



International Forestry Quarantine Research Group



International Meeting # 17

28 September – 2 October 2020

Proceedings of the Virtual Symposium

MAY 14, 2021

INTERNATIONAL FORESTRY QUARANTINE RESEARCH GROUP
SCIENCE STEERING COMMITTEE

<https://www.ippc.int/en/external-cooperation/organizations-page-in-ipp/internationalforestryquarantineresearchgroup/>



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The Mission of IFQRG

The mission of the International Forestry Quarantine Research Group (IFQRG) is to support and address critical forestry quarantine issues for the global plant health community through scientific analysis, discussion and collaborative research.

IFQRG is an independent, open international body providing scientific analysis and review of global forestry-related phytosanitary issues. IFQRG serves as a forum for the discussion and clarification of key issues related to the phytosanitary implications of global trade with forest plants and products.

IFQRG's goal is for membership to include global representation from scientific, industrial and phytosanitary organisations from both developed and developing nations. Membership is open to suitably qualified individuals who have demonstrated expertise in disciplines relevant to plant health. IFQRG endeavors to recruit members from all FAO regions.

To become a member of IFQRG, the individual submits a short biography or curriculum vitae to the Science Steering Committee (SSC) outlining research or other relevant experience. Membership applications will be accepted by the SSC if information on the applicant indicates they would be a suitable member of IFQRG. There is no membership fee.

Symposium Proceedings

These proceedings communicate the discussions and conclusions from the 2020 International symposium number 17 of the International Forestry Quarantine Research Group. The symposium was held on-line (virtually) from the 28 September – 2 October, 2020.

Recommended citation:

IFQRG (2020) Proceedings of the 2020 Symposium #17 of the International Forestry Quarantine Research Group. October 2020, Virtual Symposium. International Forestry Quarantine Research Group.



List of Abbreviations

ALSC	American Lumber Standards Committee
APPPC	Asia Pacific Plant Protection Commission
CFIA	Canadian Food Inspection Agency
CLSAB	Canadian Lumber Standards Accreditation Board
CPM	IPPC Commission on Phytosanitary Measures
CRADA	Cooperative research and development agreement
CWPCA	Canadian Wood Pallet and Container Association
DH	Dielectric Heating
EAB	Emerald Ash Borer (<i>Agrilus planipennis</i>)
EDN	Ethanedinitrile (C ₂ N ₂)
EPPO	European Plant Protection Organisation
FPSA	Forest Products System Approach
HACCP	Hazard Analysis and Critical Control Points
HT	Heat Treatment
IFC	IPPC Implementation and Facilitation Committee
IFQRG	International Forestry Quarantine Research Group
IFU	Implementation and Facilitation Unit
IPPC	International Plant Protection Convention
IPRRG	International Pest Risk Research Group
IRSS	Implementation Review and Support System
ISPM	International Standards for Phytosanitary Measures
ISPM15	ISPM No. 15 <i>Regulation of wood packaging material in international trade</i>
ISPM28	ISPM No. 28 <i>Phytosanitary treatments for regulated pests</i>
ISPM42	ISPM No. 42 <i>Requirements for the use of Temperature Treatment as Phytosanitary Measures</i>
IUFRO	International Union of Forestry Research Organizations
IYPH	International Year of Plant Health
MBr	Methyl bromide
MW	Microwave
NAPPO	North American Plant Protection Organization
NEPPO	Near East Plant Protection Organization
NGS	Next Generation Sequencing
NPPO	National Plant Protection Organisation
OECD	Organisation for Economic Co-operation and Development
OTUs	Operational taxonomic units
PCE	Phytosanitary Capacity Evaluation



PMRG	Phytosanitary Measures Research Group
PWN	Pine Wood Nematode (<i>Bursaphelenchus xylophilus</i>)
RoP	Rules of Procedure
RPPO	Regional Plant Protection Organisation
SC	IPPC Standards Committee
SSC	IFQRG Science Steering Committee
STDF	Standards and Trade Development Facility
ToR	Terms of Reference
TPFQ	IPPC Technical Panel for Forest Quarantine
TPPT	IPPC Technical Panel for Phytosanitary Treatments
USDA-APHIS	United States Department of Agriculture- Animal and Plant Health Inspection



MEETING REPORT

1. Welcome Address

The meeting of IFQRG 17 was hosted online by the Penn State University. Forests and their sustainable management all over the world have presented researchers with many challenges during the past decades. Responses with solutions were and are only possible because of scientific cooperation among institutions and their dedicated scientists.



The meeting of IFQRG 17 was also affiliated with the International Year of Plant Health.

2. Opening of the meeting

IFQRG Chair, Dr. Michael Ormsby, opened the meeting and welcomed all participants.

3. Introductions

A list of the recorded participants is provided in Appendix 1.



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5. Presentation Abstracts

1.1 IFQRG Introductory Remarks *Allen*

Author: Eric Allen

Presenter Bio: Dr. Eric Allen, now retired, was head of the Forest Invasive Alien Team with the Canadian Forest Service at the Pacific Forestry Centre in Victoria, Canada for more than 20 years. He worked extensively on non-indigenous species that impact forest ecosystems; their biologies, their movement with international trade, and the assessment of mitigation measures. During his career, he was the founder and chair of the International Forestry Quarantine Research Group (IFQRG), and member of the North American Plant Protection Organization (NAPPO) expert group on forestry systems approaches and the International Plant Protection Convention (IPPC) Technical Panel on Forest Quarantine. Through these fora he has supported the creation of a number of regional and international standards for phytosanitary measures and guidance documents for both and has recognized the importance of team work and collaboration through bringing global experts from science, industry and regulatory communities together to solve phytosanitary issues in forestry.

Purpose: To give an historical overview of the International Forestry Quarantine Research Group

The International Forestry Quarantine Research Group, created in 2003, had its first meeting in Rome in February 2004. Since then 14 meetings have been held, many in Rome, but also in Canada, Portugal, Australia, Wales, China, New Zealand and Brazil. This year because of COVID-19 the meeting is being held online.

A key client of the IFQRG is the Commission of Phytosanitary Measures (CPM) and its subsidiary bodies: technical panels, expert working groups, regional and national plant protection organizations, in particular the Technical Panel on Forestry Quarantine. The relationship among these bodies is evolving, in particular the need for specific questions raised by the Standards Committee or the TPFQ to be addressed. This helps refine the role of IFQRG to bring together all available information on a particular topic and to provide a response based on the best available information.

IFQRG has, through analysis and specially focused research, provided the scientific background necessary for the ongoing refinement of ISPM 15 e.g. re-infestation studies, recommendation of bark tolerances, and publication of new perspectives on treatment efficacy – probit-9.

The original vision of IFQRG was to pursue collaborative scientific activities, to foster a culture of respect and cooperation among the members. Although open debate is encouraged, this should not be a stage for political messaging or advocacy of national policies. Finding solutions



to reduce the international movement of forest pests, in many cases this means looking beyond the borders of our own countries or regions; it means considering the issues and challenges of all countries whether developed or developing.

IFQRG has a wide diversity of background, expertise and experience, comprising predominantly scientists, working in government institutions, universities, and industry labs as well as plant protection experts and industry leaders. Participants are encouraged to join as critical thinkers, ready to share knowledge and expertise, but to leave “positions” at the door.

Since its inception in 2003, IFQRG has matured and its role and relationship with other groups, especially the TPFQ has evolved. It has been increasingly clear that the most useful function of the group as a partner in advancing forest phytosanitary issues is providing science and interpretation of science. To this end, more scientists from developing and developed countries are needed to participate in IFQRG activities.

1.2 FAO Forest Health Program 2020-2021 *Sathyapala*

Author: Shiroma Sathyapala

Presenter Bio: Dr. Shiroma Sathyapala, Forestry Officer FAO has been leading the Forest Health and Protection Program in FAO, Rome, Italy since 2014. Through this programme, FAO assists, advises and supports countries and regions to safeguard the health and vitality of forests, forest ecosystems and trees outside forests, with special reference to insect pests, diseases and other harmful biotic and abiotic agents.

Purpose: To inform the IFQRG members of upcoming FAO forest health activities and seek collaboration where appropriate

Abstract: FAO forest protection and health programme assists, advises and supports countries to safeguard the health and vitality of forests, forest ecosystems and trees outside forests, with special reference to insect pests, diseases and other harmful biotic and abiotic agents. Through projects the program offers emergency assistance to countries with pest outbreaks and also develops pest management strategies to prevent further outbreaks in the medium and long term. In addition, FAO is facilitating four Regional **Networks** dedicated to the issue of forest invasive species. The presentation aims to provide update on the Forest health program activities for 2020-2021.



1.3 Modelling Phytosanitary Risks to Forestry – IBRAM Ormsby

Authors: Michael Ormsby¹, Lisa E. Jamieson², Owen Woodberry³, Steven Mascaro³, Nicolas Meurisse⁴, Rodelyn Jaksons², Samuel D. J. Brown²

Presenter Bio: Dr. Mike Ormsby manages a team of scientists in the New Zealand Ministry of Primary Industries that assess pest risks to New Zealand and oversee research programmes to support pest management. Dr. Ormsby has worked in the phytosanitary area for over 23 years and has been a member of IFQRG and the IPPC technical panels for treatments and forest quarantine since 2005.

Abstract: Under Better Border Biosecurity, a New Zealand multi-partner, cooperative science collaboration that researches ways to reduce the entry and establishment of new plant pests and diseases in New Zealand, a research team developed the Integrated Biosecurity Risk Assessment Model (IBRAM) for evaluating the risk of establishment and dispersal of invasive species using a Bayesian network (BN) approach. The model includes dynamic BN components and interfaces with a Geographic Information System (GIS), allowing users to explore the spatial and temporal distributions of pest populations and establishments. BNs are used to model these distributions and propagate the uncertainty in the data through a sequence of nodes. The model is supported by a web-based tool that allows users to run the model on real-world pest examples and investigate the impact of alternative ‘what-if’ risk management scenarios, to explore the effect of various interventions and resource allocations. The model was validated using data on the risks of establishment and spread of a number of unwanted organisms invading New Zealand including the Asian gypsy moth (*Lymantria dispar*) (Lepidoptera: Erebidae). The results of the modelling of the risks of AGM to New Zealand will be shown in this talk.

1.4 Vacuum steam treatment of hardwood logs: Biological efficacy for diseased *Metrosideros* and *Juglans* logs Juzwik

Author: Jennifer Juzwik, Northern Research Station, U.S. Forest Service, St. Paul, MN, USA

Presenter Bio: Jennifer Juzwik has worked as a Research Plant Pathologist with the U.S. Forest Service, Research and Development, in St. Paul, MN, USA, since 1989. She is a national expert on diagnosis, epidemiology and control oak wilt caused by *Bretziella fagacearum*. Within the past 10 years, she also has investigated the etiology of thousand cankers disease of *Juglans* species and of rapid ‘ohi’ a death of *Metrosideros polymorpha*.

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² The New Zealand Institute for Plant and Food Research, Mount Albert Research Centre, Auckland, New Zealand

³ Bayesian Intelligence, Melbourne, Australia

⁴ Scion, Rotorua, New Zealand



Purpose: To report on ability of vacuum steam to eradicate causal agents of thousand cankers disease (TCD) and rapid `ohi`a death (ROD) in colonized host logs

Abstract: Five replicate trials with three logs per load were conducted in a portable vacuum chamber to test two vacuum steam treatment schedules, 60° C for 60 minutes and 56° C for 30 minutes for each tree species. The insect vector (*Pityophthorus juglandis*) and the canker pathogen (*Geosmithia morbida*) were completely eliminated in diseased walnut logs with bark attached using the minimum schedule at 5 cm targeted depth below the bottom of the bark furrow. The two ROD pathogens (*Ceratocystis lukuohia* and *C. huliohia*) were completely eradicated in diseased `ohi`a logs with bark removed using the 60° C for 60 minutes treatment at 70% radius targeted depth below the cambium.

1.5 Worldwide diversity of fungi and herbivorous insects associated with dormant tree twigs *Franić et al.*

Authors: René Eschen, Simone Prospero and Iva Franić

Presenter Bio: For her PhD project Iva Franić looked into the insect and fungal communities of tree seeds and twigs on a large scale to determine the main drivers of the observed diversity patterns and to assess the phytosanitary risk associated with the movement of plant material. She obtained her PhD from University of Bern, and has been working on her project at CABI Delémont and WSL in Switzerland. She will soon start her postdoc at SLU Alnarp where she will look more closely into vertical transmission of fungal endophytes of tree seeds.

Purpose: To determine the relative importance of geographic, climatic and host related factors in shaping the diversity of fungi and herbivore insects associated with dormant tree twigs; and to determine which potentially invasive phytopathogenic pests may be moved via trade of asymptomatic plant material.

Brief abstract: We assessed the diversity of herbivorous insects and endophytic fungi associated with asymptomatic dormant tree twigs collected at 53 locations in 33 countries worldwide, across broad geographic and climatic gradients, and for hosts of 161 tree species belonging to 10 tree genera. The results reveal the high diversity of tree associated taxa, including potential pests, and the differences in the importance of study factors in shaping fungal and insect diversity. However, geographic distance, climate and host phylogeny were the main drivers of the diversity of both groups of tree associated taxa, indicating that: 1) intercontinental movement of plant material could facilitate introductions of new pests, 2) establishment of pests in the new area depends on the presence of suitable climatic conditions and tree hosts, and 3) climate change might substantially restructure insect and fungal communities with potentially severe consequences for tree health and forest ecosystem functioning.



2.1 Understanding mechanisms behind the toxicity of EDN to NZ invasive forest pests *Gidiglo et al.*

Authors: Godwin Nutifafa Gidiglo, Adriana J. Najjar-Rodriguez, Matthew Hall, Maria Minor and Wang Qiao

Presenter Bio: I am Godwin Nutifafa Gidiglo from Ghana, where I received my Bachelor of Science degree in Applied Biology from the University for Development Studies. I had my Master's degree in 2016 from Tehran University of Medical Sciences, where I pursued Medical Entomology and Vector Control. Currently, I am a final year PhD student of Applied Entomology at Massey University in New Zealand and researching on “understanding the mechanisms behind the toxicity of alternative fumigants”.

Purpose: To present the results of a PhD study carried out to understand the mechanisms behind the toxicity of EDN to insects

Abstract: We compared the toxicity of EDN to two invasive NZ forest pests, *Arhopalus ferus* (Coleoptera: Cerambycidae) and *Hylurgus ligniperda* (Coleoptera: Curculionidae), with the former species being highly susceptible to EDN while the latter one being highly tolerant. We conducted anatomical studies to test for differences in cuticle and spiracle size and morphology across the two species. We also tested the differences in behavioral responses of the two species while being fumigated. Finally, we investigated main pathways for EDN entry into the insect body and final target sites. We will present the main results of our studies and discuss the implications of our results.

2.2 Research and registration update on EDN™ as a postharvest treatment for forest product *Swaminathan*

Author: Dr. Swaminathan Head of Research & Regulatory Affairs, Draslovka Services Pty Ltd Australia

Presenter Bio: Dr. Swaminathan is working as a Head of Research and Regulatory Affairs with Draslovka Services group based in Sydney, Australia. I am involved in the registration and biosecurity approval of EDN, Bluefume and eFume products globally. I was responsible for getting the world first EDN registration for timber and soil in Australia. I have completed a PhD in Agriculture with specialisation in Entomology.

Purpose: The purpose of this presentation is to provide an update to IFQRG group regarding EDN™ work for forest product treatment.



Abstract: EDNTM has been identified as a potential alternative to methyl bromide fumigant for the treatment of forest products. It is registered in Australia, the Czech Republic (under permit) and recently approved in South Korea. Registration is expected this year in Russia, New Zealand and Malaysia. Registration is in the process in the USA, EU, Israel, South Africa, Turkey, Egypt, Philippines, Thailand, Indonesia and Vietnam. Recent efficacy studies have shown that EDNTM is very effective on NZ timber pests and Pinewood nematode in logs and wood chips.

2.3 Development of Certification Protocols and Advancements for Radio Frequency (RF) Technology for Phytosanitation of Wood Packaging Material (WPM) in Compliance with ISPM-15 – *Szymona et al.*

Authors: Karolina Szymona, John Janowiak, Mark Gagnon, Kelli Hoover Penn State University, University Park, PA USA; Ron Mack, USDA APHIS, Buzzards Bay, MA USA

Presenter Bio: Dr. Karolina Szymona obtained her Ph.D. at Warsaw University of Life Sciences in Forest Sciences. She works as a researcher at Penn State University in the project related to the development of the radio frequency phytosanitation for wood packaging materials in compliance with ISPM-15 international standard. She conducts experiments and assists with data and economic analyses and extension activities related to the project.

Abstract: Our research team conducted a series of experiments to assist with establishment of the first certification protocols of RF equipment used for dielectric heat (DH) treatment of wood packaging materials (WPM) in compliance with ISPM-15. DH is the first new method approved by the Commission on Phytosanitary Measures of the IPPC a few years ago, but certification of equipment protocols has not yet been developed. This research was conducted by Penn State University researchers in collaboration with USDA APHIS and in the presence of representatives from the Canadian Lumber Standards Accreditation Bureau (CLSAB) and American Lumber Standards Committee (ALSC). We proposed and performed 10 initial experimental trials to collect RF bulk treatment data to develop a certification protocol process for North American commercial applications. The results of this study led to an extended conversation with CLSAB and ALSC about options for temperature monitoring during treatment as well as ideas for upgrading the RF unit to further enhance heating uniformity throughout the workload to improve economic competitiveness of RF with conventional heat treatment.

3.1 Contaminating organisms associated with treated wood products - North American Plant Protection Organization (NAPPO) Science and Technology Document *Noseworthy et al.*

Authors: NAPPO Forestry Expert Group, including Meghan Noseworthy, Ron Mack, Eric Allen & Brad Gething



Presenter Bio: Meghan Noseworthy is a research manager of the Forest Invasives and Phytosanitary group with the Canadian Forest Service – Natural Resources Canada. She chairs the NAPPO Forestry Expert Group, currently developing the *Contaminating pests on wood commodities* Science and Technology document and is a member of the International Plant Protection Convention (IPPC) Contaminating Pests virtual working group.

Purpose: To update NAPPO's work on forest quarantine accomplished by the NAPPO Forestry Expert Group.

Abstract: In 2019 a new forestry expert working group was established to create a Science and Technology document on *Contaminating organisms of wood commodities*. The objective of this document is to provide scientific background on live contaminating organisms on wood commodities and provide guidance regarding actions appropriate for addressing associated phytosanitary risks.

3.2 The western conifer-seed bug (*Leptoglossus occidentalis*): global invasion history and apparent potential for contaminative dispersal Blackburn

Author: Gwylim Blackburn CFS, NRCan

Presenter Bio: Dr. Gwylim Blackburn is a research scientist of entomology at the Pacific Forestry Centre (CFS) in Victoria, BC. In his research, he develops tools aimed at advancing pest risk assessment and phytosanitary policy by combining field and lab-based sampling techniques with genomic analysis to illuminate aspects of insect biology that are key to assessing and managing their impact on forests and urban trees.

Abstract: Effective preventative measures for limiting biological invasion require knowledge of species-specific propensity for dispersal to novel habitat, establishment, and impacts on the invaded ecosystem. We review the biology of the western conifer-seed bug (*Leptoglossus occidentalis*, WCSB) and its recent global invasion history, highlighting progress and knowledge gaps on these fronts. Emerging data illustrates that WCSB is a strong natural disperser, can establish in a geographically broad set of habitats, and may have devastating impacts on a variety of forest and agricultural tree host species. Documented detection data also indicate that WCSB may frequently disperse via contamination of shipping conveyances or their cargo. However, more data are needed to determine key factors mediating this latter dispersal mode.

3.3 Impacts of spotted lanternfly on the wood products industry Hoover

Author: Kelli Hoover



Presenter Bio: Dr. Kelli Hoover is a professor of Forest Entomology at Penn State University. She has been a member of IFQRG for many years. For years she has collaborated with Ron Mack of USDA APHIS and Dr. John Janowiak at Penn State on microwave and radio frequency treatment of wood packaging materials; she worked with the UK on preparing the submission of Dielectric Heating (DH) as an alternative treatment for phytosanitation of WPM in compliance with ISPM-15. For the past 3 years, she has been studying the spotted lanternfly, an invasive species that arrived in the U.S. in 2014.

Abstract: Spotted lanternfly (SLF) is a serious phloem feeding planthopper that was introduced into the U.S. from China about 6 years ago and is having a major impact on the forest products industry. It has spread rapidly from 1 to 26 Pennsylvania counties in 5 years. Several other states in the Northeast and Mid-Atlantic region also have established quarantines, most recently in Staten Island, New York. SLF takes advantage of transportation corridors to move greater distances, as has occurred with many other invasive insects. Soft maples, some oaks and black walnut are the major timber species that serve as hosts for SLF. The greatest impact on the timber industry comes from the cost of complying with best management practices.

3.4 Exploring pest mitigation research and education associated with the solid wood packaging supply chain in North America *Greenwood et al.*

Authors: Leigh Greenwood, Meghan Noseworthy, Chris MacQuarrie, David Coyle

Presenter Bio: Leigh Greenwood is the Forest Health Program Director for The Nature Conservancy. Her work focuses on bringing multiple stakeholders together to achieve common goals in Forest Health, including: managing the Don't Move Firewood campaign, convening the Continental Dialogue on Non-native Forest Insects and Diseases, and working to improve the international biosecurity measures in place for solid wood packaging.

Purpose: To identify knowledge gaps, policy needs, management options, and educational opportunities related to pest incidence and pest mitigation in association with the production and utilization of solid wood packaging.

Abstract: The forest- to- recycling production chain for solid wood packaging material is examined with respect to the dynamics of wood-boring and hitchhiker pest incidence via the international supply chain. Each step of the production pathway is detailed and the current systems in place, published research, and regulatory environments are reported. Knowledge gaps and research opportunities are considered for each step and recommendations provided. This project lays out a big picture overview to allow for a full system review of where new or improved pest risk management strategies could be explored.



4.1 New data on the efficacy of the vacuum pressure impregnation with wood preservatives to eliminate pinewood nematode from wood *Fonseca et al.*

Authors: Luís Fonseca, Isabel Abrantes and Paulo Verdasca

Presenter Bio: Luís Fonseca is a PhD researcher at the Center for Functional Ecology, Department of Life Sciences, University of Coimbra, Portugal. He has published several articles in international scientific journals and has been involved in international and national projects focused on the Pine Wilt Disease. He has been actively collaborating with Portuguese industrial companies of wood and bark treatment, Portuguese Authority for Animal and Plant Health, and has participated in national inspections for the detection of the pinewood nematode in pine forests, in collaboration with the National Institute for Nature Conservation and Forests

Purpose: To validate the use of the vacuum pressure impregnation with wood preservatives to eliminate the pinewood nematode from wood, avoiding the subsequent heat treatment.

Abstract: In order to demonstrate the efficacy of the vacuum pressure impregnation (VPI) with wood preservative products for the elimination of the quarantine organism pinewood nematode (PWN), *Bursaphelenchus xylophilus*, from *Pinus pinaster* wood, a multidisciplinary working group was established in Portugal. This working group is composed by the Association of Industries of Wood and Furniture of Portugal (Associação das Indústrias de Madeira e Mobiliário de Portugal - AIMMP); 12 Portuguese Industrial Companies of wood impregnation; Lenhotec, a consulting company in wood technology and Nematology laboratory (NEMATO-lab), at the Coimbra University.

Research activities are being carried out on closed cylinders in industrial treatment autoclave tanks using naturally PWN infected *P. pinaster* trunks with more than 30 cm diameter. Furthermore, VPI treatment is being performed with different wood preservative products and different impregnation pressures. Nematode mortality is being assessed after VPI treatment and after a wood incubation period. New data will be presented and discussed.

4.2 BioSurveillance of Alien Forest Enemies (BioSAFE) - genomics-enhanced detection and surveillance tools *Hamelin et al.*

Authors: Richard Hamelin and Adnan Uzunovic

Presenter Bio: Dr. Richard Hamelin obtained a B. Sc. from McGill University in 1982, a Master's of Pest Management from Simon Fraser University in 1986 and a Ph. D. from the University of Kentucky in 1990. He has 30 years of experience in forest health research and has published over 150 peer-reviewed scientific articles. His work aims at using genomics to better understand forest disease epidemics in the face of climate change and to design detection and monitoring methods to prevent invasions of pests and pathogens that threaten forests. He was president of the Canadian Phytopathological Society and the Quebec Society for Plant Protection and was awarded the Fellowship of the American Phytopathological Society (2020)



International Union of Forest Research Organization Scientific Achievement Award (2014), the Queen Elizabeth II Diamond Jubilee award (2012), Merit Awards from Natural Resources Canada (2008), the Canadian Forest service (2008), the Canadian Food Inspection Agency (2007), and the Quebec Society for Plant Protection (2008) for his pioneering work on the application of genomics in forest protection.

Purpose/ Abstract: A summary of 5-year project BioSAFE that is finishing this year. The project mission was to improve the detection and surveillance of forest invasive species by developing the next generation of genomic bio surveillance tools that will allow rapid and accurate identification of insects and pathogens, determine their origin, provide an assessment of the risk they pose and provide the end users with a decision-support system to guide their management and mitigation actions. They tried to identify markers of Fitness and Outbreak-Related Epidemiological traits as some traits that can be clearly associated with invasiveness and could be useful in predicting some aspects of outbreaks. Virulence and host range in pathogens, and flight capacity and overwintering capacity in insects have been related to global outbreaks or risk of epidemics and are likely to be heritable and, therefore, amenable to genetic and genomic analyses. The project focused on 4 major forest pests ALB (Asian longhorn beetle), AGM (Asian gypsy moth), DED (Dutch elm disease fungi-*Ophiostoma ulmi* and alike, also covering harmless and borderline pathogenic blue stain fungi) and SOD (sudden oak death causing oomycetes like *Phytophthora ramorum* and alike). This will be a great segue for our continuing discussion on the practical use and standardization of emerging molecular tools in regulatory world.

4.3 Can genomics contribute to the efficient management of pathogens in wood products?

Dale et al.

Authors: Angela Dale, Stacey Kus and Adnan Uzunovic, FPIInnovations

Presenter Bio: Angela Dale is a scientist with FPIInnovations for the past 12 years. Her research at FPIInnovations has been in the field of wood protection. She specializes in detection and identification of microorganisms including decay fungi and invasive pathogens in wood using DNA and genomics. She has a PhD from the Forestry program at the University of British Columbia and an MSc and BSc from the Natural Resources & Environmental Studies program at the University of Northern British Columbia.

Purpose: Review the efficacy of different detection methods in wood products

Abstract: Pathogen detection in wood products can pose many problems, for instance materials may not show signs of infection, or signs could resemble abiotic damage. Some pathogens are difficult or impossible to recover from infected material, a problem encountered



for many *Phytophthora* pathogens. Many *Phytophthora* species are invasive and can cause significant damage and financial losses, prompting many countries to impose quarantines or trade restrictions. Accurate detection is important in monitoring and eradication efforts and could potentially be used to alleviate concerns regarding infected wood. This presentation will discuss research and preliminary results on the efficacy of different detection methods for three *Phytophthora* species in a variety of artificially infected wood products ranging from live trees to sawn lumber and will discuss the advantages and limitations of each method as well as interpretation of results in the context of trade regulations.

5.1 Heat Treatment – Determining specific lethal doses for pests of quarantine concern *Noseworthy/ Humble*

Authors: Meghan Noseworthy, Lee Humble CFS, NRCan

Presenter Bio: Meghan Noseworthy is a research manager of the Forest Invasives and Phytosanitary group with the Canadian Forest Service – Natural Resources Canada. She manages a team of forest entomologists and mycologists and conducts research on scientific solutions to phytosanitary issues associated with the trade of wood products to protect global forest resources.

Purpose: To determine the lethal dose required to devitalize forest product pests.

Abstract: There is broad international acceptance of heat treatment protocols for reducing pest risk associated with a variety of commodities, however there is a surprising lack of data that define the precise temperature schedules that result in insect mortality. Quantification of species-specific lethal time-temperature regimes will provide the data required to define treatment schedules for a range of pests associated with wood products. Preliminary results of test subjects treated using a programmable hot water bath and platinum resistance thermometers with an accuracy of $\pm 0.03^\circ\text{C}$ will be presented.

5.2 Balancing the impact of phytosanitary protection measures under ISPM15 and carbon emissions *Evans/ Freijo et al.*

Authors: Hugh Evans, Juan Jose Freijo, Edmundo Sousa and Paulo Verdasca

Presenter Bios: **Dr. Juan José Freijo** is the Global Head of Sustainability and EMEA Government Affairs at Brambles. He has worldwide responsibility for the definition and implementation of the company's sustainability strategy, based on its circular business model of continuously sharing and reusing assets. He also leads a global team focused on programs to reduce Brambles' environmental impact, improve communities and develop sustainable solutions for



supply chains. He holds a Master's degree in Environmental Engineering and Management, and a PhD in Physics.

Dr. Hugh Evans: Although now retired from full-time work, Professor Hugh Evans continues to work on aspects of research into the health of trees, with particular emphasis on national and international phytosanitary and biosecurity issues. He also works on the integrated management of tree pests, especially using biological control agents. He provides expert consultancy on a range of issues, especially international biosecurity risk assessment and management. He has BSc in zoology from Cardiff University and DPhil in insect predatory behaviour from Oxford University.

He coordinated the European Union research projects REPHRAME – Research Extending Plant Health Risk And Management Evaluation which dealt with the threats posed to Europe by pine wood nematode, *Bursaphelenchus xylophilus*. It involved 11 partners in 8 countries (Austria, China, France, Germany, Norway, Portugal (2), Spain (2) and UK (2)). Full details and reports can be found on the project website – www.rephrame.eu.

Professor Evans retains a particular interest in the interactions of pine wood nematode, *Bursaphelenchus xylophilus* and its cerambycids beetle vectors in the genus *Monochamus*. Research developed in the EU REPHRAME project continues with current collaboration with INIAV in Portugal (Dr. Edmundo Sousa). He also provides consultancy services and assisted the Phytosanitary Directorate in Montenegro to develop a pine wood nematode contingency plan.

Currently, he is science coordinator of a EU Euphresco Project entitled Risk-based strategies to prepare for and manage invasive tree borers – PREPSYS (Pest Risk Evaluation and Pest management SYStems; www.forestry.gov.uk/fr/prepsys). This includes partners from UK (coordinator), Austria, Ireland, The Netherlands and USA.

Purpose: Review the implementation of ISPM15 within the increasingly challenging context of climate change and the need to take action to mitigate carbon emissions.

Abstract: The presentation will review the state-of-the-art scientific knowledge on the transmission of insect and nematode pests in thermally treated timber in compliance with ISPM15. The existing operational models of reusable pallet systems will be also explored. Finally, a critical analysis of the current compliance process will be presented, highlighting the unnecessary carbon emissions associated with it, with the intention to make a positive impact in reducing the effects on climate change.

5.3 International border interceptions of insects *Turner*

Author: Rebecca Turner



Author Bio: Dr. Rebecca Turner is a mathematical biologist and biosecurity scientist at Scion, New Zealand Forest Research Institute. She completed her PhD on mathematical modelling of long distance animal navigation in 2018 at the University of Auckland, NZ. Then, over the past two years she has collected and analysed border interception data as part of a Postdoctoral fellowship with Scion, New Zealand's Biological Heritage National Science Challenge and Te Pūnaha Matatini (the Aotearoa New Zealand Centre of Research Excellence for Complex Systems), and in collaboration with a Global Insect Invasions working group hosted by the National Socio-Environmental Synthesis Center, US. Rebecca is interested in the use of mathematics to understand biological systems.

Abstract: Border biosecurity agencies inspect imports and passenger baggage to prevent and monitor the risk of the introduction and establishment of non-native species that may have detrimental impacts. However, the high volume of arriving goods and passengers means that it is not practical to screen everything, so interceptions from the border inspections represent only a small sample of all arriving insects. We have gathered interception data from nine countries/regions around the world (New Zealand, Australia, South Korea, Japan, Hawaii, mainland USA, Canada, UK, and the European and Mediterranean region), to examine if an integrated dataset might be useful for understanding global insect invasions. The combined international dataset has 1,899,573 insect interception events, of 8716 species. Here we will focus on the taxonomic groups containing forestry pests. We expect genuine differences in the composition of insects arriving in each country due to differences in the composition of the commodities and origins of the imports and people arriving into a country, as well as differences in phytosanitary requirements. However, we also expect a degree of similarity given the global nature of trade and travel, which we do see as species interception frequencies are positively correlated between regions. On the other hand, interception data is also influenced by the inspection methodology, leading to additional differences between regions and taxonomic groups.

5.4 Industry Science Questions for ISPM 15 *Global Wood Packaging Forum*

Author: Global Wood Packaging Forum

Author Bio: The Global Wood Packaging Forum is a collaboration of associated wood packaging organizations and representatives that meets to discuss global issues that affect the industry. It was formed to serve as a forum of global dialogue among national and regional industry associations and their leadership to cooperate in the development of common positions on issues of mutual interest; represent the wooden packaging and container industry with global policy organizations; and coordinate action and distribute information through member associations.

Questions:



The global wood packaging industry fully supports the ISPM 15 program and views that it has successfully mitigated the spread of invasive pests in wood packaging. Mitigation is a relative benchmark, and the system can be continuously improved to further facilitate safe trade.

The following list of topics summarize several science questions related to ISPM 15 from the global industry perspective that may provide an opportunity to improve compliance and further reduce the risk of spreading pests.

Clarifying and Prioritizing Research Projects by Type of Wood Packaging

Solid wood packaging includes various types of transport packaging, including but not limited to pallets, boxes and crates, and dunnage. Feedback from some NPPOs indicates that certain types of WPM are of greater concern of ISPM non-compliance than others, but data is scarce in this regard. Enhanced reporting on non-compliance that identifies the specific WPM in question could lead to research that better identifies the risk profile by each type of WPM (dunnage, pallets, crates). Industry is seeking input on the feasibility of distinguishing between types of WPM, and how to advance research on this topic with NPPOs and the IPPC. Assistance with any data collection and analysis would be readily welcomed.

Understanding Establishment vs Interdiction Thresholds

Among the public, and particularly with individuals or groups who oppose the use of wood packaging in international trade, there exists a belief that every interdiction at ports of entry equates to a significant potential for pest establishment. Industry is seeking clarity to understand what factors help identify the risk of pest establishment.

Harmonization of Repair Regulations

ISPM 15 provides the latitude for NPPOs to enforce aspects of the standard differently. As the program has matured, a disparity in the enforcement of ISPM 15 regulations has developed, which is to be expected based on the structure of ISPM 15.

Industry believes that more clarity related to repair regulations would lead to enhanced ISPM 15 compliance. Some industry partners have made previous requests to explore harmonization to NPPOs as well as IPPC with little success. With the growing establishment of ISPM 15 and corresponding knowledgebase of NPPOs, it is believed there is new opportunity to propose a more harmonized approach. Industry is seeking guidance from IFQRG to ensure that any future approach is based in science.

Future IFQRG/Global Industry Cooperation

The global wood packaging industry remains dedicated to ongoing collaboration to strengthen ISPM 15. With the creation and advancement of the Global Wood Packaging Forum, industry now has a forum through which a more cohesive global perspective can be developed and communicated.



Industry considers IFQRG to be a highly valued setting to interact with experts on scientific issues and would welcome the opportunity to expand this engagement with IFQRG. If feasible, what would that entail?

6. Review of IFQRG-17 report

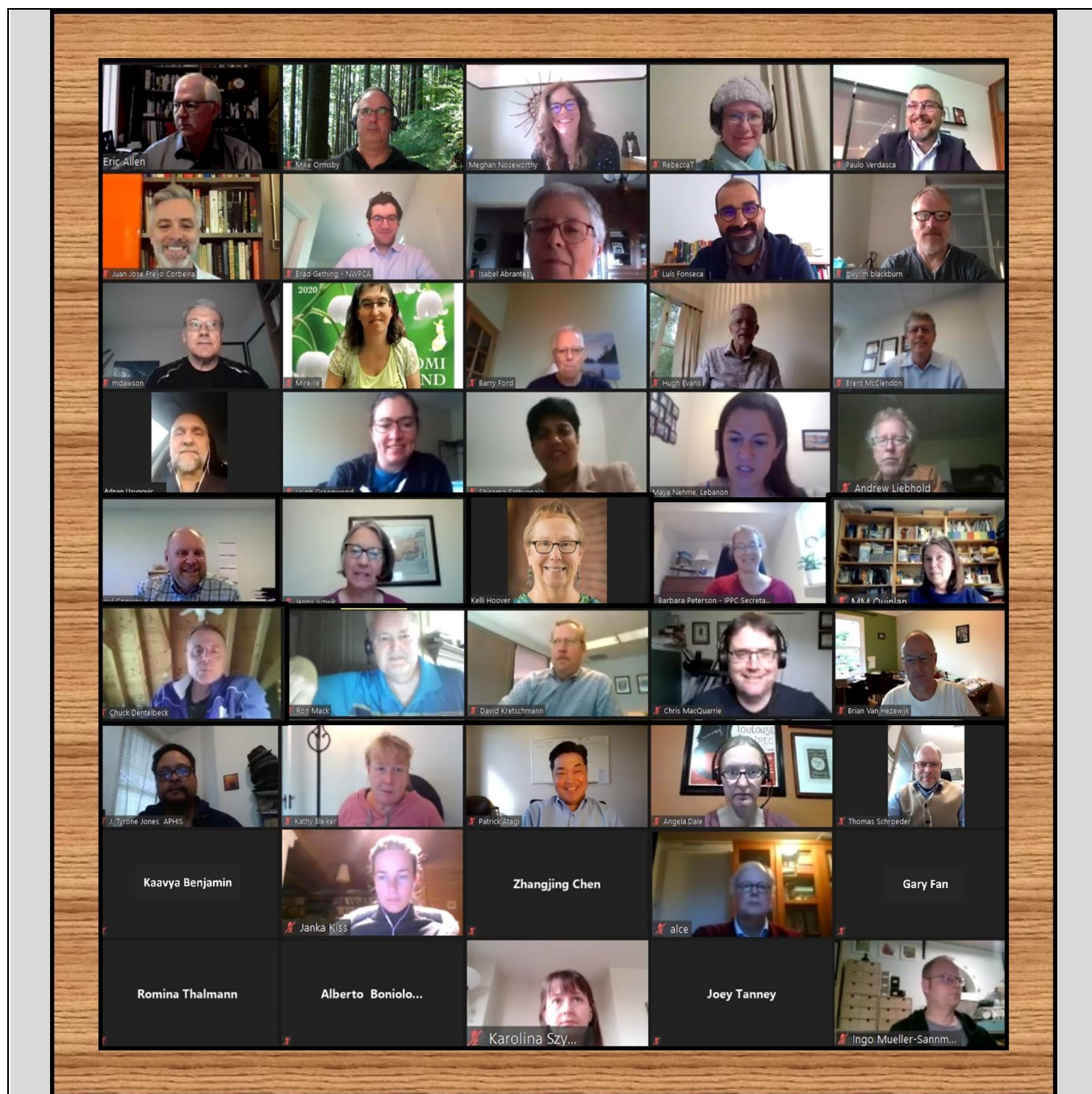
The meeting report was reviewed by the SSC before adoption.

7. Close of Meeting

The Chair thanked the participants for their commitment and participation and encouraged them to participate in other IYPH activities.



Appendix 1: List of Participants at IFQRG 17



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