## International research collaboration

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Purpose

1. This paper provides a conceptual proposal as to how the IPPC could enhance the prevention of international movement of pests of plants and plant products, and better control the introduction and spread of these same pests through greater international collaboration of research, development and extension (RDE).

Background

1. The importance of international RDE collaboration, and linking with end-users of RDE are well understood. Collaboration across nations, institutions, and disciplines, leads to higher quality science, efficiencies of resource use, better outcomes and wider adoption of results. However, these benefits of collaboration only occur where there is mutual interest and alignment of goals, leadership, and support for collaboration (it costs money!).
2. A good example of an international collaboration is the International Forestry Quarantine Research Working Group (IFQRWG). This forum was created about 15 years ago from the core of international scientists who worked on ISPM 15, the International phytosanitary standard developed to manage pests risks in solid wood packaging material.
3. After the standard was finalised, IFQRWG was formed and has worked on international research and collaboration on new treatments for timber pests and many other areas of forest Biosecurity. Central to the success of this group has been the leadership of Dr Eric Allen from the Canadian Forest Service.
4. A second example is that of Rubber vine (*Cryptostegia grandiflora*): it was introduced to Australia from Madagascar in the 19th century. It is an aggressive climber, capable of smothering trees up to 40m high, and is well-adapted to extensive areas of the seasonally dry tropics in Australia. By the 1990s it had infested about 40,000 square kilometres in Queensland, particularly along water courses where it formed dense thickets, creating a barrier for livestock as well as smothering and replacing native plants and reducing grass growth. The remoteness and size of the infested area, and the ability of rubber vine to produce vast numbers of seeds that are spread both by wind and water meant that it was impracticable to control it using chemicals or fire, although both these approaches were (and still are) used where feasible.
5. In 1995, based on several years of research by scientists from CABI and the Queensland Government, a strain of rust (*Maravalia cryptostegiae*) from Madagascar was released at 29 sites in Queensland. The rust acts slowly but eventually causes defoliation, reduced plant growth, reduced seed production and, sometimes, death of rubber vine. It usually does not kill mature, well-established plants, but it does reduce the ability of infestations to spread and, by creating leaf litter and other combustible material, increases the effectiveness of fire.
6. Overall, this rust has been an outstandingly successful biological control agent[[1]](#footnote-1). The prospective benefit to Australian agriculture from this successful biocontrol was estimated in 1991 to be AUD 295-528 million[[2]](#footnote-2). The actual benefit calculated in 2004 was estimated to be AUD 232.5 million, and the estimated benefit:cost ratio was estimated to be 108:1[[3]](#footnote-3).
7. Australia’s Plant Biosecurity Cooperative Research Centre is also powerful example of collaboration. It has six years of funding, 27 partners representing government, industry, beneficiaries, research investors and research providers, international and domestic, all working towards common goals. It will deliver a significant range of impacts for the $30m of national government investment, including that investment being leveraged to over $160m of resources.
8. Further examples of international collaboration are attached.
9. The ingredients for successful collaboration are facilitating processes and structures, leadership, a ‘vision’ and ultimately funding - for both research and collaboration. Further, there needs to be a balanced portfolio or work, ranging from strategic to applied research and extension for adoption, but all ultimately aligned to outcomes.

# Discussion

1. The goal should be enhanced global connectivity and collaborative RDE on all things relevant to optimising plant health in its broadest application – including plant production, protection and the management of phytosanitary risks - leading to greater plant health outcomes **and** greater efficiency in resource use. There is a role for the IPPC and its structures to facilitate the establishment of targeted RDE activities that develop solutions to global problems within its remit. The enhanced connectivity and collaboration should be in the broadest sense – more than just scientist to scientist, but to ensure government and industry end-users and beneficiaries of RDE are integral to the process. These government and industry stakeholders must be a part of strategic planning and directing the priorities of RDE, be they through existing IPCC or other mechanisms.
2. The IPPC should lead the development of a Global Plant Health RDE plan 2020-2030. Each aspect of the Plan should be clearly aligned with end-user outcomes (industry, government, capacity development etc). For example a structure of themes, sub-themes and potential investment areas, each level describing the problem/opportunity being addressed, the outcomes desired and the outputs required.
3. The development of the Plan should be completed by a small working group (say 10-12) of both key researchers and end-users from IPPC, relevant international bodies (eg International Plant Pathology Society) and research agencies. Leadership by the Working Group and its Chair, supported by the IPPC is critical. This working group will need to have a significant knowledge of the area, and include members of the IPPC. Existing IPPC processes to highlight urgent issues of plant protection must be fed into the process of RDE plan development and review.
4. At a high level, an ‘audit’ and review of sorts should be conducted – what do we know now and what R&D is being done and where against the Plan. This would be informed by the analysis and reporting of the status of plant protection in the world – as required by the Convention.
5. The Global RDE plan should be regionally prioritised, firstly to raise awareness and understanding of the Plan, secondly to highlight the key regional priorities for investment, and thirdly to identify opportunities for cross-regional knowledge transfer, particularly in a capacity building context.
6. With the agreement to develop the Plan, the IPPC should seek to have all contracting parties support the implementation of the plan through their respective NPPOs.
7. Following development of the Plan, the audit and review, and regional prioritisation, the IPPC should consider providing funding for some of the highest priority and most urgent issues raised. Further, each NPPO should consider the same for its national and regional priorities as per the Plan.
8. While the Plan is a decadal plan, it should be reviewed biennially, including at a regional level. Plant protection issues arise relatively quickly and often a global response might be required. The Xylella challenge comes to mind.
9. Ultimately the IPPC should seek to have NPPOs encourage their domestic research agencies to align with the Global plan and regional priorities. That is, should the research agencies, including public and private sector organisations, wish to work on something supported by national funding there should be a clear link to the Global RDE plan and/or regional priority and articulate what gap that it fills.
10. The IPPC should seek to support or facilitate mechanisms by which the scientific community is aware of and has the opportunity to input to the process and take direction from the Plan. This may be supported through existing professional bodies (eg International Plant Protection Society) or facilitated in a specific event, such as those promoted by FAO, development agencies, WTO etc.

Recommendation

1. That the SPG:
2. Discusses the strategic opportunities and values offered by an RDE function for the IPPC for inclusion in the 2020-2030 strategic framework.
3. Considers the development of a pilot project to test the concepts in this paper and, in doing so, provides solution(s) to a significant global phytosanitary issue.

Attachment 1. Collaboration examples

**Xylella Genome consortium**

Brazil was heralded for completion of the first genome sequence of a plant pathogen (*Xylella fastidiosa*) following the development of a virtual research centre — a collaborative network of laboratories throughout the state of São Paulo, drawing on the expertise of a dispersed and diverse scientific community and on investment from both the government and the private sector. Strategies key to the success of this model are discussed in the context of continuing collaborative scientific endeavours in both developed and developing countries. The most commonly adopted strategy for genomics, and in particular genome sequencing, has been to create large, stand-apart genome centers where the means to generate a vast amount of data are concentrated, recognizing that this kind of science has no real place in the average traditional research laboratory. In Brazil, however, a developing country with a reasonably well developed scientific infrastructure and with aspirations to integrate science and technology into its further economic growth, a different strategy was used — that of the collaborative research network. In this approach, the necessary hardware, consumables, financing, and expertise are distributed within the existing scientific community, constituting a virtual research center that is, in reality, a large number of well-equipped laboratories linked by the Internet. Such networks can be set up rapidly and can strengthen the general scientific community by disseminating financing, novel equipment, and expertise. Moreover, they can undertake complex and socially relevant projects that would be impossible within the traditional model of modern science organized around an individual researcher and his or her immediate colleagues; thus they can attain a higher level of scientific achievement. This network structure may not only enable developing countries like Brazil to move into more challenging areas of research but is also germane to the international community.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC171397/>

**Invasive species information networks: collaboration at multiple scales for prevention, early detection, and rapid response to invasive alien species**

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1. Accurate analysis of present distributions and effective modelling of future distributions of invasive alien species (IAS) are both highly dependent on the availability and accessibility of occurrence data and natural history information about the species. Invasive alien species monitoring and detection networks (such as the Invasive Plant Atlas of New England and the Invasive Plant Atlas of the MidSouth) generate occurrence data at local and regional levels within the United States, which are shared through the US National Institute of Invasive Species Science. The Inter-American Biodiversity Information Network's Invasives Information Network (I3N), facilitates cooperation on sharing invasive species occurrence data throughout the Western Hemisphere. The I3N and other national and regional networks expose their data globally via the Global Invasive Species Information Network (GISIN). International and interdisciplinary cooperation on data sharing strengthens cooperation on strategies and responses to invasions. However, limitations to effective collaboration among invasive species networks leading to successful early detection and rapid response to invasive species include: lack of interoperability; data accessibility; funding; and technical expertise. This paper proposes various solutions to these obstacles at different geographic levels and briefly describes success stories from the invasive species information networks mentioned above. Using biological informatics to facilitate global information sharing is especially critical in invasive species science, as research has shown that one of the best indicators of the invasiveness of a species is whether it has been invasive elsewhere. Data must also be shared across disciplines because natural history information (e.g. diet, predators, habitat requirements, etc.) about a species in its native range is vital for effective prevention, detection, and rapid response to an invasion. Finally, it has been our experience that sharing information, including invasive species dispersal mechanisms and rates, impacts, and prevention and control strategies, enables resource managers and decision-makers to mount a more effective response to biological invasions

[**http://www.tandfonline.com/doi/abs/10.1080/14888386.2009.9712839**](http://www.tandfonline.com/doi/abs/10.1080/14888386.2009.9712839)

**QUADS**

1. The Plant Health Quadrilaterals (PHQuads) Group is a strategic coalition composed of the national plant protection organisations of the United States, Australia, Canada, and New Zealand. It is not an official treaty organisation, but an informal alliance.

Some of their objectives are to:

* coordinate priorities and positions for [International Plant Protection Convention](https://www.ippc.int/en/) (IPPC) standards
* promote and secure international collaboration in various areas of plant protection
* influence the work of the IPPC and the future development of standards, including international phytosanitary policy and emerging issues.
* collaborate in the area of science and technical information exchange, including technical resources, such as diagnostic technologies

The PHQuads has developed a strategic plan and terms of reference. PHQuads also has progressed work on implementation and joint [Asia and Pacific Plant Protection Commission](http://www.apppc.org/) (APPPC) and [North American Plant Protection Organization](http://www.nappo.org/) (NAPPO) workshops on wood and surveillance.

The EU has funded really large collaborative projects over the years that have benefitted Plant Health. For example:

**PRATIQUE: ENHANCEMENTS OF PEST RISK ANALYSIS TECHNIQUES**

1. PRATIQUE has 15 partners. It brings together pest risk analysts, phytosanitary experts, invasive alien species specialists, ecologists, economists and risk modellers from eleven leading institutes from across the EU, two international organisations, one institute from Australia and one institute from New Zealand. Sub-contractors in China and Russia are also involved.
2. They produced a structured inventory of PRA datasets for the EU and undertook targeted research to improve existing procedures and develop new methods for:   
   (a) the assessment of economic, environmental and social impacts;   
   (b) enhancing consistency and summarising risk while taking account of uncertainty;   
   (c) mapping endangered areas;   
   (d) pathway risk analysis and systems approaches; and   
   (e) guiding actions during emergencies caused by outbreaks of harmful organisms.
3. The results were tested and provided as protocols, decision support systems and computer programs with examples of best practice linked to a computerised European and Mediterranean Plant Protection Organization (EPPO) PRA scheme.
4. The new methods for pest risk analysis were tested with a variety of the major pests and invasive alien species affecting the cultivated and uncultivated habitats of the EU and independently validated by phytosanitary experts. Considerable assistance has also been provided by the project's observers, notably from experts in the EU Plant Health Standing Committee and from the Canadian and United States (US) phytosanitary services.
5. The deliverables are provided as protocols, decision support schemes and computer programs with examples of best practice that are available to pest risk analysts through modules and direct links to the PRA scheme. The revised PRA decision support scheme based on that prepared by the European and Mediterranean Plant Protection Organization (EPPO) has been computerised providing:   
   (i) new users with context-sensitive guidance;   
   (ii) experts with not only a more efficient and user-friendly process but also greatly enhanced access to key datasets and analytical tools;   
   (iii) policy makers with an improved and robust scientific basis for managing risks;   
   (iv) stakeholders with a more transparent presentation of the risks.   
     
   EPPO has already adopted the decision support scheme for PRA revised by PRATIQUE and is committed to its future maintenance and improvement.  
     
   List of websites: [http://www.pratiqueproject.eu](http://www.pratiqueproject.eu/)

Other EU projects

<http://cordis.europa.eu/project/rcn/100052_en.html> --> food security, bioterrorism

<https://www.plantfoodsec.eu/latestnews_article.php?id=291&t=L&s>=

<http://www.emphasisproject.eu/index.php>

[PLANT AND FOOD BIOSECURITY](http://cordis.europa.eu/project/rcn/100052_en.html) --> food security, bioterrorism

From 02/02/2011 to 31/01/2016  closed project

1. This project will focus on biological threats having the capacity to affect and damage agriculture, infect plants and ultimately affect the food and feed at any stage in the food supply chain.  
   Traditional thinking and planning regarding bioterrorism has focused primarily on humans as the primary target. If the perpetrator’s objectives can be met solely through the creation of human illness, death and associated panic, this may be appropriate. However, if economic and political vulnerabilities are included as contributing factors, agricultural bioterrorism must be considered among other possible avenues of attack.  
   Agricultural bioterrorism (agroterrorism) is a subset of bioterrorism, and it is defined as the deliberate introduction of an animal or plant disease/pest with the goal of generating fear, causing economic losses, and/or undermining stability.  
   Programmes preparing for attacks against agriculture are not new, and have been conducted both by nation-states and by substate organisations throughout history. At least nine countries (Canada, France, Germany, Iraq, Japan, South Africa, United Kingdom, USA and the former USSR) had documented agricultural bioweapons programmes during some part of the 20th century. Four other countries (Egypt, North Korea, Rhodesia and Syria) are believed to have or have had agricultural bioweapons programmes.  
   In the meantime, natural outbreaks of diseases demonstrate the destructive potential of an agroterroristic attack.  
   Recent trends in biosecurity recommend a shift from a largely national approach to biosecurity towards greater international cooperation. Current capabilities to detect and respond to agroterrorism are limited and spread among many organisations, with a corresponding lack of coordination.  
   The project deals with threats which are multifaceted, interrelated, complex and increasingly transnational in their impact. The European Network of Excellence PLANTFOODSEC aims to establish a virtual Centre of Competence in plant and food biosecurity to enhance preparedness and response capabilities to prevent, to respond and to recover from a biological incident or deliberate criminal activity threatening the European agrifood system.

[Virtual toolbox to bolster Europe’s food and agricultural security](http://cordis.europa.eu/news/rcn/124784_en.html)

**The international taskforce on Biosecurity**

<https://www.plantfoodsec.eu/latestnews_article.php?id=291&t=L&s>

1. The creation of a taskforce at European level comprised of top international experts in biosecurity, able to make full use of a wide variety of expertise and experience acquired in this field and to make an important contribution to developing strategies to respond rapidly in the event that pathogens are accidentally or deliberately introduced to crops and the agro-food supply chain.
2. The partners of the Plant and Food Biosecurity - Network of Excellence project:

ITALY: *Agroinnova*, Center of Competence for Innovation in the Agro-environmental and Agro-food Field; University of Turin, (Project coordinator); *Spin-To* Srl, Public Relations and Communication agency

UK: National Institute of Agricultural Botany (*NIAB*); Food and Environment Research Agency (*FERA*); Imperial College of Science, Technology and Medicine, London

GERMANY: Rheinische Friedrich-Wilhelms-Universität Bonn (*UNIBONN*) –

      Institute for plant science and preservation of resources of Bonn University

FRANCE:     Institut National de La Recherche Agronomique (*INRA*)

      National Institute of Agro-food research

HUNGARY: Regional Environmental Centre for Central and Eastern Europe (*REC*)

TURKEY: Middle East Technical University (*METU*)

UNITED NATIONS: United Nations Interregional Crime and Justice Research Institute (*UNICRI*)

ISRAEL: The Agricultural Research Organisation (*ARO*)

UNITED STATES: National Institute for Microbial Forensics & Food and Agricultural Biosecurity (*NIMFFAB*), Oklahoma State University; Kansas State University (*KSTATE*)

[EMPHASIS](http://www.emphasisproject.eu/index.php)

1. Effective management of pests and harmful alien species – integrated solutions.
2. A four-year project with almost EUR 7 million in EU funding, and a consortium of 22 partners including research institutes, associations, and small and medium sized private companies from 10 different countries.

[PhD thesis : A draft framework on pest management in the EU](http://www.emphasisproject.eu/upload/publications/file/Xiong-J-2015-CEP-MSc-Thesis.pdf)

1. [Crop Biosecurity : Assuring our Global Food Supply](https://books.google.com.au/books?id=D94nVU62fl8C&pg=PA125&lpg=PA125&dq=european+union+crop++biosecurity&source=bl&ots=5gPnfsmk4n&sig=-dsW3KNwBfAn3_h9Uy-qI3ROoJo&hl=en&sa=X&ved=0ahUKEwiBycDGoYHPAhXJnZQKHYq4AI8Q6AEIQjAH#v=onepage&q=european%20union%20crop%20%20biosecurity&f=false)  2005 book, publication supported by The NATO Science for Peace and Security Programme

[EU Horizon 2020 work programmes 2016-2017](http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-food_en.pdf)

1. This Work Programme will achieve its objectives through four calls, addressing all the bioeconomy sectors from the sustainable exploration of the oceans and seas and the development of a blue economy, to climate-smart agriculture, new models for development in rural areas, new biobased goods and services:
2. Including 1: Sustainable Food Security – Resilient and resource-efficient value chains: this call addresses the issues of resilience and efficiency in the food value chain. It will support research and innovation all along the food chain, from primary production, food processing to healthy and safe foods and diets

1. Palmer, WA, Heard, TA, and Sheppard, AW (2010): A review of Australian classical biological control of weeds programs and research activities over the past 12 years, Biological Control 52 (2010) 271–287. [↑](#footnote-ref-1)
2. Chippendale, JF (1991): Potential returns to research on rubber vine (*Cryptostegia grandiflora* R.Br.) in north Queensland. M.Sc.Agric. thesis, University of Queensland, Brisbane. [↑](#footnote-ref-2)
3. Page, AR and Lacey, KL (2006): Economic Assessment of Australia Weed Biological Control. Cooperative Research Centre for Australian Weed Management, Adelaide. [↑](#footnote-ref-3)