Assessment of the International Trade Pathway for introduction of IAS into and between Barbados and the OECS via agricultural commodities, used equipment and vehicles, tyres and wood and wood products

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EXECUTIVE SUMMARY

The countries of the Caribbean are heavily reliant on the import of food. Much of the fresh produce is imported from USA although smaller quantities arrive from Europe and South America. There is some internal trade of agricultural produce within the region and there is an ongoing drive by the region to decrease the amount of food imported with the aim to locally produce 25% of the region's food by 2025.

The island nations of the Caribbean are particularly prone to invasive species due to their terrain, large coastline to area ratio and the amount of traffic which passes through the region. The role of an effective and functional phytosanitary system is extremely important for each island and for the wider region.

Generally, the phytosanitary system of the region falls well short of the guidelines of the International Plant Protection convention (IPPC) International Standards For Phytosanitary Measures (ISPM) 23 Guidelines for inspection. In many cases achieving none of the 7 bullet points outlined in that document. Similarly, compliance to standards within other IPPC documents which describe inspection processes; ISPM 41 (movement of used Vehicles, machinery and equipment) and ISPM 15 (Wood packaging material) were found not to be in full compliance.

Overall, the phytosanitary inspection facilities were poorly resourced with deficiencies in buildings, laboratory equipment and Wi-Fi access. The inspection process is not working as it should, and the lack of equipment and recognition reduces the morale of those working at the front line, whilst there are exceptions there are significant gaps within the inspection procedures.

The staff often lack authority to work effectively and reports of importers arguing with inspectors were common. There was little literature provided to front line staff and there was few to no ongoing training to ensure that inspections take place to the highest standard. Whilst the more senior members of the system were familiar with the potential invasive pests it was not clear that the inspectors knew what to look out for and no literature was provided to assist them in that regard. An attempt was made by the project to address this via the Caribbean Biodiversity Interception System (CBIS) that includes information on invasive species but at the time of the study this was only beginning to be used by the countries surveyed.

Once inspections have been made, the recording system and the records of phytosanitary inspection are generally inadequate, either a relatively small proportion of the cargo is inspected, or the records were incomplete. Moreover, once a potential threat was identified the level of diagnosis of the threat was inadequate.

There was almost no collaboration between customs and phytosanitary inspectors and given they are doing similar tasks (inspecting incoming material) in the same environment; it would benefit each country to ensure data was shared between the two authorities. There appeared to be reluctance to provide information held by customs to phytosanitary inspectors.

Within the allocation of resources there is too much emphasis placed on surveillance and management of invasive species and not enough on the prevention of an incursion. Money would be far better spent on prevention rather than management.

There appeared to be a lot to be gained by islands collaborating on Pest Risk Analysis and Horizon scanning, harmonised phytosanitary inspection and decision-making but that did not appear to happen. There was very little sharing of information between islands with regard what finds have been made and what pests they admit to having. In one case an island was making international enquiries to identify a pest whilst a neighbouring island had a large farmer-focused publicity drive on how to manage it.

The unwillingness to cooperate between islands is partially driven by political forces. Politicians are pushing for fluidity in trade within the region and phytosanitary system is seen as a hinderance to this process. The announcement of the presence of a pest would stymie the free flow of trade and disadvantage the country. Pressure is put on quarantine officers, not to release information on what pests are present in their country. Failure to yield to the pressure may have negative consequences on their careers. There is urgent need to sensitise, create awareness and advocacy as well as rejuvenate the phytosanitary system in Barbados and the OECS.

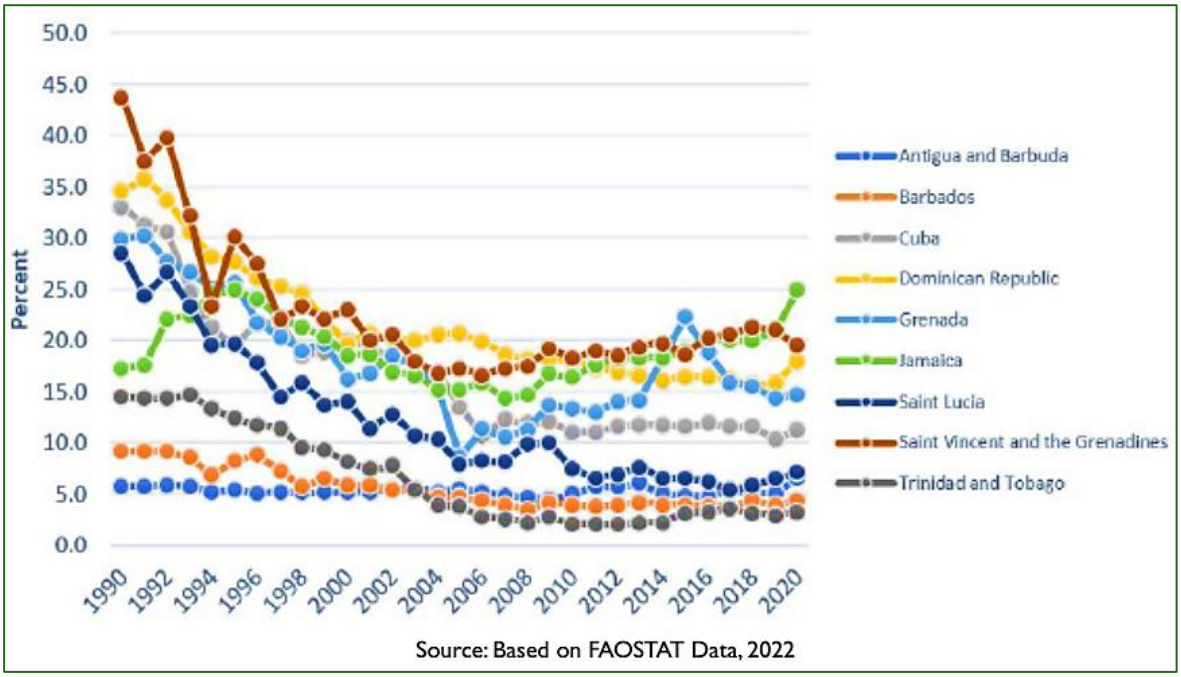
INTRODUCTION

The Caribbean region is a thriving community of many island nations whose economy is mostly based around agriculture and tourism.

The region is a net food importer and according to the FAO (2021), the Caribbean imports between 60 per cent and 80 per cent of its basic food requirements, to meet its domestic food needs, as well as feeding a significant number of visitors for its thriving tourism sector.

Traditional agricultural production reflected the colonial legacy of a plantation type agriculture where former Caribbean colonies produced tropical agricultural commodities for export under preferential conditions to European markets. Such exports have included in various periods, sugar, tobacco, cocoa, coffee, citrus, cotton, rice and most recently bananas. These trade agreements have all but disappeared now and due to the small size of the areas of production, and in some cases the terrain, there is little opportunity for economies of scale relative to continental production. This makes competition in the global market extremely difficult for small island economies. These factors have led to a reduction in the proportion that agriculture contributes to GDP in all countries of the region (Phillips, 2022) (Graph 1).

Graph 1: Agri-Value Added as a Share of GDP Selected Caribbean Countries: 1990-2020



https://repositorio.cepal.org/server/api/core/bitstreams/13ca87a7-82f8-4c86-820f-85514fe63fb2/content

There is now a drive within many Caribbean countries to increase food production and diversification for local consumption. This has been spearheaded by CARICOM with the **VISION 25 by 2025** initiative (Anon, 2022). This vision calls for "long term social and economic partnership between: Member States, the Regional Private Sector (CARICOM Private Sector Organization-CPSO), Regional Organizations, Producer Groups, Development Partners and Civil Society" and has the aspiration to reduce the net importation of food into the region by 25% by 2025. It will be guided by the Special Ministerial Taskforce on Food Production and Food Security (MTF).

The initiative will focus on 6 priority objectives. Table. 1.

Table 1: CARICOM 20% x 2025 Priority Foods for Extra-regional Import-Reduction

Objective		**Priority action**
1	Removing the barriers to access of markets being faced by the sector	Policy Development and Implementation to facilitate agri-food trade
	Securing greater private sector participation	
2	Provision of alternate financing and insurance for the sector	De-risking of the Agricultural Sector
3	Increase availability of transportation services to MS for the transportation of agri-food products	Improve the Transportation and Logistics throughout the region
4	Greater Cross Border investment, human resource development and adaptation/introduction of climate smart production mechanisms	Investment in Production, Research, development, climate smart adaptation
5	Implementation of an E-Agriculture Strategy	The digitization of the Region's Agricultural Sector
6	Revisiting Rules of Origin and revising CET and Suspensions Regime	Improving trade and private sector investment/involvement in the sector
https://agricarib.org/caricom-25-by-2025-initiative/		

The vision is to see a thriving agricultural sector readily transporting foodstuffs between islands. Whist it is the intention to streamline inter island trade, there is also a note within "Policy implementation" of "Implementation and operationalization of Sanitary and Phytosanitary (SPS) related policies"

Port inspections are an essential part of preventing the establishment of invasive alien species on an island but there are many other aspects that augment this approach and make the inspections more focused and targeted. Desk-based Horizon scanning (ie the identification of potential invasive threats to the island) should be an integral part of preventing the establishment of invasive alien species. An example of horizon scanning

software is the CABI Horizon scanning tool https://www.cabi.org/HorizonScanningTool/.

This lap top computer-based tool interrogates databases of pests and diseases comparing them between countries and enabling the creation of lists of priority pests that pose the greatest threat. This is especially important with countries with a similar climate and ones that receive a lot of traffic, be it traded commodities or people. In a similar vein Pest risk analysis (PRA) focuses on how various potential pests could arrive and how to prevent their arrival and mitigate their effects if they were to arrive https://www.cabi.org/wp-content/uploads/Pest-Risk-Analysis-Tool-2021-HR.pdf. CABI has provided training in Horizon scanning and Pest risk analysis in two countries of the region in 2019 and 2020. Likewise regular communication and the sharing of data between neighbouring countries is another means of making the physical inspection processes more effective.

The international guidelines for the inspection of agricultural commodities between countries is ISPM 23, wooden packaging materials ISPM 15 and used vehicles and equipment ISPM 41. It was these three pathways of potential entry of invasive species that were investigated in this study. Each of these three documents describe the expected process of phytosanitary inspection and the responsibilities of the importing country. The guidelines stipulate the following:

As authorized officers or agents by the NPPO, inspectors should have:

- authority to discharge their duties and accountability for their actions
- technical qualifications and competencies, especially in pest detection
- knowledge of, or access to capability in, identification of pests, plants and plant products and other regulated articles
- access to appropriate inspection facilities, tools and equipment
- written guidelines (such as regulations, manuals, pest data sheets)
- knowledge of the operation of other regulatory agencies where appropriate
- objectivity and impartiality

Also listed within ISPM23 are factors that require consideration:

- the mitigation measures taken by the exporting country
- whether inspection is the only measure or combined with other measures
- commodity and intended use

- place/area of production
- consignment size and configuration
- volume, frequency and timing of shipments
- experience with origin/shipper
- means of conveyance and packaging
- available financial and technical resources (including pest diagnostic capabilities)
- previous handling and processing
- sampling design characteristics necessary to achieve the inspection objectives
- difficulty of pest detection on a specific commodity
- experience and the results of previous inspections
- perishability of the commodity (see also Article VII.2(e) of the IPPC)
- effectiveness of the inspection procedure.

In addition to the physical inspection of materials inspections at ports the ISPM guidelines also include the examination of documents associated with a consignment (that they are complete, consistent, accurate and not fraudulent) and verification of consignment identity and integrity (to ensure that the cargo does relate to the documentation and that its as described and has not been altered or security seals breached).

The documentation associated with traded commodities was not assessed in this study, it was taken as read that the documentation was intact and accurate.

This short survey of the phytosanitary inspection procedures and results thereof is intended to assess the extent to which the inspection processes are being met.

Barbados and the six islands of the Organization of the Eastern Caribbean States (OECS) are predisposed to invasions from Invasive Species. Several factors account for this: very high border to land ratios with many illegal entry points; high level of movement of people and cargo between islands. Many neighbouring countries with similar environment as potential sources of invasives. Hilly terrain, that hinders surveillance and attempts at eradication. The potential negative impact on the endemic species by invasive species is significant to the point that it is regarded as the most serious threat to biodiversity conservation second to habitat destruction, the main cause on mainland ecosystems.

The case of the pink hibiscus mealybug *Maconellicoccus hirsutus* is an excellent example of how, once in the region a pest can spread rapidly between islands. It was first

identified in the region in 1994 and had spread widely across the Caribbean islands and reached mainland USA in less than 10 years. On arrival the damage caused was measured in millions of US dollars (Sherwood, 2009).

PREVIOUS STUDIES

Plant quarantine needs to be a strong well-resourced operation, but previous investigations have found weak surveillance systems; inadequate levels of human resource to detect and prevent the entry of IAS into this sub region. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://uwispace.sta.uwi.edu/server/api/core/bitstreams/23cd3439-116c-49ec-8ec0-01d624e00dfe/content

The world bank is aware of the difficulties facing the region and is in addressing these challenges. (Anon 2022; https://www.worldbank.org/en/country/caribbean/overview) they also note that the cost and time related to intra-regional food trade are high (Arias et al., 2024).

There have been previous reports investigating specifically the phytosanitary procedures of the region. The 2014 report by the Wageningen based Institute for Marine Resources & Ecosystem Studies, on the Dutch Caribbean islands made recommendations for the Caribbean Netherlands, to decrease the threat of invasive species and to mitigate their effects on arrival (Smith et al., 2014).

The Meissner study of 2009, which was a collaboration between the Caribbean Invasive Species Working Group (CISWG) and the United States Department of Agriculture, Plant Protection and Quarantine (USDA-PPQ) investigated pest movement pathways into and within the Greater Caribbean Region (Meissner et al., 2009). They investigated many routes but those of relevance to this study were classed as “Maritime traffic” “Hitchhiker pests” and “Wood packaging material” and “Plant propagative material”.

Hitchhiker pests (inadvertent contamination of an inanimate item with a pest) are covered in this current study through inspections of used vehicles, tyres and wood packaging.

However, it is interesting to note that within the Meissner study of 2009 although “Plant propagative material” was identified as a potential route for invasive species; agricultural products (for consumption) were not considered important enough to warrant their own section (Meissner et al,. 2009). Pest within or on agricultural produce could have been classed as hitchhiker pests but this does not appear to have been the case as the description of hitchhiker pests relates to shipping containers and other inanimate objects (Meissner et al,. 2009).

The sentence “Agricultural and non-agricultural shipments, cargo containers, and vessels themselves *have been reported to be* pathways for the movement of pests, pathogens, and weeds” rather points out the inadequacies of this study in this regard (Meissner et al., 2009). The study rated the risk of introduction though hitchhiker pests, wood packaging and propagative plant materials as very high but they were unable to rate the risk associated with Maritime trade (which included the transport of fresh produce).

Many recommendations were made as part of this report (Meissner et al., 2009) the most pertinent of which is “Monitor inter-island trade via small vessels. Little data is available on inter-island trade, including the transhipment of cargo from one country to another via small vessels. Determine what commodities are being shipped, as well as their quantity, country of origin, country of destination, and the incidence of wood packaging material.”

Internationally there is general acknowledgement that phytosanitary procedures could be improved and to this end the International Plant Protection Convention (IPPC) Secretariat and Regional Plant Protection Organization of the Caribbean held an online conference in August 2022 with the theme of Innovative Plant Health for Food Security.

The two concepts of seamless borders to facilitate trade and phytosanitation would appear to be mutually exclusive. Clearly there must be some form of middle ground where commodities are transferred rapidly between countries whilst at the same time maintaining phytosanitation and preventing the needless spread of pests and diseases.

The Caribbean region is not unique in its phytosanitary concerns regarding agricultural trade into the region and between small island states. The Pacific islands are in a similar position and face the same challenges. The New Zealand Department of Conservation Te Papa Atawhai (DOC) has prepared a document “Guidance on preventing the movement of invasive species between islands in Pacific countries and territories” which is regularly updated ensuring it is relevant and includes the current status of pests and threats of pests (Anon 2023).

The study presented here is therefore vital to assess the current status of phytosanitary inspections with regard traded commodities (and the packaging thereof) within the region and into the region. Whilst the bulk of material that poses a phytosanitary risk is generally considered to be agricultural produce this project also investigated wooden material, including packaging and pallets, and used vehicles and used tyres. All these commodities are potential vectors of agricultural pests. Unlike previous investigations the data generated by the port authorities and quarantine were interrogated thus gaining a greater insight into the actual practices on the ground.

In a changing climate, new geographical areas are becoming hospitable to pests and diseases that were otherwise out of their range. In addition to this there is far greater international trade than ever before making the ingress of pests and diseases more likely.

MATERIALS AND METHODS

The countries participating in this regional project: Preventing the Costs of Invasive Alien Species in Barbados and the OECS, *viz* Antigua and Barbuda, Barbados, Dominica, Grenada, St Kitts and Nevis, St Lucia and St Vincent and the Grenadines

Senior plant health officials from these countries were invited to Barbados for the opening meeting along with Mr Naitram Ramnanan the regional CABI coordinator of the Caribbean region and Dr Philip Taylor a senior plant health advisor form CABI UK, and Dr Kelvin Hughes Head of Inspectorate Programme at Animal and Plant Health Agency UK.

In most cases the local representatives of the countries are the National Plant Protection Officer but, in some cases, a deputy had been sent with the full authority of the NPPO. Note that there was a representative from Nevis in addition to St Kitts due to the higher level of political and administrative self-government in Nevis but in the case of other island nations the NPPO represented the smaller islands within the nation, i.e. the Grenadines and Barbuda (Table 2).

Table 2: Local Members of the Project Team

Country	Name	Email contact
Antigua	Janil Gore-Francis	Janil.Gore-Francis@ab.gov.ag
Barbados	Ian Griffith	CIGriffith@agriculture.gov.bb
Dominica	Nelson Laville	nelson.laville@gmail.com
Grenada	Thaddeaus Peters	thaddeauspeters@gmail.com
Nevis	Quincy Bart	bartquincy@gmail.com
St Kitts	Kadian Banton	Kadian.Banton@gov.kn
St Lucia	Cherrianne Johny	cherrianne.johny@govt.lc
St Vincent	Janiene Bramble	princessjbram@hotmail.com

The experimental set up was for the plant quarantine inspectors to document their findings as they inspected cargoes arriving in the ports. There were no additional checks instigated by this study but the routine checks that were made were documented and made available to the study. In this regard it was an attempt to monitor the actual work carried out by the quarantine staff and to assess their levels of detection, diagnosis and identification.

Biosecurity risks were documented on a handheld tablet with the Caribbean Biosecurity Interceptions System software (CBIS) installed. This software was bespoke for the region and was written for the project to record port interceptions. It was the intention for any phytosanitary finds to be documented immediately at the port. Inspections that took place but revealed no biosecurity concerns were documented in an excel spreadsheet. Should items be found for which identification was not possible the items were to be photographed, and these sent to CABI and if identification was still not possible, samples were to be sent to CABI along with the forms contained in Annex 3.

SAMPLING PROCEDURE

A standard operating procedure for the sampling is provided as an Annex.

ISPM 23 states "A sample is taken from consignments or lots to determine if a pest is present, or if it exceeds a specified tolerance level. The ability to detect in a consistent manner the presence of a regulated pest with the desired confidence level requires practical and statistical considerations, such as the probability of detecting the pest, the number of units making up the lot, the desired confidence level, and the sample size (i.e. the intensity of inspection)"

The proportion of the consignment that is to be inspected (the "intensity of inspection" in the language of the ISPM 23) has always been a contentious issue. For there to be 100% assurance that no pest was present, every box/unit would have to be inspected but this is both impractical and unnecessary in many cases. As there was no agreed sampling protocol standard between countries or even within a country in operation, we made use of the North American Plant Protection Organisation sample size calculator for the duration of the study

This Excel based "workbook" can be used to calculate the number of samples that an inspector should inspect from a commercial consignment or lot given the following parameters – level of detection or level of risk acceptance, level of confidence, lot size and sample unit. The workbook will calculate the sample size if the parameters are entered in the appropriate workbook cells.

The formula (Fig 1) used to calculate the sample size (n) is based on hypergeometric probability Sample Size Calculator :: nappo.org (Fosgate, 2009).

Figure 1: The formula on which the NAPPO calculator is based

$$n = \left(1 - (\alpha)^{1/D}\right)\left(N - \frac{D-1}{2}\right)$$

Where,

D is the level of detection, 1-(α) is the level of confidence and N is the lot size.

✓ Level of detection/acceptance (D): is the minimum infestation percentage or proportion detected at a specified level of confidence established by the National Plant Protection Organization (NPPO). For illustration purposes we will use 10%.

✓ Confidence level (1-α): indicates the probability that a consignment with a particular level of infestation is detected. A 95% confidence level is routinely used; it should be entered as 0.95 in the workbook.

✓ Lot size (N): the total number of units in the consignment.

✓ Sampling Unit: the unit chosen for sampling, for example box, individual fruit, individual bouquet, etc.

However, this versatile calculator was not use routinely and the project settled on a sampling regime that would detect a 10% infestation with a 95% accuracy. Once this had been standardised it was possible to print out a sheet (Figure 2.) which provided the numbers of units that had to be inspected relative to the whole cargo. It was this sheet that dictated numbers of units inspected and the calculator was not used thereafter.

The inaugural meeting took place in Barbados in July 2023 and was an opportunity to explain the project and for the various countries to present on their facilities and staff. Subsequent to the meeting Mr Ramnanan, Mr Hughes and Dr Taylor had the opportunity to visit all the countries represented (including Nevis) except St Vincent.

Figure 2: Poster displayed in the ports to allow inspection staff to avoid having to refer to the NAPPO calculator.

NAPPO calculator summary for GEF/CABI project inspectors.

10th August 2023

As previously discussed the NAPPO tool allows you to determine the likelihood of finding pest/problem with various degrees of certainty depending on the level of infestation.

We have agreed on an infestation rate of 10% and confidence interval of 95%, with these two parameters in the calculator the out put (the numbers of boxes/kgs/units) that needs to be inspected is provided in the table below.

Given the difficulties of using the NAPPO app on the tablets (as it is locked) and the simplicity of this approach we recommend that you look up the number of items that need to be inspected in this table.

Sample size	Number of items to be inspected
10 or below	Total number
11-12	11
13	12
14-15	13
16-17	14
20-22	16
23 - 25	17
26-28	18
29 - 32	19
33 - 38	20
39 - 44	21
45 - 53	22
54 - 65	23
66 - 82	24
83 - 108	25
109 - 157	26
158 - 271	27
272 — 885	28
886 — 10,000	29

Any numbers above 886 the number to be inspected is 29 and any produced that comes in in small quantities (below 10) all the produce/boxes should be inspected.

REPORT OF THE INSPECTION OF THE FACILITIES

- **Barbados:**

The phytosanitary inspection facilities in Barbados appeared efficient and effective. The Plant Quarantine Unit (PQU) is run by Ian Griffith with a staff of 12, most of whom have tertiary level academic and practical education and have completed the Regional Plant Quarantine Inspectors course. At the time of the visit the unit was understaffed by 4 (8 working members of staff) but after the visit the staff numbers have been permanently reduced to 9. The staff shortages have led to difficulties relating to the provision of data for this study.

SPECIMEN MANAGEMENT & PEST IDENTIFICATION:

Specimens collected from "consignments of concern" were transported to the subject-matter specialist at the Ministry of Agriculture (i.e. Entomology or Plant Pathology Units or the UWI). Specimens were also sent to universities in USA or UK (CABI) to verify diagnoses or pest identification. Adequately sized facilities are available to hold (commercial/non-commercial) consignments at the points of entry (i.e. Cargo bonds, PQU offices etc. in mostly temperature-controlled conditions.

Photo 1. Inspection of bananas in Barbados at the Bridgetown Harbour

- **St Kitts and Nevis:**

St Kitts and Nevis have a staff of 10 quarantine officers (7 St Kitts 3 Nevis).

They have limited laboratory facilities but where identification of a pest is required the items are usually sent to the University of Florida via the regional Caribbean Pest Diagnostic Network (CPDN).

The most common pest they encounter are mealybugs and ants. There is no systematic checking of wood or vehicles and tyres. The major pest of concern are the Giant African snail along with Mediterranean fruit fly and Banana fungal pathogen Panama wilt TR4. In

addition to the port facility, on St Kitts we inspected the barrel facility on Nevis, used to transport belongings by house holders. We were shown the paperwork used to document the confiscated items.

- **St Vincent and the Grenadines:**

The Plant Protection and Quarantine (PPQ) Unit of SVG functions as the NPPO. The unit has 33 staff of which twenty-four staff are directly involved in providing plant quarantine services. Eleven workers are assigned to quarantine full time.

Services are provided from three offices; the main quarantine office is located at the Kingstown port; approximately 3500sq ft. The greater part is used for storage and inspection of produce. The space for officers is somewhat inadequate. Services are also provided at the PPQ head office at Campden Park and an office has been provided for quarantine at the Argyle International Airport (AIA) that's approximately 100sq ft. The offices are fitted with desks, chairs, computers (3), printer (1) and inspection tables (2).

No quarantine officer is stationed on the Grenadines islands. Services to the Grenadines are coordinated from the offices on the mainland.

The head of PPQ and the Agricultural Officer in charge of quarantine are trained at the master's level. One other officer directly involved has a first degree and there are 2 with associate degrees. Other workers have O' levels. The experience in the unit ranges from four to thirty years.

On average 78 used vehicles are imported monthly. No inspections are done on regular vehicles and only farm equipment is inspected. In addition, approximately 8, 40ft containers of used tyres are imported monthly and fumigation is mandatory.

- **Grenada:**

Thaddeaus Peters is the Pest Management Officer/Chief Plant Protection Officer and heads the Pest Management Unit. The unit has a staff of 6 plant protection quarantine officers with either a diploma or degree in agriculture. At the time of the inspection there was no laboratory technician. The lab run by Thaddeaus was well set up for morphological identification of both insects (rearing chambers) and fungi. When external identifications are required, samples are sent to the University of Florida or CABI.

Tyres are not part of the remit of plant quarantine but fall under the Grenada Bureau of Standards, only if excessive soil is recorded is Plant quarantine involved. Vehicles are covered by plant quarantine, but numbers of vehicles or dates of inspection are not documented.

Wood products are brought in 2-3 times per month. No Phytosanitary documents are requested for the importation of lumber. Periodic inspection by Plant quarantine and pallets are inspected for heat treatment (HT) or methyl bromide (MB) treatments. One-time requests are made by individuals for importation of furniture wood.

Foodstuffs are brought in several times a week for smaller shops and weekly/fortnightly for the main supermarkets (20 & 40 ft containers) whereas hotels have deliveries every 3-4 weeks; Shipments are mostly mixed. Sampling was described as random/visual and sometimes destructive.

- **Dominica:**

The quarantine offices had been in the botanic gardens but recently they were relocated to a building more centrally. We were able to view old plant quarantine offices but only the outside of the molecular biology lab at the botanic garden.

Woodbridge bay is the main deep-water port for Dominica. On the day we visited there was no fresh produce deliveries, but we did have the opportunity to inspect vehicles that had recently been imported. Many of the vehicles were imported by those who had purchased them from overseas whereas, one car had been imported by the owner (from Hull). We were advised that those imported by the owners were often less well cleaned than those imported whilst being sold. This is presumably because those who import vehicles regularly appreciate the necessity for Phyto sanitation and private importers do not.

Longhouse port is the port where smaller vessels transport produce to other Caribbean islands. The Phytosanitary system (for goods to be exported) involved the couriers bringing produce to one side of the loading shed where it was opened and inspected before being loaded back onto the vehicle and driven round to the boat.

On the day of visit, plantain, chilli peppers, ginger, bananas, tania, citrus, avocados, and sweet potatoes were being exported. The system did not require all the produce to be unloaded, the inspectors looked at several boxes (usually on the top) only. The amount of produce of each consignment was provided by the courier and superficially checked by the phytosanitary inspectors. In addition to the quarantine inspectors there were personnel from the Bureau of standards and statistics present at the port. During our brief visit no consignments were rejected but mealybug on citrus, rubbing damage on avocado and a rot in ginger were seen along with an unusual lumpy citrus fruit.

- **St Lucia:**

The airport security area of the George F. L. Charles Airport, Castries is a small room with a fridge and freezer used to store confiscated items. On the day of visit most of the

material was for consumption although some onions for planting had been seized a few days previously. The documentation relating to the confiscation was available for inspection.

Hewanorra International Airport, Vieux Fort is the main airport on the island which houses Hewanorra Air Cargo Services (HACS) where fresh produce imported and exported by air was inspected. We learned that fresh flowers are a very common import on the day of inspection bananas being exported via air to Britain.

The main airport terminal for passengers housed the customs, plant quarantine rarely intercepts passenger luggage directly, and seizers relating to plant quarantine were generally related to inspections by customs. Plant quarantine material intercepted was mostly wooden artefacts and honey which was held in a small room in the passenger terminal.

The docks at Vieux Fort are the main timber importation point onto the island. On the day of inspection timber was stacked up on the quay, it all looked to be pest-free, and the wooden dunnage appeared to have been treated.

St Lucia has a large marina and attracts considerable amounts of international pleasure craft. The Plant Quarantine Officer explained that because most travellers did not bring fruit and veg ashore (but stopped to take on supplies) that there are few plant quarantine concerns. However, there was the occasional finding of planting material that boat owners were intending to bring onto the island to cultivate, deliberately bypassing the port phytosanitary procedures.

- **Antigua:**

At the airport in Antigua, there was a small, dedicated PQ office (approx. 8' x 10') and an inspection room (approx. 12' x 9') which is fitted with fridge, freezer, stainless steel countertops, storage cabinet and sink. The inspection room is not totally secure as immigration personnel at times reportedly enter the room and laboratory equipment has not been purchased due to security concerns.

The main port of Antigua is a Deep-water harbour port, and the customs facility was built recently by a Chinese company. However, as part of the planning process it was built without a plant quarantine inspection area and with no thought to plant quarantine at all. The small office that comprised “plant quarantine” was hived off from customs and housed personnel who were responsible for the prevention of plastic packaging entering Antigua. It did not appear to have any kind of plant quarantine equipment, there was not even a fridge in the room.

There is, therefore, no security and no space to quarantine or secure commodities as required. There are currently no computers at either the air or the seaport and there is also no Internet access. Officers can only access the Internet or conduct computer-based activities at the Plant Protection headquarters. Many attempts have been made for port management to address the poor accommodation and lack of internet access and equipment but have proved futile to date. Consequently, all cargoes are checked on the open wharf with the bare minimum of equipment.

Plant quarantine has 5 inspectors who serve in rotation between the air and seaport with 2 additional inspectors who mainly inspect produce arriving from Dominica. These inspectors generally work alongside at least one inspector with PQI certification training.

One inspector took the UWI 1-year certificate course in Plant Quarantine, 4 have received the 2-week CPHD/UWI Plant Quarantine Inspectors course. Inspectors have a secondary school level of education; the remaining inspectors have high school education. The number of years of service within Plant Protection, is from 14 to 40 years.

A regulation is being developed currently under the Plant Protection Act to formalise the requirements for a PQ station at the ports of entry designated for plants. There are no PQ facilities in Barbuda at present.

On inspection of the timber unloading area, we saw timber stacked up and the dunnage was marked appropriately. However second-hand furniture was being imported and there appeared to be little concern over the wooden frame. Frass from a wood boring insect was noticed and it was clear that insects were active however this did not cause concern to local staff.

The inspection of cargo took place on the open wharf under makeshift sun protection. In addition to plant quarantine, customs officials were present. The normal protocol involved waiting for the whole of the consignment to be unloaded before checking it and they preferred for the customer to be present when the checks were made.

On the day of visit one of the boxes had some sticky tape that had caught a lot of flies, but this was not of great concern although Janil Gore Francis did say she would take some photos. Cars that were being imported were very clean both inside and out. It was clear that they were nearly new.

DURATION OF SURVEY

The period of data collection for this study was due to run for 8 weeks from the beginning of September to the end of November but for various logistical reasons countries had to

determine their own time period and whilst these were broadly overlapping, they did not completely coincide.

It was intended that three data sets were collected by each country. The CBIS dataset in which findings of biosecurity concerns were recorded, the Nil finds sheet which recorded inspections where nothing of concern was found, and the ASYCUDA data relating the customs records of how many items were imported during the recording period. The ASYCUDA data is not generated by plant quarantine but is a customs record of material entering the country. This data is not intended for SPS use but for accountancy purposes to ensure the movement of material is monitored and the correct revenue is paid. It is noted that the system offers an SPS module that is not yet in effect in this sub-region.

In addition to the survey, the national representatives were asked to list the pests and diseases they were most concerned about gaining access to their countries. They provided both pest lists and crops of greatest concern.

RESULTS

Data collected directly from delegates on their opinions of threats:

One of the findings that came from the Barbados meeting was the crops and commodities that the NPPOs were most concerned about from a biosecurity perspective. They were invited to provide a list of the top 20 crops that caused them most concern in their professional careers. There was no complete consensus between islands but there were general themes/crops which appeared on multiple lists. A generalised list of crops of concern is provided as Annex 2.

Similarly, the delegates were invited to provide a list of the pests and diseases that, in their professional capacity as senior phytosanitary staff, they were most concerned about entering the country (Table 3).

Table 3: Pests and diseases of considered to be of greatest concern to the plant quarantine officers of the Barbados meeting.

Pest or disease of concern	Location as per the CABI Crop protection compendium April 2024
Mediterranean Fruit fly (Ceratitis capitata)	Not in the region
Fusarium oxysporum Tropical Race 4 (Foc TR4)*	Not in the region
Red palm weevil (Rhynchophorus ferrugineus),	Guadeloupe only
Two-Spotted Mites, (Tetranychus urticae)	Guadeloupe only
Western flower thrips (Frankliniella occidentalis)	Puerto Rico, Guadeloupe, Martinique

Table 3: Pests and diseases of considered to be of greatest concern to the plant quarantine officers of the Barbados meeting.	
Pest or disease of concern	Location as per the CABI Crop protection compendium April 2024
Taro leaf blight (Phytophthora colocasiae)	Puerto Rico and Dominican republic
Tomato leaf miner (*Tuta absoluta*)	Haiti and Trinidad and Tobago
Tephritid fruit flies Papaya fruit fly (Toxotrypana curvicauda)	St Kitts and Nevis, US Virgin Islands, Trinidad and Tobago
Red Ring Nematode (Bursaphelenchus cocophilus)	Trinidad and Tobago St Vincent and Grenada
Citrus canker (Xanthomonas axonopodis*), Xanthomonas citri pv. citri	Martinique and BVI
Giant African Snail	Anguilla, Antigua, Barbados, Dominica, Guadeloupe, Martinique, Saint Lucia, Trinidad and Tobago

Survey data based on port inspections.

In some cases, all three data sets were not provided i.e., CBIS data findings of biosecurity concerns; the Nil finds sheet and the customs ASCYCUDA records. The table below indicates the data collection period and number of inspections as per the negative inspection sheet (left) with the CBIS data (right). In some cases, the data was not provided, and this has generated some apparent anomalies.

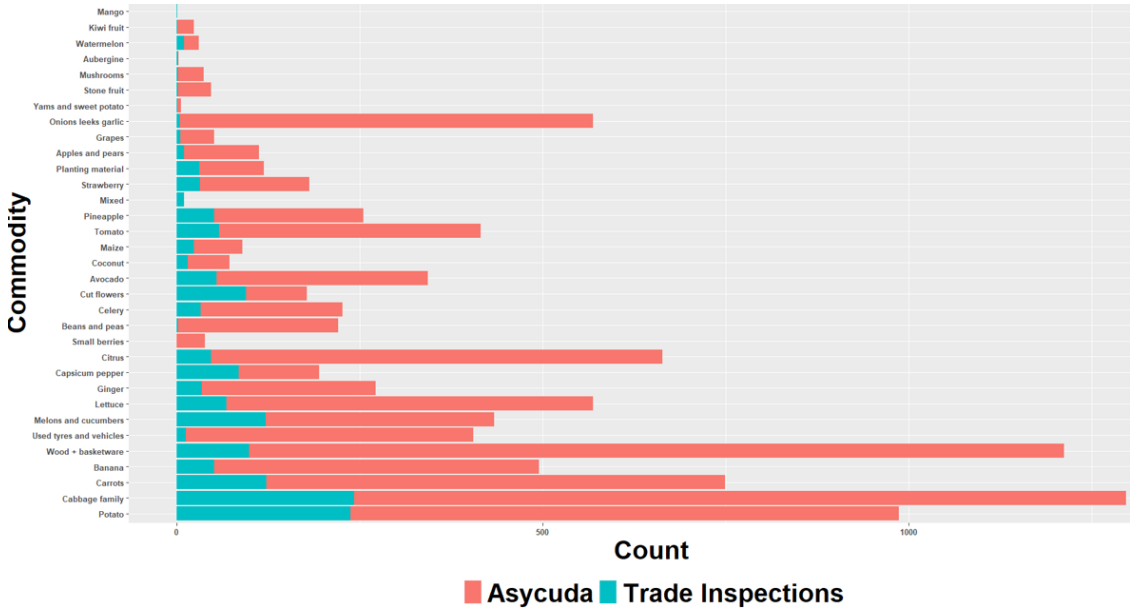
Table 4: Survey Duration and Number of Records in 2 of the three data sets requested							
	Nil Returns data					CBIS data	
Country	Records	Start date	End date	Number of days	Average checks per day	Records on CBIS	% of inspections appearing on CBIS
Antigua	262	4 Sep	15Nov	103	2.5	25	9.54
Barbados	556	5 Sep	5 Dec	91	6.1	N/A	N/A
Dominica	Nil	1 Sep	13 Nov	74	1.3	97	100
Grenada	322	31Aug	10 Nov	72	4.5	19	5.90
Nevis	636	9 Aug	15 Nov	99	4.2	2	0.31
St Kitts	68	23 Aug	30 Oct	69	1	0	0.00
St Lucia	396	10 Aug	16 Nov	99	4	2	0.51
St Vincent	504	9 Aug	15 Nov	99	5	1	0.20

It was intended that the data of the CBIS and that of the Nil finds sheet combined could be cross referenced and tallied with the ASYCUDA data, but this proved difficult as the

ASYCUDA data frequently lacked dates and quantities were not included. Based on a less than satisfactory data set it, would appear that only a relatively small proportion of the ASYCUDA data is represented in the other two data sets. However, it was not possible to cross reference the data sets accurately.

Graph 2. represents the total ASYCUDA data for each commodity plotted along with the SPS inspection data. If all the data represented in ASYCUDA were in the other data sets the two portions of each bar (red and blue) would be of equal length. It is clear that there is a mismatch in the data sets. The data were difficult to interpret but the graph presents the most appropriate interpretation of what was provided.

Graph 2: Comparison of number of ASYCUDA records versus data received in Trade study.



Bars represent absolute numbers, so a heavy "red" tail indicates more ASYCUDA records were received than trade data. Barbados, St Kitts and Nevis data were not included as ASYCUDA was not provided from these countries.

The ASYCUDA data was not collected by SPS and they were reliant on customs to provide the data, in some cases it was not provided at all and in others it was delivered in a form that lacked important details such as amounts and dates.

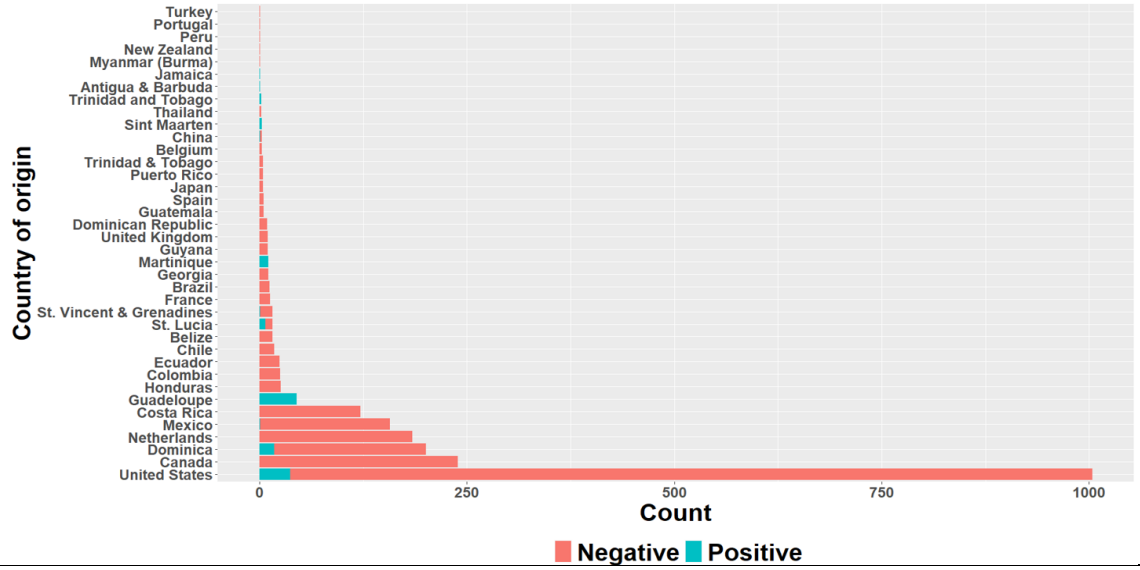
Therefore, as the ASYCUDA data could not be deciphered it was not included in further analysis. The analysis of the data therefore consisted of comparisons between the Nil returns sheet and the CBIS data. In some cases, the data was combined and investigated in its entirety, in other cases it was broken down by country or another parameter.

The amount of data in CBIS was compared to that of the Nil returns divided by country of *origin* i.e. not the country which recorded the data but the country from which the produce came. Graph 3 provides information on the level of trade from the exporting

countries from both within the region, intra Caribbean, and produce arriving from outside the region. The level of SPS finds (CBIS data) is represented as the blue section of the bar and the Nil finds as the red section.

The CBIS and Nil finds data was also segregated by commodity type, the produce was grouped along botanical lines (i.e. the same plant families were grouped) with the exception of "planting material" which included both seeds and plants for cultivation and "cut flowers" which were grouped together (Graph 4).

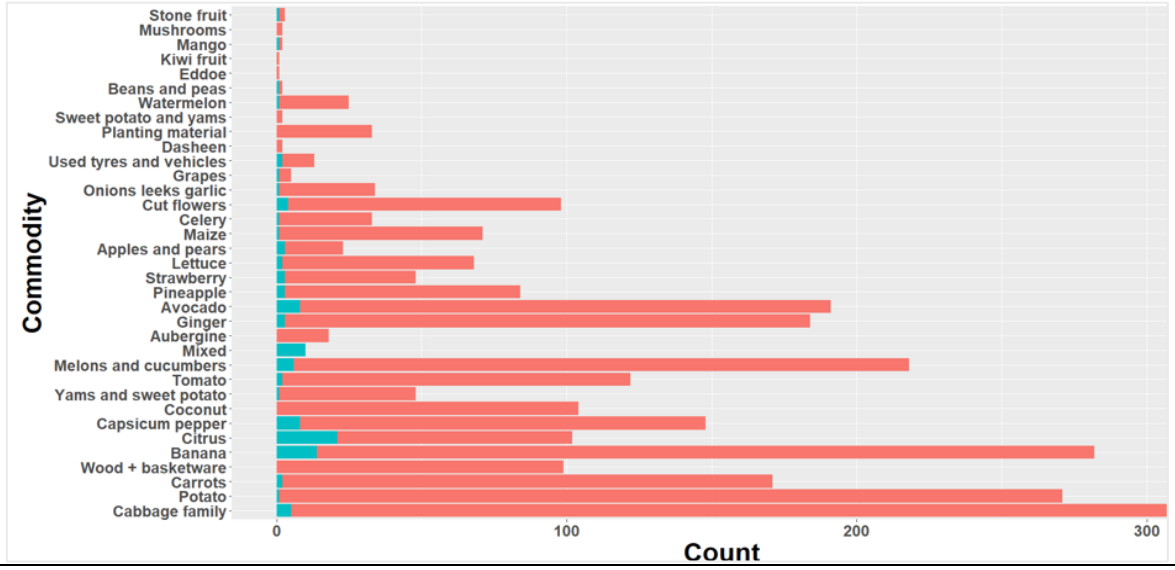
Graph 3: Amount & Proportion of Data Featured on CBIS Divided up by Exporting Country



The proportion of the imports appearing on CBIS (ie biosecurity issue found) are indicated in blue.

In some cases, it was not possible to determine if some of the ornamentals were imported as cut flowers or a planting material. They were allotted according to their most common use. When there was nothing to indicate the cargo other than the word "mixed" this has been included as the category as its identity was not determined. Note that "Used tyres and vehicles" and "wood and basket ware" are included as categories.

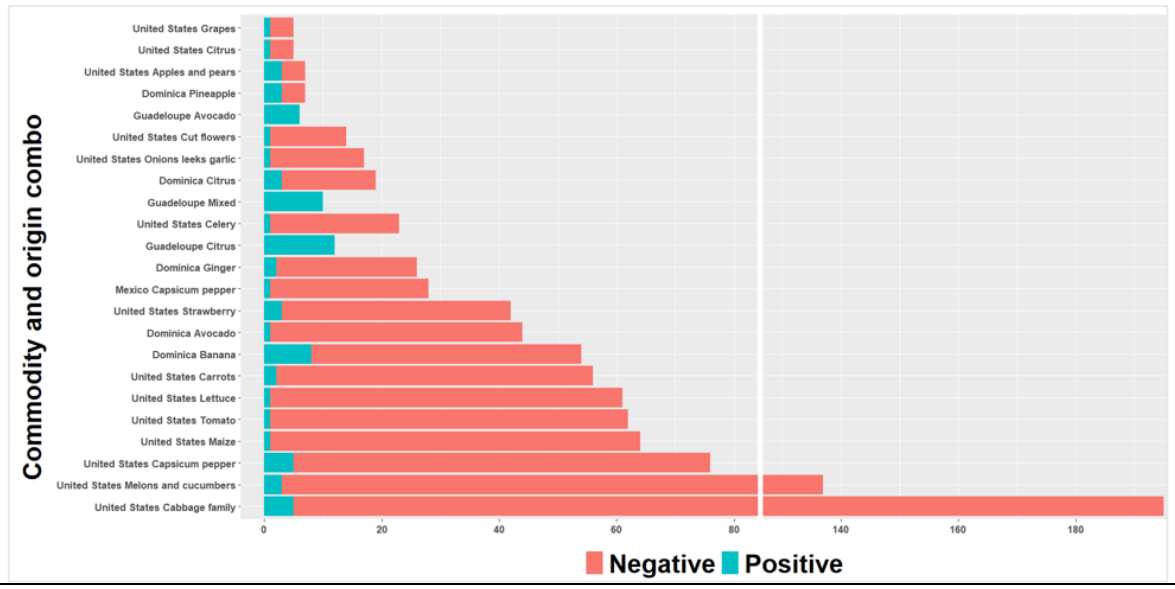
Graph 4: CBIS and Nil finds data Segregated by commodity type



Proportion of Inspected Imported Produce in CBIS relative to Nil returns segregated according to plant species or use. Blue representing CBIS and red the Nil returns.

As the amount of data on CBIS was relatively small it was possible to plot the exporting country/crop combinations that featured in CBIS (Graph 5).

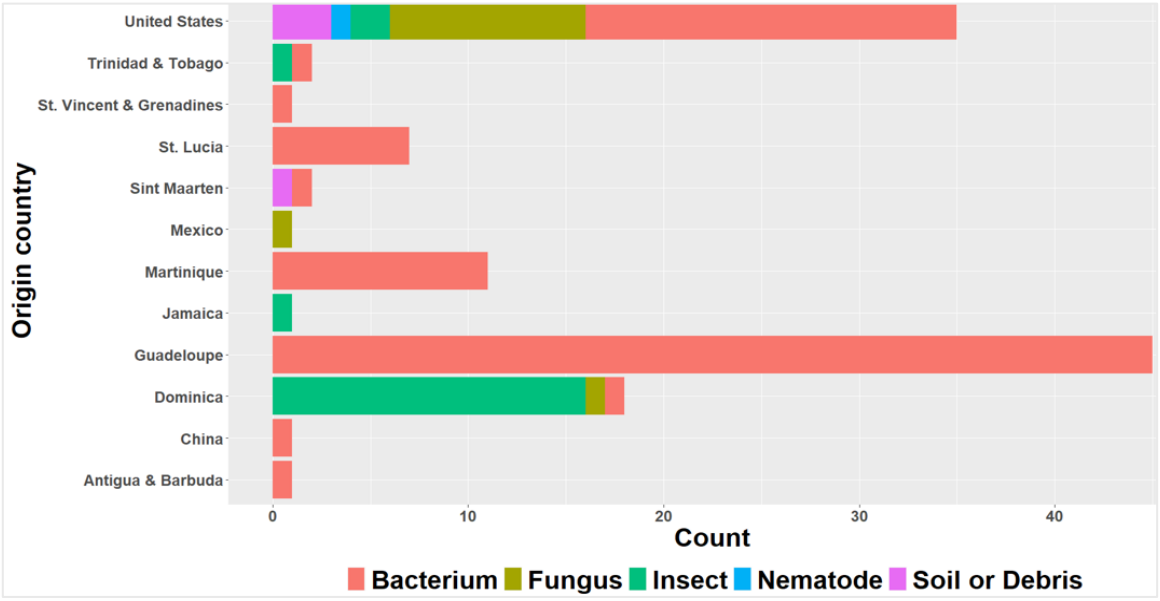
Graph 5: CBIS and Nil finds data Segregated by Commodity/Exporting Country



Combination of Commodity and Exporting country which appeared in CBIS (positive, blue) combined with the proportion which appeared in the Nil returns (red negative). Many other combinations are not represented as there was no data in CBIS. Note the break in the X axis

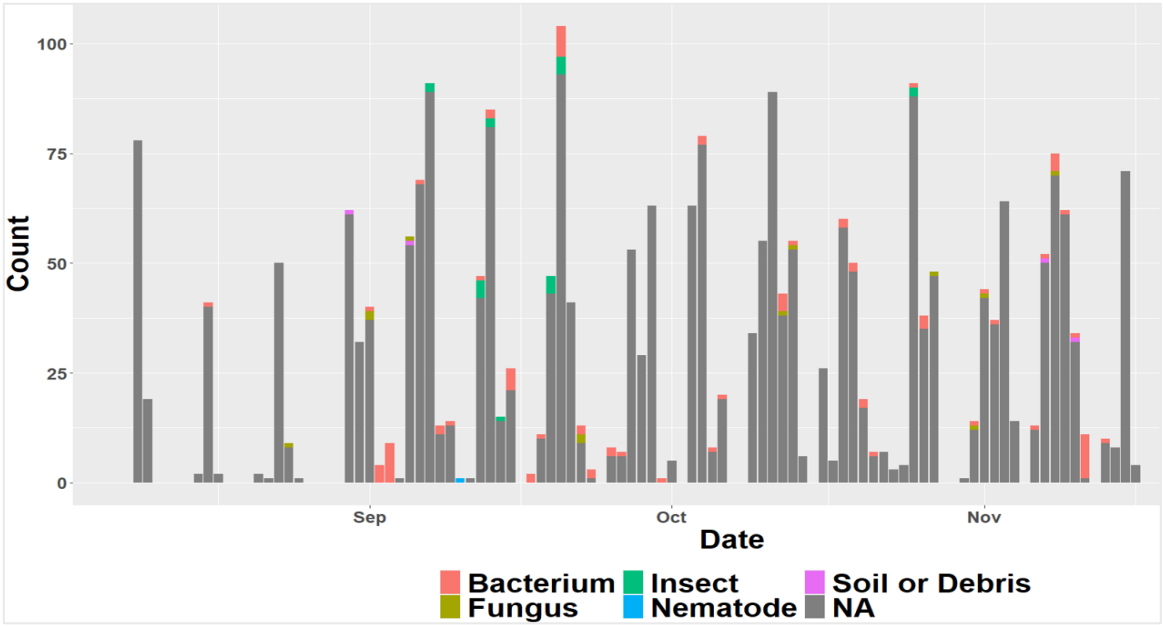
It was also possible to breakdown the type of pest found in the CBIS data segregated by exporting country Graph 6.

Graph 6: Breakdown of CBIS Data by Exporting Country and Pest Type



As the survey ran over several months it was possible to investigate seasonal trends by plotting the number of imports and the proportion of CBIS finds over time (Graph 7).

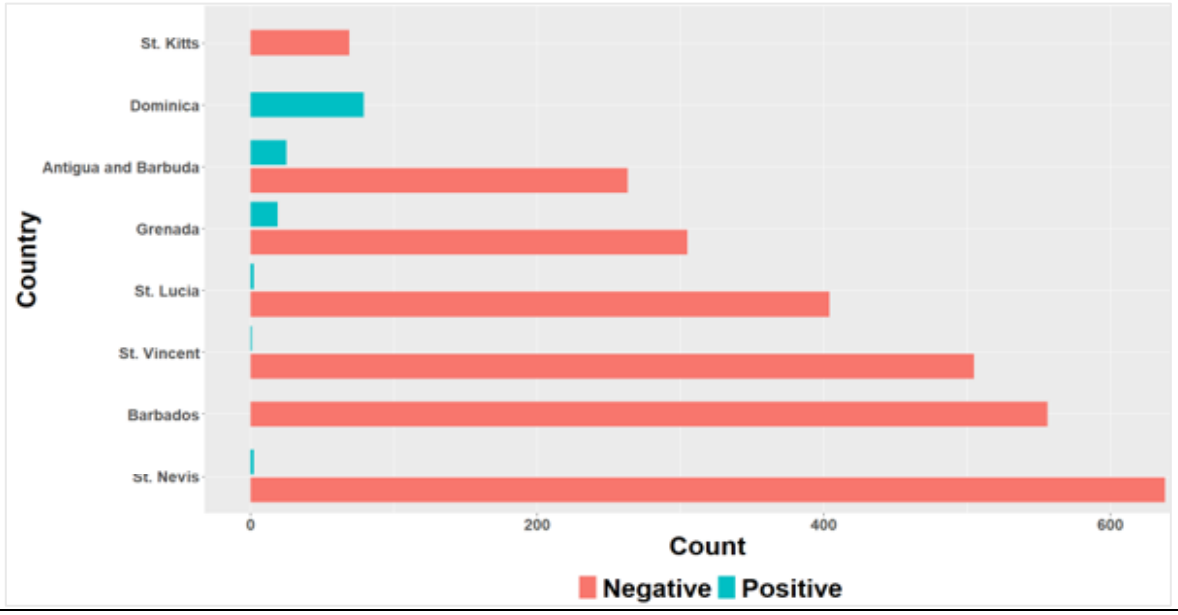
Graph 7: Data Timeline Showing Proportion of CBIS & Type of Pest Against Nil returns



NA represents the Nil returns data.

The proportion of inspected produce found to be carrying biosecurity issues was broken down by country (Graph 8).

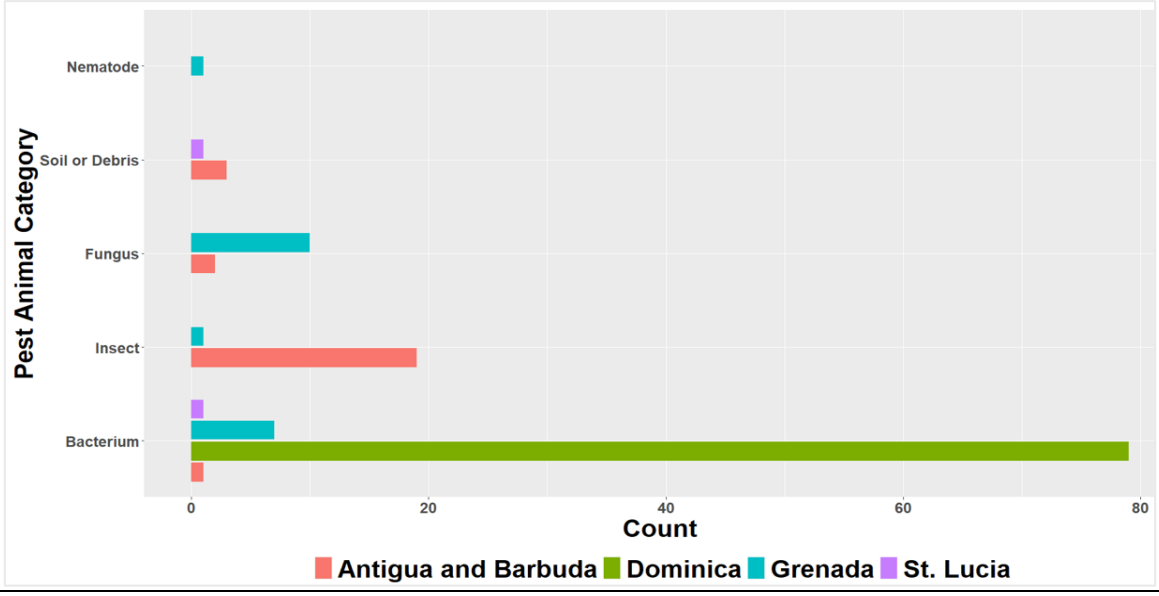
Graph 8: Proportion of Inspected Imported Produce in CBIS (+) vs Nil returns (-)



Dominica provided no Nil return data and Barbados and St Kitts provided no CBIS data.

The country specific CBIS data was broken down into what the finds were that caused the cargo to be entered into CBIS (Graph 9). In most cases the level of identification was only supplied at the phylum level (as per the graph).

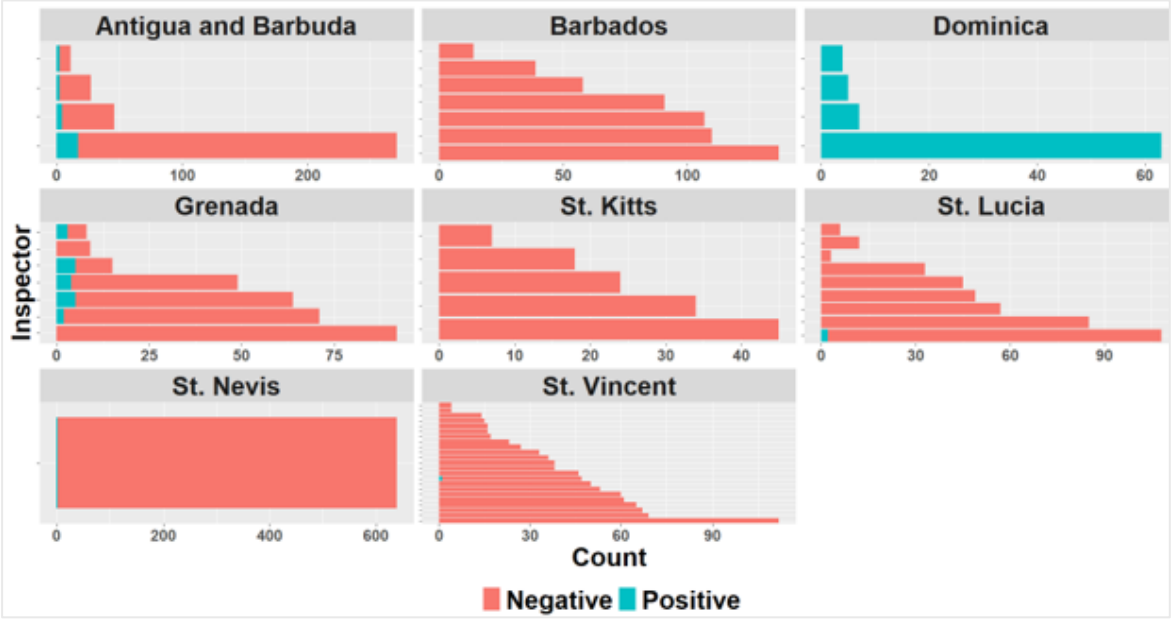
Graph 9: Category of pest species which featured in the CBIS data by country



In some cases, there were more detailed diagnoses/identifications provided but the validity of these identifications should be questioned. In three cases the pathogen was identified on a crop on which is not a host and therefore has to be incorrect. It is interesting to note that all the CBIS finds from Dominica were “bacteria”.

The nil returns data and the CBIS data was broken up by country and by inspector to investigate if some inspectors are more demanding/scrutinise more thoroughly than others (Graph 10). The results below are segregated by country with each bar representing the returns of a single inspector. Blue is the CBIS data whereas the Nil finds are represented in red. Note that Dominica did not return any Nil finds data and only CBIS data is represented the converse is true for Barbados and St Kitts. The one thing of note here is the many inspectors of St Vincent compared to the other islands. The names of the inspectors have been withheld.

Graph 10: Proportion of Inspected Goods Represented on CBIS Segregated by Inspector



Each bar represents a single inspector. St Kitts and Nevis data were combined as there was only one inspector on Nevis. Note: the differing scale on the X axis.

DISCUSSION:

The job of a port inspector and an NPPO is not an easy one, they are often seen as an impediment to the seamless borders promoted as the ideal state. The likelihood of preventing the ingress of a serious pest on any one day is tiny and yet checks have to be made. The praise or recognition for preventing invasive alien species entering the country is often negligible but the impact on the country and the resentment received if one were to enter is considerable.

The port inspector's job is often routine and mundane, and it may be difficult to keep motivated in some regards. Some fundamental questions could be asked as to what the purpose of any inspection is.

ISPM 23 states:

"If the objective of the inspection is the verification of the general phytosanitary condition of a consignment or lot, such as when:

- no regulated pests have been specified
- no tolerance level has been specified for regulated pests
- the aim is to detect pests when there has been a failure of a phytosanitary measure, then sampling methodology should reflect this".

COMMENTS ON THE DATA GATHERED FROM THE MEETING IN BARBADOS.

The lists of crops of greatest concern as provided by the delegates was interesting in that many of the crops listed are not grown commercially in the region and an invasive pest specific to the commodity would not survive. The volume of these imports may explain why they are represented in this list as the greater the amount of import the greater the likelihood of a polyphagous pest arriving.

The list of pest and diseases of concern is much more illuminating (Table 4). All the pests and diseases listed would have considerable economic impact if they were to reach an island as they are either polyphagous or are pests of an important crop of the region. The lists of countries which admit to having these pests was taken from the CABI Crop protection compendium which is an authoritative source of information on pest and disease presence. However, with any data set the information is only as good as the information it receives and the reasons why it may not be accurate are discussed later. What can be stated is that for those countries which do not yet have these pests they are extremely high priority, and phytosanitary staff should be made aware of them and given as much information regarding appearance, host, presence in exporting countries as possible. Also, inspectors should be informed that these types of pests and should be

considered as regulated quarantine pests, that ideally should be on each country participating in this study regulated pest

A similar study in the Caribbean regions (asking experts of the greatest threat to their agriculture) was undertaken in 2014-2018 and published in 2023 (Saravanakumar et al., 2023). The researchers used the Delphi method to prioritize which were pests of concern. The results obtained in this current study are comparable to the previous study with 6 of the pests present on both lists. Pests which are **not** duplicated are provided below (weeds were excluded).

Saravanakumar, et al. 2023 Study	**This Study**
Carambola fruit fly (*Bactrocera carambolae*) Cassava mite *(Mononychellus tanajoa)* Frosty pod rot in Cacao *(Moniliophthora roreri)* Black Sigatoka leaf spot in Banana *(Mycosphaerella fijiensis)* Citrus leprosis virus Bacterial wilt in banana (Ralstonia solanacearum) Lethal yellowing in coconut *(Candidatus Phytoplasma)*	Two-Spotted Mites, *(Tetranychus urticae)* Western flower thrips *(Frankliniella occidentalis)* Taro leaf blight *(Phytophthora colocasiae)* Tephritid fruit flies *Toxotrypana curvicauda* (papaya fruit fly) Red Ring Nematode *(Bursaphelenchus cocophilus)*

Saravanakumar, et al. (2023) used the pest list that the Delphi process generated to undertake surveillance for the top pests of concern. As a result of this surveillance the Mediterranean fruit fly (*Ceratitis capitata*), frosty pod rot (*Moniliophthora roreri*) and the tomato leaf miner (*Tuta absoluta*), were subsequently detected in the region (Saravanakumar, et al. 2023). This reinforces the point that vigilance is often not enough to detect invasive species, and targeted surveillance is required to detect the problem at an early stage but even then, it cannot usually be contained.

Thus, all the pests and diseases on the list are officially (CPC; 2024; Saravanakumar, et al. 2023) present somewhere in the Caribbean region with the exception of *Fusarium oxysporum* Tropical Race 4.

Saravanakumar, et al. (2023) showed that pests can often be overlooked unless detailed surveillance is undertaken and, therefore it is considered likely that the pests and diseases on the list are in more countries than those who have officially declared them. It was not determined how the delegates learned about the threats these pests pose to their agriculture. There was no mention of the use of the CABI Horizon scanning tool or Pest Risk Analysis tool, and based on brief discussions they are not widely used. It was noted that one of the delegates involved in this survey was an author on the

Saravanakumar, et al. (2023) paper. Saravanakumar, et al. 2023 also states that "This exercise guided the authorities in advance to allocate resources and to develop response plans including capacity building for surveillance and detection of priority pests". Whilst this may have occurred to an extent it is not nearly enough and much greater capacity building needs to take place in the inspection staff.

It is likely that there are many, as yet unrecognised, threats in addition to those listed.

Recommendation: The offices of the NPPOs of the region work together using the CABI Horizon scanning tool and the Pest risk analysis tool to identify pests and diseases threatening each country's biosecurity. This is particularly poignant with regard the pests and diseases which are already in the region but only in localised islands.

Once the potential pests have been identified the production of regional literature would be a cost-effective means of providing material to quarantine staff which would be appropriate to all the islands of the region. This would promote the symptoms/signs of the threats to the quarantine staff in an effective manner whilst also alerting them to which islands the pests are present.

COMMENTS ON THE DATA COLLECTION PROCESS AND THE QUALITY OF DATA RECEIVED.

Whilst the timescale of the inspection period was agreed; for reasons often outside the control of those involved there was a delayed start. Therefore, the period of inspection was not exactly the same for each country. Patterns of detection within the timescale of the study were investigated but it was not possible to see any trend or correlation with the season. This may have been because they were not present on imported material or that the data we were working with was too crude to detect what could have been subtle changes over the course of the study.

The quality and completeness of the data received in this study was generally poor. It was our intention to receive three clear data sets; ASYCUDA (all the agricultural produce, used tyres and vehicles and wood and wood products that entered the country during the study period) the Nil returns data (all that was inspected but nothing of significance found) and the CBIS data findings of significance on agricultural produce, wood packaging and used vehicles. However, the data received was of poor quality and often incomplete.

Most alarmingly there appeared to be a considerable mismatch between the volume of data as recorded by the ASYCUDA and that of the port inspectors. We can only speculate as to why this may be the case. When questioned on the mismatch, the port inspectors assured us that the port inspector's data was correct.

Several countries indicated that Customs were reluctant to share the ASYCUDA data and in the countries that were able to source the customs data it was provided in a manner

that was impossible to interpret. The dates were either given as month or in one case the dates were not included at all. The weights (or the units of the weights) and sizes of the consignments were not provided, and it was not possible to ascertain exactly what was in each consignment. It is these difficulties that explains the discrepancy between the data sets. Whilst the CBIS and the Nil returns were comparable the ASYCUDA could not be included in the analysis. The time scale regarding the delivery of the ASYCUDA data and the difficulty in obtaining it makes it appear that there are not clear lines of communication and cooperation between customs and SPS.

Within the ports, customs are the top authority, they effectively run the port and in comparison, phytosanitary inspections are vastly under-resourced. The job of customs is a huge one as they are keeping out contraband material as well as charging revenue on imports. They are generating income for the country. In comparison phytosanitation does not *generate* income but prevents huge *potential* losses by ensuring pests do not enter the country. This is almost certainly reflected in the allocation of funds to these two authorities.

It would appear that an inventory of the goods being imported is being made by customs and by SPS independently of each other. This duplication of effort seems somewhat backward especially in these days of digital sharing of information. They may be reasons why this is impractical, but it would appear eminently sensible to share the data produced by customs with SPS and to provide some means of recording the pest status of the consignment within the same data set.

It was interesting to note that according to the port inspectors' data there were relatively few inspections given the amount of produce believed to be arriving in any country, the average number of inspections per day ranged from 1 and 5 (discounting countries that did not return data). Whilst this is the average number of inspections, and the arrival of boats is not regular, it does seem surprisingly low. This could be for a variety of reasons, because the:

1. amount of produce is low
2. produce is not being inspected
3. inspections were not recorded
4. records of the inspections were lost before they were put onto the digital system.

In all countries there were verbal reports of inspections being recorded on paper and then being transferred to digital format. This obviously increases the likelihood of data not being recorded on the computer system and mistakes being made. It would seem logical that the CBIS should include some means of recording an inspection even though

nothing of significance was found. If this were done there would only be one interface and it would be relatively quick and easy to use, especially if there was internet connection at the port and or the ASYCUDA data was made available to port inspectors.

Recommendation: for customs and phytosanitary or quarantine staff/service to work with the same data set to avoid duplication of work and to ensure all materials are accounted for.

If good data were collected at borders, the data can be used for risk profiling, helping spot where the risks are higher. So particular countries and commodities might all be shown to be higher risk based on the interceptions; it can also be done for particular shippers – some companies are more likely to be non-compliant than others.

It was the intention of this study to use statistical analysis techniques to provide data on the likelihood of levels of detection and predictive stats to indicate the levels of biosecurity risks on various commodities received from various countries.

There are sophisticated models which can predict the likelihood of pests arriving on a particular commodity from a particular destination (Decrouez and Robinson, 2013; Kim et al., 2018). All these models rely on prior recordings, however the data recorded in this survey was insufficient in quantity and precision to make predictions with degrees of certainty on the presence of pests in the cargo. The size of the consignment, number of units inspected for pests and crucially the level of infestation within the sample all need to be recorded if these statistical models are to be used. The data collected in this survey needs to become routine so that long term observations can be provided and predictions on the threat posed by invasive alien species from various suppliers and on various crops can be made.

It was not clear who had filled in the digital versions of the forms. This may have been the inspectors or a colleague who took the paper copies. However, it appeared that those inputting data were unfamiliar with the use of Excel and were filling in the spreadsheet as if it were an electronic piece of paper. Ditto marks were inserted to indicate “same as above” and in other cases the cells were left blank (with the presumption that the uppermost cell of the column represented all that was beneath). The CBIS has a more user-friendly interface, and it is hoped that the data from that source was cleaner although the raw CBIS data was never supplied.

Recommendation: staff need to be trained in computer skills and wifi access at the port established.

As part of the study, Olympus TG6 cameras were supplied. These cameras have an excellent macro facility and automatic photo-stacking options that can produce extremely high-definition images. It was hoped that the exchange of digital photographs could be used to identify pests to a high degree of specificity. A tutorial was given to

explain the use of the camera with a highly experienced CABI colleague to demonstrate the macro and photo-stacking facility. Despite this, very few photos were submitted (photos were received from one country only) and the quality of those photos was extremely poor. The poor quality of the images meant that it was not possible to identify the pests to species level based on the photographs received.

Recommendation: Train the staff in photography so that they can take high quality photos of pests and diseases for identification purposes and as reference material.

It has to be acknowledged that many of those involved in the study worked hard at making this study a proper assessment of the SPS interceptions at their ports. However, despite the good intentions of many of these officers there was less enthusiasm within their staff and with customs.

It was also reported that some of the staff were reluctant to use the NAPPO calculator, it is not clear why this was the case as the proportion of inspections required was on a printed sheet meaning there was no need to use the tool at all. However, some importers complained that their goods were receiving additional checks, over and above what was routine and had previously been inspected.

Recommendation: Enthuse staff to do their job well and provide greater authority (as customs has) to prevent confrontation with importers. The NAPPO calculator should be established as part of a Standard Operating Procedure.

Comments Relating To The Interpretation Of The Survey Data

As mentioned previously it was not possible to include the AYSCUDA in any analysis other than to show the extent to which the datasets did not align. There could be several reasons for this inconsistency namely; there may have been misinterpretation of the AYSCUDA data, failure to log all the inspections and the consignments. Whilst it is possible to acknowledge the difficulties of interpreting the ASYCUDA data it is not possible to estimate to what extent inspections were unrecorded or consignments not documented. However, the levels of inspections do appear to be rather low as recorded on an average daily basis. An extreme example is that of St Kitts which recorded on average only 1 inspection per day over the whole of the survey period. Given that a huge amount of the food of this island is imported, it is difficult to reconcile the levels of inspections with the number of foodstuffs that must have been imported. The neighbouring sister island of Nevis is much smaller (and with only 25% of the population) but was averaging 4.2 inspections over the same time period.

The data relating to the country of origin and the proportion of those cargoes which are represented on CBIS shows that the USA was by far the largest exporter of produce but it

was intra Caribbean trade that was *proportionally* most represented on CBIS. The results on the country of origin need to be considered with caution as in some cases produce is imported and repackaged in the region before being exported to a neighbouring island. Whilst in Grenada it was noted that potatoes which appeared to have been grown in Trinidad were actually Dutch potatoes which had been repackaged in Trinidad. Despite these concerns and the relatively low numbers, it is the Caribbean islands that stand out as exporting the produce containing the most pests and diseases. It is difficult to speculate on why the produce from other Caribbean islands should be more likely to contain a pest or a disease. It could be that the produced from nearby islands is given greater scrutiny or that the exporting country has relatively lax inspections on export. The USA has tight quarantine regulations for material coming into the country and this may be reflected in the material being exported too.

This phenomenon is reflected in the combination of produce and exporting country (Graph 4). When broken down by commodity it would appear that the highest proportion of imports which are a biosecurity risk (i.e. appear on CBIS) are citrus fruits and banana. We can only speculate as to why this may be the case, but it may be due to the exporting country and not the commodity itself. Citrus and banana are traded within the region and as described above it would appear that the exporting countries from within the region are not so tight on their exporting quality control or the produce is given greater scrutiny on arrival.

The proportion of biosecurity issues (ie CBIS entries) as a proportion of the Nil returns data varied considerably by country (Graph 7). This may have been because the produce imported into some countries had more issues or it may have been due to greater scrutiny and or documentation by those countries. It is not possible to differentiate these two possibilities based on the information available and to speculate would be irresponsible. The data from Dominica appears to be entirely skewed to CBIS but no Nil returns data was submitted.

Interrogating the data to ascertain which was the most common type of pest or disease and if there were trends with certain types of pest arriving from a particular country was not particularly informative (Graph 6). Of the 12 countries of origin the only pest of concern were bacterial problems found in half of them. This is unusual as there are far more fungal diseases of crops than bacterial ones, but the result may reflect the fact that this produce has been in store and may be indicative of storage diseases.

Investigating the seasonal aspect of pests and diseases found on the cargo did not reveal any obvious trends (Graph 7). It is likely that there would be seasonal trends in the crops that are imported and the pests that they carry but this was not seen in the limited timescale of this study. A longer survey period with more accurate identification of problems would provide data that would assist the process of prediction.

Once a biosecurity issue was spotted on the commodity, there was little attempt to identify the pests as recorded on CBIS data. There were only 4 CBIS records from St Kitts, Nevis, St Lucia and St Vincent combined (with no data from Barbados) (Graph 8). Of these four records one was categorized as "fungus" one as "bacterium" one as "soil or debris" and one as "unknown". Whilst the levels of CBIS recorded interceptions are low it is frustrating that there was no greater attempt to identify the pest. The lack of identification of positive findings will inhibit any attempts to use statistics to make predictions as to where threats lie.

All of the 79 records from Dominica were recorded as "bacterium". Whilst it is not possible to identify bacteria in the field (other than by the symptoms they produce on the host plant) it seems rather extraordinary that all 79 records were identified as bacteria and yet it was not possible to provide any additional data as to which bacterium was the problem. It also seems highly unlikely there were no other interceptions other than those due to bacterial infection. This was not one rogue inspector providing this data as all the diagnosis of bacterium came from all of the 4 inspectors who submitted data. The NPPO of the island does admit the data is unusual but does not provide any explanation as to why this result was obtained.

The only two countries that made any serious attempt to identify, and to document, what was seen as a potential biosecurity issue were Grenada and Antigua. Within the records of these two countries there were 25 attempts (out of 44) to record something more precise than a phylum level classification, of these 12 were "mealybug" identified in Antigua. Whilst this is an improvement on "insect" there are over 2000 species of mealybug which still leaves a precise identification some way off. The famous case of the invasive pink mealybug is still firmly in the consciousness of the region and yet a diagnosis of "mealybug" would not prevent this from happening again.

The only examples of precise identification of the pests were from Grenada where there were six records identified to a species (and named pest/disease).

It is unfortunate that of the named species in the CBIS data, three of them are almost certainly incorrect. *Fusarium oxysporum f. sp. conglutinans* is a pathogen of Brassica crops (Cabbage family) and to report it infecting cantaloupe and lettuce is wrong. Similarly, *Synchytrium endobioiticum* is a pathogen that attacks potatoes and few other crops and its reported as a pathogen of Bell pepper. Whilst it was once reported as attacking Bell pepper in 1929 there are no other reports, if this record is indeed correct it would be significant finding for plant pathology.

Recommendation: provide staff with training on pests and diseases. Supply lists with photos of the shared pests between islands but also those pests that may be a threat if

they were to arrive and how to tell them apart from more common pests. Photos should specifically point out the differences between the pests common to the region and potential threats. This is especially important for those pests and diseases known to be in the Greater Caribbean region but not yet in the country.

Most importantly, staff need to be encouraged to share photographs and build up a dataset of either positively identified pests or the unknown pests.

Given the extremely low levels of CBIS entries in most of the countries it was not surprising that few of the inspectors had recorded data in CBIS (except for Dominica where all inspectors had recorded in CBIS because no Nil returns data was submitted (Graph 10). As expected, not all inspector reported pest detections at the same level of frequency. One can only speculate as to the reasons for this. However, the numbers of inspectors submitting data in St Vincent was surprising. Twenty-three names were recorded as having inspected the material, which is far more than the other countries. However, St Vincent did indicate that they had 24 staff directly involved in plant quarantine services which indicates this is not an error.

GENERAL COMMENTS WITH REGARD SPS IN THE REGION

Recommendation: so as to bolster the morale of those working in biosecurity at the port and to acknowledge the important job they do, any seizures of material at the border which may negatively affect the agriculture of the region should be given prominence in the media and government.

At the close out meeting there were several speakers who referred to the processes involved in invasive species namely:

- Prevention of IAS introductions into the region and between islands
- Early detection and rapid action, crucial to prevent its establishment: with the intention of eradication
- Where eradication is not feasible or resources are not available, containment management and long-term control measures should be implemented.

However, the emphasis, even among those involved in invasive species, appears to be misplaced.

Once an invasive species has become established to anything other than an extremely localised outbreak (such as a racoon emerging from a container) the chances of preventing further establishment are remote.

Unless the pest can be prevented from entering the country, hopes of doing anything other than slowing the spread are unrealistic. Despite this, the emphasis at the meeting was not on exclusion of invasive pests and diseases. Whilst the exclusion of pests and disease was a topic, surveillance and management of invasives was given an equivalent weighting. Surveillance and management are process that are active (you are looking for something that you know is there) and can be undertaken with tangible results (e.g. it is possible to document the number of sightings or kills). It is difficult to apply the same metrics to port inspections when the observations almost always are nothing of significance.

The converse of this, exclusion, the business of port inspections does not provide any tangible benefits on a regular basis. Whilst the management and surveillance of an invasive is likely to attract more attention and money, exclusion is a much better investment.

Based on the results obtained it is difficult to assess the level of biosecurity at the ports but they are inadequate, and the documentation of the results is poor. When it was suggested that better laboratory facilities should be provided at the port, participants in the study replied that their needs were more fundamental and that tables to work on and chairs to sit on would be a more appropriate request.

The countries of the Caribbean should work together to keep pests out of the region but when there is an incursion there are international obligations to immediately alert neighbouring islands (especially those that they export to) of the presence of an invasive pest. Despite these lofty ideals and international responsibilities, it would appear that this does not happen in practice. There is nothing to be gained for an individual country by announcing that it has a pest other than praise and recognition for having done the right thing and thanks from trading partners.

This announcement to the IPPC of a new invasive pests is the responsibility of the NPPO. However, the NPPO representatives who took part in this study all indicated that they would have considerable pressure put on them NOT to release data revealing that a new pest had arrived in the country. They expressed concerns that doing so could compromise their career and possibly they could lose their position. This situation is not unique to the Caribbean region and is a common mentality among neighbouring countries across the globe.

An example of this exact situation is the current incursion of the highly invasive species *Amrasca biguttula*, commonly known as the cotton jassid. This pest has recently arrived in the region and has been reported by some islands. Other islands have launched big awareness campaigns for farmers but without acknowledging it internationally and others are yet to announce they have it. Whilst it is likely that most islands have the pest

now there may be some which do not. No attempt to spread the information of the arrival of this pest to neighbours has been made.

Overcoming the secrecy surrounding the presence of new pests is not easy as anyone involved in the detection has a vested interest. At the close out meeting in St Kitts it was suggested that a pan Caribbean social media site could be used to record pests. If enough members of the public were to post photos on social media of an invasive pest in their locality, it would make it impossible for the government of an island to continue to deny that the pest was present. Whilst there are obvious attractions to this process there are lots of pitfalls and the likelihood of it working to force the hand of a government is small.

The following are recommendations/suggestions that could be implemented to improve the biosecurity of the region.

One of the most important things to change is the access to the ASYCUDA data from customs so that SPS can add to the data rather than recreating it. The consignments are already listed on ASYCUDA so a lot of work could be saved. If possible, a few additional columns in the ASYCUDA sheet would suffice; namely who inspected the cargo, how much they inspected, when they inspected it and what was found (including a nil response).

To facilitate this, internet access at the port needs to be available to all plant quarantine staff.

Recommendation: to improve biosecurity of commercial trade: The staff complement must be significantly increased and the relevant officers trained, preferably at the UWI certificate level, even if they come with degrees in a Plant Protection related field. Additionally, the matter of providing proper facilities at the ports of entry designated for entry of plants, must be seen as one to be urgently and appropriately addressed. Formal and more clearly defined linkages with Customs and customs procedures must be developed and implemented at the earliest possible time.

In addition to these changes to the infrastructure, phytosanitary inspection staff need better training in the identification of pest and diseases and the use of computer technology, functional laboratory facilities at the ports are also necessary.

Staff should also be trained in photography and encouraged to share photos internally, within the region and internationally.

Simple pest guides should be provided to Port inspectors who make identifications. When identifications are not possible inspectors should take photographs, which are stored in a repository. This repository will gradually build into a database. In the absence

of good identification at the port the library of photos could be some sort of record of what was found at the port.

Key pests are identified and detailed information is given on what to look out for as well as photos of the pests provided on the CBIS tablet.

Previous assessments of the biosecurity of the region have been critical of systems in place to protect the islands from invasive species Kairo et al., (2003) and Waugh (2009) found systems and funding to be lacking. The recommendations from both studies are provided in annex 4. The findings of both reports are remarkably similar to each other and to the findings of this study.

The findings of this report are not new and not a surprise to anyone who has been monitoring the situation over the past 20 years. The world is increasingly reliant on electronic digital equipment and this report emphasizes the necessity for data to be shared which is now simpler than it has been in the past due to increased computer power, general familiarity with the operation of digital equipment and the reduced size of modern equipment. Although the changes in sharing of digital information could have only come about recently, other changes that could have been made based on the recommendations of previous reports have not been enacted.

The problems observed are not unique to the region, poorly trained staff who are not properly equipped, working in poor conditions with considerable pressure from the ports and the traders are all typical of the environment of port inspectors.

If the governments continue to not provide not enough support and training to their inspectors there is no doubt that pests and diseases will continue to spread into the region and within the region.

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Annex 1: Standard Operation Procedure (SOP) for gathering at border intelligence on goods which may pose a risk to Caribbean plant health.

6th August 23

Overview:

This SOP should be followed by all partners participating in the Global Environment Facility (GEF) project which is being co-ordinated by CAB International. The aim of the project is to assess the risk posed by international trade, considered to be a high-risk pathway which may introduce invasive species into and between Antigua and Barbuda, Barbados, Dominica, Grenada, St Kitts and Nevis, Saint Lucia and Saint Vincent and the Grenadines.

Introduction:

An initial set-up meeting for the project was held by videocall on the 20th of July which was followed by a workshop in Barbados on 25th July. At the workshop partners gave talks on their service and provided information on pests they consider to be threats to their country. Participants were also given refresher training on the Caribbean Biosecurity Interceptions System (CBIS), introduced to the NAPPO sample calculator and general plant pathogen symptom recognition. Participants were also given digital cameras with photo stacking facilities and USB microscopes for project use.

Scope:

With the assistance of all partners the workshop refined the project scope as:

- For three-months all participating countries should collect plant health inspection data for the following three commodities: i) Wood imports and packaging; ii) Used machinery, vehicles, and tyres; iii) Fresh agricultural produce (with a focus of 20 key commodities).
- As part of the collection participants should record information including: What was inspected, a description of any pest and disease signs and symptoms seen and an opinion of what could be causing the symptoms providing as much precision as possible without losing accuracy. E.g.
    - (i) Exit hole in timber caused by a wood boring beetle which has been sent for laboratory identification.
    - (ii) Necrotic sunken spots on citrus, dark margin and black spots within believed to be fungal probably *Phyllosticta citricarpa* images sent to CABI.
    - At the end of the project collective data will be merged and analysed statistically then interpreted to assess low, medium or high risks posed by these various

"vectors" for the introduction of Invasive Species into the sub region, and by extension, the wider Caribbean.

Materials:

- Standard inspection kit including: Sampling knife, hand lens, sample bags and tubes and tape for resealing consignments.
- Project tablet loaded with NAPPO Sample calculator, CBIS and Excel spreadsheet for recording inspections where no issues were identified.
- Project template for recording inspected consignments which were negative for pests, or soil.
- List of ISPM 15 country codes used on wood: https://www.canadianpallets.com/en/list-of-country-codes.aspx

Methodology:

- All effort should be made to inspect as many imported goods as possible.
- If resource is limited inspections should be prioritised (providing the biosecurity is not compromised) according to the table in Annex 2: Prioritisation for sampling.
- Samples for inspection should be selected from whole consignments according to the NAPPO sample calculator. (ie number of items/boxes inserted with a 10% risk and 95% confidence setting and the appropriate number of items/boxes inspected). *
- It is essential that all inspections are recorded (even if free of any observable contaminants / invasive species) to enable statistical analysis.
- CBIS must be used for all pest findings; consignments rejected because of phytosanitary certificate problems, or occasions when ISPM 15 stamps are not seen on wood packaging, timber, or dunnage where their presence would be expected.
- Country inspections where no issue was identified should be recorded on the Excel Spread sheet which will be loaded onto your tablet.
- Loads of timber should be inspected as best as possible, do not breakdown load due to difficulty of restabilising and repacking cargo. Similarly caution needs to be applied if used tyres are to be inspected. In both situation it may be best to inspect consignments at the point of delivery rather than at point of arrival (port).
- When pests and diseases, their symptoms, or soil in samples, or as a contaminant is observed a diagnosis is required. If a local diagnosis cannot be made samples must be taken and sent for laboratory diagnosis following appropriate biosecurity procedures. If no other route is available samples should be sent to the CABI diagnostic and advisory service for diagnosis. Details on the procedure for sending samples to CABI can be found at: CABI BIOSCIENCE ♦A division of CAB

INTERNATIONAL (plantwise.org) and the legal forms that must be submitted with the sample are provided as documents within annex 3.

Health and Safety:

All local rules must be followed, which is the responsibility of the person performing each inspection.

- *If more detail inspection is considered necessary for the biosecurity of the country, then this should also be done, but it is not necessary for this project.

Annex 2: Prioritisation for sampling.

To ensure data provided is appropriate for statistical analysis these are the priority crops which should be sampled, keep crop names as specific as possible when recording.

Country specific banned or high priority hosts*
Live plants or seeds
Cabbage, broccoli, Cauliflower, sprouts Kale
Irish potato
Banana / Plantain
Citrus
Lettuce
Pineapples
Honeydew & cantaloupe melons
Strawberry
Avocado
Cut flowers
Sweet & chili peppers
Zucchini / Squash
Sweetcorn
Tomatoes
Carrots
Celery
Ginger
Coconut
Palms and palm products

Annex 3: Essential documents when sending samples to CABI. (Four documents)

GUIDANCE for completing new LoA

LoA to import, move and keep plan

DAS Collecting and sending plant mate

DAS sample submission form 20

Annex 4: Recommendations to improve the biosecurity of the Caribbean region as made by Waugh, (2009)

1. That standards for trade in and handling of horticultural species in the insular Caribbean be adopted, building upon Voluntary Codes of Conduct for the horticulture industry (Center for Plant Conservation, 2001 and as amended in 2002 at http://www.centerforplantconservation.org/invasives/codesN.html).
2. That the US government's Caribbean Safeguarding Initiative be modified to foster and encourage regional cooperation on invasive species issues in trade-related pathways.
3. That trade agreements should provide for cooperation between the parties to build the capacity to identify, intercept, and manage undesirable biological transient species such as potential pests and invasive species.
4. That sanitary/phytosanitary rules and regulations within the region be revised, consistent with WTO's SPS agreement, to strengthen protection against invasive species introductions, with particular attention to standards for the trade in and use of horticultural species.
5. That governments of the region work together and with other governments, to assure that trade rules are fully consistent with and supportive of Article 8 (h) of the Convention on Biological Diversity and with best practices to prevent the introduction of invasive species, and that standards for the prevention and control of invasive species be developed and agreed between countries sufficient to withstand challenges under the international trade regime.
6. That further studies be conducted to model disturbance resulting from extreme weather events and to analyse risk of invasive species introduction and spread associated with climate change
7. That governments, the private sector, academia, and civil society organizations work together to create a regional learning network on invasive species, to aid in identification, provide early warning (including notification of discovery), and share resources to rapidly respond to invasive species outbreaks to ensure eradication.
8. That each government in the Caribbean region be supported to develop a comprehensive biosecurity strategy, integrating disaster risk management, food security, anti-terrorism, sanitary/phytosanitary and ecosystem management responsibilities.

Summary of recommendations prosed by Kairo et al 2003

- The databases established under this project should be further developed, made publicly available, and up dated as part of an on-going initiative to provide essential baseline information on the distribution of invasive species (and relevant expertise) at a national and regional level throughout the Caribbean. ·
- A regional network for the exchange of information on invasive species issues should be formally established, initially (at least) through the on-going operation of the discussion group.
- National and regional strategies for the management of invasive species threats should be developed. A useful first step would be to hold a regional workshop to clarify needs and opportunities. This process should take account of the following:
    - Valuable insights can be gained from experience elsewhere in the world. International support is available through the Global Invasive Species Programme (Ginvasive speciesP) and the Invasive Species Specialist Group (invasive species SG) of the IUCN/Species Survival Commission, and full advantage should be taken of the facilities that these groups have to offer.
    - Invasive species threats represent a cross-sectoral issue. The most effective action to address these threats will come through greater co-operation between government, nongovernment and commercial bodies, and through greater co-operation between those concerned with agriculture, environment, tourism, trade and other relevant activities. Currently, communication between major stakeholders is often poor.
    - Enhancement of capacity to deal with invasive species threats (either nationally or regionally) will involve development of legislative/regulatory frameworks, as well as development of human and physical infra-structure. Where some capacity already exists (generally in the agricultural sector) this should be built upon, but this process must take account of the cross-sectoral nature of the problems to be addressed.
- One immediate need is for greater awareness-raising effort, to emphasise the socio-economic and environmental consequences of species invasions. Awareness needs to be raised amongst policymakers (to facilitate political action), those directly engaged in relevant activities “on the ground” (including civil servants and commercial operators), and the public. A broad programme of awareness-raising activities would help to emphasise the cross-sectoral nature of the invasive species problem and should be used to stress the message that prevention (or early action) is more effective than attempts to deal with species invasions in their later stages.