Tree Health and Plant Biosecurity Expert Taskforce

Final Report

20th May 2013

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Chairman's Foreword

Trees are an iconic part of our landscape. Many are long-lived, representing long-term investments that provide environmental, social and economic benefits that are realised over several human generations. Our trees provide direct economic benefits from timber and wood products for the construction, furniture, paper and biomass industries. They have immense recreational, amenity and aesthetic value in countryside, towns and cities. Trees are also an integral part of ecosystems, supporting biodiversity and resilience and promoting stability in natural and semi-natural woodlands. They absorb pollutants, protect water quality and sequester carbon which helps mitigate climate change.

Trees are also susceptible to attack by pests and pathogens. Some of these can spread quickly over large areas causing rapid death or decline of trees. The problems are exemplified by the recent incursion of Chalara into the UK, following spread across the European continent, where the pathogen killed many ash trees. The devastating effects of an earlier epidemic involving Dutch elm disease during the 1970s are still evident in the UK landscape. New diseases, such as acute oak decline and ramorum disease on larch, are already here and spreading. Others, such as chestnut blight, are known to be approaching the UK as they enter and become established in nearby countries.

The numbers of new tree pests and diseases recorded in the UK are increasing. The UK needs to be better prepared in understanding the risks of what pests and diseases are likely to arrive, when, where and how they might invade, how severe the impact is likely to be and what options are available for interception, eradication, mitigation or adaptation. This Taskforce was established by the Defra Chief Scientific Adviser, Professor Ian Boyd, in order to consider these issues and to make recommendations about how the UK should protect tree health and strengthen plant biosecurity.

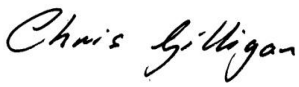
The Taskforce has undertaken an intensive review of current threats and practices, publishing an interim report in December 2012 in which we presented our initial recommendations together with a list of crucial knowledge gaps. Building upon feedback from the wide stakeholder community, and additional reviews of national and international practice, the Taskforce now presents the final report. The supporting evidence for each recommendation has been carefully reviewed, as has the tractability for practical implementation of the recommendations. Knowledge gaps have also been reviewed in relation to policy and implementation needs, as has the information on pest and pathogen threats.

Our recommendations address what the UK can do in the national and international context. The recommendations range from the development of a Plant Health Risk Register in order to identify and prioritise the main risks, through implementation of

procedures for preparedness and contingency planning, to strengthening biosecurity at the borders and to minimising the impacts of pests and disease within the UK. We also address governance and leadership for strategic and tactical responses to pest and disease threats. The report proposes the roles to be played by Government, industry, other stakeholders and the public. We consider how to improve communication using modern, user-friendly methods to provide quick and intelligent access to information and we identify skills shortages. While it is clear that some investment will be necessary, if we are to protect the long-term health and investment in our trees, some changes can be achieved by doing things differently, making use of modern technology for diagnostics, predictive modelling and information sharing.

The remit for the Taskforce was expressly directed at trees and related woody species but it is clear that plant biosecurity encompasses pests and diseases of other plants. These include agricultural and horticultural food crops, biomass crops, indigenous vegetation and ornamentals. The withdrawal of widely used fungicides and pesticides and the failure of others due to selection for resistance amongst pests and pathogens are increasing the risks of crop loss. The effectiveness of some forms of genetic resistance are also under threat. These are exemplified by the risks of significant crop losses from the rapid, continental-scale spread of new virulent strains of wheat stem rust and yellow rust that are capable of infecting previously resistant crop varieties. Many of the actions that underpin our recommendations for tree health could be readily extended to include a wide range of plant species.

I gratefully acknowledge the dedicated work and generosity of time, given by members of the Taskforce in meeting and in producing both the interim report and this final report in a short period. The Taskforce undoubtedly benefited from the broad and valuable input on current practice of various stakeholder organisations, as well as from an advisory group of officials, with membership drawn from Defra, the Forestry Commission and the Defra Network organisations. I am also grateful to Border Force officials for advice on border issues and to the UK Chief Veterinary Officer and his colleagues who provided valuable insight and lessons from their experience of preparing for and tackling animal disease outbreaks. Finally, I would like to thank the government officials who have supported the work of the Taskforce and Professor Ian Boyd, for his insight and support.



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I. Executive Summary

Background

Plants are vital, yet often taken for granted. They contribute significantly to our natural environment and social wellbeing, as well as to the productivity and competitiveness of several commercial sectors. In the last few years, several new and/or previously unrecognised pests and pathogens have emerged as significant risks to the UK's crops and other plants, including trees in woodlands, commercial forests and in the urban environment. These threats have increased with globalisation in trade and travel and the resulting escalation in volume and diversity of plants and plant products entering the UK[1]. This, in turn, has led to a build-up in the number of harmful plant pests and pathogens. The changing frequency of extreme weather events may also result in new pest and pathogen threats and may also amplify the impacts of those already here[2]. Once they become established, pests and pathogens can cause a wide range of adverse impacts on landscapes and biodiversity, timber and crop production and, in certain circumstances, human health. Responding to this mounting pressure is a challenge facing public and private landowners, farmers, foresters, local authorities, Government services and non-governmental organisations.

Given this background, Defra's Secretary of State asked the Chief Scientific Adviser to Defra, Professor Ian Boyd, to establish an independent, expert Taskforce to provide advice on threats from pests and pathogens and to recommend how to protect the UK from those threats. The Taskforce published an interim report on 6th December 2012 with eight recommendations and a list of knowledge gaps. Building upon feedback on the interim report from the wide stakeholder community, the Taskforce reviewed the evidence base and the likely costs, benefits and practicality of implementation for each recommendation. The conclusions presented in this final report take account of additional reviews of current national and international practice. Our conclusions also benefit from input and engagement with stakeholders, an advisory group of officials with membership drawn from Defra, the Forestry Commission and the Defra Network organisations, advice from Border Force officials, and from independent peer review.

[1] Brasier, C.M. (2008). The biosecurity threat to the UK and global environment from international trade in plants. *Plant Pathology* **57** (5), 792-808.

[2] Garrett, K.A., Forbes, G. A., Savary, S., Skelsey, P., Sparks, A. H., Valdivia, C., van Bruggen, A. H. C., Willocquet, L., Djurle, A, Duveiller, E., Eckersten, H., Pande, S., Vera Cruz, C. and Yuen, J. (2011). Complexity in climate-change impacts: an analytical framework for effects mediated by plant disease, *Plant Pathology* **60** (1) 15-30.

Key Recommendations

A. National Context

- Develop a prioritised UK Plant Health Risk Register.
- Appoint a Chief Plant Health Officer to own the UK Plant Health Risk Register and to provide strategic and tactical leadership for managing those risks.
- Develop and implement procedures for preparedness and contingency planning to predict, monitor, and control the spread of pests and pathogens.
- Review, simplify, and strengthen governance and legislation.

B. International Context

- Improve the use of epidemiological intelligence from EU/other regions and work to improve the EU regulations concerned with tree health and plant biosecurity.
- Strengthen biosecurity to reduce risks at the border and within the UK.

C. Capabilities and Communication

- Develop a modern, user-friendly system to provide quick and intelligent access to information about tree health and plant biosecurity.
- Address key skills shortages.

The Taskforce considered the current threats to tree health and, how, when and why future threats are likely to arise, and what current protocols are in place to detect, prepare for and respond to pest and disease outbreaks. The evidence shows that tree health in the UK continues to be at significant risk from pests and diseases. Some pests and pathogens

have arrived recently and are becoming established. Others are present and spreading in EU member states, posing risks to the UK from entry by trade or other means of dispersal; while risks also arise from inadvertent transmission either directly into the UK or indirectly via countries from beyond the EU[3].

The Taskforce concluded that current arrangements are not satisfactory and action needs to be taken if tree health and plant biosecurity are to be improved. Some investment will be necessary but the advantages of minimising environmental, social and economic impacts from pests and disease will be considerable. Moreover, the recommendations are designed to improve the effectiveness of current resources by raising awareness of the need for biosecurity amongst Government, stakeholders[4], and the public. Further efficiencies accrue by making greater use of modern technology, including modelling, surveillance and diagnostics, by making better use of current legislation and by directing efforts according to risk-based assessments of threats to plant biosecurity.

The Taskforce observed that there are numerous risk assessments for individual pests and pathogens at both the national and European levels but concluded there should be a single national Plant Health Risk Register. The purpose of the risk register is to identify and prioritise the risks of those pests and pathogens that pose the greatest threat, including the probability of entry of exotics or the occurrence of new strains of indigenous species. The risk register should take account of pathways of entry and establishment, including private and commercial import, introductions by air, soil, timber, seeds, saplings, and by other means such as plant parts and wood packaging. The risk register should also include endemic pests and pathogens that continue to pose serious threats to tree health. Horizon scanning, with wider stakeholder involvement, is an essential component of the process. The risk register would inform choices and policy options, as well as identifying how best to deploy resources most effectively to manage a range of threats.

The Taskforce highlighted the need for a Chief Plant Health Officer, at a senior level, to be responsible for owning key risks and managing outbreaks. The Chief Plant Health Officer would be responsible for preparedness and contingency planning: measures should include methods for detection and diagnosis, efficient epidemiological surveillance to detect early incursions, and pest and pathogen modelling. Models for known threats should be developed in advance while generic models should be available to prepare for novel threats. There is scope for sharing of epidemiological models amongst EU member

[3] Newly arrived or recently established threats include acute oak decline, ramorum disease of larch, Dothistroma needle blight of pine, ash dieback and oak processionary moth. Pests and pathogens currently established and spreading in EU member states include Asian and citrus longhorned beetles, each with wide host ranges, red oak borer, chestnut blight, zigzag elm sawfly and pine pitch canker. Major threats from non-EU countries include emerald ash borer, spruce budworm and sweet chestnut gall wasp, oak wilt and plane wilt.

[4] Stakeholders include non-Governmental organisations, industry, and landowners (both public and private).

states for prediction and analysis of pest and disease spread and comparison of mitigation and control strategies.

Contingency plans should be developed and agreed with stakeholders ahead of incursions. These plans should clearly define the roles of those organisations involved with outbreak response, including the process of communicating with stakeholders.

The Taskforce does not consider that the current legislative and governance arrangements are satisfactory. Responsibility for plant health within and amongst the statutory authorities should be reviewed in order to create a coherent strategy for identification and management of the key threats across the whole of the UK. The Plant Health Act 1967 should be reviewed and updated to include all plants, and rendered consistent with other plant/tree protection legislation.

To minimise the risks of pest and pathogen incursions, control measures should be tightened through more proactive use of existing legislative mechanisms by both the UK and by other EU Member States; for example, by seeking protected zone status[5] *before* rather than after a pest or pathogen arrives in the UK. Businesses that import, or cultivate imported trees and other plants, should take significantly more responsibility for biosecurity, for example, by assuring the provenance of both the plants and associated soils from their suppliers.

There should be promotion of greater awareness of risks posed by plant pests and diseases amongst stakeholders and the public. The Taskforce proposes that no plant material for personal use be imported from outside the EU.

The Plant Passport scheme should be strengthened and also applied to seed as a means of ensuring greater traceability. Changes to EU legislation should be pursued to ensure the Plant Passport scheme is run in conjunction with an industry-led certification scheme so that the key stakeholders are part of the system that ensures good plant health status. Trade, involving new products or a new country of origin outside the EU, should not take place until an appropriate UK risk assessment has been conducted by the industry/importer.

Improved biosecurity arrangements provide an opportunity for growth in trade of healthy plant material and plant products for the UK and other partners. Greater attention to biosecurity could also renew interest in the local production of trees for woodland and amenity planting and the use of natural regeneration, where site conditions and woodland objectives allow.

[5] A zone in the EU, recognised in EU legislation, in which (i) a quarantine pest, which is established in other parts of the EU, is not established in that particular zone, despite favourable conditions for it to occur there, (ii) there is a risk that a pest that is not present in the EU may become established because of favourable conditions which are limited to that zone.

The Taskforce also recommends the development and use of efficient web-based interactive tools to facilitate access to information to enable effective risk-based decisions to be made, and to share up to date information with stakeholders. There are also opportunities for the public to contribute to the collection of data on plants and plant health.

The Taskforce noted with concern certain skill gaps. There has been an erosion in the UK and elsewhere of certain crucial field- and research-based expertise necessary to ensure tree health and plant biosecurity.

Knowledge Gaps

The Taskforce focused attention on knowledge gaps likely to impact on the ability to implement the recommendations. Particular attention was paid to scientific, technological, logistical, social and political issues. Knowledge gaps were identified in epidemiology, surveying and surveillance, detection, mitigation and adaptation strategies, social science, trade patterns, and environmental change. The Taskforce noted that the initiative on Tree Health and Plant Biosecurity[6], coordinated by *Living with Environmental Change,* provides a welcome opportunity to fill some of the key knowledge gaps. However, the Taskforce urged action to halt the decline of natural and social science expertise and to build capacity to address the full range of evidence needs required for actions to protect plant health.

Next Steps

This report represents the conclusion of the work of the Taskforce for the Chief Scientific Adviser to Defra. Government and the stakeholder community will need to consider the package of interdependent recommendations and set out actions in response to strengthen the regime supporting tree health and plant biosecurity. The Taskforce noted that as a helpful first step Defra's Tree Health and Plant Biosecurity Evidence Plan[7] has been adapted to take account of the Interim Report[8] from the Taskforce. To address all of the recommendations, concerted partnership actions by Defra, the Devolved Administrations and a wide range of stakeholders will be required to protect plant health. A review of progress against the recommendations after a year would be an important step to assess impact and direction of travel.

[6] www.lwec.org.uk/stories/tree-health-and-plant-biosecurity-initiative

[7] www.gov.uk/government/uploads/system/uploads/attachment_data/file/181846/pb13929-evidenceplan-tree-health-plant-biosecurity.pdf.pdf

[8] www.defra.gov.uk/publications/2012/12/06/pb13842-tree-taskforce-interim/
https://www.gov.uk/government/publications/tree-health-and-plant-biosecurity-expert-taskforce-interim-report

II. Background

The UK Government has made a long-term commitment to addressing threats to tree health and plant biosecurity. The need to address these threats has taken on additional urgency because of the 2012 discovery of the fungal infection *Chalara fraxinea (Hymenoscyphus pseudoalbidus)* in native ash trees in the UK. The progression of Chalara illustrates the vulnerability of plants in the UK to pests and pathogens transmitted from mainland Europe. There is also a heightened risk of importation of pests and pathogens from other parts of the world. A new variant of Dutch elm disease arrived in the UK in the late 1960s resulting in almost complete loss of mature elms from the British countryside[9]. A number of other pests and pathogens have followed[10]. Some of these are changing the structure of woodlands and threatening the environmental, social and economic value of trees. The Taskforce was established by Defra's Chief Scientific Adviser to consider these issues and to make recommendations on how the UK should strengthen its responsiveness and preparedness in order to strengthen plant biosecurity and support tree health.

Threats to tree and plant health

There has been an increase in the rate at which harmful tree and plant pests and pathogens are becoming established in the UK (see Annex A). This is due to changing trade and movement patterns, possibly exacerbated by extreme weather events[11] and by evolutionary changes to pests and pathogens. These pests and pathogens can cause a wide range of adverse impacts on landscapes and biodiversity, timber and crop production, the economy and, in certain circumstances, human health[12].

Several new or previously unrecognised pests and pathogens have emerged as significant risks in the last few years. Threats to tree and plant health have increased with globalisation; and financial pressures on UK nurseries have led many to reduce costs by

[9] Potter, C, Harwood, T, Knight, J and Tomlinson, I (2011). Learning from history, predicting the future: The Dutch Elm Disease Outbreak in relation to contemporary tree disease threats. *Philosophical Transactions of the Royal Society* **366**:1966-1974.

[10] www.forestry.gov.uk/forestry/infd-6abl5v

[11] www.forestry.gov.uk/pdf/FCRN201.pdf/$file/FCRN201.pdf. Cole, H., Dinon, H., Megalos, M. and Temple, C. (2013).
Healthy Forest, *Managing for Resilience*. North Carolina State University Cooperative Extension. Information Sheet AG 772. www.ces.ncsu.edu/forestry/pdf/ag/ag772.pdf

[12] For example, oak processionary moth is a risk to human health. The larvae (caterpillars) are covered in hairs that contain a toxin and contact with these hairs, or their inhalation, can result in skin irritation and allergic reactions. These problems are particularly significant because oak processionary is often most abundant on urban trees, along forest edges and in amenity woodlands.

purchasing or growing stock overseas[13]. Subsequently, there has been a marked increase in the volume and diversity of plants and plant products entering the UK. UK imports of live plants, foliage, branches, and other plant parts have increased by 71% since 1999[14]. In 1996, the import value of the trade in live plants was £113M (£157M in 2011 prices). This has increased to £287M in 2011, a real rise of 83% in 15 years (data from HMRC trade statistics). With this, comes an increased likelihood of plant pests and pathogens being introduced, spreading through gardens, crops, and woodlands and potentially causing serious damage to our native flora or commercial crops. An increasing number of outbreaks in the UK have highlighted these threats (Annex A); for example, *Phytophthora ramorum* and *P. kernoviae* affecting woodland trees, heathland plants and trees in heritage gardens. Other recent examples include horse chestnut leaf mining moth (*Cameraria ohridella*), oak processionary moth (*Thaumetopoea processionea*), bleeding canker of horse chestnut (*Pseudomonas syringae pv. aesculi*)[15], and *Dothistroma* needle blight on pines.

Native, or alien, pests and pathogens that cause minor damage sometimes change their behaviour and become more damaging. This may result from changes in climate, pollution, land use, or host distribution, or by evolutionary changes in the pest or pathogen populations. For example, *Phytophthora alni*[16] (alder phytophthora) is a hybrid species that is affecting alder in riparian ecosystems (a host not seriously affected by either parent species)[17]. Although not arising directly from a new introduction, such diseases nonetheless need a co-ordinated response.

Trees have a significant place in our rural and urban landscapes and make a vital contribution to our rural economy, heritage, and wellbeing[18]. The National Ecosystem Assessment highlighted the significant contribution of trees, forests and woodland ecosystem services essential to society, as well as through direct economic value and social amenity[19]. The UK has an estimated 3 million hectares of woodland (13% of land

[13] Galloway, A.F. (2013). An overview of the U.K. horticultural market and how influences have affected worldwide industry. Available at https://sites.google.com/site/aghorticulture1/3-global-horticulture
[14] HM Revenue and Customs data: www.uktradeinfo.com
[15] www.forestry.gov.uk/forestry/infd-6abl5v
[16] Ersek T. and Nagy ZA, (2008). Species hybrids in the genus *Phytophthora* with emphasis on the alder pathogen *Phytophthora alni*: a review. *European Journal of Plant Pathology* **122**:31-39.
Bearchell SJ, Fraaije BA, Shaw MW, Fitt BDL, (2005). Wheat archive links long-term fungal pathogen population dynamics to air pollution. *Proceedings of the National Academy of Sciences of the USA* **102**: 5438-42.
[17] Brasier, C. M., Kirk, S. A., Delcan, J., Cooke, D. L., Jung, T. and Man in't Veld, W. (2004). *Phytophthora alni* sp. *nov.* and its variants: designation of a group of emerging heteroploid hybrid pathogens. *Mycological Research* **108**:1172–1184.
[18] Office of National statistics (measures for wellbeing): www.ons.gov.uk/ons/dcp171766_272242.pdf
[19] UK National Ecosystem Assessment: http://uknea.unep-wcmc.org; and www.defra.gov.uk/environment/natural/uknea/

area) contributing ca. £1.7 billion Gross Value Added in 2010[20] to the economy through wood processing (£1.4 billion) and forestry (£0.33 billion). In addition, there is estimated to be a further ~£1.8 billion[21] (2012 prices) per year of non-market benefits (from recreation, biodiversity, landscape, air pollution absorption, protection of water quality, and from carbon sequestration to help mitigate climate change)[22].

The importance of tree health to people in Britain is underlined by the strong cultural values associated with the countryside and rural spaces, and the cultural, affective, and symbolic meanings of woods and trees for very many people in Britain[23]. The significant response of the public and the media to the Chalara outbreak illustrates how threats to tree and plant biosecurity hold the potential to drive very significant social and institutional mobilisation and controversy, with effects that go far beyond any direct impacts of the physical risk itself[24].

Pests and pathogens can also cause serious economic losses in arable and horticultural crops. The total value of UK crop output in 2010 (excluding forestry) was about £7.5 billion. As arable crops and most other commercial crops are intensively managed and harvested regularly, the identification of outbreaks of new pests and pathogens and responses to them is usually early and rapid. There is also a range of tools available for effective management of pests and pathogens, and rapid genetic change in the crops is possible by conventional breeding methods. However, in the case of trees, which are long-lived and not closely managed it can be years before an infection or infestation becomes obvious, by which time effective mitigation action may be far more difficult and expensive. This is also true for short life-cycle species that are not being actively managed and for those that are a part of semi-natural ecosystems such as heathland.

Tree Health and Plant Biosecurity Expert Taskforce

Responding to this mounting pressure on our tree and other plant populations challenges both public and private landowners, Government services and non-governmental organisations. Defra's Secretary of State asked the Chief Scientific Adviser to Defra,

[20] Forest Statistics 2012: www.forestry.gov.uk/pdf/ForestryStatistics2012.pdf/$FILE/ForestryStatistics2012.pdf (N.B this national value figure has low precision.

[21] Christie M, Hanley N and Hynes S (2007). Valuing enhancements to forest recreation using choice experiment and contingent behaviour methods. *Journal of Forest Economics*, **13** (2-3), 75-102.

[22] www.forestry.gov.uk/pdf/sebreport0703.pdf/$file/sebreport0703.pdf

[23] Henwood, K.L. and Pidgeon, N.F. (2001). Talk about woods and trees: threat of urbanization, stability, and biodiversity. *Journal of Environmental Psychology*, **21**, 125-147. Also, Stewart, A. and O'Brien, L. (2010). *Inventory of social evidence and practical programmes relating to trees, woods and forests and urban/peri-urban regeneration, place-making and place-shaping*. Forest Research, Edinburgh.

[24] Pidgeon, N. and Barnett, J. (2013). *Chalara and the Social Amplification of Risk*: https://www.gov.uk/government/policy-advisory-groups/tree-health-and-plant-biosecurity-expert-taskforce

Professor Ian Boyd, to establish an independent, expert Taskforce to advise on the current threats to trees and woody hosts from pests and pathogens and to make recommendations about how those threats could be addressed. The aims of the Taskforce are summarised below and repeated in Annex B for ease of reference:

- To review domestic and international risks presented from new and emerging tree and related plant[25] pests and pathogens, including using best available evidence, assessment of risk status, and appropriate risk assessment tools.

- To provide an independent perspective on costs and benefits to inform priority setting and resource allocation[26].

- To identify potential obstacles to removing barriers to improve tree health and plant biosecurity, and suggest ways of resolving them.

- To make use of international best practice in tree health and plant biosecurity management.

- To produce a rapid evidence assessment and make recommendations for next steps including identifying crucial knowledge gaps.

- To consider whether the current plant health policy and delivery infrastructure and risk mitigation framework needs to be overhauled and make recommendations for change, if required.

- To review the current contingency planning and emergency response arrangements and recommend changes, if required.

Each Taskforce recommendation is prefaced by a brief explanation of why the recommendation is necessary, followed by a short explanation of what would be required to support the recommendation. The report also summarises how the Taskforce worked and who was convened to support the work of the Taskforce.

[25] The Taskforce was requested to consider tree health and related biosecurity in the UK. This includes trees in woodlands, forests and in the wider environment, including amenity, fruit, and urban trees. Woody shrubs associated with trees and green spaces, are relevant as either a pathway of introduction/spread of serious pest and pathogen threats, or where they act as sources of infection or infestation of trees (LWEC, 2011). Available at Securing Tree Health in a Changing Environment.

[26] The Taskforce considered likely broad costs and benefits in order to ensure that each recommendation and the actions arising from them were tractable and likely to be in society's best interests. Detailed cost-benefit analyses were beyond the scope of the review since these will depend upon the precise ways in which the Government and other stakeholders deliver the recommendations. The Taskforce discussions were informed by *Chalara in Ash Trees: A framework for assessing ecosystem impacts and appraising options:* https://www.gov.uk/government/policy-advisory-groups/tree-health-and-plant-biosecurity-expert-taskforce.

III. The Approach Taken by the Taskforce

The Taskforce comprised experts in a wide range of relevant fields. The Taskforce was chaired by Professor Chris Gilligan, Professor of Mathematical Biology and Head of the School of Biological Sciences, University of Cambridge.

The Taskforce was convened and met as a group, but also in subgroups, a number of times over the period November 2012 to March 2013 (see Annex B). A combination of small groups feeding into plenary discussions ensured that all members of the Taskforce had a common grounding in the evidence. The Taskforce focused on trees and woody species, as specified by the terms of reference, but noted that the principles addressed in the recommendations would have broader applicability to pests and pathogens of other plant species, as summarised in the Chairman's foreword. Expert opinion was sought about the risks posed by pests and pathogens and the principles that should be used to prioritise and address these risks. The Taskforce also considered current and emerging knowledge gaps.

Whilst the main Taskforce meetings provided an opportunity for Taskforce members to deliberate the key issues amongst themselves, an Officials Advisory Group (see Annex C for Terms of Reference) was also convened to work both with and alongside the Taskforce to provide input and to ensure the recommendations were feasible. Subgroups allowed Taskforce members to examine key evidence issues and further refine the recommendations. Each subgroup was chaired by a member of the Taskforce to ensure independence but, importantly, subgroups also included members of the Officials Advisory Group. The main meetings included open sessions between Taskforce members and the Officials Advisory Group and closed sessions for the Taskforce members alone.

The Taskforce undertook an initial broad review of the problems and potential solutions, leading to the establishment of a series of recommendations to Government. Comments and input from the Officials Advisory Group and other key stakeholders were incorporated, and the initial recommendations were subject to external peer review. This led to the publication of an interim report in December 2012[27]. The Taskforce subsequently undertook further work to ensure thorough analysis of the recommendations, reviewing the evidence underpinning each recommendation. At this point, the Taskforce also reviewed issues on practicality and manageability for each of the recommendations and identified essential actions required to implement each recommendation. In considering the feasibility of recommendations, the Taskforce took advice from the Officials Advisory

[27] http://www.defra.gov.uk/publications/files/pb13842-tree-taskforce-interim-121206.pdf.
Note original site now ported to following site:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69619/pb13842-tree-taskforce-interim-121206.pdf.

Group, expert peer reviewers (see Annex D), and key stakeholders who were invited to provide written comments, and who met with the Taskforce to discuss the recommendations[28]. Written comments provided on the interim report were also considered. Where appropriate the final recommendations take account of the advice provided by these groups.

This final report represents the conclusion of the considerations of the Taskforce for the Chief Scientific Adviser to Defra, building on the findings set out in the interim report. Whilst the main thrust of the Taskforce recommendations remains the same, the recommendations have been categorised, refined and re-focused based on further consideration of the evidence base. In particular, the Taskforce reviewed national and international risks; provided a perspective on costs and benefits; and reviewed international best practice in tree health and plant biosecurity management. The Taskforce recommendations have been the subject of considerable scrutiny and challenge and Defra's Chief Scientific Adviser has been fully informed and engaged throughout the deliberations. The conclusions and recommendations in this report, however, are the sole responsibility of the Taskforce members.

[28] The Stakeholder Engagement report is at: https://www.gov.uk/government/policy-advisory-groups/tree-health-and-plant-biosecurity-expert-taskforce

IV. Key Recommendations

A. National Context

In considering the national context, the Taskforce first addressed what should be done to ensure the UK is well placed to manage existing plant pest and pathogen problems, and what is needed to enable the UK to respond to new threats. The recommendations cover how the UK might identify the key risks, who might be responsible for owning a risk register, and how to prepare for outbreaks. The Taskforce also addressed the issue of governance. In implementing the recommendations, it will be essential to work closely with the Devolved Administrations. The Taskforce is also aware that responsibility for dealing with disease outbreaks is currently shared between the Forestry Commission, the Devolved Administrations, and Defra (see Annex E for details). Such complexity must not get in the way of dealing with plant pests and pathogens, so the Taskforce proposes that governance arrangements should be reviewed, strengthened and simplified.

1. Identifying and Assessing Risk

The Taskforce observed that there are numerous risk assessments for individual pests and pathogens at both the national and EU/EPPO (European and Mediterranean Plant Protection Organisation) level but concluded there should be a single national risk register for plant health. Building on Defra's recent work to develop and implement the Tree Health and Plant Biosecurity Action Plan[29], a new Plant Health Risk Register would serve to prioritise risks and guide systematic and proportionate risk management responses, including stakeholder engagement. The Taskforce recognised the threat from unknown pests and the importance of generic measures to protect against them and strengthen resilience across the UK.

The Taskforce noted that HM Treasury lays down five generic governance principles (openness and transparency, wide involvement of stakeholders, proportionate and consistent action, the use of evidence, and clear allocation of responsibilities) that Government Departments should follow when managing risks[30]. The Taskforce also recognised the importance of using a wide range of methods to take account of uncertainties, ambiguities and ignorance in assessing risk[31]. This approach could help

[29] www.gov.uk/government/uploads/system/uploads/attachment_data/file/69330/pb13657-tree-health-actionplan.pdf

[30] www.hm-treasury.gov.uk/d/managingrisks_appraisal220705.pdf

[31] Stirling, A. (2010). Keep it complex. *Nature*. Vol. **468**:1029-1031.

promote risk management responses that are flexible, adaptive and innovative (in accordance with the principle of wide stakeholder engagement in the HM Treasury guidance). The development of any risk register needs to be consistent with these governance principles.

The purpose of the Plant Health Risk Register is to identify those pests and pathogens that pose the greatest threat, including the probability of entry of exotics or the occurrence of new strains of indigenous species; and to identify immediate actions should the threat materialise. The risk register should also include endemic pests and pathogens that continue to pose serious threats to tree health. The Taskforce recognised the moves by the European Commission to focus attention on risks, rather than specific pests, in the revision of the EC Plant Health Directive. Risks arise from a combination of harmful agents (pests and pathogens), accessible pathways (for example trade movement), and receptor systems[32]. The proposed Plant Health Risk Register should set priorities using the combination of these risk factors. Specifically, it should prioritise the pests/pathogens, pathways and receptor systems with respect to a number of factors. These include: risk of incursion and establishment; the potential for prevention of entry or eradication; the mitigation of effects; the impact of incursion in terms of speed and intensity of spread; and environmental, social and economic consequences.

RECOMMENDATION 1
Develop a prioritised UK Plant Health Risk Register.

Assessment procedures to populate the Plant Health Risk Register need to incorporate a compilation of evidence of risks with an assessment of the quality of the evidence, and procedures for the inclusion of expert evidence. Horizon scanning[33], with wider stakeholder involvement, is an essential component of the process. The Plant Health Risk Register would inform choices and policy options, as well as identifying how best to deploy resources most effectively for risk assessment and management actions to deal with a range of threats. Priorities for action will be determined by the risk combined with the availability, feasibility and cost of options for interception, mitigation or adaptation. The Plant Health Risk Register would need to be updated on a regular basis (to be determined depending on how dynamic the agents, pathways and receptors are). It would also be used to identify priorities for research to fill key gaps in the evidence base.

[32] Receptor systems include the location and connectedness of susceptible host populations as well as the cultivation systems.

[33] Horizon scanning being the identification of current and future threats and opportunities.

The Plant Health Risk Register should take account of a range of factors, including:

- the type of pest/pathogen agents;
- pathways of entry and establishment (e.g. commercial import, private import, introductions by air, soil, timber, seeds, saplings, and other means such as plant parts, wood packaging);
- the nature of the receptor systems, including the connectedness and distribution of susceptible host species;
- environmental, social and economic impacts;
- current uncertainties, with the capacity for horizon scanning to identify potential future threats; and
- assessment of the feasibility of management of pest introduction and spread.

The format of the Plant Health Risk Register is a matter for further discussion but a possible template for assessing and prioritising risks taking account of environmental, social and economic impacts is set out in Annex F. Building on such a template, potential components of a prioritised Plant Health Risk Register could include:

- assessment of the baseline risk (without mitigation or controls and with likelihood and impact quantified as far as possible):
    - likelihood: to include probability of entry and probability of establishment; and
    - impact: to include potential for spread and intensity, effects on economic, social and environmental factors;
- current controls and mitigation;
- residual risk (after controls and mitigation are implemented), quantified as for the baseline risk; and
- identification of the risk indicators, including pest and pathogen intelligence from Europe and other regions (see Recommendation 5), susceptibility of target hosts, monitoring of trade and aerial movement of the pest and pathogen:
    - establishment of the acceptable level of risk;
    - further action to refine the risk indicators; and

- current risk assessment and requirements for further information to reach acceptable levels of confidence.

The Taskforce did not wish to be overly prescriptive about form and content, and recognised that considerable further analysis will be necessary to complete the register and enable prioritisation (see also Recommendation 7 and Annex F).

The pests and pathogens representing the greatest risks should be included on the Defra Risk Register and, if appropriate, on the National Risk Assessment[34]. How risks are added to, and removed from, the Plant Health Risk Register should be considered and clear protocols derived, including how to use evidence from the Register to inform decisions about protected zone status. The Plant Health Risk Register should be a public document and consideration should be given to how the risks are communicated effectively to multiple stakeholders and the public[35].

2. Chief Plant Health Officer

The Taskforce highlighted the need for an individual at a senior level to be responsible for prioritising and owning key risks and managing outbreaks. This involves adopting a similar approach to animal health, including strategic prioritisation of resources, informed by the Plant Health Risk Register (see Recommendation 1). In the case of animal health control, the Chief Veterinary Officer does not have budget responsibility but there is a clear, and well-defined, requirement to adopt a 'command and control' role in animal-related emergencies. The Taskforce noted the establishment of the UK Plant Health Strategy Board, which aims to co-ordinate plant health strategy amongst responsible official bodies across the UK, including the Devolved Administrations. The Taskforce concluded that the function of the UK Plant Health Strategy Board required further consideration (see also Recommendation 4), especially to clarify and strengthen its strategic aims and the relationship with the proposed Chief Plant Health Officer.

RECOMMENDATION 2

Appoint a Chief Plant Health Officer to own the UK Plant Health Risk Register and to provide strategic and tactical leadership for managing those risks.

[34] https://www.gov.uk/risk-assessment-how-the-risk-of-emergencies-in-the-uk-is-assessed

[35] Delivering effective risk communications has to be approached with considerable care, paying close attention to both process design and message content. A range of evidence-based guidelines to good practice exists, such as Chapter 5 in Risk: Improving Government's Capability to Handle Risk and Uncertainty, 2002, Cabinet Office, HMSO. www.hm-treasury.gov.uk/d/orange_book.pdf

The Taskforce considered a range of possible models for a Chief Plant Health Officer and anticipated that the role could work in a manner analogous to, and at the same grade as, the Chief Veterinary Officer. While animal health has clear links to public health and ensuring safe food, plant health covers a wider range of activity and potential risks[36]. Responsibility for assessing and managing the risks to tree and plant health more generally ought to be combined with a centralised role. In the UK context, this will need to be organised taking into consideration the requirements and responsibilities of the Devolved Administrations. It is likely that the role would encompass responsibilities for management of all plant health, subject to future discussion, and would be most effective if carried out at a UK-wide level. There are different models for filling this role, for example, external recruitment, secondment, or by Civil Service appointment, which is a matter for further consideration.

A Chief Plant Health Officer would have:

- seniority and credibility, and standing across Government, and the stakeholder and academic communities, such that he or she would command authority and ensure policy is implemented;
- equivalence of function and grade to the Chief Veterinary Officer; and
- authority to vary the Terms of Reference for the UK Plant Health Strategy Board and to be the customer for the products of the Board [37].

The Chief Plant Health Officer should be responsible for planning and preparedness including:

- supervising the initial design of the Plant Health Risk Register;
- updating the Register, epidemiological intelligence, surveillance and management protocols;
- communicating with Ministers and senior officials and coordination of action across the Devolved Administrations (see Recommendation 4) with a key representative role at the appropriate European and international level;
- co-ordinating engagement with the media, industry and stakeholders, long-term strategy and horizon scanning and general communication;

[36] The host range for plant species, even amongst trees, is much larger than for animals, and the panel of pest and disease risks is very large for trees. Surveillance of animal diseases is also assisted by the reporting potential of the veterinary profession in the local context.

[37] In line with Recommendation 4 to strengthen the role of the UK Plant Health Strategy Board.

- challenging relevant policy and its implementation and co-ordinating activity on plant pests and pathogens across Defra policy areas in relation to risk of incursion, mitigation and control;
- contingency plans and emergency response at the UK level;
- together with Ministers and senior officials, putting in place mechanisms for timely access to information and data about plant pests and pathogens from EU Member States and beyond;
- strengthening border controls as appropriate (see Recommendation 6);
- ensuring the UK is recognised as a responsible exporter of quality trees and plants; and
- identifying and informing priorities for research.

The Chief Plant Health Officer should also lead the disease response for Defra in the event of a major outbreak.

3. Preventing and preparing for outbreaks

The Taskforce noted the remarkable efforts that had been made to monitor the infection of UK ash trees by Chalara in 2012. With the benefit of hindsight it also considered what additional resources would have helped with the response and reduced disruption to work related to pre-existing priorities, and what could have been in place to ensure effective preparedness. In line with Recommendation 2, future contingency planning and preparedness should be the responsibility of the Chief Plant Health Officer. Preparedness requires an understanding of the data needs and of the range of possible data sources, as well as the capability for rapid analysis of these data sources. Adequate maps and related resources for identifying where key susceptible host species are located are required. Work by the National Biodiversity Network[38], for example, is already collating data in an easily accessible form. The National Forest Inventory is currently the main source of data on trees in woodland, providing data for risk assessment, modelling and directing site inspections[39]. Data about host distribution in natural and managed environments, importers and nurseries and the distribution of tree and plant hosts requires consolidation, quality-assurance, coordination and maintenance. There is also a need to determine gaps in data when these relate to identified threats.

[38] www.nbn.org.uk/

[39] Data will be adequate for most tree species, but an increased sampling intensity would be required to provide comparable data for less common species or attributes that would increase the costs of the scheme.

Understanding data requirements is crucial to ensuring development and maintenance of appropriate surveillance and reporting. A ‘catalogue’ of recommended data sources should be developed that could be called on rapidly (see also Recommendation 7). The catalogue would state which data sources could be used for different types of host (native, non-native, street tree) and degrees of host rarity. Improvements in data should focus on the distribution of host species on non-public land, in the urban environment, and along motorways and trunk roads to bring it up to the same level as for public forests, woodlands and other open lands not in the built environment. Information about trade networks is important for identifying the potential likely occurrence of a problem, for efficient deployment of inspectors to detect and manage outbreaks, and for understanding vulnerability to inadvertent spread of introduced pests and pathogens. In addition to data for the pathogen, host and networks, it is essential to have ready availability and access to environmental data, including soil type, and meteorology.

It was clear to the Taskforce that preparedness for emerging livestock disease was more developed than preparedness for emerging plant disease, not least to protect the food chain and public health. However, in the plant sector the larger number and diversity of pests and pathogens and pathways for their introduction, make for a different challenge than for animal disease. The procedures for animal disease outbreak control include clear protocols for engagement with stakeholders, the deployment of resources, command and control, access to models, sampling and reporting protocols, and communication with the media.

RECOMMENDATION 3

Develop and implement procedures for preparedness and contingency planning to predict, monitor and control the spread of pests and pathogens.

The Taskforce recognised that although preparedness measures are in place, a different approach is required to provide assurance that there is the capacity to model the epidemics, infestations, and stakeholder behaviour, and to act on recommendations arising from such analyses. This would ensure policy makers receive high quality and timely information and advice. It is also important to have in place effective and reliable methods for detection and diagnosis and to understand any limitations, for example, to allow for false positives and false negatives. These capacities would enable an efficient response to both known threats on the Plant Health Risk Register as well as newly emerged pests and pathogens about which little is known and ultimately, to cope generically, with the many unknown pests and pathogens moved in international trade. In an effort to improve the efficiency of pest and pathogen management measures are

needed that promote the early detection of incursions, through the ability to obtain, mobilise and direct resources. Such measures should include:

Detection and diagnosis[40]:

- forward planning for the detection of pests and pathogens and diagnosis of diseases; strategies for known threats should be drawn up in advance and gaps in knowledge (e.g. taxonomy) and resources (e.g. rapid molecular diagnostic tests) should be identified and commissioning research to address them considered; and

- generic plans should be prepared for novel threats, to include pests and pathogens with different models for spread, with allowance for threats in which the causal agent may initially be unknown.

Statistical epidemiology:

- assurance of statistical epidemiological[41] capacity for different types of threat to enable cost-effective monitoring and surveillance of the spread of pests and pathogens; and

- capacity to estimate directly or indirectly (for example using data from related species) key parameters for use in epidemiological models.

Trade and human behaviour:

- planning to incorporate human activity into a novel threat response, for example human-mediated spread of disease, and the response of different sectors (forestry industry, nursery trade, retailers, travellers, the public) to different types of interventions; and

- protocols to trace forward and trace back the sequence of past or potential incursions through trade networks.

Pest and pathogen modelling:

- capacity to model the spread of different pests and pathogens to predict their rate of spread, the effectiveness of different control measures, and to identify key epidemiological parameters and hence prioritise research needs;

[40] These together confirm presence of an agent – diagnosis may not always be needed, for example for a clearly identifiable insect or may not be possible at early stages of an outbreak when the agent is unknown.

[41] The study of the patterns, causes and effects of health and disease on changes in the size and age composition of defined populations.

- models should be developed in advance for specific known threats while generic models should be available as the basis for studying novel threats;
- models should be open to examination and testing by the research community and be as transparent as possible to all stakeholders;
- models should be refined and updated based on field verification data obtained whilst dealing with new or established pests and pathogens; and
- ecological and epidemiological models should be constructed so that, according to the problem, they can be easily linked to diverse models of economic and social drivers and responses.

Contingency planning:

- designed to anticipate incursions and define the roles of those organisations responsible for outbreak response, including communication with stakeholders; and
- prepared and agreed with stakeholders including identification of responsibilities ahead of incursions and shared amongst other EU Member States.

4. Governance

The Taskforce does not consider that the current legislative and governance arrangements are satisfactory.

Plant Health Act and current governance

The Plant Health Act 1967[42] resulted in responsibilities being split between the Forestry Commission and Defra[43]. Responsibility for plant health in Scotland lies with the Scottish

[42] The Plant Health Act (1967) states:
(1)This Act shall have effect for the control of pests and diseases injurious to agricultural or horticultural crops, or to trees or bushes, and in the following provisions of this Act —
(a) references to pests are to be taken as references to insects, bacteria, fungi and other vegetable or animal organisms, viruses and all other agents causative of any transmissible disease of agricultural or horticultural crops or of trees or bushes, and also as including references to pests in any stage of existence;
(b) references to a crop are to be taken as including references to trees and bushes.
(2) The competent authorities for purposes of this Act shall be—
(a) as regards the protection of forest trees and timber from attack by pests, the Forestry Commissioners ("timber" for this purpose including all forest products); and
(b) otherwise, for England and Wales the Minister of Agriculture, Fisheries and Food and for Scotland the Secretary of State.

Government and in Wales with the Welsh Government. Responsibility for the Forestry Commission's powers in Wales under the Plant Health Act has recently been transferred to Welsh Ministers who will delegate delivery of these back to the Forestry Commission. Separate arrangements apply in Northern Ireland. There are good working relationships amongst the different organisations and governments concerned when responding to pest and pathogen incursions. The Taskforce was concerned, however, that this depended on the goodwill of the individuals concerned and senior level support and that the governance arrangements for a joint response to managing pest and pathogen incursions are unclear. In addition to timely production of risk assessments for individual pests and pathogens, there is a need for more coherent governance in order to enable overall prioritisation and responsiveness to risks.

Based on recent experience with the management of tree disease, there are major challenges in integrating the management and control responses in the diverse components of tree populations. These components include trees in forests, amenity sites (e.g. parks and gardens), street trees, orchards, trees along motorway and rail lines and in trade networks, including nurseries. Surveillance responsibility for organisms harmful to trees in the wider environment is shared between the Forestry Commission (where there is a threat to forests or woodland), Defra, Fera, Local Authority tree officers, landowners and managers, and householders. Management of an invading pest or pathogen currently requires the collection and collation of information from across this range of bodies in order to formulate mitigation and control strategies. The task is confounded where the data are owned by or only accessible to different organisations. More effective governance is necessary to manage the spread of the pests or pathogens in future.

The Taskforce also noted that current legal instruments treat forest trees separately from other plant species. Various organisations have responsibility across the spectrum of tree and plant health and biosecurity (with Defra itself having different teams responsible for different areas that include forestry, crops, agriculture, and plant health). The current arrangements can lead to lack of clarity in the delimitation of responsibilities.

The Taskforce noted the establishment of the UK Plant Health Strategy Board, which has the benefit of representation from the Devolved Administrations and from statutory bodies, along with collaboration with key stakeholders. The Taskforce recognised the potential benefits of this Board, and the importance of the right level of membership to ensure that joined-up policy decisions are being taken across the UK on the basis of common evidence. While the Board is strong on representation, it was not clear to the Taskforce that the body is currently well suited for decision making in relation to prioritisation of risks and contingency planning.

[43] As a first step towards improving plant health governance, plant health policy has been brought closer to the heart of Government, by transferring the Plant Health Policy Team from Fera (which carries out much of the co-ordinating role) to Defra on 31 December 2012.

The Taskforce was clear on the need for consistent and coordinated strategies across the Devolved Administrations and effective and timely liaison with the Irish Government. Pests and pathogens transcend political or geographical boundaries so a UK-wide, and ideally a British Isles, approach in identifying and managing threats is as essential as an EU-wide strategy.

Responsibility, cost-sharing and learning from other countries

The Taskforce recognised that partnership approaches to identify and tackle threats will be essential. A key consideration is to ensure a fair balance of costs and responsibilities between Government and others with an interest in maintaining healthy tree populations. Protocols need to be set up with key stakeholders that establish a procedure for sharing responsibilities and costs in advance. The Taskforce acknowledged the advantage of learning from experience gained by other countries[44]. Protocols for allocation of responsibilities and cost sharing in Australia and New Zealand have been considered. Both countries consider the risks of entry of potentially damaging organisms along a continuum that begins at the point of origin of the pest/pathogen or the goods that may bring such pests/pathogens into the country. There are clearly defined responsibilities for Government and industry along the pathway from point of origin to final destination and this includes agreements defining who bears the costs, at what levels and how judgements will be made about when costs will be incurred. Both Australia and New Zealand are moving toward a model in which those who pose the highest risks to plant health have to bear most of the costs of prevention. In particular, the Taskforce noted the "Deed approach"[45], which is the Australian system of cost-sharing in biosecurity policy. This is based on an assessment of the extent to which the impact of the pest or pathogen is private versus public - the more public the impact, the greater the share of taxpayer funding. A similar scheme could be considered for the UK.

RECOMMENDATION 4

Review, simplify and strengthen governance and legislation.

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[44] Australia and New Zealand Biosecurity Review published at: http://www.fera.defra.gov.uk/plants/plantHealth/documents/australiaNewZealandBiosecurityReview.pdf. This Fera review explicitly addressed the relationship between the recommendations from the interim report and the Australian system, drawing out parallels and common lessons. The Taskforce took this analysis into consideration in refining the recommendations in this report.

[45] The Australian 'Deed approach' is based on Government-industry agreements prior to a biosecurity breach, which prioritise and predefine post border surveillance, responsibility for incursion responses and who bears the costs of disease incursions.

The Taskforce concluded that current governance of tree and plant pests and pathogens needs to be strengthened and proposes that:

- the Plant Health Act 1967[46] should be reviewed and updated to include *all* plants, and rendered consistent with other plant/tree protection legislation;
- responsibility for plant health should be reviewed within and amongst the statutory authorities to create a coherent strategy for identification and management of the key threats *across the whole of the UK* to reduce the risks to the UK and Europe as a whole;
- a common understanding is developed of who is responsible for preparedness and who takes control in emergencies; and
- organisational cultures that may act as barriers to developing a strategic approach to contingency planning should be challenged.

Development of governance should also consider the role of partnerships between statutory authorities and stakeholders, including non-governmental organisations, industry and landowners (both public and private), in order to:

- establish a clear understanding of the respective responsibilities to ensure effective management of pests and pathogens;
- examine approaches to cost-sharing, for example the Australian Deeds approach described above; and
- establish risk management systems that can deal with different levels of uncertainty (following the principles set out in Recommendation 1).

[46] The Act was designed to protect commercial plantings of all plants and all plantings of trees and bushes, but not non-commercial plantings of other plants or wild plants other than trees and bushes.

B. International context and border security

The Taskforce focused its attention on two core components. The first addresses the extent to which it is possible to access and use data and information about the spread of pests and disease in the EU and other regions in order to inform the Plant Health Risk Register and to prepare contingency plans (see recommendations 1 and 3). This would enable the UK to be better informed about the spread of pests and pathogens across the EU *before* they arrive in the UK. It would also assist in assessing changing risks of importing pests and pathogens from countries outside the EU with which there are major trading and travel links. The second component addressed by the Taskforce relates to ways of improving national biosecurity.

5. International Intelligence

Informed decision making about how to manage the spread of newly-arrived pests and pathogens requires an understanding of the biology, epidemiology and taxonomy of the agent. This includes knowledge of the host range of the agent, how it infects or feeds and reproduces on a host, how it the spreads between hosts, and what distinguishing features of the agent could be used for detection. Some information may be available in the scientific literature and in pest risk assessments. The Taskforce noted, however, that while even for well-studied pests and pathogens there are likely to be gaps in crucial information, some of these gaps could be filled by improved interrogation and collation of data from other regions in which the pest or pathogen has spread or is spreading. Accessing this form of epidemiological intelligence is particularly appropriate amongst Member States in the EU and within the European and Mediterranean Plant Protection Organisation (EPPO[47]) where there are already agreements in place for exchange and communication of pest and disease information[48]. The Taskforce was not convinced, however, that these lines of communication were yet being optimally used, particularly in understanding the spread of disease.

The potential value and previous under-use of international intelligence has been especially evident in assessing the information needed to devise management plans for

[47] EPPO is the European and Mediterranean Plant Protection Organisation. www.eppo.int/

[48] Before the discovery of *A. glabripennis* outbreak in Kent in March 2012, Fera and FR had learnt about how to manage *Anoplophora* outbreaks from other EU member states at the EU standing committee and via collaborative research projects such as the EUPHRESCO funded project Anoplorisk. This included visits to outbreak sites in the USA and Italy and the knowledge gained from these visits was shared within the UK and more widely in Europe. Since the outbreak of *A. glabripennis* was discovered in Kent, Fera scientists sought and received advice on how to manage the outbreak from colleagues in countries with experience of running eradication campaigns against the pest. A workshop on Fera / FCs management of the Kent outbreak was held in Germany in December 2012.

the recent outbreak of Chalara ash dieback in the UK. Analysis of relatively coarse data for regional spread of the disease across the continent could have enabled assessment of the risk of aerial spread to the UK, showing when and where it was likely to occur by this means of dispersal[49]. Data for the continental spread could also have been used earlier to inform epidemiological models to predict the likely rate and extent of spread in the UK[50]. There would also be advantages in sharing better resolved maps of susceptible host species and trade data throughout EU and EPPO Member States in order to understand how the spatial distribution of hosts and trade movements affect pest and disease spread. Early and accurate information on the taxonomic status of the new pathogenic species for ash dieback[51] would have enabled more timely risk assessments to be carried out at European and UK levels, thereby increasing the possibility of earlier action against the disease.

The Taskforce would like to see post-outbreak analyses of management strategies being made more widely available to show not only what worked but what did not work. One way to enable this would be to develop a shared understanding across key organisations in Member States of how epidemiological models could be used to analyse information about disease spread and the effectiveness of control strategies (see Recommendation 6) and also to foster improved use of data-bases to organise and share information (see Recommendation 7).

Data on the frequency of interceptions of alien pest and pathogens to EU Member States from outside the EU via trade and individual imports would also prove useful in highlighting major pathways of risk. The Taskforce noted that Australian authorities were increasingly using intelligence from trading members to assess risks[52]. In considering the effectiveness of controls to prevent entry, the Taskforce also noted that it is almost impossible to know the extent to which current controls have prevented introduction of new pests and pathogens since ordinarily only those that do get through are publicised. The Officials Advisory Group reported 1,400 interceptions per annum[53] of pests and pathogens on consignments moving in trade, mostly imported from non-EU countries[54].

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[49] www.gov.uk/government/uploads/system/uploads/attachment_data/file/181840/pb13936-chalara-management-plan-201303.pdf.pdf

[50] www.gov.uk/government/uploads/system/uploads/attachment_data/file/181840/pb13936-chalara-management-plan-201303.pdf.pdf

[51] www.fraxback.eu/index.php?view=category&catid=8&option=com_joomgallery&Itemid=465

[52] Fera Biosecurity Review: http://www.fera.defra.gov.uk/plants/plantHealth/documents/australiaNewZealandBiosecurityReview.pdf.

[53] The Taskforce recognised that many of these interceptions represent a relatively low risk to the UK, being findings of, for example, fruit flies on fruit from subtropical climates, or low levels of other insect pests on plant produce intended for immediate consumption.

[54] www.fera.defra.gov.uk/scienceResearch/science/pestDisease/

RECOMMENDATION 5

Improve the use of epidemiological intelligence from EU/other regions and work to improve the EU regulations concerned with tree health and plant biosecurity.

In the future, maximising the use of epidemiological intelligence to inform the risk of pest and pathogen incursion and spread would require a combined UK and broader EU response including:

- better positioning of tree health and plant biosecurity within EU regulations to ensure that threats from pests and pathogens are formally recognised at early stages and are followed by appropriate responses[55];
- strong support for the proposed EU 'reverse strategy' of robustly assessing risk in advance of new trade links and explicitly permitting trades rather than explicitly regulating trades that have already proved problematic (see Annex H);
- improved reporting of data on the spread of emerging pests and pathogens;
- sharing of epidemiological models amongst EU and EPPO Member States for analysis of epidemiological spread and comparison of mitigation and control strategies;
- improved sharing of post-outbreak experience amongst EU and EPPO Member States to identify successful approaches to mitigation and control;
- improving the communication of information about the pattern and intensity of spread of introduced pests and pathogens into and within the EU; and
- accessing better data about trade imports into the EU, intra-EU movements, and the provenance of imports and plant materials traded within the EU.

6. National Biosecurity

The Taskforce noted trends in trade and travel towards greater volume of movement of people and goods, greater distances and speed of movement[56], and novel types of trade,

[55] See Annex H for discussion of border controls.

such as mature trees in soil. All these increase the risk of introduction of non-native pests and pathogens.

The Taskforce reviewed the regulatory framework, natural geographical barriers, and the potential for management of introductions of pests and pathogens. The Taskforce saw this as an area for significant improvement because the Single European Market currently means that all pests and pathogens introduced to the EU are likely to be eventually experienced across the whole of Europe (subject to variations in environmental conditions). The UK's biosecurity from non-European threats is therefore largely dependent on the level of biosecurity applied by other EU Member States and by the effectiveness (in meeting EU requirements) of non-EU countries exporting plants and plant products to the EU.

In addition, the Taskforce felt that businesses that import, or cultivate imported trees and other plants, should take significantly more responsibility to strengthen biosecurity by, for example, assuring the provenance of their supplies including both the plants and any soil associated with those plants. The Taskforce emphasised the additional risks posed by importation of larger quantities of soil, for example with mature trees for instant landscaping, in which pests and pathogens might be inadvertently present.

The Officials Advisory Group pointed out to the Taskforce that significant progress could be made in some areas of biosecurity without additional legislative changes across the EU. The Taskforce proposes that tighter controls should be achieved through more proactive use of existing mechanisms both by the UK and by other EU Member States, for example, by seeking protected zone status *before* rather than after a pest or pathogen arrives in the UK. The Taskforce noted that the upcoming review of the Plant Health Regime by the EU was timely and represented an opportunity to improve the current regime to support better tree and plant biosecurity (see Annex H).

RECOMMENDATION 6

Strengthen biosecurity to reduce risks at the border and within the UK.

The interim report identified three areas for action: activity within the UK; intra-EU trade; and non-EU trade into the UK (and other EU Member States). In developing this recommendation, the Taskforce recognised the need to balance effective enforcement to

[56] Rodrigue, J.P., Comtois, C. & Slack, B. (2013). *The Geography of Transport Systems*, Routledge, London, pp 408: http://www.routledge.com/books/details/9780415822541/.

improve biosecurity with the need to keep trade and travel moving both within and outside the EU; as well as the need for the UK itself to act as a responsible exporter. The Taskforce recognised that any actions should also apply to soil, wood-based packaging and other plant products, each of which can harbour pests and pathogens. Certain pathways can be identified where there is a high risk of pathogen introduction, for example unsterilised soil imported with rooted plants, and action at the European level is needed to reduce the threat. The Taskforce was also mindful that any recommendation should not require significant resources to enable implementation, and that it should be simple and straightforward to maximise the likelihood of compliance and complemented by a programme of information and communication to increase understanding of the problem.

Import for personal use:

The Taskforce proposes that no plant material[57] for personal use be imported from outside the EU[58]. Under a complete ban on material from outside the EU, Border Force staff would not need to be trained in recognising different species, thereby simplifying customs enforcement. However, implementation would need to be supported by an effective education programme to ensure travellers are aware of the risks and understand the necessary control and rules[59]. Communications would also need to be reviewed regularly to ensure that they are used effectively to reflect latest risk control priorities and are effectively targeted at specific regions to address the greatest risks of non-compliance.

Given the risks to the UK, the Taskforce would ideally like to have seen the ban extended to the import of plants within personal baggage from within the EU. The Taskforce accepted, however, that major difficulties would arise in seeking exemption from the free movement of goods within the Single Market and accordingly did not include this formally within the recommendation.

Import for commercial use:

The Taskforce proposed that the Plant Passport[60] scheme be strengthened and also applied to seed as a means of ensuring greater traceability (showing all ports of call for the

[57] Plant material covers dead matter, cut flowers and propagated plants.

[58] Following detailed consultation with representatives of the Border Force, the Taskforce concluded that a complete ban was the only practicable solution to prevent introductions of pests and disease by personal import from outside the EU. A detailed risk-based ban would be prohibitively expensive to implement requiring detailed botanical knowledge for customs officials and the public.

[59] Existing information available to travellers can be found at: https://www.gov.uk/bringing-food-animals-plants-into-uk/plants

[60] When the Single European Market was created in 1993, plant passports were introduced to replace phytosanitary certificates for trade between Member States, and provide additional security for movements of plants within Member States. They are currently only required for plants associated with specific plant health risks, though the draft revised EU rules would extend passports to all plants other than retail sales. In

consignment within the EU and last port before entry to the EU). The scheme would not directly provide a measure of good plant health status but could be used by Plant Health Inspectors to decide whether a consignment needs an additional, precautionary inspection by officials. Any inspections would not happen at the UK border, because this would be difficult to implement without impeding the flow of trade and would miss potential problems as a result of latent infections that are difficult to detect until symptoms develop. Plant Health Inspectors could, however, use the Plant Passports to decide, taking a risk-based approach, which commercial premises need inspecting. In the event of sporadic outbreaks, the passporting information would help trace the source area and prevent further imports from it.

The Taskforce proposed that changes to EU legislation should be pursued to ensure the Plant Passport scheme is run in conjunction with an industry-led certification scheme so that the key stakeholders are part of the system that ensures good plant health status. Such a scheme could follow a similar design to voluntary forest product certification schemes such as the Forest Stewardship Council and the Programme for the Endorsement of Forest Certification. Certification would inform buyers that the plant product comes from a production chain that is designed to minimise plant health risk, and that the product itself is pest- and disease-free. Certification could lead to a price premium, and thus an incentive for producers and retailers to improve their plant health practices throughout the supply chain. However, the Taskforce noted that any significant sales volume of non-certified products would pose risks of pest and pathogen spread throughout the system; thus a certification scheme would only be effective if it achieved high levels of adoption from producers, wholesalers and retailers. Government would have an important role in facilitating the creation of such a scheme.

Risks from wood-based packaging, biomass products and soil:

The Taskforce recognised that wood-based packaging can be a significant source of infection as demonstrated in 2012 by 228 findings of pests during import inspections of such material from non European countries. This included 67 critical findings of pests like *Anoplophora glabripennis* and other longhorn beetles. Such packaging can be a significant pathway for movement of pests and pathogens and the Taskforce was concerned that the current rules (whereby packaging wood and pallets are covered by International Phytosanitary Measure ISPM15[61] that requires treatment of the wood used) are not implemented with sufficient rigour, or that the mark of compliance may be used

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the UK, plant passports are issued by authorised nurseries under official supervision from the plant health service.

[61] ISPM 15 is an International Phytosanitary Measure that sets out the need to treat wood materials of a thickness greater than 6mm that is used to ship products between countries. It affects all wood packaging material, requiring that it be treated with heat or fumigated and marked with a seal of compliance. Products exempt from the ISPM 15 are made from alternative material, like paper, plastic or wood panel products (i.e. hardboard, plywood and oriented strand board).

inappropriately. Additional work needs to be done to improve compliance. The Taskforce also noted the risk of introducing pests and pathogens in soil with imported plants and the need to include the soil-pathway in managing risks. Of particular concern was the growing volume of soil imported into the EU in this way, with the associated increase in the risk of pests and pathogens being introduced into Europe[62].

Trade in biomass for energy production or as a raw material is likely to increase and a workable but inclusive framework for risk assessment and regulation is needed. The large UK biomass power generators anticipate a significant increase in the level of imports of woodfuel products. Almost all the large users are planning to import wood pellets, which are not currently a controlled commodity because the heat and pressure involved in manufacture acts as a phytosanitary treatment. The risks associated with a switch to importing wood chips needs to be monitored.

A risk-based approach:

The Taskforce proposes that a risk-based approach should be taken to dealing with commercial plant health issues, both at UK borders and on commercial premises. Efforts can then be focused on high-risk pathways, hosts, and pests or pathogens and those from countries where organisms when transported to the UK have been shown to present a risk. Border Force receives monthly updates from Defra on the status of animal health issues in other countries, and this approach could be extended to plant health.

The Taskforce identified three areas in which progress could be made to strengthen national biosecurity to control and prevent the introduction of new pests and pathogens. These should be balanced against the benefits of pest and pathogen control and consideration of any unintended consequences**.**

- Activity in the UK should include:
    - promotion to the public of the risks posed by plant pests and pathogens, and the importance of tree health and plant biosecurity;
    - promotion of, and responsibility for, biosecurity in the commercial movement and importation of plants, seeds, plant products and soil amongst key stakeholders. These particularly include forestry, arboriculture, tree horticultural nursery trade businesses; but private imports by the public, e.g. via tourism, mail order, and through internet purchases are also important;

[62] The Taskforce welcomed the fact that new EU legislation is now in force setting specific and harmonised standards for inspecting Chinese wood packaging, which represents a significant threat.

- systems of industry-led certification, including original provenance, plant transport trail/chain of custody, monitoring, assurance of trade partners' sources, linked to the regulatory inspection regime;
- provision and use of rapid diagnostic tests by industry to identify and remove pests and pathogens at the point of entry or within current stock;
- promotion of the value and use of certified and audited provenance (and other potential product labelling) for pest- and pathogen-free plants to encourage a culture of biosecurity; and
- encouragement of the local production of trees for woodland and amenity planting and the use of natural regeneration, where site conditions allow, and it is consistent with woodland objectives.

- Action on intra-EU trade could include:
  - timely notification by all EU Member States to other Member States of occurrences of new pest and pathogen hazards;
  - reviewing, extending and strengthening the use and effectiveness of plant passports for controlling pest and pathogen spread, including full chain of custody information (i.e. place(s) of production and origin of seed to ensure traceability back through the supply chain) and this information reaching the end customers;
  - pest risk analysis and commodity risk analysis at a larger scale (i.e. across the EU) to match the scale of the entry pathway of pests;
  - timely establishment of protected zones, in the light of epidemiological intelligence, and strengthening the use of protected zone status by shifting the emphasis towards precaution;
  - supporting a proposal in the review of the EU plant health regime to extend the internal movement controls to all plants for planting, subject to the outcome of the review of the effectiveness of such a regime (see above);
  - notification across all EU Member States of the import within any individual EU Member State of plants of high-risk as defined by the UK Risk Register;
  - monitoring of threats including pathways into the UK in order to take rapid protective action if necessary; and
  - a more robust approach by the EU to imposing sanctions on those who break the rules - e.g. by masking infection through the use of fungicides, or exporting

plants from areas known to have pests or pathogens present - and on member states who fail to report in a timely manner.

- Non-EU trade into the UK (and other EU Member States) could include:
    - new trade, involving new products or a new country of origin, should not be carried out without strict risk management measures until an appropriate UK risk assessment has been conducted by the industry/importer (see Annex I);
    - a risk-based approach where inspectors target highest risk source countries [63];
    - consideration of the role and practicability of import levies or damage liability bonds across a range of plants and wood material to reflect expected damage costs, and to allow cost recovery for mitigation and adaptation strategies;
    - introduction of a quarantine mechanism for imports of plants and wood material, where there is a high risk of pest or pathogen presence because of the nature of the import or the source area;
    - introduction of mechanisms to reduce the likelihood of people coming into the UK carrying diseased or pest-infested plant material;
    - review of the potential for treatment to kill pests and pathogens on imported wood products and live plant material; and
    - review of the risks posed by imports of soil, either on its own or associated with plants.

The Taskforce noted that implementation of some of these proposals involves strengthening compliance with existing legislative requirements but others would be likely to involve the introduction of new legislation and a change in EU legislation. They also noted that original research will be needed to design methods for treating live plant imports when they represent a high risk.

[63] The Taskforce noted that Australia has increasingly switched its security from the borders to consider a risk based approach to identify heightened threats from those countries that are likely to be sources of important pests and pathogens.

C. Capabilities and Communication

Implementation of the recommendations set out in this report depends on accurate data and evidence to inform risk-based approaches and to implement control measures. The recommendations also depend upon having the right skills to deal with tree and other plant pests and diseases at different scales, as well as underpinning natural and social science essential to inform and implement policy decisions. In this section, the Taskforce considered the need for efficient web-based interactive tools to facilitate access to information to enable effective risk-based decisions to be made, and to ensure that all stakeholders are informed and up-to-date. The Taskforce also considered the key skills gaps that might hinder implementation of suitable plant biosecurity measures.

Tree health and plant biosecurity is a complex issue, and while new research funding and capacity can always be employed to good effect, it is clear that it will be increasingly important to engage wider society in supporting efforts to improve the UK's biosecurity. Such initiatives would clearly help create a wide network of individuals able to identify plant pests and pathogens. Alongside that, it is important that better links are made between the statutory bodies, non-governmental organisations, research institutes and universities – perhaps through (although not limited to) co-financing, co-supervising or hosting PhD studentships or secondments and advanced courses of appropriate types.

7. Co-ordination of information and communication

While there are multiple sources of information about pests and pathogens (e.g. the illustrative list at Annex G), including risks and methods of control and management, the Taskforce identified a need to introduce new methods for the collation of information. Currently, much of the information base consists of accumulated reports and stand-alone databases, for example, the European and Mediterranean Plant Protection Organisation's database[64]. Using modern information technology and the science of informatics there is an opportunity to develop a structured approach to the knowledge base that will allow the efficient interrogation of databases, using the "semantic web" and related tools. Such a resource would make information readily available and enable it to be accessed, summarised and updated more efficiently, whether it is required for high-level policy or for detailed studies of particular threats. Implementation of an information system would be linked to the implementation of the Plant Health Risk Register outlined in Recommendation 1. The Taskforce acknowledged that some of this can be achieved using internet search engines, but is recommending a more sophisticated approach that will utilise current rapid advances in information science. The aim is to ensure the provision of efficient and reliable

[64] http://www.eppo.int/DATABASES/databases.htm

access to the data and information that have been collected for the purposes of improving tree health and plant biosecurity. This resource would include the Plant Health Risk Register, and enable epidemiological preparedness and intelligence about the spread of pests and pathogens including threats to the UK. Effective categorisation of the information should also enable easy access through search engines.

The Taskforce noted the promise and relevance of collaboration between scientists and members of the public to record and analyse observations and measurements[65] concerning tree health and plant biosecurity. Improved methods for collecting and retrieving data therefore need to be designed with public accessibility or involvement in mind; drawing on the UK Environmental Observation Framework's good practice guide[66].

RECOMMENDATION 7

Develop a modern, user-friendly, system to provide quick and intelligent access to information about tree health and plant biosecurity.

Robust approaches to biosecurity increasingly rely upon genomic, taxonomic, ecological, epidemiological, social and economic analyses as well as the integration of information from disparate sources. Tools for interrogation and analysis of the information and data need to be intelligent and based on user-focused design. In particular, there is a need to consider:

- learning from elsewhere (e.g. animal health tools and international practice) to develop expert systems for rapid and efficient interrogation of information related to risk registers, epidemiological preparedness and contingency plans for pest and pathogen threats, including changes in strain prevalence within species;
- updating of information about factors affecting spread, impact and the effectiveness of interception, mitigation and adaptation strategies for different classes of pest and pathogen as a basis to inform reactions to new threats;
- provision and linkage of host data and other relevant data such as meteorological data;

[65] An early Defra-funded study examined the role of the public in collecting data about the leaf-mining moth *Phyllonorycter leucographella:* Agassiz, D. J. L., Nash, D. R., Godfray, H.C. J. and Lawton, J.H. (1994). Estimating the spread of small invading organisms using information from the public. *Global Ecology and Biogeography Letters.* **4**:1-8.

[66] www.ukeof.org.uk/co_citizen.aspx?cookieConsent=A

- developing cost-effective surveillance and response strategies;

- helping members of the public to contribute to surveillance efforts, taking account of the strengths (e.g. in sampling many more sites) and weaknesses (e.g. uncertainty in reporting accuracy of this approach). Such assistance from the public may come through provision of the necessary knowledge or skill via the internet; or from specialised groups, such as societies devoted to the study of particular taxonomic groups[67];

- development of a user-friendly portal that goes beyond core plant health issues but which can, for instance, direct importers to information on import regulations; and

- promoting effective awareness raising and general communication about tree and other plant pests and pathogens.

8. Maintaining and Building Capability

The Taskforce noted with concern that there has been an erosion of capability, in the UK and internationally[68], to deal with some aspects of tree and other plant pests and disease. In addition, there has been a decline in some of the underpinning natural and social science expertise essential to inform and implement policy. Some issues can be addressed with the existing skills base but others require a longer-term strategic review involving the Research Councils, Higher and Further Education Institutions, and Government.

RECOMMENDATION 8
Address key skills shortages.

The skills needed to perform key tasks lie in a range of disciplines. An indicative list of areas in which there is a threat of loss of capability includes:

- understanding of the taxonomy and whole-organism biology of organisms considered to present a high risk to plant health, and their hosts;

[67] Examples of such successes include public recognition and reporting of the Colorado beetle helping to keep it from establishing in the UK despite being present in France for 100 years. Also, if the Asian longhorn beetle is successfully eradicated from Kent, it will only be because someone saw the beetle in 2009 and raised the alarm thus leading to continued surveys in the area that eventually picked up the outbreak.

[68] European and Mediterranean Plant Protection Organisation (EPPO) Madeira Declaration (2003): Plant Health Endangered. http://gd3.eppo.int/reporting.php/article1664

- development of new detection and management methods and approaches;
- analysis of environmental, social and economic aspects of pest and disease risk at the regional and landscape scales;
- integration of socio-economic and environmental considerations into analysis of disease impacts and response strategies;
- the ability of the plant health inspectorate to identify and mitigate plant health risks;
- advice to industry on how to plant resilient forests and the research base required to design them;
- capture and use of specialist biological data and knowledge;
- epidemiological analysis to assess risks with integrated socio-economic analyses of pest and disease impacts; and
- training and leadership in knowledge and understanding of pests and pathogens within the wider stakeholder community.

V. Knowledge Gaps

Knowledge gaps are likely to make it difficult to implement effective policy in the short and long term. Some of these gaps have emerged in the discussion of the preceding recommendations. The Taskforce, with input from the Officials Advisory Group, explored knowledge gaps against a set of evidence categories in the table below. Attention was also given to scientific, technological, logistical, social and political barriers that might affect implementation of policy but which might be overcome by research.

The principal knowledge gaps and potential areas for improvements, along with short explanations, are summarised in the table below. Some of these knowledge gaps are reflected in the Defra Tree Health and Plant Biosecurity Evidence Plan[69]. They have already fed into the current call for the cross-departmental research initiative on Tree Health and Plant Biosecurity. The latter is jointly funded by Defra, Devolved administrations, the Forestry Commission and several Research Councils (BBSRC, NERC, ESRC)[70], and is supported by the Living with Environmental Change (LWEC) partnership. This joint strategic research initiative brings together, and helps develop, a wide research capacity and capability in the UK. The initiative seeks to address the urgent need for innovative and cutting-edge interdisciplinary research to help ensure the future health and resilience of trees, woodlands and their associated ecosystems, including appreciation of their significance as a landscape, and cultural and social value. The Taskforce welcomed the initiative, noting that longer-term support of the research base would be essential to build on this initiative in order to respond effectively to continuing pest and disease threats.

[69] http://www.defra.gov.uk/publications/files/pb13929-evidenceplan-tree-health-plant-biosecurity.pdf
[70] www.bbsrc.ac.uk/funding/opportunities/2012/tree-health-and-plant-biosecurity.aspx

Category	Examples of knowledge gaps
Epidemiology[71]	• Shortage of data on host distributions: essential to collate and make data available. • Generic modelling and parameter estimation frameworks: promoting transparency in model assumptions and flexibility in adapting for new pests and pathogens including 'unknown' but related genera and species. • Knowledge of transmission and dispersion patterns to inform estimates of spread and effectiveness of landscape-scale control strategies. • Interactions between different pests and pathogens and their simultaneous combined impacts. • Economic and social costs of disease including factors leading to changes in virulence or hosts attacked; and the behaviour of relevant people and organisations.
Surveying and Surveillance	• Methods for sensitive and rapid detection at ports of entry. • Improvement of the resolution and effectiveness of remote sensing. • Intelligent surveying informed by modelling, including risk-based sampling. • Sensible sampling: reporting of negative results; taking account of temporal and spatial nature of pest and pathogen spread for optimal sampling. • Behaviours and compliance of stakeholders in relation to controls. • Quality assurance / development of systems to handle large volumes of data of variable quality collected by non-experts in different locations.
Detection	• Diagnostic tools, genomics; portable equipment for improved detection. • Improved taxonomy including within-species variation. • Sentinel plants (both in the UK and abroad) to identify unknown risks. • Understanding the costs versus benefits of detection in the context of significant uncertainty.

[71] Epidemiology is taken here to include the introduction, establishment, spread, and control of pathogens and the impacts of disease.

Category	Examples of knowledge gaps
Mitigation and adaptation strategies	• Role of chemical control in managing pest and pathogen incursions. • Breeding methods (including developing host cultivars with durable pest and disease resistance): understanding of native and non-native trees in ecosystem services and the role of forest diversification (including genetic diversification). • Control by alterations in forest management: matching the scale of control with the inherent temporal and spatial scales of an epidemic. • Biological control (has proved effective in controlling selected tree pests and pathogens), but requires reappraisal of likely effectiveness for new threats. • Impact of policy measures on disease spread (linked to epidemiology) and related benefits and costs of mitigation and adaptation. • An understanding of resilience at the tree, stand and landscape scales and of the influence of silvicultural systems on epidemiology and pest dynamics. • Assessment of capacity of mitigation procedures to remove multiple pests and pathogens in a 'manage once, remove many' process.
Social science	• Lessons for governance, management and stakeholder engagement from critical reconstructions of past outbreaks (including study of the risk perceptions of key stakeholders and the identification of 'risk amplification' indicators). • Better understanding of the identity, behaviour, interests and influence of key actors and stakeholder groupings involved in ensuring tree health and health of other plants. • Critical assessments of the potential contribution and limitations of citizen science in relation to surveillance and disease control. • Analyses of the cultural values attached to trees and woodland and the use of both economic and deliberative methods to test and refine the public interest case for government intervention to protect tree health. • Evaluation of the impacts and outcomes of policy interventions.
Trade patterns	• Effects of changing patterns of trade and travel on risk of pest and pathogen introductions. • Trade patterns (volume and pattern) including traceability and private importers. • Industry imports and costs of import controls to different stakeholders (e.g. to forestry sector, to households).

Category	Examples of knowledge gaps
Environmental change	• Predicting effects of environment change on susceptibility of trees and risks of known pest and pathogen threats.

VI. Concluding remarks

- The recommendations in this report map out a new approach to protecting tree health and improving plant biosecurity in the UK.

- The eight recommendations are inter-related. Collectively, they comprise a coherent programme to improve tree health and plant biosecurity that encompasses:

    - a risk-based approach for prioritisation and preparation for pest and disease threats to the UK;

    - improved governance to enable greater co-ordination and acknowledgement of shared responsibilities amongst key stakeholders in managing pest and disease;

    - improved use of recent scientific developments for detection and diagnosis, for predictive epidemiological modelling, and for rapid information exchange amongst key stakeholders; and

    - enhanced control of pest and disease at the borders through greater use of current EU legislation and effecting timely influence of EU legislation currently under review.

- The remit for the Taskforce required a focus on tree health. Many of the recommendations also apply to improving biosecurity of agricultural and horticultural crops and of plants in urban and wider environments.

- Knowing how, when and where to manage pest and disease effectively requires: an understanding of how to prevent entry, how to improve interception and how to effect eradication quickly following early detection. It is also important to improve understanding of mitigation and adaptation to deal with endemic and newly-established pests and pathogens. Effective control requires an understanding of likely risks including environmental, social and economic impacts. It also requires detailed knowledge of where the susceptible hosts are, the nature of trade links to enable forward and backward tracing of incursions, and an understanding of social and behavioural responses to pest disease threats and to demands for control.

- Partnership between Government, statutory authorities and stakeholders, including non-governmental organisations, industry and landowners, and the public is important for effective biosecurity. The recommendations present an opportunity to ensure that the roles and responsibilities of all participants are clearly defined and collectively understood.

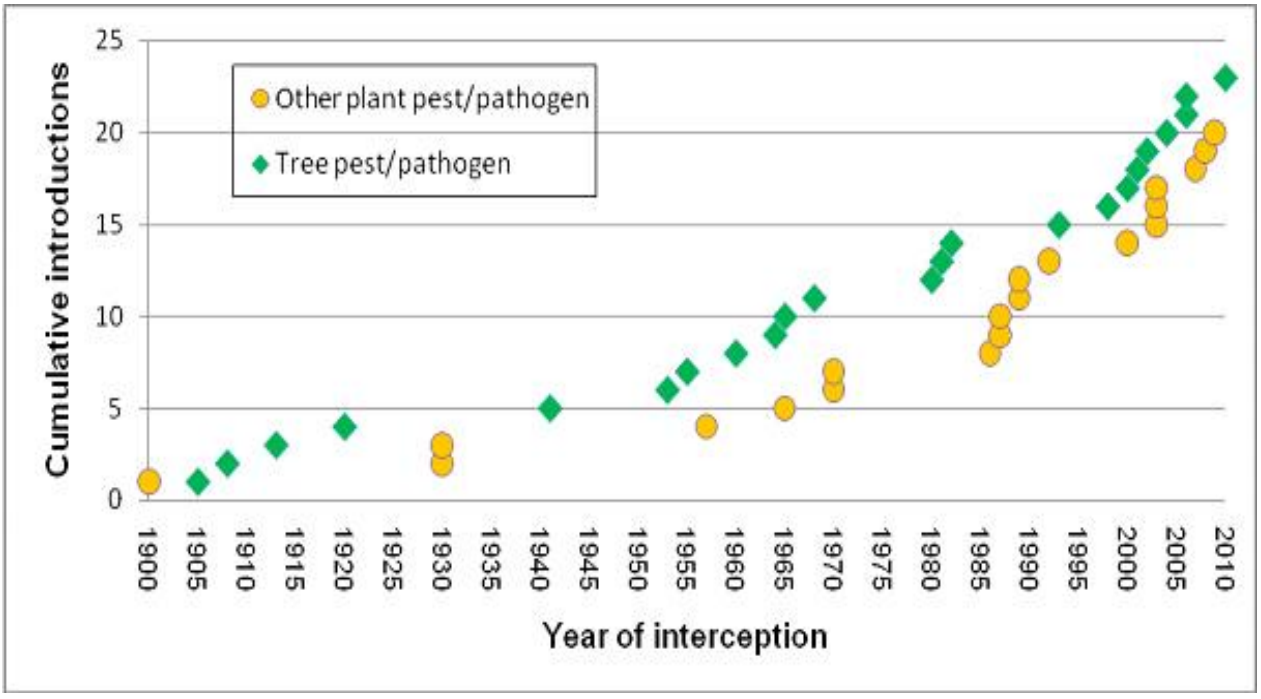
- Turning such a strategic system for managing pests and disease into an operational system to improve biosecurity within trading networks will require the costs to be distributed between those carrying responsibility at each step in the supply chain. Clearly, benefits are likely to be maximised across the whole trading system by ensuring those who supply plants or plant products are aware of their responsibilities to prevent incursion, and that they bear the costs associated with both implementation of effective prevention and with infraction if that occurs. Much of this can be implemented at the point of origin of the plant or plant product.

- Some investment will be necessary but the recommendations are also designed to improve the effectiveness of the deployment of current resources by raising awareness, by focusing efforts using risk-based assessment, by making greater use of modern technology and better use of current legislation.

- Finally, the recommendations are designed to protect plant health and tree health especially in the UK. This also provides an opportunity for the UK and other partners for growth in trade of healthy plant material and plant products.

Annex A – UK major plant and tree pest/pathogen introductions 1900-2010

The following table draws on data from the Forestry Commission and Fera and shows UK major tree and other pest / pathogen introductions over the period 1900-2010 (cumulative).



Annex B – Taskforce Terms of Reference, membership, and Register of Interests

TREE HEALTH AND PLANT BIOSECURITY EXPERT TASKFORCE

Terms of Reference

Summary

Professor Ian Boyd, Defra's Chief Scientific Adviser (CSA), has convened a Tree Health and Plant Biosecurity[72] Expert Taskforce to support Defra's response to tree and plant disease outbreaks. The Taskforce will draw on and review evidence to provide recommendations to identify risks to the UK from tree pests and pathogens and on the steps necessary to prepare for and deal with outbreaks.

The Taskforce will provide independent expertise on tree and plant health and will support Defra's CSA in ensuring the Secretary of State for Defra has access to the most up-to-date and robust evidence to inform decisions on dealing with tree and plant disease outbreaks. The Taskforce will work towards a new UK Tree and Plant Health Strategy and will be giving focus and drive to work already underway as part of the Tree Health and Plant Biosecurity Action Plan.

Aims of the Taskforce:

- To review domestic and international risks presented from new and emerging tree and related plant pests and pathogens, including using best available evidence, assessment of risk status, and appropriate risk assessment tools.
- To provide an independent perspective on costs and benefits to inform priority setting and resource allocation.
- To identify potential obstacles to removing barriers to improve tree health and plant biosecurity, and suggest ways of resolving them.

[72]The Taskforce will focus on tree health and related Biosecurity in Great Britain. This includes trees in woodlands, forests and in the wider environment, including amenity, fruit, and urban trees. Woody shrubs associated with trees and green spaces, are relevant as either a pathway of introduction/ spread of serious pest and pathogen threats, or where they act as sources of infection or infestation of trees (LWEC, 2011). Available at Securing Tree Health in a Changing Environment).

- To make use of international best practice in tree health and plant biosecurity management.
- To produce a rapid evidence assessment and make recommendations for next steps including identifying crucial knowledge gaps.
- To consider whether the current plant health policy and delivery infrastructure and risk mitigation framework needs to be overhauled and make recommendations for change, if required.
- To review the current contingency planning and emergency response arrangements and recommend changes, if required.

Governance:

The Taskforce is chaired by Professor Chris Gilligan and will report to Professor Ian Boyd, Defra's Chief Scientific Adviser who will in turn make recommendations to Defra's Secretary of State. It is acknowledged that Taskforce members may have links to other groups working on behalf of Defra or may be in receipt of Defra funding. Any potential conflicts of interest will be recorded. The Taskforce will be supported by a public sector Officials Advisory Group, and external peer reviewers.

The outputs of the Taskforce are expected to be:

(i) an interim report including evidence-based recommendations (by end Nov 2012);

(ii) a final report on the Taskforce's strategic view of the evidence (Spring 2013).

Taskforce Members

Professor Christopher Gilligan (Chair):
Professor of Mathematical Biology, University of Cambridge.

Professor Robert Fraser:
Professor of Agricultural Economics, University of Kent.

Professor Charles Godfray:
Hope Professor of Zoology (Entomology), University of Oxford.

Professor Nicholas Hanley:
Professor of Environmental Economics, University of Stirling.

Professor Simon Leather:
Professor of Entomology, Harper Adams University.

Professor Thomas Meagher:
Professor of Plant Biology, University of St Andrews.

Professor John Mumford: (from January 2013)
Professor of Natural Resource Management, Imperial College London.

Professor Judith Petts CBE:
Professor of Environmental Risk Management, University of Southampton.

Professor Nicholas Pidgeon:
Professor of Environmental Psychology, Cardiff University.

Dr Clive Potter: (from January 2013)
Reader in Environmental Policy, Imperial College London.

Professor Michael Shaw: (from January 2013)
Professor of Plant Disease Ecology, University of Reading.

Dr Jens-Georg Unger:
Head of the Institute for National and International Plant Health in Germany.

Dr Stephen Woodward:
Reader at the School of Biological Sciences, University of Aberdeen.

Professor Michael Jeger, Observer (November meeting):
Imperial College London

Register of Interests

The register records declarations made by members in respect of interests they have that are relevant to the remit of the Tree Health and Plant Biosecurity Expert Taskforce.

Members agreed to withdraw from discussion of matters in which they felt that they could not act impartially.

Taskforce Member	Declared Interest
Professor Chris Gilligan (Chair)	Head of School of Biological Sciences, and member of senior management committees at University of Cambridge concerned with research, including the General Board, Research Policy Committee. Staff in the School of Biological Sciences for whom I am responsible receive funding from Defra. Head of Epidemiology and Modelling Group at University of Cambridge that is funded to provide advice on emerging plant pathogens used by Defra (*including Chalara fraxinea, Phytophthora ramorum,* acute oak decline), USDA and other international organisations. Current and recent research grant funding in epidemiology and mathematical biology from Biotechnology and Biological Sciences Research Council (BBSRC), Gates Foundation, Defra, DfID, United States. Department of Agriculture (USDA), BP. Chair Management Board Cambridge Programme for Sustainability Leadership. Chair of Defra's Science Advisory Council. Trustee Natural History Museum. Honorary Research Fellow, Rothamsted Research.
Professor Thomas Meagher	Member, NERC Council. Co-Chair, LWEC DEFRA/BBSRC Tree Health and Plant Biosecurity Phase 1 funding panel.

Taskforce Member	Declared Interest
Professor Nick Pidgeon	Member DEFRA/DECC Social Sciences Advisory Panel. Member DECC Science Advisory Group. Director of Understanding Risk Research Group at Cardiff University, and principal investigator on research grants looking at risk, new technology and the environment from NERC, ESRC, EPSRC, and USNSF. None currently concerned with tree health or biosecurity. Co-investigator Cardiff University Institute for Sustainable Places. Co-investigator Climate Change Consortium for Wales (C3W), and member of Tyndall Centre for Climate Change Research. Advice to Government Office of Science via recent Foresight programmes, and Review of DECC science. Member of the external Academic Advisory Panel to the ESRC Genomics Research and Policy Forum.
Dr Clive Potter	Leading two Defra funded research projects on stakeholder engagement in, and public awareness of, tree health issues.
Professor Nick Hanley	Member of Defra's Economic Advisory Panel.

Taskforce Member	Declared Interest
Professor John Mumford	Chair of the Great Britain Non-native Species Risk Analysis Panel (Defra, Welsh Assembly and Scottish Government). Contract with EFSA to develop a quantitative pathway analysis for pest pathways related to various edible commodities. Investigator in an EC FP7 Security Theme project PLANTFOODSEC on agricultural bioterrorism and bio-crime related to plant and food security. Investigator on "Beyond Compliance" projects funded by the STDF and AusAID on export quality horticultural biosecurity in SE Asia. Vice Chairman of the East Malling Trust, a charity promoting horticultural research. Director of Agra-CEAS Consulting Ltd, a consulting company partly owned by Imperial College London, which on occasion provides consulting services to Defra. Academic employed by Imperial College London; the range of duties and research sponsors is available at www.imperial.ac.uk/people/j.mumford.
Dr Steve Woodward	Lead on one of the LWEC Tree health and Plant biosecurity Phase I projects; and an evaluator for LWEC Phase 1 bids. Co-ordinator for an EU-funded RTC project that deals with alien invasive pests and pathogens of trees (ISEFOR). Management Committee Member for FP1002 PERMIT (Pathway Evaluation and Pest Risk Management in Transport) and 1102 DIAROD (Determining Invasiveness and Risk of Dothistroma). Until November 2012 - Chair of COST Action FP0801 Established and Emerging Phytophthora: Increasing Threats to Woodland and Forest Ecosystems in Europe.
Professor Robert Fraser	Member of Defra’s Economic Advisory Panel.

Taskforce Member	Declared Interest
Professor Judith Petts	Dean, University of Southampton. Member of the Board of University of Southampton Science Park. Member of the Defra Science Advisory Council. Chair, Defra/DECC Social Science Expert Panel. Member, Veolia Environmental Services Advisory Board. Member, The Engineering and Physical Sciences Research Council (EPSRC) Strategic Advisory Network. Member of BIS Sciencewise Steering Board. Staff of the Faculty of Social and Human Sciences at the University of Southampton for which I am responsible receive funding from multiple sources, including ESRC, EPSRC, NERC, BBSRC, Defra, DfiD and the Environment Agency.
Professor Charles Godfray	Member, NERC Council. Member of a number of committees (unpaid) on food security and the environment (but not specifically on tree health).
Professor Simon Leather	Some Defra funded projects: • TH103 - Analysis of the Management of Outbreaks of Oak Processionary Moth in the UK • CTX1201 - Acute Oak Decline in the UK.

Taskforce Member	Declared Interest
Dr Jens-Georg Unger	Member of EFSA Scientific Network for Risk Assessment in Plant Health. Head of Institute for National and International Plant Health [within JKI] which participates in research projects related to plant health and surveillance (EFSA project “Plant health pest surveys for the EU territory” [PERSEUS]); FP 7 EU-research project „Analysis of the potential of the pine wood nematode (Bursaphelenchus xylophilus) to spread, survive and cause pine wilt in European coniferous forests in support of EU plant health policy [REPHRAME]; COST Action FP1002 “Pathway Evaluation and pest Risk Management in Transport [PERMIT]”; COST Action FP1103 “Fraxinus dieback in Europe: elaborating guidelines and strategies for sustainable management (FRAXBACK)”. Technical/scientific advice to the *Federal Ministry of Food, Agriculture and Consumer Protection* of Germany and in this function participation in the Standing Committee on Plant Health (EU-Commission) and the COPHS (EU-Council).
Professor Michael Shaw	Part of short term project receiving Defra funding. TSB funding for project on novel disease management in orchards. McKnight Foundation funding for modelling of banana wilt.

Taskforce meetings

Full Taskforce meetings

13 - 14 November 2012

24 January 2013

25 - 26 February 2013

Subgroup meetings

12th February 2013 – Border controls

13th February 2013 – Evidence

18th February 2013 – Risk register

19th February 2013 – Epidemiological intelligence

Meeting with Stakeholders

21st March 2013

Annex C – Officials Advisory Group Terms of Reference

TREE HEALTH AND PLANT BIOSECURITY OFFICIALS ADVISORY GROUP (OAG): Terms of Reference

Summary

Professor Ian Boyd, Defra's Chief Scientific Adviser (CSA), has convened a Tree Health and Plant Biosecurity[73] Expert Taskforce to support Defra's response to tree and plant disease outbreaks. The Taskforce will draw on and review evidence to provide recommendations to identify risks to the UK from tree pests and pathogens and on the steps necessary to prepare for and deal with outbreaks.

An Officials Advisory Group (OAG) comprising experts from Defra and the Defra Network will support the Taskforce. The OAG will help to ensure complementary actions to work already underway for the Tree Health and Plant Biosecurity Action Plan.

Aims of the OAG:

- To raise awareness of the Taskforce of planned and current activities on the ground.
- To provide expert advice to the Taskforce where required.
- To review recommendations from the Taskforce to consider their feasibility and how they complement existing activities.
- To develop operational plans to support policy implementation of the Secretary of State's response to the Taskforce recommendations.

Governance:

The OAG provides an advisory role to the expert Taskforce and as such will not make an independent report or meet separately. The Taskforce will draw on the OAG advice to revise recommendations and in their work towards a new Tree and Plant Health Strategy.

[73]The Taskforce will focus on tree health and related Biosecurity in Great Britain. This includes trees in woodlands, forests and in the wider environment, including amenity, fruit, and urban trees. Woody shrubs associated with trees and green spaces, are relevant as either a pathway of introduction/ spread of serious pest and pathogen threats, or where they act as sources of infection or infestation of trees (LWEC, 2011). Available at Securing Tree Health in a Changing Environment.

Officials Advisory Group members

Dr Chris Cheffings	Joint Nature Conservation Committee
Dr Joan Webber	Forest Research
Tony Kirkham	Royal Botanical Gardens, Kew
Nigel Gibbens	Defra
Wilma Harper	Forestry Commission
Martin Ward	Food and Environment Research Agency
Roger Coppock	Forestry Commission
Dr John Morgan	Forestry Commission
Julie Hitchcock	Defra
Ian Mitchell	Defra
Prof. Peter Freer-Smith	Forest Research
Hugh Clayden	Forestry Commission Scotland
Prof. Hugh Evans	Forestry Research in Wales
Dr David Slawson	Food and Environment Research Agency

NOTE – Invaluable advice was also provided towards the end of the Taskforce's deliberations by Sharon Mole – Interim Deputy Director, National Customs Operations, Border Force.

Annex D – Peer Reviewers

We gratefully acknowledge the contributions of peer reviewers who undertook to provide their quality assurance and thoughtful comments:

Professor Ian Bateman

University of East Anglia

Dr Keith Kirby

University of Oxford

Professor John Lucas

Rothamsted Research

Annex E – Governance arrangements for UK tree and plant health issues

The responsibilities of public agencies for plant health are set out in the Plant Health Act 1967 [1], which splits responsibility in England between the Forestry Commission and Defra (who in 2009 delegated responsibility for plant health to the Food and Environment Research Agency (Fera)). The Plant Health Act 1967 prescribes the Forestry Commissioners as the competent authority in Great Britain for the protection of forest trees and timber, although the Act does not define "forest trees".

The Forestry Commission monitors forest tree health, at a national level, for quarantine pests, in accordance with EC Directive 92/70/EEC. More generally it monitors the condition of woodland trees as part of the National Forest Inventory and through reports to the Tree Health Diagnostic and Advisory Service. Whilst there is no legal definition of "forest trees" the Forestry Commission's remit, has through custom and practice, been interpreted as including at least those tree and shrub species for which the Forestry Commission would pay grant aid [2] for woodland creation and regeneration.

Forestry is a devolved matter. The Secretary of State for the Environment, Food and Rural Affairs has responsibility for forestry in England as well as certain activities such as international affairs, which are reserved. Responsibility for forestry in Scotland lies with the Scottish Government and in Wales with Welsh Ministers. Separate arrangements apply in Northern Ireland covered by the Plant Health Act (Northern Ireland) 1967.

The Department for Environment, Food and Rural Affairs (Defra) co-ordinates plant health policy across the UK and Crown Dependencies and represents the UK as the "Single Central Authority" under the EU Plant Health Directive. Defra is also the contact point for the UK "National Plant Protection Organization" under the International Plant Protection Convention. These responsibilities were delegated to Fera, but, as a first step towards improving plant health governance, Defra decided to bring plant health policy closer to the heart of Government. As a result, the Plant Health Policy Team in Fera (which carries out much of the co-ordinating role) transferred to Defra on 31 December 2012.

Fera implements plant health policy (a devolved matter) in England. The Welsh Government is responsible for plant health policy in Wales, but has a concordat with Fera and Defra in relation to plant health and seeds functions in Wales. Fera Inspectors carry out inspections of plants (including trees) and produce imported from non-EU countries, and targeted monitoring of plants (including trees) moving within the Single Market. Fera scientists carry out assessments of risk to plant health (other than forest trees), diagnosis of pests and pathogens, and research on risk assessment, detection, diagnosis and

control. A concordat signed in 2011 between Forestry Commission and Fera sets out the way the two organisations work together, including in outbreak situations.

Pest or disease outbreaks are the joint responsibility of Fera and Forestry Commission with roles agreed based on where the sites are and what resources and capability are required to deal with the outbreak. Surveillance for harmful organisms of trees in the wider environment including street trees, public parks and gardens responsibility is shared between Forestry Commission (where there is a threat to forests or woodland), Fera, Local Authority tree officers, landowners and managers, and householders.

Although the statutory plant health services have lead responsibility, a key element of the Tree Health and Plant Biosecurity Action Plan is the engagement of statutory conservation bodies, industry sectors, NGOs, local authorities, landowners and the public in reporting new pest and disease outbreaks and helping to manage them.

The Secretary of State for the Environment, Food and Rural Affairs has responsibility for forestry in England as well as certain activities such as international affairs, which are reserved. Responsibility for forestry in Scotland lies with the Scottish Government and in Wales with Welsh Ministers. Separate arrangements apply in Northern Ireland covered by the Plant Health Act (Northern Ireland) 1967. The Forestry Commission monitors forest tree health, at a national level, for quarantine pests. More generally, it monitors the condition of woodland trees as part of the National Forest Inventory (NFI) and through reports to the Tree Health Diagnostic and Advisory Service.

Annex F - Example template to assess impact and prioritise risks

This example (provided by Professor Rob Fraser, School of Economics, University of Kent) illustrates how an overall pest risk prioritisation could be developed based on an assessment of economic, social and environmental impacts. Note that: (i) this example includes a simple estimate for the baseline risk which includes the likelihood of incursion, normally comprising of the probability of entry and the probability of establishment (see main text); (ii) the prioritisation presented in the table would need to take account of the cost and effectiveness of interventions to determine an action plan.

		Monetised Impacts			Expected Cost	Non-monetised Expected Impacts (based on Prob. Outbreak & size of impact) (Small/Med/Large)			Overall Pest Risk Priority (Low/Med/High)
Pest (A)	Prob. Outbreak (B)	Economic (C)	Social (D)	Environmental (E)	(F) Based on B(C+D+E)	Economic (G)	Social (H)	Environmental (I)	(J) Based on F, G, H and I
W	0.1 to 0.3	£100M	£50M	£50M	£20-60M	Med	Med	Med	Med
X	0.4 to 0.6	£70M	££50M	£0M	£48-72M	Med	Large	Large	High
Y	0.05	£200M	£0M	£100M	£15M	Med	Small	Small	Low
Z	1	£0M	£15M	£15M	£30M	Small	Small	Small	Low

Note: The overall priorities in column J are judgements that could change if different weights (importance) were attached to different criteria. Similarly, if the probabilities of an outbreak were revised, then this could change the prioritisation, and again if the estimates of monetised and non-monetised impact were to change then this could change the prioritisation.

Annex G – Tree Health: Examples of Current and Potential Pests and Pathogens

The following table provides a summary of some key aspects of current and potential pests and pathogens of threat to the UK. Note that the table is illustrative and is not intended to be exhaustive neither in the coverage of organisms nor in the detail provided for each organism. The table however is indicative of the sorts of information that would be required to produce the Plant Health Risk Register initially for trees.

Established Pest / Disease: **Acute Oak Decline**	
Organism(s)	Complex of biotic factors - primarily bacteria and oak buprestid beetle *Agrilus biguttatus*, but abiotic factors may also play a role.
Hosts	UK native oak species, *Quercus robur, Q. petraea*
Potential scale of damage	Dieback and/or rapid mortality of infected native oaks. On average 25% of trees on an affected site symptomatic, over one year of monitoring 1% of trees died. Currently limited distribution, which coincides with known distribution of *Agrilus biguttatus.*
Origin and current distribution	Unknown but likely to be caused by resident organisms. *Agrilus biguttatus* is a native species and the bacterial species involved may also be native. Affected oak currently mainly south of the Wash.
Means of spread	**Unknown:** pruning, machinery and human transmission implicated. Also possible involvement of insects (including *Agrilus biguttatus*), birds or animals.
EU Regulated organism [YES/NO] Control measures	**NO:** research required so control advice is evidence based. In the interim, preventative measures (e.g. disinfect tools, destruction of infected material, containment of affected areas) is recommended. Also, raising of public and sector awareness through information and training.
Control approaches being used in other countries	Felling, but status of disorder uncertain elsewhere.

Established Pest / Disease: **Acute Oak Decline**	
Detection / Diagnostics	Identification of micro-organism likely to be involved underway. Real-time Polymerase Chain Reaction (a DNA amplification method) detection of some of the bacteria involved under development.
Knowledge gaps	Causes of the condition: role played by organisms, host status, environmental conditions and effects of climate change. Epidemiology and transmission: extent and severity in Britain, rate of spread Control and management. Research is critical to determine these aspects so that management practises can be tested and implemented. A recent Defra grant (£1.1 million) will allow progress against several of these research gaps.

Established Pest / Disease: **Bleeding Canker of Horse Chestnut**	
Organism(s)	Bacterial canker, *Pseudomonas syringae pv aesculi* (bacterium)
Hosts	Horse chestnut, *Aesculus hippocastanum*; also other *Aesculus* spp., particularly *A.* x *carnea.*
Potential scale of damage	Survey has revealed 33-79% horse chestnut trees affected by symptoms in England (depending on region), 36% in Wales and 42% in Scotland (2007 survey). Some trees remain completely unaffected suggesting resistance in horse chestnut population.
Origin and current distribution	Considered likely to originate from Himalayas causing low level damage to *Aesculus*. Now known to be present in Netherlands, Belgium, Germany, France, Ireland and UK.
Means of spread	**Long distance:** planting material. **Locally:** rain splash dispersed and possibly through movement of contaminated machinery and soil/debris.
EU Regulated organism [YES/NO] **Control measures**	**NO:** no formal control measures (e.g. chemical treatments) available. Maintenance of affected trees to prevent safety hazards including pruning affected branches.
Control approaches being used in other countries	None.
Detection / Diagnostics	Real-time Polymerase Chain Reaction (a DNA amplification method), diagnostic developed.
Knowledge gaps	Pathways of spread into and within Europe, genetic processes facilitating infection of woody parts of the tree, spread and survival outside of the host.

Established Pest / Disease: **Dothistroma Needle Blight** **NB. - Two pathogens can cause the disease, *D. septosporum* and *D. pini*; only the former is known to be present in GB.**	
Organism(s)	*Dothistroma septosporum* (fungus)
Hosts	Pine species; many other conifers are infected, but symptoms are mild.
Potential scale of damage	Most commercial pine species susceptible. Now found across Britain. Major loss of timber yield, increasing and rapid mortality being observed, particularly in Lodgepole pine. Reports on native Scots pine (including nurseries where fungicides applied) resulting in concerns not only for commercial forestry but also native Caledonian pine forests.
Origin and current distribution	Origin is unknown, although Himalayas and South America are possibilities. Disease is present in the Southern Hemisphere, but since the 1990s it has become widespread and common in the Northern Hemisphere including Europe (as far north as the Arctic circle). It has also had a major impact on pine in Canada since the 1990s.
Means of spread	**Long distance:** planting material and potentially seed lots contaminated with needle debris. **Locally:** rain and longer distances by wind-blown mists.
EU Regulated organism [YES/NO] **Control measures**	**YES (Regulated in nurseries):** destruction of infected planting stock. Use of alternative (resistant) species. Silvicultural practices, i.e. increased planting density, good weed control, thinning reducing humidity and inoculum can provide some benefit. Copper based fungicides in nurseries (not currently approved for use in the forest) suppress or prevent the disease but do not eradicate it if trees are already infected.
Control approaches being used in other countries	Similar control measures but a greater reliance on aerial spraying of copper fungicides (e.g. New Zealand). Some tree breeding also undertaken but the reduction in susceptibility is modest. Management methods are fairly well developed in New Zealand but large losses still occur e.g. approx.. £10 million per annum.
Detection / Diagnostics	Detection based on visual symptoms limited to June/July when fruit bodies and other symptoms most evident. Diagnosis well developed where fruit bodies are present, i.e. mainly June/July (both through microscopic analysis of spores and standard and real-time Polymerase Chain Reaction). Polymerase Chain Reaction methods available for mating type identification, with population studies using microsat and RAPD molecular markers.

Established Pest / Disease: **Dothistroma Needle Blight** **NB. - Two pathogens can cause the disease, *D. septosporum* and *D. pini*; only the former is known to be present in GB.**	
Knowledge gaps	**Diagnostics:** extent on all susceptible commercial species (including spruce, Douglas fir); severity and rate of change on above; the potential for using aerial surveys/remote sensing; Improved monitoring and detection, particularly when fruit bodies are not present; presence/absence of *D. pini* and the sexual state of *D. septosporum*; **Disease epidemiology** including timing of spore dispersal, dispersal distances, spore persistence and critical loads, impacts of other environmental factors including climate change, relationship with other pests & pathogen; **Economic, environmental and social impact** including volume loses, mortality rates, rates of decay, timber properties, fire risk, ground nesting birds, recreation, health, Caledonian forest ecosystems.

Established Pest / Disease: **Large pine weevil**	
Organism(s)	*Hylobius abietis* (weevil)
Hosts	Conifers
Potential scale of damage	Around 30% mortality of unprotected transplants in areas at risk. Nationwide risk in conifer plantation forestry.
Origin and current distribution	Widespread across Europe and Asia.
Means of spread	Predominantly by adult flight. Some potential for international spread in infested bark.
EU Regulated organism [YES/NO] **Control measures**	**Yes:** protection of conifer transplants using insecticides. Some potential for biocontrol with parasitic nematodes. Limited potential for use of physical barriers on transplants. Monitoring and management support system to minimise risk to transplants; fallow periods.
Control approaches being used in other countries	Insecticides. Scarification of planting sites and spray on physical barriers..
Detection / Diagnostics	Larval populations in root stumps at clearfell sites. Feeding damage to stems of transplants. Transplant mortality.
Knowledge gaps	Impact of climate change on population dynamics and damage. Methods of improving transplant resistance. Variation in pathogenicity of nematodes and synergism with pathogenic fungi in biocontrol.

Established Pest / Disease: **Great Spruce Bark Beetle**	
Organism(s)	*Dendroctonus micans* (beetle)
Hosts	Species of spruce
Scale of damage / Commercial loss amenity / Landscape (die back, reduced vigour, tree mortality)	Significant mortality in infested stands.
Origin and current distribution	Origin: Eurasia, widely distributed on range of spruce species and occasionally on Scots pine. Invasive in Georgian Republic, Turkey and Great Britain, still spreading west in France.
Means of spread	**Long distance:** unbarked spruce logs/spruce bark from regions where native or established. Single females can establish. **Local:** movement of infested material. Natural spread by adult flight.
EU Regulated organism [YES/NO] Control measures	**NO**. biocontrol. Thinning to remove infested trees. Ireland has Protected Zone against this beetle and wood exports from UK must comply (debarking). Previous GB Protected Zone has been dropped.
Control approaches being used in other countries	Biocontrol with *Rhizophagus grandis*. Monitoring and destruction of infested trees.
Detection / Diagnostics	Resin bleeding/resin tubes on stem. Discolouration of foliage, especially top death. Tree mortality from repeated attacks. Galleries in bark.
Knowledge gaps	Influence of climate change on semi-voltine life cycle and damage. Potential to escape biocontrol as climate warms.

Newly arrived: **Oak Processionary Moth**	
Organism(s)	*Thaumetopoea processionea* (moth)
Hosts	Wide range of oak species
Potential scale of damage	Affects oaks in urban areas and in woodlands and forests. Currently limited to urban areas in west London, a smaller outbreak in Berkshire and an outbreak in the London Boroughs of Bromley and Croydon. Capable of defoliating native oaks over several seasons, leading to dieback, long-term decline and mortality. Larval hairs cause severe health problems for people and animals (skin rash, eye and throat irritation, allergic reactions). Impact could be greater due to interaction with other biotic and abiotic factors associated with acute oak decline.
Origin and current distribution	Central and Southern Europe with periodic outbreaks in more northerly countries (e.g. Austria, Belgium, Netherlands). Invasive to GB and currently at very high levels in Belgium and Netherlands.
Means of spread	**Long distance:** on live plants-for-planting. **Locally:** natural dispersal by adult flight (up to 2km); transport on arboricultural arisings.
EU Regulated organism [YES/NO] **Control measures**	**YES**: e**mergency measures** under Plant Health (Forestry) Order to prevent further importation on live plants and transport within UK. Application to EU for **Protected Zone** pending. **Current:** insecticide application from ground against young larvae (limited application against older larvae); removal of older larvae and larval nests by hand or vacuum equipment. Potential aerial application of *Bacillus thuringiensis* in non-urban woodlands.
Control approaches being used in other countries	EU as in UK but also insecticide application from the air (France, Germany). Trials with entomopathogenic nematodes currently being carried out in Netherlands.
Detection / Diagnostics	Pheromone trapping for adult moths, but traps inefficient. Visual surveys for eggs, larvae and nests.
Knowledge gaps	Life-cycle and biology under UK conditions, e.g. timing of egg hatch, oviposition and larval distribution in the canopy, dispersal distances. Climate relations: rate of development and population increase in relation to environmental temperatures. Natural controls: parasites, predators & pathogens. Monitoring & surveillance methods, especially factors limiting the effectiveness of pheromone traps. Interaction with other defoliators, pests and pathogens and impact on oak.

Newly arrived: **Ramorum Disease (canker, dieback, leaf blight)**	
Organism(s)	*Phytophthora ramorum* (oomycete)
Hosts	Wide range including ornamentals, heathland plants, and a wide range of broadleaved and coniferous species.
Potential scale of damage	**Larch:** massive (landscape-level death). **Fagaceae:** minor (death/dieback). **Heathland:** major (death/dieback). **Gardens:** major (dieback/leaf blight). **Hardy Ornamental Nursery Stock:** moderate (dieback/leaf blight)
Origin and current distribution	Origin is unknown although Asia considered a strong possibility. Current distribution: widespread in Europe although mainly limited to ornamental plant nurseries and outlets with outbreaks in the wider environment in about 10 European countries including UK and Ireland. Also present in the wider environment in the USA (California & Oregon).
Means of spread	**Long distance:** planting material; soil. **Locally:** rain, wind-blown mists, via water courses, contaminated footwear, machinery, vehicles.
EU Regulated organism [YES/NO] **Control measures**	**YES:** current *Phytophthora* Disease Management Programme (PDMP) and EC measures (incl. plant passporting). Eradication and containment and management methods well developed (in heathland less so). Plant destruction. Fungicides well researched and slow-sand filtration. Disinfectants. Modelling in support of eradication and containment.
Control approaches being used in other countries	EU: as in UK. USA: similar to UK/EU.
Detection / Diagnostics	Well developed: Lateral Flow Device; in-field and lab-based Polymerase Chain Reaction; real-time Polymerase Chain Reaction (in *planta* and for cultures) baits. Restriction Fragment Length Polymorphisms (a DNA-based diagnostic technique) to distinguish between the four lineages, as well as genotyping methods.
Knowledge gaps	***Phytophthora* Disease Management Programme (PDMP) having success, but step-change in disease on larch (PDMP ends 2014).** Research gaps: Epidemiology on larch; impact of newly discovered EU2 lineage; potential impact on other forestry species. Remote sensing. Understanding and influencing behaviours. Host resistance (forestry species).

Newly arrived: **Kernoviae Disease (canker, dieback, leaf blight)**	
Organism(s)	*Phytophthora kernoviae* (oomycete)
Hosts	Wide including ornamental species principally rhododendron, pieris and magnolia. Also beech and heathland plants such as *Vaccinium* (billberry).
Potential scale of damage	**Heathland:** major (death/dieback). **Trees:** minor (some death/dieback). **Gardens:** major (dieback/leaf blight). **HONS:** minor (dieback/leaf blight).
Origin and current distribution	Likely to be New Zealand. Known distribution is UK (England, Scotland and Wales), Republic of Ireland, and New Zealand.
Means of spread	**Long distance:** planting material; soil. **Locally:** rain, wind-blown mists, via water courses, contaminated footwear, machinery, vehicles.
EU Regulated organism [YES/NO] **Control measures**	**NO but regulated in the UK. Current *Phytophthora* Disease Management Programme**. Eradication and containment and management methods well developed (in heathland less so). Plant destruction. Fungicides well researched and slow-sand filtration effective in nurseries. Disinfectants.
Control approaches being used in other countries	**EU:** as in UK.
Detection / Diagnostics	**Well developed:** Lateral Flow Device; in-field and lab-based Polymerase Chain Reaction; real time Polymerase Chain Reaction; baits. Limited genotyping methods.
Knowledge gaps	**PDMP having success (ends 2014).** Research gaps: Remote sensing. Epidemiology. Understanding and influencing behaviours. Host resistance (*Vaccinium*).

Newly arrived: **Lateralis Root Rot**	
Organism(s)	*Phytophthora lateralis* (Oomycete)
Hosts	Lawson cypress (*Chamaecyparis lawsoniana*) and other related species including ….
Potential scale of damage	Evidence suggests disease limited to Lawson's cypress in the UK (little if any Pacific yew present), so impact major on ornamental plantings, nurseries; minor for forestry.
Origin and current distribution	Considered to be East Asia and has recently been discovered in Taiwan associated with native *Chamaecyparis* but with little/no impact, so likely area of origin. In Europe present in UK, France, Netherlands, Ireland. Also present in USA where it is highly damaging to native *Chamaecyparis lawsoniana* and Pacific yew.
Means of spread	**Long distance:** planting material; soil. **Locally:** via water courses, soil on machinery, footwear, possibly rain, wind-blown mists if aerial infection common.
EU Regulated organism [YES/NO] **Control measures**	**YES** (European and Mediterranean Plant Protection Organisation A2) **Current:** destruction of infected plant material; nursery inspections; import controls.
Control approaches being used in other countries	Controls in place in USA to minimise movement in forests; development of resistant Lawson Cypress genotypes.
Detection / Diagnostics	**Well developed:** lateral Flow Device; in-field and lab-based Polymerase Chain Reaction; baits. Microsat genotyping methods.
Knowledge gaps	Host range; pathway analysis; pathogen variation; risk mapping; epidemiology (particularly in relation to aerial infection); potential for hybridisation with *P. ramorum* (closest relative).

Probably newly arrived: **Pine Tree Lappet Moth**	
Organism(s)	*Dendrolimus pini* (moth)
Hosts	Pines including Scots pine.
Potential scale of damage	Can cause extensive damage and tree death over large areas of forest in some countries, notably Poland and Germany and this frequently requires aerial insecticide application to control the outbreaks (but not regarded as a serious pest in some European countries).
Origin and current distribution	Northerly distribution in Western and Central Europe and European part of Russia. May be a new arrival in GB (Scotland) but molecular studies have, so far not ruled out the possibility that this is a hitherto unrecorded native species that has gone through a genetic bottleneck.
Means of spread	**Long distance:** planting material, forestry machinery from abroad, with wood products or wood packaging and deliberate releases cannot be ruled out. **Locally:** natural spread by adult flight; eggs and larvae could also be spread on harvested logs being transported on lorries or on plants or foliage.
EU Regulated organism [YES/NO] **Control measures**	**NO**. **Current:** not a regulated EU organism. In Scotland control is via movement restrictions within the outbreak area and application of biosecurity measures.
Control approaches being used in other countries	Considered a native elsewhere in Europe.
Detection / Diagnostics	Developing: Polymerase Chain Reaction based identification. Also, visual surveys for larvae and use of sticky bands to detect larvae moving down trunk to overwinter and up trunk in spring, annual light trapping for adult moths and pheromone trapping for adult male moths.
Knowledge gaps	Standardise survey techniques to monitor pine-tree lappet moth population's extent and size over time; phenology; DNA studies to try and clarify the origin of the Scottish moth (native or introduced); growth, consumption, and development rates of the caterpillars and adult fecundity.

Newly arrived: **Ash Die Back**	
Organism(s)	*Chalara fraxinea* (fungus)
Hosts	Common ash (*Fraxinus excelsior*) and narrow-leaved ash (*F. angustifolia*) severely affected; Manna ash (*F. ornus*) is a host but little dieback on this species. Asian ash species likely to be highly resistant; status North American ash species uncertain, but likely to be susceptible.
Potential scale of damage	**Ash: potentially major;** bark death, dieback and mortality. In northern Europe many ash stands are affected and death very widespread.
Origin and current distribution	Origin likely to be East Asia - has recently been reported in Japan. Now widespread across Europe (France to Ukraine and Russia).
Means of spread	**Long distance:** spread via movement of infected plant material and some evidence of longer distance spread by wind. **Locally:** through wind-borne spores initiating infection on leaves.
EU Regulated organism [YES/NO] **Control measures**	**NO**. Recent ban imposed on imports of ash plants from other EC countries and on movement of trees from UK nurseries. Destruction of infected trees on nursery sites and containment strategy currently adopted at woodland/forest sites.
Control approaches being used in other countries	Very difficult to prevent spread once disease is established. The disease has spread rapidly in Europe. Preventative measures include sanitation, cultural methods, long term breeding strategy and chemical control.
Detection / Diagnostics	**Well developed:** both *in planta* (conventional and real-time Polymerase Chain Reaction) and for cultures (conventional and Polymerase Chain Reaction based). Lateral Flow Device in development.
Knowledge gaps	Detailed surveys of ash in the wider environment; nursery surveys; pathway analysis; epidemiology studies; host susceptibility.

Potential threats in EU: **8-toothed Europe Spruce Bark Beetle**	
Organism(s)	*Ips typographus* (beetle)
Hosts	Spruce
Potential scale of damage	Occasional landscape scale outbreaks and tree mortality in over mature forests following wind blow and/or pronged drought/high temperatures causing 'stress' on trees. Tree mortality along newly exposed forest edges.
Origin and current distribution	Widely distributed in Eurasia, including Japan. Intercepted frequently internationally, associated with wood plus bark.
Means of spread	**Long distance:** unbarked spruce logs/spruce bark from regions where native or established. **Locally:** infested logs, timber. Natural spread by adult flight.
EU Regulated organism [YES/NO] **Control measures**	**YES.** *Keep out, knowledge of trade routes, awareness on nurseries, foresters, public.* **Current:** import controls, destruction of infested wood/lumber, port inspections/ pheromone traps to intercept beetles. Eradication attempt essential if local incursion. UK and Ireland have Protected Zones against this pest and 2 other European *Ips* species (*I. amitinus* and *I. duplicatus*).
Control approaches being used in other countries	Risk assessment in mature spruce forests. Monitoring with pheromone traps. Mass trapping has been used in large outbreaks. Prompt removal of trees following wind blow and forest hygiene. Felling and removal of infested trees before beetle emergence and destruction of infested bark. Pheromone trapping to detect any beetle populations.
Detection / Diagnostics	Pheromone traps at docks where spruce imported. Signs of infestation include resin bleeding on stem often with multiple attacks on same trunk. Discolouration of foliage and top death followed by full tree mortality. Distinctive galleries in bark.
Knowledge gaps	Life cycle on Sitka spruce in UK, especially ability of moribund host material to support endemic populations. Susceptibility/resistance of mature Sitka & Norway spruce. Pathogenicity of beetle associated fungi to Sitka spruce. Potential fungal associates that could already be present in GB.

Potential threats in EU: **Citrus Longhorned Beetle**

Potential threats in EU: **Citrus Longhorned Beetle**	
Organism(s)	*Anoplophora chinensis* (beetle)
Hosts	Wide range of broadleaved trees, especially maples (*Acer* species), chestnuts (*Aesculus* species), *Citrus* species., Hazel (*Corylus* species), Cotoneaster species, beech (*Fagus* species), figs (*Ficus* species), *Hibiscus* species, *Lagerstroemia* species), *Mallotus* species) crab apple (*Malus* species), plane (*Platanus* species), poplar (*Populus* species), cherry (*Prunus* species), pear (*Pyrus* species), willow (*Salix* species), rose (Rosa species), and elm (Ulmus species); also attacks Japanese red cedar (*Cryptomeria japonica*)
Scale of damage / Commercial loss amenity / Landscape (die back, reduced vigour, tree mortality)	Die back of foliage during early attack phase. Sustained attacks can result in tree mortality.
Origin and current distribution	East Asia (China, Taiwan, Korea, Japan, Burma, Vietnam). Current infestations in Italy (established), Netherlands, France, UK (all have records but now absent).
Means of spread	**Long distance:** spread via movement of infested living trees (especially *Acer palmatum*) and less commonly on wood packaging. **Locally:** adult flight over relatively short distances (up to 2 km).
EU Regulated organism [YES/NO] Control measures	**YES.** Control of movement of infested plants and wood to prevent long distance spread. Surveys around nurseries that have imported large numbers of maples or other host tree species from China or from already infested areas of Europe (e.g. Italy). Control of infestations by early detection and felling/destruction of infested trees. EU regulated pest (Annex I and II).
Control approaches being used in other countries	Felling of infested trees. Trunk injection with imidacloprid or thiamethoxam.
Detection / Diagnostics	Attacks usually near base of trunk of suitable hosts. First sign usually round exit hole. Small indentation from female chewing and oviposition and frass/wood shavings from larval activity are other external signs. Difficult to detect.
Knowledge gaps	Flight distances of adult beetles. Identification of potential natural enemies for possible classical biological control programmes. Early detection methods to be improved with increased discrimination between Citrus Long-horned Beetle and other species of longhorn and wood boring insects.

Potential threats in EU: **Asian Longhorned Beetle**	
Organism(s)	*Anoplophora glabripennis* (beetle)
Hosts	Similar host range to citrus longhorn beetle (see above) and particularly sycamore and poplar..
Potential scale of damage	Die back of foliage during early attack phase. Sustained attacks can result in tree mortality.
Origin and current distribution	China, Hong Kong, Democratic People's Republic of Korea, Republic of Korea. Recorded or under eradication in Austria, Canada, France, Germany, Italy, Poland, Slovakia, UK and USA.
Means of spread	**Long distance:** spread via movement of infested living or sawn wood, including wood-packaging material (WPM), notably WPM that has been used to package stone and other heavy commodities such as machinery and wire spools. **Locally:** Adult flight over relatively short distances (up to 2 km).
EU Regulated organism [YES/NO] **Control measures**	**YES.** Control of movement of infested plants and wood (e.g. International Standards For Phytosanitary Measures 15) to prevent long distance spread. Control of infestations by early detection and felling/destruction of infested trees. EU regulated pest (Annex I and II).
Control approaches being used in other countries	Felling of infested trees. Trunk injection with imidacloprid or thiamethoxam.
Detection / Diagnostics	Attacks usually in the upper part of trunks of suitable hosts. First sign usually round exit hole. Small indentation from female chewing and oviposition and some evidence of larval frass/wood shavings during high density attacks are the only other external signs. Difficult to detect, particularly in the upper parts of the tree during low density attacks.
Knowledge gaps	Flight distances of adult beetles. Identification of potential natural enemies for possible classical biological control programmes. Early detection methods could be improved with increased discrimination from other species of longhorn and wood boring insects.

Potential threats in EU: **Pine Processionary Moth**	
Organism(s)	*Thaumetopoea pityocampa* (moth)
Hosts	Pine, Atlas cedar (*Cedrus atlantica*), European larch (*Larix decidua*).
Potential scale of damage	Defoliates *Pinus* species in Mediterranean Europe. Moving northwards in France associated with climate change (now north of Paris and in Brittany and an outlier near Strasbourg). Larval urticating hairs cause human health problems.
Origin and current distribution	Albania, Algeria, Austria, Bulgaria, Croatia, Cyprus, France (including Corsica), Greece (including Crete), Hungary, Italy (including Sardinia and Sicily), Libya, Macedonia, Montenegro, Morocco, Portugal, Serbia, Slovenia, Spain (including the Balearic Islands), Switzerland, Syria and Tunisia.
Means of spread	**Long distance:** spread via movement of pupae in the soil and larvae on foliage (overwintering stage within silken nests) with any trees (*Pinus* species and non-hosts) from areas where the pest is present. **Locally:** adults can fly a maximum of approximately 10 km. In France the average rate of spread with climate change is between 5 and 10 km per year.
EU Regulated organism [YES/NO] **Control measures**	**NO.** The species is not currently regulated in the EU. New regulations would be required to ensure that plants for planting from EU member states where the pest is present are free from the pest.
Control approaches being used in other countries	Trapping of adults and larvae, manual removal of nests, insecticide applications and biological control.
Detection / Diagnostics	Larval nests easy to detect. Adults attracted to pheromones and light. Pupae in the soil are very difficult to detect.
Knowledge gaps	The suitability of the climate for establishment in the UK is uncertain. Winter temperatures seem similar to those in Orleans where damage occurs but effects of UK winter solar radiation and late winter frost prevalence on pest needs further study.

Potential threats in EU: **Pine Wood Nematode**	
Organism(s)	*Bursaphelenchus xylophilus* (nematode)
Hosts	*Pinus* species; most pines are host to the nematode, though North American pines are not damaged.
Potential scale of damage	Nematode lives in all species of conifer other than *Thuja, Tsuga* and *Taxus*. Massive loss of susceptible trees, especially pines, in areas where wilt expression occurs. Economic and environmental damage. However, since the *Monochamus* beetle vectors are absent from the UK, both the nematode and the beetle would need to enter and establish for outbreaks to occur.
Origin and current distribution	Canada, Mexico, USA, Current distribution, China, Hong Kong, Japan, N & S Korea, Portugal, Spain (eradicated) and Taiwan.
Means of spread	**Long distance:** spread via movement of infested living or sawn wood. Main risks are associated with presence of vector beetles in the genus *Monochamus*. **Locally:** adult beetle vectors fly over relatively short distances (up to 2 km), but could be longer distances.
EU Regulated organism [YES/NO] **Control measures**	**YES.** In areas where pine wilt expression occurs (linked to monthly isotherms >20^{o}C and low soil moisture), early detection of wilt and felling of infested trees before emergence of vector beetles. Destruction or treatment of infested material to kill both nematode and vectors. The nematode can also be present in trees not showing wilt since the vector insect breeds in weakened or freshly killed trees and the nematode develops saptrophically. EU Regulated Pest, Annex I (along with its vectors in the genus *Monochamus*).
Control approaches being used in other countries	As above. There are no control measures applied in North America where the nematode is native and does not kill native trees other than occasionally in southern USA.
Detection / Diagnostics	In wilt areas, rapid loss of oleoresin pressure and reddening of foliage, followed by tree death. In non-wilt areas, sampling at the pupation sites of the vector *Monochamus* spp to detect nematodes. Nematodes can be extracted from infested trees to confirm diagnosis.
Knowledge gaps	Precise flight distances of adult beetles. Extent of likely wilt expression in Europe under current and future climates. Possible non-vector transmission. More accurate early detection of infestation.

Potential threats in EU: **Pine Pitch Canker**	
Organism(s)	*Gibberella circinata* (fungus)
Hosts	*Pinus* species; Douglas fir (*Pseudotsuga menziesii*)
Potential scale of damage	**Pine: potentially major**; bark death causing girdling, dieback and mortality. Some trees show induced resistance after infection.
Origin and current distribution	Origin possibly southern North America (Mexico) or Central America. Distribution: North, Central and South America, South Africa, Haiti, Japan, South Korea. Europe: currently established in Spain and Portugal; recently found in France and Italy, but assumed eradicated.
Means of spread	**Long distance:** spread via movement of infected plant material and seed. **Locally:** insect spread with longer distances via wind, wind-blown rain.
EU Regulated organism [YES/NO] **Control measures**	Not known to be present in the UK. Treatments aimed at preventing entry: import controls and inspection, kiln drying of timber.
Control approaches being used in other countries	In EU and USA: Destruction of infected material; seed treatments; altered silviculture; selection of resistant pine species; sanitation of equipment.
Detection / Diagnostics	**Well developed:** both *in planta* (conventional and real-time Polymerase Chain Reaction) and for cultures (conventional and Polymerase Chain Reaction based).
Knowledge gaps	Risk mapping to determine areas at most risk (climate/host maps); susceptibility of key pine species under UK conditions; review of potential vectors; ring testing of diagnostic protocols

Potential threats in EU: **Brown Spot Needle Blight**	
Organism(s)	*Mycosphaerella dearnessi* (fungus)
Hosts	Many pine species
Potential scale of damage	In North America it causes serious growth check to seedlings and young trees and has rendered Christmas tree plantations unsalable. It has recently been found affecting several pine species, including Scots pine, in a number of European countries e.g. Austria, Czech Republic, Estonia, Slovenia, Switzerland.
Origin and current distribution	Origin uncertain: first recorded in southern USA in 1920s. Currently present in North, Central and South America, central and eastern Europe, South Africa, Korea, China, Japan
Means of spread	**Long distance:** infected plant material and potentially seed lots contaminated with needle debris. **Locally:** rain splash, wind, insects and forestry equipment.
EU Regulated organism [YES/NO] **Control measures**	**YES:** not known to be present in the UK. EC listed disease - import controls and inspection.
Control approaches being used in other countries	Silvicultural control i.e. burning to destroy infected needles, use of resistant species/provenances, Fungicide control e.g. chlorothalonil and Bordeaux mixture, benomyl and maneb.
Detection / Diagnostics	Conventional and real-time Polymerase Chain Reaction.
Knowledge gaps	Pest risk analysis specific to GB; detection and diagnosis; risk mapping.

Potential threats in EU: **Chestnut Blight**	
Organism(s)	*Cryphonectria parasitica* (fungus)
Hosts	Sweet chestnut (*Castanea* species); also other members of the Fagaceae: including oaks (the UK-native *Q. robur* and *Q. petraea* are susceptible); *Castanopsis* species. Reported hosts from other families include hickory (*Carya ovata*), maple (*Acer*) species and sumach (*Rhus typhina*). Symptoms are slight on species other than North American and European *Castanea*, although on these species, only small, superficial cankers are formed, and the damage is not serious.
Potential scale of damage	**Potentially major:** has largely eliminated chestnut from its native range in North America and is damaging to productive chestnut orchards in much of Europe.
Origin and current distribution	Origin Japan but introduced into North America in early 1900s, Europe in 1930s where it is now widespread. Recent incursions into England and Republic of Ireland - currently considered eradicated.
Means of spread	**Long distance: s**pread via movement of infected plant material (plants, wood, bark) and birds. Small risk of transmission by fruits or seeds. **Locally:** insect spread, splash dispersal via rain.
EU Regulated organism [YES/NO] **Control measures**	**YES:** found on infected stock in the UK in 2011/12, plants destroyed; treatments aimed at preventing entry: import controls and inspection.
Control approaches being used in other countries	In EU and USA: destruction of infected material, use of hypovirulence where disease has established in Europe, sanitation of equipment.
Detection / Diagnostics	Conventional Polymerase Chain Reaction based method developed for *in planta* detection and authentication of isolates. Disease symptoms also very characterised and well described.
Knowledge gaps	Risk mapping to determine areas at most risk (climate/host maps), host testing; testing of diagnostic protocols.

Potential threats in EU: **Zigzag Elm Sawfly**	
Organism(s)	*Aproceros leucopoda* (Hymenoptera, wasp)
Hosts	Elms (*Ulmus* species)
Potential scale of damage	Could potentially exacerbate impact of Dutch elm disease on what elms are left in UK. Larval feeding on leaves can cause severe defoliation in urban areas, along roadsides and in forests. In Romania individual trees have shown severe defoliation (up to 98%). Trees can produce a secondary bud burst but these leaves are also eaten causing twig and branch dieback. No tree mortality reported at present, but repeated defoliation over several years is likely to have an impact on tree vitality.
Origin and current distribution	Asia: China, Japan, Russia (Far East). Europe: Austria, Germany, Hungary, Italy, Poland, Romania, Serbia, Slovakia, Slovenia and Ukraine.
Means of spread	**Long distance:** by movements of infested twigs or shoots and young plants. Adult females are strong fliers in spring & summer. Cocoons can be formed on non-host goods close to infested trees. Infested goods can then be shipped and moved long distance with pupae as hitchhikers. **Locally:** air currents caused by traffic is also to be expected, since spread is observed along roads and highways.
EU Regulated organism [YES/NO] **Control measures**	**NO.** On the European and Mediterranean Plant Protection Organisation Alert list as a potential emerging pest of forestry.
Control approaches being used in other countries	Has spread quickly in EU region. Control is difficult, insecticides (deltamethrin, teflubenzuron) have been found to be effective against the first and second instar larvae. Destroy infested plants.
Detection / Diagnostics	Could be detected by surveys. Conventional morphological keys have been developed to identify specimens.
Knowledge gaps	Factors likely to limit distribution. Much basic biology. If there are any EU natural enemies.

Potential threats in EU: **Red Oak Borer**	
Organism(s)	*Enaphalodes rufulus* (beetle)
Hosts	Oaks and possibly other tree species; no data on susceptibility of European oak species.
Potential scale of damage	In USA during 1980s was estimated that 38% of oak wood used for lumber, cooperage and veneer was affected by *E. rufulus*, and could lead to 40% reduction of the tree value at the time of sawing. Normally tree mortality is not associated with *E. rufulus* infestations but in the early 2000s severe mortality of red oaks (Q*. rubra, Q. falcata* and *Q. velutina*) was observed in the Ozark National Forest (Arkansas) and then in the nearby states of Oklahoma and Missouri. This severe oak mortality and decline which affected tens of thousands of oaks, primarily *Q. rubra*, was associated with an unprecedented outbreak of *E. rufulus*. Although there might be other factors involved (e.g. drought), *E. rufulus* was considered to be an important component of this severe oak tree decline.
Origin and current distribution	Native to North America, it occurs in the south-eastern part of Canada and the eastern part of the USA. No records of establishment in Europe - interception by UK in 2008.
Means of spread	**Long distance:** a previous unidentified pest finding from USA timber was highly suspected to be this pest. Hence trade of infested wood and wood products could provide a pathway for spread. **Locally:** adults can fly but data are lacking regarding spread rate.
EU Regulated organism [YES/NO] **Control measures**	**NO.** On the European and Mediterranean Plant Protection Organisation Alert list as a potential emerging pest of forestry.
Control approaches being used in other countries	In forests, control measures are limited (removal of highly infested trees, general measures to encourage tree vigour); in parks and gardens, insecticide treatments can be applied for high value trees.
Detection / Diagnostics	Detection difficult (as for all wood boring beetles). Conventional morphological keys have been developed to identify specimens.

Potential threats in EU: **Red Oak Borer**	
Knowledge gaps	No data regarding susceptibility of European oak species (e.g. *Q. petraea, Q. pubescens, Q. robur*). Hosts in USA include *Quercus rubra* (northern red oak), *Q. velutina* (black oak), *Q. coccinea* (scarlet oak). Other oak species are less commonly attacked, *Q. alba* (white oak), *Q. stellata* (post oak), *Q. palustris* (pin oak), *Q. macrocarpa* (bur oak), *Q. lyrata* (overcup oak), *Q. laurifolia* (laurel oak).

Potential threats in EU: **Redneck Longhorn Beetle**	
Organism(s)	*Aromia bungii* (beetle)
Hosts	Wide host range on tress in several families. Mainly on cherry (*Prunus* species), particularly peach (*P. persica*) and apricot (*P. armeniaca*); also plum (*P. domestica*) and wild cherry (*P. avium*). Also found on neem (*Azadirachta indica*), bamboo (*Bambusa textilis*), American persimmon (*Diospyros virginiana*), European olive (*Olea europea*), white poplar (*Populus alba*), wingnuts (*Pterocarya* species), pomegranite (*Punica granatum*).
Potential scale of damage	Reduces yield from fruit trees such as plum, cherry, peach, apricot. Damages other hardwood trees such as Poplar.
Origin and current distribution	Asia: China (present throughout China but more prevalent in the central and northern provinces), Korea (Republic of), Korea (Peoples' Democratic Republic of), Mongolia, Taiwan, Vietnam. Present in Germany and Italy but under eradication. UK and USA interceptions in 2008.
Means of spread	Found in UK with wooden pallets from China in 2008. However, pest is not known to have established in UK.
EU Regulated organism [YES/NO] **Control measures**	**NO.** On the European and Mediterranean Plant Protection Organisation Alert list as a potential emerging pest of forestry. Strict application of International Standards For Phytosanitary Measures 15 (control of Woody Packaging Material) will kill larvae in timber.
Control approaches being used in other countries	International Standards For Phytosanitary Measures 15 is recommended almost globally (all IPPC contracting parties).
Detection / Diagnostics	No formal surveys known. Found through public reporting.
Knowledge gaps	Big knowledge gaps on general biology - little is published in its native China.

Other threats globally: **Spruce Budworm**	
Organism(s)	*Choristoneura fumiferana* (moth)
Hosts	Mainly spruce (*Picea*) and true fir (*Abies*) species, but also on Doulgas fir (*Pseudotsuga menziesii*), *Pinus spp* and *Tsuga* and *Larix*.
Potential scale of damage	It especially attacks *Abies balsamea, Picea glauca* and *P. rubens* in eastern North America and *A. lasiocarpa, P. engelmannii, P. glauca* and *Pseudotsuga menziesii* in the West. Periodic very large outbreaks causing severe defoliation and occasional tree mortality throughout range in North America.
Origin and current distribution	North America (Canada and USA). No records in Europe or outside native range.
Means of spread	**Long distance:** possible spread via movement of infested plant material (plants or cut foliage). **Locally:** adult flight or 'ballooning' of early larval stages on air currents.
EU Regulated organism [YES/NO] Control measures	**YES**: prohibition of the import of plants and cut foliage of *Abies, Larix, Picea, Pinus* and *Pseudotsuga* from infested countries, as recommended by European and Mediterranean Plant Protection Organisation for other North American insect pests of conifers. EU Regulated Pest (Annex I).
Control approaches being used in other countries	Aerial application of insecticides (mainly *Bacillus thuringiensis*) is the most commonly used method against *C. fumiferana*. However, natural enemies (e.g. *Apanteles fumiferanae, Omotoma fumiferanae*) can limit populations of the pest and inundative releases of *Trichogramma minutum* have been made. Sex pheromones are under investigation for trapping and mating disruption.
Detection / Diagnostics	Defoliation and presence of larvae and associated silken threads.
Knowledge gaps	Potential for damage in Europe extrapolated from widespread planting of suitable host tree species. No direct knowledge of impacts and no known interceptions.

Other threats globally: **Sweet Chestnut Gall Wasp**	
Organism(s)	*Dryocosmus kuriphilus* (Hymenoptera: Cynipidae - gall wasp)
Hosts	The gall wasp attacks *Castanea crenata, C. dentata, C. mollissima, C. sativa* and their hybrids.
Potential scale of damage	Extensive damage to chestnut production (60-70% losses have been recorded). The species poses the greatest threat to chestnuts in southern Europe.
Origin and current distribution	Asia: China, Japan, Korea. Present in North America - Alabama, Georgia, Kentucky, North Carolina, Ohio, Tennessee and Virginia. Europe: Croatia, France, Italy, Slovenia, Switzerland.
Means of spread	**Long distance:** plants for planting and cut branches of *Castanea* (young chestnut plants or cut branches with buds moving in trade can contain eggs or first instar larvae within buds). **Locally:** adult females disperse between trees. The species is parthenogenetic (female only).
EU Regulated organism [YES/NO] **Control measures**	**NO**: prohibition of movement of infested plants or cut branches of sweet chestnut (Castanea species). Removal of infested branches (low infestation) or whole trees (high infestation). European and Mediterranean Plant Protection Organisation A2 listed but not EU regulated.
Control approaches being used in other countries	Direct removal of infested chestnuts carried out in China. Not regarded as practical in EU and European and Mediterranean Plant Protection Organisation region.
Detection / Diagnostics	Damage to development and to fruit, with signs of characteristic gall development.
Knowledge gaps	Natural enemies under European conditions where the wasp has already established, e.g. Italy.

Other threats globally: **Emerald Ash Borer**	
Organism(s)	*Agrilus planipennis* (beetle)
Hosts	North American ash species susceptible. European ash species are susceptible. Asian ash species are tolerant.
Potential scale of damage	High mortality expected if borer becomes established with major economic and environmental impacts.
Origin and current distribution	Asia; China, Japan, Korea (DPR), Korea (Republic), Russian Far East, Taiwan. Canada, USA (Eastern and Central). Europe: Russia (Moscow region).
Means of spread	**Long distance:** via live ash trees imported for planting, potentially also in woodchips and wood for bioenergy (increasing), wood products, especially with bark. Risk of hitch-hiking on vehicles from Moscow area to EU. **Locally:** natural dispersal (adults are strong fliers); human assisted movement in wood products e.g. firewood.
EU Regulated organism [YES/NO] **Control measures**	**YES:** not present in UK. No successful control measures once established. EU regulated pest. Import controls to prevent entry.
Control approaches being used in other countries	EU import controls on live ash trees and wood; new (2011) regulations on wood fuel, including minimum size of wood chips, heat treatment, compliance with International Standards For Phytosanitary Measures 15 protocols. Injections with emamectin benzoate.
Detection / Diagnostics	Early detection difficult. Larval feeding on inner bark leading to girdling and leaf yellowing and branch dieback. Tree mortality usually within a few years. Characteristic D-shaped exit holes but only once adults have left.
Knowledge gaps	In early 2013, known to be 250 km west of Moscow and spreading at approximately 20 km per year. No current intensive survey or direct control measures in Russia. Further information needed on situation in Russia, especially on the quantities of ash material moved along internal and international pathways.

Other threats globally: **Bronze Birch Borer**	
Organism(s)	*Agrilus anxius* (beetle)
Hosts	European and Asian species of birch
Potential scale of damage	Birch spp. are highly susceptible and have been widely killed in North America. High mortality of European birch expected if *A.anxius* becomes established with major economic and environmental impacts
Origin and current distribution	Canada and USA. Absent in EU and European and Mediterranean Plant Protection Organisation region.
Means of spread	**Long distance:** via woodchips and wood for bioenergy (increasing), live plant material, or wood products, especially with bark. **Locally:** natural dispersal (adults are strong fliers); human assisted movement in wood products e.g. firewood.
EU Regulated organism [YES/NO] **Control measures**	**YES.** European and Mediterranean Plant Protection Organisation A1 list. Not present in UK. No successful control measures once established. EU importation controls to be put in place for birch products from North America.
Control approaches being used in other countries	European and Mediterranean Plant Protection Organisation Pest Risk Analysis recently completed; import controls to be established for birch products from North America, including minimum size of wood chips, heat treatment of wood products & importation of small plants only.
Detection / Diagnostics	Early detection difficult. Larval feeding on inner bark leading to girdling and leaf yellowing and branch dieback. Possible swellings where tree has healed, tree mortality usually within a few years. Characteristic D-shaped exit holes but only once adults have left.
Knowledge gaps	Uncertainty regarding the quantities of material and birch species moved along international pathways. Susceptibility of some European birch species unknown.

Other threats globally: **Oak Wilt**	
Organism(s)	*Ceratocystis fagacearum* (fungus)
Hosts	Oak species. Red oak group (subgenus *Erythrobalanus*) is highly susceptible, white oaks (subgenus *Lepidobalanus* including Europea oak species) take many years to die, but dieback may be obvious and serious.
Potential scale of damage	**Potentially major:** native European oaks have been shown to be susceptible to this pathogen and Europe also has a native oak bark beetle *Scolytus intricatus,* which may be more effective at spreading the pathogen than North American vectors.
Origin and current distribution	Indigenous to eastern and mid-western states of North America. Not known elsewhere.
Means of spread	**Long distance:** spread via movement of infected logs and lumber. **Locally:** insect spread (nititulid beetles and bark beetles), root transmission via natural root grafts.
EU Regulated organism [YES/NO] **Control measures**	**YES**. European and Mediterranean Plant Protection Organisation A1 list. Not known to be present in the UK; treatments aimed at preventing entry: import controls and inspection; treatment of oak logs/lumber from North America.
Control approaches being used in other countries	In the USA: Early detection and prompt removal of dead or dying trees; severing root grafts between diseased and healthy trees. Minimising bark damage to trees when insect vectors most likely to transmit the pathogen.
Detection / Diagnostics	Nested and real-time Polymerase Chain Reaction assay recently developed, capable of detecting pathogen in artificially infected wood and soil. Fungal morphology and disease symptoms also very characteristic and well described.
Knowledge gaps	Review of pest risk analysis; testing of diagnostic protocols.

Other threats globally: **Plane Wilt**	
Organism(s)	*Ceratocystis platani* (fungus)
Hosts	Plane (*Platanus* species). Oriental and hybrid (London) plane very susceptible.
Potential scale of damage	Very damaging to *Platanus* (up to 80% of trees affected in some parts of France). Oriental plane (*Platanus orientalis*) in its native range in Greece is very badly affected. Impact in UK will be to the abundant *Platanus* used as street trees in urban areas.
Origin and current distribution	Probably native to North America but introduced to Italy, Greece, France, Switzerland. Single interception in Spain. Single report from Belgium unconfirmed.
Means of spread	**Long distance:** spread via movement of infected plants, logs and lumber. **Locally:** infested soil; transmission via natural root grafts, water courses (fragments of infected material), insect transmission.
EU Regulated organism [YES/NO] **Control measures**	**NO.** Not known to be present in the UK but movement of *Platanus* plants/timber from affected EU member states not currently regulated.
Control approaches being used in other countries	Europe/USA: Early detection and prompt removal of dead or dying trees; severing root grafts between diseased and healthy trees; disinfection of pruning tools; control on movement of earth on infected sites.
Detection / Diagnostics	Fungal morphology and disease symptoms well described. Routine Polymerase Chain Reaction based and real-time diagnostic methods not developed.
Knowledge gaps	Pathway analysis; review of pest risk analysis; development of molecular diagnostic protocols.

Annex H – Border Controls

The EU's plant health rules are currently being revised, and formal proposals are expected from the European Commission in May 2013. It is not only in the UK that threats to plant health are causing increasing concern. A number of plant pests and pathogens have arrived in Europe in recent years, spreading and causing serious damage to trees and crops. Red palm weevil (*Rhynchophorus ferrugineus*), pinewood nematode (*Bursaphelenchus xylophilus*) and maize borer (*Diabrotica virgifera*) are among the most prominent examples. Increased awareness of this damage, and the threat of further such introductions, has led to calls for a review of the ways in which plant health risks are managed across Europe. The main elements and concepts of the EU Plant Health Directive had been developed before the establishment of the internal market in 1993, the present version was consolidated in 2000.

The key UK objectives for a new regime, developed in consultation with UK stakeholders over the last four years, have been:

- faster decision making, so that measures are put in place before new pests and pathogens arrive in Europe;
- management better targeted and proportionate to risks, including regionalisation where justified by differences of risk, and a shift of emphasis from lower risk plant produce to higher risk plants for planting; and
- more collaboration between plant health inspectorates across Europe.

A study evaluating the current regime, funded by the European Commission, is available at http://ec.europa.eu/food/plant/plant_health_biosafety/rules/index_en.htm. Its conclusions are in line with the UK analysis. In particular, it found that the main problems with the current regime are:

- insufficient focus on prevention in relation to increased imports of high risk commodities;
- a need for prioritising harmful organisms at EU level across all Member States;
- a need for better measures for controlling the presence and natural spread of harmful organisms that manage to enter the Union territory; and
- a need for modernising and upgrading the measures concerning the phytosanitary control of intra-EU movements (plant passports and protected zones).

Since the evaluation was published, the Commission has continued informal consultation in the framework of meetings of the Member States "Chief Plant Health Officers" and a series of task forces to aid the Commission's thinking in drafting proposals on different

aspects of the regime. Major elements that remain to be resolved and are likely to feature in the negotiations once the proposals are published include:

- cost and responsibility sharing between the EU, Member States and industry sectors;
- compensation for eradication action against outbreaks; and
- whether to reverse the burden of proof so that new trades in plants must be assessed for risk before they are allowed to develop (the so-called "reverse strategy").

The legislative proposals could take up to two years to negotiate. As a result of the Lisbon Treaty, and for the first time in relation to plant health legislation, the European Parliament will be involved in negotiations. A similar period will be allowed for the Member States to implement the new rules. However, the new European plant health strategy needs to cover not just legislation but also co-ordination of research, collection and sharing of information, development of IT systems for import controls, contingency planning, training of plant health inspectors, and influencing and using the international standards developed under the International Plant Protection Convention. Many of those elements can be taken forward in advance of the legislation taking effect.

EU proposals and the Taskforce Recommendations

The Taskforce has considered the EU proposals and recognises that the current review offers a clear opportunity to improve European plant health rules in the directions that the taskforce is recommending. In particular, the Taskforce notes the following ways in which its recommendations may be advanced through the review.

Develop a prioritised UK Plant Health Risk Register

The draft Commission proposals require establishment of a "priority list" of harmful organisms for the EU, to comprise not more than 10% of the current long list of some 250 organisms listed in the annexes of the Plant Health Directive. These priority organisms would be the subject of mandatory surveillance, contingency planning and eradication of outbreaks, with the possibility of EU co-funding. The Taskforce notes that although there is a helpful parallel with the prioritisation they have recommended for the UK, the priority organisms will not all be the same for the UK and for other Member States. The Taskforce proposes that the proposals be closely examined to ensure that sufficient regionalisation will be available to ensure that risks from organisms that are a priority to the UK, but not to all other Member States, can be effectively managed. The Taskforce recognises that this will also allow other Member States with specific plant health risks to take measures to manage those risks, provided they are technically justified.

The draft Commission proposals do not make clear how the Commission is going to speed up decision making to ensure that pest risks identified through horizon scanning by the European and Mediterranean Plant Protection Organisation (EPPO), the European Food Safety Authority (EFSA) or other international networks, are rapidly assessed and, where appropriate, regulated. The Taskforce proposes that the UK press the Commission for further information about their plans in this respect, and notes that progress on decision making does not need to await legislative changes.

If decision making is slowed by lack of resources in the Commission, the Commission should consider the appropriate balance of staff resources between animal health and plant health.

Improve the use of epidemiological intelligence from EU/other regions

The Taskforce proposes increased support for the horizon scanning work of EPPO and EFSA. The Taskforce proposes that the UK seeks clarification of the obligation in the draft Commission proposal on Member States to notify suspected presence of new pests and pathogens that are not yet listed. It also proposes that the UK seeks assurance that the Commission will apply sanctions to those Member States that fail to disclose information about outbreaks in a reasonable time. The Taskforce welcomes the potential for the EU and Member States to gather more detailed, accurate and comprehensive information on plant imports through the TRACES[74] system.

Develop and implement procedures for preparedness and contingency planning to predict, monitor and control the spread of pests and pathogens

The Taskforce welcomes the emphasis in the draft Commission proposals on systematic surveillance, contingency planning and exercises for priority pests and pathogens. The Taskforce proposes that European capability in epidemiological modelling be used to inform contingency planning and survey design, and that information and plans are shared to make best use of information from across Europe.

Develop a modern, user-friendly system to provide quick and intelligent access to information about tree health and plant biosecurity

The Taskforce proposes that information and communication systems be given a high priority in the development of a Europe wide plant health strategy, recognising the benefit of pooling information from as wide a range of sources as possible. The Taskforce

[74] The EU system for recording and tracking imports, exports and EU movements of animals and animal products, including links to Customs processes.

recognises the importance of EPPO as the major European repository of tree health and plant biosecurity information, and the major user of such information for horizon scanning purposes.

Strengthen biosecurity to reduce risks at the border and within the UK

a) Imports from non-EU countries

The Taskforce strongly supports a shift towards a "reverse strategy" whereby risks from new trades in plants are assessed before the trade is allowed to develop. Without such a shift in the burden of proof it is difficult to see how the EU regime can be effective in guarding against new and emerging risks. The current draft proposal of the Commission addresses new risks from plants for planting without really incorporating the necessary elements of such an approach. The Taskforce notes that this approach is common in other countries around the world, and is also a key part of the EU approach to import controls to protect animal health. Existing trade should also be reviewed periodically to establish where any new risks may be arising from changes occurring in production systems.

The Taskforce welcomes the Commission's proposals to apply the TRACES system (see also above) to imports of plants and plant produce, to enable more data to be gathered on imports, which can be compared with the records of interceptions and thereby be used to target new risks and intensify and focus inspection efforts.

The Taskforce supports the removal of the passenger baggage concession which currently allows Member States to set aside plant health rules on small quantities of plants and plant produce in passengers' baggage. Removal of the concession, and application to passengers of the same rules that apply to commercial imports, would not only be more secure and more equitable, but would make it easier to publicise and enforce controls.

The ability for Member States to take effective emergency action against new threats on a precautionary basis ahead of formal risk assessment must remain a key part of the control system.

b) Movement of plants and produce within the EU

The Taskforce welcomes the proposal to extend plant passporting to all genera of plants for planting through to the last commercial buyer. The lack of plant passporting for ash trees was a significant barrier to gathering intelligence on the risks from *Chalara fraxinea* and to tracing deliveries once the risks were understood. The Task Force also welcomes UK moves to require notification of deliveries into the UK of certain high risk plants, so that compliance with the plant passporting rules can be checked.

Address key skills shortages

The Taskforce proposes that as part of the new plant health strategy, key skills shortages should be addressed on a Europe wide basis. Training and development of relevant expertise in traditional taxonomy, molecular diagnostics, epidemiology, and inspectorate skills should be planned collaboratively between European countries. The European Commission should play a role in retaining expertise which is essential to delivery of the EU plant health regime.

Annex I – Acknowledgements

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This document/publication is also available on our website at:

https://www.gov.uk/government/policy-advisory-groups/tree-health-and-plant-biosecurity-expert-taskforce.

Any enquiries regarding this document/publication should be sent to us at: planthealthprogramme@defra.gsi.gov.uk

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