Improving nursery resilience against threats from *Phytophthora*

Phyto-threats workshop
(http://www.forestry.gov.uk/fr/phytothreats)

October 6th 2016, APHA, Sand Hutton, York

EXECUTIVE SUMMARY

PHYTO-THREATS is a collaborative research project involving seven participating institutions from across Britain and is funded by the Living With Environmental Change partnership through the Tree Health and Plant Biosecurity Initiative. It will run from April 2016 till the end of March 2019. The four main objectives of the project are to;

(i) Examine the distribution, diversity and community interactions of *Phytophthora* in UK plant nursery systems
(ii) Provide the evidence base for a voluntary nursery 'best practice' accreditation scheme to mitigate further spread
(iii) Identify and rank global *Phytophthora* risks to the UK
(iv) Gain a greater understanding of the evolutionary pathways of Phytophthoras

Sarah Green, Phyto-threats project co-ordinator, welcomed everyone and introduced the aims of the workshop. The aims of this first workshop were:

- to introduce the scientific aims of the project
- to develop collaborative networks across individuals and groups with an interest in working towards collective best practice in nurseries
- to share lessons and experiences around the challenges and opportunities of managing disease threats
- to identify nurseries and other stakeholder groups and individuals who could and would become involved in the research

The meeting was attended by c45 academics, nursery managers, Plant Health inspectors, foresters, policy makers and others

Richard McIntosh (Defra) provided **a policy context for plant health in the UK**. He emphasised the value of healthy landscapes and the benefits they can provide. Increased vigilance is important but also having the capacity to quickly intervene in the event of an incursion. Richard outlined the 5 'Ps' approach (predict, prevent, protect, prepare, partnering) and highlighted the range of approaches the government is taking pre-border, at the border and inland. He posed a challenge to the audience to think of how they could incorporate a 5'Ps' approach to their business.

Mike Harvey (Maelor Forest Nurseries) highlighted the changes they have seen in their **nursery** over the last 20 years, particularly in the numbers of new pests and diseases and he noted the limited range of tools that nurseries have to deal with damage and control. Maelor have invested in **Integrated Pest Management** which guides use of water, clean areas and purchasing behaviour.

Ian Nelson (Johnsons of Whixley) presented **a trade perspective** and noted the complexity of the trade network. Business is largely driven by price and profit. He said that UK growers currently cannot meet the UK demand for plants and therefore import from abroad. However, he recognised that the inspection regime in other countries may not be as robust as in the UK. Ian called for greater education amongst customers such as landscape contractors to look for alternatives to plants that can host serious diseases.

David Edwards (Tilhill Forestry) started by describing the devastating impact that ***Phytophthora ramorum*** has had on larch forests in South Wales. David explored the efficacy of different approaches to deal with *P. ramorum* but also the huge challenges of trying to predict the next outbreak. He made a plea for prevention rather than cure for tree health and warned that any solutions should not impact heavily on the economics of forestry (e.g. abandoning Sitka Spruce).

A **panel discussion** chaired by Sarah Green (FR) elaborated on some of these challenges, highlighting the dilemmas of 'unknown unknown' as well as 'known unknown' harmful organisms. The use of correct tools for detection was said to be important and discussions touched on the closure of high risk pathways. The value that plants add to the environment is believed to be highly under-valued by society, which facilitates the desire for cheaper products and imports. Reducing bureaucracy was considered to be key to making changes in the sector as well as seeking opportunities to increase the quality and quantity of UK plant production.

Each of the **4 project Work Packages** presented a 5 minute introduction to their work.

Work Package 1 (presented by David Cooke from James Hutton Institute) focusses on understanding **Phytophthora distribution, diversity and management in the UK nursery system.** The team are developing a diagnostic system that can detect Phytophthoras and identify individual species using DNA methods. The team have been collecting samples at a number of nurseries. David thanked the nurseries who have volunteered so far and welcomed more participants.

Work Package 2 (presented by Mike Dunn from Forest Research) involves social science and economics. The core focus on WP2 is **a feasibility analysis and development of 'best practice' criteria**. The research will involve exploration of nursery practices and issues they deal with on a daily basis as well as attitudes towards best practice guidance and accreditation. A consumer survey will be undertaken to understand better plant purchasing behaviours and public attitudes towards accreditation and what this could entail.

Work Package 3 (presented by Bethan Purse from Centre for Ecology and Hydrology) involves **modelling global *Phytophthora* risks** to the UK. The team are mapping trade pathways from source countries and ecological zones and linking ecological traits of all known *Phytophthora* species globally to likely impacts if they were to arrive in the UK. They are looking to learn lessons from past introductions in order to develop a predictive tool.

Work Package 4 (presented by Sarah Green on behalf of Paul Sharp from the University of Edinburgh) will look at **predicting risk via analysis of *Phytophthora* genome evolution.** Questions that this work package will explore include how Phytophthoras have evolved to kill trees, why they are so adaptable and how they can hybridise. The team will sequence the genomes of three *Phytophthora* species which will add to a comparative analysis of genomes across a range of Phytophthoras.

Two international speakers **provided an overseas perspective** on *Phytophthora* risks and nursery accreditation. **Susan Frankel** (US Forest Service) focussed on California and the impact of Phytophthoras on native plants and wildlands. She noted the unintended consequences of

restoration projects that are introducing Phytophthoras. The US National Plant Board have started a certification scheme with 8 nurseries currently signed up (pilot phase). Susan emphasised that complying with the certification standards required a lot of work but the nurseries involved are then free from intensive inspection per pest. There is also a voluntary accreditation scheme that involves following best practice guidance. Susan recognised that the scheme was not easy and she said you couldn't claim to be *Phytophthora*-free but you could claim to have done everything possible to be disease-free following a systems approach. **Giles Hardy** (Murdoch University, Perth) was unable to attend in person but presented a video on the Australian NIASA scheme (available as a slideshow without sound on http://www.slideshare.net/ForestResearch1/niasa-nursery-industry-accreditation-scheme-of-australia-a-working-model) whereby production nurseries and those involved in growing media sign up to follow best practice management guidelines. This scheme has been in operation since 1997 and the guidelines are now in their fifth edition. Giles described the guidance in detail including crop hygiene, crop management practices, general site management and water management. Giles also described in detail a method for composting. Alongside the nursery accreditation guidelines there is also a national nursery and garden industry biosecurity plan which focuses on risk mitigation.

There followed a **workshop session** led by Mariella Marzano (Forest Research) to explore what a nursery accreditation scheme would look like in the UK. Feedback suggested that accreditation might need to be tailored for different stakeholders but possibly under a single umbrella. A scheme could include different levels of standards to encourage businesses to improve their practices. A number of practicality issues were raised and need further exploration. However, there was a strong consensus that any scheme should have minimal bureaucracy. It was felt that there would need to be consumer support for any scheme to provide an incentive for nurseries to be involved. Decisions over what the scheme should include would best be made by representatives from a mix of sectors. Brexit might provide an opportunity for the UK to promote its own best management practices and to have more control over quality of imports. There are practices (e.g. mail orders, garden shows, illegal trade in plants) that could undermine an accreditation scheme. The scheme would require consumers to be informed and supportive.

Jon Knight gave a **keynote listener talk**, reflecting on the day's discussions. He emphasised that we need to understand market constraints and explore how to ensure that regulations and legislation work better for the sector and consumers. He noted that capacity will have to be increased if we are to produce more 'home-grown' plants but businesses need to be profitable in order to keep trading and that currently involves importing from abroad. He highlighted that if there is a desire to change trading practices then consumers need to be willing to pay more for 'home-grown' plants and that involves recognising the value e.g. of a disease-free environment. He made a plea for models to provide some foresight on future risks to facilitate traders becoming more resilient.

For further information on this meeting, including links to the presentations plus other project details, please see the project web site: http://www.forestry.gov.uk/fr/phyto-threats or contact the project lead, Sarah Green Sarah.Green@forestry.gsi.gov.uk.

FULL REPORT

BACKGROUND TO THE PROJECT

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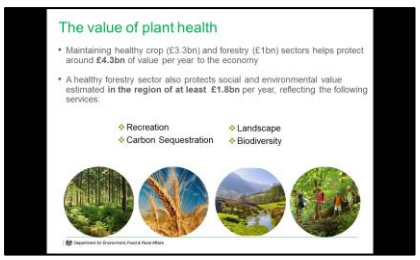
The meeting was attended by 45 academics, nursery managers, Plant Health inspectors, foresters, policy makers and others.

STAKEHOLDER PRESENTATIONS



1. Policy perspective

Richard McIntosh, Assistant Chief Plant Health Officer, DEFRA

Richard asked why are we bothering to protect plant health, why is it so important? He said it comes down to value, both the economic value of maintaining a healthy crop (a healthy forestry sector in terms of its value to the economy) but also in terms of the social and environmental benefits. Richard presented some quantitative values which he thought were likely to be an under-estimate. This level of value means that the government takes a great interest in plant health. In terms of government priority, plant health is listed but it also feeds into other priorities such as world leading food and farming industry, a cleaner environment and thriving rural economy. Richard introduced the government plant biosecurity strategy emphasising that all activities have a strong science and evidence base and commonality across government departments (e.g. animal health, aquatic health, non-native species). Richard said that increased vigilance and prevention is important but if incursions do occur, the key is to tackle them quickly to stop establishment. He also stated that it was very important to work in partnership with the public, trade and other organisations to ensure plant biosecurity. This should lead to beneficial outcomes such as less incursions or effective eradication/containment leading to reduced costs for everybody. The government wants to ensure it takes a balanced approach pre-border (e.g. collaboration with international and European partners), at the border (e.g. identifying the most significant risks, collaboration and ensuring inspectors have the best tools to detect threats), inland (e.g. risk targeting, contingency planning, building resilience, partnership approach). Richard outlined the five precepts of plant health - '5 P's' approach – PREDICT (risk register, horizon scanning, sentinel networks), PREVENT (legislation, targeted inspections), PROTECT (risk-targeted surveillance, control programmes), PREPARE (contingency plans, effective research and modelling), PARTNERING (advice, promoting good practice, shared responsibility approach). The government are monitoring the 5 P's to make sure there is a balance and Richard provided examples in relation to specific pathogens and pests.

Richard posed a challenge at the end asking the audience to think about what their businesses can do to better protect plant health, particularly from Phytophthoras. He then asked the audience to reflect on what a '5P's' approach would look like for business and industry. What would the sector have to do and how can Phyto-threats help?

2. Nursery perspective

Mike Harvey, Maelor Forest Nurseries

Maelor nurseries operate in Wales and produce for the forestry sector. They grow a mix of broadleaved and conifer species. Most of the market is in the UK and Maelor produces between 20-24 million trees a year. Mike highlighted the changes that have happened over the past 20 years including increasing incidences of pest and diseases with climate change but limited (by various directives) tools to cope with the associated control and damage. Maelor have invested heavily in IPM (integrated pest management) at an additional cost of £200k over the past few years (more staff and training, control measures, sampling and analysis etc.). When disease happens, it has a terrible effect. For example *Phytophthora ramorum* in Wales led to the destruction of hundreds of thousands of pounds worth of crops. The market in larch evaporated but also affected the UK's ability to sell to other markets because of fear of contamination (e.g. in Scandinavia). It cost Maelor a lot but the international trade in plants is a pathway for disease spread. Another pathway is water. Maelor have three supplies of water. Most of the nursery is irrigated with water from a reservoir. The reservoir is fed from a canal, which is fed by the Dee River and Maelor take samples for *Phytophthora* testing. They use filters. They also have their own supply of water on site, which they use for older crops. They use mains water for the limited area of protected crops but don't produce much in the way of high value crops under cover so they don't use expensive technical water systems. They try to manage another pathway – transport and contractors – by insisting they clean and disinfect vehicles and equipment but this can create other environmental problems. Maelor try to have clean areas and they have adopted an idea they saw at another nursery – providing 'clean' wellies for contractors and visitors. It is often those little things that can make a big difference. When school parties visit, they talk to the teachers so all arrive in clean footwear.

The riskiest pathway was discovered during the *Chalara* outbreak – buying in imported material from nurseries. Mike asked whether reducing trade from overseas would be a good thing. Maelor did a risk and economic impact assessment of closing that pathway and decided to buy only from UK nurseries. However, the trade is very complicated and driven by the government grant system and there can be a sudden, very short-notice demand for trees. Bureaucracy of the grant system can have a ripple effect on suppliers. Mike said they have now taken the decision not to bring any plants from overseas into the nursery so they can assure their customers and themselves that they have closed that potential pathway for diseases. It is costly but they believe they are doing the right thing. Should we be investing more in tree breeding and DNA testing? Looking to the future, Mike said there were good things happening in terms of technology developed but it should not be too expensive.

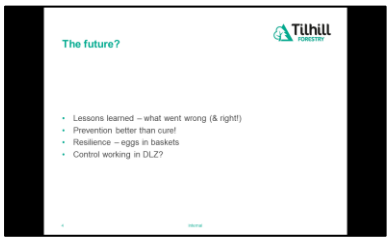
3. Grower and trader

Ian Nelson, Johnsons of Whixley

Ian presented a trade perspective and highlighted how business is led by the customer. Their needs are many and driven by price. Customers include the landscape contractor, garden centres, cash and carry etc…all want the best deal to make maximum profits. Somewhere in that thought process is a desire to have an environmentally strong landscape which is sustainable but that is a principle that Ian said can unfortunately disappear when it comes down to the nursery contractor who is supplying the plant. Trade is an almost murky place – suppliers within it can vary from a back garden in one European country to a trader in another European country through the UK into the nursery and from the nursery to customers.

Ian said the supply chain is variable. UK growers cannot fill the demand for plants and resultantly look to suppliers abroad. However, in other countries there are big pest and disease problems and they may not have such rigorous inspections as the UK. We are the recipients of problems from outside the UK. You also cannot guarantee the provenance of plants. Plants bought from one country may have come from elsewhere. Although many nurseries are reputable, including Johnsons, the trade system is not ideal and there is only so much nurseries (in partnership with inspectors) can do. Once a plant comes over the border, its history is lost. Ian noted that customers were not represented at the meeting. He said that more education amongst customers is needed as often price undermines environmental considerations. Nurseries such as Johnsons receive orders from landscape contractors. Ian suggested that it would be better to work with end-users directly but trade doesn't work that way. There is also scope for landscape architects themselves to educate and move away from plants that are hosts of serious diseases, particularly bacterial diseases that are difficult to control. Indeed, trade could be improved with greater linkages between landscape designers (customer), suppliers and science. Ultimately the benefit will not be reaped by treading on the nurseries, which means they have increased costs and ultimately have to go to the cheapest supplier to offset those costs. Ian ended by emphasising that the 'trade' is a murky place.

4. Forestry perspective



David Edwards, Tilhill Forestry

David introduced himself as a district manager for Tilhill forestry in Wales and the Marches and they manage around 20,000 ha of commercial forestry in this area, in excess of 1.5 million trees every year. He highlighted that *Phytophthora ramorum* has had a big impact in Wales over the past 5-6 years. The disease is progressive and the initial dramatic intervention by Forestry Commission Wales involved mostly felling to stump which had a big impact on the environment in the South Wales valleys. The South Wales valleys are the largest urban forest in Europe so the impact was significant. There was a *Phyophthora* outbreak team established in the early days but a perceived failure to engage with/by the private sector. Statutory Plant Health Notices (SPHNs) have not always been dealt with by landowners (including public estate) and that has neutralised enforcement powers (at least morally) when dealing with future diseases. There followed a period of dramatic spread of the disease. When it came to containment, David asked whether it was necessary because the disease wasn't controlled initially and would it have spread anyway? We don't know. The response in Wales was to come up with a containment policy, which was basically damage limitation. The South Wales valleys and parts of West Wales were identified as the core disease zone with the rest of Wales as a disease limitation zone. In the core disease zone, the disease was accepted as endemic and there is a management process to clear the larch over a period of time whereas in the rest of Wales it is much more reactive. SPHNs are served and the infected trees dealt with. The introduction of stem injections to kill the trees quickly has an advantage over felling to stump. It is cheaper and quicker and better for health and safety in difficult terrain.

David asked how is the disease going to progress? Science can always tell us why we've got to where we've got to. What they are not able to predict is when we are going to get the next outbreak. The spread in the last couple of years has slowed down. Is this due to the weather? (but we still can't predict how the weather will affect the disease). Are biosecurity practices effective? (probably not as haphazard at best). David pointed out that that trying to get biosecurity over 20,000 ha is a different ball game all together. Is the slowed outbreak due to felling of hosts or the location of larch in Wales? Is geography slowing it down?

David said he had a concern about the containment policy and whether it would lead to a build-up of spores. He asked if this was a problem and would *Phytophthora* mutate to affect Sitka spruce on which the industry so much relies? There has been talk of trying to identify natural resilience within larch but if you are doing that in the field you are potentially leaving the disease to spread. Resistance identification should be lab-based. Both healthy and diseased larch are being removed, largely because there is grant funding to fund restocking. If a landowner is served an SPHN there is no obligation to restock hence the grant funding to encourage re-stocking. David has heard suggestion that there are problems with the licensing system that deals with healthy and diseased larch. Larch lends itself to remote sensing (e.g. changes colour in winter) but we are currently relying on helicopter flights for monitoring which is expensive and potentially hit and miss. By the time you identify it from the air, is it too late? It is important that we learn the lessons from our experiences with *Phytophthora* in Wales and other parts of the country. David ended by making a plea for prevention rather than cure. He warned that upland commercial forestry currently has all its eggs in one basket (Sitka spruce) but that Sitka should not be abandoned in the name of resilience as if you take the economics out of forestry you lose the resilience.

Questions to panel of speakers and discussion

Q Can we take away any positives as well as negatives (from the situation we find)? Only positive I heard was that stem injection of infected larch stands is better than felling…for us that hasn't worked.

A Stem injections have been done on the NRW estate…contractors suggest it is working. It is better for health and safety and cost and the timber is standing for longer rather than lying on the ground and rotting. The positives are what is happening in the disease limitation zone where public and private estates are dealing with outbreaks as and when they occur. The question is if this had been done in the South Wales valleys, would we be in the situation we are in…?

C. Juan Suarez at Forest Research has a project ongoing where he is looking at remote sensing and early detection of *P. ramorum* on larch.

A. There's detection and knowing what's actually there. The other thing is monitoring the rate the larch is being cleared.

Q. Have you thought of using drones instead of helicopters?

A. It's not ourselves who do the monitoring, this is done by NRW. Drones are a potential but it is the scale. You can only use a drone in a relatively small area of forest. Tilhill have just started sponsorship of a PhD student in Aberystwyth who is looking at use of drones for surveillance in plant health.

Q. How can the trade become less murky?

A. When you use the word trade, you've got to differentiate. In forestry trade you could just use UK suppliers. The biggest pathway we are told is plant imports and you can't control for this. You can't inspect a tree and identify whether it has *Phytophthora* so controls are ineffective. Why present you've got a control when you haven't ?. Therefore you close that pathway. The capacity to produce trees in the UK is currently only one third of what it was 20 years ago. I would emphasise though that you need to sort out the bureaucracy.

A. The ornamental side make a contribution in a different way…aesthetics, environmental enhancement, wildlife passage. This is what we're providing and it is extremely under-valued because it is there and nobody really thinks about it. The biggest issue is economics. Nurseries are under pressure from buyers to keep it cheap. As an example we received plants from Belgium yesterday. Two plants in 2L pots cost less than a Mars bar. Not much input has gone into that. That's the way that landscape contractors are pressurising nurseries. We don't produce like that but it is a fact that half of our turnover is contributed to by international trade. The true value of the environment we live in needs to be appreciated.

Q. What about if you compare the loss of plants /your reputation to costs of stricter biosecurity measures?

A. You can't make a correlation between cheap and disease. There are no direct comparisons. The standards of the nurseries we are interacting with would probably be far lower than our own. If we don't make any sales we haven't got any business. If we have no business then people are out of work so we have to look at it pragmatically.

A. It's not the nurseries that are creating the market. In the garden centre market we have managed to increase prices and quality. In the landscape market it hasn't changed a bit. If you want to blame anything then perhaps blame education that suggests the landscape is of low value. The only way to come out of this cycle of cheap, cheap, cheap is to understand that the value of a m^2 of land is worth £100 not £5.

C. I agree that we have two very different markets. In forestry you are talking about a limited range of plants grown on a vast scale and plant health responsibilities are taken more seriously because the consequences of losing a single species of importance is really big. In this (forestry) sector there are a small number of species, small number of clients and small number of barriers to doing more. What you need is more advance notice of what's required. If people were allowed to place orders two years in advance, it is possible to up capacity.

A. In restock we do get an advance warning. The other side – woodland creation – that's the difficulty. Bureaucracy stops the forester from knowing what he'll be planting.

C. Even if they don't know where plants will go in two years' time, people should know what they want in two years' time so it should be possible to make a prediction.

A. This year in terms of woodland creation I don't know if I'm going to plant 10ha or 200ha because of the bureaucracy.

C. In the amenity sector the issues become far greater. There are many more species and more customers and more subtle reasons why we are not already growing more. It is very easy to get almost anything very quickly from Holland. Why can't they do this in the UK? Post-Brexit we need to understand what barriers there are to increasing production within the UK and look at why it is so easy to trade in Holland but not the UK? I don't see the relevance or issue with landscape architects – they do not determine plant health. Nurseries are not doing as well in plant health in the UK or as well as forestry.

A. There are 3000+ plants on my production.

Q. What do you want from landscape architects? To stop using so many plants?

A. I would like architects to be more knowledgeable and move away from plants that we know carry diseases. To look pragmatically at what they are trying to achieve, linking with the nurseries and what could they use that is healthy to achieve the end result. We need substitutes for known vectors. We are responsible for plant health internally. What is outside my control is cheap imports. Cheap imports are foisted upon us because we can't make any money unless we use them e.g. the landscape architect specifies price, the intermediary asks for something cheaper, he goes to the nursery with the request, and the nursery aims to fulfil it with a cheaper supplier. We could strengthen the link between landscape architects and nurseries.

Q. The value of forestry and crops have been mentioned, what about in landscapes and amenity?

A. The value of plants from social, economic and environmental perspective is huge, which is why the government is so concerned.

Q. Often there is nothing in a contract to specify quality of plants. Could contracts be improved in particular premium landscapes (e.g. Areas of Outstanding Natural Beauty) to make it better from a legal framework?

A. We do try to limit diseases. There isn't any area where we should be tolerating rubbish plants. I have good relationships with my suppliers but they are from Europe. We have to increase the value perception of what we do.

C. Lot of sympathy for nurseries but in the public sector the tendering system means that the lowest cost will win. Working for the private sector you can argue the toss. This is a problem. The other issue is imports. There are 4.5k tonnes of freight that come through the channel tunnel per day. Can we do anything about it? Of course not. The big issue is future. The key is resilience and part of that is to educate landscape architects. If you look at trees in the urban landscape, most landscape architects use about 14-15 species out of the 400 they could use. We need resilient woodlands. 80% of our woodlands contain around 10 species. That's aboricultural suicide. We need to expand the range of trees that we use and if we can, get them within UK.

Q. Any views on opportunities from Brexit? E.g. could government tariffs on imports make it more competitive for the UK plant suppliers?

A. Right now we don't know what the fall out is going to be. It would be possible, the market has the skills required but it would need long term commitment to quality in UK plant production.

A. We need leadership in the industry for people to specify UK grown trees. It's beginning to happen in the forestry sector. If you could get the market to specify it wants UK grown trees that could help. The forestry sector is very vulnerable because it is driven by timber (highlights the role of Sitka Spruce).

C. Some businesses are negotiating. The Dutch want to keep trade so getting UK trade will be a fight.

A. Customer-led markets are even more important. The influence can come from the end user.

Q. Does the EU review of plant health in trade offer anything?

A. Even under the current regime there are certain things we can do to protect against plant imports where there is a threat e.g. protected zone status, statutory notification schemes. The review of the EU plant health regime provides opportunities. There is going to be an emphasis on identifying high risk trades and measures to protect against them. There is going to be more emphasis on surveillance and inspections. There is a common understanding amongst Member States about what the priorities should be. We are a few years away from regulation being in place. UK has had quite a lot of input so we should benefit.

Q. How can Belgium produce plants so cheaply?

A. Via 'backyard projects' (as a hobby almost). They don't pay tax on it. Traders have a lorry and the small growers haggle to get their plants on the lorry.

A. Our government needs to encourage the entrepreneurial spirit in the UK! Overseas we see huge providers doing one crop only e.g. lavender in Holland. All the buyers go to him. Also the Dutch growers are better at cooperating to provide plants. They also have a quick turn-around. What is stopping the UK from doing this?

SCIENCE PERSPECTIVES FROM THE PHYTO-THREATS PROJECT TEAM

Work Package 1: Phytophthora distribution, diversity and management in UK nursery systems

David Cooke, James Hutton Institute

David stressed that in working with nurseries they are trying to help with finding new methods for early detection in nursery, NOT to make life difficult. He gave an overview of *Phytophthora* (oomycete) biology – they are water moulds. *P. infestans* (massive invasive potential) and *P.ramorum* have airborne spores, whereas many other Phytophthoras live in soil, invisible to scrutiny (especially if treated with fungicides) and therefore present a high risk to the trade. They are now looking at a diagnostic system that detects *Phytophthora* and can identify the individual species using DNA methods (PCR) to identify *Phytophthora* diversity in soil and water at critical control points in nurseries. The DNA sequences act like a 'barcode' to identify specific species. David pointed out that in contrast to a lateral flow device in the field (which does not distinguish species), this technology is a bit slow currently but it is developing fast. David stressed that there will be management challenges. He thanked nurseries that have already volunteered and welcomed more participants.

Work Package 2: Feasibility analyses and development of 'best practice' criteria

Mike Dunn, Forest Research

Mike outlined that this WP is looking at the feasibility of a UK-wide accreditation scheme; how might nurseries implement best practice criteria and what is the best way forward? Objective 1 has been about mapping key stakeholders - mostly nurseries but also other sectors and end-users. Mike thanked everyone for their help. Objective 2 is about developing an understanding of nursery practices and the issues they deal with on a daily basis as well as which best practice guidance is feasible. This WP is also interested in challenges faced by nurseries e.g. do participants have any particular concerns around plants or pathogens? How do they deal with these concerns currently? What techniques/steps are employed? Objective 3 is examining what accreditation will mean for nurseries? Is there interest? What's in it for nurseries? Will they get involved? What would it involve? It will also be useful to track how/if attitudes change throughout the duration of the project. A consumer survey will be undertaken to gauge where people buy from, how much they

would be prepared to pay, understanding of pest/disease issues, if they would support an accreditation scheme and how far they would be prepared to travel to an accredited supplier.

Work Package 3: Global *Phytophthora* risks to the UK

Bethan Purse, Centre for Ecology and Hydrology

Beth explained that the overall objective of the WP is to predict which of the globally known *Phytophthora* species (that we don't currently have in the UK) present the highest risk and in which areas (locations) of the UK. They are looking at why some species are able to pass some barriers from Europe to the UK and others not. Where do these species come from (which pathways) and from which ecological zones? This WP is also exploring if species from similar climates to the UK pose a higher risk, why only some species survive transport pathways, and what are the 'riskiest' biological traits (in terms of ability to spread quickly in a new area). The team are trying to learn from past introductions but also aim to develop a predictive tool. They would like to hear from you if you import from a certain area and are worried about a particular species. How would you want the system to work? Their analyses will also cover forest species as potential hosts, and they are looking at soil and water as pathways of spread. A key part of the research is linking ecological traits of species to likely impact, which is valuable for horizon scanning. Some of the factors being considered are spore types, temperature range (climatic tolerance), host range, dispersal mechanisms and breeding systems. They have developed a database of 169 *Phytophthora* species worldwide, with biological traits data so far completed for 90 species. It is a dynamic process with new species being continuously incorporated.

Work package 4: Global *Phytophthora* risks to the UK

Sarah Green, Forest Research on behalf of Paul Sharp, University of Edinburgh

There is a high *Phytophthora* diversity in some environments, for example up to 5-6 species within a single 300g soil sample. This WP asks the questions; how have *Phytophthora* species evolved to kill trees? What genes do they have? What happens when several Phytophthoras are present together - how is genetic information exchanged? We know about hybrids, for example *Phytophthora alni* that kills alder. How are Phytophthoras so adaptable? For example *P. ramorum* originally infected mainly shrub species in Britain for several years. How was it able to 'jump' to a conifer (larch)? Genomics is

being used to understand what genes species have. Genomics is the study of genomes of organisms (its hereditary information encoded in its DNA). There are *Phytophthora* genome sequencing projects all over the world with (currently) ~25 publically available *Phytophthora* genomes comprising 11 canker causing Phytophthoras that kill trees, 5 Phytophthoras that infect tree foliage and 9 Phytophthoras that infect herbaceous hosts. In this WP, three more *Phytophthora* pathogens will have their genomes sequenced for comparison with all other *Phytophthora* genomes. They will draw on experience and methods developed for *Pseudomonas syringae* where genes shared between species were identified, illustrating the importance of horizontal gene transfer (enabling very rapid evolution) in adaptation. Information generated will increase our understanding of long-term risks to forests and woodlands.

OVERSEAS PERSPECTIVES ON PHYTOPHTHORA RISKS AND ALLEVIATION THROUGH NURSERY ACCREDITATION

"A common foe: Phytophthoras in nurseries and landscapes in the USA" - Susan Frankel, US Forest Service, Albany, California, USA

Susan started her presentation by saying that she would mostly focus on California and a bit on the rest of the US. Sudden oak death (*Phytophthora ramorum*) does continue to knock the oaks dead. She showed a picture based in Oregon which had to create an infested area as it had so much dead tanoak. Pathogen spread is linked to the weather, in particular rainfall, and there are new incursions happening too. For example, the EU1 strain of *P. ramorum* was recently introduced to the US for the first time in a nursery. Subsequently they found it in a forest a couple of km from the nursery. Now this strain of *P. ramorum* is thought to be eradicated although simultaneously the nursery went out of business (not related). Susan stated that the incursion was worrying because this happened in 2015 and they had all quarantine processes in place. Another example provided by Susan was an historic garden in Washington State that had a *P. ramorum* infestation. The estate has forest land and formal gardens. Since the outbreak there has been lots of screening of plants and monitoring of soil and they have not recorded the pathogen yet this year. The local forests do not have *P. ramorum* so Susan said it is disturbing to find the pathogen in a high value botanical garden in this area.

The US is a huge country and infestations and detections of quarantine Phytophthoras are quite low, about 20 a year. The US has changed quarantine requirements, now there are much fewer required inspections and monitoring. The only people who are regulated are those who have had positive detections in the last three years. However, despite the reduction in inspections they are still finding about the same number of *Phytophthora* detections.

The forest service does a wildland survey (involving water baiting for *Phytophthora*) and Susan is worried that in eight states across south eastern USA, the pathogen has moved from the nursery into the waterways where it lives. In California they have had 25 years of sudden oak death in forests which continue to deteriorate. In the bay area of San Francisco that has lost all its tanoak they are trying to carry out restoration with other less susceptible plant species. Susan covered an issue they are dealing with relating to Phytophthoras on native plants. She gave a number of

examples such as a project to replace a 250km water pipeline from Yosemite to San Francisco that required restoration projects to enhance the environment to make up for the damage. They found *Phytophthora tentaculata* on Toyon, a small native tree and it is likely to have come from plants that were planted. When they started to look for where the plants had come from, they found several *Phytophthora*-positive nurseries and planting sites. They think that when nurseries came to collect their pots from these sites they didn't take their own pots and *Phytophthora* was transferred among nurseries from reused pots that hadn't been cleaned.

Restoration plantings in California

In California they have many Manzanitas and some are very rare. *Phytophthora cinnamomi* has been slowing spreading for 20 years affecting these plants.

Other causes for concern include the San Jose water department flood control projects. As part of these projects they buy plants, for example the rare shrub *coyote ceanothus*, to enhance the sites but some plants have been infested with *Phytophthora cactorum*. Therefore, instead of enhancing the site they are contaminating the rare sites with *Phytophthora cactorum*. The vegetation ecologists who did this restoration got very upset and nurseries volunteered to be inspected and sent samples to the California Department of Food and Agriculture. They found quite a lot of *Phytophthora* in the native plants - 25% of the submitted samples were contaminated. The water company then asked what else do we have on our property? They hired experts to go out to the restoration site and they found *Phytophthera quercina.* At least five new species of *Phytophthora* have now been found there.

In order to identify the extent of the problem Susan and colleagues did a simple survey in Washington State, Oregon and California with funding from the USDA. In Washington and Oregon they purchased landscape plants and tested about 300 plants each. They found that 25% of the material purchased was positive for *Phytophthora*. There was a first detection in a nursery of one of the parents of *Phyophthora alni*. It is known in Alaska on alder that isn't affected by *Phytophthora* disease but this is the first time they have found the species in nurseries. They don't want one of the hybrid parents moving in the nursery chain.

They did an operational survey in a national park in San Francisco with very rare manzanitas and other rare species. The national park voluntarily tested every plant purchased in the last year and a half and found that 26% of landscape plants were contaminated with *Phytophthora*. One pathogen is a first for the USA but Susan couldn't confirm what it is yet as the work is not complete.

People are very concerned. Susan hopes that concern can transfer to the horticultural industry and raise fears. The horticulture sector has been under *P. ramorum* regulation for a long time (2002) and they are getting frustrated with the additional work. *P. ramorum* has been a very difficult problem to regulate and has highlighted the short-comings of their systems.

The US has a National Plant Board, a non-profit organisation made of heads of Department of Agriculture from all 50 states plus the federal government APHIS. They work together to try and

determine how important a pest is. It is very powerful; a lot of policy decision making is channelled through this Board. They started a certification programme in 2012 based on a systems approach. They have only 8 nurseries participating across the US so far. It is quite a lot of work for a nursery to join this programme. The reward for the nursery is that they are no longer subject to pest by pest regulation inspection. You can ship freely which means that the certification must meet all the standards for each quarantine pest. It is a tough standard to make and has to meet all the international requirements. There is a risk assessment and then the nursery has to create a manual for what best practices will actually be put in place in their nursery. They have three audits in the first year. If you pass then you get certification and continue to work together with the Agriculture Department to keep it going.

Another example of a certification programme is for *Phytophthora cinnamomi* in avocado, a big industry for California. Growers pay $300 to have the certification. The Agriculture department will come and survey and certify nurseries.

Returning to the native plant nursery problem, people are very motivated. Susan and colleagues brought the stakeholders together and formed a '*Phytophthora* in native habitats' work group. They have come up with best practice management guidelines that are industry wide. They are voluntary. It is hard and not very popular, e.g. can't use fungicides, heat treating soil, plants have to be off the ground etc. Some nurseries are voluntarily complying and trying to do even more. Based on those best management practices, they have seven nurseries that have volunteered to take part in an accreditation programme. You can't claim to be *Phytophthora*-free but you can claim to be doing everything right with a systematic approach.

Susan ended with a bit of inspiration. A nursery at the National Park in San Francisco had one *Phytophthora* detection and this made front page news in the San Francisco Chronicle. There was a panic in the media and the environmental community. The nursery manager decided to take care of the problem and re-did soil storage and had volunteer programmes to assist with the new measures. The nursery has now had zero *Phytophthora* detection for two years.

Volunteer workers from the local community helping at the national park nursery, San Francisco

"NIASA: Nursery Industry Accreditation Scheme of Australia - a working model" - Giles Hardy, Murdoch University, Perth, Australia (by Video)

NIASA is a national, audited scheme for production nursery (growers) and growing media (potting mix) businesses which operate in accordance with a set of national Best Management Practice guidelines.

- The aims of NIASA are to:

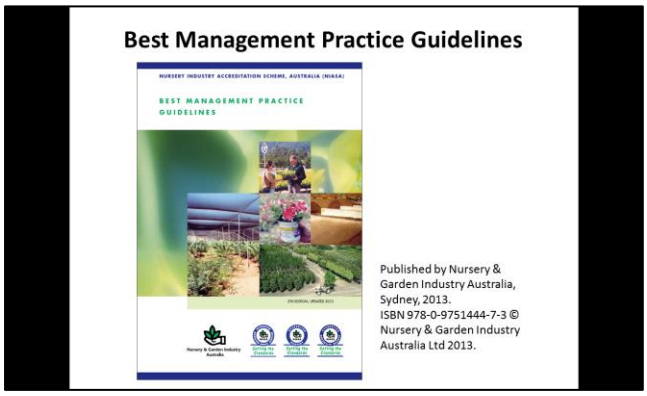
- Improve customer confidence at all levels of the distribution chain
- Improve the profitability of NIASA accredited businesses through the adoption of industry Best Management Practice
- Encourage the use of environmentally sound work practices
- Encourage the continuous improvement of NIASA accredited businesses and those working towards accreditation

Any wholesale/production nursery or growing media manufacturer can join NIASA if they implement the NIASA Best Practice Management Guidelines. The guidelines were first written in 1997 and are reviewed annually to remain relevant with current production and environmental issues. The industry is worth ~ 14.5 bn Au$ annually and needs to be 'clean'. The guidelines are now in the 5th edition, providing the standard used by professional production nurseries, growing media suppliers and green life market industries.

Building into NIASA is:

- EcoHort- the industry specific Environmental Management System (EMS)
- BioSecure HACCP – the industry specific biosecurity module

Together NIASA, EcoHort, and BioSecure HACCP form the nursery Production FMS designed for businesses and their future risk analysis and action planning.



Giles explained that guidelines have been divided into five major sections: Crop hygiene (root disease prevention, and disease, pest and weed control); Crop management practices (nutrition and environment control); General site management; Water management; and Appendices, and he explained each in detail:

Prevention of root diseases, particularly *Phytophthora* diseases, are a major consideration in the guidelines, because once contracted most cannot be eradicated. Crop hygiene was emphasized, water from deep bores or roof catchments requires no disinfestation; dam water needs disinfestation. Soil needs routine disinfestation – no requirement if materials are considered free of major pathogens or those from a source consistently tested free of specific pathogens. Sand presents a significant risk for pathogens and nematodes if sourced from a depth less than 2 m.

A detailed method was given for composting. Disinfestation procedures for nursery growing media were explained. Aerated Steam: A temperature of 60°C for 30 minutes; Basamid®: For bulk growing media, quantities of between 150–220g/m3 of Basamid® granular need to be thoroughly incorporated into the medium preferably with the aid of soil blending equipment. Heaps should be covered. Alternatively soil solarisation can be used.

Media and containers must be stored on surfaces that shed and exclude run-off water, and contamination by soil or other contaminated materials excluded. Motherstock plants must be monitored for pests and diseases, this includes seeds, cuttings, divisions, work surfaces, tools etc. Crop hygiene extends to floors and pathways, propagating and production facilities (bitumen, concrete, coarse gravel), quarantine areas, potting facilities etc. Putting a weed mat over soil represents a significant problem for disease control and is not sufficient. Where benches are used the height depends on the type of surface underneath. On sealed or aggregate surfaced floors and paths and in polyhouses with low precipitation rate irrigation outlets, benches need to be no higher than 30 cm. Where splash or other methods of contamination are likely, height should be 75 cm or higher. Where there is 'in ground' production, sites have to be tested free of soil-borne pathogens and need to have very robust quarantine. Sites contaminated with pathogens need to be disinfested (fumigants or pasteurization). Area has to be well drained with good surface drains.

The guidelines cover weed control: All areas of the nursery need to be free of weeds and weed propagules. Insects and other pests must be controlled using Integrated Pest Management (IPM). IPM has to be applied wherever feasible (an aim for all NIASA businesses). Pest monitoring and record keeping are essential and there has to be prompt removal and disinfestation of sick plants and other materials.

Crop management practices are of equal importance to crop hygiene criteria so water quality, irrigation, humidity, light, temperature, nutrition and fertiliser are some of the variables monitored and kept to certain limits to optimize plant growth and limit pest and disease development.

General site management is another key area of the NIASA guidelines. A professional business that projects a good image is critical. Integral to this is good staff training, good health and safety policy, as well as ensuring quality and customer expectations are met in an ongoing basis.

All NIASA businesses must aim for efficient management of water in order to reduce the demand on water resources and ensure minimal impacts on the environment-key points were listed.

There are extensive appendices in the guidelines to cover all the aspects mentioned.

Giles cited the example of *Phytophthora alticola* in the wheat belt. 10 million seedlings were planted in the wheat belt and they died as a result of *P. alticola*. The nursery that supplied the stock was not accredited but followed the accreditation guidelines. When their practices were scrutinized, the only weak point found was the re-use of trays. Trays were bleached and then used again. It was eventually found that the wash step was inadequate, that potting mix adhered to the container and was not washed out. The pathogen was surviving in the substrate even though it was bleached. *Phytophthora* could still be isolated after 100^{o}C dry heat treatment even overnight! Improvement was only achieved once steam sterilization was used. This illustrates how the recommendations must be regularly reviewed to ensure efficacy!

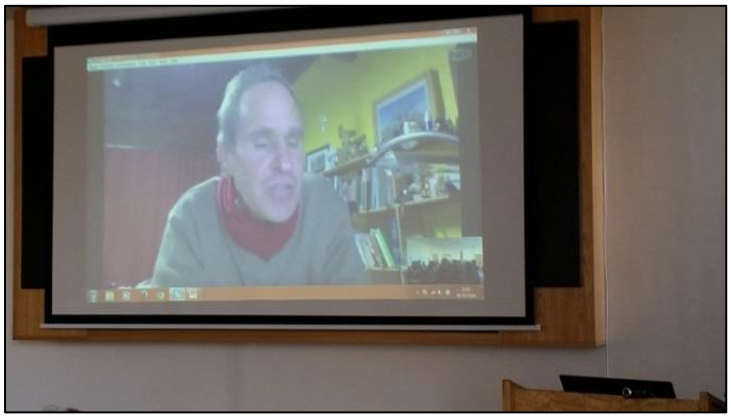
Alongside the nursery accreditation guidelines, there is also a national nursery and garden industry biosecurity plan and this is all about risk mitigation and it operates at national, state and regional levels. Finally, there is an industry biosecurity plan for the nursery industry.

For more about the nursery garden industry of Australia visit:

- https://www.ngia.com.au/
- http://fmsmanuals.ngia.com.au/

Presentation available online: http://www.slideshare.net/ForestResearch1/niasa-nursery-industry accreditation-scheme-of-australia-a-working-model

Discussion summary



Giles Hardy answering questions via Skype link from Australia

Questions were focussed around the number of nurseries that had signed up and the costs involved in taking part in an accreditation scheme. In California, the local best practice scheme is in its infancy and so it is hoped that more nurseries will sign up as the costs of getting *Phytophthora* diseases are far greater. While it was recognised that 'cleaning up' nursery sites is expensive, disease management is part of building a resilient nursery and increasing consumer confidence. A good way is to start small such as having a 'clean area' and then build up to wider site practices. Another question related to availability of biological control for *Phytophthora*. Both Giles and Susan indicated that that no biological control was being used in Australia or the USA. There may be some available but it would be difficult to release in practice and is unlikely to work on its own. There was a request for the Australian guidance on bark composting.

WORKSHOP SESSION ON NURSERY ACCREDITATION AND ITS POTENTIAL IN THE UK

Participants were broken up into groups and asked to discuss the following questions:

- What does an accreditation scheme means to you?
- What do you think an accreditation scheme should include?
- Who should decide on criteria for accreditation?
- Do you have any experience/examples of accreditation from other sectors/countries? Lessons learned?
- What are the opportunities/challenges that people foresee?

A summary of the feedback is provided below:

What would a nursery accreditation scheme look like?

Participants felt that the main premise for an accreditation scheme should be to slow down the introduction and spread of *Phytophthora* species, but that this should not be its sole purpose. Instead it was suggested that the scheme could enhance the UK's plant health status more generally while protecting the wider natural environment from pests and disease.

Accreditation would need to reflect that minimum standards (relating to best practices) had been reached, with the possibility of different levels of achievement e.g. bronze, silver and gold standards. This would encourage nurseries to improve their operations, so that what are now considered best practices eventually become the norm. Measuring for and awarding accreditation would require an audit. The scheme would also need to be recognisable, which would include adopting a unique and catchy logo for plant growers/sellers to display at their sites, on any materials produced and on their products. It is imagined that such a scheme would provide assurance to the consumer, giving peace of mind and confidence that they are purchasing from a respected source, and aren't complicit in

furthering the spread of pests and disease. The most commonly suggested incentive for nurseries to seek accreditation was the possibility of increasing their market share as a result of an enhanced reputation. Whether accreditation would be sought would be left to the nurseries themselves, i.e. participation would be voluntary.

Questions remain about whether the same scheme could apply to different sectors (forest nurseries, horticulture etc.) or whether it would need to be tailored for different stakeholders. Queries around some of the practicalities also remained unresolved, for example, would trade between different nurseries be allowed? Finally, there was a consensus that accreditation would be synonymous with recording and tracking of stock, and thus increased time, expense and paperwork. This led some to comment that the process would need to be kept simple with minimal bureaucracy.

What/who should it involve?

To maximise impact it was felt that an accreditation scheme should be applicable across sectors and stakeholders. One suggestion was that it may involve a single umbrella scheme but with differing guidelines for each domain. It was stressed that such guidelines would need to reflect the desired outcomes and be communicated to nurseries with clarity (no jargon!).

APHA, SASA and the existing Plant Health inspectorates emerged as the most suitable candidates to implement the auditing process due to their existing relationships and routine visits to nursery sites. Examples of the type of measures thought to be important components of an audit include:

- The testing of imported plant material and growing media
- Testing for exotic and existing regulated pests/pathogens (perhaps with certain root requirements)
- Evidence of effective pot cleaning being implemented
- Environmental standards (water use, pollution residues, invasive pathways)
- Paperwork demonstrating traceability
- Uniformity of good practice to mitigate risks throughout the site

The question of what should accreditation involve generated some discussion on whether there would be any flexibility in the system, i.e. would it be possible to have a percentage of stock which is not accredited? Or should there be a requirement that accredited nurseries insist on UK provenance with the assurance that all stock is grown completely in the UK (i.e. not started elsewhere). Furthermore the issue of penalties for nurseries failing to meet standards remained unresolved. For example, would an accredited nursery that is found to have sub-standard practices be given time to improve or would accreditation be immediately withdrawn?

Who decides?

A variety of suggestions arose as to who should decide on the guidelines and outcomes of an accreditation scheme. Some felt that the customers (groups and representatives of all types of buyer) needed to be supportive of the specifics, reflecting the assumption by many that the scheme would be market driven. Without adequate support from those purchasing the plants it is argued that the scheme would be unable to make a meaningful impact. In contrast, a customer supported scheme would provide nurseries with the necessary incentive to seek accreditation due to the advantage this would presumably provide within the marketplace. Others felt that those most informed on the science and policy should take a leading role to ensure that the latest knowledge about how to mitigate the threats remained central. Yet, there is a counter-argument that it is the practitioners – the nursery sector itself – that have the best understanding of what is actually practical to implement on the ground, and so they too were identified as being key to determining what a scheme should involve. One suggestion was that nurseries may be adequately represented through the Horticultural Trade Association.

In recognition of the value and limitations of including or relying on the different stakeholders, most participants accepted that decisions around the scheme's direction and implementation would be best made through the inclusion of a mix of sectors. By ensuring representation across sectors and throughout the chain of supply it is thought that decision making could be more balanced and independent than if one particular group is given the lead.

Experiences of accreditation/certification

Experiences with existing domestic and international accreditation and certification schemes provide insight into what makes a scheme effective. Participants noted that some schemes are too prescriptive whereas others are not prescriptive enough. The UK Wood Packaging Material Marking Programme (UKWPMMP) and Seed Potato Classification Scheme (SPCS) were highlighted as being particularly successful.

The UKWPMMP arose in response to the risks of introducing and spreading tree pests through the transport of packaging material made of unprocessed wood. The Programme has been widely adopted, with most of the UK's international trading partners around the globe now implementing landing regulations for wood packaging material based on its ISPM15 guidelines. These guidelines were established by the Forestry Commission and Northern Ireland's Forest Service in conjunction with the trade. Operation of the UKWPMMP is overseen by an Advisory Council consisting of representatives from the Forestry Commission, Forest Service, Timber Packaging and Pallet Confederation (TIMCON), National Association of Pallet Distributors (NAPD), United Kingdom Forest Products Association (UKFPA), CHEP (Commonwealth Handling Equipment Pool) and the British European Pallet Association Ltd (BREPAL). By law all companies in the UK involved in producing ISPM15 compliant wood packaging material must be authorised to do so by a valid certificate.

The SPCS provides assurance that seed potatoes delivered to buyers and growers meet specified minimum health and quality standards. Every EU member state operates certification schemes to ensure that all seed potatoes marketed within the EU are officially classified, and comply with regulations. In England and Wales, the SPCS is administered by APHA on behalf of Defra. To market seed the owner of the variety must apply to the relevant certifying authority for approval. An application to APHA is made at the beginning of the growing season, which is then handled by the PHSI. A fee for inspection of the crop must also be paid based on the area planted and the grade for which the crop is entered.

Having heard about the Nursery Industry Accreditation Scheme of Australia (NIASA), participants noted the importance of considering plant buyers and government contractors in a scheme. Specifically, landscapers are required to include in their contracts that they will purchase plants from accredited nurseries (meaning without *Phytophthora* and with Best Management Practices in place). The nurseries are tested annually and are expected to be seeking continual improvement in areas such as weed presence, water quality, irrigation systems, humidity, aeration and water holding of the growing medium, light and temperature, recording of plant nutrition and fertilizers. However, the implementation of this model has proved too costly for some nurseries. Smaller nurseries in particular have been unable to afford the associated costs and are increasingly being bought up by larger ones.

Further examples worthy of investigation include those by the Woodland Trust, and those in the nursery sector (past attempts, and emerging attempts such as Tim Edwards of Boningale Nursery who is basing a scheme on the ISO14001 model, and the California Association of Nursery and Garden Centers' (CANGC) guidance on best practice management for *Phytophthora ramorum*).

Opportunities and Challenges

Many feel that Brexit is an opportunity for the UK to outline and promote its own best management practices while gaining greater control of imports which may fall below an acceptable standard.

Others noted that the introduction of an accreditation scheme may offer an opportunity to educate customers, supermarkets, landscapers etc. about the current and emerging threats, and best management practices. Now is thought to be a very good time to launch a scheme because plant health appears to be a hot topic within political circles and so government support and willingness to pay is likely to be relatively high.

A scheme would also allow the UK nursery sector to become healthier and more robust – improvements which would complement the demonstrable standard of practices reflected through accreditation. Nurseries could use this recognition to increase their market share, initially amongst the early adopters, but eventually for the sector as a whole (if UK growers become celebrated in the international marketplace). Ensuring a requirement for accredited sources to be included in procurement/tendering would also be advantageous to those involved in the scheme.

In addition, there are opportunities for greater cooperation between nurseries, such as through sharing knowledge and experience around implementing best practice.

Uncertainty over who would pay to establish and administer an accreditation scheme emerged as a potential challenge, though some have suggested that a fee of several hundred pounds paid by the nurseries to cover such costs would be considered a small amount for most larger nurseries. Identifying what type of organisation would be eligible to apply is seen as another challenge to establishing a scheme, since different growers have different priorities and concerns. Yet, the involvement across the sectors should be sought, since collectively the system is only as strong as its weakest link. Even so, accreditation would unlikely be able to definitively prove whether a nursery is disease-free, only that none had been found.

Encouraging growers to alter their behaviour, adopt best practice and seek accreditation is regarded as a further challenge. Some wondered whether the changes required might be too difficult or inconvenient for some nurseries to accommodate. For example, if they had to adjust their supply chain so no imported material was used. This would require a stable market which encouraged UK plant propagation, rather than a reliance on cheaper imports. A requirement to label or tag plants was also considered unfeasible by at least one participant. The costs incurred to implement these kinds of changes and to gain accreditation may be too much for some nurseries, particularly the smaller businesses. Furthermore, the scheme would require consumers to be informed and to buy-in to the idea because if no market advantage could be derived nurseries may revert to old practices in a bid to remain profitable.

If there is limited interest across the sector then the impact on pest and disease in the wider landscape is likely to be negligible. Similarly, mail ordering, garden shows and illegal trade in plants

could all potentially undermine the scheme's goals. There are also question marks about the impact a scheme would have on protecting against new or emerging threats, which by their definition cannot be fully understood. Finally, it was recognised that any attempt to apply the polluter pays principle could be very difficult when dealing with outbreaks, since in many cases the origin of the problem will be difficult to ascertain.

SUMMARY OF THE DAY KEYNOTE LISTENER

Jon Knight, AHDB

Jon highlighted a number of issues that had been raised during the day:

Understanding the market and constraints within the market. Jon gave an example of a customer that comes to you stating they will plant a certain acreage under a planting scheme but they don't have approval yet. Two years down the line, you've grown what they want but the approval still hasn't come through and you have to bin whatever you've grown for them. This scenario applies to all regulation and legislation and it needs to work better. Decisions are made at different times across different departments. Jon wondered whether in two years and six months [post Brexit] we might be in a different position in regard to what regulations we have to comply with.

Jon then picked up on a discussion earlier in the morning which highlighted that **we don't have capacity currently to produce everything** even if we have done historically. So at the moment there is a need to import. It is driven by profit and people will do what is needed to make their businesses profitable in order to continue to trade. He said you can't blame anybody for doing that but that if want to change things you need to change what people are willing to pay for a product and recognise the value e.g. to protect the wider environment or your own garden from pests and pathogens. Somebody somewhere has to pay or the government needs to cover the cost if it is recognised as a public good.

Models are very good at confirming what we already know. However, while he understood it might be difficult Jon asked whether it is possible to create a model that gives people a bit of foresight, to enable them to think about what they need to incorporate in their business to make them more resilient to see what is coming down the road.

Jon also highlighted lack of knowledge such as **not knowing where all the larch is.** Clearly there is lots going in the area of remote sensing – one of those initiatives is the new agritech centre (Harper Adams University) but it is not linked up to forestry very well. They have a specialist drone area – close links to Boeing. There are other things going on and other people working on remote sensing. It's about finding the right person to do it for you.

A plea from one of the questions after this morning's presentations was to **reduce the murkiness** in reference to what trade goes on, where it comes from and which provenance.

Other issues include **looking at contract specification** – the idea that you would specify within a contract that you wanted material produced in the UK or sourced responsibly and could show its provenance. Is there an ability to do that? We are constrained in what we can and can't ask for. Perhaps two years down the road we may have more freedom but we will still have tendering processes and have to get best value for money. This should not be just about the cheapest but what offers best overall value. In the long term if you put a value on the environment you might have to go for a different type of supplier.

Brexit can offer some opportunities but looking at the tariffs that the EU could put on produce if we drop out completely the talk of opening up new markets seems unlikely. Jon said we need to keep

in mind that it's not quite a golden world out there. However, we are a big market for the EU and work is being done looking at different sectors and their values.

When listening to the **science presentations,** Jon wondered whether any new **Phytophthoras** had been found in the nursery surveys [Reply – not yet]. Sometimes you spend time to find new pathogens but that doesn't always make a difference to nursery management. Therefore research should think about how to provide value to the sector.

In Mike Dunn's WP2 presentation he mentioned **accreditation**. Ultimately the measure of a good scheme is what changes as a result.

In WP3 and the **development of a model** to be able to predict things, Jon highlighted that current risk is useful but future risk is more useful to prepare for the future.

Genomics in WP4 - it will be fascinating to see what falls out of looking at the weak pathogens as to whether they are fundamentally different to the strong ones. Jon asked whether we can usefully use the information to inform growers and change their behaviour. What do they need to know to combat these things? It is important to make sure that science is translated into a language that growers can use to make a difference on their holdings.

Jon referred to Susan Frankel's presentation and especially **the $5 million spent post-*Phytophthora* outbreak on sterilising soil** which is more than the value of the UK industry. If you've got that sort of driver that changes things dramatically and they are finding new species of *Phytophthora* from the surveys. Jon assumed they were not new but resulted from an increased effort to find pathogens (Susan confirmed this was the case).

Moving onto **Australia**, the nursery industry is worth 14.5 billion Australian dollars annually. This gives you a sense of the scale as agriculture and horticulture are still a fundamental part of the Australian economy. While the sector is still important in the UK it is relatively small in comparison to some other sectors.

Phytophthora shell shock…Jon thought it is perhaps perhaps more *Phytophthora* fatigue in that we keep hearing not just about *Phytophthora* but other new invasive pests and diseases. How, in a growers mind, do you assess and react to the risk? Being able to articulate and demonstrate risk around *Phytophthora* (and other pests and diseases) clearly does have value but there is a need to make sure that information provided is no more than it needs to be. Nurseries are looking for diseases and training their staff. Hopefully getting more focussed information will enable people to make effective changes.

Jon ended by stating that there were some **useful ideas** that came out of today. He noted that there was clearly no magic bullet. For some, managing for diseases might be a costly process - small growers can go out of business as they can't compete or are bought by larger businesses. That's the model elsewhere in horticulture. Getting **growing media** tested and certified might be a useful way forward.

WHAT NEXT ?

In October 2017, Phyto-threats will hold a second stakeholder workshop which will focus on identifying effective management options to underpin a UK nursery accreditation scheme, in light of findings from the first 18 months of the project. Information on this workshop will be circulated next summer.