



Department  
for Environment  
Food & Rural Affairs

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## **Tree Health and Plant Biosecurity Evidence Plan**

**Policy portfolio: Plant Health**

**Policy area within portfolio: Tree Health and Plant Biosecurity**

**Timeframe covered by Evidence Plan:**

**2013/14-17/18**

**Date of Evidence Plan: March 2013**

This evidence plan was correct at the time of publication (March 2013). However, Defra is currently undertaking a review of its policy priorities and in some areas the policy, and therefore evidence needs, will continue to develop and may change quite rapidly. If you have any queries about the evidence priorities covered in this plan, please contact [StrategicEvidence@defra.gsi.gov.uk](mailto:StrategicEvidence@defra.gsi.gov.uk).

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# 1. Policy context

## What are the key policy outcomes for the policy programme/area?

This evidence plan supports the Plant Health policy area, including tree health and statutory plant health. It takes account of and supports: the Tree Health and Plant Biosecurity Action Plan<sup>1</sup>; emerging recommendations from the Expert Taskforce of Tree Health and Plant Biosecurity; and the chalara (ash dieback) management plan. The wider policy context also includes the current review of EU Plant Health regime and the planned development of a new UK Plant Health Strategy.

Plants are an important economic, environmental and social resource for our rural economy, heritage, and wellbeing<sup>2</sup>. The total value of UK crop output in 2010 was £7.54 billion. The benefits from plant health policy relating to the protection of the environment have yet to be fully monetised. However, for trees and forests, the National Ecosystem Assessment highlighted the significant benefits from the ecosystem services these provide to society, as well as through their direct economic value and social amenity<sup>3</sup>. In 2012 the UK had an estimated 3.1 million hectares<sup>4</sup> of woodland (12.8% of land area) with forestry and the primary wood processing sector contributing £1.7 billion<sup>5</sup> to the economy in 2010 and a further £1.8 billion per year (in 2012 prices) of non-market benefits (from recreation, biodiversity, landscape, air pollution absorption and from carbon sequestration to help mitigate climate change)<sup>6</sup>. Preserving the health of trees in both our urban and rural landscapes is therefore vital.

In recent years, various new pests, pathogens and syndromes have emerged as significant risks to the UK's crops and plants, including trees in woodlands, commercial forests and in the urban environment. These have included specific new arrivals, most notably, various *Phytophthora* species on trees and shrubs (e.g. *P. ramorum*, especially on commercial larch and on ornamental shrubs and trees in heritage gardens; *P. kernoviae*; *P. lateralis*; and *P. austrocedrae* on native juniper), oak processionary moth, acute oak decline, dothistroma needle blight (DNB) of pine, Asian longhorn beetle (*Anoplophora glabripennis*) and most recently chalara ash dieback. For agricultural and horticultural crops specifically, recent arrivals (established or eradicated) include: potato ring rot (*Clavibacter michiganensis* subsp. *sepedonicus*), potato brown rot (*Ralstonia solanacearum*), the South American tomato moth (*Tuta absoluta*) and the corn root worm (*Diabrotica virgifera*). Many other pests and diseases have yet to arrive in the UK from Europe or elsewhere.

Increased risks to plant health have primarily resulted from the increased globalisation of trade and the marked increase in the volume and diversity of plants and plant products entering the UK, which has increased the risk of importing pests and pathogens capable of causing serious damage. There are about 300 EU-listed pests and many new and emerging non-native pests. In 2011, there were 1,296 interceptions and 108 outbreaks of harmful plants pests introduced through imports into England and Wales. The cost of

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<sup>1</sup> Tree Health and Plant Biosecurity Action Plan (October 2011): <http://www.defra.gov.uk/food-farm/crops/tree-health/>

<sup>2</sup> Office of National statistics (measures for wellbeing): [http://www.ons.gov.uk/ons/dcp171766\\_272242.pdf](http://www.ons.gov.uk/ons/dcp171766_272242.pdf)

<sup>3</sup> UK National Ecosystem Assessment: <http://uknea.unep-wcmc.org>; and [www.defra.gov.uk/environment/natural/uknea/](http://www.defra.gov.uk/environment/natural/uknea/)

<sup>4</sup> Forestry Statistics 2012, Table 1.2 (Forestry Commission)

<sup>5</sup> Forestry Statistics 2012, Table 8.3 (Forestry Commission)

<sup>6</sup> Willis *et al.* (2003) The Social and Environmental Benefits of Forests in Great Britain

eradicating outbreaks is mostly borne by the landowners, the average cost to whom is estimated at £40,000 per outbreak<sup>7</sup>.

Predicted climate change effects, such as warmer winters and changes in seasonal rainfall and storm patterns, may also increase the risk of pest and pathogen establishment, spread and impact. It is estimated that invasive non-native species, including pest and diseases of plants, cost the British economy at least £1.7 billion per year<sup>8</sup> (excluding significant indirect costs). In the case of some of the new tree pests and diseases introduced into the UK, some are already having a landscape-level impact, as observed previously with the Dutch elm disease epidemic of the 1970s. DNB has resulted in moratoriums on the planting of certain key commercial species of pine across Great Britain as well as threatening native Caledonian pine forests; *P. ramorum* threatens the future of larch as a commercial forestry species; and chalara ash dieback may remove most of our ash trees. The recent finding (2012) of *Chalara fraxinea* on ash in the UK has significantly raised the public and political profile of plant health.

The rationale for Government intervention in this area relates to the issue of market failure. Market mechanisms alone may fail to prevent or correct negative economic and environmental impacts that could arise from introductions of non-native pests and diseases which reduce UK agricultural and forestry output, increase production costs and damage ecosystems. The evidence supports delivery of these controls (based on EU and UK legal provisions) balanced with the need to minimise regulatory burdens on the trade. The significant non-market benefits of trees and woodlands compared to the market value of forestry activities also contributes to the rationale for government intervention in relation to trees more generally.

Plant Health is a high priority for Defra and relevant to four of its current departmental objectives. These are to:

- Support and develop British farming and encourage sustainable food production
- Enhance the environment and biodiversity to improve quality of life
- Support a strong and sustainable green economy, including thriving rural communities, resilient to climate change
- Prepare for and manage risk from animal and plant disease.

The main aim of this policy area is to protect plant health in England and Wales by preventing the introduction and spread of quarantine pests and diseases, and ensuring the availability of healthy planting material.

The policy area is responsible for:

- Co-ordinating plant health across the UK and crown dependencies as the 'Single Central Authority' under the EU Plant Health Directive, and the 'National Plant Protection Organisation' under the International Plant Protection Convention.
- The Phytophthora Disease Management Programme, which aims to reduce risks from *Phytophthora ramorum* and *Phytophthora kernoviae*.
- The Tree Health and Plant Biosecurity (THPB) Action Plan, jointly with the Forestry Commission. The overall policy rationale and objectives of THPB Action Plan are to

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<sup>7</sup> CABI report (2010). The economic cost of Invasive non-native species on Great Britain.  
<https://secure.fera.defra.gov.uk/nonnativespecies/index.cfm?sectionid=59>

protect trees from current and imminent pests and diseases, as well as ensuring longer-term resilience to such threats within a changing environment (prevention, response and adaptation). The report from the Independent Panel on Forestry<sup>8</sup> and its recommendation that “*Government should speed up delivery of the Tree Health and Plant Biosecurity Action Plan by additional investment in research on tree and woodland diseases, resilience and biosecurity controls*” is relevant, as are the recommendations from the Defra Chief Scientific Advisor’s Expert Task Force on Tree Health and Plant Biosecurity (interim report<sup>9</sup> November 2012; final report due spring 2013). Reports from both groups will inform adaptation and development of the THPB Action Plan, and this evidence plan, especially in terms of focus and the need to quicken our response to increasing threats.

The key high-level outcomes for this policy area are:

- Policy on plant health effectively informed by evidence, agreed with stakeholders and delivery bodies, promoted successfully in negotiations and implemented.
- Harmful plant pests<sup>10</sup> are kept out of Europe and UK.
- Outbreaks of new plant pests are eradicated or contained.
- Losses to the economy and our natural capital, caused by introduced pests, are reduced.
- Trade is facilitated safely through plant health certification and assurance.
- Stakeholders including landowners, woodland managers, the horticulture sector, academics and the public are better informed about pests and help prevent their spread in the wider environment.
- The right evidence is commissioned and used effectively to underpin sound management practices and to minimise new threats.
- *Phytophthora ramorum* and *P. kernoviae* are reduced to epidemiologically insignificant levels by removing sporulating host plants from high-risk areas.
- Plant health capability is maintained and developed for the public good, including: detection, diagnosis and control; and increased research and science capacity to help deal with future threats.

## 2. Current and near-term evidence objectives

**What are the current and near-term objectives for evidence and how do they align to policy outcomes?**

Minimising risks of entry to the UK of new pests and preparation for future pest threats all require a suitable evidence base to inform contingency planning and management options. In the case of trees, effective management is also necessary for those pests that have become established.

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<sup>8</sup> Final Report from the Independent Panel on Forestry: <http://www.defra.gov.uk/forestrypanel/>

<sup>9</sup> Interim report of the Expert Task Force on Tree Health and Plant Biosecurity: <http://www.defra.gov.uk/food-farm/crops/plant-health/tree-taskforce/>

<sup>10</sup> Definition of ‘pest’ includes pathogens (see: <http://www.eppo.int/QUARANTINE/ISPM05.pdf>)

Evidence needs are likely to be different for pests that are endemic and well established in the UK (in the case of tree pests), as opposed to those newly arrived to the UK (under eradication, containment or suppression) or those which are potential future or emerging threats that are present in the EU or globally but are not yet present in the UK. As such, current and near-term evidence objectives are to address the following:

### **1. Generic evidence needs:**

- Establish and maintain a prioritised list of pests via the development of a risk register<sup>6</sup>.
- Review successful and unsuccessful control policies to inform risk management strategies and contingency plans, including analysis of best international practice.
- Strengthen the use and integration of social science and economics in policy making and research, including: improving the robustness of cost-benefit analyses for intervention and control strategies, whilst accounting for uncertainty; developing bio-economic modelling approaches, linking economics with biological models; improving tools and data for informing evaluations of economic, environmental and social impacts of pests, including valuation of non-market benefits; improving tools and data for informing prioritisation (e.g. for allocating resources and prioritising activity between different pests and different activities); improved understanding of public and stakeholder attitudes, motivations, knowledge, risk perception, social risk indicators and behaviours in relation to plant biosecurity.

### **2. Pests and diseases newly arrived or established in the UK**

- Commission short-term research on specific priority pests to inform management strategies and mitigate impacts, including: oak processionary moth; non-native *Phytophthora* species; acute oak decline; chalarash dieback (especially: identifying and exploiting resistance for longer-term adaptation and resilience; identifying disease management approaches through appropriate experimentation and modelling; quantifying the potential social, economic and environmental impacts).
- Establish 'Expert Advisory Groups' for specific priority pests involving UK and overseas expertise, to bring together current knowledge and to advise on management strategies, e.g. dothistroma needle blight, *Phytophthora ramorum*, chalarash dieback.

### **3. Potential threats to the UK, present in the EU or globally (not established in UK)**

- Improved preparedness through Pest Risk Analysis (PRA), enabling evidence-based policy and regulation on specific pests and diseases. PRA includes both risk assessment (including economic, social and environmental impacts) and risk management; it must be flexible enough to respond to both immediate and longer-term threats. Prioritisation of PRAs will be informed by the development of a risk register<sup>9</sup> and from surveillance, monitoring and horizon scanning activities. Use of geographic data is a key part of risk assessment and needs to be strengthened. Evidence gaps and uncertainties can be addressed by specific research.
- Improve preparedness through contingency plans, including pesticide approvals, advice on handling infested pathways, and establishing links with experts in countries where pests are already present (including improved access to, and use of, epidemiological intelligence). Explore the use of models and improved data to integrate information on pest spread in order to gauge effectiveness and costs/benefits of control strategies, taking account of uncertainties in the current

status of knowledge and the role of trade. Commission further generic and pest-specific research to improve the level of preparedness.

- Improve preparedness for priority pests through improved approaches and methods for early detection, including more generic approaches involving citizen science.

### 3. Future evidence needs

#### What are the longer-term evidence needs for the policy area/ programme?

There is a need to combine a long-term programme of strategic research, horizon scanning and evidence gathering with the more immediate applied research (Section 2 above) that supports contingency planning and practical actions. Note: Future evidence needs will also include many of the needs outlined under 'current' evidence needs, especially on-going surveillance and PRA activities together with socio-economic analyses and biological research needed for developing policy on specific pests. Longer-term evidence needs centre around improving future preparedness and resilience, especially in the context of a changing environment.

The EU regime underpinning Plant Health Policy is currently under review with formal proposals being issued in 2013. It is likely that these will include: improved risk-based targeting and enhanced or improved surveillance (aiding early detection and effectiveness of intervention strategies); increased partnership working between stakeholders and official services, including greater cost and responsibility sharing. The proposals have the scope to change plant health policy radically in ways that are not yet completely clear. Gathering further evidence to prepare for these changes will be key both for negotiation on the new regime and its implementation.

Many of our more-strategic and longer-term research and evidence needs will be addressed through an interdisciplinary research initiative within the framework of the Living With Environmental Change (LWEC) partnership launched in September 2012, i.e. a co-funded and co-designed initiative involving Defra, Forestry Commission, Research Councils and Devolved Administrations. The scope of this LWEC research initiative will take account of the longer-term and strategic knowledge gaps identified by the THPB Expert Task Force<sup>9</sup> (e.g. related to epidemiology, surveying and surveillance, detection, mitigation and adaptation strategies, trade patterns, environmental change, and integration of social science).

This LWEC Tree Health and Plant Biosecurity Research Initiative will address four key areas through collaborative and inter-disciplinary approaches. The research will address different levels of biological organisation, from the molecule to the population or ecosystem, as well as interactions with the environment, or wider systems studies including social or economic aspects. Examples of relevant social and economic research might include: the cultural and social value attached to trees, woods and forests, as well as their landscape and ecosystem significance; establishment of the rationale for intervention (and by whom) through analysis of beneficiaries; identification, valuation and integration of economic and social impacts in policy appraisal; process and impact evaluation of policy interventions, including behavioural alternatives to regulation; and prioritisation of options



through social cost-benefit analysis, including integration of non-monetary evidence using multi-criteria analysis<sup>11</sup>. The four key areas are:

- **Biology:** improved fundamental understanding of pest/pathogen and host interactions and biology, as well as the application of genomics and post-genomic methods and modelling, to improve tree health and underpin and inform pest and disease management. This should also address improving public understanding of biological evidence in relation to tree health and plant biosecurity.
- **Detection**<sup>12</sup>: improved and cost-beneficial methods and approaches for early detection of tree-related pests and pathogens and for surveillance and monitoring, especially the development and use (including barriers to adoption) of new or emerging technologies (e.g. remote sensing/imaging, portable on-site detection technologies, exploiting genomics and post-genomics to develop and improve diagnostics and resolve taxonomic confusion and within-species variation) as well as through improved public and stakeholder engagement and pest reporting, including developing the potential use of citizen science (including how to mitigate quality issues and assessment of capacity and governance required for processing, analysis and integration of citizen science data).
- **Systems:** improved tree and forest health that supports the sustainability of trees, woodlands and their associated biodiversity in a changing environment (including climate change, increased international trade in plants and plant products, etc.). This includes addressing the issues involved in a wider context of the ecosystem affected and, for example, genetic resources, the application of ecological principles, integrated control strategies (chemical, biological, cultural, etc.), integrated use of economic, social and environmental impact analyses and understanding of trade-offs, identification of underlying social and economic causes and trade drivers of threats to biosecurity, how to improve public risk awareness, and development of policy and governance frameworks that inform mitigation and adaptation strategies to build longer-term resilience.
- **Biosecurity:** improved biosecurity and risk management through better regulation, management and awareness - including understanding and application of use of evidence of economic and social influences - of both the broad range of stakeholders involved in the area and the public, together with an improved understanding of how biosecurity policies can best be developed and implemented and how management of forestry operations, as well as trade pathways, impact on the introduction, establishment and spread of tree-related pests and pathogens.

## 4. Meeting evidence needs

### What approach(es) will be taken to meeting evidence needs?

Research and evidence needs will be identified by Defra in consultation with others, including the Forestry Commission (FC), Devolved Administrations, The Joint Nature Conservation Council (JNCC), other government agencies and stakeholders. We aim to do this responsively to new situations and emerging threats via a range of fora, including:

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<sup>11</sup> See Defra Evidence and Analysis Series 5 (<http://www.defra.gov.uk/evidence/series/>)

<sup>12</sup> Some of these evidence needs and knowledge gaps related to 'detection' were highlighted in the Defra Expert Task Force's interim report<sup>4</sup> (November 2012). Some of these needs may be appropriate for the LWECC THPB Research Initiative, while others may need to be considered and taken forward separately by Defra or others.

- The UK Plant Health Strategy Board (PHSB), which takes advice from an Advisory Forum (composed of key stakeholders), a new Science and Evidence Coordination Workstream (SECW) and The THPB Action Plan's Theme Leaders Delivery Group.
- We will specifically establish a new Science and Evidence Coordination Workstream under the UK PHSB. This will especially help facilitate long-term coordination of plant-health-related research funding and alignment of relevant research agendas and evidence activities (e.g. Defra, FC, Research Councils, Devolved Administrations, JNCC, Kew and relevant industry levy bodies).
- Expert Advisory Groups, including: discrete expert groups, stakeholder groups and workshops advising on specific management strategies for specific established pests (such as dothistroma needle blight, *P. ramorum*, and chalara ash dieback); the Plant Health Risk Management Workstream (PHRMW) constituted under the UK PHSB and composed of risk managers and science specialists from the Food and Environment Research Agency (Fera), Forest Research (FR), FC and Devolved Administrations, advising on risk assessment, risk management, preparedness and associated research needs for future and emerging pest threats.

This evidence plan also takes account of examples of knowledge gaps identified in the interim report<sup>9</sup> of the Expert Task Force on Tree Health and Plant Biosecurity and we will also take account of the findings and recommendations published in the final report (due spring 2013).

In its interim report, the Task Force recommended the development of a UK Risk Register, which will help inform prioritisation, especially in relation to specific pests. Defra, with the FC and others, will also review and develop specific methods and approaches for prioritisation relevant to different prioritisation needs. Prioritisation of research and evidence needs for specific pests will also continue to be informed by on-going PRAs and associated socio-economic analysis. Research and evidence needs will also be informed by consultations and workshops with stakeholders and internal/external experts, e.g. those that informed the development of the THPB Action Plan<sup>13</sup>.

Sources of evidence will continue to be supplied through: surveillance and monitoring (in the UK, but also including surveillance reporting from the wider EU and globally); PRAs (produced nationally or internationally and accounting for uncertainties and confidence ratings) supported also by social, economic and environmental impact analyses and modelling as appropriate; maintaining and developing historic plant-health-related datasets and systems at Fera; maintaining national and other pest and pathogen collections at Fera; commissioning of primary research and analysis in support of policy and its implementation.

We will also undertake a rapid and strategic mapping of our anticipated research and evidence themes over the next ten years and the capabilities and capacities needed to deliver them. This will include an initial assessment of our current capability and capacities and will identify how to build new capability and capacities where required.

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<sup>13</sup> Workshops informing the development of the Tree Health and Plant Biosecurity Action Plan: [www.forestry.gov.uk/pdf/Reporttreehealthworkshop16Feb2011.pdf/\\$FILE/Reporttreehealthworkshop16Feb2011.pdf](http://www.forestry.gov.uk/pdf/Reporttreehealthworkshop16Feb2011.pdf/$FILE/Reporttreehealthworkshop16Feb2011.pdf); [www.lwec.org.uk/stories/lwec-collaboration-tree-health](http://www.lwec.org.uk/stories/lwec-collaboration-tree-health); [www.forestry.gov.uk/website/forestry.nsf/byunique/infd-8gykmt](http://www.forestry.gov.uk/website/forestry.nsf/byunique/infd-8gykmt)

Within Defra, we align our evidence plans with those from other relevant policy areas (e.g. Crops and Horticulture; Biodiversity and Ecosystems). Defra will work closely in partnership with the following external partners:

- The FC, as joint initiators of the THPB Action plan, to ensure that commissioning to meet applied research and evidence needs complements the on-going programme of FC-funded tree health work at FR. We will also ensure that our evidence plan links closely with FC's Science and Innovation Strategy<sup>14</sup>; the current FC strategy is under evaluation for its impact and is being revised in 2013.
- Devolved Administrations in Wales, Scotland and Northern Ireland.
- The co-funders of the LWEC Tree Health and Plant Biosecurity (THAPB) Research Initiative, e.g. the FC, Research Councils and Devolved Administrations. Where possible, Defra (with the FC) will also explore co-funding or alignment with stakeholder-led research initiatives.
- Plant health research funders in other European countries, especially to leverage funds, expertise and research opportunities via transnational research projects (i.e. under the EUPHRESKO<sup>15</sup> Plant Health ERA-Net, of which both Defra and the FC are partners).
- The European Commission, e.g. by advising on tree and plant health research priorities in its framework programmes (e.g. Horizon 2020) under EUPHRESKO's mandate from the EU Council Working Party of Chief Officers of Plant Health.

Research needs will be met mainly through competitive tendering, including: Defra research calls for both applied and more-strategic research; calls under the LWEC THAPB research initiative for more strategic and longer-term research. For some applied research, commissioning will be by single tender, e.g. with the government agencies (Fera and Forest Research) that are the core capability for tree health and plant biosecurity in England and Wales. In such single tender projects, other UK or international expertise will be included as necessary. We will also maintain a Plant Health Horizon Scanning and Technology Implementation Programme for small, short research projects.

In terms of scientific and research collaboration, we will also:

- Encourage and take a fully interdisciplinary approach to research and to internal analyses that improves the impact of social research and economics in this area, including in the framing of research and evidence needs. This will be facilitated through the establishment of a new interdisciplinary Plant Health Evidence and Analysis (PHEA) team in Defra. PHEA will link to other external evidence specialists or providers (e.g. in government agencies, FC, JNCC, Devolved Administrations, and through partnerships with external providers in, for example, universities).
- Facilitate collaboration between specialists in tree health and plant biosecurity with the wider natural, social, economic or other relevant research communities.
- Build research and science capability and capacity strategically, including through the use of fellowships.

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<sup>14</sup> Forestry Commission's Science and Innovation Strategy for British Forestry ( 2010-2013): [http://www.forestry.gov.uk/pdf/SIS\\_final\\_2010-2013.pdf/\\$file/SIS\\_final\\_2010-2013.pdf](http://www.forestry.gov.uk/pdf/SIS_final_2010-2013.pdf/$file/SIS_final_2010-2013.pdf)

<sup>15</sup> EUPHRESKO Plant Health ERA-Net: <http://www.euphresco.org/>

- Increase access to expertise in other countries (e.g. through European and international science networks, EU-funded and EUPHRESKO research projects, and COST (Cooperation in Science and Technology) Actions (e.g. PERMIT<sup>16</sup>; FRAXBACK<sup>17</sup>).
- Facilitate the translation of knowledge, evidence and skills from other areas (agricultural crops; ecological and environmental studies) and between research projects.
- Encourage innovation, especially through the more strategic LWEC THAPB Initiative but also through wider discussion with other funding partners directly (e.g. Research Councils, the Technology Strategy Board, and through the influencing of EU-funded research programmes).

In the case of modelling, we will review our approaches for commissioning, managing, parameterising, delivering and using epidemiological modelling to ensure modelling is robust, transparent, usable and fit for purpose; we will also consider approaches for developing and maintaining long-term modelling capability for plant/tree health that makes best use of internal and external expertise and represents value for money. Our approaches to modelling will be informed by the outputs of on-going work looking at the use of modelling for plant health (within Project PH0441 on 'Future Proofing Plant Health'), experience from animal health, outputs from past and current Defra reviews on modelling, as well as outputs from the Defra Expert Task Force on Tree Health and Plant Biosecurity.

## 5. Evaluating value for money and impact

### What approach(es) will be taken to maximise and evaluate value for money and impact from evidence?

To ensure on-going value for money and impact we will consider and review our evidence needs and research commissioning, in line with Defra's Evidence Handbook requirements, through:

- The UK Plant Health Strategy Board, subordinated workstreams related to science (SECW) and to risk management (PHRMW), and a prioritised risk register. Coordination and collaboration with other potential funders, e.g. through the SECW, provides specific added value and maximises the quality and quantity of evidence.
- Involving analysts (e.g. tree health specialists, economists and social scientists) in Defra, FC and elsewhere (e.g. JNCC) in the development of specifications for research calls.

The robustness and quality of research and evidence will be assured through:

- Immediate and applied research being commissioned primarily via competitive tender (Defra calls) with proposals typically being peer reviewed and the evaluation panel including both policy and operational end-users (e.g. from Defra, FC, Welsh Government, JNCC). Invited single tenders will also be subject to similar review.

<sup>16</sup> Pathway Evaluation and Pest Risk Management In Transport (PERMIT): <http://www.forestry.gov.uk/fr/INFD-8JZDQK> (EU COST Action FP1002)

<sup>17</sup> FRAXBACK: <http://www.fraxback.eu/> (COST Action FP1101 on *Chalara* ash dieback)

Evaluations of research proposals include 'value for money' and 'quality of science' as key criteria.

- Research contractors delivering research in line with the Joint Code of Practice and under appropriate quality assurance standards.
- Steering groups being established for all commissioned Defra projects to review progress, provide challenge and evaluate the quality of science and impact (e.g. through appraisals of annual and final reports).
- Outputs being peer reviewed by both external experts and internal government analysts (e.g. social scientists and economists) as appropriate, depending on the size of the project and the potential impact and significance of the generated evidence on policy and/or its implementation. We will actively encourage and require publication of research outputs in peer reviewed journals, while ensuring that emerging results can be used to inform and support urgent decisions where necessary, pending publication.
- Strategic and longer-term research being commissioned under the LWEC THAPB Initiative using scientific peer review following Research Council processes. Evaluation criteria will ensure high-quality, innovative research that brings together tree health and plant biosecurity specialists (e.g. in government agencies) with expertise in the wider scientific communities (e.g. in novel combinations) to provide cutting-edge and interdisciplinary research that will have significant impact on tree health and plant biosecurity.
- PRAs supporting regulation being reviewed within the European Commission's Standing Committee on Plant Health. PRAs may also be referred to the European Food Safety Authority (EFSA) for evaluation, from which formal 'opinions' are produced. PRAs identify uncertainties and confidence levels in relation to the quality of evidence or knowledge.

Research commissioned in direct support of the THPB Action Plan will provide both immediate and short-term research to meet policy and operational needs over a 3(-5)-year period. The impact of this research and the programme of work are expected to be reviewed in 2017/18, as well as wider plant health research. The more-strategic LWEC initiative is expected to run to 2017 after which the impact of the initiative will be reviewed, including its contribution to building capability and capacity. We expect to also analyse the relative importance of plant health against other Defra priorities and determine the contribution this policy area makes to economic growth.

Knowledge will be shared and evidence disseminated through the following mechanisms:

- Involvement of policy and operational end-users on steering groups for Defra-funded projects.
- Mechanisms to facilitate links between research projects to ensure added value.
- Publication of final research reports on the Defra website. Contractors are also proactively encouraged to publish outputs in peer-reviewed journals and disseminate their research to the wider community.
- Final research project dissemination workshops/meetings with stakeholders and end-users of the research.
- Translating research outputs into guidelines and best management practice as outputs from specific research projects.

- Summaries of key research findings published on the Defra website for specific areas of work.
- Publication of PRAs and contingency plans on the Defra website as part of standard consultation practice.

Success of the evidence plan, in terms of its underpinning of policy and science objectives, can be measured in terms of an increased ability to assess, prepare for and respond to plant health threats, as follows:

- Production and use of a prioritised risk register<sup>6</sup>, supported by qualified evidence.
- Robust evidence produced to inform negotiations on the review of the EU Plant Health Regime, supporting its development and its implementation.
- Robust evidence supporting risk assessments of specific pests or commodities underpinning the development of policy and regulation, supported by social, economic and environmental impact analyses, modelling and research to address gaps and uncertainties.
- Robust and cost-effective methods and approaches developed for early detection, identification and reporting of pests (evidence-based surveillance, monitoring and sampling approaches; improved laboratory and on-site detection and diagnostic methods and tools; improved use of citizen-science approaches).
- Robust natural and socio-economic evidence relating to the biology and management of prioritised pests and pathogens, supporting eradication, containment or management, including contingency plans, and improving longer-term resilience (e.g. through improved environmental management, systems approaches and a better understanding and use of genetic resources and integrated pest management).
- An improved understanding of stakeholder and public awareness, knowledge and motivations in relation to tree health and plant biosecurity issues, together with an improved understanding of how best to influence behaviours and to communicate and engage with the public and wider stakeholders on biosecurity issues.
- Improved coordination of research and evidence to get the best value for money from resources and avoid duplication, including: establishment of a Science and Evidence Coordination Workstream under the UK PHSB; establishment of an LWEC research initiative that draws on the widest possible funding base; improved capability and capacity (e.g. increased collaboration between tree health specialists and the wider science community, including a strengthened use of social and economic evidence and increased involvement of international expertise, e.g. through EUPHRESKO's transnational research coordination and collaboration).