ecosystems, making them vulnerable to invasions. For example, a hurricane that destroys native plants can leave gaps in vegetation in shoreline areas that are quickly occupied by invasive alien plants.

2.2 Economic Impacts of Invasives

Economic impacts of invasives include:

- Interference with biological resources that support fishing (e.g. when fish stocks collapse)
- Loss of unique biodiversity, rare and endemic species
- Interference with fisheries (e.g. fouling of nets)
- Interference with agriculture and silviculture
- Disruption to tourism (e.g. coral reefs less attractive due to decreased fish diversity, increased health concerns from malaria)
- Damage to infrastructure
- Decreased water quality
- Decreased property value (e.g. beach erosion associated with coastal IAS plants)
- Costs of clean up and control
- Costs of treatment or quarantine
- Health costs and loss of productivity

Weeds reduce crop yields, increase control costs and decrease water supply by degrading catchment areas and freshwater ecosystems. Invasive plants in national parks degrade protected ecosystems and drive up management costs.

Discharge of ballast water can introduce harmful aquatic organisms including diseases, bacteria and viruses to both marine and freshwater ecosystems, and resulting in degradation of commercially important fisheries. Invasive parasites continue to kill or disable millions of people each year around the globe with associated impacts to the healthcare sector.

The direct economic costs of invasive alien species run into many billions of dollars annually. A recent effort by United States ecologists to calculate the annual costs of all alien invasives in the United States concluded that invasive weeds cost US agriculture about \$27 billion per year. The

total costs to the United States of all non-indigenous species (plants, animals, and microorganisms) were estimated at over \$137 billion per year.

In addition to the direct costs of management of invasives are economic costs from their indirect environmental consequences and other non-market values. For example, invasives may cause changes in ecological services. Ecological services include flood control, water supply, waste assimilation, recycling of nutrients, soil regeneration, pollination of crops and seed dispersal. Such services have both current use value and option value (i.e. potential value in the future).

2.3 Socio-cultural Impacts of Invasives

Infectious disease agents often are invasive alien species. Pests and pathogens can also undermine local food and livestock production. An example of an invasive species pathogen is the avian influenza virus. This virus has its origins in birds, but multiplies through domestic pigs. Pigs can be infected by multiple strains of avian influenza virus and then act as genetic ‘mixing vessels’ that yield new viral strains. These strains can then infect humans that tend pigs and these persons can then infect others. Table 1 shows invasive species pathways for disease outbreaks which have occurred in the United States.

Table 1: Invasive Species Pathways and Disease Outbreaks

High Pathogenic Avian Influenza	Foot and Mouth Disease
<ul style="list-style-type: none">• Human biological• Game (fighting) birds• Illegal human migration• Mis-manifested shipments• Illegal movement or labeling of products• Imports from infected or neighbouring countries• Pet birds in home quarantine• Migratory birds• Chicken products without inspection certificate• Mail and courier packages• Garbage from many sources• Internet orders and shipments• Zoo animals• Military movements	<ul style="list-style-type: none">• Contraband meat products (carried by passengers, in cargo containers, sent by mail, black market)• Illegal transshipments• Garbage• Edible animal products• Illegal human migration• Legal human migration (by tourists, zoo personnel, animal health workers, livestock brokers and news media)• Live animals (for zoos and breeding livestock)• Animal semen and embryos• Military movements

Adapted from *Economics of Detection and Control of Invasive Species*. Center for Agricultural Policy and Trade Studies, North Dakota State University. 2004.

Large development projects, such as dams, land reclamation, road construction and population resettlement have contributed to the invasion of diseases such as malaria, dengue and schistosomiasis. An example is the Aswan dam project in the 1960s. The prevalence of lymphatic filariasis in the southern Nile Delta increase 20-fold since the construction of the dam. This increase was due primarily to the increase in breeding sites for the mosquito vector of the disease, following the rise in the water table caused by the extension of irrigation. The problem was exacerbated by increased pesticide resistance in the mosquitoes (due to heavy agricultural pesticide use) and by rural-to-urban commuting among farm workers.

Cultural impacts include competition with native species used for subsistence harvesting and degradation of culturally-important habitats and resources, such as coral reefs and fish that live there.

Box 1: The Lionfish Invasion

Lionfish are species of the Scorpion fish family that are natives to coral reefs in the tropical waters of the South Pacific and Indian Oceans (Indo-Pacific region) and the Red Sea. In recent years, the lionfish (*Pterois volitans*) has been observed and captured along the east coast of the United States, Bermuda and throughout the Wider Caribbean, including The Bahamas, Turks and Caicos Islands and the Eastern Caribbean States. Estimations of lionfish in non-native waters increased 50% in 2 years from 2004 to 2006. There are now as many as 160 lionfish per acre of reef in the waters of The Bahamas.

One of the reasons the lionfish invasion has been so rapid and prolific is their reproductive behavior. Lionfish lay eggs all year long and mating pairs spawn every 4 days. Females releasing an egg mass containing 2,000 – 15,000 eggs during each spawning event which can be over 2 million eggs over the course of a year. The egg mass floats and is fertilized by males when it surfaces. The egg mass floats for approximately 2 days before it breaks apart, dispersing the lionfish larvae.

There are various theories about how the lionfish was introduced into the Western Atlantic:

- Intentional and unintentional releases from aquariums – There are accounts from Florida and North Carolina of lionfish being released from aquariums. A lionfish that grew too large for its home fish tank was released into open waters off the North Carolina coast. At least 6 lionfish were released into Biscayne Bay in Florida after a beach-side aquarium broke during Hurricane Andrew in 1992.
- Introduction of lionfish by ballast water – Lionfish may have been transported to the Western Atlantic by ballast water of ships travelling from the Indo-Pacific region.

To date, none of these theories have been confirmed. Research is currently underway as a part of the GEF Full-Sized Project on Building a Sustainable Network of Marine Protected Areas for The Bahamas. Ballast water samples are being collected from ships in the ports of New Providence, Grand Bahama and Abaco in an effort to determine the presence or absence of lionfish eggs and larvae.

One control measure that has been employed by the Department of Marine Resources is promotion of the eating of lionfish through public demonstrations of lionfish cleaning and cooking methods. Lionfish is now served on the menu of a number of restaurants in the country and more persons are consuming the fish as an alternative seafood to native finfish. A local NGO, Bahamas Reef Environmental and Education Foundation (BREEF) is also promoting lionfish as an alternative to Nassau grouper (*Epinephelus striatus*) in an effort to conserve grouper populations.

Adapted from invasive species information document produced by BREEF and DMR

3.0 Mechanisms to Manage and Control Invasive Species

Measures that can be taken to address invasion by alien species include:

- Prevention
- Early detection and response
- Control, eradication and mitigation

In exploring all the options available for addressing the invasive species problem, we must recognize the role that human habits and behaviours play in the introduction and spread of invasives and work to modify or change these. For example, in management of dogs, we must also focus on fostering responsible care of owned dogs, implementation of current and new legislation to achieve this and enforcement of legislation.

Human decisions and human activities not only affect the introduction and spread of invasive species, but also affect the resilience of ecosystems and the possibility of timely policy responses to deal with invasions. Degraded habitat, such as land that has been clear-cut, is prime habitat for invasion. If policy responses are slow, the risk of invasive species becoming established is increased and the success of preventive or control measures is negatively affected.

Any meaningful prevention and control strategy has a cost. Given budget constraints, any decision-making on what measures to apply will inevitably involve setting priorities and accepting trade-offs. In consequence, the determination of costs and benefits of invasive alien species control and the related options for prevention, control and management becomes vital.

There are a number of reasons why it may be economically worthwhile to protect native biological diversity. These include protecting:

- human health and safety - invasive species that introduce disease can impact directly on human well-being through sickness, debilitation and death.
- production standards - invasive species may disrupt production processes by reducing the productivity of pasture, plants and livestock. Such incursions of invasive species may impact on production through increased costs, reduced output volumes or lower prices from products perceived as of inferior quality.
- access to overseas markets - other countries may use the presence of potentially damaging invasive species in The Bahamas as a reason to erect trade barriers against Bahamian seafood and produce exports. These barriers can impact the prices for exports, and in the long term, may also lead to changes in the volume of products sent to export.
- a sense of security and cultural identity - such impacts are difficult to quantify, but there can be a real reduction in well-being for the population at large from introduction of invasive species which damage parts of the environment significant for national or cultural identity, such as traditional use beaches and fisheries.

3.1 Prevention

Prevention of the entry and establishment of unwanted invasive species will require a comprehensive infrastructure that includes a national inspection system, training of human resources, and funding. Public education and awareness is also an important part of prevention.

New Zealand offers several examples of prevention strategies, particularly as it relates to border control. The risk exposure at the airport in Auckland, New Zealand was more than halved by the introduction of x-ray machines and detector dogs in 1997; it was nearly halved again in 2001 by the introduction of 100% x-raying or searching of baggage. Every vessel visiting New Zealand is required to exchange its ballast water before entering the country's Exclusive Economic Zone (EEZ). On entering port, the vessels are boarded and inspected before they are allowed to discharge ballast in New Zealand waters. On average, 1 vessel every 6 months is refused permission to discharge its ballast. Manifests for sea containers are screened and risk cargo processed according to international standards. Twenty-four percent (24%) of containers are sampled to ensure validity of their cleaning certificate and the absence of exotic species. Non-compliant containers are sent for cleaning and fumigation.

Prevention also involves reduction or elimination of those activities that make invasion possible, i.e. clear-cutting, pollution and other forms of habitat degradation.

3.2 Early Detection and Response

Early detection and response includes surveillance and monitoring; it may also include habitat restoration. An early detection system was previously used in The Bahamas for the Pink Hibiscus mealy bug (*Maconellicoccus hirsutus*). Early detection and response involves inventory and mapping of species, a rapid-response plan, public notification, and the resources to act quickly when a new invader is discovered. This system is the same as would be employed by a public health agency in the event of a new disease outbreak. A system for addressing invasive species would include components for:

1. Raising public awareness;
2. Generating support and funds for quality programs;
3. Developing effective integrated management plans with specific control actions; and
4. Assessing the economic and social impact of invasives.

An important component of an early detection system is monitoring. Monitoring of species must occur on a regular basis.

Early detection is facilitated by collaboration within the country to maximize human and financial resources with monitoring being carried out by those who are regularly in the field, i.e. birdwatchers, landscape crews and researchers.

3.3 Control, Eradication and Mitigation

Control of invasive species requires initial treatment followed by maintenance control. Maintenance control involves use of techniques in a coordinated manner on a continuous basis in order to maintain invasive populations at the lowest acceptable level. Options for control include prohibition and restriction with conditions. Control also involves ensuring the use of proper disposal methods and areas, especially with respect to invasive plant material. Control methods should be socially, culturally and ethically acceptable as well as efficient and non-polluting. Methods employed should minimize adverse effects on native flora and fauna, human health and well-being or agricultural stocks.

Out of all possible management strategies of invasive species, eradication (removal of the entire population) is an essential step in preparing to restore native biological diversity, although it is also the most difficult and expensive strategy to employ. Whether or not eradication can be accomplished is affected by whether it is feasible and if it can be carried out early enough in an invasion to be successful. Eradication of established populations of invasive species requires significant resources and years of committed action to accomplish. It is important to note that the most successful examples of eradication are from small islands.

Mitigation can include:

- Eradication – eliminating the IAS completely
- Containment – keeping the IAS within regional barriers
- Suppression – reducing IAS population levels to an acceptable threshold

A critical first step in developing a mitigation program is to determine the management goal for each particular invasive species. Once a goal is established, the program would also prioritize geographic areas for attention (e.g. raccoon listed for control in New Providence and Grand Bahama and eradication on all other Bahamian islands). The program would also contain measures for achieving the management goal, such as research, surveys, and monitoring.

Box 2: Evolution of Customs for IAS Management

Generic Customs in the 20 th Century	Generic Best Practice Customs in the 21 st Century
Controlling goods at borders.	Overseeing the management of international supply chains and flows of both goods and people.
Reliant on coercion.	Focused on consent and voluntary compliance.
Responsive to information received at the border.	Proactive; information is received and processed well in advance of arrival at the border.
Transaction-based approach.	Systems-based approach.
100% checking of goods crossing the border.	Risk analysis based and targeted searches.
At high risk of corruption. Low staff morale and limited career opportunities.	High level of integrity and at low risk of corruption. High staff morale and staff training.
Applies manual system independently of other border agencies.	Develops a single electronic system in cooperation with other border agencies, i.e. 'single window' system.
Development of customs controls independently of other countries.	Applying common controls with international quality standards with high mutual recognition.
A technical, subordinate administration with little influence over policy.	A highly integrated border management approach with strong political support commensurate with the importance of customs to the border.
Procedure bound – lacking flexibility and responsiveness to stakeholders.	Generates flexibility to respond to priorities and demands from stakeholders.

Taken from *New Zealand Customs Service: Strategic Outlook to 2015*.

The World Customs Organization website offers resources to assist national customs agencies in their capacity building, including training programs, events, bookshop, library and databases (see www.wcoomd.org/en/online-services.aspx).

4.0 Management Objectives of the NISS

There were 12 objectives outlined in the 2003 NISS. In the 2013 NISS revision, these have been developed into management objectives with associated strategic actions and tasks for their implementation. The 9 management objectives of the 2013 NISS are described in Table 2.

Table 2 – 2013 NISS Management Objectives

	2013 NISS Management Objective	Description	Alignment with 2003 NISS Objectives
1	Collaboration	Includes national inter-agency coordination, regional and international collaboration, and information sharing.	Objective 4 - Identify a national mechanism or institutional framework that would coordinate action in the field with respect to IAS. Objective 12 - Facilitate The Bahamas' compliance with the multilateral environmental agreements it is a Party to.
2	Prevention	Includes risk assessment of organisms to be imported, and improvement of border control and containment.	Objective 3 - Build capacity amongst officers within the public services about IAS and how to identify, safely handle, hold or transfer these species, namely officers within the Customs Department, Department of Agriculture, Department of Fisheries, Royal Bahamas Police Force and Royal Bahamas Defence Force.
3	Early Detection and Response	Includes development of an inventory of species and mapping of their locations, a rapid-response plan, public notification system, and the resources to act quickly when a new invader is discovered. This objective is closely linked to monitoring.	Objective 3 - Build capacity amongst officers within the public services about IAS and how to identify, safely handle, hold or transfer these species.
4	Control	Includes measures to eliminate or reduce the effects of invasive species, including eradicating infestations, reducing populations of invasive species, preventing their spread and mitigating their impact on the economy.	Objective 7 - Identify priority species for eradication and control. Objective 6 - Identify barriers to invasive species control and management. Objective 6 - Outline the sequenced approach to be taken for invasive species control and management.
5	Monitoring	Includes ongoing surveys to track the presence and status of invasive species over time and at priority	Objective 4 - Prioritize those sites to be monitored for IAS, i.e. public areas, national parks, protected areas, freshwater

		sites to evaluate their impact on ecosystems and to evaluate the effectiveness of prevention and control activities.	sources and field stations.
6	Education and Awareness	Includes development of public awareness campaigns and educational materials, sensitization within the public service about invasive species, and training of managers and field staff tasked with any aspect of sequenced approach to invasive species control and management.	Objective 1 - Build awareness of IAS through the development of an IAS database.
7	Research	Includes developing scientific knowledge, methods and technologies to prevent, detect, control and monitor invasive species or to restore native species and habitats.	Objective 4 - Prioritize those sites to be monitored for IAS, i.e. public areas, national parks, protected areas, freshwater sources and field stations.
8	Policy and Legislation	Includes implementation of National Invasive Species Policy, review and amendment of existing legislation to facilitate NISS implementation, drafting of new legislation to address gaps in legislation for invasive species management and control, and ensuring alignment of other national policies and legislation to support NISS implementation.	Objective 5 - Amend existing and draft new legislation where these have been identified as barriers to invasive species control and management. Objective 8 - Detail the National Invasive Species Policy to be implemented by the Government of The Bahamas. Objective 9 - Detail the mandatory Code of Conduct to be followed by all divisions of the Government of The Bahamas. Objective 10 - Detail the codes of conducts that can be voluntarily followed by various sectors within The Bahamas.
9	Economic Tools	Includes integration of IAS management into economic policy development and development of economic tools to facilitate management.	Objective 11 – The Government commit funding and seek funding for a sustained management program for invasive species and explore the option of maintaining a contingency fund specifically for emergency response purposes.

5.0 Barriers to Implementation of the NISS

While there has been progress on implementation of the 2003 NISS, the Strategy cannot be said to have been fully implemented. Barriers to implementation have been:

1. Lack of adequate legislation – Existing legislation is not adequate to address the IAS issue. The 2003 NISS called for the Government to address the inadequacies of Bahamian legislation with respect to IAS. This call subsequently led to the development of the draft Biosecurity Act in 2005. The Biosecurity Act addresses many of the legislative gaps. This Act, however, is still in draft form.
2. No formalized institutional framework – While agencies address IAS individually, there is no overall framework for IAS management with clear responsibilities for tasks that has been agreed by agencies involved.
3. Limited inter-agency coordination – There is limited coordination between agencies on IAS management. The best example of coordination has been seen with the National Implementation Support Programme (NISP) agencies (BEST, DMR, BNT and TNC) who are working together on the MTIASIC project and the GEF MPA project.
4. Limited capacity – There is limited human, institutional and financial capacity to enable proper IAS management. While agencies may have some technical capacity for addressing IAS, the numbers are severely limited and officers with technical expertise always have a myriad of issues they have to deal with, not only IAS. Agencies are limited in the resources (e.g. equipment, software, field gear, vehicles) they have available to manage IAS. Financial resources are stretched extremely thin for Government agencies and IAS is usually not on the priority list when budgets are developed. Much of the funding for IAS work to date has come from external funding sources.
5. Inadequate research – There is some research on invasives (e.g. lionfish, *Melaleuca*), but is not sufficient to assist agencies in developing management plans for priority IAS.
6. Lack of economic policies and tools to support IAS management – IAS management is not factored into economic policy development and there are no economic tools to facilitate management.
7. Limited risk assessment – Some agencies do conduct risk assessments for imported species (e.g. Customs, Agriculture and Marine Resources). However, these assessments are not as comprehensive as they should be nor are they executed in a coordinated fashion. A coordinated response would allow for the sharing of information between and among agencies.
8. Limited information management – While agencies that collect IAS information store data internally, it is seldom available to or shared with other agencies to guide their management or decision-making with respect to IAS.

9. Limited public education and outreach – There have been several public education and outreach campaigns over the years, which have usually targeted specific species (e.g. Lionfish, Casuarina, Scaevola and Brazilian pepper). There has been no regular outreach on IAS and limited coordination to develop a national program.
10. Lack of species-specific management plans – Only 2 species-specific management plans have been developed since 2003 - one for Melaleuca and the other for Lionfish. There are many more species that have been targeted for eradication and control. It is imperative that management plans be developed for these as well.
11. Limited fulfillment of international and regional obligations and limited cooperation with international and regional organizations – The Bahamas has made limited progress in meeting its international and regional obligations under agreements like the Convention on Biological Diversity and the Cartagena Convention. It has also cooperated on a limited basis with agencies that also work on IAS, including GISP, IABIN and CABI.

6.0 NISS Implementation Strategy

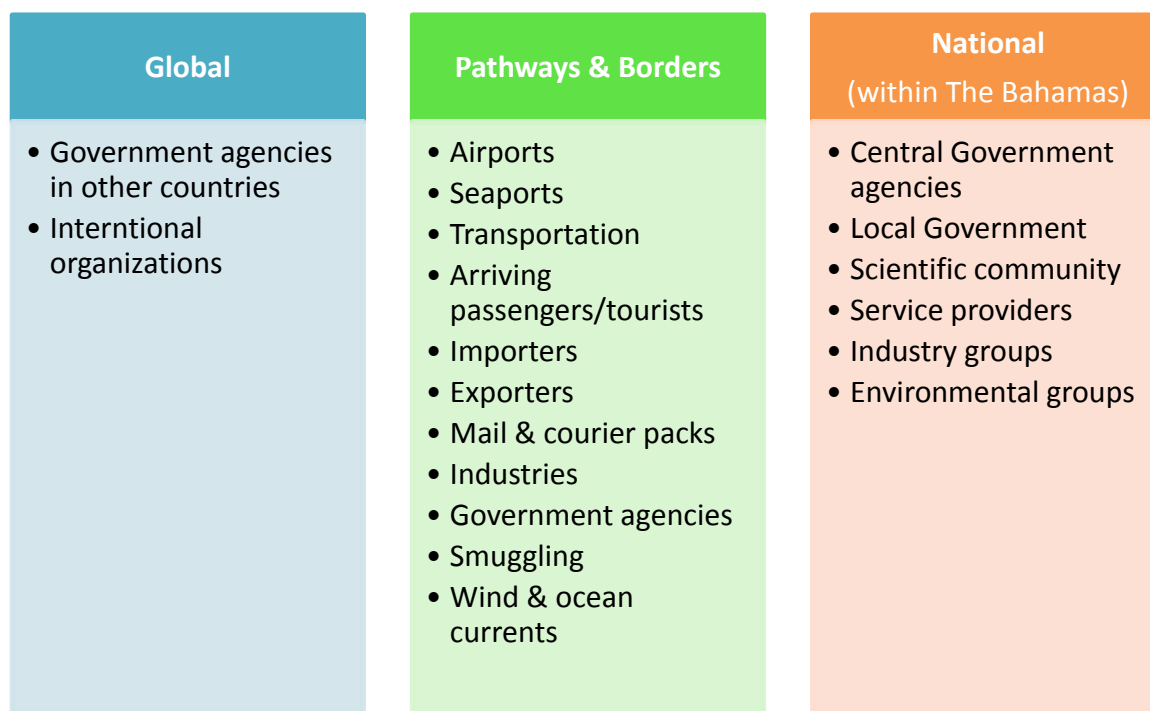
The first NISS lacked a specific implementation strategy for its various recommendations. Over the years, this has resulted in sporadic implementation of the NISS based on a particular agency's prioritization of the issue. Stakeholders agreed that an implementation strategy was key in revision of the NISS with specific goals set and agencies made responsible for particular tasks. Timelines for the Implementation Strategy are outlined as follows:

- Short-term: By end of 2015
- Medium-term: By end of 2018
- Long-term: By end of 2023
- Ongoing: Begin in the short-term and continuously implement

It should be noted that there are limitations to this Strategy. Micro-organisms, including bacteria, viruses, diseases and protists, are a part of the invasive species problem and while they are referenced in the NISS, the information required to effectively strategize for management of invasive micro-organisms is currently not available for The Bahamas. More research needs to occur into the spread of these types of invasives and developing a sequenced approach to their management.

Implementation of the NISS involves action across spatial zones and stakeholders. Diagram 1 outlines the various zones and stakeholders that can be involved in IAS management.

Diagram 1: Invasion Zones and Stakeholders



The key strategic actions and tasks of the NISS Implementation Strategy are outlined in this section and detailed in Table 5.

6.1 Legislation

Current legislation is not adequate to address IAS management. The draft Biosecurity Act (2005) was developed under the first NISS and fills many of the gaps in legislation. Passage of this Act and development of regulations under it are recommended as they would facilitate greater implementation of the revised NISS.

6.2 Institutional framework

An institutional framework is needed to outline the roles and responsibilities of various organizations in implementation of the NISS. The framework is detailed in Diagram 2. The agencies responsible for the various aspects of the framework are detailed in Table 4.

6.3 Inter-agency coordination

There is a need to reorganize national-level agencies or establish national-level mechanisms to bring together biodiversity specialists with agricultural quarantine specialists to cooperate on IAS management. Establishing IAS specialist positions within natural resource management agencies would also help bring focus to this issue and help guide implementation of the NISS.

Information sharing is an important part of inter-agency coordination. Information easily and regularly shared can alert management agencies of the potential dangers of new introductions and enable them to take prompt action. This can be achieved through development of an information management system which is described in more detail in section 6.8.

6.4 Capacity

Increasing technical and management capacity for IAS will include development of or participation in training courses aimed at agency field staff, managers, specialists and policy makers. Formulation and implementation of educational programs at the community level will aid in early detection and control of IAS. Educational institutions should have invasive species biology as a part of their curricula at the primary, secondary and tertiary level. Pilot projects on IAS can be used as a basis for raising public awareness and building capacity through ‘learning by doing’. All staff involved in agricultural quarantine, customs or food inspection should be aware of the provisions of the Convention on Biological Diversity and the Biosafety Protocol and the implications of these provisions to their work. These multilateral environmental agreements (MEAs) should be a part of Government agency training programs.

6.5 Research

Our current knowledge about IAS in The Bahamas is inadequate. We need to build our capacity to research these organisms and to fill the gaps in information so we can manage them. IAS should be a priority area under a national research program. Agencies would be targeted to conduct or facilitate research based on their mandate and skill set. For example, Department of Marine Resources would have research on marine IAS as a priority. DMR staff would conduct research on species of interest or the Department could contract scientists to do the research.

6.6 Economic tools

Invasions can be a consequence of economic decisions and they certainly have economic impacts. If left only to the market, the control of IAS, like the control of communicable human diseases, will be underprovided. An important part of any strategy to manage IAS is to make markets work for conservation wherever possible. Important principles in developing economic policies and tools for IAS management include:

- ***User pays*** - make those responsible for the introduction of economically harmful invasive species liable for the costs they impose.
- ***Full social cost pricing*** - ensure that the prices of goods and services whose production or consumption worsens the damage of invasives reflect their true cost to society.
- ***Precautionary principle*** - base IAS management and policy on the precautionary principle because of the potentially irreversible damages and high costs of invasives even in the face of scientific uncertainty.
- ***Protection of the public interest*** - since the control of harmful invasives yields benefits that are a public good, it requires public investment in prevention, eradication, control, mitigation and adaptation.
- ***Subsidiarity*** - operate policies and management at the lowest level of government that can effectively deal with the problem.

Economic policies that can be adopted by the Government which reflect the principles outlined above include:

- ***develop appropriate property rights*** - ensure that use rights to natural or environmental resources include an obligation to prevent the spread of potentially harmful invasive species;
- ***estimate social costs*** - assess the economic costs of harmful or potentially harmful IAS;
- ***assign liability*** - require importers/users of potentially harmful IAS to have liability insurance to cover the unanticipated costs of introductions or of activities that risk introductions;
- ***promote empowerment*** - enable people injured by the spread of potentially harmful IAS to seek redress;
- ***apply price-based instruments*** - apply economic instruments such as commodity taxes, differential land use taxes, user charges or access fees to ensure that importers/users of IAS known to be harmful take account of the full social cost of their activities;
- ***apply precautionary instruments*** - apply precautionary instruments such as deposit-refund systems or environmental assurance bonds where the risk of damage depends on the behaviour of importers/users of IAS.

6.7 Risk assessment

Risk assessment measures should be used to identify and evaluate the relevant risk of a proposed activity regarding alien species and determine the appropriate measures that should be adopted. Risk assessment can be incorporated into the Environmental Impact Assessment (EIA) process in determining the impacts of particular processes or development projects and whether they should be allowed or allowed with strict mitigation measures in place.

Current risk assessment measures should be reviewed to ensure their compatibility with World Trade Organization (WTO) and International Plant Protection Convention (IPPC) risk analysis

criteria. IABIN I3N also has applicable risk analysis criteria for the Caribbean with respect to plants, fish, and terrestrial vertebrates.

Results of risk assessments should be shared through the national information management system.

6.8 Information management

Management of information on IAS must occur internally within agencies and externally between agencies. An information management system that links regional and national databases on IAS would provide the mechanism to ensure agencies have information in a timely manner to guide their management responses. Establishment of the system will require coordination by a dedicated data centre to service the network, set data standards and facilitate input and sharing of data. The system can include the following:

- An early warning mechanism to notify agencies of new/predicted IAS
- Examples of failed and successful eradication and control methods that agencies can learn from
- Links to additional resources to assist them in IAS management

6.9 Education and Awareness

A national program for IAS education and awareness should be developed with the following components:

- Sharing of information through the national information management system;
- Coordination of messages to avoid contradiction and maximize efficiency;
- Engaging the public in NISS implementation by linking IAS management plans with established societal priorities (e.g. the way Lionfish control has been linked to Nassau grouper conservation)
- Increasing capacity of local communities and civic groups to manage IAS where they live

6.10 Species-specific management plans

Response plans have been developed for Melaleuca and Lionfish which outline management measures. Species-specific management plans need to be developed for the following species as a matter of urgency:

<i>Canine</i>	Dogs
<i>Casuarina glauca</i>	Suckering Australian Pine
<i>Casuarina equisetifolia</i>	Casuarina, Australian Pine, (beefwood)
<i>Felis catus</i>	Cats
<i>Molothrus bonariensis</i>	Shiny Cowbird
<i>Mucuna pruriens</i>	Monkey Tamarind
<i>Procyon lotor</i>	Raccoon
<i>Rhinella marina</i>	Cane Toad
<i>Scaevola taccada</i>	Asian Scaevola, White Inkberry, (Hawaiian Seagrape)
<i>Schinus terebinthifolius</i>	Brazilian Pepper, Bahamian Holly

Once management plans for these are completed, agencies should aim to develop at least one plan every 2 years for other prioritized species listed in the NISS and those that may arise.

6.11 International and regional obligations and cooperation

In order to meet its international and regional obligations, the Government of The Bahamas needs to:

- Ensure staff are aware of these obligations through incorporation into agency training programs;
- Articulate to all agencies the interactions between IAS and other elements of global change including biodiversity conservation and sustainable use, climate change and land use change;
- Quantify the current and anticipated impacts of IAS on The Bahamas; and
- Ensure IAS is factored in decision-making with respect to development, policies and legislation.

In order to facilitate cooperation with international and regional agencies, the Government should:

- Use internationally agreed terminology and standards in implementing legislation and regulations;
- Participate in international and regional fora that enable sharing of lessons learned, data and information, and new technologies for IAS management (e.g. IABIN); and
- Develop harmonization and linkages with international and regional institutions that deal with phytosanitary, biosafety and biodiversity issues including IAS.

Examples of legally-binding multilateral environmental agreements that have an IAS focus include:

- **Convention on Biological Diversity (CBD)** – Article 8(h) calls on member governments to prevent the introduction of, control and eradicate those alien species which threaten ecosystems, habitats or species. The CBD has introduced guiding principles (see Appendix VI) and programmes of work focused on IAS.
- **International Plant Protection Convention (IPPC)** – This agreement applies primarily to pests of plants that occur in international trade. Member countries must implement a series of phytosanitary measures to prevent the spread of organisms potentially harmful to plants and plant products. Regional plant protection organizations exist to facilitate implementation of the Convention.
- **International Maritime Organization (IMO)** – In 2005, the Marine Environmental Protection Committee (MEPC) adopted formal guidelines for the implementation of the 2004 International Convention for the Control and Management of Ship's Ballast Water and Sediments.

Examples of non-binding international instruments and guidance on IAS include:

- **United Nations Food and Agriculture Organization (FAO)** – The FAO addresses IAS through a variety of economic sectors and cooperates with other international instruments. It has developed codes of conduct relevant to fisheries (1995) and biocontrol agents (1995) which recommend actions that member governments can take to limit the introduction of IAS.
- **International Civil Aviation Organization (ICAO)** – The ICAO Assembly has requested the ICAO Council to work with UN organizations and other concerned bodies to support

States' efforts to reduce the risk of introducing potential IAS through civil air transportation to areas outside their natural range (Resolutions A32-9, A33-18, A35-19 and A36-21).

Table 3 outlines various international organizations involved in IAS management.

Table 3: International Organizations and IAS Management

Instrument	Enforcement	Website	IAS Engagement	IAS Focus
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Regulatory	www.cites.org	Active	Species Pathway
Codex Alimentarius Commission	Regulatory	www.codexalimentarius.net	Potential	Species Pathway
United Nations Food and Agriculture Organizations (FAO)	Voluntary	www.fao.org	Very Active	Species Pathway
International Airline Transport Association (IATA)	Voluntary	www.iata.org	Active	Pathway
International Civil Aviation Organisation (ICAO)	Voluntary	www.icao.int	Active	Pathway
International Maritime Organization (IMO)	Regulatory Voluntary	www.imo.org	Very Active	Pathway
International Plant Protection Convention (IPPC)	Regulatory	www.ippc.net	Very Active	Species Pathway
International Union for the Conservation of Nature (IUCN)	Voluntary	www.iucn.org	Very Active	Species Pathway Ecosystem
Office International des Epizooties (OIE) – World Organization for Animal Health	Regulatory	www.oie.net	Active	Species
Ramsar Convention on Wetlands	Regulatory	www.ramsar.org	Active	Ecosystem
United Nations Framework Convention on Climate Change (UNFCCC)	Regulatory	unfccc.int	Potential	Ecosystem
World Customs Organization (WCO)	Voluntary	www.wcoomd.org	Potential	Pathway
World Health Organization (WHO)	Voluntary	www.who.int	Potential	Species Pathway
World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures	Regulatory	www.wto.org	Potential	Pathway
World Tourism	Voluntary	unwto.org	Potential	Pathway

Organization (UNWTO)				
----------------------	--	--	--	--

Taken from CBD Secretariat 2011 Draft Report: *Considerations for Implementing International Standards and Codes of Conduct in National Invasive Species Strategies and Plans.*

Box 3 – The WTO and Invasive Species Management

The World Trade Organization's primary purpose is to open trade for the benefit of all. The WTO provides the forum and structure for member governments to negotiate rules governing international trade and a mechanism to resolve trade disputes.

One of the WTO trade agreements is the Agreement on the Application of Sanitary and Phytosanitary Measures or the SPS Agreement. This agreement addresses the measures that governments may take to minimize the risks to human, plant and animal life and health, in particular the risk of unsafe food or the introduction and spread of animal diseases or plant pests. The SPS Agreement permits governments to impose measures to protect their territory from other potential damages from the entry, establishment or spread of pests. These provisions were intended to address measures that governments may take to minimize the spread of invasive species through trade. The SPS Agreement does not prescribe species measures so member governments must ensure that any measures they impose that affect international trade are based on scientific evidence and risk assessment. Governments are encouraged to base their national requirements on relevant standards developed by the International Plant Protection Convention, World Organization for Animal Health and FAO/WHO Codex Alimentarius Commission.

As The Bahamas seeks to become a Member of the WTO, the Government of The Bahamas needs to ensure the following:

- Measures for IAS management can be built into national programs for developing SPS capacity and addressed within the corresponding legislation. The 2005 draft Biosecurity Act would be a legislative mechanisms to do so.
- It takes advantage of assistance provided by FAO to develop appropriate national agricultural legislation, particularly with respect to pest and disease control.
- It takes advantage of the assistance provided by OIE in the modernization of national veterinary legislation.
- It evaluates the country's needs for SPS capacity development. Evaluation tools are available from the Secretariat of the Standards and Trade Development Facility (www.standardsfacility.org).
- Harmonization of measures to address plant and animal disease issues with those related to IAS.

Diagram 2 – NISS Institutional Framework



Table 4 – NISS Institutional Framework: Agency Responsibilities

	Management Objective	NISS Framework Institutions
	Coordinating Body (Data Centre)	Quasi-government agency led by Department of Agriculture with BNGIS as Data Centre Alternative: Specialists within each institution who meet regularly
1	Collaboration	Bahamas Maritime Authority (BMA) BEST Commission Department of Agriculture (DOA) Department of Marine Resources (DMR) Ministry of Foreign Affairs Ministry of Health National Emergency Management Agency (NEMA) Royal Bahamas Defence Force (RBDF)
2	Prevention	BEST Commission BMA Bahamas National Trust (BNT) Customs Department DOA DMR Forestry Unit, Ministry of the Environment Grand Bahama Port Authority (GBPA) Environmental NGOs Civic groups
3	Early Detection and Response	BMA Customs Department DOA Department of Environmental Health Services (DEHS) Department of Immigration DMR Forestry Unit, Ministry of the Environment GBPA Ministry of Health RBDF
4	Control	BMA Customs Department DOA DEHS DMR GBPA RBDF Department of Immigration Ministry of Health
5	Monitoring	BNT BMA BNGIS Customs Department DOA DMR DEHS

		Forestry Unit, Ministry of the Environment GBPA Ministry of Health RBDF
6	Education and Awareness	Bahamas Information Services BMA BNT Bahamas Reef Environment and Educational Foundation (BREEF) College of The Bahamas DOA DMR DEHS GBPA Ministry of Education Ministry of Health Ministry of Tourism Environmental NGOs Civic groups (e.g. Rotary and Kiwanis) All agencies involved in IAS management
7	Research	BNT Cape Eleuthera Institute COB DOA DMR FORFAR Field Station RBDF Ministry of Health Environmental NGOs Scientific community
8	Policy and Legislation	Attorney-General's Office Cabinet Parliament Senate All agencies involved in IAS management
9	Economic Tools	Attorney-General's Office Department of Physical Planning GBPA Ministry of Finance

Table 5 – NISS Implementation Strategy

	Management Objective	Strategic Action	Barriers Addressed	Tasks	Timeline
1	Collaboration	1A. National inter-agency coordination	Limited inter-agency coordination	1A.1 Establish National IAS Coordinator position within one of the natural resource management agencies; the Coordinator will meet regularly with Coordinating Body and manage the Data Centre.	Short-term
				1A.2 Establish Coordinating Body and Date Centre to bring together agencies that are involved in IAS management and facilitate information sharing.	Short-term
			No formalized institutional framework	1A.3 Approve and operationalize NISS Institutional Framework	Short-term
		1B. International and regional collaboration	Limited fulfillment of international and regional obligations	1B.1 Ensure the Government of The Bahamas meets its international and regional obligations, particularly with respect to multilateral environmental agreements (e.g. CBD, CITES, Ramsar)	Ongoing
				1B.2 Establish an ongoing process to consider the risks of invasive species during international trade negotiations.	Ongoing
			Limited cooperation with international and regional organizations	1B.3 Participate in international and regional fora that enable sharing of lessons learned, data, information and new technologies for IAS management (e.g. IUCN, CABI, IABIN)	Ongoing
				1B.4 Develop harmonization and linkages with international and regional institutions that deal with phytosanitary, biosafety and biodiversity issues as well as IAS.	Ongoing
		1C. Develop IAS information management system	Limited information management	1C.1 Develop IAS database that natural resource management and border control agencies can access and input information.	Short-term
				1C.2 Expand capabilities of IAS database so	Medium-term

	Management Objective	Strategic Action	Barriers Addressed	Tasks	Timeline
				that all organizations within NISS Institutional Framework can access and input information.	
				1C.3 Allow components of IAS database to be shared with international and regional organizations involved in IAS management.	Medium-term
2	Prevention	2A. Develop risk assessment measures	Limited risk assessment	2A.1 Incorporate IAS risk assessment into the EIA process in determining the impacts of development projects.	Short-term
				2A.2 Review current risk assessment measures for compliance with WTO and IPCC risk analysis criteria.	Short-term
				2A.3 Establish or adopt standardized risk assessment measures.	Short-term
				2A.4 Share results of risk assessments with IAS information management system.	Medium-term
		2B. Develop risk assessment infrastructure		2B.1 Expand quarantine, screening and control facilities at ports in Abaco, Eleuthera, Exuma, Grand Bahama and New Providence.	Short-term
				2B.2 Establish and expand quarantine screening and control facilities at ports in other Bahamian islands.	Medium-term
				2B.3 Develop diagnostic facility for risk assessment and screening of exotic plant, animal and micro-organism species.	Medium-term
		2C. Reduce the threat of introductions via commercial shipping pathway.	Lack of public education and awareness on IAS issues	2C.1 Develop a sector-specific management plan to provide ballast water management best practices information to key shipping industry decision makers.	Ongoing
				2C.2 Develop national ballast water management standards and begin their enforcement.	Short-term
		2D. Reduce the threat of introductions via		2D.1 Develop awareness materials	Short-term

	Management Objective	Strategic Action	Barriers Addressed	Tasks	Timeline
		recreational boating and fishing		explaining the potential transport of IAS via boats and their trailers for distribution with boater registration forms and commercial fishing licenses.	
3	Early Detection and Response	3A. Improve early detection and response	Limited information management	3A.1 Develop an inventory of IAS.	Ongoing
				3A.2 Map IAS locations in the country.	Ongoing
				3A.3 IAS information management system to include an early warning mechanism to notify agencies of new or predicted IAS.	Short-term
				3A.4 Develop a rapid-response plan for IAS detected including mechanism for resource mobilization for action. Mechanism for resource mobilization can take the form of a contingency fund with monies set aside for emergency responses.	Short-term
				3A.5 Develop an IAS public notification system.	Short-term
4	Control	4A. Increase technical and management capacity	Limited capacity	4A.1 Develop of IAS training courses for border control and natural resource staff, managers, specialists and policy makers. Courses to include IAS identification, safe handling, multilateral environmental obligations and their implications for work of Government agencies' staff.	Short-term
				4A.2 Increase staffing to effectively implement sequenced approach for IAS management. Natural resource Government agencies (BEST, DMR, DOA, DEHS and Ministry of the Environment) and Customs Department should have at least one staff member dedicated to IAS management.	Ongoing
				4A.3 IAS information management system to include exotic species permit details, failed	Short-term

	Management Objective	Strategic Action	Barriers Addressed	Tasks	Timeline
				and successful eradication and control methods and links to additional resources to assist border control and natural resource management staff.	
		4B. Develop species-specific management plans	Lack of species-specific management plans	4B.1 Develop species specific management plans for dogs, cats, Cane Toad, Shiny Cowbird, Raccoon, Suckering Australian Pine, Casuarina, Asian Scaevola and Brazilian Pepper.	Short-term
				4B.2 Introduce stricter controls on movement of exotic plants and animals and known IAS between Bahamian islands as a matter of priority.	Short-term
		4C. Expand and create control measures	Sporadic implementation of 2003 NISS	4C.1 Expand removal of coastal IAS plants and beach restoration strategies to all islands of The Bahamas.	Ongoing
				4C.2 Continue and expand lionfish removal on dive sites and lionfish derbies in the country in collaboration with private dive companies and local environmental NGOs.	Ongoing
				4C.3 Explore ‘pest to profit’ concept for control of Casuarina trees to develop a cottage industry. Implement, if feasible.	Short-term
				4C.4 Develop and fund Government initiative to remove invasive plants from all Government properties and replace them with native species. Another goal of the initiative should be to ensure that only native plants are used in the landscaping of any new Government buildings, roads or infrastructure.	Short-term
				4C.5 Develop and fund Government native plant and tree nursery or partner with private	Ongoing

	Management Objective	Strategic Action	Barriers Addressed	Tasks	Timeline
				nursery to propagate plants for landscaping of Government offices and complexes, public schools, public green spaces and roads.	
				4C.6 Develop or adapt facility to safely store and protect native and endemic genetic resources for plants and animals, particularly those important for agricultural purposes.	Short-term
5	Monitoring	5A. Develop monitoring system for priority sites - public areas, national parks, protected areas, freshwater sources and field stations.	Limited monitoring at priority sites	5A.1 Continue regular surveys at priority sites (e.g. South Berry Islands Marine Reserve).	Ongoing
				5A.2 Begin regular surveys at priority sites not currently being monitored.	Ongoing
6	Education and Awareness	6A. Develop national program for IAS education and awareness	Lack of public education and outreach on IAS issues	6A.1 Develop educational programs (inclusive of an IAS web portal) at the community level to aid in early detection and control of IAS. This includes replication of successful educational materials produced by local organizations and companies (e.g. BNT, BREEF, DMR, Dolphin Encounters, TNC).	Short-term
				6A.2 Target local nurseries to stop the propagation of IAS, such as Hawaiian Scaevola.	Short-term
				6A.3 Invasive species ecology incorporated as a part of curricula at secondary and tertiary levels.	Medium-term
				6A.4 Develop pilot projects with local communities and civic groups on IAS built on the concept of “learning by doing”.	Short-term
				6A.5 Allow components of IAS information system to be shared with public	Medium-term
7	Research	7A. Build research capacity	Inadequate research	7A.1 IAS identified as a priority under a	Short-term

	Management Objective	Strategic Action	Barriers Addressed	Tasks	Timeline
				national research program.	
				7A.2 Government agencies pursue research on IAS specific to their sector; this may require agencies to also pursue donor or grant funding to support research activities. Department of Marine Resources is already involved in lionfish control pilot projects.	Ongoing
				7A.3 Invasive micro-organisms research pursued as a priority.	Short-term
				7A.4 Expand lionfish seed grant program to promote research of other invasives.	Ongoing
8	Policy and Legislation	8A. Implement National Invasive Species Policy	Sporadic implementation of 2003 NISS	8A.1 Increase compliance of Government agencies with mandatory Code of Conduct	Ongoing
				8A.2 Encourage compliance of various sectors with voluntary codes of conduct	Ongoing
		8B. Improve legislative framework for NISS implementation	Lack of adequate legislation	8B.1 Review and amend existing legislation to facilitate IAS management, particularly as it relates to continued import and propagation of known invasives (e.g. Hawaiian Scaevola, Brazilian Pepper) and SPS measures.	Short-term
				8B.2 Enact draft Biosecurity Act (2005) and associated regulations specific to IAS.	Short-term
9	Economic Tools	9A. Integrate IAS management into economic policies	Lack of economic policies and tools for IAS management	8B.3 Use internationally agreed terminology and standards in implementing legislation and regulations.	Short-term
				9A.1 NISS Framework institutions advocate for economic policies that reflect the user pays principle, full social cost pricing, precautionary principle, protection of public interest and subsidiarity.	Ongoing
				9A.2 Government enacts economic policies that develop appropriate property rights,	Ongoing

	Management Objective	Strategic Action	Barriers Addressed	Tasks	Timeline
				estimate social costs, assign liability and promote empowerment for persons injured by the spread of harmful IAS.	
		9B. Develop economic tools		9B.1 Government applies price-based instruments to ensure that importers and user of harmful IAS account for the full social costs of their activities. These instruments can include commodity taxes, differential land use taxes, user charges and access fees.	Short-term
				9B.2 Government established deposit-refund systems or environmental assurance bonds where there is risk of damage from import or use of IAS.	Short-term
				9B.3 Quantify current and anticipated economic impacts of IAS on The Bahamas.	Medium-term
		9C. Ensure funding for NISS implementation and sustained IAS management.		9C.1 Government commits funding for NISS implementation in its annual budget starting in 2014 and into the future. This should be clearly outlined in a programmatic budget for IAS management and not buried in traditional budget categories where it can be spent on other issues inadvertently.	Ongoing
				9C.2 Government and its non-Government partners seek funding for NISS implementation and sustained IAS management whether in the form of monetary gifts, grants, loans or donations.	Ongoing
				9C.3 Complete capacity needs assessment and cost analysis for NISS implementation and IAS management to ensure human, physical and financial resources are made available in a timely and sustained manner.	Short-term

References

- Biosecurity Council, 2003. *Tiakina Aotearoa Protect New Zealand: The Biosecurity Strategy for New Zealand*. Auckland, New Zealand.
- Creative Resource Strategies LLC, 2010. *A Statewide Management Assessment of Invasive Species in Oregon*. Oregon Invasive Species Council. Salem, Oregon.
- De Poorter, Maj et al. *Marine Menace: Alien invasive species in the Marine Environment*. IUCN. Gland, Switzerland.
- Franco, Gaston et al, 2011. *The challenge of invasive species and destructive insects*. European Parliament Intergroup on Climate Change, Biodiversity and Sustainable Development. Brussels.
- Global Invasive Species Programme, 2000. *Draft Global Strategy on Invasive Alien Species*. Cape Town, South Africa.
- Hoefert, Richard A., 2001. *Army Policy Guidance for Management and Control of Invasive Species*. U.S. Department of the Army, Assistant Chief of Staff for Installation Management. Washington, D.C.
- Koo, Won. W and Jeremy W. Mattson, 2004. *Economics of Detection and Control of Invasive Species*. Center for Agricultural Policy and Trade Studies, Department of Agribusiness and Applied Economics, North Dakota State University. Fargo, North Dakota.
- Krauss, Ulrike, 2011. *National Invasive Species Strategy: National Consultations – Summary of Conclusions and Recommendations*. St. Lucia.
- Massachusetts Office of Coastal Zone Management, 2002. *Massachusetts Aquatic Invasive Species Management Plan*. Massachusetts Aquatic Invasive Species Working Group. U.S.A.
- Ministry of Agriculture and Forestry, 2007. *Biosecurity New Zealand - Strategic Plan*. Auckland, New Zealand.
- National Invasive Species Council, 2001. *Meeting the Invasive Species Challenge: National Invasive Species Management Plan*. Washington, D.C.
- New Zealand Customs Service, 2009. *New Zealand Customs Service: Strategic Outlook to 2015*. Auckland, New Zealand.
- Secretariat of the Convention on Biological Diversity, 2011. *Considerations for Implementing International Standards and Codes of Conduct in National Invasive Species Strategies and Plans*. Montreal, Canada.

Shluker, Andrea D. et al, 2003. *State of Hawai'i: Aquatic Invasive Species Management Plan*. Department of Land and Natural Resources, Division of Aquatic Resources. Honolulu, Hawaii.

Smith, Ross L., 2010. *Invasive Alien Plant Species of The Bahamas and Biodiversity Management – A Practicum Report*. Miami University. Oxford, Ohio.

U.S. Coast Guard, 2009. *Proposed Ballast Water Discharge Standard Rulemaking*. Office of Operating and Environmental Standards. www.regulations.gov – docket number USCG-2001-10486.

U.S. Commission on Ocean Policy, 2004. *An Ocean Blueprint for the 21st Century - Chapter 17: Preventing the Spread of Invasive Species*. Washington, D.C.

United States General Accounting Office, 2000. *Invasive Species: Federal and Selected State Funding to Address Harmful Nonnative Species*. Report to Congressional Committees. Washington, D.C.

Appendices

I. List of Known Invasive Alien Species in The Bahamas

Plant Species

<i>Abrus precatorius</i>	Rosary pea
<i>Acacia auriculiformis</i>	Northern black wattle
<i>Acacia farnesiana</i>	Sweet acacia, Acacia
<i>Albizia lebbbeck</i>	Woman's tongue
<i>Antigonon leptopus</i>	Coral vine
<i>Asparagus densiflorus</i>	Asparagus fern
<i>Bauhinia variegata</i>	Poor man's Orchid, Orchid tree
<i>Bothriochloa pertusa</i>	Indian bluegrass, Barbados sour grass
<i>Calotropis procera</i>	Apple of Sodom
<i>Cardamine flexuosa</i>	Woodland bittercress
<i>Casuarina equisetifolia</i>	Australian Pine, Beefwood
<i>Casuarina glauca</i>	suckering Australian pine
<i>Cestrum diurnum</i>	Day jessamine
<i>Colubrina asiatica</i>	Lather leaf
<i>Dioscorea alata</i>	Winged yam
<i>Dioscorea bulbifera</i>	Air potato
<i>Eichhornia crassipes</i>	Water hyacinth
<i>Eugenia uniflora</i>	Surinam cherry
<i>Haematoxylon campeachianum</i>	Logwood
<i>Impomoea purpurea</i>	Morning Glory
<i>Jasminum fluminense</i>	Azores jasmine, Brazilian jasmine
<i>Lantana camara</i>	Lantana, Shrub verbena, angel lips, big sage, black sage, white sage, prickly lantana
<i>Launaea intybacea</i>	Bitter lettuce
<i>Leucaena glauca</i>	Jumbey
<i>Melaleuca quinquenervia</i>	Melaleuca, paper bark
<i>Nephrolepis multifora</i>	Asian sword fern
<i>Neyraudia reynaudiana</i>	Burma reed
<i>Panicum repens</i>	Torpedo grass
<i>Passiflora foetida</i>	Fetid passion flower, Stinking passion flower
<i>Pennisetum purpureum</i>	Napier grass
<i>Pimenta racemosa</i>	Bay Rum
<i>Prunus amygdalus</i>	Almond
<i>Pteridium aquilinum</i>	Bracken
<i>Ricinus communis</i>	Castor Bean
<i>Ruellia brittoniana</i>	Mexican petunia
<i>Scaevola sericea</i>	Alternative: <i>Scaevola taccada</i>
<i>Scaevola taccada</i>	Asian Scaevola, Hawaiian seagrape, White inkberry
<i>Schefflera actinophylla</i>	Schefflera, Queensland umbrella tree
<i>Schinus terebinthifolius</i>	Brazilian pepper, Bahamian holly
<i>Spathodea campanulata</i>	African tulip tree, flame of the forest

<i>Syngonium podophyllum</i>	Arrow head vine
<i>Syzygium cumini</i>	Black plum
<i>Thespesia populnea</i>	Seaside mahoe, cork tree, Spanish cork
<i>Thymophylla tenuiloba</i> var. <i>tenuiloba</i>	Bristleleaf, Dogweed, Dahlberg daisy
<i>Trachelosperumum jasminoides</i>	Star Jasmine
<i>Urochloa maxima</i>	Guineagrass
<i>Wedelia trilobata</i>	Wedelia, carpet daisy
<i>Ziziphus mauritiana</i>	Jujube, Chinese apple

Bird Species

<i>Bubulcus ibis</i>	Cattle egret
<i>Columba livia</i>	Rock Dove
<i>Molothrus bonariensis</i>	Shiny Cowbird
<i>Myiopsitta monachus</i>	Monk parakeet
<i>Passer domesticus</i>	House Sparrow
<i>Streptopelia decaocta</i>	Eurasian Collared Dove

Terrestrial Animals Species

<i>Aedes aegypti</i>	Yellow fever mosquito
<i>Anolis equestris</i>	Knight anole
<i>Iguana iguana</i>	Green Iguana
<i>Aphis spiraecola</i>	Spirea aphid
<i>Bos taurus</i>	Holstein
<i>Cactoblastis cactorum</i>	Cactus moth
<i>Canine</i>	Dogs (all breeds and types)
<i>Capra hircus</i>	Goat
<i>Cryptotermes brevis</i>	Powderpost termite
<i>Diaphorina citri</i>	Asian citrus psyllid
<i>Pantherophis guttatus</i>	Corn snake
<i>Eleutherodactylus coqui</i>	Caribbean tree frog, common coqui
<i>Equus asinus</i>	Donkey
<i>Euglandina rosea</i>	Rosy predator snail
<i>Felis catus</i>	Cats (all breeds and types)
<i>Gastrophryne carolinensis</i>	Eastern narrowmouth toad
<i>Maconellicoccus hirsutus</i>	Pink hibiscus mealybug
<i>Monomorium floricola</i>	Bicoloured trailing ant, Singapore ant
<i>Mus musculus</i>	Mouse
<i>Ovis aries</i>	Sheep
<i>Paratachardina pseudolobata</i>	Lobate lac scale
<i>Paratrechina longicornis</i>	Crazy ant, Long-horned ant
<i>Pheidole megacephala</i>	Big-headed ant
<i>Procyon lotor</i>	Raccoon
<i>Rattus norvegicus</i>	Norway rat
<i>Rattus rattus</i>	Ship rat
<i>Rhinella marina</i>	Cane toad
<i>Solenopsis geminata</i>	Tropical Asian fire ant, Red ant

Solenopsis invicta
Sus scrofa
Tapinoma melanocephalum
Trachemys scripta
Loxosceles reclusa
Wasmannia auropunctatus

Red imported fire ant
Pig
Ghost ant
Red-eared slider
Brown recluse spider
Little fire ant

Aquatic Species

Amphiprion sp
Artemia cysts
Callinectes sapidus
Callionymus lyra
Cherax quadricarinatus
Chiloscyllium punctatum
Chkosoyllium piunctatum
Chrysoara quinquechirra
Family Cichlidae
Crassostrea virginica
Dunaliella sp.
Epinephelus lanceolatus
Euglandina rosea
Euxiophipops navarchis
Euxiophipops xanthometapm
Hemiscylliidae
Heterodontus zebras
Nannochloropsis oculata
Oreochromis aureus
Oreochromis mossambicus
Oreochromis ureblepis
Pterois miles
Pterois volitans
Radianthus
Tubastraea coccinea
Xiphophorus hellerii

Clown fish
Brine shrimp
Blue crab
Dragonet
Red claw
Banded shark
Brown Bamboo shark
Sea nettle
Cichlid fish
American oyster
Green algae
Queensland grouper
Cannibal snail
Blue-girded angelfish
Yellow-faced angelfish
Bamboo shark
Zebra Bullhead shark
Algae
Blue tilapia
Mozambique tilapia
Tilapia
Lionfish
Lionfish
Sea anemone
Orange-cup coral, Colonial-cup coral
Swordtail, Red velvet

Microorganisms

Fusarium oxysporum
f.sp. Cubense

Panama disease of banana (fungi)

II. Plant and Animal Species Recommended for Eradication

<i>Casuarina glauca</i>	Suckering Australian Pine
<i>Melaleuca quinquenervia</i>	Melaleuca, (paper bark)
<i>Mucuna pruriens</i>	Monkey Tamarind
<i>Scaevola taccada</i>	Asian Scaevola, White Inkberry, (Hawaiian Seagrape)
<i>Schinus terebinthifolius</i>	Brazilian Pepper, Bahamian Holly
<i>Molothrus bonariensis</i>	Shiny Cowbird
<i>Procyon lotor</i>	Raccoon (for all islands except New Providence and Grand Bahama)
<i>Rhinella marina</i>	Cane Toad
<i>Pantherophis guttatus</i>	Corn snake

III. Plant and Animal Species Recommended for Control

<i>Albizia lebbbeck</i>	Woman's Tongue
<i>Antigonon leptopus</i>	Coral Vine
<i>Bauhinia variegata</i>	Poor Man's Orchid
<i>Casuarina equisetifolia</i>	Casuarina, Australian Pine, (beefwood)
<i>Delonix spp.</i>	Poinciana
<i>Eichhornia crassipes</i>	Water Hyacinth
<i>Haematoxylon campeachianum</i>	Logwood
<i>Impomoea purpurea</i>	Morning Glory
<i>Leucaena glauca</i>	Jumbey
<i>Pimenta racemosa</i>	Bay Rum
<i>Prunus amygdalus</i>	Almond
<i>Ricinus communis</i>	Castor Bean
<i>Spathodea campanulata</i>	African Tulip Tree, Flame of the Forest
<i>Schefflera actinophylla</i>	Schefflera, Queensland Umbrella Tree <i>Trachelosperum</i>
<i>jasminoides</i>	Star Jasmine
<i>Wedelia trilobata</i>	Wedelia, (carpet daisy)
<i>Columba livia</i>	Rock Dove
<i>Passer domesticus</i>	House Sparrow
<i>Pterois miles</i>	Lionfish
<i>Pterois volitans</i>	Lionfish
<i>Streptopelia decaocta</i>	Eurasian Collared Dove
<i>Canine</i>	Dogs
<i>Felis catus</i>	Cats
<i>Procyon lotor</i>	Raccoon (for New Providence and Grand Bahama)
<i>Anolis equestris</i>	Knight anole
<i>Iguana iguana</i>	Green Iguana

IV. National Invasive Species Policy

The Government of the Commonwealth of The Bahamas,

Recognizing its obligation as a Party under Article 8(h) of the Convention on Biological Diversity to “prevent the introduction of, to control or to eradicate those alien species, which threaten ecosystems, habitats or species”,

Acknowledging that scientists and governments throughout the world recognize that biological invasions by alien species pose serious threats to native biological diversity,

Noting that invasive alien species are found in all taxonomic groups: plants, animals and microorganisms,

Noting that invasive alien species are as damaging to native species and biological diversity as the loss and degradation of habitat,

Recognizing that, globally, hundreds of species extinctions have already resulted from invasive alien species,

Noting that the natural barriers to the movement of species - oceans, rivers, mountains and deserts - that provided the isolation essential for the evolution of unique and endemic species, have become increasingly ineffective,

Acknowledging that globalization, and the emphasis on free trade, provide even greater opportunities than hitherto for species to be introduced, either deliberately or accidentally, to new habitats, with the opportunity to become invasive,

Aware that small islands developing states are particularly vulnerable to the impacts of seemingly innocuous invasions, and The Bahamas perhaps especially so, given its archipelagic nature and many ports of entry,

Aware that the impacts of alien invasive species are immense, insidious, and often irreversible and that the costs due to their damage on a global scale are enormous, both in ecological and economic terms, and in terms of human welfare,

Recognizing that The Bahamas relies heavily on its natural resources, and has an open economy heavily dependent on imports,

Recognizing that the cost of allowing the introduction of invasive alien species is the irretrievable loss of endemic species and of unique ecosystems,

Recognizing also that there are direct economic costs of control of alien animals and plants, disease and pests,

Noting that introduced alien diseases and parasites of humankind not only result in suffering, and perhaps death, but also have economic costs of medical treatments and the loss of productivity,

Noting that global climate change is also a significant factor in facilitating the establishment of many alien species, and

Determined to conserve and sustainably manage the biological diversity of The Bahamas for the benefit of present and future Bahamians,

Has decided to adopt the following Policy:

- To enact legislation to prevent the introduction of, to control and to eradicate those alien invasive species which threaten the ecosystems, habitats, endemic species and the human health and welfare of The Bahamas, in support of the Convention on Biological Diversity;
- To prepare a National Invasive Species Strategy for The Bahamas, which lists and prioritizes in order of significant impact those invasive species present in The Bahamas;
- To prepare Strategic Management Plans for individual species of high priority as identified under the National Invasive Species Strategy;
- To facilitate research on the occurrence, distribution and impacts of invasive alien species and invasive native species in The Bahamas;
- To prevent the introduction of invasive alien species into The Bahamas by regulatory and other relevant means;
- To monitor invasive species populations in The Bahamas by the conduct of surveys and risk assessments;
- To undertake control and management activities in an environmentally and cost-effective manner;
- To monitor potentially invasive alien species not yet established in The Bahamas;
- To promote, undertake and facilitate the reestablishment of native species, where appropriate, and the restoration of invaded and damaged habitats;
- To conduct and facilitate research into the best management and control practices for individual species, including plants, animals and microorganisms, using chemical, physical and biological methods that are environmentally sound;
- To promote public education and outreach on invasive alien species at all levels of society by appropriate methods;

- To promote international and regional cooperation which would aid in the fulfillment of this policy and implementation of the National Invasive Species Strategy;
- To mandate such cooperation between Government Ministries, Departments and other Agencies including Non-Governmental Organizations and the Private Sector, as necessary, to implement this policy and to carry out the Strategy.
- To promote and facilitate such infrastructural development as is necessary to enable Ministries, Departments, and other Agencies, to implement this Policy and the National Invasive Species Strategy.

V. Code of Conduct for Government

Require risk assessment for Government-led or financed plant and animal introductions to ensure that no new harmful species are introduced, intentionally or unintentionally.

Do not distribute existing holdings of invasive plant and animal species to areas where they can potentially do harm.

Coordinate and facilitate collaboration in databases, early warning systems, monitoring and other means of preventing invasive plant species problems.

Lead and fund the development of environmentally sound methods to control harmful invasive plant species, seek control of such species on Crown and other public lands and promote their control on adjacent private lands.

Develop and promote the use of non-invasive plant species within all Government agencies and to the public.

Facilitate, lead, coordinate and evaluate public outreach and education on harmful invasive species.

Encourage public servants and managers to participate in ongoing training programmes on invasive species.

Foster international and regional cooperation to minimize the risk of import and export of potentially invasive species.

Develop partnerships and incentive programmes to lessen the impact of invasive species and provide non-invasive restoration materials.

Provide a forum for regular evaluation of the effectiveness of these voluntary codes of conduct towards preventing the invasive species problem.

Enforce existing invasive species legislation at all levels, and enact new legislation where deficiencies occur in existing legislation.

VI. Guiding Principles for Invasive Species Management

The Guiding Principles for the Prevention, Introduction and Mitigation of the Impacts of Alien Species that threaten Ecosystems, Habitats or Species was adopted at the Sixth Conference of the Parties of the Convention on Biological Diversity. These principles are outlined below.

A. General

Guiding principle 1: Precautionary approach

Given the unpredictability of the pathways and impacts on biological diversity of invasive alien species, efforts to identify and prevent unintentional introductions as well as decisions concerning intentional introductions should be based on the precautionary approach, in particular with reference to risk analysis, in accordance with the guiding principles below. The precautionary approach is that set forth in principle 15 of the 1992 Rio Declaration on Environment and Development and in the preamble of the Convention on Biological Diversity.

The precautionary approach should also be applied when considering eradication, containment and control measures in relation to alien species that have become established. Lack of scientific certainty about the various implications of an invasion should not be used as a reason for postponing or failing to take appropriate eradication, containment and control measures.

Guiding principle 2: Three-stage hierarchical approach

1. Prevention is generally far more cost-effective and environmentally desirable than measures taken following introduction and establishment of an invasive alien species.
2. Priority should be given to preventing the introduction of invasive alien species, between and within States. If an invasive alien species has been introduced, early detection and rapid action are crucial to prevent its establishment. The preferred response is often to eradicate the organisms as soon as possible (principle 13). In the event that eradication is not feasible or resources are not available for its eradication, containment (principle 14) and long-term control measures (principle 15) should be implemented. Any examination of benefits and costs (environmental, economic and social) should be done on a long-term basis.

Guiding principle 3: Ecosystem approach

Measures to deal with invasive alien species should, as appropriate, be based on the ecosystem approach, as described in decision V/6 of the Conference of the Parties. This regional strategy seeks to specifically address Fresh Water; Marine and Terrestrial Ecosystems in the Caribbean.

Guiding principle 4: The role of States

1. In the context of invasive alien species, States should recognize the risk that activities within their jurisdiction or control may pose to other States as a potential source of invasive alien species, and should take appropriate individual and cooperative actions to minimize that risk, including the provision of any available information on invasive behaviour or invasive potential of a species.
2. Examples of such activities include:
 - a. The intentional transfer of an invasive alien species to another State (even if it is harmless in the State of origin); and

- b. The intentional introduction of an alien species into their own State if there is a risk of that species subsequently spreading (with or without a human vector) into another State and becoming invasive;
 - c. Activities that may lead to unintentional introductions, even where the introduced species is harmless in the state of origin.
3. To help States minimize the spread and impact of invasive alien species, States should identify, as far as possible, species that could become invasive and make such information available to other States.

Guiding principle 5: Research and monitoring

In order to develop an adequate knowledge base to address the problem, it is important that Caribbean States undertake research on and monitoring of invasive alien species, as appropriate. These efforts should attempt to include a baseline taxonomic study of biodiversity. In addition to these data, monitoring is the key to early detection of new invasive alien species. Monitoring should include both targeted and general surveys, and benefit from the involvement of other sectors, including local communities. Research on an invasive alien species should include a thorough identification of the invasive species and should document: (a) the history and ecology of invasion (origin, pathways and time-period); (b) the biological characteristics of the invasive alien species; and (c) the associated impacts at the ecosystem, species and genetic level and also social and economic impacts, and how they change over time.

Guiding principle 6: Education and public awareness

Raising the public's awareness of the invasive alien species is crucial to the successful management of invasive alien species. Therefore, it is important that States should promote education and public awareness of the causes of invasion and the risks associated with the introduction of alien species. When mitigation measures are required, education and public-awareness-oriented programmes should be set in motion so as to engage local communities and appropriate sector groups in support of such measures.

B. Prevention

Guiding principle 7: Border control and quarantine measures

1. States should implement border controls and quarantine measures for alien species that are or could become invasive to ensure that:
 - a. Intentional introductions of alien species are subject to appropriate authorization (principle 10);
 - b. Unintentional or unauthorized introductions of alien species are minimized.
2. States should consider putting in place appropriate measures to control introductions of invasive alien species within the State according to national legislation and policies where they exist.
3. These measures should be based on a risk analysis of the threats posed by alien species and their potential pathways of entry. Existing appropriate governmental agencies or authorities should be strengthened and broadened as necessary, and staff should be properly trained to implement these measures. Early detection systems and regional and international coordination are essential to prevention.

Guiding principle 8: Exchange of information

1. States should assist in the development of an inventory and synthesis of relevant databases, including taxonomic and specimen databases, and the development of information systems and an interoperable distributed network of databases for compilation and dissemination of information on alien species for use in the context of any prevention, introduction, monitoring and mitigation activities. This information should include incident lists, potential threats to neighbouring countries, information on taxonomy, ecology and genetics of invasive alien species and on control methods, whenever available. The wide dissemination of this information, as well as national, regional and international guidelines, procedures and recommendations such as those being compiled by the Global Invasive Species Programme should also be facilitated through, *inter alia*, the clearing-house mechanism of the Convention on Biological Diversity.
2. The States should provide all relevant information on their specific import requirements for alien species, in particular those that have already been identified as invasive, and make this information available to other States.

Guiding principle 9: Cooperation, including capacity-building

Depending on the situation, a State's response might be purely internal (within the country), or may require a cooperative effort between two or more countries. Such efforts may include:

- a. Programmes developed to share information on invasive alien species, their potential uneasiness and invasion pathways, with a particular emphasis on cooperation among neighbouring countries, between trading partners, and among countries with similar ecosystems and histories of invasion. Particular attention should be paid where trading partners have similar environments;
- b. Agreements between countries, on a bilateral or multilateral basis, should be developed and used to regulate trade in certain alien species, with a focus on particularly damaging invasive species;
- c. Support for capacity-building programmes for States that lack the expertise and resources, including financial, to assess and reduce the risks and to mitigate the effects when introduction and establishment of alien species has taken place. Such capacity-building may involve technology transfer and the development of training programmes;
- d. Cooperative research efforts and funding efforts toward the identification, prevention, early detection, monitoring and control of invasive alien species.

C. Introduction of species

Guiding principle 10: Intentional introduction

1. No first-time intentional introduction or subsequent introductions of an alien species already invasive or potentially invasive within a country should take place without prior authorization from a competent authority of the recipient State(s). An appropriate risk analysis, which may include an environmental impact assessment, should be carried out as part of the evaluation process before coming to a decision on whether or not to authorize a proposed introduction to the country or to new ecological regions within a country. States should make all efforts to permit only those species that are unlikely to threaten biological diversity. The burden of proof that a proposed introduction is unlikely to threaten biological diversity should be with the proposer of the introduction or be assigned as appropriate by the recipient State. Authorization of an introduction may, where appropriate, be accompanied by conditions (e.g.,

preparation of a mitigation plan, monitoring procedures, payment for assessment and management, or containment requirements).

2. Decisions concerning intentional introductions should be based on the precautionary approach, including within a risk analysis framework, set forth in principle 15 of the 1992 Rio Declaration on Environment and Development, and the preamble of the Convention on Biological Diversity. Where there is a threat of reduction or loss of biological diversity, lack of sufficient scientific certainty and knowledge regarding an alien species should not prevent a competent authority from taking a decision with regard to the intentional introduction of such alien species to prevent the spread and adverse impact of invasive alien species.

Guiding principle 11: Unintentional introductions

1. All States should have in place provisions to address unintentional introductions (or intentional introductions that have become established and invasive). These could include statutory and regulatory measures and establishment or strengthening of institutions and agencies with appropriate responsibilities. Operational resources should be sufficient to allow for rapid and effective action.

2. Common pathways leading to unintentional introductions need to be identified and appropriate provisions to minimize such introductions should be in place. Sectoral activities, such as fisheries, agriculture, forestry, horticulture, shipping (including the discharge of ballast waters), ground and air transportation, construction projects, landscaping, aquaculture including ornamental aquaculture, tourism, the pet industry and game-farming, are often pathways for unintentional introductions. Environmental impact assessment of such activities should address the risk of unintentional introduction of invasive alien species. Wherever appropriate, a risk analysis of the unintentional introduction of invasive alien species should be conducted for these pathways.

D. Mitigation of impacts

Guiding principle 12: Mitigation of impacts

Once the establishment of an invasive alien species has been detected, States, individually and cooperatively, should take appropriate steps such as eradication, containment and control, to mitigate adverse effects. Techniques used for eradication, containment or control should be safe to humans, the environment and agriculture as well as ethically acceptable to stakeholders in the areas affected by the invasive alien species. Mitigation measures should take place in the earliest possible stage of invasion, on the basis of the precautionary approach. Consistent with national policy or legislation, an individual or entity responsible for the introduction of invasive alien species should bear the costs of control measures and biological diversity restoration where it is established that they failed to comply with the national laws and regulations. Hence, early detection of new introductions of potentially or known invasive alien species is important, and needs to be combined with the capacity to take rapid follow-up action.

Guiding principle 13: Eradication

Where it is feasible, eradication is often the best course of action to deal with the introduction and establishment of invasive alien species. The best opportunity for eradicating invasive alien species is in the early stages of invasion, when populations are small and localized; hence, early detection systems focused on high-risk entry points can be critically useful while post-

eradication monitoring may be necessary. Community support is often essential to achieve success in eradication work, and is particularly effective when developed through consultation. Consideration should also be given to secondary effects on biological diversity.

Guiding principle 14: Containment

When eradication is not appropriate, limiting the spread (containment) of invasive alien species is often an appropriate strategy in cases where the range of the organisms or of a population is small enough to make such efforts feasible. Regular monitoring is essential and needs to be linked with quick action to eradicate any new outbreaks.

Guiding principle 15: Control

Control measures should focus on reducing the damage caused as well as reducing the number of the invasive alien species. Effective control will often rely on a range of integrated management techniques, including mechanical control, chemical control, biological control and habitat management, implemented according to existing national regulations and international codes.