PROTREE Stakeholder Workshop

December 15th 2014

Table of contents

Executive summary

- Tree Health is a major concern for all those who manage trees and forest in Britain today.
- The PROTREE project aims to measure how variable and adaptable the threats are to Scots pine, to test how much variation there is in the tree species in resistance to these threats, and to find ways to get people involved in making healthier pine forests.
- Science is an important part of coping with the problem, but to have an impact research must remain firmly rooted in the realities of tree and forest management on the ground.
- A key aim of PROTREE is therefore to seek the active input of a range of relevant stakeholders to make sure the science in the project stays relevant to the management challenges faced by all interested parties.
- A first interactive, participatory stakeholder workshop was organised in December 2015, bring together and gathering input from over 40 scientists, practitioners and policy makers.
- Input was gathered on three main themes: 1. Planting the right tree in the right place: factors affecting tree performance in different places. 2. How pests and pathogens attack: Why and how pests and pathogens become a problem. 3. Putting theory into practice: What are the management options and are they acceptable?
- Ideas for future collaboration were gathered, and included increased nursery contacts and visits and exchange of material to compare among and between groups of stakeholders.
- Future important methods of communication for project stakeholders were presented, discussed and evaluated at the workshops. The most effective were considered by participants to be face to face meetings, including workshops, but also more hands on events such as field visits and forest demonstrations.
- Now and in the future we aim for the PROTREE project to continue to offer opportunities for a wide range of people to get actively involved and to help to shape research that is relevant, practical and effective.

Introduction to the workshop

Tree Health is a major concern for all those who manage trees and forest in Britain today. Science is an important part of coping with the problem, but to have an impact research must remain firmly rooted in the realities of tree and forest management on the ground.

On Monday 15th December we held a one-day workshop at the Centre for Ecology and Hydrology on the Bush Estate in Penicuik. This was the first stakeholder workshop of the PROTREE* project and aimed to outline the PROTREE research plans and seek the active input of a range of relevant stakeholders to make sure the science in the project stays relevant to the management challenges faced by all interested parties.

The PROTREE project started in April 2014 and will finish in March 2017 and is funded through the LWEC (Living with Environmental Change) Tree Health and Plant Biosecurity Initiative (http://www.bbsrc.ac.uk/funding/opportunities/2013/tree-health-and-plant-biosecurity-phase2.aspx).

A key part of the project is to ensure the research addresses the needs of stakeholders and produces results that can be used on the ground. A lot of work will be done throughout the project to promote communication and collaboration with all interested parties.

As part of this aim, the workshop in December 2014 was intended to:

- give participants a chance to identify their experiences and issues which will feed into current research
- get participants' voice heard by scientists and policymakers
- build a network of individuals and groups who have a stake in healthy and resilient forest landscape

Participants included 40 scientists, practitioners and policy makers (*Annex 1 List of participants*) who took part in an interactive, participatory workshop. More detail on the programme can be found in Annex 2 (*Workshop programme*).

General introduction to the PROTREE project

It has been made clear by examples such as Ash Dieback, that our trees face a serious threat from new diseases and pests. As trees are everywhere and are well-loved parts of our landscape, an important part of our economy and an essential part of our biodiversity, their loss has serious consequences. However, dealing with each new threat as it comes along is difficult, expensive and potentially futile as threats can evolve so much faster than their tree hosts. Also, tree health is not just about a single pest or disease, but about growing trees in the right place, about keeping population sizes up, about ensuring seedlings get a chance to grow and about allowing forests to change as the environment changes. So, in order to find a

sustainable long-term strategy for keeping our trees healthy, we need to consider the range of real and potential threats that trees face and try to deal with these together. At the same time, we need to ask what is possible for changing the way we grow trees: how do we use trees now, what do we want from our trees in the future, and how much change we are willing to accept. By finding a middle ground, that brings together the best biological knowledge with a clear understanding of the possible ways to adapt, we can give our trees the best possible chance of withstanding new threats.

The most important part of finding a way to do this is bringing together many different groups of people, with a range of experiences and different types of knowledge. A lot is known about many of our trees already, but usually this knowledge comes from unlinked, independent studies and rarely do results from one study tell us something about another, even for the same tree species. Much better coordination is needed. To show how this can be done, we aim to use the example of Scots pine, an important native tree species.

For Scots pine, we know of several serious threats that are either here or are likely to reach the UK soon. The remaining native Scots pine forests are small and fragmented, but we know that they are adapted to their local environments: so pine trees from one part of the country grow differently than those from another. There are large plantations of Scots pine in many parts of the UK – there is ten times as much planted as remains in the native forests – and these are often at much higher densities than are found in nature, and often alongside plantations of pines from other parts of the world. There is also a strong cultural attachment to the species; in many places pinewoods are being replanted and it is often used as a garden or amenity tree.

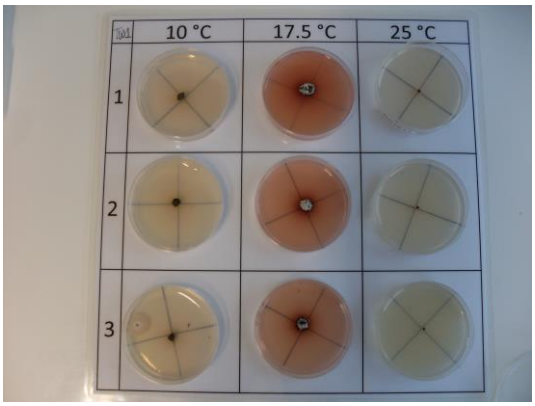
The PROTREE project aims to measure how variable and adaptable the threats are to Scots pine, to test how much variation there is in the tree species in resistance to these threats, and to find ways to get people involved in making healthier pine forests. By doing this we also aim to show how the same approach can be taken for any other tree species, and to put in place the tools for getting it done. We will focus on three important threats to Scots pine – Dothistroma needle blight, the pinetree Lappet moth and pine pitch canker. We will bring together a group of scientists – specialists in ecology, tree genetics, forest pathology, plant biochemistry, fungal ecology and evolution and social science – who will work together on the same, carefully chosen pine trees. This work will tell us how much the UK Scots pine population varies and how much it can change from generation to generation; how populations of the threats grow and change; and what can be done to make the pine forests we have more resilient. We will bring in lessons from crop agriculture, where similar problems have been faced for generations, and adapt these for trees and forests, that have much longer lifespans. Finally, by talking to people who work with and use trees, and the general public, we will find ways to use this information to make things change on the ground.

Scots pine is an ecologically and economically important UK native species. As well as substantial planted forests (roughly 10 times the area of remnant native woodland), there are 81 recognised old-growth native Scots pinewoods – the only remaining UK habitat with a continuous history going back to the postglacial colonisation. Recent work has demonstrated local adaptation to environmental variation in the UK native population. However neutral

genetic diversity is high, pollen dispersal distances are long and population structure very low, suggesting that local adaptation results from local divergent selection acting on a gene pool common to all populations. This is an ideal scenario within which to pursue genetic signatures of selection, as searches for markers related to traits are unconfounded by population structure; furthermore, the rapid decay of linkage disequilibrium typical of the pine genome means that positive identifications are likely to be very close to or within the relevant gene. To pursue the genetic basis of these adaptive patterns, a database of genomic variation has been established, which included 164,784 single-nucleotide polymorphisms (SNPs) in expressed genes, some involved in traits relevant to pest and pathogen resistance.

The PROTREE work programme will focus on five key studies:

EXPERIMENT 1: Evolution of Dothistroma Needle Blight (DNB). Lead: Prof Richard Ennos. Others: Marta Piotrowska, Carolyn Riddell, Peter Hoebe (for contact details see Annex 2).

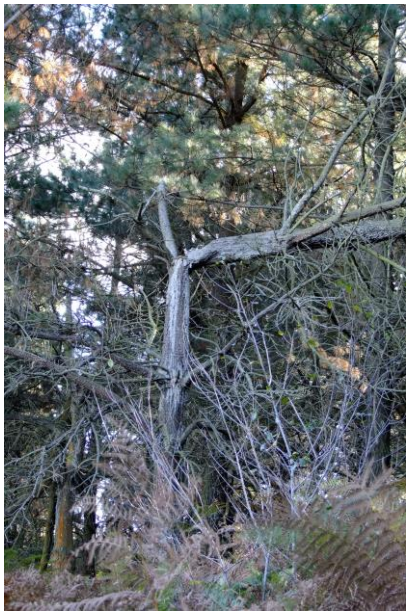


The current dramatic increase in DNB damage to pines in the northern hemisphere may be due to climate change and / or forest management driving evolution of a more virulent form the pathogen. The experiment will use DNA sequencing to compare DNB populations in managed and unmanaged forest to see if human activity like fungicide use or planting of non-native trees has accelerated evolution of the pathogen.

EXPERIMENTS 2-5: Scots pine trees from different parts of the country are known to grow slightly differently due to being adapted to their local environments. One part of the project (Experiment 5) will focus on measuring these differences in detail and understanding what it is about the environment that is important in shaping them. However little is known about differences in susceptibility to various pests and pathogens. If we grow trees from different places together on one site, we can see these differences easily and measure them. In a series of experiments (2-4), the project will test for variation in susceptibility to DNB, pine pitch canker and the pine tree lappet moth.

EXPERIMENT 2: Variation in resistance to DNB in Scottish Scots pine. Lead: Annika Perry. Others: Stephen Cavers, Anna Brown (for contact details see Annex 2).

The fungus Dothistroma needle blight has emerged as a major threat to both exotic and indigenous pines, causing substantial damage to plantations. Since the 1960s a dramatic escalation in disease damage levels has been observed leading to death of trees in some stands. In Britain major disease outbreaks have occurred since the 1980s on exotic Corsican and lodgepole pine, and more recently Scots pine.



EXPERIMENT 3: Variation in resistance to pine pitch canker in Scots pine. Lead: Steve Woodward Others: Hazel Davidson (for contact details see Annex 2).

The fungus is highly virulent attacking Pinus species, causing pitch canker. Native to Mexico, it has spread into many of the major pine growing areas of the world and, in the early 21st Century, was discovered in southern Europe. It is arguably the most important pathogen of pine seedlings in nurseries, causing extensive mortality; mature trees may also die. Based on knowledge of spread of the pathogen to date, there is an extremely high risk that F. circinatum will spread further in Europe and Scots pine has proven highly susceptible to infection.

EXPERIMENT 4: Variation in resistance to Pine-tree lappet moth in Scots pine. Lead: Glenn Iason. Others: Roger Moore (for contact details see Annex 2).

The moth specialises on Scots pine trees, although it also uses other coniferous species. Its caterpillars can cause significant defoliation in some parts of its natural range and a breeding population was discovered in Scotland in 2009.

EXPERIMENT 5 Genetic diversity in Scottish Scots pine. Lead: Stephen Cavers. Others: Dan Chapman, Glenn Iason, Joan Cottrell, Jo Taylor, Richard Whittet (for contact details see Annex 2).

This work will focus on measuring the genetic variation within Scots pine in Scotland, and identifying the parts of the environment that have shaped this evolution.

Stakeholder values, knowledge and practices: developing feasible options for improved resilience. Leads: Juliette Young, Mariella Marzano (for contact details see Annex 2).

A key part of the project is to ensure the research addresses the needs of stakeholders and produces results that can be used on the ground. A lot of work will be done throughout the project to promote communication and collaboration with all interested parties.

Workshop Process

The first part of the workshop focussed on a general introduction to tree health issues, and the PROTREE project. Stephen Cavers (CEH) opened the workshop by welcoming all participants and outlining the aims of the workshop. Jill Thompson (CEH) introduced herself and her role as science coordinator of the Tree Health and Plant Biosecurity Initiative (or THAPBI)[1]. Hugh Clayden from the Forestry Commission Scotland gave a presentation on the tree health landscape in Scotland, before an overview from Chris Quine (Forest Research) on a Defra-funded project on the Social and Economic analyses of Dothistroma Needle Blight management. Finally, Stephen Cavers and Work Package leaders provided an introduction to the PROTREE project. All presentations are available on the PROTREE project wiki.

Following on from these overviews, the workshop followed a participatory approach adapted from the 'world café'[2] methodology. Participants were invited to join one of three facilitated round tables (one or two facilitators moderated each table). Each table was assigned a specific theme and participants discussed in parallel each topic for 45 minutes. They were then invited to change table/topic, form new discussion groups and consider the theme assigned to the second table for 45 minutes. Finally participants changed table for a last round that would allow them to address a third theme.

The following themes were the focus of the break-out groups:

- Break-out Group 1: Planting the right tree in the right place: factors affecting tree performance in different places. Facilitated by Stephen Cavers (CEH), rapporteur Joan Cottrell (FR);
- Break-out Group 2: How pests and pathogens attack: Why and how pests and pathogens become a problem. Facilitated by Richard Ennos (Edinburgh University) and Jo Taylor (RBGE), rapporteur Peter Hoebe (SRUC);
- Break-out Group 3: Putting theory into practice: What are the management options and are they acceptable? Facilitated by Anna Brown (FC) and Hugh Clayden (FC), rapporteur Annika Perry (CEH).

The carousel of discussions concluded with a short plenary reporting from the table facilitators summarizing the key points each table had identified for each theme, and highlighting opportunities for future collaboration with stakeholders.

Finally, an interactive session was available for participants to explore the most effective means of communication and knowledge exchange. Means of communication displayed included films, podcasts, animations, and exhibition installations. For a description of media presented, see Annex 3.

[1] http://www.lwec.org.uk/activities/tree-health-and-plant-biosecurity-initiative
[2] http://www.theworldcafe.com/

Workshop summary

Theme 1: Planting the right tree in the right place: Factors affecting tree performance in different places

1. Seed zones and seed sourcing policy

    - Need to consider whether the delineation of seven zones is overly prescriptive
    - Since the seed zones were established, more data has become available on the distribution of adaptive variation within and between native Scots pine remnant populations
    - Environmental conditions in Scotland, to which Scots pine may be adapted, can vary over a very narrow geographic scale
    - May be more appropriate to devise a system that is based on matching source and planting site conditions.

2. Problems with seed supply

    - Adherence to plant sourcing advice can, and has, led to problems in supply of planting material
    - Foresters depend on nurseries to supply healthy plants of the appropriate provenance to meet their planting needs
    - More needs to be done to clarify and identify problems in the plant supply chain
    - Nursery sector tended to feel that they have always been the ones who have had to shoulder all the risk and there is a feeling that this is unfair
    - To reduce risk, it would be helpful to [the nursery sector] to have at least two years forewarning of the need for plants (but WGS typically requires action within 1 year)
    - Due to constraints based on disease concerns on planting of ash, Scots pine and larch, the demand for Sitka spruce has increased from 29% of the total plants supplied to 50%. Need to review choices of planting stock for Sitka.

3. Sources of Scots pine seed for commercial plantations of Scots pine

    - Most commercial Scots pine plantations are based on seed produced from FC seed orchards (mostly from A70) which are based on tested clones collected from across Britain which are superior in terms of height and stem form (for details see Lee 1999[3])
    - Original provenance of these clones often unclear and they may have experienced introgression from introduced German material.
    - Need for new commercial seed orchards of Scots pine to be established.
    - Difficult to trace seed back to origins even when resistant types are observed.

[3] Lee S.J. 1999 Genetic gain from Scots pine: potential for new commercial seed orchards. Information Note FCIN27

- Lack of easily searchable records was an issue and funding to make such records more accessible was desirable.
- Big breeding programmes for species such as larch and Douglas-fir exist elsewhere in Europe and these provide a source of improved seed for British nursery needs.
- No continental source of improved material of Scots pine and British requirements for commercial plantations are served by the FC seed orchards alone.
- No testing of the material in these orchards for disease or pest resistant traits - might have been beneficial to have included this material in the current trials.
- Lack of guidance on which seed source should be used to plant Scots pine plantations in places as far south as Devon was mentioned.

4. Are our Scots pine ecosystems resilient to climate change and threats from pests and diseases?

- Concerns raised that trees growing now might not be resilient to climate change and, if mature Scots pines were lost, the ecosystem they support may also be lost.
- Although it was agreed that the remnant Caledonian pinewoods retain high adaptive potential to adapt to changing future conditions, some people still worried that the loss of veteran trees might alter the conditions for organisms which depend on these trees.
- Discussion required on action to take if loss of mature trees reaches levels that will endanger the ecosystem itself.
- Need to be clear about the different objectives of conservation woodlands and plantation forests.

5. How can we find resistance to disease in our current woodlands?

- There is no such thing as total resistance to disease: some individuals are less susceptible than others.
- Felling all Larch where disease is detected risks the loss of resistant genotypes, although retaining symptomless trees probably difficult due to wind damage if all surrounding diseased trees were felled
- Some stands of infected larch have been retained to allow identification of resistant individuals and to study the disease.
- Establishing research forests where more experimental management approaches could be tested would be valuable.

6. Learning from agricultural systems

- Use of single inbred varieties in crops such as cereals is declining in favour of a mixture of varieties.
- This reduces the risk of losing an entire crop to disease, lowers the amount of pesticide and herbicide and results in less damage by herbivores.
- Establishment of plantations based on a low number of clones has been adopted in forestry for species such as poplars, but disease resistance of clones is short lived as pathogens quickly evolve. Hence new clones needed continually.

- Most forestry plantations contain high levels of genetic diversity, hence have a high potential to be resilient and to adapt and evolve to threats such as climate change and novel pests and diseases.

Theme 2: How pests and pathogens attack: Why and how pests and pathogens become a problem

- Use of exotic species in Scotland for forestry
    - Policy driven is the consensus but no need for this
- Gap between policy makers and scientists
    - Policy makers are not paying enough attention to scientific research
- Need for new species in forestry?
    - Point was made that there is enough information in historical records from neglected species/varieties that could do as well as novel material
- Matching of environment to the tree species
    - Discussion about specific genotypes for environments on a local scale which would also deal with disease problems which ties in with local nurseries
- Fungicide use in nurseries
    - Is fungicide use effective enough, could there be space for improvement?
- Is DNB endemic or not?
    - Is DNB present in 'natural' forests and kept at bay by coexisting micro organisms
- Who should bear the cost of crop destruction after DNB infection
    - Nurseries feel that they should not bear all these costs since it is a society driven policy
- Effect of fungicides on cohabiting micro communities on needles
    - This ties in with the earlier point of endemic DNB, do fungicide treatments preferentially affect certain micro-organisms leaving space for others to take over and turn from symbionts into pathogens?
- Spraying trials
    - Ties in with fungicide use, what is the most effective spraying regime
- Effect of thinning and planting densities
    - Directly affects disease levels which are low at low densities
- Need for local nurseries?
    - Local nurseries for local needs, disease would be restricted to confined areas
- Conflict of conservation and forest management especially thinning
    - Ties in with planting densities, certain conservation managements prefer high densities to comfort certain organisms which is in direct conflict with disease risk
- Mixtures/mosaic of tree stands for sustainable management
    - How effective is species diversity at stands to keep disease at bay?
- Use of deer for keeping forest at bay

    - Deer would graze on young plants keeping forest low density which would complement conservation and forestry management.

Ideas for future collaboration were mostly to do with nursery contacts and visits and hopefully exchange of material to compare.

Theme 3: Putting theory into practice: What are the options and are they acceptable?

Ten major points emerged from the discussions in this group. They were the following:

- **Procurement rules** – Woodland Trust have now put in their contracts that they will only buy trees which have been grow in the UK, but this is not standard across the board, but this being made standard practice might improve the situation?
    - EU free trade rules means you can't do anything which gives one country an unfair competitive advantage
- **Agriculture vs Forestry**: The situation in agricultural is quite different than forestry – e.g. effectiveness of fungicides, approval of use of certain types of fungicides, development of fungicides (off-label approval is relatively straightforward)
    - Some confusion about measures which may be publically acceptable in agriculture but not forestry
    - Misunderstanding what is legislatively possible – expectation that things are not allowed when they are (e.g. UKWAS and FSC forestry certification scheme)
- **Cooperation and communication between nurseries**: There are about 30 active tree nurseries in Scotland with 9 main pine producing nurseries – bringing these groups together is very important
    - People are keen to use an **integrated management option**, rather than relying on one treatment/option
    - BUT what should be done in the meantime while options which may take longer to take effect are still in early stages
- **Some management options affect the long term resilience of forests**, and would have impacts on e.g. wider ecosystem or resilience to other pests/pathogens
    - How do we go about getting a balance?
    - How to avoid using the cheapest short-term option
    - Potential negative long term impacts if there is a uniformity of response
    - Expected that different tools will be used under different scenarios
    - Guidance on landscape scale and stand scale is required
    - Different districts, and different areas within the districts will use different strategies – case studies?
- **Weak in silvicultural skills**, particularly thinning – toolbox would be strengthened with case studies
    - FES have a 'thin whenever you can' approach
    - Would be beneficial to provide more detailed information on the basics especially when they aren't used commonly any more

- **Certification** – you are supposed to reduce (year on year) your chemical reliance – doesn't square with long term management of pests and pathogens
    - Suggested that it would be better to reduce to a minimum level, need evidence that other approaches don't work, and that chemicals do and that it is a problem
    - Not unique to the forestry industry (EU wide) that all avenues have to be explored prior to the use of chemicals
    - BUT this justification could be done at a higher level and not each individual land owner doing it separately
- **Using management of DNB as a model**: the decision making for management of Dothistroma has been very successful – could use as a model for other systems where it has not been so good
- **Use of fungicides in nurseries**: If infection is suppressed rather than eradicated by fungicides, especially in nursery use – it shifts the infection cycle and can mask symptoms, rather than preventing it (and may result in complacency?)
    - The only fungicide which is used all the time (not just when it is required) is copper for DNB – but even though they may not be used to an excessive degree, if they are banned it will have a massive impact on what nurseries will grow (because when they are used, it is deemed essential)
    - Use of high-risk systemic fungicides in nurseries which may increase the possibility of resistance in DNB evolving is a concern, as well as the small current selection of approved fungicides (lack of choice)
    - In agriculture, fungicides are used more frequently with a greater intensity
- What is the **quantified risk** of planting susceptible species in the long term as a result of changes in the pathogen - hybridisation, evolution of greater virulence in Dothistroma etc?
    - Very difficult to get sexual reproduction in lab
    - Genetic admixture is relatively low
    - Concern about impact of genetic changes in the pathogen on shifts in the 'behaviour' of pathogens
- **Why aren't management options which will clearly be very effective not being currently used more frequently?**
    - 13-14 options in the toolbox – 6 of these are lacking in evidence (may be evidence in other countries/systems but not DNB in Scotland) but these are not necessarily being done across the board – why?
    - Primary seems to be economic
    - Knowledge transfer – getting the information out there
    - Tying these options to receiving grants – possibility that until these options are grant-aided, they are not commercially viable
    - Where crops are badly infected and close to harvestable age – clear felling is a good option and is being used, but they are also therefore felling trees which may be more resistant but clear felling is still used as a precautionary approach – there is no incentive to make further use of potentially resistant trees within these stands

- **Getting key messages (e.g. biosecurity practice when harvesting) out to industry, and for them to implement them**
    - Guidance is out there but the information is obviously not getting out there – why?
    - Cut red tape as there is already so much out there
    - Unless something is statutory or accepted practice it is difficult to expect them to be implemented
    - The need to do it must be proved to the industry – especially in terms of the long term economic and impact
    - Keep it simple
    - This is a marketing problem and needs to involve marketing experts
- **Targeting individual companies**
- **Should all infected stock be completely destroyed?** Potential scientific value – either in stands (rather than clearfelling) or from nurseries, collaboration with nurseries/foresters and scientists?
    - Difficulty in the use of fungicides in nurseries, so infection is never very high
    - Some problems with provenance labelling etc.
    - In Scotland – potentially asymptomatic plants are not necessarily destroyed
    - Only nurseries have legislation on this issue
- **Leading by example** – rather than shifting responsibility to groups where possible
    - Legislation would prevent ambiguity with the issue of e.g. biosecurity
    - Very strict biosecurity measures are often only possible to implement and police in the short term (e.g. foot and mouth) and are not realistic to maintain over long term/permanent
    - Difference between maintaining e.g. biosecurity measures
- Establish a **sub-regional forestry forum**
    - Primary aim is communication and to establish a regional approach to the problem
    - Bringing together sub-regional groups with forest interests - plant health, deer management, hauliers, etc. controlled by practitioners
    - Easier to use an existing structure
    - FC haven't had any requests for something like this to be stimulated to date
    - Producing e.g. a newsletter to disseminate information? Pilot for tree health at a regional level has started
- Tree health should be a much larger part of a **management plan** (should this be a requirement)
- **Research forests** have not been used sufficiently effectively – would be good to take foresters out to demonstration areas as well as using them for research
- **Christmas tree growers** – very little pine moving around (more fir, spruce etc.) and therefore low risk market for DNB, but potentially other diseases
    - Trees tend to be very heavily treated with chemicals in order to prevent appearance being affected

Exploring the most effective means of communication and knowledge exchange

All workshop participants were asked to explore different forms of media (see Annex 3), and then select the relevance and appropriateness of different media in the context of the PROTREE project. The results from the questionnaire are presented here.

Type of communication media (Qs1; 2; 3)

Three questions were about the type of communication media people were most familiar about, if they liked them or whether these types of media were considered effective. Four types of communication were most appreciated rated as being most effective: flyers, reports, posters and videos. Podcasts and portable exhibitions were liked but people were generally less familiar with them and as such were unsure of the effectiveness of those media. The project coordinator is no doubt quite relieved that stand-up comedy was not generally considered effective by workshop participants.

Communication of PROTREE (Qs4; 5; 6; 7)

The questionnaire results highlight that all participants felt that a wide range of people (general public, industry stakeholders, NGOs and policy stakeholders) should be informed about PROTREE and its results, but not necessarily using the same media for all potential audiences.

	Videos	**Animation**	**Portable exhibitions**	**Reports**	**Flyers**	**Posters**
Public	X	X	X			
Industry			X	X	X	X
NGO			X	X	X	X
Policy	X			X	X	

• For the general public, workshop participants agreed on videos, animations and portable exhibitions as the most effective forms of communication.

• For industry stakeholders, workshop participants agreed on reports, flyers, posters and portable exhibitions as the most effective forms of communication.

• For the NGOs, reports, flyers, posters and portable exhibitions were considered the most effective forms of communication.

• Finally, for policy stakeholders, reports, flyers and videos were considered the most effective forms of communication.

Future important methods of communication for project stakeholders were considered to be face to face meetings, including workshops, but also more hands on events such as field visits and forest demonstrations.

The best ways to contact stakeholders were identified as being through clear and short emails, regular newsletters, updates on the project website and regular workshops.

Website (Qs7 to 10)

We asked workshop participants to provide feedback on the PROTREE website. Participants emphasised the need for the PROTREE website to be simple, up to date, with a clear and consistent style, informative, containing links of tree health initiatives and information. In terms of content, participants wanted the website to contain in-depth reports and short summaries, news items, videos and a discussion forum.

Conclusions and Next Steps

The workshop was an excellent opportunity to get a wide range of people interested in tree health together, introducing them to the PROTREE project and have interesting discussions. A number of important topics were raised during the workshop, as outlined in this report, and we hope these discussions continue throughout the lifetime of the PROTREE project, through direct one-to-one contact between the project researchers and interested parties at meetings, annual workshops, field visits and forest demonstrations, and other communication through the project wiki forum and regular email updates.

We hope this workshop has started the process of forging some strong new links. Over the next couple of months we will try to initiate the specific collaborations proposed at the workshop, and will also contact those interested parties who could not attend the workshop to see how best to engage with them. In the meantime, it would be very helpful for those who attended the workshop to talk to their colleagues about the PROTREE project, and encourage anyone who is interested to get in touch with us to see how they could become involved.

Now and in the future we aim for the PROTREE project to continue to offer opportunities for a wide range of people to get actively involved and to help to shape research that is relevant, practical and effective.

List of Annexes

Annex 1: List of participants.

Annex 2: Workshop programme.

Annex 3: Examples of media presented for effective communication

Annex 1: List of participants

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N.B. Participants in italics are part of the PROTREE research team.

Annex 2: Workshop programme

10.00-10.30 Registration and coffee on arrival

10.30-11.45 Welcome and introductions

Stephen Cavers – Opening message

Jill Thompson – Introduction to new role in LWEC

Hugh Clayden – Tree Health issues

Chris Quine – Overview of Defra-funded project - Social and Economic analyses of Dothistroma Needle Blight management

Stephen Cavers and Work Package leaders- Introduction to the project

11.45-12.30 Knowledge café - Group activities to explore three key themes:

Discussions should aim to focus on how scientists and stakeholders can collaborate on understanding the following:

- Planting the right tree in the right place

  Factors affecting tree performance in different places
- How pests and pathogens attack

  Why and how pests and pathogens become a problem
- Putting theory into practice

  What are the options and are they acceptable?

12.30-13.00 Lunch

13.00-14.30	Knowledge cafés
14.30-15.15	Exploring the most effective means of communication and knowledge exchange: Interactive session including exhibition with films, podcasts, animations, mobile installations
15.15-16.30	Identifying opportunities for future collaboration and next steps
16.30	Coffee available at finish for networking

Annex 3: Examples of communication media

Video (4:06):
https://www.youtube.com/v/fMHq3NZSl9U?version=3&loop=1&playlist=fMHq3NZSl9U

Inverkeithing High School students produced this video using footage shot during a school visit to the Royal Botanic Garden Edinburgh. Producing good sound quality and interesting editing with cut away sequences does require time and practice. The school has a group called The Media Network that has developed considerable experience.

Video (2:59):
https://www.youtube.com/v/tJBhKc1ya_U?version=3&loop=1&playlist=tJBhKc1ya_U

This short video was made to advertise an HND course and is a good example of using a series of talking heads with interesting cut away sequences. The video was produced by a self-taught film maker who has gained considerable experience. The strength of the film is in the introduction and the ending using the same person. The invitation to get in contact at the very end is an important element.

Animation (3:51):
https://www.youtube.com/v/lkZlDdm085g?version=3&loop=1&playlist=lkZlDdm085g

Stop motion animation is something that could be created by the researchers themselves if they had some time and creative skills. This example was created to communicate the findings of ecological research on the impact of pine plantations on connectivity of native forest habitat for birds. No audio commentary is provided but the music is a key part of the finished video.

Animation (2:36): https://www.youtube.com/v/HIll-_blL5c?version=3&loop=1&playlist=HIll-_blL5c

This animation was professionally produced to communicate the issues around ash dieback. It was intended to stand alone and to provide a point of interest within a static panel display containing further information and images. The display and video travelled Scotland as it was designed to be relatively easily moved. A more mobile fabric version of the display was also created.

Video of scientist doing stand-up comedy (10:36):
https://www.youtube.com/v/9eBlxgbYBTU?version=3&loop=1&playlist=9eBlxgbYBTU

Dan Ridley-Ellis of Edinburgh Napier University has used stand-up as a way to communicate his research in wood science. This video is about the selection of a national tree for Scotland. It is an example of how very amateur video skills can be acceptable if the speaker is sufficiently engaging.

Podcast (9:18): http://planetearth.nerc.ac.uk/multimedia/story.aspx?id=1523

This podcast from the NERC Planet Earth Online website explores how genome sequencing might enable disease resistance genes to be identified in ash trees as a way to tackle ash dieback through tree breeding.

Podcast (10:31):
http://www.thenakedscientists.com/HTML/content/interviews/interview/1000020/

This podcast from The Naked Scientist at Cambridge University explores what ash dieback is and the possible consequences of this disease spreading through Britain.

Mobile displays: To communicate the potential impact of ash dieback a display was created in two forms. One was wooden and had an inset screen to play a short video and the second was fabric over a metal frame and was readily moved to different venues. The more mobile version is displayed here.

Examples of **project posters, flyers and reports** were also displayed, discussed and evaluated by participants.