International Forest Quarantine Research Group 14
October 2-6, 2017, Rotorua, New Zealand
Meeting Report

1. Welcome Address

Mr Hammond introduced himself as the chair of STIMBR, an industry organisation set up to work on reducing the use of Methyl Bromide for forest quarantine purposes in New Zealand. The organisation is doing the work to protect environment when managing phytosanitary risks to forestry from trade. He also introduced the organisation hosting IFQRG 14, SCION, which is New Zealand's leading forestry science provider. The city of Rotorua lies in the centre of New Zealand's forestry, close to the largest timber sawmill in the southern hemisphere. The forest industry is New Zealand's third biggest export earner. Rotorua is also tourist centre with hot pools and geothermal activity that participants are encourage to visit. For New Zealand, 90% of log exports go to China, India, Japan, and Korea. Trade is very important to the New Zealand economy – a trading nation. Phytosanitary rules are important to protect trade, the environment and production. Welcome to Rotorua, New Zealand. Enjoy your visit.

2. Opening of the meeting

The IFQRG Chair welcomed the participants to the 14th meeting of IFQRG. IFQRG first met in 2003 in recognition of the need for international experts to meet and discuss forest phytosanitary science and research issues facing international trade. The role of IFQRG is to discuss and undertake or co-ordinate collaborative research and science efforts on international phytosanitary issues e.g. pest issues across continents. A key client for IFQRG is the Commission on Phytosanitary Measures (CPM) of the Food and Agricultural Organisation (FAO) in Rome, which oversees the International Plant Protection Convention (IPPC). Under the CPM work programme, there are a number of Expert Working Groups (EWG). IFQRG has a particular relationship with Technical Panel for Forest Quarantine (TPFQ).

IFQRG has achieved much over last 14 years. IFQRG has provide science support for the development of key International Standards for Phytosanitary Measures (ISPM) such as ISPM 15 (Wood packaging material) and ISPM 39 (Wood). In particular issues related to the tolerance of bark on wood, and the treatment criteria for ISPM 15, have been particularly difficult problems that IFQRG has provided valuable science input.

The CPM now has 183 member countries, up from around 120 some 14 years ago. CPM relies on subsidiary bodies to develop ISPMs, most significantly the Standards Committee (SC), which establishes EGWs including Technical Panels (TPs). The overall goal of the IPPC is to prevent plant pests moving in international trade. ISPM 15 was adopted in 2002 to reduce the movement of plant pests on wood packaging material. It was recognised at the time that there were some issues with ISPM 15, so the TPFQ was established to look at those issues.

IFQRG is an independent body who primarily acts as an advisory body to the CPM. It provides science that underpins the technical justification for measures on international trade. IFQRG also helps to foster a culture of intercollegiate cooperation/understanding between regions/countries to help overcome trade issues. Members are encouraged to leave their country positions behind, and talk on science. Local meetings allow for more regional participation, but all are encouraged to attend IFQRG. Membership is open, but is more than just meetings as it includes participation in the programmes between meetings. All meeting participants are encouraged to question and discuss throughout the meeting. Further presentations are welcome if they fit with the discussion.

3. Local information	2017 IFQRG-14-03a
4. Meeting logistics and arrangements	2017 IFQRG-14-03b

5. Introductions

Meeting participants introduced themselves to the group. The Chair noted that there were seven countries participating, with 42 people attending over the 5 days. A good mix of industry, regulatory and research scientists are participating to support the discussions.

6. Review and adoption of agenda — 2017 IFQRG-14-05

6.1 List of Documents — 2017 IFQRG-14-04

The document list will be updated with any further documents presented at the meeting.

6.2 Selection of secretary and rapporteur

Dr Michael Ormsby will act as meeting Secretary, and Dr Jamie Nicholls as meeting Rapporteur.

7. Report of the 2014 IFQRG-12 meeting

7.1 Review of action items — 2017 IFQRG-14-07

The last meeting of IFQRG was in 2014. Action items from that meeting include the following:

- Forestry surveillance and monitoring - The topic was not prioritised by the IPPC. Work may be done as annexes to current ISPM on surveillance (ISPM 6 *Guidelines for surveillance*).
- EPPO non-manufactured wood standard – the standard was developed by consultants to EPPO.
- Contaminant pests on ISPM 15 WPM – it is still recognised that many countries have problems. NAPPO looking to develop a support document on contaminant pests.
- Training for treatment applicators – simplified training documents can be submitted to the IPPC implementation group (IFC) to be posted on the phytosanitary resources page. Members are encouraged to send useful training documents through to the IFC if they are available.
- Letter to pallet industry requesting data on pallet storage – USA and Europe provided detailed information. **Action A1:** Report on pallet storage data provided will be posted on IFQRG website (Mike Ormsby).
- Infestation rates for key pests – this issue was progressed by IFQRG members through other means.

7.2 IFQRG terms of reference — 2017 IFQRG-14-08, 2017 IFQRG-14-31

A terms of reference (ToR) was prepared by the IFQRG Scientific Steering Committee (SSC) at a meeting in Victoria, Canada in June 2016. The committee noted that IFQRG members are varied (e.g. industry, regulators, researchers) but the group focuses on science. More than 172 different people have attended IFQRG meetings over the years, however only 12% (21) attended more than 5 times, and now 50% have retired. The SSC holds the core memory of IFQRG. A ToR allows IFQRG to define its role enabling the CPM to understand the purpose of the group. A ToR may help IFQRG continue and grow even as key members continue to retire.

IFQRG 14 participants considered it would also be valuable to have an IFQRG strategy document to go along with the ToR. List of issues that IFQRG has prioritised/identified as in need of resource/focus internationally. Perhaps ask representatives from regions to put forward issues for consideration into a strategy. Ideas have come from top down (e.g. the SC and standards development e.g. TPFQ) and bottom up from researchers (e.g. fungi and role in international standards).

IFQRG has no decision making power under the IPPC. However IFQRG does not just do work for the IPPC, it works independently. IFQRG can connect expertise to help ensure research effort is used to best effect by ensuring research design is appropriate to solving the problem or overcoming the requirements. The participants recognised the need to work better between meetings, and to look at wider membership so that there are representatives from whole world (all regions).

The ToR will be finalised for 2017 by membership after comments from the IFQRG 14 meeting.

Action A2: Establish working group with regional representation to draft an IFQRG Strategy document. Undertake a survey of wider IFQRG and (perhaps) NPPOs/RPPOs for input into the strategy. Steve Pawson to lead and co-ordinate. Team includes Adnan Uzunovic and Ron Mack.

Action A3: Establish process for regular intersessional updates on IFQRG actions (Mike Ormsby, Brent Larson).

Action A4: Finalise ToR and circulated to membership for approval (Eric Allen).

8. Update of other bodies

8.1 Overview of the IPPC standard setting process and where researches can have input

2017 IFQRG-14-30

The IPPC Standards Officer provided an overview of the IPPC standard setting process and structure. Currently there are 41 ISPMs, 24 Diagnostic protocols (DPs), and 31 Phytosanitary Treatments (PTs). There are also 69 topics on work programme. The IPPC is the recognised standard setting body for phytosanitary measures under the World Trade Organisation (WTO) Sanitary and Phytosanitary Agreement (SPS).

8.2 Update from the IPPC Secretariat

2017 IFQRG-14-09

The IPPC Standards Officer provided an update on the activities of the IPPC Secretariat. There is now a new standard setting procedure which allows the Secretariat to go straight to scientists to resolve scientific issues raised in comments on draft ISPMs.

Only contracting parties or RPPOs can submit topics except for phytosanitary treatment development which is a little different, in that submissions (via the ISPM 28 process) can occur at any time and get added to the work programme (if appropriate) after review by the Technical Panel for Phytosanitary Treatments (TPPT). There is now only one consultation period per year (of 90 days) not two. There is also more onus on objectors to resolve the issues they have raised.

Current topics on the work programmed that are relevant to IFQRG include:

- the revision of Dielectric Heating treatment annex under ISPM 15;
- the revision of ISPM 12 *Phytosanitary certificates*;
- a new topic on Systems Approaches for Wood Products.

Recently approved IPSMs include ISPM 38 *International movement of seeds*, ISPM 39 *International movement of wood*, ISPM 40 *International movement of growing media in association with plants for planting*, and ISPM 41 *International movement of used vehicles, machinery and equipment*. There are also two new phytosanitary treatments (PTs) approved under ISPM 28 – *Sulphuryl fluoride fumigation treatment for insects in debarked wood* (PT 22) and *Sulphuryl fluoride fumigation treatment for insects and nematodes in debarked wood* (PT 23). New diagnostic protocols (DPs) have been approved for *Bursaphelenchus xylophilus* (Pine Wood Nematode) (DP 10), *Phytophthora ramourm* (Sudden Oak Death) (DP 23), *Dendroctonus ponderosae* (Mountain pine beetle) (DP 20), and *Fusarium circinatum* (pitch canker) (DP 22).

Participants had a brief discussion on now to improve visibility of the ISPM development programme so the scientific community could contribute to the development of standards. The IPPC Secretariat makes efforts to contact experts for diagnostic protocols, and contact points are notified of consultation. The most important time for contribution from experts is during the consultation period, which always starts on 1 July.

Action A5: IFQRG members are encouraged to check the IPPC web page (IPP) (www.ippc.int) for information on what is available for input and provide comments via their IPPC official contact point.

Action A6: IFQRG members are encouraged to suggest new topics for ISPMs (including DPs) to their IPPC official contact point in response to the biannual call for topics.

8.3 Update from TPFQ 2017 IFQRG-14-10

The TPFQ was formed in 2005 with the Chair of IFQRG as a member (membership list https://www.ippc.int/en/publications/1191/). The panel last met in Victoria, Canada in June 2016 and worked on a number of issues including:

- New treatments for ISPM 15 (DH and SF)
- The ISPM 15 annex on treatment criteria
- The draft ISPM for the international movement of wooden handicrafts
- The draft ISPM for the international movement of wood (which the panel started drafting in 2006)
- The draft ISPM on the international movement of seed
- The explanatory document for ISPM 15, which is now available in French, Spanish and English.
- The IRSS survey on implementation of ISPM 15
- An issue related to wood moisture content and Methyl Bromide (MBr) penetration

The future work plan of TPFQ includes continued work on the ISPM 15 treatment criteria.

8.4. Update from TPPT 2017 IFQRG-14-11

The TPPT meets annually face-to-face and 5 or 6 times virtually per year (Membership list https://www.ippc.int/en/publications/81655/). A call for treatments went out in February this year, with 25 treatments submitted. The following items from the TPPT work programme are relevant to IFQRG:

- Two treatments for wood products using Sulphuryl fluoride (SF), on for insects and one for insect and nematodes, were approved at CPM 12 (2017). The insect and nematode treatment is has just completed its final round of consultation for inclusion into ISPM 15.
- The wood treatment using dielectric heating (DH) under ISPM 28 received an objection at CPM 12 (2017). This treatment will not proceed through ISPM 28 and then ISPM 15 until the technical objection has been resolved.
- Four wood treatments were submitted in the call for treatments issued earlier this year. One heat treatment for wood chips using 56°C for 30 minutes, and five fumigations for wood, one using Ethanedinitrile (EDN), three using hydrogen cyanide, and one SF treatment for bamboo borer on bamboo articles.
- TPPT is developing five ISPMs to support the application of treatments – Temperature, fumigation, modified atmospheres, chemical, and a review of ISPM 18 *Guidelines for the use of irradiation as a phytosanitary measure*. The temperature treatment draft ISPM has just completed its second round of country consultation, while the fumigation draft ISPM has just completed its first.
- The IPPC Secretariat has developed a database for treatments that is now available on the IPP (https://www.ippc.int/en/core-activities/standards-setting/technical-panels/technical-panel-phytosanitary-treatments/phytosanitary-treatments-tool/).

Meeting participants were reminded that treatments approved in ISPM 28 can be used in bilateral trade while treatments in ISPM 15 are for multilateral trade (wood packaging material to all countries). Treatments for ISPM 15 must now first be approved under ISPM 28.

The SF treatments now approved under ISPM 28 took 12 years to move through the development and approval process. The SF treatments tested the willingness of countries to accept incomplete information for generic treatments. The approval of SF provides a degree of confidence that new generic treatments can be developed for wood products. There were three limitations placed on the SF treatments - depth of penetration, moisture content and temperature.

Existing treatments such as Methyl bromide have a long history of successful use. This not only provides good evidence of efficacy on many pest species, it also provides countries with confidence that the

treatment works even if the science is lacking. New treatments need more data compared to existing treatments, to provide the assurance otherwise lacking from experience. Generally countries want to see evidence that the treatment will be efficacious against the important pests' e.g. Asian gypsy moth (AGM), Pine wood nematode (PWN) etc.

An issue raised by TPPT for IFQRG consideration was that of the heat treatment of 56°C for 30 minutes submitted for use on wood chips is approved under ISPM 15 but not under ISPM 28. TPPT considers the information supplied in the submission but also looks at other information to support the country submission. TPPT has requested from IFQRG the efficacy data that was used to approve this treatment for ISPM 15. Participants discussed whether existing data on 56°C for 30 minutes would be sufficient for ISPM 28. New research may be required to improve data quality. It was noted that the under ISPM 39 the list of pests of concern on wood chips was small.

Action A7: Develop a document for TPPT on scientific evidence supporting the efficacy of 56°C for 30 minutes on pests potentially associated with wood chips (Adnan Uzunovic, Mike Ormsby, Eric Allen, Thomas Schröder, Jamie Nicholls). April 2018 deadline.

8.5 Update from FAO Forestry

2017 IFQRG-14-28
2017 IFQRG-14-29

Keeping forests healthy. Field programs in range of countries around the world, technical support and capacity building, including: Turkey wasp program, oak decline in Iran, box moth in Georgia etc.

Training programs: *Guide to implementation of phytosanitary standards in forestry* (http://www.fao.org/3/a-i2080e.pdf) provides a condense understanding over all forest standards.

Facilitates meetings: Practical guide for classical biocontrol of insects pests in forestry

9. Highlights of other meetings

9.1. NAPPO COSAVE ISPM 15 workshop

2017 IFQRG-14-13

The North American Plant Protection Organisation (NAPPO) organised a workshop on the implementation of ISPM 15 in Costa Rica in 2016. The main aim of the meeting was to share experiences regarding implementation ISPM 15 to adopt best practices to increase compliance and minimise pest risks associated with WPM. NAPPO standard development process looks at implementation at the same time as standard development. For some countries in the region, kilns are not feasible, so alternatives looked at such as solar kilns. Some countries had good implementation systems, some countries had virtually no system. Phytosanitary awareness was low in some countries. Many issues to work through both on resources and technical capability. Specific issues identified included:

- Post-treatment contamination (non-target pest contamination)
- Revision of ISPM 15 to include components on moisture content and an expiry date.

Participants considered a revision was unnecessary for these reasons, as ISPM 15 manages tree diseases that, once treated, are removed. It is proposed that guidance material be developed by NAPPO on the issue of post-treatment contamination of WPM.

9.2. Nairobi 2017-07 STDF workshop on ISPM 15 - Video from STDF project on four African Countries and the implementation of ISPM 15

Report
Video

Four countries took part in this **Standards and Trade Development Facility** (STDF) funded project (Botswana, Cameroon, Kenya and Mozambique, carried out by Dr Luca Tasciotti, School of Oriental and African Studies, and Dr Elissaios Papyyrakis, Institute of Social Studies). Overall the findings of the project were that there was no detrimental impact from implementing ISPM 15 however most countries do not have adequate systems to adequately manage implementation. It was noted that many of these countries have particular challenges with implementation, for instance:

- Some big manufacturing companies do not have a re-use policy of pallets, only use new pallets.

- Many much smaller companies recycle pallets for the smaller traders, in low technology single person operations which are very difficult to regulate.
- Some countries included the standard in legal Acts of Parliament, which effects the speed of revisions to their regulatory tools to keep pace with ISPM revisions, as change to Act is slow.

Action A8: If IFQRG members are aware of good policies for managing the implementation of ISPM 15, then please submit to the IFC for consideration for posting so others know how it is done elsewhere in the world.

11.2 ISPM 15 science questions from Nairobi 2017-07 workshop 2017 IFQRG-14-14

Issue 1: Some facilities treating WPM believe that the HT and MB treatment are only effective for three months and after this period, the policy of the treating facility is to have the WPM treated again if that WPM has not been used for export. The NPPOs share this idea. Could we get some scientific evidence or a statement from IFQRG to indicate this is not technically justified?

The ISPM 15 mark on wood packaging material provides assurance that ISPM 15 has been followed. The measures in ISPM 15 when applied correctly lower significantly the phytosanitary risk of the wood packaging to importing countries, particularly in relation to pests of living trees. This assurance is valid for the service life of the wood packaging material unit and no retreatment is necessary.

Issue 2: Wood that is dry for 6 months is no longer a risk (of green tree diseases).

IFQRG participants discussed this issue and agreed that there is already good published evidence of pest survival beyond 6 months in drying wood. Therefore air drying wood packaging is not a valid option. No further research will be pursued on this topic.

Issue 3: Can IFQRG provide guidance for heating from solar. Participants looked at work in Australia using solar panels (rather than heat absorbing structures). IFQRG members were not aware of any functioning solar kilns for WPM.

Action A9: Report on developments in the feasibility of solar kilns and report to the IFQRG Chair (Jamie Nicholls)

Action A10: Report IFQRG responses to Nairobi ISPM 15 Workshop questions to the researchers of the STDF study (Eric Allen)

10. Current phytosanitary issues

10.1. Regional Plant Protection Organizations (APPPC, COSAVE, EPPO, NAPPO, etc) 2017 IFQRG-14-32

Standards approved by EPPO Council 2016:

- PM 3: consignment inspection and inspection place of production for *Xylella fastidiosa*
- PM 5 (PRA): Guidelines on the measure “plants grown under complete physical protection”
- PM 7 (DP): DNA-barcoding as identification tool for selected regulated pests (ALB, CLB, forest fungi) and guideline on the authorization of laboratories to perform diagnostic activities for regulated pests
- PM 9 (NRCS): *Popillia japonica* (Japanese beetle) procedures for official control (hosts: *Acer*, *Corylus*, *Malus*, *Prunus*, *Salix*, *Tilia*…).

A number of PRAs on wood pests have also been completed.

NAPPO workshop on Risk Based Sampling (RBS) in Baltimore, Maryland, USA (June 2017) (http://nappo.org/english/rbs-symposium-2017-report/): The advantage of using RBS is the consistent infestation threshold and confidence level, and the reduction in resources required to implement the system. Allows interception data to be analysed more easily due to these consistencies. Hypergeometric probability distribution, varies with lot size- provides a consistent level of sampling so technically defensible and practical. Some issues when destructive sampling on small lots (such as seeds), as the whole lot should be sampled (and destroyed). New Zealand is working with Australia to resolve this issue.

If pathway is clean, can consider compliance based sampling and reduce number of lots sampled or target sampling to non-compliant commodity types or pathways.

11. Update on the development of standards

11.1. Overview of standards (under development and adopted) that are related to forest quarantine issues

2017 IFQRG-16, 17, 18, 19

ISPM 38 *International movement of seeds*: Potential issues for implementation. Guidance document can be developed when needed. Ned to identify issues that can benefit from guidance.

ISPM 39 *International movement of wood*: Supports systems approaches and includes bark thresholds. Significant to have this recognised in ISPM 39 as bark on wood is still a contentious issue.

Action A11: IFQRG members are encouraged to look at standards and use the expertise of group to identify implementation challenges and possible solutions and submit this to their IPPC contact point for consideration by the IFC.

Specification on the international movement of wood products and handicrafts made from wood (SP57): Considering a redrafting the draft ISPM. The NAPPO standard RSPM 38 for handicrafts could be used as a basis for the re-drafting.

11.3 Criteria for Treatment Development: ISPM 15 treatments

2017 IFQRG-14-22
2017 IFQRG-14-33

Treatment developers will need to:

- Provide confidence that pests risks have been addressed
- Evaluate against requirements outlined in ISPM 28 *Phytosanitary treatments for regulated pests*.
- Anything can be used to support- grey documents, talk to researchers and put in as bucket of evidence as part of homework
- Collaborate to get all pests internationally considered, otherwise is a local treatment
- Consult with specialists (not necessarily a statistician, a person who understands the history of the development of ISPM 15, specialist needs understanding of bigger picture, if a statistician, one who is familiar with non-Probit 9 view of forest insect research)

12. Research reports

12.1 Pest epidemiology

12.1.1 New Invasive Species and Recent Research on Forest Quarantine Pests in the Russian territory

2017 IFQRG-14-38

Overview of current pest issues in Russia. Also a quick summary of issues with WPM.

12.1.3 Wood chips as potential pathway for pinewood nematode *Bursaphelenchus xylophilus* (PWN)

2017 IFQRG-14-25
2017 IFQRG-14-39

Work on board to board transmission of PWN already reported to IFQRG (Portugal). Question is can it get into local hosts (containing local *Monochamus*) via imported chips?

Use heat treatment currently (56/30) for wood chip imports. However changing end use of wood chips in EU.

Conclusions (from Hopf-Biziks A, Schröder T, Schütz S. (2017) Long-term survival and non-vector spread of the pinewood nematode, *Bursaphelenchus xylophilus*, via wood chips. For Path. 47; e12340. https://doi.org/10.1111/efp.12340):

- PWN can survive in woodchips for long time
- PWN transmission to healthy pines with wood chips is possible

- Correlation with temperature
- Correlation with damage on stems/roots
- Distance of wood chips from the tree seems to influence infestation success
- PWN could multiply in woodchips

Participants then discussed the issue. Where heat is generated in piles of bark chips, the heating is not even. Outcome of an assessment on wood chip pile heating was that the bark chips needed to be heat treated on a conveyor belt. Systems approach (end use controls before processing) could be used to manage the risk.

12.1.4 Interceptions of living insect stages in ISPM 15 heat treated WPM – are 56/30 parameters to be revised?

Pest still being detected on ISPM 15 marked wood moving in international trade. There are claims that 56°C for 30 minutes may not be effective against PWN in wood. There is pressure to move to non-wood or manufactured wood use in packaging material.

IFQRG participants agreed that failure was more likely to be due to fraud or incorrect application of the treatment and non-target pest detections, rather than problems with efficacy of ISPM 15.

Things to do? Check treatment parameters (schedules) to ensure the treatment is delivering the schedule that is effective e.g. 56/30 as a kiln treatment. Support guidance/training on implementation of ISPM 15 including the application of the treatment. Some technologies that can confirm the wood has been heat treated (sufficiently). Fraud detection would reduce failures.

Participants discussed this issue further. Re-infestation is not the primary pests, just dry-wood pests and contaminants etc.

Action A12: IFQRG members are encouraged to improve communication about the availability of the ISPM 15 explanatory document (https://www.ippc.int/en/publications/2506/).

12.1.5 Perceived and real threat of pathogenic fungi in forest commodities, in the context of international trade 2017 IFQRG-14-35

More recent concerns raised about fungi in wood in international trade (traditional concerns with insects/nematodes). Genomic-based detection tools in development for fungi. Phytosanitary measures need to be scientifically based. There are around 99,000 described fungal species, with an estimated 1.5 million worldwide. Over 800 Oomycetes. Need to focus on fungi in wood, not other pathways. While publications can focus on individual species, international standards need higher focus (families/epidemiological groups). Some groups not considered a concern after analysis e.g. blue-stain fungi. Better to focus on characteristics that make individuals better invaders, regardless of groups. Further science is required to better resolve these invasive attributes for the groups of fungi.

Action A13: IFQRG to develop a concept paper to characterise the risk of fungal movement on wood in international trade (Adnan Uzunovic, Johan van der Linde, Jennifer Juzwick, Lindsay Bulman, Nari Williams, Eric Allen, Brenda Noseworthy, others to be contacted).

12.1.5b Bio-surveillance of IAS (BioSAFE project) 2017 IFQRG-14-46

Prior project TAIGA (Tree Aggressors Identification using Genomics Approaches) (http://taigaforesthealth.com/) – 60 assays developed for 40 pathogens (ranked top 50) on multiple hosts.

Action A14: Follow-up with IPPC Secretariat to help communicate to scientists, information on the development programme for ISPMs on Diagnostic Protocols (Adnan Uzunovic).

BioSAFE (https://www.genomecanada.ca/en/biosurveillance-alien-forest-enemies-biosafe) project purpose is to develop rapid and accurate monitoring and diagnostic tools to detect fungal pests at different life stages, identifying the source and pathway of fungal entry, and assessing the likelihood of establishment. The project is focusing on four pest systems: *Anoplophora glabripennis* (Asian Longhorn Beetle - ALB),

Ophiostoma novo-ulmi (Dutch elm disease), *Lymantria dispar* (Asian gypsy moth - AGM), and *Phytophthora ramorum* (Sudden oak death - SOD).

12.1.6 Analysis of wood pellets for fungi and PWN 2017 IFQRG-14-37

First approach was to sample wood that was infested, turn into pallets, and then test for survival. However a small plant to run test could not be found. Instead obtained pallets and pre-curser material and tested both for PWN and fungi. Pallets receive 150°C for a short time during manufacture. Plates for fungi found moulds etc. but no pathogens. PWN (using RNA test for viability) was not found in any pallets (or pre-cursor material), though PWN DNA was found in pre-cursor material.

12.1.7 Insect escape through shipping container vents

Containers have vents for equalising pressure. Nine 1 cm holes in these vents on the inside. As it is dark inside the containers, phototactic insects would be attracted to any light sources. Set up trial with bolts of wood in sealed chambers in containers, naturally collected organisms. Results found that many agriculture, horticultural, forestry, and stored product pests could emerge, see the light and have no trouble escaping from a container. Risk is present along the entire transport chain.

12.2 Pest detection

12.2.1 Identification of host wood and wood boring beetles intercepted at US ports in SWPM 2017 IFQRG-14-23, 2017 IFQRG-14-24, 2017 IFQRG-14-34

Great data set of all of the marked ISPM 15 records collected by various parts of the organisation from 2012 to 2017 (e.g. Otis, USDA, Homeland Security). Identification was by rearing to adult stage to diagnose by morphology, as well as DNA barcoding. Photos of larvae and adults were taken to create a diagnostic key. Host wood was also identified.

Three groups of pests were detected the most frequently: Cerambycids (1050), Buprestids (189), and Siricids (40). Eleven US ports participated. Any larvae that died during rearing were identified using DNA. Interceptions were analysed by origin, with China and Mexico accounting for ~50% of records which reflects US trade patterns. Turkey at 12% was higher than expected. Would be useful to weight interception number against trade volume (WPM volume) to compare infestation rates. Wood packaging associated with stone products accounted for the highest numbers. Alternative destruction methods of wood packaging material was also investigated, with a hammermill developed to turn WPM into dust which can be pelletized.

Participants noted that other destruction methods included deep burial of infested WPM, but did a study and collected the most amazing exotic collection of species in trapping studies near these sites.

12.3 Phytosanitary policy and regulations

12.3.1 Risk-based approaches to phytosanitary treatments for *Pinus radiata* export logs from New Zealand 2017 IFQRG-14-41

Quantify phytosanitary risk of species in New Zealand. Area of Low Pest Prevalence (ALPP) may be possible for some species. Carried our surveys across New Zealand for 3.5 years to establish pest prevalence. Only six species found in any significant numbers (*Hylurgus ligniperda*, *Hylastes ater*, *Arhopalus ferus*, *Prionoplus reticularis*, *Pachycotes peregrinus*, and *Sirex noctilio*). First change based on study was to move 36 hour post-fumigation window over winter to a 7-day (Northland) and 21 day (rest of country) window to reflect low beetle activity.

Adult presence + flight conditions + insect abundance = active insect presence = risk of insect presence in logs.

- Use of dead-wood abundance as an indicator (surrogate) for potential insect abundance.
- Modelling beetle distribution (flight distances etc.) to predict beetle pressure on sites.

- Last step is to link beetle presence (in field) to likely log infestation levels.

12.3.2 Calculating levels of protection for pathway risk management

2017 IFQRG-14-15
2017 IFQRG-14-42

Research completed to develop models for estimating efficacy levels required for measures on pathways of entry. STDF funded Beyond Compliance research program developed Control Point Bayesian Networks for measuring the effectiveness of systems approaches (Quinlin *et al*. 2016). Technique that uses data and expert judgements.

Action A15: IFQRG members are willing to help out with Bayesian modelling if needed.

12.3.2 NAPPO Systems Approach in Forestry

2017 IFQRG-14-20
2017 IFQRG-14-21
2017 IFQRG-14-43

A NAPPO RSPM 41 on systems approaches in forestry has completed consultation and expected to be adopted in October. Increasing interest in reducing the reliance on end point (single) treatments. Improves overall pest mitigation through system, cost efficacy improves (potentially), builds into production system.

An example provided was *Agrilus planipennis* (Emerald Ash Borer - EAB) in ash flooring (timber) for export from Canada to the EU. System includes de-barking, milling (sawing, plaining), and heat treatment (kiln drying).

Explanatory document provides background and supporting information, and detail on options and procedures e.g. options and verification methods for silviculture, pest free areas (PFA), pest free places of production (PFPP), resistant gene-stock, log removal after harvest, grading, post-harvest protection, anti-aggregation pheromones, inventory control, bark removal, branch removal, HT/KD etc.

Explanatory document for RSPM 41 is in drafting and will likely be sent to IFQRG members for comment/review. IFQRG can help by recommending other pest risk reduction options that can be included in a systems approach, and share knowledge of wood product systems approaches and unique wood product certification systems.

12.3.3 Conceptual framework for low pest prevalence

2017 IFQRG-14-40

New Zealand is free of most of the forestry pests found around the world. New Zealand has been physically isolated for most of its history (80 million years) and has a relatively young planted (exotics) forest industry (~100 years). New Zealand is looking to enhance trade (improve movement of wood products, market access) without increasing movement of invasive alien species (IAS). Need more tools in the tool box. One approach being developed is a systems approach, using ALPP, stand density, management, absence of symptoms, grading, maturity, harvest time out of forest, inspection.

The main driver for New Zealand is the need action on replacements for Methyl Bromide (MBr).

12.3.4 Trade-related pest introductions

2017 IFQRG-14-36

Purpose of work was to identify main pathways of pest introductions, rates of novel pest arrivals, early detection strategies, success metric, link between risk perception vs survey strategy. The output would be a generic model and set of guidelines for different pests/regions to estimate pest establishment risk and an early detection systems/strategies to detect pests before the control becomes too costly/unfeasible. Decision makers are concerned about minimising maximum damage and/or maximum time to detection. Difference between these two survey types can be significant if decision-maker's level of risk-aversion is high. Early detection is most cost-effective at small budget levels (when risk-neutral survey strategy is considered). As trade-off under risk-averse strategy (between early detection and limiting damage) is significant, budget must be high enough to survey large number of sites (ideally, to survey as many sites as possible at low sampling rates).

Action A16: Please log onto the website of the International Pest Risk Research Group (www.pestrisk.org) and keep track of their work.

12.4 Wood treatments

12.4.1 RF Innovations for Dielectric Heating of Solid Wood Packaging Materials (WPM)

2017 IFQRG-14-53

Research to support the bulk treatment of WPM with dielectric heating (DH). Main species are Ash as cants (90-100% heartwood) of around 4-by-4 inches or 6-by-4 inches. The treatment was of a bulk volume of 7.7 m^3 or 3300 board feet which produces 206 shipping pallets. Wood was stacked 5 pieces across and 14 layers deep in chamber. Radio frequency (RF) system was 6.8 MHz frequency, 120 kW oscillator design system, with a chamber having a 5000 board feet capacity.

Measures of success: short time/efficient use of energy, temperature achieved, moisture content (MC) of wood maintained.

Results: With pressure (10 psi), 20% lower RF power needed to reach target temperature. Pressure prevents water vaporisation that causes cooling. 20% of energy required to counter cooling under normal pressure, not required under pressure.

Under these conditions the run time was about 5 hours, all wood achieved 60°C for 1 minute, and MC% remained above fibre saturation point (FSP), under lower power use.

Modelling allows user to accurately predict the performance of RF under different wood treatment conditions. Further experiments looking at the effect of insulation (wool) on heating with RF. Control was without 100% wool blanket. Four species tested, with improvement in 2 of the 4 species. In all cases the MC was maintained. Bark also acts as an insulator and improves RF performance.

Action A17: IFQRG to develop guidance on the application of Dielectric Heating for Wood and WPM, for submission to the IFC (Kelly Hoover, Adnan Uzunovic, John Janowiak, Mike Ormsby).

12.4.2 Vacuum steam as a targeted phytosanitary treatment for hardwood veneer logs

2017 IFQRG-14-26
2017 IFQRG-14-54

Testing the ability of vacuum steam treatment to achieve target temperatures at targeted depths in the log (where pests are found). Research and development of vacuum steam treatment has been going on since 2011. Tested five species of logs and checked veneer quality, and found that vacuum steam did not affect quality. After treatment, pathogens were not detected in any oak logs. Target temperatures were achieved in the log to the depths required for phytosanitary purposes with negligible end checking observed. This vacuum steam treatment is achieving the target temperatures much more rapidly than conventional heating systems, and achieves phytosanitation more rapidly and reliably than fumigation.

12.4.3 Bark beetle breeding for disinfestation trials

2017 IFQRG-14-47

Purpose of work was to provide a supply of Bark Beetles (*Hylurgus ligniperda*, *Hylastes ater*) for treatment development. Need all life stages, with ages in days (standardised), and quality (viability etc). Need insects from field and biological data such as life cycle, diet, oviposition method etc. Developed colony management system. First attempts using “bark sandwich” but difficult to recover life stages (time consuming, damage). Developed many prototypes but found stripping back phloem into thin layers sandwiched between sheets (e.g. glass) was the best. Phloem falls apart easily so easy to recover many eggs safely. Eggs then transferred to artificial diet. Test tubes allow singles to test diet and view development, but using dishes allows mass rearing (on known effective diet). Having successfully developed eggs to adults, then need to determine how long adults require to mature and lay eggs (depends on species). New diet may be required for adult maturation. Life stage development times need to be known to enable selection of specific life stages for testing.

Problems with fungi, with nutrient mix (quality of ingredients), agar quality, food mites, and handling insects (transfer for fumigation). Freezing bark of storage was best as can thaw in water and use within an hour. Sexing by sound, but normal testing is rough and time consuming, so developed stethoscope method for testing. 170,000 insects have been supplied for trials to date.

12.4.4 Ethanedinitrile including emissions during fumigation and on venting, toxicology, mutagenicity test results 2017 IFQRG-14-52

Ethanedinitrile (EDN) has been found to be an effective commercial soil treatment including against weed seeds. EDN mixes well with water. Higher vapour pressure than MBr (so penetrates better). Lower density in air, therefore circulation better as well as dispersal after treatment. Smaller/lighter molecule helps with penetration. Registered in Australia for wood, currently in process in other countries for wood and soil.

Modelling at higher doses to predict potential maximum use. Modelling to show exposure levels surrounding port during and after fumigation work. Proposing an exclusion area the same as that currently required for MBr in New Zealand (50 metres).

Participants discussed whether resistance expected based on mode of EDN action. No data on this but it is not expected. Further work underway on testing against further pest groups including PWN.

12.4.5 EDN: a new fumigant for export logs 2017 IFQRG-14-50

Research programme: 3 phases using 3 main (most common by numbers) insect pests in New Zealand. High numbers needed before breeding programme developed. In direct exposure experiments, EDN shows high levels of toxicity to all life stages, increasing with temperatures. Eggs most susceptible, larval and pupae most tolerant as per MBr, but at lower concentrations. Sorption measured for different wood characteristics – measured as head-space conc. at 44% loading. Combined LD_{99} with sorption data (CT in head space), to give fumigation rates for surface pests that needs head-space gas to treat. Treating naked insects found very high doses required (for adults), but not replicated when pests in wood. Mode of action of EDN in insect vs wood will need to be explained.

At 10 and 20°C for 24hr treatment in logs, pupae were the most tolerant *Hylurgus* life stage. Same for *Hylastes*.

12.4.6 EDN a potential fumigant for *Pinus radiata* logs 2017 IFQRG-14-49

New Zealand needs a replacement for MBr. MBr is currently used for 20% of New Zealand log exports (Phosphine is used for the majority of the other fumigations). Public perceptions (health) are driving restrictions. Monitors for EDN measure a limited range of concentrations.

A review project screened available fumigants/treatment options as replacements to MBr and EDN looked like the best option (limited known limitations but little science).

Mode of Action: Active (toxic) breakdown product is the cyanide ion. Prevents mitochondria using oxygen. Metabolised and de-toxified in tissues (e.g. liver) as it is found naturally in a normal diet. Inhalation is primary effect. Proposed human exposure threshold limit value (TLV) of 10ppm, and annual tolerable exposure limits (TEL) of 1ppm. Acute inhalation LC_{50} of 136 ppm for 4 hours. An antidote is available.

Field trials: Recorded rates of decay under tarp log fumigation. Only 1% left after 24 hours as predicted from laboratory modelling. Rapid dispersal, no measurable desorption (limits of measurement 1ppm).

Costs of EDN fumigation are likely to be the same as MBr, but need to finish the testing before accurate estimates can be calculated. Product cost is small.

Registration in a number of countries has been applied for, and is currently registered for use in Australia.

12.4.7 Methyl bromide fumigation schedule for export logs 2017 IFQRG-14-48

The purpose of this work was to reduce the required rate of MBr use on logs. Seen as a possible approach to reduce use of MBr in New Zealand. Research plan involved **1:** identifying most tolerant pest/life stage; **2:** testing scenarios for application; and **3:** operational trials.

Tested many factors so needed many insects. Looked at doses, exposure times, mortality tested in a number of ways over different times, life stages etc.

Pupae (or larvae) were the most tolerant. Using longest post-treatment mortality test (96 hours), *Hylurgus* pupae was the clearly most tolerant life stage/species. Now modelling MBr fumigation under different conditions including temperature and duration. Regression analysis of data to LD_{99} for comparison. Toxicity

varies with time and temperature (not just temperature). Developing equations to calculate (predict) CT values for untested temperatures/times. For MBr, higher rates of sorption not good as it removes gas from insects. Found that testing in larger chambers required higher doses, probably due to higher sorption rates. Next phase is to test *Hylastes* under same conditions, which should be completed in September 2018.

12.4.8 MB destruction developments 2017 IFQRG-14-44

New Zealand must export logs (not the capacity to saw them all domestically). One tuck-load of logs fumigated every 46 seconds. In hold logs fumigated by Phosphine, top-stow logs fumigated with MBr (currently). All MBr used under tarps therefore head space is released to the air. Recapture required across New Zealand by 2020 for human health reasons (primarily). All other recapture technologies (worldwide) not feasible (too long/expensive etc.). Tested existing technology and developed a fusion of technology to meet operational requirements.

As you remove MBr from atmosphere, logs desorb as concentration drops below equilibrium. So can remove atmospheric concentration if substrate is not absorbent, but chase the curve if desorption occurring. Recycling is not possible (feasible) at this time, which therefore necessitates disposal of the residue. Recycled MBr needs a separate regulatory approval (limited use to logs (e.g. non-food)). Some issues with desorption after time, and leaking from unit (vacuum). Units now built to handle a ships hold (4000 tonnes), but technology while in use is still under development to optimise efficacy.

12.4.9 Joule heating 2017 IFQRG-14-45

Joule heating is the direct application of an electrical current to wood (logs), with the resistance generating heat. The purpose of the work was to test the ability of joule heating to achieve 56°C for 30 minutes on local New Zealand wood species (*Pinus radiata*). Developed an electro-thermal model to predict heating based on log properties (size, MC, density, across heart and sap wood separately). Deepest pest was 32 mm (paper in press), so temp measured at 32 mm as target. Temperature measured across log found that 56/30 achieved but through heat diffusion (post heating). Cost-effectiveness considered on energy input basis (not operational implementation perspective). Hottest part of log is outside, so cold spot is inner. Now looking to investigate other wood species. Cold zone around some types of knots (e.g. dead knots where the wood has rotted). Once wood above fibre saturation, conductivity not dependent on MC but more affected by temperature. Log drying not a problem unless the MC drops below the fibre saturation point (FSP).

12.4.10 Oak wilt: evaluation of Sulphuryl Fluoride (SF) and Methyl Bromide (MBr)

The driver for this research was the need to do more testing of fumigants (SF/MBr) on fungal pathogens (Oak wilt). Oak wilt initially lives in outer sap ring, but moves through sap wood after tree dies (6-8 months). It produces a sporulation mat (rare in *Ceratocystis*) that is important epidemiologically (vectored by beetles attracted to the mats). Work on SF on oak wilt stopped in late 1990s. The work tested natural and artificial inoculated logs (trees that produced logs). Isolation via plates and drilling with DNA extraction and nested PCR for detection. Sampling not easy (sporadic distribution within tree). Isolation plates worked best. Oak wilt could be isolated from 92% of artificially inoculated trees, 64% from naturally infected trees, therefore artificial inoculation of logs was used.

Results of the trials are still under analysis.

12.4.11 Statistical framework for data analysis methods for quarantine research 2017 IFQRG-14-51

Looking at data from MBr testing as discussed earlier in meeting (12.4.7). Modelling using dose (not concentration over time (C/T)) applying a binomial generalized linear mixed model. Testing link functions, and log transformation of dose. Found logit (link function) was the best fit and did not include controls in the analysis. Control mortality above 20% considered indication of poor insects and excluded from results.

Results: more variation (over time) at 5°C than at higher temperatures (time not such a variable).

13. Review and adoption of IFQRG-12 report

13.1. Research opportunities

Identifying the mode of action of heat treatment on pests (insects and fungi) in wood.

13.1.1 Industry science questions

Feasibility of the use of e-beam irradiation facilities for treating wood products including WPM.

13.2. Work program for 2017-18

	Action Item	Participants (Bold = Lead)
A1	Report on data on wood packaging storage patterns will be posted on IFQRG website	**Mike Ormsby**
A2	Establish working group with regional representation to draft an IFQRG Strategy document. Undertake a survey of wider IFQRG and (perhaps) NPPO/RPPO for input into the strategy.	**Steve Pawson**, Adnan Uzunovic, Ron Mack
A3	Establish process for regular intersessional updates on IFQRG actions	**Brent Larson**, Mike Ormsby
A4	Finalise IFQRG Terms of Reference and post on IFQRG web site (https://www.ippc.int/en/external-cooperation/organizations-page-in-ipp/internationalforestryquarantineresearchgroup/).	**Eric Allen**
A5	IFQRG members are encouraged to check the IPPC web page (IPP) (www.ippc.int) for information on what is available for input and provide comments via their IPPC official contact point.	**All members**
A6	IFQRG members are encouraged to suggest new topics for ISPMs (including DPs) to their IPPC official contact point in response to the biannual call for topics.	**All members**
A7	Develop a document for TPPT on scientific evidence supporting the efficacy of 56°C for 30 minutes on pests potentially associated with wood chips. April 2018 deadline.	**Mike Ormsby**, Adnan Uzunovic, Eric Allen, Thomas Schröder, Jamie Nicholls
A8	If IFQRG members are aware of good policies for managing the implementation of ISPM 15, then please submit to the IFC for consideration for posting so others know how it is done elsewhere in the world.	**All members**
A9	Report on developments in the feasibility of solar kilns and report to the IFQRG Chair	**Jamie Nicholls**
A10	Report IFQRG responses to Nairobi ISPM 15 Workshop questions to the researchers of the STDF study	**Eric Allen**
A11	IFQRG members are encouraged to look at standards and use the expertise of group to identify implementation challenges and possible solutions and submit this to their IPPC contact point for consideration by the IFC.	**All members**
A12	IFQRG members are encouraged to improve communication about the availability of the ISPM 15 explanatory document (https://www.ippc.int/en/publications/2506/).	**All members**

A13	IFQRG to develop a concept paper to characterise the risk of fungal movement on wood in international trade.	**Adnan Uzunovic**, Johan van der Linde, Jennifer Juzwick, Lindsay Bulman, Nari Williams, Eric Allen, Brenda Noseworthy, others to be contacted
A14	Follow-up with IPPC Secretariat to help communicate to scientists, information on the development programme for ISPMs on Diagnostic Protocols.	**Adnan Uzunovic**
A15	IFQRG members are willing to help out with Bayesian modelling if needed.	**All members**
A16	Please log onto the website of the International Pest Risk Research Group (www.pestrisk.org) and keep track of their work.	**All members**
A17	IFQRG to develop guidance on the application of Dielectric Heating for Wood and WPM, for submission to the IFC.	**Kelly Hoover**, Adnan Uzunovic, John Janowiak, Mike Ormsby

13.3. Date and location IFQRG-15

October 1-5 2018. IFQRG meeting to be held at the FAO headquarters in Rome, Italy.

Brent requested sponsors for the meeting e.g. refreshments, dinner.

14. Close of Meeting

The Chair closed the meeting by recognising the good work of the meeting organising committee. He noted that the Science Steering Committee (SSC) will be meeting in the next few weeks to finalise the report and select a new Chair for IFQRG.

Participants thanked the Chair for his long and successful stewardship of IFQRG, and look forward to the continued good success of the group in the years to come.

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