

In a

Nutshell

Invasion of
Alien species





This is the age where knowledge and information are critical factors for successful decision-making, social interactions and economic transactions. It raises awareness and gives us insights into those attributes that will empower and enable us to sustain ourselves and flourish in today's world. The ***In a Nutshell*** series is designed to contribute to the need for enhancing the supply of and access to information for development. It introduces and provides general information about critical topics to promote awareness, stimulate interest and inform ordinary people on issues and topics of importance to sustainable development of agriculture and rural livelihoods in Caribbean countries

Invasive Alien Species (IAS) is a critical issue in the Caribbean. With a global focus on food and nutrition security amidst serious concerns about impacts of climate change on water resources and food production, it is important to be aware of, and understand how IAS impact on our lives, livelihoods and environment. Such understanding can go a long way in determining our roles in preventing the introduction of IAS and controlling them once they have 'arrived'. In 2008, Loretta Burke et al. concluded that the coral reef-associated tourism contributes significantly to economies of Tobago and Saint Lucia. The authors' valuation of the 'pull factor' of coral reefs' share in tourist arrivals was an estimated 40% for Tobago and 25% for Saint Lucia. Direct economic input was estimated at US\$43.5 million for Tobago and US\$97.6 million for Saint Lucia. However this could be lost from IAS damage. The threat of IAS is very real and can be very costly to our island economies.

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All errors and omissions are the sole responsibility of the authors and do not reflect the views of the CTA.

“For an alien species to become invasive, it must arrive, survive and thrive. It must successfully out-compete native organisms for food and habitat, spread through its new environment, increase its population and harm ecosystems in its introduced range.”

Ecosystems and Invasive Alien Species (IAS)

Invasive **Alien** Species are plants, animals or micro-organisms in all major (taxonomic) groups of organisms, **Not Native** to an ecosystem, such as, viruses, fungi, algae, mosses, ferns, higher plants, invertebrates, fish, amphibians, reptiles, birds and mammals. Within each group, numerous species, including perhaps as many as 10% of the world's 300,000 woody plants, have the potential to invade other ecosystems and affect native biota in a direct or indirect way.² They are often referred to as 'pests' or 'exotic pests'. Diverse yet delicate island ecosystems that have developed largely in isolation and lack certain predators or competition, are particularly at risk from non-native species. A good predictor of invasiveness is whether a species has successfully or unsuccessfully invaded local biodiversity found in...

Terrestrial



Antigua & Barbuda Landscape
(Photo IICA Antigua & Barbuda)

Freshwater



Lake Capoey, Guyana
(Photo IICA Guyana)

Marine



Underwater scene, Dominica
(photo Derrick Theophile)

... **Ecosystems** that support fertile soils, water and clean air and provide the base for services and industries, such as, farming, fisheries, tourism, trade; all essential for human life and livelihoods. These Ecosystems are very vulnerable to the multiplicity of pathways for IAS introduction.³

Safeguard our Ecosystems!

¹ "Invasive Alien Species a Threat to Biodiversity" Secretariat of the Convention on Biodiversity

² "Plant invasions and invasibility of plant communities" Rejmánek, M. Richardson and Pyš. P. (2005) Vegetation ecology (ed. E. Van de Maarel) pp.332-355. Blackwell Publishing, Oxford.

³ "Redefining Wealth – UNEP frames new action plan with ecosystems services at its core" Amanda Harris, <http://www.ecosystemmarketplace.com/>



IAS are second to habitat destruction as the cause of species extinction. They cause enormous damage to biodiversity and to the valuable ecosystem upon which we depend. IAS introduced by humans are a leading cause of species extinctions and populations decline on Island ecosystems worldwide

IAS...a serious problem for Small Islands

The **Caribbean**, one of the World's **biodiversity hotspots**⁴, has an exceptionally high level of species endemism (Box 1) that supports extremely diverse ecosystems of global ecological and economic importance. In 2002 the UN designated the Caribbean Sea a special area in recognition of its globally important biodiversity, in particular the marine ecosystems surrounding the Islands. Jamaica has been ranked fifth among islands of the world in terms of endemic plants. The country also enjoys a high level of endemism for animal species, as 98.2% of the 514 indigenous species of amphibians are endemic to Jamaica.


Box 1: Species diversity and Endemism in the Insular Caribbean			
Taxonomic Group	No. of Species	No. Endemic Species	% Endemism
Plants	13,000	6,550	50
Mammals	89	41	46
Birds	604	163	27
Reptiles	502	469	93
Amphibians	170	170	100
Freshwater Fishes	161	65	40

Biodiversity on Small Islands is fragile and particularly vulnerable to IAS⁵ due to their relatively low buffer capacity to severe environmental fluctuations and events. The fact that species become concentrated in small and fragmented areas and that some endangered species have below critical mass breeding populations, which are further restricted by habitat fragmentation, further exacerbates their vulnerability.

Protect our Biodiversity!

⁴ <http://biodiversityhotspots.org/xp/hotspots/Caribbean> (7/7/09)

⁵ <http://www.cdb.int/decisions/>



IAS are being introduced at an increasing rate. The key pathways, the 4-Ts – Trade, Transport, Travel and Tourism – are directly related to their spread, either deliberate or accidental. Once an IAS is introduced into one Caribbean Island it is likely to become invasive in the rest of the region.

Pathways for IAS introductions in the Caribbean

There are a several **Pathways** for IAS introduction **into the Caribbean**. The increase in international economic and cultural links in such areas as agriculture, aquaculture, transport and trade in crops and livestock have provided a multiplicity of pathways⁶ for these introductions, each rated by the level of risk (Box 2). There is considerable overlap between them. **None of the pathways assessed was rated as low-risk.**

Box 2: Pathways and Risk Rating for IAS		
Very High Risk	Medium Risk	No Rating
Human movement	Airline Passenger Baggage	Maritime trade
Wood Packaging material	Natural spread	
Forestry related pathways	Mail	
Propagative material		
Hitchhikers		

Changing climate will create suitable conditions for the further spread and invasion of invasive and potentially invasive species. Changes in weather patterns and increasing temperatures may also enable species to expand their current range as is the case of disease carrying mosquitoes. Increased carbon dioxide enrichment in aquatic ecosystems will affect all organisms and could also contribute to the invasiveness of certain terrestrial and aquatic species. It appears that successful IAS introductions into the Caribbean come from an area of similar ecological conditions and one with which the region has significant trade ties. Trade may also be via a secondary source. E.g., a pest from the Indo-Pacific region is first introduced into the Southern USA and then from there, to the Caribbean.

Guard our Borders!

⁶ Mesissner, H. et al (2009) Caribbean Pathways Analysis. United States Department of Agriculture (USDA) in Collaboration with Caribbean Invasive Species Working Group (CISWIG).



The 1995 World Trade Organisation (WTO) Agreement on the Application of Sanitary and Phytosanitary (SPS) Measures allows Members to adopt national measures or standards to prevent entry, establishment or spread of pests, diseases, or disease-carrying organisms and limit their damage.

Impact of IAS in the Caribbean

An **indicator** of invasiveness is how **successfully** an IAS invaded elsewhere. Common characteristics of IAS include rapid reproduction and growth, high dispersal ability (ability to move from one place to another), phenotypic plasticity (ability to adapt physiologically to new conditions), and ability to survive on various food types and in a wide range of environmental conditions.

Concise data on the economic loss caused by IAS in the Caribbean is limited to the outbreak of the Pink Hibiscus Mealy Bug (PHMB) in:

- Grenada, where losses between 1995 and 1998 totalled US\$18.3 million.
- Trinidad and Tobago, where potential losses to agriculture and forestry were predicted to cost US\$125 million. However, successful control considerably reduced this to US\$ 5.1 million between 1994 and 1997.

Research on the impact of the lionfish in the Bahamas (Albins & Hixon, 2008) also provides the first evidence of negative effects of lionfish on native Atlantic coral-reef fishes. The recruitment of coral-reef fishes was studied during the 2007 recruitment period (July-August) on small patch reefs in the Bahamas with and without a single lionfish. Over the five week period, net recruitment (i.e., accumulation of new juvenile fishes via settlement of larvae) was reduced by 79% on reefs with lionfish compared to reefs without lionfish. Stomach content analyses and observations of feeding behaviour showed that reductions in native fish density were almost certainly due to predation by lionfish.⁷

Track IAS Introductions!

⁷ Schofield, PJ, JA Morris, Jr, JN Langston, and PL Fuller. 2010. *Pterois volitans*/miles. USGS Nonindigenous Aquatic Species Database, Gainesville, FL., <http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=963>
Revision Date: 2/15/2010

Fast Facts about....

giant african snail

The Giant African Snail⁸



Origins

The giant African snail - *Achatina fulica* - is a tropical species native to East Africa. Typically about 1 cm tall, it can grow as large as 20 cm and weigh as much as a kilogram. They are hermaphrodite - having both male and female sex organs - and away from their natural enemies, after a single mating, can lay up to 1,200 eggs in a year. They are now widely distributed in southern and eastern Asia, as well as many islands of the Indo-Pacific and Caribbean. The snail has, in many cases, been deliberately introduced for food, medicinal use or as an ornamental species. They are capable of surviving adverse conditions.

Impact

Giant African snails are already present in several Caribbean countries. In terms of environmental impact, the snails feed on indigenous vegetation and pose a conservation problem by altering habitat and out-competing other snails for food. For agriculture, they have become a destructive pest of crops and garden plants. To humans, they are vectors for disease, such as, eosinophilic meningitis, caused by the parasite rat lungworm that is passed to humans through eating raw or improperly cooked snails.

Control

Hand-collecting followed by proper disposal remains the safest means of control. Some programs advocate the use of snail traps, using beer as bait. Others have incorporated poisoning with molluscicides and other chemicals, and even using flame-throwers to burn snails alive, but there are safety concerns associated with these methods.

Biological control backfired when the rosy wolf snail *Euglandina rosea* introduced to more than 20 oceanic islands and a number of Asian countries as a bio-control agent, caused the extinction or decline of indigenous snail species.

**Once established
the snail is extremely difficult to eradicate!**

⁸ "South America Invaded – The Growing danger of invasive alien species", The Global Invasive Species Programme (GISP) page 50.

Fast Facts about....

lionfish The Lionfish⁹

Origins

The lionfish (*Pterois volitans*) are coral reef fishes from the tropical waters of the South Pacific and Indian Oceans. Now found in the western Atlantic Ocean, the most probable explanation for their arrival is via the aquarium trade. The lionfish is a nocturnal species and moves to deeper waters at night to forage. The species is relatively quick to adapt to novel prey types. Preliminary genetic studies from North Carolina suggest that as little as three females could be responsible for an entire population.

Impact

Lionfish were first seen in 1985 in North Carolina, USA, in Bermuda in 2001, the Bahamas in 2004 and are now listed as a priority IAS in Jamaica. They have spread throughout the Bahamas and the northern Caribbean. They are efficient carnivores that feed on a wide variety of smaller fishes, shrimps and crabs, out-competing native species. They also have the potential to decrease the abundance of ecologically important species such as parrotfish and other herbivorous fishes that keep seaweeds and macro-algae from overgrowing corals. The potential for loss to commercial fishers and reef-based tourism is severe. Venomous spines are also a serious threat to human health.

Control

Lionfish venomous dorsal, anal and pelvic spines make them almost immune to predators. Current options to manage the lionfish threat are limited. They are being removed individually at key locations through training and licensing of dive professionals to respond to sightings. Groupers, a known natural predator of the lionfish, will be part of control solutions. A few lionfish have been found in the stomachs of native groupers in the Bahamas. Other management solutions will include detection and response, medical issues, collection and handling techniques and monitoring and assessment protocols.

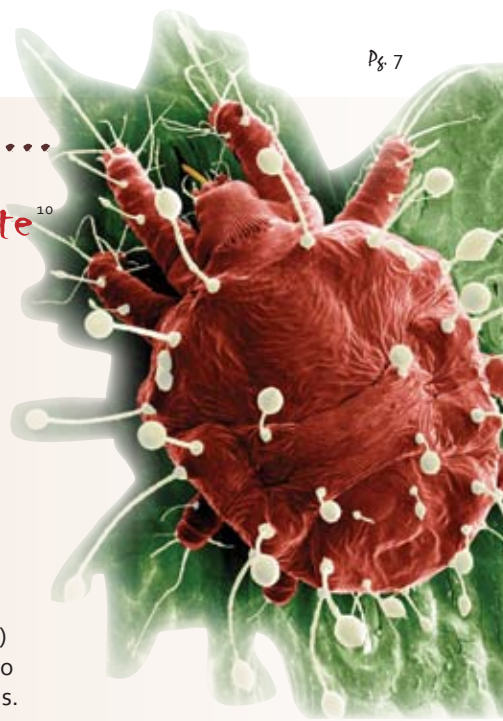
**Once introduced...
they are very likely irreversible!**

⁹ Information from P.A Schofield et al (2010) and Hare, J.A., and P. E. Whitfield. 2003. An integrated assessment of the introduction of lionfish (*Pterois volitans/miles* complex) to the western Atlantic Ocean. NOAA Technical Memorandum NOS NCCOS 2.

Fast Facts about....

red palm mite

The Red Palm Mite¹⁰



Origins

Red palm mite, *Raoiella indica* Hirst (acari: Tenuipalpidae) is a pest of coconut, areca palm and date palm in the Eastern Hemisphere - Egypt, India, Iran, Israel, Mauritius, Pakistan, Sri Lanka and Sudan. They can be distinguished from spider mites by their red colour, long spatulate setae (hairs) and flattened bodies.

Transport of infested plants or plant material appears to be the major mode of spread for this mite. Seed coconuts and handicraft(hats, bowls, etc) have been found to harbour live mites and viable eggs.

Impact

The 2004 sighting of red palm mite on Martinique was the first in the Western Hemisphere. Since then, the mite has been confirmed in Saint Lucia and Dominica in 2005, and Trinidad, Guadeloupe, Jamaica and Grenada among others in 2006.

The mites are usually found on the underside of leaves, often in large groups of hundreds of individuals and are visible to the naked eye. The explosive appearance of red palm mite in these countries makes it a serious pest risk for the Caribbean and sub-tropical regions of the USA. The mite could be an enormous threat to the ornamental palm industry as well as banana, coconut and date production. Significant infestations have been observed in the Caribbean on banana plants (*Musa* spp., *Musaceae*), heliconias (*heliconiaceae*) and gingers (*Ziniberaceae*).

Control

There are pesticides that can control the red palm mite. The US Institute of Food and Agricultural Sciences (IFAS) is developing treatment protocols and research for long-term, biological control agents is ongoing. Some of the possible biological control agents that have been useful in the Eastern Hemisphere include predatory mites (*Phytoseiidae*), predatory beetles (*Chrysomelidae*), lacewings (*Chrysopidae*) and other mite predators.

Monitor their movements!

¹⁰ 'Significant Pest Bulletin-Red Palm Mite', United States Department of Agriculture Animal and Plant Health Inspection Service and 'Red Palm Mite Information' by Cal Welbourn, FL Department of Agriculture & Consumer Services, Division of Plant Industry (FDACS/DPI)



Fast Facts about.... *frosty pod rot* Frosty Pod Rot

Origins

Frosty pod rot, also called Monilia, is an invasive disease affecting cocoa caused by the fungus *Moniliophthora roreri*. Until the 1950s, frosty pod rot was confined to the North-western South America (Colombia, Ecuador, Western Venezuela) and was not of widespread interest to other cocoa-producing countries. Its appearance in Panama in 1956 and Costa Rica in 1978 increased the geographic confines of the pathogen and changed perceptions of the disease. It has a high potential for transmission, carried by the wind, which extends its range.

Impact

Frosty pod rot produces masses of spores that appear as a white or tan powder on the pod's surface. The disease distorts the pods; they become asymmetric or develop a mosaic-like pattern of green, yellow, and cream. It rots the pod's interior. The beans are already destroyed by the time the symptoms begin to surface. Infested plantations may suffer dramatic yield loss, leading to neglect of trees by farmers and complete loss of production. Trinidad and Tobago is the home of fine flavoured Trinitario cocoa and the International Cocoa Genebank (ICGB). Frosty Pod Rot is a threat to cocoa and the ICGB. The prevention of Frosty Pod Rot from invading the cocoa resources of the Caribbean will be of critical importance to the economic well-being and bio-diversity of Trinidad and the rest of the Caribbean.

Control

Avoidance is the best strategy to be followed in countries or areas still free of the disease. Because human-mediated dispersal of this fungus into new areas and countries represents the most serious threat, major efforts should be made to strengthen quarantine measures and educate producers about the risks of moving pods from affected areas. Various cultural, chemical, and biological strategies have been tested for the control of Frosty pod rot. The best time for cultural control is when the symptoms first appear. Suspected pods should be harvested and destroyed by burning before the pod turns frosty.

Keep it Out!



An Ounce of Prevention... better than A Pound of Cure

Preventing IAS is the most cost effective and feasible control strategy.

However, generally, within the Caribbean the management capacity to mitigate the threat of IAS is limited. There is little awareness of IAS beyond the agriculture and trade sectors.

Further, no comprehensive national legislation on invasive species has been developed in any country in the region except for the Bahamas. For example, the Control of Importation of Live Fish Act (1952) in Saint Lucia and the Mongoose Act (1918) in Trinidad and Tobago are species-specific legislation, indicating that impact of introduction of non-indigenous species was historically recognised.

Generally, policies developed to address the conventional externalities surrounding biodiversity loss, such as, economic tools (taxes, subsidies, permits), may not always be suitable for addressing the problems caused by invasions.

The IAS problem in the Caribbean is multi-sectoral in nature that demands the involvement of governmental and non-governmental agencies, as well as collaboration among a broad range of stakeholders at the local, national, regional and international levels.

There is an urgent need for new economic approaches to mitigate the IAS threat to local biodiversity and economy.

IAS also leads to adverse social and health impacts. Outbreaks can restrict travel from and to affected areas (e.g. swine flu, disrupt school system), limit hosting of public events, such as, cultural festivals; affect availability of local foods due to devastation on local agriculture, increase the demands on health systems and cause significant loss of productive man hours due to ill health.

Tackling the IAS Problem in the Caribbean

a role for all
Who and What?

Public Sector Policy Makers and Public Service

Plan:	Develop a national policy and strategy Clearly define goals and objectives, as the first step in formulating an invasive alien species plan.
Prioritise:	Pace yourself since successful management and mitigation of the threat of IAS requires capacity for both rapid response and long-term mitigation.
Publicise:	Communicate the plan to all sectors of society. Undertake public education and enhance public awareness.
Protect:	Establish national regulations in accordance with the International Plant Protection Convention and strengthen enforcement capacities for successful IAS control.
Pull-it-all together:	Improve coordination among stakeholders... multilateral environmental agreements and other regional and international institutions in particular with sharing of information on the status of IAS

Educators and Youth

Empower the Public	Public education is an important tool to minimize invasive species introductions. Provide information, including brochures, posters, and lectures on invasive alien species to target sections of employees, the public and media houses.
Educate the Children	Teachers encourage students to explore the role of species introduced into our natural ecosystems and how to prevent their introduction. There are many online resources with information, interactive games and classroom activities.
Engage the Youth	Youth get involved and volunteer to help with local invasive plant eradication or control initiatives. Learn to recognise invasive species and be alert for signs of new potential threats. Learn more about the environment and adopt what you learn in your daily lives.

Tackling the IAS Problem in the Caribbean

a role for all

Who and What?

Business Sector

Micro & Small Enterprises - Medium and Large Companies

Horticulturalists/Landowners

Be Informed:	Seek information; educate yourself; keep abreast of the issues of the environment.
Be Responsible:	Incorporate good practices in production, processing and waste disposal operations. Ensure that business activities do not damage the environment
Be Compliant:	Adhere to all laws and quarantine regulations regarding import and export of all biological material, including Pest Risk Analysis. Comply with all public advisories on new IAS.
Be Proactive:	Educate and train employees and associates on IAS issues and the environment
Be Selective:	Use native plants to landscape and create gardens that provide food, cover or nesting sites for local wildlife, including butterflies and birds
Be Vigilant:	Be cautious when buying plants and seeds on the Internet or by mail order. If you see your local nursery selling invasive plants or seeds, inform them of your concerns. Report all suspicious plants and/or animals to the competent authorities.

Consumers

Pet Owners:	Purchase pets from reputable dealers. Do not keep pets and animals that could escape and become invasive. Never release an unwanted pet to the wild- return it to a qualified person, pet shop, zoo or humanely dispose of it.
Travellers:	Leave biological items in their natural habitats. Clean hiking boots before walking in a new area as invasive weed seeds are common hitchhikers. Comply with all quarantine rules and regulations.
Boating and Fishing Enthusiasts:	Always wash boats with hot, high pressure, tap water on the land-side before travelling to a new waterway. Let boats dry five days before using it in another water way. Remove all suspicious material and wash all fishing equipment

Tackling the IAS Problem in the Caribbean *a regional response*

The Caribbean has several ongoing regional initiatives for dealing with IAS. These include:

Technical Teams/Working Groups:

Caribbean Invasive Species Working Group CISWG: initiated as an action group to focus on invasive species at the Caribbean Food Crops Society (CFCS) 2003 meeting. In 2004, the group eventually became CISWG and includes a range of regional, national and academic organisations (e.g., CARDI, CABI, CARICOM, USDA/APHIS, FAO, IICA UWI, UF, TNC). CISWG is focussed on the prevention of introduction of IAS, particularly in the agriculture and trade sector. The group maintains its focus on agricultural commodities recognising the role of other groups focussed on the environmental and veterinary aspects of invasive species. At its 2004 meeting, a draft Caribbean Invasive Species Intervention Strategy (CRISIS) was developed.

Caribbean Regional Invasive Species Intervention Strategy (CRISIS): an initiative of the CISWG was accepted by CARICOM in 2006 as a working framework for enhanced cooperation on activities to safeguard agriculture, fisheries, human health and Natural Resources against invasive species threats. The strategy identifies the following overarching goals: prevent the introduction of invasive species, reduce the impact and spread of existing invasive species, develop harmonised policies and regional cooperative networks, develop and maintain effective communication networks, build management and research capacity, raise awareness, facilitate access to and retain markets, promote interaction with stakeholders and develop technical capacity to manage invasive species and their major pathways of introduction

CISWG also promoted a project to develop a Caribbean Invasive Species Surveillance and Information Program (CISSIP) that would create six information hubs in the Caribbean to develop a diagnostic network support program on pest detection and identification, pest surveys and public education.



invasive aliens

Tackling the IAS Problem in the Caribbean
the CABI project



STOP

INVASIVE ALIEN SPECIES (IAS) ENTERING, INVADING AND DESTROYING THE CARIBBEAN

THE OBJECTIVES OF THE PROJECT:

Promoting Regional IAS Strategy

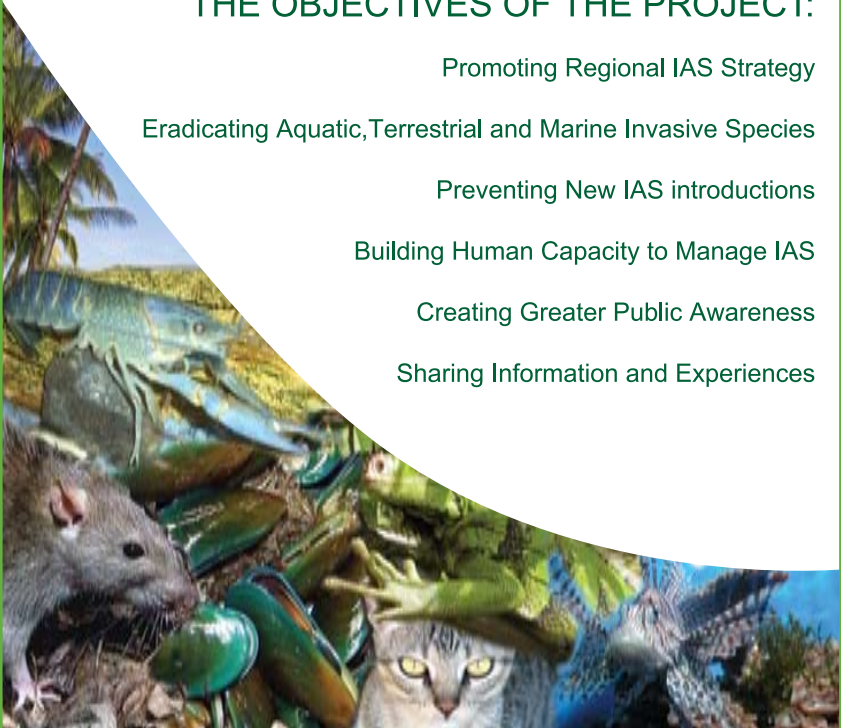
Eradicating Aquatic, Terrestrial and Marine Invasive Species

Preventing New IAS introductions

Building Human Capacity to Manage IAS

Creating Greater Public Awareness

Sharing Information and Experiences





This issue features 'Invasive Alien Species' (IAS) which is a leading cause of loss of native biodiversity in the Caribbean. They also directly impact human lives. For example, the 'invasion' of Africanized bees has caused a change in the local strain of bees and loss of human life. Loss is also measured in economic terms as a result of direct damage to crops and livestock. Post harvest losses are also quite significant. This is a serious problem in many Caribbean islands.

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