IMPLEMENTATION REVIEW AND SUPPORT SYSTEM (IRSS)

Food and Agriculture Organization
of the United Nations

2017

ENG

Analyzing the benefits of implementing the IPPC

A review of the benefits of contracting party implementation

International Plant Protection Convention
Protecting the world's plant resources from pests

ANALYZING THE BENEFITS OF IMPLEMENTING THE IPPC

A review of the benefits of contracting party implementation

Important note – this document is DRAFT and is subject to formal editing, formatting and publishing processes.

This study presents a summary of the benefits of implementing the International Plant Protection Convention (IPPC), international standards for phytosanitary measures (ISPMs) and recommendations made by the Commission on Phytosanitary Measures (CPM). Analysis of benefits was conducted by the IPPC Secretariat in conjunction with experts from the fields of plant health, international trade, international economics and environmental protection. This work has been developed by the IPPC Secretariat, with case studies provided by contracting parties and reviewed by selected experts. The elaboration of this study was possible thanks to the European Commission's support of the IPPC Implementation Review and Support System (IRSS) project.

Contents

Acronyms

AFM	Avocados from Mexico brand
AGP	Plant Protection and Protection Diversion (of the FAO)
APEAM	Asociación de Productores y Empacadores Exportadores de Aguacate de México
APHIS	Animal and Plant Health Inspection Service (of the USDA)
BLG	Biodiversity Liaison Group
CABI	Centre for Agriculture and Biosciences International
CBD	Convention on Biological Diversity
CDC	Capacity Development Committee (of the IPPC)
CIHEAM	Centre International de Hautes Etudes Agronomiques Méditerranéennes
CPM	Commission on Phytosanitary Measures (of the IPPC)
EMPRES	Emergency Prevention System (of the FAO)
EU	European Union
FAO	Food and Agriculture Organization of the UN
GDP	Gross domestic product
IAEA	International Atomic Energy Agency
IAG	Independent Advisory Group
IAS	Invasive alien species
IRSS	Implementation Review Support and System (of the IPPC)
IPM	Integrated pest management
IPPC	International Plant Protection Convention
ISPM	International standard for phytosanitary measures
MHAIA	Mexican Hass Avocado Importers Association
MPI	Ministry for Primary Industries (of New Zealand)
NPPO	National Plant Protection Organization
OCS	Online commenting system (of the IPPC)
OWP	Operational work programme
PCE	Phytosanitary Capacity Evaluation tool

PHEL	Plant Health and Environment Laboratory (of the MPI, NZ)
RDF	Remote Diagnostic Facility (of New Zealand)
REC	Regional Economic Committee
RPPO	Regional Plant Protection Organization
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (of Mexico)
SC	Standards Committee (of the IPPC)
SDG	Sustainable development goal (of the United Nations)
SPG	Strategic Planning Group (of the IPPC)
SSC	South-South Cooperation Programme (of the FAO)
STDF	Standards and Trade Development Facility (of the WTO)
TC-RPPO	Technical Consultation among Regional Plant Protection Organizations
TCP	Technical Cooperation Programme (of the FAO)
UN	United Nations
UNEP	United Nations Environment Programme
USDA	United States Department of Agriculture
WCO	World Customs Organizations
WPM	Wood packaging material
WTO	World Trade Organization
WTO-SPS	World Trade Organization Sanitary and Phytosanitary Agreement Committee

Preface

Since 2011, the Implementation Review Support and System (IRSS) project of the International Plant Protection Convention (IPPC) has focused on reviewing contracting parties' implementation of the Convention, international standards for phytosanitary measures (ISPMs) and recommendations made by the Commission on Phytosanitary Measures (CPM). This review work has largely focused on understanding contracting parties' implementation challenges, to assist the IPPC Secretariat to prioritize its work programme to enhance implementation. Over this period, contracting parties have come a long way in their improvement of implementation, and to recognize this the IRSS is for the first time undertaking a study to understand these successes: *Analyzing the benefits of implementing the IPPC.*

This study was commissioned by the CPM Bureau, to identify the benefits of implementing the IPPC at the national, regional and global level, while also considering benefits to different industries and sectors relating to plant health. The different aspects that were to be considered were in relation to implementation of the Convention, ISPMs and CPM recommendations, in achieving the IPPC strategic objectives[1].

To undertake this study, IPPC Secretariat conducted a meeting of experts from the fields of plant health, trade, international economics and environmental protection to outline the scope of the study, explore options for assessment of implementation benefits and to collect relevant case studies and references. In addition to engaging a target group of experts, the study was discussed by the CPM Bureau and the IPPC Strategic Planning Group (SPG) at their October meetings, the e-Phyto Industry Advisory Group (IAG), the IPPC Standards Committee (SC), the Technical Consultation among Regional Plant Protection Organizations (TC-RPPOs) and the IPPC Capacity Development Committee (CDC).

The outcomes of this study are intended to highlight to the beneficiaries and stakeholders of the IPPC, how implementation of the Convention, ISPMs and CPM recommendations is of value to them. The beneficiaries are considered the IPPC community, at the global, regional and national levels, who are involved in plant health implementation activities. The study will demonstrate benefits using a series of case studies.

[1] IPPC Strategic Framework 2012-2019
https://www.ippc.int/static/media/files/publications/en/2013/06/03/1344410402_ippc_strategicframework_e_w_201305101054en.pdf

Introduction

The International Plant Protection Convention (IPPC) is an international plant health agreement with a vision of protecting global plant resources from pests. The IPPC mission "To secure cooperation among nations in protecting global plant resources from the spread and introduction of pests of plants, in order to preserve food security, biodiversity and to facilitate trade" (IPPC, 2012a) is the shared responsibility of a membership of 183 contracting parties.

The mechanisms established by the IPPC for cooperation among contracting parties, standards development for procedural harmonization, information exchange, capacity development, legal and policy guidelines have all resulted in a very predictable, stable and reliable platform for international trade in plants, plant products and other regulated articles as well as addressing domestic pest problems. The international standards for phytosanitary measures (ISPMs) have provided a basis for the application and harmonization of acceptable and technically justified measures applied in this international trade.

Contracting parties' implementation of the IPPC and its ISPMs responds to national priorities as well as international obligations and carries with it responsibilities and obligations. In context of international trade and principles applied, the protection of plant resources also translates into major benefits nationally, regionally and internationally. These benefits may be classified broadly as economic, trade facilitation, food security and environmental.

The IPPC as an international treaty recognized by and working hand in glove with the World Trade Organization (WTO), to confer on its contracting parties obvious benefits that relate to the promotion and facilitation of safe international trade. Increasing agricultural production and exports are recognized as critical paths for economic development for many countries in which agriculture contributes significantly to the national gross domestic product (GDP).

Many countries grapple with the issue of food security which is constantly being threatened by pest introduction and spread. Increased food security is an obvious expectation from the vision and mission of the IPPC. It is also a specific focus in the strategic objectives of the Food and Agriculture Organization (FAO) and the United Nations sustainable development goals (UN SDGs).

The strengthened relationships between the IPPC and environmental agencies, such as the Convention on Biological Diversity (CBD), bring into sharp focus environmental concerns to be addressed jointly in fulfilling their mandates. ISPMs and CPM recommendations now reflect greater consideration for environmental issues. Additionally, measures that are decidedly more environmentally sound are being promoted and applied in order to preserve the environment and its biodiversity.

This study attempts to explore the benefits of the implementation of the IPPC with particular emphasis on benefits at the national level.

IPPC vision and mission statements

The vision of the IPPC is: Protecting global plant resources from pests.

The mission of the IPPC is: To secure cooperation among nations in protecting global plant resources from the spread and introduction of pests of plants, in order to preserve food security, biodiversity and to facilitate trade.

Benefits

The nature of benefits

A benefit can be described as a positive effect of implementing activities within an IPPC mandated phytosanitary system. Benefits can be realized on different time scales, from having an immediate effect, to contributing to a long term bigger picture good. They can also vary in scale spatially, with positive effects being realized at a sub-national, national, regional or global level. Benefits can both have bottom-up and top-down effects, dependent on their temporal and spatial nature. This can be seen with how benefits have wider flow on effects to different levels, within the spatial levels from sub-national, to national, regional and global implementation and within and between the strategic frameworks that IPPC operates and contributes to, being the IPPC Strategic Framework (IPPC, 2012), the FAO Strategic Framework (FAO, 2013) and the UN Sustainable Development Goals (UN, 2015) (Figure 1).

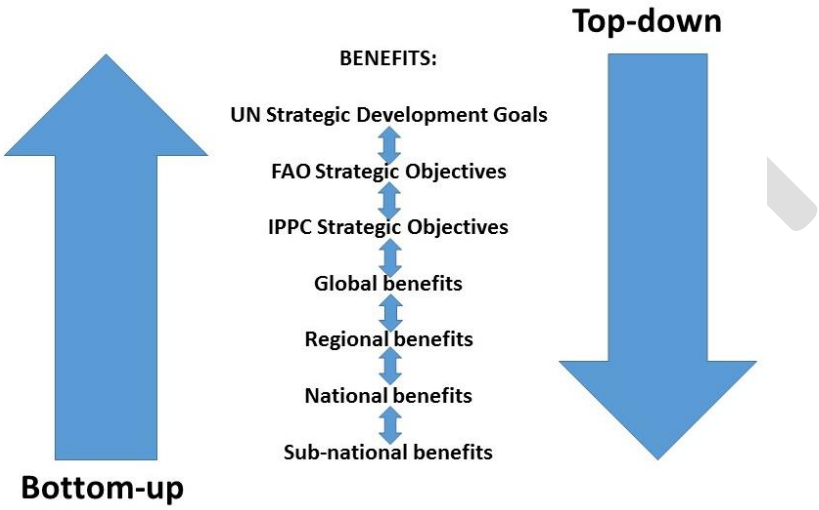

Figure 1: Visual representation of the inter-connectedness of the levels of benefits.

The inter-connectedness of levels of benefits provides a basis for their sustainability. However, for a benefit to be sustainable it requires continued investment, which starts with commitment at the national level to provide inputs, usually in the form of resources, into implementation activities to achieve a desirable impact. This doesn't mean that sustainability relies on financial resources to be achieved, it means that participants at the national level have both the capacity and the will to implement the IPPC, ISPMs and CPM recommendations and continually seek ways to increase their efficiency through innovation and use of new technologies and techniques. The logic of this chain of events is represented in Figure 2.

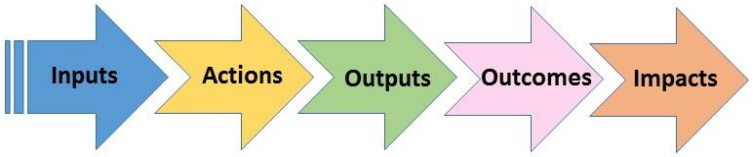

Figure 2: The logic chain for achieving implementation benefits.

Generally, the realization of benefits is considered from an economic perspective using quantitative analysis, however there are many wider benefits that are less tangible, that can be measured qualitatively. As such, this study will look at different categories of benefits in relation to implementation of the Convention, ISPMs and CPM recommendations. The relationship between categories of benefits and contracting party implementation can be found in Annex 1.

Categories of benefits

- Global protection of plant resources
- International cooperation
- Trade facilitation and economic development
- Environmental protection
- Food security

IPPC Beneficiaries

In the context of this study the beneficiaries are those included in the IPPC Community (Figure 3) and further defined with sub-groups belonging to each community group (Table 1).

Figure 3: Beneficiaries of the IPPC Community.

The IPPC Community groups can be further defined by sub-groups belonging to each group in Figure 1. Particular attention is paid to the national level, represented to the IPPC as the contracting party. It is at this level that key phytosanitary activities are implemented, by a wide range of national stakeholders. Oversight of a national phytosanitary system is the responsibility of the NPPO, the official organization of the contracting party. Official NPPO activities are sometimes delegated to authorized service providers and many activities are undertaken by participants from the value supply chain, who are day to day implementers of the provisions of the Convention, ISPMs and aspects of CPM recommendations. These participants include, but are not limited to, producers, retailers, processors, marketers, importers and exporters.

Table 1: IPPC Community groups and sub-groups

Global community	Regional level	National level (contracting party)	Affiliated international organizations[2]	Collaborative international organizations[3]
World population	RPPOs	NPPOs	UN	Technical related: - IAEA - CABI - CIHEAM
	RECs	Plant health practitioners	FAO	Trade related: - WTO-SPS - WCO
		Authorized service providers	WTO	Environmental related: - CBD - BLG - UNEP
		Value supply chain participants: - producers - retailers - processors - marketers - importers - exporters		Resource related: - STDF - EC - International development banks
		Consumers		FAO related: - AGP - EMPRES - FAO regional and sub-regional offices
		Research institutions		
		Academia		

The importance of implementation capacity

Especially important is the capacity of a contracting party to implement the Convention, ISPMs and CPM recommendations. The national phytosanitary capacity of a contracting party is defined by the IPPC as: "The ability of individuals, organizations and systems of a country to perform functions effectively and sustainably in order to protect plants and plant products from pests and to facilitate trade, in accordance with the IPPC" (IPPC, 2012b). The IPPC Capacity Development Strategy highlights sustainability factors that include but are not limited to:

- An enabling environment in countries such as policies which allow plant health activities to evolve and adapt to changing circumstance;
- Plant health legislation which empower NPPOs to function;
- Visibility and understanding of the IPPC;
- Understanding of the importance of implementation;
- Viable business plan(s) for protecting plant health and trade; and

[2] Acronyms include: UN (United Nations); FAO (Food and Agriculture Organization of the UN); WTO (World Trade Organization).

[3] Acronyms include: IAEA (International Atomic Energy Agency); CABI (Centre for Agriculture and Biosciences International); CIHEAM (Centre International de Hautes Etudes Agronomiques Méditerranéennes); WTO-SPS (World Trade Organization Sanitary and Phytosanitary Agreement Committee); WCO (World Customs Organizations); CBD (Convention on Biological Diversity); BLG (Biodiversity Liaison Group); UNEP (United Nations Environment Programme); STDF (Standards and Trade Development Facility(; EU (European Union); AGP (Plant Protection and Protection Diversion of the FAO); EMPRES (Emergency Prevention System of the FAO).

- National commitment to sustain phytosanitary capacity.

What are the benefits of being an IPPC contracting party?

Contracting parties to the IPPC ('the Convention') accept both rights and obligations specified therein and from adherence to the Convention they derive a variety of benefits. These include being part of an international trade agreement, being able to contribute to the international standards setting process, being able to request technical assistance, and having mechanisms for dispute resolution and information exchange. The IPPC provides a platform for contracting parties to establish and operate their phytosanitary systems, with the purpose of facilitating safe international trade. Adherence to the IPPC increases the credibility of national phytosanitary systems for trading partners and provides opportunities for interaction within the IPPC community and other international fora.

As of 2017, IPPC has 183 contracting parties

The benefits relating to international trade include consistency between the IPPC obligations to the WTO SPS agreement (WTO, 1994), of which the majority of trading partners are also WTO members, providing opportunities for interaction with the IPPC community through the WTO-SPS committee. Likewise the annual meeting of CPM and other subsidiary body meetings provide an opportunity for active involvement in decision making processes, thus contributing to global phytosanitary policy and adoption of international standards, directly inputting into the processes of global harmonization.

Where contracting parties see the need, they also aid their fellow contracting parties in implementation of the Convention. This is often seen in the form of technical assistance through capacity building and projects to strengthen plant protection, assistance with reviewing and updating legislation and coordinating the availability of expertise. Such cooperation for technical assistance is actively promoted through the CPM and can be coordinated by the IPPC Secretariat or on a bilateral or multilateral basis.

Services and mechanisms to facilitate plant health activities provide contracting parties a way to work through their implementation challenges, which often include working to resolve informal disputes and exchanging information in the effort of cooperation. As such, the IPPC includes a provision for dispute settlement for instances where there are unjustified barriers to trade and dialogue between two parties needs to be facilitated to seek a mutually beneficial and agreed resolution. To be a transparent trading partner to the IPPC there is the necessity for the publication and exchange of official information, for which an online platform is provided to contracting parties – the International Phytosanitary Portal (the IPP). The IPP provides a wealth of information that is easily accessible to contracting parties, including contracting party profiles and who their official contact point is, news of IPPC activities, notifications of opportunities for involvement in technical meetings and direct access to international standards and related information, all on a neutral forum.

Other tools available for use, including the Phytosanitary Capacity Evaluation (PCE) tool and the Online Commenting System (OCS) to submit comments on draft international standards during consultation. Additionally, in development is the e-Phyto solution for the electronic certification exchange.

To further promote the implementation of the Convention contracting parties and the IPPC community have access to technical resources developed by the IPPC Secretariat in conjunction with international experts and resources contributed by external providers that have been reviewed for consistency with the Convention and international standards. Such resources are available on the IPPC Phytosanitary

Resources website and include guides and manuals on various aspects of phytosanitary systems and operations, e-learning modules, resources for advocacy such as photos and factsheets and a roster of consultants that can be used when seeking expert assistance.

The benefits that can be realized through contracting party implementation of the Convention, ISPMs and CPM recommendations are varied and may be direct or have flow on and wider benefits at the national, regional and global levels. In any case, the benefits of implementation significantly outweigh the costs of not implementing the Convention. The realization of this comes from the old adage – prevention is better than cure!

Why do we need a Convention and international standards?

IPPC aims to protect cultivated and wild plants by preventing the introduction and spread of pests. To do this the Convention sets out a way for contracting parties to undertake actions to prevent the spread and introduction of pests of plants and plant products, through using appropriate measures for their control. In addition to plants and plant products, the Convention also provides coverage of storage spaces, packaging, conveyances, containers, soil and any other organism, object or material capable of harboring or spreading plant pests (FAO, 1997).

With respect to protecting plant resources, the IPPC contributes to:

- protecting farmers and foresters from the introduction and spread of new pests;
- protecting food security;
- protecting the natural environment, plant species and diversity; and
- protecting producers and consumers from costs associated with combating and eradicating pests.

So why implement the IPPC?

A world without protection of global plant resources would surely be a very risky (no measures) or restrictive place (prohibition or too many measures). The IPPC provides a framework for the development and application of harmonized phytosanitary measures and the coordination of global plant health activities. Through promotion of international cooperation and providing a set of international standards to follow, gives contracting parties a level playing field in which to safely trade in plants and plant products.

International standards for phytosanitary measures (ISPMs)

The intention of international standards is to harmonize phytosanitary measures for the purpose of facilitating safe international trade. ISPMs cover a wide range of activities, which include but are not limited to, surveillance, pest risk analysis, the establishment of pest free areas, export certification, phytosanitary certificates and pest reporting. Additionally, IPPC has responded to the need to harmonize phytosanitary treatments and diagnostic protocols as annexes of ISPMs. To ensure global applicability the IPPC Standards Committee oversees the development of ISPMs, which are then adopted by contracting parties at the annual CPM meeting.

The availability of ISPMs is a significant benefit to contracting parties as it allows them access to a set of globally harmonized standards that are the basis for phytosanitary measures, and their associated activities, to be applied in international trade. This provides contracting parties with certainty and credibility in the establishment and management of their phytosanitary systems.

Through appropriate implementation of ISPMs contracting parties benefit from strengthened phytosanitary systems and contribute to the IPPC strategic objectives of sustainable agriculture and global food security, protection of the environment, forests and biodiversity, economic and trade development and enhanced national phytosanitary capacity.

The phytosanitary principles of protecting plant resources

At the highest level, there are a set of principles for the protection of plants that are embodied in the Convention, which are outlined in ISPM 1 (*Phytosantiary principles for the protection of plants and the application of phytosanitary measures in international trade*). These principles cover the protection of plants, both cultivated and wild, on land or in aquatic environments, the application of measures for the international movement of plant resources, conveyances and people and how these relate to the objectives of the IPPC. The principles provide the basis from which to establish and maintain an effective phytosanitary system, reflecting the provisions of the SPS Agreement and the rights and obligations of the Convention.

Two of the key elements in operating a phytosanitary system, from which other activities are interconnected, include surveillance of plant resources for associated pests and the conduct of pest risk analysis. These are operational principles that are core to the establishment, implementation, monitoring and to the official administration of phytosanitary systems.

Surveillance

Contracting parties should collect and record data on pest occurrence and absence to support phytosanitary certification and the technical justification of their phytosanitary measures. In this regard, the IPPC also provides, "Contracting parties shall, to the best of their ability, conduct surveillance for pests and develop and maintain adequate information on pest status in order to support categorization of pests, and for the development of appropriate phytosanitary measures."

Relevant Articles in the IPPC: IV.2(b), IV.2(e) and VII.2(j).
Relevant ISPMs: ISPM 6 (*Guidelines for* surveillance) and ISPM 8 (*Determination of pest status in an area*)

Pest risk analysis

NPPOs should, when performing pest risk analysis, base it on biological or other scientific and economic evidence, following the relevant ISPMs. In doing this, threats to biodiversity resulting from effects on plants should also be taken into account.

Relevant Articles in the IPPC: Preamble, II, IV.2(f) and VII.2(g)
Relevant ISPMs: ISPM 2 (*Framework for pest risk analysis*), ISPM 5 (*Glossary of phytosanitary terms*, including Supplement 2: *Guidelines on the understanding of "potential economic importance" and related terms including reference to environmental considerations*), ISPM 11 (*Pest risk analysis for quarantine pests*) and ISPM 21 (*Pest risk analysis for regulated non quarantine pests*).

The importance of plant pest surveillance

A foundation activity of a well-functioning phytosanitary system is the surveillance of plant resources for associated pests. At the national level, plant pest surveillance is a primary function of an NPPO, with outputs of general surveillance and specific surveys used for many purposes. Surveillance information and data allows NPPOs to develop lists of regulated pests, determination of pest status in an area and pest categorization, all which enable the conduct of pest risk analysis. The importance of surveillance to contracting parties is understood, with the implementation of ISPM 6 (*Guidelines for surveillance*) considered to be the highest priority for implementation of any of the ISPMs (IPPC, 2014a). Likewise, the IPPC Secretariat has acknowledged the importance of surveillance, which is the focus of a pilot project to enhance contracting party implementation of surveillance[4].

General surveillance supports pest status determination in Australia

At CPM 11 in 2016 Australia gave a presentation about their general surveillance framework and how it is used to determine pest status at a state and federal level. The Australian General Surveillance Framework was developed to better define general surveillance and to improve the level of confidence that a pest is present. The approach can also be used to determine that a pest is absent. This is in accordance consistent with ISPM 8 (*Determination of pest status in an area*), which states that "reliable records" (which can be general or specific surveillance) should be used to determine presence. Within this framework are two broad categories of interconnected elements relating to, the biosecurity system and pest and/or host specific biosecurity components.

The comprehensive General Surveillance Framework includes the below aspects below (Table 3) within each of the two main categories of elements. These, which closely align with the requirements of ISPM 6 (*Guidelines for surveillance*), regarding general surveillance and specific survey systems.

Table 3: Elements of the Australian General Surveillance Framework

Australian General Surveillance Framework	
Biosecurity system elements*	Pest and/or host specific elements
Effective quarantine measures in place to minimize the risk of introduction of the pest - Provides confidence that the likelihood of the pest entering Australia or a region within Australia is very low	Pest biology and ecology are well documented - Provides confidence that sufficient knowledge is available to detect the pest (how, when and where)
Legislative regulations in place that mandate reporting and official control of the pest if detected - Provides confidence that general surveillance activities will result in the pest being reported and controlled if detected	The pest or its symptoms can be readily detected - Provides confidence that the pest or its symptoms can be detected visually, especially by less specialized identifiers/ collectors
Reporting system in place (e.g. Plant Pest Hotline) - Provides confidence that a pest will be reported to relevant authorities if detected using general surveillance	Absence of a suitable host or climatic conditions for spread and establishment of the pest - Provides confidence that the likelihood of the pest becoming established in Australia or a region within

[4] https://www.ippc.int/static/media/files/publication/2015/03/03/CPM_2015_23_Rev_02_IPPC_Implementation_IRSS_update_2015-03-03.pdf
https://www.ippc.int/static/media/files/publication/en/2016/01/15_CPM_April_2015_Implementation_pilot_surveillance-2016-01-12_rXulCt9.pdf

Awareness raising processes for the pest are directed at relevant stakeholders or community groups
- Provides confidence that identifiers/ collectors have information to detect and report the pest

Pest is included in national, regional or industry priority pest lists
- Provides confidence that relevant stakeholder groups are aware of the significance of the pest

Surveillance activities are recorded and able to be retrieved by relevant government authorities
- Includes recording of data within repositories such as regional/ national databases

Diagnostic expertise and tools are available to identify the pest
- Provides the ability to identify a pest and/ or its symptoms

Training programs are available for pest detection and monitoring
- Provides confidence that potential identifiers/ collectors have sufficient expertise to detect and report the pest

Plant health monitoring that directly targets the hosts
- Provides confidence that unusual pests or symptoms will be detected by individuals undertaking plant health monitoring who have expert knowledge of the pest

To demonstrate the effectiveness of the framework it was tested using four case studies pests to evaluate if general surveillance could be used to declare the absent status of pests, in alignment with ISPM 8. Four plant pests which are absent now and have never been recorded or were established and are no longer present in Australia were used for case studies – Citrus canker (*Xanthomonas citri* subsp. *citri*), Khapra beetle (*Trogoderma granarium*), Onion smut (*Urocystis cepulae*) and Asian Papaya fruit fly (*Bactrocera papayae*).

The case studies determined that the framework would be sufficient to determine pest status, but should be supported by specific surveys where it is used to claim pest free status during an emergency response or other situations that are guided by international standards, such as ISPM 4 (*Requirements for the establishment of pest free areas*), official control as defined in ISPM 5 (*Glossary of phytosanitary terms*), ISPM 22 (*Reuirements for the establishment of areas of low pest prevalence*) and ISPM 9 (*Guidelines for pest eradication programmes*). Additionally, the threshold of evidence required may vary depending on the pest in question and the requirements of the potential trading partner. Where a threshold is set above that described in ISPM 8 by a potential trading partner, scientific justification in alignment with WTO SPS Agreement is necessary and will inform the surveillance method.

Australia is now using the General Surveillance Framework as the basis for its general surveillance activities.

The use of surveillance systems comprising both general and specific surveys has allowed Australia to understand its phytosanitary situation in relation to pest presence and/or absence, distribution and prevalence. This information feeds into many different components of Australia's biosecurity system at both the state and federal levels, thus facilitating trade and allowing resources to be allocated where pest control efforts are most needed.

Understanding risk and selection of technically justified measures

To effectively protect a territory, be it a whole or part of a country or several countries, it is necessary to understand the pest risk associated with trade pathways of plant resources. Having a pest risk analysis (PRA) framework allows a contracting party to undertake pest risk assessments and make technically

justified risk management decisions, as outlined in ISPM 2 (*Framework for pest risk analysis*) and ISPM 11 (*Pest risk analysis for quarantine pests*).

Vietnam's successful application of the PRA process

Vietnam became a contracting party to the IPPC in 2005. Since then, Vietnam has successfully negotiated market access through the exchange of technical information, pest risk analysis and selection of technically justified phytosanitary measures to eight different countries for 16 commodities (Table 4).

Table 4: Summary of Vietnamese commodities that successfully gained access to new markets (2007-2016)

Country	Commodities
Australia	Mango (*Mangifera indica*) Lychee (*Litchi chinensis*)
Chile	Dragon fruit (*Hylocereus undatus*) Lychee (*Litchi chinensis*)
Japan	Dragon fruit (*Hylocereus undatus*) Mango (*Mangifera indica*)
Korea	Dragon fruit (*Hylocereus undatus*) Mango (*Mangifera indica*)
New Zealand	Dragon fruit (*Hylocereus undatus*) Mango (*Mangifera indica*)
Peru	Cashew nut (*Anacardium occidentale*)
Taiwan	Dragon fruit (*Hylocereus undatus*)
United States of America	Dragon fruit (*Hylocereus undatus*) Longan (*Dimocarpus longan*) Lychee (*Litchi chinensis*) Rambutan (*Nephilium lappaceum*)

By following the pest risk analysis process Vietnam has been able to develop technical market access documents, to identify and select appropriate phytosanitary measures and effectively communicate with their trading partners.

Why is international cooperation beneficial to contracting parties?

An important goal of the IPPC is "to secure common and effective action", which includes efforts to harmonize approaches, build capacity and share information. As seen in the general benefits of being a contracting party to the IPPC, international cooperation features as a strong basis for realizing the impacts of these benefits.

To facilitate international cooperation the Convention sets out five main points, which are specified in Article VIII and XX and summarized below (FAO, 1997).

- *To exchange* information on plant pests, including the reporting of occurrence, outbreak or spread of pests that may be of immediate or potential danger to other contracting parties.
- *To participate* in special campaigns for combatting pests that seriously threaten crop production and that require international action to meet emergency needs.
- *To cooperate* in providing technical and biological information for pest risk analyses.
- *To designate* a contact point for the exchange of information relevant to the implementation of the Convention.

- *To promote* the provision of technical assistance to contracting parties, especially those that are from developing countries, with the objective of facilitating the implementation of this Convention.

Exchanging information

Information exchange is one of the major obligations of the Convention, as it is a primary driver facilitating international cooperation. Most of the IPPC Community will know of information exchange in relation to national reporting obligations (NROs), for which certain information is required to be reported to the IPPC Secretariat. Exchanging information has benefits on several levels, including to the reporting contracting party, who through gathering information will have national awareness of their phytosanitary situation and other contracting parties who read or use the information, such as for pest risk analysis or phytosanitary risk management decisions. RPPOs may also use this information for awareness and tracking of phytosanitary emergencies or trends in their region and the IPPC Secretariat for an understanding of the implementation needs of contracting parties.

Vietnam-Taiwan information exchange to maintain trade in dragon fruit

In 2008 Vietnam was advised by the NPPO of Taiwan that a fruit fly was determined to be associated with fresh dragon fruit (*Hylocereus undatus*) and imports were banned from Vietnam and some other countries.

After receiving this notification, the NPPO of Vietnam had several meetings with the NPPO of Taiwan and provided scientific evidence of Vietnam's fruit fly management programme. Based on this information the NPPO of Taiwan was able to perform a pest risk analysis and a risk management decision was made to use vapour heat treatment as a phytosanitary measure for exports of dragon fruit from Vietnam.

Easy access to official contact point information

An obligation under the Convention specifies that each contracting party will designate an official contact point for the exchange of information connected with the implementation of this Convention (FAO, 1997). The role of each contracting party contact point is essential for the effective communication and information exchange between contracting parties, between the IPPC Secretariat and contracting parties and sometimes between contracting parties and RPPOs. The role of the official contact point was further formalized in the form a CPM recommendation, providing guidance and the required competencies and functions of the role (CPM, 2006).

Addressing specific pest issues

When a plant pest threatens the territory of one contracting party, they can often be a risk to others with whom they share borders or are connected through trade pathways in the same geographical region. Such circumstances require cooperative actions to protect plant resources, these are referred to as 'special campaigns' for combatting pests (FAO, 1997). The benefit of coordinating plant pest control is that resource requirements of actions are shared among contracting parties, such as costs, equipment and human resources, and good will is fostered between countries.

Cooperation in monitoring fruit flies at the China-Vietnam border area

Trade activities between Vietnam and China have increased rapidly in recent years, especially in the trade of fresh produce. Associated with this trade is the risk of fruit fly introduction, which is considered to be very high in the long border area shared by Vietnam and China.

To manage the risk of fruit fly introduction the NPPOs of Vietnam and China developed and agreed to a cooperation programme for monitoring fruit flies in their border in 2014. According to this programme, both NPPOs have established specified fruit fly monitoring points and diagnostics, and share results of detections or incursions that occur.

To manage this joint fruit fly monitoring and information exchange initiative technical representatives from both countries meet once a year to discuss results, which have contributed to the development of an Atlas about fruit flies for reference purposes.

The joint Vietnam-China fruit fly monitoring initiative is an example of how international cooperation can protect plant resources from pests, maintain trade pathways and foster good will between the countries.

Technical and other assistance

Contracting parties often assist each other to help implement the Convention, in the form of financial and technical support. This kind of international cooperation benefits both the benefactor and recipient contracting parties, as assistance of this kind contributes to the main aim of protecting global plant resources from pests, through the movement of international trade.

The EU – a cornerstone of IPPC support

The EU has provided strong support to the IPPC and its contracting parties since 2003. Of particular importance, implementation of the Convention and its standards was identified as an area where contracting parties, particularly from developing countries required support. This resulted in the EU generously supporting the IPPC Implementation Review and Support System (IRSS).

The IRSS has been supported on a project basis by the EU since 2011, with the objectives of identifying the contracting party implementation challenges and successes and providing input into ways that implementation can be supported.

However, the support of the EU goes beyond the IRSS. The EU provides support and opportunities for developing countries to participate in activities such as the IPPC Standard Setting programme, the annual Commission on Phytosanitary Measures meeting and assistance with regional workshops on draft international standards and Expert Working Groups have been made possible. More recently the EU has also made a commitment to providing support to the IPPC for the development of capacity development resources to improve implementation.

The outcomes of the EU support for contracting party participation in IPPC meetings and activities ensures increased technical expertise is developed at a national level. This allows contracting parties to better understand how to efficiently maximize their participation and input in IPPC activities and provides greater transparency of the IPPC work programme.

The Republic of Korea – support to South East Asia

The Republic of Korea, has been and continues to be a crucial driver of Asia regional and international support. Support from the Rep. of Korea has been provided in multiple ways, through funding support to FAO Technical Cooperation Programme projects, hosting and facilitation of workshops, symposia and trainings and most recently the generous support to host the CPM 12 meeting.

Rep. of Korea provides an example of how a contracting party champions plant protection support to obtain mutual benefits through these activities, which includes its own capacity development, information sharing and regional and international coordination and harmonization.

China support through the FAO South-South Cooperation (SSC) Programme

The Peoples' Republic of China has committed to providing support to the FAO under the Framework for the South-South Cooperation (SSC) Programme that in turn has contributed significant funding to the IPPC for strengthening the capacity of developing contracting parties to implement the Convention.

China's support to improve contracting party implementation of the Convention is concentrated in the 'One belt, One road' geographic area, which will result in inter-regional support to a number of contracting parties. The opportunities that will be provided to contracting parties under this project include the exchange of resources, technologies, innovations and knowledge between developing countries to help build sustainable food systems and enhance their capacities to improve their own livelihoods.

How implementing the IPPC facilitates trade and economic development?

Trade is an important driver of the economic prosperity of countries. Through the implementation of international standards contracting parties have established, managed and strengthened their phytosanitary systems and positioned themselves to take advantage of new trade opportunities when they arise.

Since the first IPPC international standard was adopted in 1993 world trade (in value terms) has increased dramatically, as shown in Figure 4 (WTO, 2016). International standards provide guidelines on essential phytosanitary activities that facilitate safe trade between countries in an internationally harmonized manner.

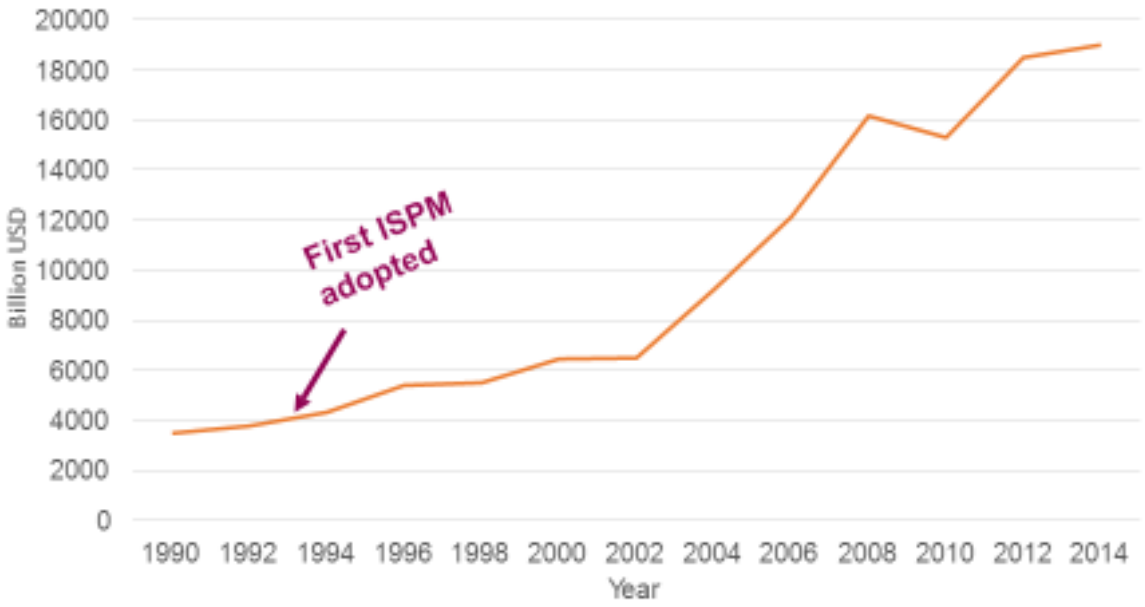

Figure 4: Economic value of trade increasing since development of ISPMs

The economics of trade facilitation is often considered as an investment-return or cost/benefit scenario, where investing in a phytosanitary system and capacity of the components thereof, provide returns in the form of prevention of pest incursions and an ability to respond to emergency scenarios in an effective and efficient way.

Australia's investment in biosecurity

In an environment of constrained and finite resources, governments need to prioritise investment to maximise return from a biosecurity risk perspective. The Australian government places a strong emphasis on preventing a serious pest or disease from establishing as this generally provides a significantly higher investment return on public funds compared to managing that pest or disease in perpetuity should it become established.

The generalised biosecurity invasion curve (Figure 5) outlines the changing role (including funding) of governments and stakeholders as actions to respond to a pest or disease change from prevention, eradication, containment to asset-based protection. The 'return on investment' of public funds generally reduces when progressing along the invasion curve. For example, governments have a greater responsibility in the earlier stages of prevention and eradication, whereas those best placed to protect assets (public or private) from established pests and diseases are generally the owners of those assets. The environmental and production costs of in-action are high. While it is possible to determine the economic cost in terms of adverse effects on production, at present there is no agreed model to measure the ecological cost to the environment of exotic pests and diseases in economic terms (Australian Government, 2014).

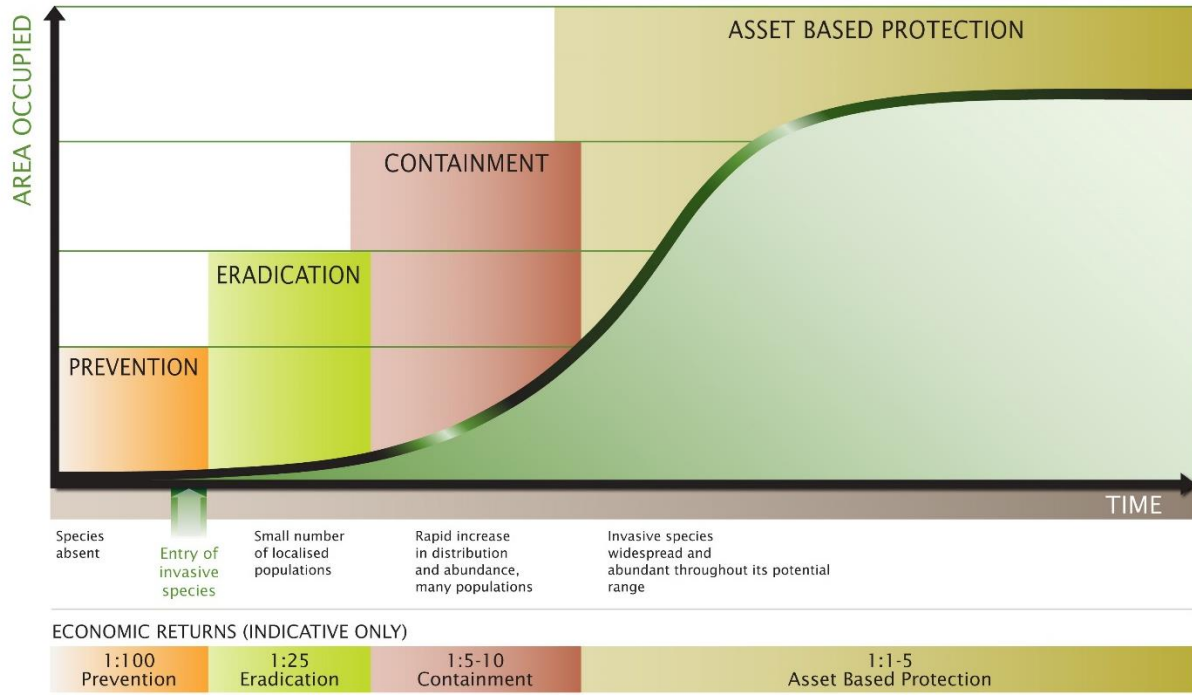

Figure 5: Generalised invasion curve showing economic returns on biosecurity investment (Department of Economic Development, Jobs, Transport and Resources, 2009)

Australia's Biosecurity Cost-Benefit Analysis initiative

To ensure national consistency and transparency, benefit-cost analysis (BCA) has been used to improve efficiency and timeliness of management decisions on biosecurity investments. The approach looks at alternative management options that could be used in biosecurity situations and reports on results to decision making bodies.

As an example, the BCA approach was used to look at the eradication of exotic fruit fly species in the Torres Strait area of Australia, through the *Long-term Containment Strategy for Exotic Fruit Flies in Torres Strait* (Queensland Government, 1996-2014). The Strategy was established following the 1995 Oriental/papaya fruit fly incursion in northern Queensland that cost $34 million to eradicate over a four year period. The loss associated with the ban on international trade to overseas countries was estimated to be 100 million (Cantrell, 2002). This analysis shows that the potential cost of an incursion ranges between $442.9 million to $3.3 billion with a benefit: cost ratio ranging from 63:1 to 339:1 depending on the probability of successful eradication, with producers' losses ranging from $269.0 million to $2.1 billion.

Implementation of the Strategy, at a cost of $200,000 per year, has since prevented incursions of exotic fruit flies through the Torres Strait onto mainland Australia, which far outweigh the response costs, such as those associated with the 1995 incursion (Australian Government, 2013). If the strategy were to cease it is predicted, based on technical advice and trapping data that an incursion on the Australian mainland would occur within 12-18 months.

The economic and social benefits of the Mexican avocado industry

Background

The Mexican 'Hass' avocado (*Persea Americana*) industry began exporting to the United States of America (USA) in 1993, when a long standing prohibition on the exportation of avocadoes was lifted, allowing exports into the State of Alaska. To extend this market access a comprehensive pest risk analysis, in accordance with ISPM 2 (*Framework for pest risk analysis*), and corresponding risk mitigation analysis were undertaken. This examined the proposed "approach" offered by Mexico and augmented by the United States Department of Agriculture (USDA) for risk reduction of each mitigation measure in the "system" (Miller *et* al., 1995; Jang & Moffitt, 1996). In 1997, this ground breaking and controversial "Systems approach" allowed the avocado trade to expand to 19 Northeastern States during winter months. Restrictions on the period of import, based on seasonal contrasts between origin and destination combined with other risk mitigation measures within a systems approach were agreed upon as the means to prevent establishment of regulated pests in the import country (USDA APHIS, 1995 and b).

To expand market access to the USA, several pest risk analyses were conducted by the Animal and Plant Health Inspection Service (APHIS) of the USDA, to gradually permit imports to more states with less restrictive measures. The appropriate selection of the measures to manage regulated pests of concern within the systems approach has proven effective with no target pests intercepted since the start of the export programme. This result is due to the hard work of the USA and Mexican government officials, Mexican growers, packers and shippers and other participants involved in the export programme. Through several iterations of import rules, exports are now allowed to all USA states, including the USA territories of Hawaii and Puerto Rico, from all Mexican states under a year around systems approach (Federal Register, 2016), however a final operational work plan (OWP) is yet to be agreed for all Mexican export states.

Under the current OWP the revised systems approach includes requirements for *orchard certification, trace back labeling, pre-harvest orchard surveys, orchard sanitation, post-harvest safeguards, fruit cutting and inspection at the packinghouse, port-of arrival inspection, and clearance activities (including additional fruit cutting)*, is required for importation of fresh avocado from all approved areas of Mexico to manage risk of regulated pests of concern (APHIS, 2015). Negotiations continue between the Mexican government and APHIS regarding the pathway pest list and associated measures based on outcomes of the most recent PRA and the best scientific evidence available.

Associated IPPC activities

The Mexican avocado export pathway to the USA clearly demonstrates the importance of implementing the Convention and its standards. Use of the IPPC principles, as outlined in ISPM 1 (*Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*) have facilitated the negotiation of market access. The principles of necessity, managed risk, minimal impact, transparency, technical justification, cooperation and particularly modification, provide the basis for both countries to work towards favorable safe trade outcomes.

Other best practices of the Mexican avocado industry in implementing international standards include pest risk analyses in accordance with ISPM 2 and ISPM 11, pest surveillance in accordance with ISPM 6, application of a systems approach to manage regulated pest risk in accordance with ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*), export certification in accordance with ISPM 12 (*Phytosanitary certificates*) and import verification processes in accordance with ISPM 20 (*Guidelines for a phytosanitary import regulatory system*) and ISPM 23 (*Guidelines for inspection*). The effectiveness of the Mexican phytosanitary system is demonstrated by their highly compliant trade history of export of avocados to USA.

A coordinated approach

The Mexican avocado industry is coordinated by the Asociación de Productores y Empacadores Exportadores de Aguacate de México (APEAM A.C.), the Mexican Hass Avocado Importers Association (MHAIA) and their public interface, the 'Avocados from Mexico (AFM)' brand. With the story of their success as fascinating as it is incredible (AFM, 2016), APEAM is dedicated to ensuring avocados produced by Mexico are of superior quality and are exported with minimal phytosanitary risk through meticulously following the export programme. In addition to phytosanitary and quality responsibilities, APEAM invests in a reforestation programme in Mexico designed to promote a healthy environment. As of 2015, Mexican imports now represent 82% of the USA avocado consumption, compared to 11% in 1990 (USDA, 2015). This significant increase in avocado trade is known as the great Mexican avocado boom.

The strong relationship APEAM shares with the Mexican national plant protection organization (NPPO) – the Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA), provides an established contact point for engagement between the two organizations. This provides the Mexican avocado industry (growers, packers, exporters) a collective voice for communication of phytosanitary and other compliance conditions to ensure their product meets all necessary requirements for trading. Similarly, this coordination helps minimize challenges that can occur through the supply chain (Coronado *et al.,* 2015). This representation also provides the industry a collective basis to negotiate with the USA when it is necessary to make changes to the pathway phytosanitary measures. This approach provides negotiation at a state and/or national level to ensure their interests are represented.

Related benefits

The benefits of the highly compliant trade in avocados exports from Mexico to the USA are far reaching, going beyond the traditionally expected economic benefits of trade. The benefits include plant protection, international cooperation, economic development, environmental protection and social aspects to both countries.

An environmental awareness and efforts to promote long term sustainability are a key consideration of the Mexican avocado industry, with a reforestation initiative overseen by APEAM (AFM, 2016). With increasing avocado production in Michoacán, Mexico, a reforestation programme was commenced to plant pine trees to help protect the natural environment. This has seen 500,000 trees planted in the past several years and has 280,000 planned for 2017 and 320,000 planned for 2018. This example of responsible production and environmental rehabilitation provides benefits to the environment and thousands of small farm-holders and farm workers (TPN, 2016).

The social impact and benefit of the Mexican avocado export pathway to the USA has expanded food opportunity and choice (seasonable availability), which has increased consumer demand in the import country for the commodity that is seen as a good nutritional choice (Huang, 2013). Traditionally avocados were only available for a limited season, sourced from domestic production, however since the opening of the Mexican market, Americans are now used to and demand year around availability of avocados. In turn, this demand has resulted in increased avocado production in the USA (as well as Mexico), instead of being a threat to domestic producers (FABA, 2016). The popular avocado based dip guacamole even featured in a Super Bowl advertisement in 2015, emphasizing how engrained the avocado now is in the American psyche, being a year-around ingredient on menus in the US (Polis, 2012).

The economic growth that has resulted from the trade in Mexican avocados to the USA has benefited both countries, by stimulating the growth along the value chain (FABA, 2016). The rate of import volume has increased dramatically since the export programme commenced, which in turn has generated economic growth and job creation in the USA through various market activities, such as transport services, marketing, wholesale and retail trade, infrastructure and manufacturing. Through industry analysis using 2013 and 2015 data, there is overwhelming evidence that avocado imports have a positive and economically important effects to the USA and state economies (FABA, 2014 & 2016). In 2015 the exports of avocados valued at $1.5 billion added a cumulative value of $3.5 billion in economic output to the USA economy, $2.2 billion in GDP, $1.2 billion in labor income, $594 million in taxes, and 18,695 jobs, thus increasing economic growth and improving the standard of living in both Mexico and the USA (FABA, 2016).

There are many benefits derived from the trade in Mexican avocados to the USA. The history of trade negotiations, risk management decisions and modifications is a clear example of how international cooperation benefits two trading partners. Through cooperation and implementation of the Convention and its standards, Mexico and the USA share the benefits of safe trade in avocados and have the peace of mind that there is minimal risk associated with the pathway.

Lessons learnt

- Implementing the Convention and its standards provides a basis for the coordinated and effective application of phytosanitary measures.
- The coordinated industry approach through representation by APEAM gives a collective voice when negotiating phytosanitary requirements and policy between the two governments.
- The value of trade can have many different kinds of benefits, not just economic, but wider social and environmental benefits.
- Imports lead to economic growth and improved standards of living in both the exporting and importing countries.

The economic benefits of using internationally harmonized phytosanitary measures

It has been demonstrated that investing in plant protection activities and strengthening phytosanitary systems protects plant resources from pests and also reduces costs when emergency situations occur. Therefore certain ISPMs have been developed to harmonize measures for specific pest risk management scenarios, including area pest freedom, use of integrated systems approaches and application of treatments for wood packaging material.

Wood packaging material (WPM) is used worldwide in international trade. Depending on the goods transported, WPM comes in a variety of forms, including pallets, boxes or dunnage used in containers, ships and aircrafts. However, associated with WPM is the risk of forest pests that can infest raw wood e.g. Asian longhorn beetle (*Anoplophora glabripennis*) and pinewood nematode (*Bursaphelenchus xylophilus*).

To manage the risk of such pests, ISPM 15 (*Regulation of wood packaging material in international trade*) was developed. This standard is an excellent example of how NPPOs and forest industries can work together to manage risk associated with WPM. Through implementing ISPM 15 and compliantly applying the treatment symbol (Figure 6), parties involved in international trade can have confidence that the forest sector is being protected.

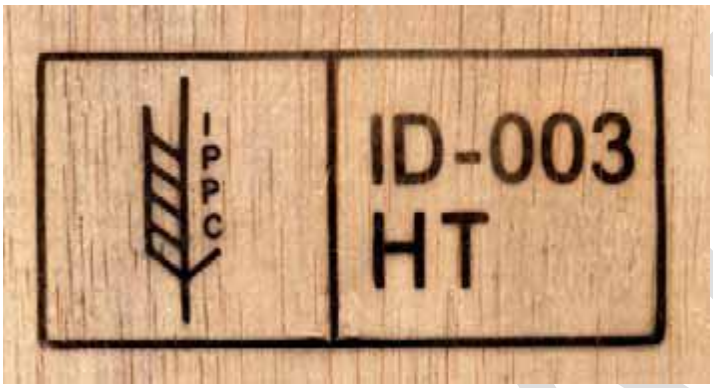

Figure 6: An example of ISPM 15 symbol.

Implementation of ISPM 15, the value of sustained exports and growth

The use of harmonized phytosanitary measures for wood packaging material (WPM) as outlined in ISPM 15 provides guidelines and technical specifications that reduce risk of introduction and spread of quarantine pests associated with WPM made from raw wood.

To analyze the regulatory affects that implementation of ISPM 15 has on the economies of a group of countries (Botswana, Cameroon, Kenya and Mozambique), Papayrakis and Tascotti have conducted a study to look at the value of exports and imports in the last 15 years. The study looked at many different aspects and includes multiple objectives:

- Cost/benefit analysis of ISPM 15 implementation using statistical models to identify trade patterns across different sectors;
- Review procedures, legislation and other controls in place for ISPM 15 implementation and associated challenges;
- Evaluate ISPM 15 implementation generated benefits and losses and associated spread of these among stakeholders;
- Raise awareness of ISPM 15 implementation in the participating countries and advise them on appropriate procedures for effective and cost-efficient implementation; and
- Through the results help other countries with ISPM 15 implementation.

The research team used qualitative information collected through interviews, micro data gathered during structured surveys directed at a total of WPM treatment facilities and macro data on trade flows (across all sectors) between the participating countries and trading partners.

The study involved a range of stakeholders within the countries, including NPPOs, government ministries (including Customs), WPM facilities, local manufacturers and exporters and importers.

The macro data revealed that across 120 different sectors of both exports and imports there is an increase in trade volumes following the implementation of ISPM 15. An interesting policy outcome from this data was that sectors with poorer implementation of ISPM 15 benefited the least in economic growth.

The lessons learnt from this study are that effective implementation of ISPM 15 has an economic benefit across many sectors. However, for this to be achieved NPPOs need to work in close collaboration with treatment facilities to ensure appropriate treatment and certification of WPM. There is also a need awareness raising so that other stakeholders understand the importance of the risk associated with WPM.

The use of area freedom to facilitate trade

The development of ISPMs for pest free areas (PFA), pest free sites and places of production (PFPP) as well as areas of low pest prevalence (ALPP) have provided tremendous opportunities and boosted exports from otherwise infested countries, to be traded with global acceptance when in conformity with the international standards.

Belize area freedom from Mediterranean fruit fly

Belize, through the support of the United States Department of Agriculture (USDA) established a Mediterranean fruit fly (Medfly - *Ceratitis capitata*) surveillance programme in 1977. In 1987 in response to the first Medfly detection in Belize, a ban on the export of medfly host commodities was put in place by the USA and steps had to be taken to re-establish area freedom. To re-open access, Belize with technical assistance from the FAO, undertook a Technical Cooperation Programme project that established a comprehensive national surveillance programme for enhanced responsiveness and eradication actions when detections occur (IICA, 2011).

By following ISPM 4 (*Requirements for the establishment of pest free areas*) and ISPM 26 (*Establishment of pest free areas for fruit flies (Tephritidae)*), working closely with FAO through the TCP and engaging the USDA throughout the re-establishment and verification process, Belize was recognized by the USA as free from Medfly in 2001 and declared country freedom in 2007.

The benefits obtained from the area freedom programme are economic, commercial, social and others for the country and the region. The direct economic benefit from establishing the area freedom programme has been calculated to be BZ$140.00 for every dollar spent. To demonstrate the success of the Medfly programme, export value of papayas rose from BZ$12.7 million in 2000 to BZ$21.3 million in 2008, an increase of 70.8%. Additionally, flow on effects from implementing the programme include generation of jobs, foreign exchange earnings, positive effects on associated businesses and host commodity industries and availability of domestic produce with minimal chemical residue.

In a commitment to maintain the Medfly area freedom programme, Belize continues to invest substantial resources, establish regional alliances and implement new technologies such as geographic information systems (GIS) to enhance the programme and seek new opportunities for market access of new host commodities.

How is the environment protected as a result of IPPC related activities?

Under Article IV of the Convention, contracting parties are required to the best of their ability to protect habitat and endangered areas (IPPC, 1997). As such, a strategic objective of the IPPC is the protection of the environment, forests and biodiversity from plant pests (IPPC, 2012a). The protection of the environment in different biomes, endangered areas, which often are the home to natural flora, forests (both indigenous and commercial) and the loss of biodiversity are closely linked to the protection of plant resources.

The framework of the IPPC thus provides for the protection of the environment, including the Convention, the IPPC Strategic Framework, ISPMs and CPM recommendations. Additionally, the IPPC also cooperates with other international organizations for the protection of the environment and biodiversity.

IPPC's link to CBD in protecting the environment

The IPPC environmental strategic objective is closely related to the mandate of the Convention on Biological Diversity (CBD) to reduce the direct pressures on biodiversity and promote sustainable use. Specifically the CBD Aichi Target 9 seeks to identify, control, eradicate or have measures in place to manage pathways to prevent the introduction and establishment of invasive alien species (IAS) ecosystems, habitats and other species (CBD, 2010). While the CBD addresses biodiversity and the environment in general, the IPPC specifically concentrates on IAS that are pests of plants and provides guidance for protection against them (IPPC, 2012a). To facilitate the awareness of the risks associated with IAS and possible actions in relation to them, an ICPM recommendation was adopted in 2005 (ICPM, 2005).

Although the mandates of the IPPC and CBD differ slightly in their protection of the environment, there are many synergies between the two conventions, which have been identified within the context of Biodiversity-related Conventions, of which both are members. To enhance cooperation between the conventions the Biodiversity Liaison Group was established to facilitate work. By identifying areas where IPPC and CBD can work together, such as in prevention of IAS movement and focusing on specific environmentally related trade issues like trade in invasive aquatic plants and e-commerce pathways, both the IPPC and CBD can share the benefits gained from protecting the environment and biodiversity while using fewer of their Secretariat resources. To track the progress of environmental protection the CBD has put in place indicators for each of their Aichi targets and for Target 9 has been able to calculate the economic and wider benefits thereof.

The value of protecting biodiversity

The CBD has estimated that by meeting Target 9 by 2020 will substantially reduce the economic cost of damage caused by IAS, calculated to be 2-5% of the world GDP or approximately US2.6-6.5 trillion per annum (HLP, 2012). However, wider benefits are also envisaged to occur by IAS management, including improvement to sector productivity, protection of biodiversity and the environment, job creation and alleviation of poverty (HLP, 2012).

Aquatic plants and the environment

In the past aquatic plants have traditionally had the spotlight due to the invasiveness nature of some species that have caused either environmental damage or damage to infrastructure such as dams and water stations. They have been considered as IAS (under the CBD framework) and regulated pests (under the IPPC framework). Examples of aquatic plants species that have had severe effects on the environment include the water hyacinth (*Eichhornia crassipes*) (Hill *et al*., 2011), the diatom didymo (*Didymosphenia geminata*) (Bothwell *et al*., 2009; Smith, 2011), among many others.

A study by the IRSS in 2012 (IPPC, 2012c), demonstrated there are benefits to be gained from protecting aquatic plants, to the environment and of an economic nature when farmed as a commercial industry. For example, aquatic plants provide valuable ecosystem services to their environments, often being the primary producers in food-webs, provide stability to landforms in and near the water line, filter sediments, and provide nutrients to the environment in the form of detritus (Madsen *et al*., 2001). Whereas, commercially farmed species such as seaweed, which as macro-algae is classified as an aquatic plant, falls under the IPPC framework and in recent years has started to boom (UNU, 2016). Although seaweed is not a new human food source, the degree that it is now produced has increased exponentially, along with production of other aquatic plants. In 2014 the world aquaculture production was calculated to be $US5. 6 trillion (FAO, 2016).

To facilitate the protection of aquatic plants, or the management of aquatic plants that are considered to be regulated pests, a CPM recommendation was adopted in 2014 (CPM, 2014). The CPM confirmed that aquatic plants should be protected and invasive aquatic plants considered as potential pests under the IPPC framework.

Ultimately, the protection of natural populations of freshwater and marine plants will ensure their continued ecosystem services and sustain their natural environment and ecosystem benefits. To quantify the benefit of this protection it is estimated that globally ecosystems provide on average US$33 trillion worth of services annually (Costanza *et al*., 1997). These estimates highlight the importance of conserving these ecosystems and the services they provide to global human welfare (Costanza *et al.*, 1997).

Protection of endangered areas such as forests

Forests are diverse ecosystems that are composed of many forms of life, which provide a variety of valuable outputs and benefits. Of particular note is the stability a forest provides to the environment and ecosystem services. Forests contribute to moderating climate change through the absorption of carbon, combat desertification, protect water reservoirs, maintain biodiversity and preserve cultural and social values (FAO, 2011).

The IPPC's designation of responsibilities to the NPPO has paved the way for coordinated action against forest pests through strengthened collaboration between forestry divisions and the NPPO. This ensures adequate and effective safeguards against quarantine pests and management of pest problems consistent with the IPPC.

Due to the long term production cycles of commercially grown trees, foresters use a range of control approaches, to reduce the risk of pest problems. Risk management measures can be applied throughout the production process from planting to management of maturing forests to harvest. When at least two independent measures are used to reduce the risk of pests, this forms the basis of a systems approach as outlined in ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*). By using a systems approach, trees can be grown and harvested with minimal pest infestation and damage. This protects forest production nationally as well as in other countries that receive forestry export commodities. Additionally, pest free forest commodities receive higher prices due to a higher level of quality.

Protection of endangered areas has benefits for agro-tourism, aesthetic value, protection of biodiversity and an economic value from the domestic and international trade in forest commodities.

A shift towards 'green' pest management

An increasing trend by contracting parties is moving towards pest management that is more environmentally friendly. By using pest management that is more targeted to specific pest issues, there are benefits to the environment, human health and reduced secondary pest management issues. In common terms, this change in approach has been called 'green pest management', often using the principles of integrated pest management (IPM) and within a plant health regulatory system can take the form of a systems approach, as outlined in ISPM 14.

China's use of green pest management through as a result of research and development

An essential element of implementing the Convention (Article IV) is the research and investigation in the field of plant protection, to seek new, more efficient and environmentally friendly ways to protect plant resources. China has been undertaking research in the area of green pest management for several years, to move towards pest management based on strategies, tactics and technologies of non-chemical practices to reduce pesticide usage and environmental damage.

The shift towards green pest management has been supported by the China Ministry of Agriculture decree for a zero increase of pesticide usage to crop intensification until 2020, which would take use to the level it was at the turn of the century. To achieve this research and development have been done for use of softer chemicals with more efficient and targeted application, increased extension services to farmers and cooperatives, use of cultural control methods (e.g. crop rotation, deep ploughing, pest nets and crop sanitation), ecological engineering to increase biodiversity, use of bio-pesticides (e.g. bacteria, fungi and virus based), release of natural enemies for pest population controls and protection of natural enemy environments to favor their lifecycles.

To facilitate the use of green pest management China has established a framework for extension to bridge the gap between research and practical pest management application. This includes promoting the use of non-chemical control methods and promotion of natural biological processes and cultural techniques in crop production.

Environmental disruption caused by pesticide overuse to control the pink hibiscus mealybug

The pink hibiscus mealybug (PHM - *Maconellicoccus hirsutus*) first arrived in Grenada in 1994 and later spread to Guyana in South America, 14 Caribbean countries and eventually the continental United States of America (USA). A serious pest of many commercial and domestic plants, the PHM caused significance economic damage to cropping systems, posed a biodiversity threat to native flora and forest plants and aesthetic damage to ornamentals (CABI, 2017).

However, the environmental damage caused by this pest was indirect through the use of pesticides applied in the initial control effort. The initial widespread application of pesticides, while controlling the pest for short periods, resulted in disruption to natural enemies in the associated environments, causing secondary pest problems and contamination of food and water and risks to human health (IFAS, 2014).

The overuse of pesticides has been a common occurrence in the past. However, it is now widely accepted by the agricultural industry that pest control needs to be targeted to a pest to be most effective. By understanding PHM biology and ecology, scientists were able to determine the natural enemies that would be most effective for control, which were subsequently released in biological control programmes (IFAS, 2014; IPS, 1998).

Losses in Grenada to crops and the environment have been estimated to be US $3.5 million annually before biological controls were put in place and serious market access loss to other Caribbean countries due to prohibition of host commodities (Francois, 1996; Peters & Watson, 1999). The implementation of the subsequent biological control programme, costing US $1.1 million, far outweighs the impact to crop loss and environmental damage (Kairo *et al*., 2000).

Another shift towards using more environmentally friendly pest control methods, which has international support, is the reduction in the use of the fumigant methyl bromide. IPPC, with other international organizations, recognizes the Montreal Protocol (UNEP, 1992) and encourages its contracting parties to replace or reduce the use of methyl bromide. This request was formalized as a CPM recommendation, promoting use of alternative phytosanitary measures to replace methyl bromide (CPM, 2008).

How does implementing the IPPC contribute to food security?

The safe and secure supply of food is essential for the health and well-being of the world's population. With increasing populations, the sustainability of agriculture plays a vital role in providing the staple foods that countries rely on. To address the need for sustainable agriculture, more land is necessary for utilization purposes, more efficient production systems, new technologies and research into pest controls, diagnostics and treatments and food storage practices that reduce wastage.

Definition of food security

"World Food Security exists when all people, at all times, have physical, [social] and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life"

(World Food Summit, 1996)

Strengthened national regulatory systems of export certification, import regulation and pest surveillance are at the core of food security. The associated ISPMs provide critical guidance to importing and producing countries alike, in preventing the introduction and spread of pests that threaten plant resources and food security.

Although the above are essential for working towards food security, developing countries often need aid when they are faced with challenges such as civil unrest, natural disasters and emergency pest situations. An essential element in promoting future food security is developing the capacity of countries to give them the ability to respond to situations and challenges when they arise to safeguard a country's food supply.

To respond to food demands, crop production needs to continue to increase. FAO has estimated that global agriculture outputs, based on 2009 data, will need to increase by 70% to adequately supply food to the projected world population in 2050 (FAO, 2012). Thus crop production research and development, technical assistance programmes and the management of new and emerging pest situations are essential.

The importance of wheat imports to Egypt for the production of baladi bread

When a country relies on a commodity for food security, the stability of the industry that produces the food staple domestically or the trade pathway from which it is imported is essential. In the case of the Egypt, a food staple of cultural significance is baladi bread, which is central to the typical diet of the country's inhabitants. The wheat that supplies this programme is made from wheat that is grown domestically and imported.

The domestic wheat industry provides an important contribution to the baladi bread programme, however this needs to be supplemented by importing wheat to meet the demands of providing baladi bread to all Egyptian citizens, a quarter of whom live under the poverty line. Thus, the strategic importance of the wheat sector has resulted in a strong involvement of the state at all levels of the wheat value chain and has been a central aspect of the country's social policies. To supply wheat for baladi bread, Egypt has become the world's biggest wheat importer and has developed a programme to decrease waste and corruption (FAO, 2015).

However, like most crops there are pest risks that are necessary to manage, which in the case of Egyptian wheat is the fungus ergot (*Claviceps purpurea*) and is the *Ambrosia* ssp. weed seeds. To manage the risk of these regulated pests and ensure security of the baladi bread programme, the Egyptian public and private sectors worked with the Food and Agriculture Organization (FAO), who provided technical assistance, and support from the European Bank for Reconstruction and Development (EBRD).

Through a collaborative approach, a full review of the wheat sector was undertaken with the objective to help policy makers and investors achieve the goal of more efficient and inclusive agricultural and food systems (FAO, 2015). Through the analysis of wheat production, consumption, trade, storage and milling and wheat policy, weaknesses in the sector were identified. The most important outcome from the analysis, to secure the industry productivity and sustainability, was determined to be the involvement of the private sector, to ensure the country's food security.

By working together, the Egyptian public sector agencies and the private sector, with assistance from the FAO were able to ensure the domestic wheat industry is managed efficiently and the wheat import pathway has requirements to appropriately manage pest risk that are technically justified.

Interview with Ruth Woode, IPPC Standards Committee member from Ghana (IPPC, 2016a)

How does the international movement of grain affect food security?

The international movement of grains has brought "exotic" pests to my part of the world. The larger Grain Borer *(Prostephanus truncates)* is an example of one of these pests which has spread over long distances and has established itself in the African continent. This has negative impacts on food security and is a serious threat to stored maize and dried cassava chips which are major staple foodstuffs.

How would this standard benefit importing and exporting countries?
The proposed standard would identify and describe specific phytosanitary measures that could help to reduce pest risks prior to export, during transfer, on arrival, and during handling and processing. Exporting and importing countries would benefit from such guidance on harmonized approaches for managing pest risks associated with the international movement of grain.

Contingency planning and response capability

Part of being able to effectively manage agriculture is to have contingency plans for new and emerging pest situations, to allow efficient response activities when required. Contingency planning, not only allows for protection of food crops, but also for the economic and food security associated with yields. Contingency planning has been identified as a responsibility of regional plant protection organizations, especially in regard to regional pests of significance to agricultural food and feed crops. However, NPPOs should also put their own contingency plans in place to allow appropriate pest responses, in accordance with ISPM 9: *Guidelines for pest eradication programmes*.

Contingency planning by the UK Department of Environment Food & Rural Affairs (DEFRA)

The UK Department of Environment Food & Rural Affairs (DEFRA) prioritizes the protection of the nation against plant health and other natural threats. Under the Plant Biosecurity Strategy for Great Britain, there is a strong commitment to develop contingency plans to help eradicate or minimize pest outbreaks when they occur (DEFRA, 2014). Protection of plant resources is a priority for the UK, as cereals, fruits and vegetables are vital to food supply, the economy and protection of biodiversity.

By having contingency plans specific to plant pests of concern to the UK, coordinated responses can be launched in an efficient manner. The contingency plans outline how the plant health service of England will respond to outbreaks and includes emergency measures that are required to manage plant health (DEFRA, 2016).

Diagnostics identifies the specific problems

Diagnostics are fundamental to technically justified (science-based) phytosanitary measures, to ensure the accurate identification and reporting of pests, which feeds into many phytosanitary system activities (CPM, 2016). However, it should be noted that while many NPPOs have their own diagnostic facilities to operate, others can outsource this service.

Pest diagnosis is a cross-cutting activity that underpins the implementation of the IPPC

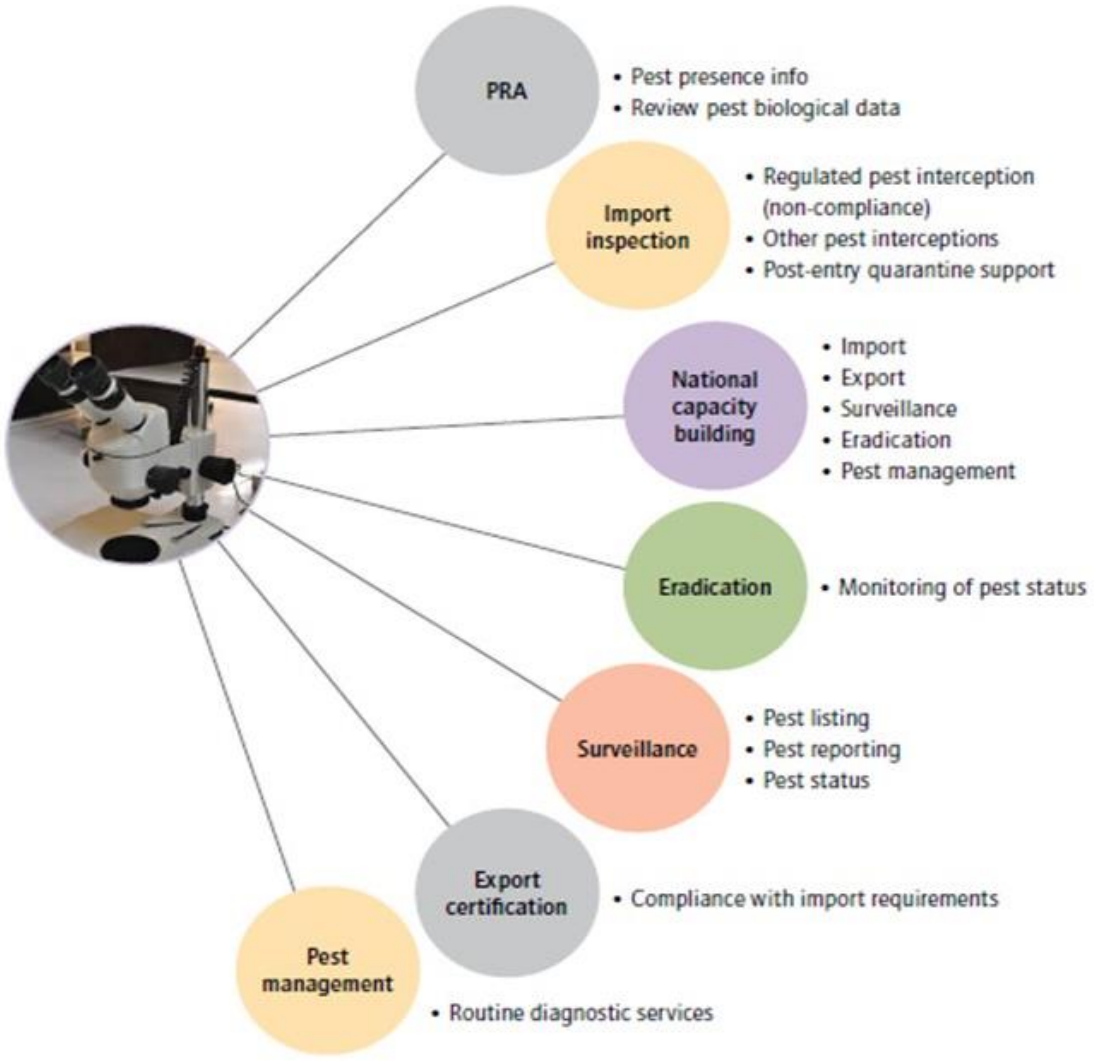

Figure 7: The range of phytosanitary activities that pest diagnoses support (IPPC, 2016c)

In acknowledgement of the importance of pest diagnosis, a recommendation was adopted by CPM 11 (CPM, 2016). The recommendation states that diagnoses should be undertaken quickly and to a high level of confidence to ensure safe trade. However, it also recognizes that many contracting parties need support with access to facilities and assistance with the growing trend of reduced expertise in the areas of taxonomy and classical identification skills.

In addition to the CPM recommendation, the Technical Panel on Diagnostic Protocols (of the IPPC Standards Committee) has produced annexes to ISPM 27 (*Diagnostic protocols for regulated pests*) for specific pest species or group of pest species of significance to international trade. According to ISPM 27, each diagnostic protocol provides the necessary information for the accurate identification of the pests:

"*Diagnostic protocols contain the minimum requirements for reliable diagnosis of the specified regulated pests and provide flexibility to ensure that methods are appropriate for use in the full range of circumstances. The methods included in diagnostic protocols are selected on the basis of their sensitivity, specificity and reproducibility, and information related to these factors is provided for each of these methods.*"

An example of how contracting parties assist each other to enhance diagnostic capabilities is the establishment of remote microscopy services.

New Zealand's Remote Diagnostic Facility (RDF)

The New Zealand Ministry for Primary Industries' (MPI) Plant Health and Environment Laboratory (PHEL) coordinates a facility to remotely identify potentially hazardous organisms. The Remote Diagnostic Facility (RDF) is currently accessible by Fiji, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. To facilitate this service a NZ Aid project *Enhancement of biosecurity and quarantine services in the Pacific* was initiated. The initiative focused on improving Pacific countries' access to diagnostic services to manage risk of their import and export pathways, particularly risks associated with trade in fresh produce (MFAT, 2013).

The end benefit to having a robust phytosanitary system, which can give efficient and accurate pest diagnoses, is the understanding of the national pest situation. This in turn allows producers and small holder farmers to improve their crop yields and get better prices for their commodities, leading to sustainable agriculture and food security.

How do IPPC tools and technical resources benefit contracting parties?

Phytosanitary Capacity Evaluation (PCE) tool

The Phytosanitary Capacity Evaluation (PCE) tool was developed by the IPPC Secretariat as a tool for use by countries to self-assess their capacity to implement the Convention and the application of ISPMs. The use of the PCE by many countries has demonstrated that it is a valuable tool that allows countries to establish their own national strategic plan and priorities for phytosanitary capacity development.

The PCE is part of a change process that is already in train. The PCE also acts as a learning exercise for the NPPO in terms of information sharing and awareness raising, two important components of cooperation and knowledge management. A request made by any country for the application of the PCE

indicates that there is already a predisposition for change, rather than the PCE being the direct cause for change.

PCE in the Pacific Island Community

In 2012 fourteen states in the Pacific Island Community (Solomon Islands, Tonga, Samoa, Tuvalu, Niue, Vanuatu, Papua New Guinea, Marshall Islands, Fiji, Palau, Cook Islands, Kiribati, Nauru, and the Federated States of Micronesia) completed national phytosanitary capacity evaluations as a result of the Standards and Trade Development Facility "Capacity building in the use of the Phytosanitary Capacity Evaluation Tool in the Pacific". Support was provided by the Secretariat of the Pacific Community (SPC) and technical assistance was provided by the IPPC Secretariat.

The national evaluations of the 14 countries yielded similar results: NPPOs had relatively strong import controls, inspection and clearance procedures for imports and were in a good position to take advantage of their geographic position to declare areas free of specific plant pests. However, the PCE results identified weaknesses with respect to legislative frameworks, limited export facilitation procedures and insufficient documentation of processes and procedures of the NPPO.

Based on the PCE results, the region formulated recommendations for next steps and priorities. In the future, the SPC and development partners will be able to use the baseline data generated through the PCE to assess improvement and progress towards goals, ensuring targeted capacity development in the region.

Strengthening Estonia's phytosanitary capabilities

Before Estonia's restoration to independence from the Soviet Union occupation in 1991, they were a net producer and exporter of several products and their food industry had strong position. Following this time almost all agricultural and horticultural sectors have suffered a decrease in production, which has fallen by 20-60%, and in certain categories even 100%. One reason for this decrease was due to the liberal agricultural policy, which resulted in the abolishment of all border protection measures (e.g. import fees, seasonal import restrictions etc.).

Since 1998, Estonia has made preparations to become a contracting party. However, the National Phytosanitary Service needed assistance to strengthen domestic phytosanitary capacity and capabilities for compliance with international obligations and new regional obligations as a member of the European Union (EU).

Working closely with Estonia's Ministry of Agriculture and the NPPO, FAO launched a Technical Cooperation Programme (TCP) project in 2002 "Strengthening of the national phytosanitary service of Estonia", TCP/EST/0165 (a). The project included:

- review of the regulatory frameworks for phytosanitary measures using the IPPC Phytosanitary Capacity Evaluation tool;
- drafting legislation or preparing drafting instructions for modernizing phytosanitary legislation for harmonization with EU and international requirements;

- review of the phytosanitary control systems for adequacy to provide a basis for further strengthening; and
- training of government personnel in ISPMs and contemporary phytosanitary procedures and practices.

Applying of the PCE helped Estonia identify both strengths and gaps in existing phytosanitary system and has triggered several positive developments. In particular, the PCE outcomes resulted in the development of obligatory legislation for the NPPO in compliance with the IPPC, which helped Estonia to conclude an Association Agreement with the European Union to meet those requirements.

The ePhyto solution

To assist countries in implementing electronic exchange of phytosanitary certificates, the IPPC is undertaking a project to develop a standardized approach to security and method of exchange, code sets and message mapping to ensure that all countries are able to participate in electronic certification (IPPC, 2016b). The ePhyto solution will complement the requirements specified in ISPM 12 (*Phytosanitary certificates*).

The future ePhyto solution will provide contracting parties with a number of benefits in comparison to paper-based phytosanitary certification, to both exporting and importing countries (IPPC, 2014b):

- reduce possibilities for fraudulent documentation;
- reduce data entry and validation functions by NPPO staff;
- improve security in transmission of certificate documentation;
- improve planning for the arrival and clearance of plants and plant products at customs;
- reduce delays in receiving replacement phytosanitary certificates;
- maximize the investment by building on existing initiatives;
- reduce ongoing and costly bilateral arrangements; and
- ability to link into the World Customs Organization "One Window" initiative and harmonize codes and processes.

The development of an ePhyto hub may help give developing countries a fair chance to join in the electronic exchange of data at reduced costs.

Interview with Nico Horn, Chair of the IPPC ePhyto Steering Group (IPPC, 2016)

What is an electronic phytosanitary certificate (ePhyto)?
An ePhyto serves the same purpose as the old-fashioned paper equivalent, it attests that a consignment meets phytosanitary import requirements which are established to prevent the movement of pests. Moving towards electronic-based, paper-free technology for the exchange of certificate information will facilitate trade even more.

How would the implementation of ePhyto benefit international trade?
The trade will become much quicker, allowing the exporting country to insert and share information almost in real time. It should also help reduce fraudulent certificates by using secure, direct exchange between national plant protection organizations.

The harmonized data format and content should make it easier to re-use the information for other purposes and will help to ensure the information is more complete and correct.

Speeding up the certification processes and eliminating the expensive paper for certificates will help to make the process more cost effective.

The Online Commenting System (OCS)

In 2011 the IPPC developed the Online Commenting System (OCS) to provide contracting parties and other stakeholders a system to comment on draft documents during member consultation on draft specifications, member consultation on draft ISPMs during commenting periods.

The new Online Commenting System (OCS) released in 2016

Its mission is to provide a simple and efficient, user-friendly online system to insert, submit and compile comments on documents.

Later reviewed in 2014 and updated to improve functionality and user-friendliness, the release of the updated OCS in 2016 has resulted in member comments almost doubling since 2011. In a record breaking consultation period in July 2016, which included the highest number of standards ever processed by the IPPC, a grand total of 84 Official Contact Points provided more than 5300 comments on 11 ISPMs.

Comments from Brent Larson, the Standards Officer with the IPPC Secretariat

"Not only do we have the highest number of standards out for consultation in our history, but we also have a record number of stakeholders commenting; almost double last year's number".

The OCS ensures confidentiality and safe submission of comments by the IPPC Official Contact Points. It implements a common commenting format and it facilitates inclusivity in the IPPC standard setting process being an efficient, user-friendly and accurate system. For the IPPC Secretariat, it accelerates and simplifies the compilation process while significantly reducing human error.

The Implementation Review and Support System (IRSS) Helpdesk

The Implementation Review and Support System (IRSS) Helpdesk aims to provide support and assistance to contracting parties seeking help in the implementation of the Convention and ISPMs. General and specific help services are provided by way of a Question and Answer Forum, a list of Frequently Asked Questions (FAQs) and links to the Phytosanitary.info webpage for further access to technical resources, country projects & activities and a consultant roster.

To improve the IRSS Helpdesk, the IPPC Secretariat conducted an analysis and found ways to enhance user experience and friendliness, access to content, organization and structure of features and ease of navigation to and within the webpage and Helpdesk.

By having access to the IRSS Helpdesk contracting parties have a point where they can contact the IPPC Secretariat to request assistance with their implementation issues and questions. Additionally, the many resources that the Helpdesk is linked to provide a wide range of information that can be used to allow NPPOs to work towards, manage or improve their phytosanitary systems.

Conclusions

The implementation of the IPPC, ISPMs and CPM recommendations provides contracting parties with a well-developed framework. However, it still remains a contracting parties sovereign right for how they choose to regulate their phytosanitary systems (IPPC, 1997).

The range of benefits from implementation are wide and varied and differ both spatially (e.g. sub-national, national, regional or global) and temporally (immediate, short and long term). In general, benefits can be realized in the following categories, although many other indirect or secondary benefits that exist.

- Protecting global plant resources from pests;
- International cooperation;
- Food security and sustainable agriculture;
- Environmental protection;
- Trade facilitation and economic development; and
- Access to globally applicable resources, systems and tools

Each contracting party will implement based on their national phytosanitary capacity, capabilities and resources, which varies widely between regions and countries. To this end, there is not a one size fits all solution for how to best establish, manage or improve a phytosanitary system, however the IPPC goes a long way toward providing appropriate guidance for how to do so in a globally applicable way.

The conclusions from this small study regarding the benefits of implementing the IPPC are taken directly from the case studies and those that can be generally taken as common themes.

National level

Quite often it takes a negative event to occur for awareness to be raised about the importance of establishing, managing and improving a national phytosanitary system. This usually occurs after a pest incursion, damage to the environment or the instability or availability of staple food crops. This highlights how important awareness is on a political level and also at the public sector level, who are the ultimate beneficiaries. However, political will and support for plant health activities is essential at all times, not just when there is an emergency.

Through implementing the IPPC phytosanitary capacity is enhanced, which results in the NPPO functioning more effectively in the achievement of national objectives and priorities. Although the functions of an NPPO are numerous, the fundamental indicator to measure the success of a phytosanitary system is the frequency of pest interceptions at the border on imports or the number of new pest introductions.

As demonstrated in the majority of the case studies included in this study, when a contracting party and its NPPO invests resources in their phytosanitary system, be it financial, human or other, they have a return on their investment in the form of a robust system that is able to manage risk and respond efficiently and effectively when issues arise. As seen in the case study on the Australian biosecurity system, their NPPO has quantified how prevention activities benefit the country as opposed to waiting for a phytosanitary issue to arise, this is often stated as - prevention is better than cure.

However, it is not just the prevention of pest introductions that benefits contracting parties, it is the benefits received through protecting plant resources by implementing the Convention, ISPMs and CPM recommendations. These are seen in the form of economic benefits through improved yields and better prices for commodities and also spin off affects, such as the creation of jobs in the agricultural sector and increased livelihoods for producers and small farmers. There is also a very close link between plant health and the protection of the environment, biodiversity and forestry and the facilitation of safe trade through the use of technically justified phytosanitary measures that are commensurate to risk.

What is obvious from the findings of this study is that the strength of a phytosanitary system and the activities thereof are the responsibility of many, not just the NPPO. It is the NPPO, the private sector, research institutions and to a certain extent, the public sector. What is often done to ensure wider input and sharing responsibility is the establishment of public-private partnerships. The more people that are involved, the greater awareness and benefits to the IPPC community will result.

Hand in hand with increasing awareness of plant health is the need for research to explore the use of new practices and technologies to improve crop yields, manage pest issues and facilitate trade. A shift towards more environmentally friendly agricultural practices is one example of how countries can manage pests without disrupting ecosystems and biodiversity, such as China's use of green pest management. It is evident that there are now many alternative options to producing crops than the traditional chemical methods, as seen by the use of integrated pest management and systems approaches, particularly in forestry. While the use of new technologies such as the ePhyto system will provide a secure system for the exchange of phytosanitary certificates, which facilitates safe trade.

The importance of IPPC and the commitment to plant health activities

The IPPC plays an important role in protecting global plant resources from pests, by providing a framework for contracting parties, RPPOs and other stakeholders to work together to manage robust phytosanitary systems. While a contracting party to the IPPC has obligations to the Convention to fulfil within its territories, the success of protecting global plant resources also rests with others in the IPPC Community (Table 1).

As discussed in this report, there are many benefits to being a contracting party, both generally and demonstrated specifically through the various case studies that have been included. What is evident is that contracting parties who invest time and resources into strengthening their phytosanitary systems and capacity benefit in many ways. It is the enhancement of phytosanitary capacity that increases national resilience. However, the most important factor to note is that an investment in plant health needs to be continuous for both short and long term benefits to be realized. Often to succeed in sustaining a robust plant health system there needs to be political will and national support, which comes through awareness raising and promoting the importance of benefits that can be gained.

In addition to contracting parties realizing national benefits from sustainable plant health systems, the commitment they show to being involved in IPPC regional and global activities is equally important, be it through the exchange of information or participation in IPPC activities. The opportunities available to contracting parties to contribute to the governance of the Convention, development and review of ISPMs, capacity development, information exchange, dispute resolution and other technical groups and panels is extensive and results in a global perspective for the greater good.

However, in reality the investment in phytosanitary systems takes resources, which are often scarce in the plant health field, and take time and effort to obtain. It is for this reason that the IPPC Secretariat has focused strongly on resource mobilization in the last several years. This drive for resources and support to plant health is two-fold, with sustainable funding required to maintain the core activities of the IPPC Secretariat and the realization that contracting parties, especially from developing countries, need assistance with gaining access to resources for technical assistance and capacity development. Resource mobilization will remain a high priority for the IPPC Secretariat and contracting parties, as with more support and funding there is significant potential for more benefits to be realized.

Wider considerations

There are many broader implications that should be considered regarding the implementation successes and challenges of contracting parties' and how they can realize greater benefits. To understand this further, the IPPC has done extensive work on evaluating implementation under the IRSS project, with particular focus on key articles of the Convention and ISPMs. The outcomes of the analysis to date have revealed that a contracting party needs to retain some level of flexibility and adaptability to address emerging issues when they arise. To do this, NPPOs need national support, both politically and from wider stakeholder groups, which is a major weakness for many contracting parties.

To gain further support for contracting parties and implementation of the IPPC, ISPMs and CPM recommendations, there needs to be a stronger drive to broaden outreach and awareness raising of the importance of maintaining plant health and the benefits thereof. Although the IPPC community contains a number of stakeholders at the global, regional, national and subnational level, at the moment not all of these groups are being fully engaged. It is often only those entities (e.g. NPPOs) and individuals (e.g. importers and exporters) that have direct input or association with a phytosanitary system that have the most awareness. However, it is essential that the message of protecting global plant resources be disseminated more widely, while maintaining relevance, effectiveness and efficiency. To increase awareness the IPPC Secretariat has re-focused resources within the Integration and Support team to enhance IPPC communication and advocacy and asks all contracting parties to also share information and promote plant health within their countries.

When contracting parties have the opportunity to review their phytosanitary systems, legislation, policies and procedures for change and improvement, it is important that any adapted or newly developed system is designed to be more results oriented. This is the case when contracting parties choose to use the Phytosanitary Capacity Evaluation (PCE) tool, which after identifying the successes and challenges within a phytosanitary system, has an output of a plan for improvement, with goals, objectives, activities, expected results and indicators thereof (referred to as a logframe). The PCE tool is therefore highly relevant and its use and results would be of benefit to all contracting parties, regardless of a country's development status, political situation and resource availability. The IPPC Secretariat recommends that the PCE be applied periodically to understand a national situation and continually plan for improvement.

To practically implement the provisions of the Convention, ISPMs and CPM recommendations, NPPOs and other government ministries or departments need to be able to lobby for national plant health support. To facilitate this, the IPPC Secretariat will be developing advocacy material based on this study outlining the benefits of implementing the IPPC.

Lessons learned

Lessons learnt from case studies

The most relevant lessons learnt from this study come from countries that demonstrate the benefits they have gained by implementing the IPPC, ISPMs and CPM recommendations.

Australia – Has established a comprehensive surveillance framework to understand their national pest situation, which informs their pest risk analyses and provides technical justification to their phytosanitary measures.

Belize – The application of the area freedoms ISPMs and strong government and private sector commitment has facilitated market access in trade of Medfly host commodities, by re-opened existing pathways and creating new opportunities for producers and traders. This has greatly benefited the country economically, commercially and socially.

China – Uses green pest management which reduces the use of agro-chemicals, this benefits the environment and produces healthier crops with less residues.

EU – Is a leader in international cooperation, providing support to many developing countries around the world to participate in IPPC activities and is the primary supporter of the Implementation Review and Support System, which reviews contracting parties' implementation challenges and successes.

Republic of Korea – Provides strong regional support to the contracting parties in Asia to participate in IPPC activities, including strong support to meetings, workshops and in 2017 is hosting the 12th session of the Commission on Phytosanitary Measures.

Vietnam – Is an excellent example of how far a country can come since becoming a contracting party to the IPPC, specifically through trade facilitation by using the IPPC pest risk analysis framework to gain access to many new markets.

Mexico – Demonstrates the power of the coordination of an industry to promote a commodity both domestically and within an importing country. Through the export of avocados to the USA, the Mexican avocado industry has received economic benefits, has created jobs in both countries and works to promote natural environmental process through re-forestation activities.

New Zealand – Uses their innovation in diagnostic technology to facilitate the domestic and regional identification of pests through a remote microscopy network. This initiative promotes international cooperation and facilitates trade through the efficient and accurate diagnoses of pests.

Estonia – Has worked hard to improve their national phytosanitary capacity through the application of the IPPC Phytosanitary Capacity Evaluation (PCE) tool. The results of the evaluation highlighted the strengths and gaps of the country and was used as a basis to develop new legislation to improve NPPO functions in alignment with the requirements of the EU and the IPPC.

United Kingdom – Has put in place comprehensive plant health contingency plans if pest incursions occur. Through development of both a general strategy and pest specific plans there is transparency in the expectations of the NPPO and other stakeholders during response events, to ensure activities are undertaken efficiently and effectively.

All lessons learnt can be of use to contracting parties who are interested in making changes or improvements to their phytosanitary systems.

Lessons learned from conducting this study

This study has been the first of its kind conducted by the IPPC Secretariat under the Implementation Review and Support System (IRSS). It has been the first step in looking at the successes and benefits of contracting parties implementing the Convention, ISPMs and CPM recommendations, as opposed to implementation challenges, which have been the past focus.

The lessons learned from conducting to this study include:

- the IPPC Secretariat's difficulty in obtaining pertinent and supporting information for this study;
- the absence/lack of information available on a regional and global level;
- the difficulty with engaging private sector to access information; and
- the difficulty in assessing benefits either quantitatively of qualitatively.

References

AFM (2016) Avocados from Mexico. Accessible online http://avocadosfrommexico.com/

APHIS (2015) Foreign Quarantine Notices 7 CFR 319.56-30. Federal Register, Washington DC, USA. Accessible online at https://www.federalregister.gov/documents/2015/02/18/2015-03289/mexican-hass-avocado-import-program

Australian Government (2013) Benefit-cost analysis of the long term containment strategy for exotic fruit flies in the Torres Strait. Research by the Australian Bureau of Agricultural and Resource Economics and Sciences. Australian Government Department of Agriculture – ABARES. Canberra, ACT, Australia.

Australian Government (2014) Joint Submission from the Department of Agriculture and Department of the Environment to the Standing Committee on Environment and Communications References Committee's Inquiry into environmental biosecurity.

Bothwell, M.L., Lynch, D.R., Wright, H. & Deniseger, J. (2009) On the boots of fisherman: the history of Didymo blooms on Vancouver Island, British Columbia. *Fisheries* 34:382-388.

CABI (2017) Datasheet *Maconellicoccus hirsutus* (pink hibiscus mealybug). The Centre for Agriculture and Bioscience International (CABI). Accessible online at http://www.cabi.org/isc/datasheet/40171

Cantrell, B, Chadwick, B and Cahill, A. (2002) *Fruit fly fighters, eradication of the papaya fruit fly*, SCARM Report no. 81, CSIRO publishing, Collingwood, Victoria, Australia.

CBD (2010) TARGET 9 - Technical Rationale extended (provided in document COP/10/INF/12/Rev.1). Accessible online at https://www.cbd.int/sp/targets/rationale/target-9/

Coronado, J. A., Bijman, J., Omta, O., Lansink, A. O. (2015) A case study of the Mexican avocado industry based on transaction costs and supply chain management practices. *Economia, 42,* 137-165.

Costanza, R., d'Arge, R., de Groote, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P. & van den Belt, M. (1997) The value of the world's ecosystem services and natural capital. *Nature* 387:253-260.

CPM (2006) The Role of IPPC Contact Points. CPM Recommendation CPM-1/2006. Accessible online at https://www.ippc.int/en/core-activities/governance/cpm/cpm-recommendations-1/cpm-recommendations/the-role-of-ippc-contact-points/

CPM (2014) IPPC Coverage of Aquatic Plants: CPM Recommendation CPM-9/2014/1. Accessible online at https://www.ippc.int/en/core-activities/governance/cpm/cpm-recommendations-1/cpm-recommendations/ippc-aquatic-plants/

CPM (2008) Replacement or reduction of the use of methyl bromide as a phytosanitary measure: CPM Recommendation CPM-3/2008. Accessible online at https://www.ippc.int/en/core-activities/governance/cpm/cpm-recommendations-1/cpm-recommendations/replacement-or-reduction-of-the-use-of-methyl-bromide-as-a-phytosanitary-measure/

CPM (2016) Recommendations on the importance of pest diagnosis. CPM Recommendation CPM-11/2016. Accessible online at https://www.ippc.int/en/core-activities/governance/cpm/cpm-recommendations-1/cpm-recommendations/the-importance-of-pest-diagnosis/

DEFRA (2014) Protecting Plant Health: A Plant Biosecurity Strategy for Great Britain, April 2014. The United Kingdom Department for Environment Food & Rural Affairs. Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/307355/pb14168-plant-health-strategy.pdf

DEFRA (2016) UK Plant Health Information Portal: Contingency planning. The United Kingdom Department for Environment Food & Rural Affairs. Accessed online at https://planthealthportal.defra.gov.uk/pests-and-diseases/contingency-planning/

Department of Economic Development, Jobs, Transport and Resources (209) Protecting Victoria from pest animals and weeds. Generalized invasion curve showing actions appropriate to each stage. Department of Environment and Primary Industries, Victoria, Australia. Accessible online at http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/protecting-victoria-from-pest-animals-and-weeds

FABA (2014) Economic Benefits of the Expansion of Avocado Imports from Mexico. Research Report to the Mexican Hass Avocado Import Association (MHAIA). February, 2014. Forecasting and Business Analytics, LLC. Texas A&M University. TX, United States of America.

FABA (2016) The U.S. National and State-Level Economic Benefits of Avocado Imports from Mexico. Research Report to the Asociación de Productores y Empacadores de Aguacate (APEAM, A.C.) and the Mexican Hass Avocado Import Association (MHAIA). August, 2016. Forecasting and Business Analytics, LLC. Texas A&M University. TX, United States of America.

FAO (2011) Guide to implementation of phytosanitary standards in forestry. FAO Forestry Paper 164. FAO, Rome, Italy. Accessible online at http://www.fao.org/docrep/013/i2080e/i2080e.pdf

FAO (2012) World Agriculture Towards 2030/2050: The 2012 Revision. ESA Working Paper No. 12-03, June 2012. Agriculture Development Economics Division, FAO. Accessible online at http://www.fao.org/docrep/016/ap106e/ap106e.pdf

FAO (2013) FAO Strategic Framework, Rome, Italy. Accessible online at http://www.fao.org/docrep/018/mi317e/mi317e.pdf

FAO (2015) Egypt Wheat Sector Review: Country Highlights. FAO Investment Centre. Accessible online at http://www.fao.org/3/a-i4898e.pdf

FAO (2016) FAO Yearbook of Fishery and Aquaculture Statistics Summary tables. Fisheries and Aquaculture Department of the Food and Agriculture Organization of the United Nations. Accessible online at: http://www.fao.org/fishery/statistics/global-aquaculture-production/en

Francois B. (1996) Measuring the impact of mealybug infestation. Proceedings of the first symposium on the Hibiscus mealybug in the Caribbean, 24-27 June 1996, Grenada.

Hill, M., Coetzee, J., Julien, M. & Center, T. (2011) Water Hyacinth, pp. 689-692. In:

Encyclopedia of biological invasions (Simberloff, D. and Rejmánek, M., eds.). Los Angeles, CA, USA, University of California Press. 765 p.

HLP (2012) Resourcing the Aichi Biodiversity Targets: A First Assessment of the Resources Required for Implementing the Strategic Plan for Biodiversity 2011-2020. High-Level Panel on Global Assessment of Resources for Implementing the Strategic Plan for Biodiversity 2011-2020. Available at http://www.cbd.int/doc/meetings/fin/hlpgar-sp-01/official/hlpgar-sp-01-01-report-en.pdf

Huang, S.W. (2013) Imports contribute to year-round fresh fruit availability. Report no. FTS-356-01, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., December. Accessible online at http://www.ers.usda.gov/media/1252296/fts-356-01.pdf

ICPM (2005) Threats to Biodiversity posed by Alien Species: Actions within the Framework of the IPPC. ICPM-7/20051. Accessible online at https://www.ippc.int/en/core-activities/governance/cpm/cpm-recommendations-1/cpm-recommendations/cpm-recommendations/threats-biodiversity-posed-alien-species-actions-within-framework-ippc/

IICA (2011) The Belize Medfly Programme. A Case Study on Maintaining a Medfly Surveillance and Eradication Programme. Inter-American Institution for Cooperation on Agriculture. Accessible online at http://legacy.iica.int/Esp/Programas/Sanidad/Publicaciones%20de%20SAIA/B2138i.pdf

IFAS (2014) Featured Creatures – Pink hibiscus mealybug (*Maconellicoccus hirsutus*). University of Florida Entomology & Nematology. Accessible online at http://entnemdept.ufl.edu/creatures/orn/mealybug/mealybug.htm

IPS (1998) Development: Pink mealybug alert in Belize. Inter Press Service, Belmopan, Belize, August 19, 1998. Accessed online at http://www.ipsnews.net/1998/08/development-belize-pink-mealybug-alert-in-belize/

IPPC (1997) International Plant Protection Convention. Rome, IPPC, FAO. Accessible online at https://www.ippc.int/static/media/files/publications/en/2013/06/06/1329129099_ippc_2011-12-01_reformatted.pdf

IPPC (2012a) IPPC Strategic Framework 2012-2019. Rome, IPPC, FAO. Accessible online at https://www.ippc.int/static/media/files/publications/en/2013/06/03/1344410402_ippc_strategicframework_e_w_201305101054en.pdf

IPPC (2012b) IPPC National Phytosanitary Capacity Development Strategy. Rome, IPPC, FAO. Accessible online at https://www.ippc.int/static/media/files/publications/en/2013/06/04/1359386736_02ippc_capacitydevelopment_e_201305101035en.pdf

IPPC (2012c) Aquatic plants and their risks: A review of the global status of aquatic plants. Implementation Review and Support System of the IPPC. Rome, IPPC, FAO. Accessible online at https://www.ippc.int/static/media/files/irss/2016/09/09/Aquatic_Plants_Their_Uses_and_Risks_A_review_of_the_global_status_of_aquatic_plants_8yCjM21.pdf

IPPC (2014a) Findings of the general survey of the International Plant Protection Convention and its Standards. Survey results from October 2012 – February 2013. Rome, IPPC, FAO. Accessible online at https://www.ippc.int/static/media/files/irss/2016/09/09/IRSS_IPPC_General_Survey_report_2014.pdf

IPPC (2014b) ePhyto Factsheet #3. Rome, IPPC, FAO. Accessible online at https://www.ippc.int/static/media/files/publication/en/2016/06/Factsheet_3.pdf

IPPC (2016a) An Introduction to the IPPC Standard Setting Process. IPPC Factsheet. Rome, IPPC, FAO. Accessible online at https://www.ippc.int/static/media/files/publication/en/2016/12/Brochure_IntrotoIPPC-SSP_W.pdf

IPPC (2016b) The global ePhyto solution. IPPC ePhyto Steering Group, v1.0 March 2016. Rome, IPPC, FAO. Accessible online at https://www.ippc.int/static/media/files/publication/en/2016/03/Global_ePhyto_solution.pdf

IPPC (2016c) Guide to Delivering Phystosanitary Diagnostic Services. Rome, IPPC, FAO. Accessible online at http://www.phytosanitary.info/sites/phytosanitary.info/files/Diagnostics_manual_English_1.1.pdf

Jang, E. B. & Moffitt, H. R. (1994) Systems approaches to achieving quarantine security, pp. 225–239. In J. L. Sharp and G. J. Hallman (eds.), Quarantine Treatments for Pests and Food Plants. Westview, Boulder, CO.

Kairo M.T.K., Pollard G.V., Peterkin D.D. & Lopez V.F. (2000) Biological control of the hibiscus mealybug, Maconellicoccus hirsutus Green (Hemiptera: Pseudococcidae) in the Caribbean. Integrated Pest Management Reviews, 5(4):241-254.

Madsen, J.D., Chambers, P.A., James, W.F., Koch, E.W. & Westlake, D.F. (2001) The interactions between water movement, sediment dynamics and submersed macrophytes. *Hydrobiologia* 444:71-84.Smith, J.E. (2011) Algae, pp. 11-15. In: *Encyclopedia of biological invasions* (Simberloff, D. andRejmánek, M., eds.). Los Angeles, CA, USA, University of California Press. 765 p.

MFAT (2013) Enhancement of biosecurity and quarantine services in the Pacific. Ministry of Foreign Affairs and Trade, Wellington, New Zealand. Accessible online at: https://www.mfat.govt.nz/assets/_securedfiles/Aid-Prog-docs/CASE-STUDY-PF-MPI-Case-study.pdf

Miller, C.E., Green, A.S., Harabin, V., & Stewart, R.D. (1995) Risk management analysis: a systems approach for Mexican avocado. May 1995. USDA, APHIS, Riverdale, MD. Accessible online at https://www.aphis.usda.gov/plant_health/ea/downloads/hass.pdf

Peters T. & Watson G.W. (1999) The biological control of Hibiscus mealybug in Grenada. In: Bell K, ed. Paths to prosperity: science and technology in the Commonwealth 1999/2000. London, UK: Kensington Publications, 130-132.

Polis, C. (2012) Mexican Hass Avocado Industry Sees Huge Growth In American Market. *The Huffington Post,* June 18, 2012. Accessible online at http://www.huffingtonpost.com/2012/06/18/americans-avocado-consumption_n_1593594.html

Queensland Government (1996-2014) *Long-term Containment Strategy for Exotic Fruit Flies in Torres Strait*. Not published.

TPN (2016) APEAM's reforestation program seeks to support long-term sustainability of Mexican avocado industry. The Produce News, August 23, 2016. Accessible online at http://www.producenews.com/the-produce-news-today-s-headlines/19555-apeam-s-reforestation-program-seeks-to-support-long-term-sustainability-of-mexican-avocado-industry

UN (2015) United Nations Sustainable Development Goals: 17 Goals to transform our world. Accessible online at http://www.un.org/sustainabledevelopment/sustainable-development-goals/

UNU (2016) Experts Warn Booming Seaweed Industry. News from United Nations University, September 5, 2016. Accessible online at http://www.sciencenewsline.com/news/20160905155700017.html

USDA (1995a) Avocado pest risk assessment, addendum and review (1995, 1996 2001) Accessible online at http://www.aphis.usda.gov/ppq/avocados/#support

USDA (1995b) Risk Management Analysis: A Systems Approach for Mexican Avocados. Accessible online at http://www.aphis.usda.gov/ppq/avocados/#support

USDA (2015). *Fruit and Tree Nuts Yearbook.* Economic Research Service, United States Department of Agriculture (USDA). November. Accessible at http://www.ers.usda.gov/data-products/fruitand-tree-nut-data/yearbook-tables.aspx

World Food Summit (1996) Declaration on World Food Security, Rome, Italy.

WTO (2016) World Trade Organization, time series. Global, total merchandise trade. Accessible online at http://stat.wto.org/StatisticalProgram/WSDBStatProgramHome.aspx?Language=E

WTO (1994) The World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures. Geneva, WTO. Accessible online at https://www.wto.org/English/docs_e/legal_e/04-wto.pdf

ISPMs cited

ISPMs are available on the International Phytosanitary Portal (IPP) at https://www.ippc.int/core-activities/standards-setting/ispms

ISPM 1. *Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*

ISPM 2. *Framework for pest risk analysis*

ISPM 4. *Requirements for the establishment of pest free areas*

ISPM 5. *Glossary of phytosanitary terms*

ISPM 6. *Guidelines for surveillance*

ISPM 7. *Phytosanitary certification system*

ISPM 8. *Determination of pest status in an area*

ISPM 9. *Guidelines for pest eradication programmes*

ISPM 10. *Requirements for the establishment of pest free places of production and pest free production sites*

ISPM 11. *Pest risk analysis for quarantine pests*

ISPM 12. *Phytosanitary certificates*

ISPM 14 (2016) *The use of integrated measures in a systems approach for pest risk management*

ISPM 15. *Regulation of wood packaging material in international trade*

ISPM 18. *Guidelines for the use of irradiation as a phytosanitary measure*

ISPM 20. *Guidelines for a phytosanitary import regulatory system*

ISPM 21. *Pest risk analysis for regulated non quarantine pests*

ISPM 22. *Requirements for the establishment of areas of low pest prevalence*

ISPM 23. *Guidelines for inspection*

ISPM 25. *Consignments in transit*

ISPM 26. *Establishment of pest free areas for fruit flies (Tephritidae)*

ISPM 27. *Diagnostic protocols for regulated pests*

ISPM 28. *Phytosanitary treatments for regulated pests*

ISPM 29. *Recognition of pest free areas and areas of low pest prevalence*

ISPM 30. *Establishment of areas of low pest prevalence for fruit flies (Tephritidae)*

Annex 1: The relationship between categories of benefits and contracting party implementation

	Benefits					
IPPC activities and coordination	**Protection of global plant resources**	**International cooperation**	**Food security and sustainable agriculture**	**Environmental protection**	**Trade facilitation**	**Other**
Rights and obligations	✓	✓	✓	✓	✓	
Principles and policies	✓	✓	✓	✓	✓	
Pest status and surveillance	✓	✓	✓	✓	✓	
Pest risk analysis and import regulation	✓	✓	✓	✓	✓	
Pest risk management	✓	✓	✓	✓		
Phytosanitary measures	✓	✓	✓	✓	✓	
Diagnostics	✓	✓	✓	✓	✓	
Export systems and certification					✓	
Information exchange		✓			✓	
Technical assistance	✓	✓	✓	✓	✓	
Dispute avoidance and settlement	✓	✓				
Standards setting	✓	✓			✓	
IPPC tools (e.g. PCE, OCS, e-Phyto)	✓	✓	✓	✓	✓	

Guidance and manuals	✓	✓	✓	✓	✓	