GOVERNMENT OF ANTIGUA AND BARBUDA

DEPARTMENT OF ENVIRONMENT

National IAS Strategy and Action Plan

Project Activity # 1.2.4 Develop Content for NIASSAP

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Acronyms

ABNSBAP: Antigua and Barbuda National Strategic Biodiversity Action Plan
CABI: Centre for Agriculture and Biosciences International
CBD: Convention on Biological Diversity
DOE: Department of Environment
GEF: Global Environmental Fund
GOAB: Government of Antigua and Barbuda
IAS: Invasive Alien Species
MALF&BA: Ministry of Agriculture, Lands, Fisheries and Barbuda Affairs
MES&T: Ministry of Education, Science and Technology
MH&W&E: Ministry of Health, Wellness and the Environment
MHL&UR: Ministry of Housing, Lands and Urban Renewal
NIASSC: National Invasive Alien Species Steering Committee
NISSAP: National Invasive Species Strategy and Action Plan 2020-2030
OECS: Organization of Eastern Caribbean States
TOR: Terms of Reference
UNEP: United National Environment Programme

EXECUTIVE SUMMARY

This National Invasive Species Strategy and Action Plan 2020-2030, (NISSAP) will guide Antigua and Barbuda's efforts to protect its natural heritage and people's health and livelihoods from the negative impacts of invasive species. The two-pronged strategy tackles the issue by:

- Preventing new invasive, or potentially invasive species from arriving and becoming established; and
- Acting against existing priority invasive species at priority sites.

The NISSAP was prepared for the Ministry of Health, Wellness and the Environment of Antigua and Barbuda. The Department of Environment is charged with the responsibility of oversight, to assist with the planning and development of the NISSAP as one of the key outputs under the UNEP-GEF/ CABI executed regional IAS project.

This document operationalizes the invasive species component in the Antigua and Barbuda National Strategic Biodiversity Action Plan 2014 - 2020. It also assists with meeting the country's commitments under the UN Convention on Biological Diversity, in particular *Target 1*.
This guide also contains activities that address invasive species under the Thematic Areas of the Guidelines. Preparation of the plan was funded as one of the priority activities of United Nations Environment Programme and executed by CABI with support from the Ministry of Health, Wellness and the Environment.

The introduction and spread of invasive plants, animals and pathogens is one of the greatest threats to biodiversity, primary production and amenity in the Antigua and Barbuda National Strategic Biodiversity Action Plan 2014 – 2020. Invasive species compete with indigenous plants, animals and other desirable species for resources, spread disease and prey on desired species for food. The most effective way to manage invasive species is to prevent their initial incursion. Invasive species have the ability to establish quickly in new areas and require a timely and rapid response. Many invasive species are already widely established in Antigua and Barbuda and their eradication across large areas is not achievable with existing resources. Resources need to be focused into areas where the benefits of management are the greatest.

The National IAS Steering Committee recognizes that the management of invasive species across Antigua and Barbuda requires the engagement and involvement of numerous stakeholders. Creating a shared understanding of invasive species issues, the most effective control techniques and our strategic direction for management is critical for success.

The National Invasive Species Strategy and Action Plan aims to prevent new incursions, contain existing populations and adaptively manage widespread species. The NISSAP seeks to foster a cooperative culture where all relevant stakeholders contribute with the aim of minimizing the impacts of invasive species in Antigua and Barbuda.

What are Invasive Alien Species?

Invasive alien species are any organism that once introduced to a new environment, prove difficult for the native species to cohabitate with. They include land and water, plants, animals, insects and other invertebrates, pathogens and parasites. They cause significant harm to the natural environment, to communities and to Antigua and Barbuda's economy. They are usually introduced as non-native species, however, in some circumstances native species can become invasive in their native environments after certain changes occur. For example, one environmental change that favors some weed species to become invasive is deforestation, as they are suited to colonizing a site rapidly after disturbance. Environmental disturbance can also be caused by the use of a slash and burn agricultural technique or after a natural disaster such as a hurricane. Nevertheless, most invasive alien species are introduced from foreign countries into a region by people, either intentionally or accidentally. Some species proliferate, expand and damage the environment, while others do not. This happens depends on the individual species' requirements and the environmental conditions into which they have been introduced. This report is concerned about particular invasive alien species that have proliferated and are causing damage within Antigua and Barbuda's environment.

1.0 INTRODUCTION

1.1 About the Plan

Invasive plants, animals and pathogens are having significant impacts on the environmental, cultural, social and economic values of Antigua and Barbuda. Impacts include loss of biodiversity, reduced agricultural productivity, deterioration of the quality of sporting grounds and playgrounds, damage to heritage sites, issues of safety and site access and increased fuel loads. This plan supports a landscape view of invasive species management across Antigua and Barbuda and provides a strategic and coordinated approach to invasive species management across the landscape. It lays out the scope, vision, objectives, guiding principles and actions that staff, external agencies, contractors and landowners can use to manage invasive species within Antigua and Barbuda.

1.2 Our Mission

To protect the environment from harmful new invasive species through prevention and early action.

1.3 Our Vision

The vision of the *National Invasive Species Strategy and Action Plan* is that:
Antigua-Barbuda-Redonda have a biosecurity system that stops new invasive alien species and reduces the impacts of existing invasive species.

1.4 Our Objectives

The NISSAP identifies seven objectives to realize this vision:

1. Raising awareness of the negative impacts of invasive species on our natural heritage, economy and people.

2. Building institutions, skills, infrastructure, technical support, information management systems, networks and exchanges.
3. Preventing new species from arriving and establishing, or existing species getting to new areas, through early detection and rapid response to reduce ecological, economic and financial pressures.
4. Monitoring, reporting and recording invasive species to track the threats posed by new and established invasive species and guide the management response.
5. Mounting Risk Assessment tools that can be used to: (i) identify invasive or potentially invasive species before they are introduced to our country; (ii) estimate the actual and potential impact of an invasive; and (iii) help with prioritizing the key actions necessary to minimize the negative impact and/or manage the invasive species.
6. Prioritizing actions that can be taken to eradicate small populations of recently arrived invasive species.
7. Reviewing the legislative framework in Antigua and Barbuda to deal with increasing trade and tourism.

In order to do this, the National Steering Committee will take a wide view of invasive species management, implement a bio-security approach, prioritize the protection of high value environmental and agricultural assets and work in partnership with all stakeholders.

The goals, objectives and actions of the *National Invasive Species Strategy and Action Plan* endeavor to deliver specific measurable outcomes that complement Antigua and Barbuda's targets for biodiversity enhancement as identified in the *Antigua and Barbuda National Strategic Biodiversity Action Plan 2014 – 2020.*

1.5 Scope

The plan is designed to build on the ongoing effort and dedication of the National IAS Steering Committee, external agencies and community to provide an effective and coordinated strategy for moving forward in the management of invasive species across Antigua and Barbuda. The plan provides a response to invasive species management with a focus on the roles and responsibilities

of National IAS Steering Committee. It includes actions to be undertaken directly by various ministry staff in managing public land and in supporting residents and community groups to mitigate the impact of invasive species on private land.

The NISSAP is one stage in the process of preventing the arrival and establishment of new invasive species and acting to manage existing priority invasive species. It provides for the protection of people's livelihoods and for the conservation of biodiversity. To maximize the benefits of available resources, the focus of the NISSAP is to manage invasive species threats to priority species and priority sites. The NISSAP addresses threats to terrestrial, marine and freshwater ecosystems. The marine and freshwater components will be expanded as information becomes available. The NISSAP is for the period 2020-2027, however the document is meant to be a working draft that will be continually updated as new information becomes available.

The Plan ensures that the National IAS Steering Committee:

• Aligns with national and state legislation and policy relating to invasive species.
• Implements best practices in invasive species management on public and private lands.
• Works strategically within council and externally with community and other agencies.
• Maximizes opportunities to engage and support private landholders to manage invasive species on their land.

1.6 Guiding Principles

The *National Invasive Species Strategy and Action Plan (NISSAP)*promotes the following principles in the management of invasive alien species.

a) Risk Management
• Management of invasive species that pose the greatest risk.
• Management methods that reduce the risk to biodiversity, cultural and productive assets and to people.

b) Asset Based

• Protecting the highest value assets at the greatest risk.

c) Biosecurity Approach

• Management of invasive species at all stages of invasion.

• Economic returns for managing invasive species are much higher when infestations are new or small.

d) Landscape Scale

• Landscape scale means considering invasive species from the impact on an individual plant or animal, a property, or the country level.

Invasive species can disperse long distances and therefore need to be managed collectively at a landscape scale to achieve long term benefits.

e) Collaborative/Cross-Tenure

• Management of invasive species is only achieved at a landscape scale when we work together across different land tenures.

f) Strategic

• Decisions are based on the best available evidence.

• Planning manages risks, is asset based and follows the biosecurity approach.

• Planning is targeted, coordinated and integrated across different programs and different stakeholders.

g) MERI Approach

- **M**onitoring –collecting the data.
- **E**valuating –interpreting the data
- **R**eporting –presenting the monitoring and evaluation.
- **I**mproving-changing processes based on monitoring and evaluation.

h) Ethical

• Invasive species are living creatures and therefore control methods should minimize pain (humane control methods).
• Prevention and methods that keep species at lower numbers reduces the need for culling

1.7 Stakeholders

Invasive species spread through private and public land and from commercial and private enterprises, therefore developing partnerships is critical to the success of invasive species management programs. The benefits of partnerships for invasive species management include the sharing of knowledge, experience and resources, as well as encouraging coordination of activities to achieve more effective outcomes. Helping people to understand the key invasive species issues, involving people in invasive species control using the most effective techniques and focusing efforts and energy in the right direction is critical to effective invasive species management.

This NISSAP was prepared for the Ministry of Health, Wellness and the Environment of Antigua and Barbuda, with the Department of Environment charged with the responsibility of oversight, to assist with the planning and development of the NISSAP. Development of the NISSAP is one of the key outputs under the UNEP-GEF/ CABI executed regional IAS project.

2.0 Strategic Aims

This strategy will guide Antigua and Barbuda's efforts to effectively address the issue of invasive alien species to protect our natural heritage and our people's livelihoods by:

- Preventing new invasive or potentially invasive species, from arriving and establishing on the islands.
- Acting against existing priority invasive species at priority sites.

3.0 Objectives

Antigua and Barbuda has decided to craft the objectives for its NISSAP to meet its national circumstances as relates to IAS and to correspond, where appropriate with the following: the

Antigua and Barbuda National Strategic Biodiversity Action Plan 2014 – 2020; Antigua and Barbuda 2017 Dossier on Invasive Alien Species; Convention on Biological Diversity, Caribbean Community; Antigua and Barbuda Fifth National Report to the Convention on Biodiversity 2014; and the United Nations Environment Programme Dossier: **Preventing Costs of Invasive Alien Species in Barbados and the OECS Countries.**

3.1 Public Awareness and Engagement

Raising awareness of the negative impacts of invasive alien species on our natural heritage, economy and people is necessary to encourage government, the business sector and the wider community to work together to reduce these risks.

3.2 Capacity Building

Capacity building of institutions, skills, infrastructure, technical support, information management systems, networks and exchanges need to be continually developed.

3.3 Establishing Bio-security

Preventing new species from arriving or the spread of existing species is the most cost-effective way to manage invasive species. Early detection and rapid response make better use of existing resources in order to reduce future ecological, economic and financial pressures.

3.4 Monitoring and Establishing Baselines

Ascertaining baselines and an effective system for monitoring, reporting and recording invasive species will help track the threats posed by new and established invasive species and guide the management response.

3.5 PrioritiseManagement of Invasive Alien Species

It is crucial to prioritize management of invasive alien species using risk assessment tools. Risk assessment is a tool that can be used to: (i) identify invasive or potentially invasive species before they are introduced to our country; (ii) estimate the actual and potential impact of an invasive species; and

(iii) help with prioritizing the key actions necessary to minimize the negative impact and/or manage the invasive species.

3.6 Development of Species Specific Management Plans

Developing species-specific management plans is an effective way to eradicate small populations of recently arrived invasive species or reduce the impacts of others invasive species.

3.7 Enforcement

Reviewing the legislative framework in Antigua and Barbuda to minimize the risk posed by international trade, international travel, pet and aquaria and horticulture trades. Update protocols and best practices to minimize risk of new marine IAS, risk for stakeholders engaged in international passenger travel. The framework must be coherent, comprehensive and effective and help government, communities and business to work together to address invasive species issues.

4.0 Why is the Issue of Invasive Alien Species (IAS) important?

Impacts from invasive alien species can negatively affect multiple aspects of Antigua and Barbuda society, both directly and indirectly. Invasive species negatively affect the health of forests, biodiversity, food gardens, commercial agriculture, food security, tourism, the wider economy and community health. Invasive species compete with (and often out compete) and/or directly harm the natural resources. These impacts are significant, real and costly.

5.0 Invasive Species in Antigua and Barbuda

Antigua and Barbuda is characterized by an environment of relatively rich agricultural land, open spaces and no rivers. However, these characteristics are under constant threat from the pressures of invasive species from residential and agricultural development. Given the huge potential for invasive alien species establishment in Antigua and Barbuda, and limited resources available, it is necessary to prioritize action. This requires the assessment of a species current distribution and its

ability to establish and spread. This determines whether it is a high threat to biodiversity, agricultural and amenity assets. There are three types of invasive species:

New: a species that is not yet in Antigua and Barbuda, but may be in neighbouring countries or regions of similar climate and conditions. These species would have significant potential to invade and spread if they were to establish within the country.

Emerging: a species that has recently been detected in the region or has been here for some time but has only recently begun to expand its distribution.

Established: a species that is already established and widespread within Antigua and Barbuda.

Over the past 25 years, Antigua and Barbuda has seen the introduction of at least 22 verified invasive alien species. Twelve (12) species have been identified in Antigua and Barbuda as priority concerns. Giant African snail *(Achatina fulica*), the Lethal Yellowing Phytoplasma of palms, Black Rats (*Rattus rattus*), Lionfish (*Pterois volitans*), the Southern Cattail *(Typha domingensis*),Cuban Tree Frog (*Osteopilus septentrionalis*), Agave Snout Weevil *(Scyphophorus acupunctatus*), Brown Rats (*Rattus norvegicus*), Citrus Greening disease *(Candidatus Liberibacter),*Budrot of palms (*Phytophthora palmivora*), Indian Mongoose (*Helogate parvula)*, Varroa mite (Varroa spp. (Varroa mite)and lemon grass (*Cymbopogan* spp) are reported to be among the nation's priority invasive alien species. Climate change modeling suggests the region will be subject to higher temperatures and lower rainfall that will affect species' distribution. The potential for more frequent extreme weather such as flood and fire events increase the opportunity for invasive species establishment. The challenge for the country is to support the protection and restoration of our valuable natural and agricultural assets from the ongoing invasion of a diversity of invasive species. According to the national budget Antigua and Barbuda spends approximately $1M XCD annually on the management of invasive alien species.

5.1 Invasive plants

Hundreds of plant species are present in Antigua and Barbuda, but not yet naturalized. Harris (1965) and other authors (Lovelace, 1960; Beard, 1949) have collectively identified 204 alien plant species in Antigua. Many were introduced for food or other specific purpose, and many have become naturalized. The current rate of new plant naturalizations in Antigua and Barbuda is at least ten per year, with an estimated 35 species already naturalized.

Table 1: Invasive Alien Plants in Antigua and Barbuda

Scientific name	**Common name**
Cymbopogan spp	Lemon grass
(typha domingensis	Southern cattail
*Antigonon leptopus**	Coral vine, Coralita
*Acacia tortuosa**	Cassie
*Acacia macracantha**	Cassie
*Haematoxylon campechianum**	Blackwood tree, Bloodwood tree
*Azadirachta indica**	Neem
*Prosopis juliflora**	Mesquite
*Leucaena leucocephala**	White lead tree, River tamarind,
*Eichhornia crassipes**	Common water hyacinth,

Source: Antigua and Barbuda 2017 Dossier on Invasive Alien Species; Invasive Alien species – Antigua and Barbuda: A Status Report (2017), *The Wild Plants of Antigua and Barbuda (2009)

Weeds, seeds and cuttings can enter and spread across the country through nursery sales, garden plantings, dumped garden cuttings, on vehicles and machinery, in waterways, by wind, by animals and on clothing. Invasive plants can destroy habitats, out-compete native plants, choke waterways, reduce farm productivity, harm livestock and reduce the amenity value of public parks and gardens.

5.2 Invasive Animals

Feral or pest animals are species that have been introduced to Antigua and Barbuda since the European settlement. Invasive non-indigenous animals can have significant impacts on Antigua and Barbuda's natural environment, as well as being detrimental to agriculture. They may graze on indigenous plant species, reduce crop production and prey on livestock or on indigenous fauna, or in the case of the mongoose feed on avian eggs, compete with indigenous animals for resources such as food and shelter. Introduced animals have become established in the country through escape from captivity and domestication, deliberate release (legal and illegal) and accidental relocation via transport. The species that establish in the wild typically have few natural predators or diseases, high reproductive potential, a generalized diet, are adaptable to a modified landscape and have a climatic match between the place where they become established and the place where they occur naturally, for example goats and pigs. These factors result in populations which do not

naturally diminish and can multiply rapidly if conditions are favourable. The National Pest Management Plan (2012) highlights alien invasive black rats as the most pervasive pests on the offshore islands of Antigua and Barbuda. Rats have been eradicated from Redonda, Maiden West, and Great Bird Island, and there has been significant success in preserving the endangered Antigua Racer Snake, improving island vegetation, bird species populations, native snail populations and turtle nesting activities. While on mainland Antigua, the Giant African Snail continues to negatively impact agriculture and residential areas and is spreading at an alarming rate. Antigua and Barbuda has achieved successes in several eradication programmes that have targeted rats and several species such as the Pink Hibiscus Mealybug (*Macoonellicoccus hirsutus*) and the papaya Mealybug (*Paracoccus marginatus*) (see table 2).

Invasive vertebrate animals of major concern within Antigua and Barbuda include invasive fish, rats and house mice. Invasive invertebrate animals in Antigua and Barbuda include European Wasps, European Honey Bees and fire ants.

Table 2: Invasive Alien Animals in Antigua and Barbuda

Scientific name	**Common name**
Passer domesticus	House sparrow
Streptopelia decaocto	Eurasian collared dove
Lonchura punctulata	Nutmeg manikin
Zenaida asiatica	White wing dove
Osteopilus septentrionalis	Cuban tree frog
Pterois volitans	Lion fish
Helogate parvula,	Indian mongoose
Rattus rattus	Black rat
Capra hircus	Feral goats
Achatina fulica	Giant African snail
Pomacea canaliculata	Golden apple snail
Zachrysia provisoria	Cuban garden snail
Maconellicoccus hirsutus	Pink mealybug
Solenopsis invicta	Red imported fire ants

Anastrepha oblique	West Indian fruit fly
Nylanderia fulva	Hairy crazy ant
Scyphophorus acupuntatus	Agave weevil
Paracoccus marginatus	Papaya mealybug
Varroa destructor	Varroa mites
Raoiella indica	Red palm mite
Amblyomma variegatum fabricius	Tropical bont tick
Aleurocanthus woglumi	Citrus black fly
Pseudacysta perseae	Avocado lace bug
Gynaikothrips ficorum	Cuban laurel thrip

Source: Antigua and Barbuda 2017 Dossier on Invasive Alien Species; Plant Pest Management in Antigua and Barbuda (2018); Invasive Alien Species – Antigua and Barbuda: A Status Report (2017)

5.3 Invasive Pathogens

Invasive pathogens can include bacteria, viruses, fungi and parasites that have negatively impacted the organisms of the native environment usually by causing disease. They can have significant impacts on many native plants and animals, agricultural crops and domesticated animals. In many cases invasive pathogens can rapidly spread through natural habitats, affecting the health and resilience of indigenous species. It is necessary to focus on vectors for effective control.

Table 3: Invasive Alien Pathogens in Antigua and Barbuda

Scientific name	**Disease name**
Capnodium spp	Sooty mold on citrus
Candidatus Phytoplasma palmae (vector: *Myndus crudus*)	Lethal yellowing of palms
Phytophthora palmivora	Budrot of Palms
Candidatus Liberibacter asiaticus	Citrus greening of citrus

Source: Antigua and Barbuda 2017 Dossier on Invasive Alien Species; Plant Pest Management in Antigua and Barbuda (2018); Invasive Alien species – Antigua and Barbuda: A Status Report (2017)

There are other pathogens which directly affect human health, e.g., HIV, COVID-19 which should not be ignored; however, they are outside the scope of this project.

5.4 Pathways of Threat

Without managing pathways of threat, management may be ineffective in the long-term as invasive alien species are successful because of their ability to disperse from many sources and through many processes. To determine a priority for response, mapping and monitoring is critical to identify where invasive species are dispersing from and at what rate. The following factors represent potential pathways for the spread of invasive species into and within Antigua and Barbuda:

1. Ongoing development and associated movement of people and vehicles can result in the spread of invasive plant species and pathogens.
2. The continued selling and planting of invasive plants through nurseries and landscape businesses.
3. Limited community interest, knowledge and skills in identifying and managing invasive species.
4. Indiscriminate dumping of garden cuttings and IAS infested soil in parks and reserves.
5. Unrestricted access to highly significant forests in protected areas by recreational users.
6. Movement of machinery used in landscaping, maintenance and earth works including soil disturbance.
7. Transporting of stock feed and soil.
8. Movement of landscape materials, especially quarry products.
9. Properties with threats not managed due to age of owner, ability of residents, inexperience, absence and attitude.
10. Occurrence of fire and drought which impacts species establishment and expansion.
11. Movement of invasive plants and pathogens by animals, spread by water, wind movement and soil disturbance.

5.5 Impacts of Invasive Species

Invasive species affect the environment, the economy and the social well-being.

5.5.1 Environmental impacts

Within natural ecosystems, invasive plants and pathogens alter the vegetative structure and reduce floristic diversity. This change often favours exotic fauna at the expense of indigenous species which can also contribute to an increase in fuel loads. Invasive animals are a significant threat to biodiversity through competition, predation, habitat destruction and through the spread of diseases. Small native mammals, ground-nesting birds and some small reptiles are particularly susceptible to predation by mongoose and rats.

5.5.2 Economic impacts

The annual cost of invasive plants to Antiguan and Barbudan agriculture, is an estimated $4M XCD (Dr. J. Gore-Francis, personal communication, October 16,2019) through yield losses and product contamination. Agricultural invasives compete with crops and affect quality and yield of produce. They reduce the carrying capacity of pastures and can poison or cause injury to livestock or contaminate fibre. In all cases their control increases the cost of production. Some water weeds, such as Water Hyacinth (*Eichhornia crassipes)* degrade the quality of waterways which then impacts on agriculture, groundwater stock, aquifers, surface water catchments, thereby affecting our water reserves for life. Additionally, invasive species affect the economy, they impact environmental services, cause health implications, increase fire risk and damage infrastructure.

5.5.3 Social impacts

Social impacts of invasive species are difficult to quantify. However, they may include:

• Conflict between neighbors and between sections of the community with differing attitudes to invasive species management.

• Stress to farm businesses due to the financial consequences of invasive species.

• Interference with recreational activities, damage to infrastructure or culturally significant sites.

• Distress caused to farmers when invasive animals injure or kill livestock.

• Development of human health problems following contact with invasive species e.g., pathogen carried by the Giant African Snail

• Disturbance from nuisance pest animals such as the presence of rats in a domicile.

There is a historical trend in the loss and extinction of biodiversity in Antigua and Barbuda by the clearing of its original vegetation. This includes the cultivation of sugar cane and cotton as well

other financially viable and unsustainable developments and land use change. However, the primary role of development is to improve the quality of human life through utilization of and access to resources. From observation, the trend shows that although most of Antigua and Barbuda's development has been based on the utilization of our environmental resources, the pathway to development has failed to find an environmentally sustainable course. If invasive alien species are not controlled or eliminated from the national landscape, the quality of human life will be compromised.

Threats to national biodiversity have been primarily due "to human activities in pursuit of economic and social development" (ABNSBAP, 2014, p12). However, in addition to "human development activities, the country is facing more emerging threats mainly in the form of invasive species and climate change associated impacts" (ABNSBAP, 2014, p12). This document highlights the biodiversity challenges and threats faced by Antigua and Barbuda (ABNSBAP, p12 & 13). The challenges are:

1. Fragile terrestrial and marine ecosystems such as mangrove wetlands and coral reefs endangered by development projects, pollution and misuse.
2. Vulnerability to external economic and natural environmental shocks, such as economic recessions, hurricanes, and climate change. Droughts and hurricanes have severely impacted the bird population, as well as vegetative communities and their dependent fauna.
3. Lack of human resource capacity in key biodiversity areas and other related fields.
4. Conflicting land use pressures, especially among housing, tourism and agricultural activities.
5. Land degradation; and limited institutional capacity to manage the development process because the presence of weak and fragmented land use and development control mechanisms.

The threats include:

1. The loss of habitat primarily through the sub-division of lands for housing, tourism development, agriculture and the mining and dredging of sand.

2. Fragmentation of natural communities by roadways, and other man-made features that form a barrier to the movement and dispersal of species.
3. The introduction of non-native species, like the Giant African Snail, mongoose, lemon grass and Lionfish that have a detrimental effect on native wild species by acting as predators, parasites or competitors.
4. Overgrazing by livestock mainly goats, sheep, cattle and donkeys that pose a serious threat, particularly in upper watershed areas.
5. Pollution as a result of excessive nutrients or sewage discharge into coastal waters, as well as the unregulated and excessive use of pesticides.
6. Natural and anthropogenic activities that stress coral reefs (directly and indirectly including through overfishing)

Invasive alien species seems to be dominant in habitats that have been modified, by destruction, overcrowding, over-exploitation, and destructive fishing methods. Mangroves that function as nurseries, breeding grounds and habitats for both marine and terrestrial wildlife are being destroyed for coastal development, especially associated with the tourism sector. The sea turtle populations are being impacted by the destruction of critical nesting and foraging habitats through coastal construction, sand mining, pollution and over-fishing. Furthermore, the regulatory mechanisms, though effectively enhanced with the enactment of the new Fisheries Act and its accompanying regulations, is undermined as the necessary capacity to enforce these laws to protect nesting and foraging turtles and their habitats is inadequate. Sea grass beds that provide food for fish and turtles and also function as nurseries for young conch, spiny lobsters, shrimp and a variety of fish are being destroyed. Coral reefs are in very poor condition, stressed by high sedimentation, and activities like over-fishing, destruction by the anchoring of boats, improper placement of fish traps, garbage, breakage by recreational diving, and the release of partly treated sewage from coastal holiday developments directly into the sea.

With an increased awareness of the impact of climate change and the importance of the country's natural resources to its economic survival, renewed efforts have been undertaken to prioritize the

protection of such natural resources in the country. This has had significant successes as the government, in partnership with a number of international and regional organizations, has begun the necessary steps to establish and implement a system of protected areas, and develop other policies for natural resource protection and management.

6.0 Meeting our Communities

Antigua and Barbuda is party to a number of international agreements that require conservation of its biodiversity and the sustainable use of its natural resources to meet the needs of the present population of Antigua and Barbuda without risking the ability of future generations to meet their own needs. The primary agreement is the Convention on Biological Diversity (CBD) to which the Government of Antigua and Barbuda acceded in May 1998.While it is important for the CBD parties to meet their obligations through ABNSBAP and other interventions, it is equally important to connect these to national priorities. In this regard, it is imperative to show this linkage in the NISSAP especially where there are socio-economic implications which need to be strengthened and addressed at the policy and implementation levels.

7.0 The Process of Ppreparing the Sstrategy and Action Plan

The Department of Environment contracted a project coordinator to prepare and facilitate through the IAS Committee developing the NISSAP. The NISSAP is based on:

1. The Antigua and Barbuda 20017 Dossier on Invasive Alien Species
2. The findings of existing public domain information,
3. The findings from face-to-face conversations / discussions / interviews with key stakeholders,
4. Discussions and agreements on priority threatened species and priority protected areas/conservation areas/valued sites with key stakeholders,

5. Antigua and Barbuda National Strategic Biodiversity Action Plan 2014 – 2020

6. Convention on Biological Diversity (2004) Antigua and Barbuda (Dossier on Invasive alien species). CBD secretariat, Quebec, Canada.

8.0 Audience for the strategy and action plan

The development of a NISSAP is a priority activity. It will support the work of government, businesses, and civil society to work in a harmonized manner in protecting the natural heritage and livelihoods of the people of Antigua and Barbuda from the negative effects of priority invasive species.

9.0 The Action Plan

Actions necessary to prevent new invasive species arriving and establishing, and to reduce the impact of existing invasive species on the natural heritage and livelihoods of the people of Antigua and Barbuda, are described in the Action Plan below. The Action Plan provides a response to invasive species management with a focus on the priorities, roles and responsibilities of government ministries and agencies. It includes actions to be undertaken directly by the government's operations and services and actions that support responses from residents and community groups. The vision, goals, objectives and actions in this document were derived through interdepartmental discussions and review as well as community feedback.

The Action Plan has been divided according to the objectives described in 3.0.
These actions have been developed through considerable internal and external consultation and are designed to ensure effective implementation of the plan. The implementation of these actions will involve the community, National Steering Committee and external organizations. All actions will be reviewed regularly and revised where necessary. Some actions will need to be supported financially by the government.
The table of actions are separated into Activities, Actions, Milestones, Review Date, and Responsibilities.

	Activities	Output	Milestones	Review Date	Responsibility	Status
*3.1**Public Awareness and Engagement*** OUTCOME 3.1: the impacts of priority invasive alien species on biodiversity, economies and livelihoods						
3.1.1 All activities maximize community involvement in planning, implementation and monitoring as appropriate	Train the community for implementation of a project	Training programme Report of training and implementation	Community group / network established. Community group maintaining invasive species project	2020	NIASSC MHW&E - DOE	
	Incorporate invasive alien species content into the biodiversity curriculum	School curriculum with invasive alien species content	Agreement with MOE to include invasive species in curriculum. Biodiversity curriculum contains invasive species content	2020	MHW&E -DOE MES&T NIASSC	
3.1.2 Government support for invasive alien species management is improved and the importance of IAS environmental, social and economic impacts is more widely understood	Develop mechanisms to factor invasive species management into national and regional decision-making processes	Mainstreaming plan	Mechanisms developed to include IAS in decision making processes in Antigua. Mechanisms tested and working. Mainstreaming plan written and effectiveness documented	2020	MHW&E - DOE NIASSC	

	Raise awareness and carry out outreach on the impacts of IAS.	Report on IAS impacts in Antigua and Barbuda Awareness material (s) Report on outreach campaign effectiveness	IAS impacts in Antigua included in outreach materials. Outreach materials distributed to key partners	2020	MHW&E -DOE MALF&BA – Department of Agriculture, Fisheries Division MW MES&T MT&I NIASSC	
3.2. Building Capacity OUTCOME 3.2: The institutions, skills, infrastructure, technical support, information management, networks and exchanges required to manage invasive species effectively are developed						
3.2.1Invasive Alien Species Coordinator is appointed and a multi - sectoral national invasive species committee is formed and operating with ongoing support from DOE	Establish position to coordinate activities under Antigua's GEF – invasive alien species project	Job description	Job description approved. Coordinator position filled and effectively coordinating project activities	2020	MHW&E MALF&BA MHL&UR	
3.2.2 A high quality National Invasive Species Strategy and Action Plan is updated	Develop a plan to monitor the effectiveness of the NISSAP	Monitoring plan	Technical working group develop monitoring plan	2020	NIASSC	
	Review and revise NISSAP	Revised NISSAP	NISSAP reviewed, revised and endorsed by GOAB.	2020	NIASSC	

3.2.3 Training / capacity needs are identified and training programs for key invasive management issues are developed and implemented	Identify skills within the technical working group. Identify necessary skills to have in country and which skills need to be procedure from abroad.	List of available and required skills. Capacity Development Plan	Training needs analysis Training plan	2020	NIASSC	
	Identify gaps in the capacity currently available to implement the components of the NISSAP and strengthen capacity where needed	List of available and required skills. Capacity Development Plan	Training needs analysis Training plan	2020	NIASSC	
3.2.4 Antigua and Barbuda's invasive species management facilities and equipment are reviewed, development plans are produced, and facilities improved	Prepare and review a list of existing equipment and facilities currently available identifying gaps and determine means of filling the gaps	List attached as appendices to the NISSAP	List completed and reviewed	2020 annually	NIASSC	
	Prepare a list of registered chemicals (e.g., herbicides, rodenticides) available for invasive alien species management	List attached as appendices to the NISSAP	List completed and reviewed	2020 annually	NIASSC	
3.2.5 National and regional identification, management and	Disseminate and use the review completed by NIASSC.	Update NIASSC Review	NIASSC Review disseminated to stakeholders.	2020	NIASSC	

information tools for Invasive Alien Species are improved to reflect country needs;	Provide update / correction of information to NIASSC as necessary		New information sent to NIASSC			
3.2.6. Regional invasive services are used to strengthen the capacity of Antigua and Barbuda for planning, implementing, monitoring and evaluating its invasive species activities	Engage regional organisations with a mandate to manage IAS in Antigua's invasive species management activities (e.g., capacity development, surveys, project planning and implementation)	Records of regional organizations with a mandate for IAS management input into invasive species management in Antigua	Regional organizations with a mandate for IAS management engaged in invasive species management in Antigua	2021	NIASSC	
3.3 Establish Biosecurity OUTCOME 3.3 Mechanisms are established to prevent the spread of invasive species across international or internal borders and quickly detect and respond to those that arrive						
3.3.1 Inspection and treatment procedures are improved to reduce the risk of new invasive species threats to Antigua	Identify potential invasive species threats, based on pathway analysis and risk assessment (s), coming from other countries and develop appropriate pre border and at border interventions for priority invasive species. Train quarantine staff in identification of	Lists of threats from pathways section of the NIASSC. Review with their risk assessment and possible interventions Staff performance reports	List drafted. List finalized. Test agreed. Design approved. Material produced. TOR for review prepared, drafted and finalized. Protocol prepared, drafted and finalized.	2020	NIASSCMALF&BA (Quarantine division) MHW&E MW MHL&UR Police	

	potential new invasive species Prepare awareness materials (e.g., posters) to help both frontline quarantine staff and business sectors (e.g., tourism, importers) Investigate ways to improve the enforcement of existing legislation to include invasive species. Develop protocols to assist businesses and tourism operators with inter island biosecurity. Identify and address issues associated with ballast water and hull – fouling of commercial and recreational vessels at all ports of entry and main vessel routes.	Posters and leaflets Review of enforcement of existing legislation and revision where necessary Protocols for inter-island biosecurity Report of issues and solutions	Issues identified. Report drafted and finalized			
3.4 Establish baselines, monitoring and reporting. OUTCOME 3.4 System are in place to generate baseline information on the status and distribution of invasive species, detect changes, including range changes and emerging impacts.						
3.4.1 Surveys or monitoring systems	Collect, strengthen and store baseline	Survey reports	Target sites and species identified.	2020	NIASSC	

are implemented to document the status and / or impact of invasive and native biodiversity in marine and terrestrial sites (including protected areas) of Antigua and Barbuda. Results are included in data bases	information about the status and distribution of invasive species and establish a programme for detecting change	Populate databases. Updated NIASSC review	Surveys completed. Databases populated. Reports written			
3.5 Prioritize Management of invasive species. OUTCOME 3.5 Effective systems are established and implemented to assess risk and prioritize invasive species for management						
3.5.1 Establish national risk assessment systems for invasive terrestrial, freshwater and marine species	Review existing risk assessment procedures, identify and address gaps. Use existing Weed Risk Assessment Use networks to find or develop risk assessments for other species	Risk assessment review	Existing information used for risk assessment. SOP (Standard Operating Procedures) produced	2020	MALF&BA (Quarantine division NIASSC	
3.6 Development of Species-specific management plans OUTCOME: 3.6 The impact of priority established invasive species are eliminated or reduced by eradicating or controlling the target species						
3.6.1 Best practices are determined and implemented for	Begin pilot management projects for priority invasive species in priority sites	Management plans for selected priority sites	Plans implemented. Progress reported	2020	NIASSC	

invasive species management	to be selected after biodiversity surveys are completed and a management plan has been prepared.	Funding strategy Feasibility Studies Project design documents Operational Plan Progress reports				
3.6.2Priority invasive species are eradicated (completely) removed from Antigua and Barbuda	Conduct feasibility studies for potential eradication projects to be selected after biodiversity surveys are completed	Prioritization Report Feasibility Studies In depth planning and implementation eradication where feasible	Funding secure for Feasibility Study team visit PS team established. PS visit completed. Planning continues for implementation of feasibility eradication project (s)	2020	NIASSC	
3.6.3 Biocontrol agents are developed and released for appropriate target of IAS	Identify existing biocontrol agents for priority invasive species in priority sites identified in the National Action Plan Implementation of Biocontrol Options	Prioritization Report Review of potential biocontrol options Control or eradication of invasive species	Biocontrol agents identified for priority species. NIASSC would advise	2020	NIASSC	

3.6.4Invasive species are contained within limited areas or controlled at high biodiversity sites	Invasive species in priority sites to be selected after biodiversity surveys are completed	Prioritization Report Funding strategy Feasibility Studies	All planning (including funding) completed. Control operations underway	2020	NIASSC	
3.7 Enforcement OUTCOME 3.7 Appropriate legislation, policies, protocols and procedures are in place and operating to underpin the effective management of invasive species						
3.7.1 Invasive species legislation, regulations or protocols are consolidated harmonised and rationalized to improve IS management and effectiveness	Propose a new bill for biosecurity using the regionally harmonised Biosecurity Bill	Harmonised Bill	Bill proposed to government	2020	NIASSC	
	Review of laws to assess their ability to address IAS management	Legal review of Bills	Legal review completed. Bill (s) developed to ensure established IAS are addressed. Bill (s) proposed to Government	2020	NIASSC	

9.1 Funding priorities

The level of service the NIASSC can provide to undertake invasive species management depends on the amount of funding available from the Government of Antigua and Barbuda and external sources. The following priorities related to invasive species control appear for the most part in the Antigua and Barbuda National Strategic Biodiversity Action Plan (2014 – 2020). This list of priorities does not include consideration of funding for work required to train operational staff, review operational procedures or incorporate invasive species management (reporting and controlling) in open space, protected areas and sports grounds. These of imperative in achieving the objectives of this plan.

Priorities for NIASSC Funding:

a. Prioritize pest plant, pathogen and animal control programs in high biodiversity protected areas and private land where there is an identified immediate and unacceptable threat toa biodiversity asset.
b. Continue to recruit staff with excellent technical knowledge and resources to provide education and expert advice to landholders and community groups.
c. Update and align existing environmental education programs and resources related to invasive species identification and management to align with education and sustainability principles.
d. Provide innovative and targeted educational programs and material to raise community awareness.
e. Organize training in invasive alien species identification and management for landholders and community groups to develop skills and knowledge.
f. Build partnerships and strong networks between all land managers to facilitate a coordinated approach to invasive species management.
g. Make funding incentives available for invasive species management to friends and land care groups and landholders in areas identified as supporting high biodiversity and agricultural values.

h. Seek funding for invasive species management in protected areas.
i. Seek funding for targeted invasive species management on government land to compliment land care activities and protect high agricultural assets. Support establishment and operation of friends and land care groups in areas identified as supporting high biodiversity values.
j. Support ongoing ecological management of protected areas.

9.2 Monitoring and Reporting

The status of invasive species will be reviewed on a regular basis by staff based on feedback from community, contractors and staff observations. The Plan will be reviewed every ten years to revise the vision and objectives, accommodate new actions and revise existing actions. The community will be invited to have input into the review.

10.0 NATIONAL IAS STEERING COMMITTEE

There shall be a committee known as the " National Invasive Alien Species Steering Committee" whose members shall be appointed by the Minister

Roles and Responsibilities of the National Invasive Alien Species Steering Committee (NIASSC)

Role

To provide coordination for all agencies responsible for prevention, control and management of Invasive Alien Species

Responsibilities

Specific areas of responsibility are:

a) To provide technical advice to matters concerning the early detection, prevention, control, management and eradication of Invasive Alien Species.

b) To make recommendations to the Department of Environment for related activities that require changes to legislation, regulations, policy or the approval budget for the National Invasive Alien species Steering Committee (NIASSC).

c) To advise on policies that support relationships between the government go Antigua and Barbuda, private sector businesses and civil society organisations that are involved in environmental management specially to IAS.

d) To provide leadership to the community on IAS issues related to the environment, natural resources and infrastructure.

e) To work closely with other communities where policy issues overlap either in a lead of supporting rile with respect to IAS.

f) To take the lead in ensuring that IAS issues related to environmental management, agriculture and fisheries development and management of natural resources and infrastructure are raised in the appropriate forums within Antigua and Barbuda.

g) An oversight committee for monitoring the implementation of Invasive Alien Species management plans related to biodiversity preservation and conservation.

h) To facilitate knowledge sharing and networking on Invasive Alien Species management among local IAS stakeholders and international and regional scientific community agencies where the focus is on ecosystem and biodiversity.

National IAS Steering Committee

1. Assistant Director of Education, Curriculum affairs (or their representative) - Ministry of Education, Science & Technology
2. Senior Tourism Officer (or their representative) - Ministry of Tourism
3. Chief Town and Country Planner (or their representative) - Development Control Authority
4. Chief Fisheries Officer (or their representative) - Antigua Fisheries Division
5. Senior Extension Officer (or their representative) - Agricultural Extension Division
6. Chief Plant Protection Officer (or their representative) - Plant Protection Unit
7. General Manager (or their representative) – Antigua and Barbuda Port Authority
8. Secretary (or their representative) - Barbuda Council
9. Executive Director (or their representative) - Environmental Awareness Group
10. President (or their representative) - Antigua and Barbuda Fisherman Cooperative Society
11. Director (or their representative) - Department of Environment
12. Executive Director (or their representative) – GARD

13. Chief Legal Officer (or their representative) - Antigua and Barbuda Department of Marine Services
14. Chief Health Inspector (or their representative) - Central Board of Health
15. Chief Executive Officer (or their representative) - Antigua and Barbuda Airport Authority
16. Comptroller of Customs (or their representative) - Antigua and Barbuda Customs and Excise Division
17. Director (or their representative) – Community Development Division
18. Director (or their representative) - Ministry of Agriculture

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