



Llywodraeth Cymru
Welsh Government



Phytophthora ramorum Strategy for Wales

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Audience

This document has been created for policy makers, forestry professionals and other stakeholders.

1. Overview

This strategy mainly focuses on managing *Phytophthora ramorum* in larch within woodlands. The disease also affects species in non-forestry environments, but due to the large scale economic, social and environmental impact *P. ramorum* has had on larch in Wales since 2010, there has been a need to focus a strategy around the woodland environment. Management in the non-woodland environment remains ongoing with organisations working together to manage the disease across all environments in Wales.

2. Introduction

The document is split into two parts.

- **Strategy** – The overarching principles and scientific knowledge.
- **Action Plan** – The operational details of the different management options that reflect the *Phytophthora ramorum* Strategy for Wales.

The Welsh Government made a commitment in its strategy, *Woodlands for Wales 2018*¹, to bring more woodlands into management, expand woodland cover in Wales and increase the resilience of woodlands and trees to deliver more benefits for the public. High quality woodland ecosystems can provide real benefits both on a local and national scale. The *Woodlands for Wales* vision is that Wales' woodlands enhance our landscape, increase biodiversity and ecosystem services, have the ability to respond to climate change and support woodland based industries.

As part of this approach we recognise pests, pathogens and invasive non-native species have significant potential to impact on the health of trees and woodlands in Wales. To enable us to try to effectively manage the introduction of invasive non-native species as well as pests and diseases the Department of Environment, Food and Rural Affairs (DEFRA) and Devolved Administrations created the *Plant Biosecurity Strategy for Great Britain, 2014*².

The overarching principles of the Plant Biosecurity Strategy for Great Britain 2014 are 'Risk based decision making, increased awareness and involvement of industry.' One of the outputs of the strategy has been the Plant Health Risk Register which provides a risk rating for potential and established pests and diseases depending on the threat they pose. The rating takes into consideration the likelihood of establishment and spread as well as the economic, social and environmental impacts. *P. ramorum* has been on the risk register since its launch in 2014 and requires coordinated management for long term social, economic and environmental benefits.

A *P. ramorum* management strategy is therefore necessary to sustainably manage natural resources in Wales and achieve the objectives set out in the *Environment (Wales) Act, 2016*³ and the *Wellbeing and Future Generations (Wales) Act, 2015*⁴.

Decisions regarding the management of *P. ramorum* on trees and the wider environment are made by the Phytophthora Operational Response Team (PORT) who will provide clear strategic advice and recommendations to the Wales Tree and Plant Health Steering Group for the management of notifiable Phytophthora species in Welsh woodlands within the context of the scientific understanding, risks and overall management of these pathogens in woodlands.

The Wales Tree and Plant Health Steering Group will consider this advice and make recommendations which will then be considered by Welsh Ministers, who will determine the policy and strategic response to outbreaks of pests and diseases affecting trees and plants in Wales.

1 <https://gov.wales/woodlands-wales-strategy>

2 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/307355/pb14168-plant-health-strategy.pdf

3 <http://www.legislation.gov.uk/anaw/2016/3/contents>

4 <http://www.legislation.gov.uk/anaw/2015/2/contents/enacted>



3. Principles and Purpose

The *P. ramorum* disease has spread rapidly throughout Great Britain since it was identified in larch in 2009 and it is accepted the disease will continue to spread in Wales. The purpose of this strategy therefore, is to slow the rate of infection and spread of the disease whilst taking account of social, economic and environmental impacts. To achieve this, a holistic approach to management of the disease needs to be taken. This requires the use of scientific knowledge, a risk based approach, recognition of the resources available and the risk of infection based on climatic data, location of larch and other factors such as local knowledge.

This *Phytophthora ramorum* Strategy for Wales aims to:

- Minimise the social, economic, environmental and cultural impacts of *P. ramorum*
- Use a scientific and evidence based approach to manage *P. ramorum*
- Use a risk based approach for decision making
- Engage with stakeholders on significant changes in the management and understanding of the pathogen in woodlands
- Monitor the spread of the disease, publish the findings and raise awareness of the disease
- Ensure the management response to infected larch is fit for purpose
- Encourage the management of larch woodlands in Wales



4. Regulation

P. ramorum is regulated under EU emergency measures (2002/757/EC)⁵, and implemented in Wales by the *Plant Health (Forestry) Order 2005*⁶ and the *Plant Health (Wales) Order 2018*⁷ which lists *P. ramorum* as a Schedule 1 organism (a tree pest which shall not be introduced into, or spread within Wales). Such measures are achieved through the use of statutory plant health notices (SPHNs) that require the felling/killing of infected larch by a specified date and/or restricting the movement of infected material.

5. Disease

5.1 History

P. ramorum is a fungus like organism that affects a wide range of species (Annex A) and the effects of the pathogen vary greatly depending on the host. The pathogen was first discovered in 2002 in the UK at an ornamental nursery in Sussex and was probably introduced via plant trade pathways. Shortly after it was discovered in the nursery the pathogen was detected on plants in parks and gardens, most notably *Rhododendron ponticum*. *P. ramorum* was initially detected in Wales in the non-forestry environment during the autumn of 2002. The disease was then found on broadleaved species such as beech and sweet chestnut on sites with *Rhododendron* present (Brasier, Et al., 2004). In 2009 the disease was found on larch in the South West of England and the following year was detected on larch in South Wales. Since then the disease has become prevalent throughout the West of Great Britain and Ireland on various plant and tree species.

5.2 Biology

There are two different lineages of *P. ramorum*, EU1 and EU2, and both are present in the United Kingdom. The EU1 lineage is the most common lineage in Europe with EU2 restricted to South West Scotland and Northern Ireland. Two other lineages also exist in North America, NA1 and NA2 which have resulted in Sudden Oak Death in North America. The presence of both the EU lineages in the United Kingdom suggests there have been at least two separate outbreaks.

The disease can infect trees and plants leading to foliar, branch and stem dieback which are common symptoms. The pathogen will travel from the needles of larch trees into the branches and through to the main stem infecting the live tissue underneath the bark causing necrosis, lesions and cankers which can eventually girdle and kill the tree. The rate of infection and necrosis depends on a number of biotic and abiotic factors such as; sporulation rate, weather, species and proximity to a source of infection. Although *P. ramorum* kills larch trees it does not affect the timber.

⁵ Commission Decision 2002/757/EC on provisional emergency phytosanitary measures to prevent the introduction into and the spread within the Community of *Phytophthora ramorum*

⁶ <http://www.legislation.gov.uk/uksi/2005/2517/contents/made>

⁷ <http://www.legislation.gov.uk/wsi/2018/1064/contents/made>



5.3 Spread

P. ramorum spreads via spores. There are 2 types of spore; zoospores which are relatively short-lived spores that swim in water films or droplets and chlamydospores which are resting spores that enable survival of the disease through unfavourable conditions. Spread is mainly through zoospores which operate most efficiently in warm, moist air conditions and are produced on the needles of larch trees and other foliar hosts. There has been a significant increase in disease spread since 2009 as a result of sporulation from larch trees. The spores are produced in large quantities and can be released up to 30-40m above ground level which enables the disease to spread over large distances. The most important time for spore production and their spread to other trees is in late summer and early autumn. The production of spores is highly variable both between and within species (Harris and Webber, 2016). This may account for the sporadic spread which can be seen in uniform stands of even aged larch.

The position is further complicated by the presence of a cryptic phase within the life cycle of the disease. Visual surveys are only able to spot the disease once the tree or plant has become symptomatic. The cryptic phase delays the onset of symptoms and allows the pathogen to spread without being picked up via surveys; this has led to the assumption the disease can be 1-2 years ahead of the surveillance programme.

One of the main factors affecting the rate of spread is the climate in Wales and a climatic model has been created by Cambridge University which shows the areas of England, Scotland and Wales most at risk of infection (Annex B). Of all the countries Wales has the largest proportion of land in the high risk area.

5.4 Terminal and Sporulating Hosts

There are two types of host species impacted by *P. ramorum* in the United Kingdom (Annex A). Terminal hosts are affected by the disease, but do not allow the disease to sporulate and spread. Sporulating hosts can produce spores, but at different rates, depending on the species, which enables the disease to spread. All species of larch sporulate abundantly from needles in the tree canopy.

5.5 *Phytophthora ramorum* in Wales

P. ramorum is the most serious tree disease to have affected forests in Wales. Although it affects other hosts such as Rhododendron and Vaccinium the scale of the social, environmental and economic impact on trees – in particular larch – is far greater. Annex C and Annex D show the disease spread spatially on trees in woodlands and in the wider environment respectively to the end of 2018.

Since 2010 an annual surveillance programme of larch, in woodlands, through aerial and ground surveys has been conducted and was led by Forestry Commission Wales and is now supervised by NRW. Surveys of other species, in the wider non-woodland environment in Wales have been conducted by the Animal and Plant Health Agency (APHA).

The *Phytophthora Management Strategy* has been implemented since 2010. It has provided a strategic direction to the operational management of the disease.

In 2014 Welsh Government and stakeholders reviewed the strategy and introduced 2 disease management zones; a Core Disease Zone (CDZ) and a Disease Limitation Zone (DLZ) as part of the revised disease management strategy introduced in 2014. The review took account of scientists' understanding of the disease at the time, new knowledge about its spread and the social, economic and environmental impacts of the management strategy. In the CDZ any infected material would not be subjected to any time limit on the felling; this would enable resources to be targeted in the DLZ where the disease was largely absent. If infection was found in the DLZ then SPHNs and Notification Letters with time limits would continue to be issued. More information on how the disease has affected the rest of Great Britain and what management strategies have been utilised by the other devolved administrations can be found in Annex E.

Following the progression of the disease in 2017/18 and 2018/19 there was a consensus to refresh the management strategy for *P. ramorum* and develop an action plan based on the latest knowledge and practice. As part of the process for reviewing the CDZ it became clear that both the disease situation and our understanding of the disease had significantly changed since the strategy was produced in 2014. The disease management strategy review has been led by Welsh Government and has included significant consultation with stakeholders in the context of the changes in Wales and potential pressures from other pests and disease e.g. *Ips typographus*.

As the disease has spread the management of *P. ramorum* has needed to adapt. The new *P. ramorum* action plan describes in detail the ongoing operations and processes which are being implemented to slow rate of spread of the disease in larch across Wales.



6. *Phytophthora ramorum* Action Plan for Wales 2019

6.1 Overview

The action plan outlines the management approaches and operations that are currently being taken in Wales to manage the spread of the disease. These measures adhere to the principles and objectives set out in the *Phytophthora ramorum* Strategy for Wales.

The Action Plan and CDZ boundaries will be reviewed annually by the Phytophthora Operational Response Team and will incorporate:

- Efficacy of the management of the spread of *P. ramorum* and CDZ and DLZ boundaries
- A change in the availability of resources
- Change in the behaviour of the disease
- New scientific knowledge of the disease
- An analysis of efficacy of the CDZ boundaries

Recommendations will be passed onto the Wales Tree and Plant Health Steering Group for approval. The operational schedule for *Phytophthora ramorum* on larch in Wales (Annex G) has been attached to provide a comprehensible overview of the operations that enable us to deliver the *Phytophthora ramorum* Strategy for Wales. Currently an action plan only exists for larch due to the large scale impact on the species which covered approximately 24,000 hectares of land in 2011.

6.2 Surveillance

As part of the ongoing disease management, surveillance takes place to identify disease spread. This not only forms the basis for issuing SPHN's but is also used to inform the management strategies and action plans. NRW regularly produce situation reports based on both aerial surveys and site visits. These reports are presented to the Phytophthora Operational Response Team and the Wales Tree and Plant Health Steering Group. Table 1 shows the figures collated by NRW at the end of every year and shows the known spread of the disease in Wales.

Table 1. Rate of Increase of Areas Under an SPHN or Notification Letter*

Year	Areas under SPHN per year (ha)	Cumulative area under SPHN (ha)
2010	836	836
2011	476	1311
2012	1478	2788
2013	5285	8074
2014	508	8581
2015	109	8690
2016	199	8888
2017	1273	10162
2018	1028	11190

*Data compiled from NRW Situation Reports, 2010-2018

6.3 Statutory Plant Health Notices and Notification Letters

SPHN's are the mechanism employed to enforce the destruction of host trees. The area covered by each SPHN depends on a number of factors including topography, species and appropriate operational boundaries. All SPHN's have minimum distances of buffers, to be treated, from the infected trees. Evidence from Forest Research was used (Joan Webber, Et al., 2010) to set the appropriate distance for each species. Infection of larch in woodland requires all larch species within a 100m buffer zone from the point of infection to be treated. Infection of Sitka spruce in a woodland environment requires treatment of Sitka spruce within a 20m buffer zone from the point of infection whilst treatments of all other host species in forestry and non forestry environments will be assessed on a case by case basis.

Any logs or other products with bark of specific species that arise from the management of sites issued with a SPHN can only be moved if covered by an appropriate movement licence to premises that have also been licensed to process the material. *P. ramorum* movement and processor licences for businesses in Wales are authorised by the Forestry Commission on behalf of Welsh Government.

Whilst Tree Health duties are the responsibility of the Welsh Ministers, some functions have been delegated to NRW who carry out the operational duties. NRW issues 'Statutory Notices' on findings of *P. ramorum*, except on the Welsh Government Woodland Estate (WGWE). Due to the legal ownership of the land NRW will issue a 'Statutory Letter' if *P. ramorum* is found on the WGWE. The requirements of both a SPHN and Notification Letter are the same and provide instruction to land owners/managers.

6.4 Treatment following receipt of a SPHN or Notification Letter

There are two options for the treatment of infected larch:

1. Harvest or destroy the trees before sporulation
2. Kill the trees and leave them standing before sporulation

Option 1 is the preferred treatment for the disease, as it is more effective in killing trees and only requires one operation to reduce the potential spread of the disease and harvest the timber.

Option 2 can be carried out a number of different ways e.g. Stem injection, however success rates of killing trees effectively to stop sporulation with one treatment is variable. It should only be used if option 1 is not viable. Killing trees and leaving them standing will require a separate harvesting operation licence and will increase costs. Dead trees also pose a higher risk to the public e.g. falling branches and to those who will be felling the trees. These subsequent risks should be accounted for when planning the treatment of diseased larch.

6.5 The Core Disease Zone Boundaries

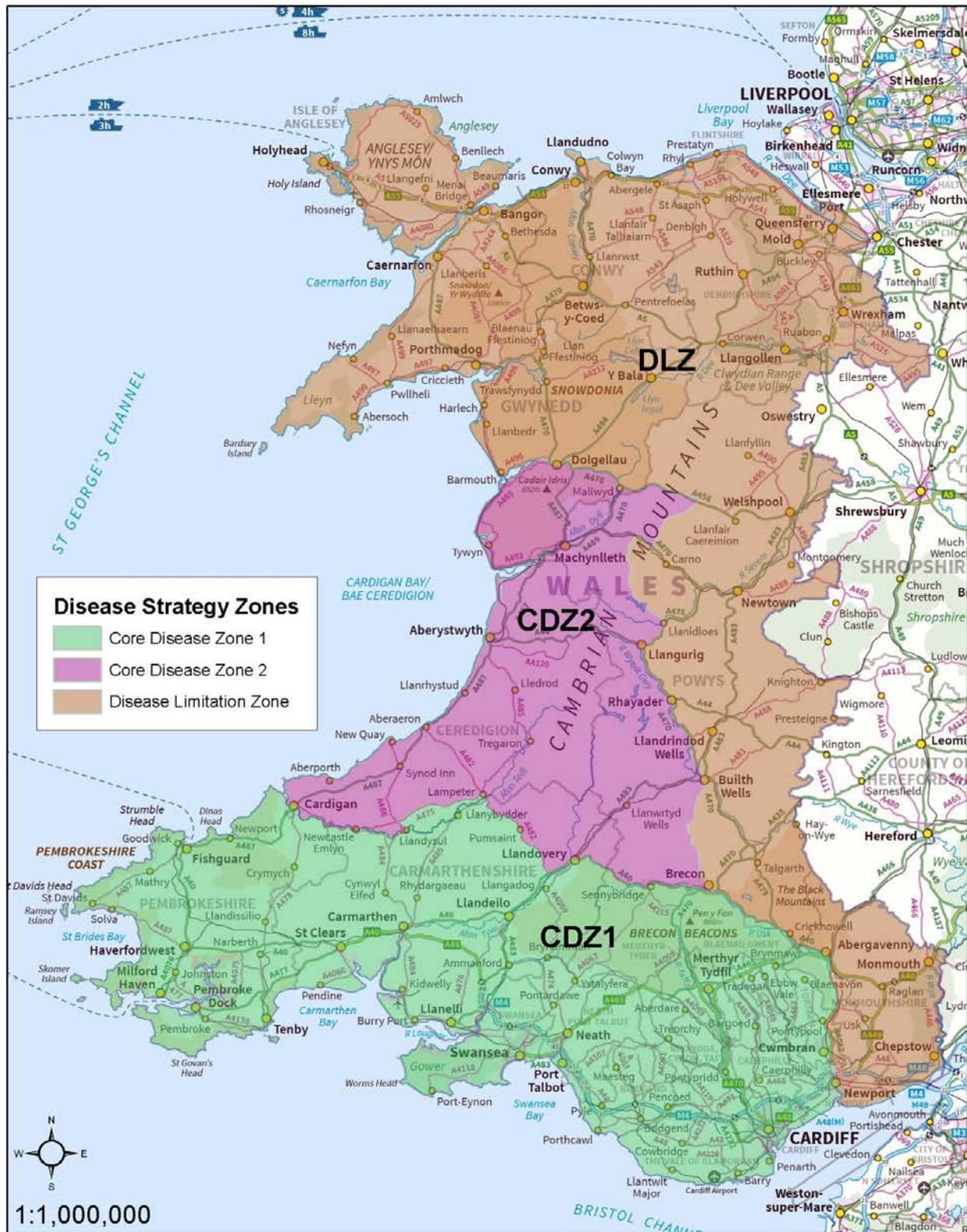
The extent of the boundaries of the core disease zones is based on several factors:

- Level of infection in the area (Annex F)
- The relationship of the area to the climatic model
- Resource management
- Direction of the spread of the disease
- Potential impacts of disease management on the environment
- Potential impacts of disease management on local communities
- Location of contiguous stands of larch
- An understanding of the cryptic phase of the disease

As part of the overall review Wales will now be split into 3 different disease zones (Map 1). These have been discussed with representatives from the private sector and NRW in the Phytophthora Operational Response Team and have been agreed by the Wales Tree and Plant Health Steering Group and approved by Welsh Ministers. More detailed information regarding regulation and operations within CDZ1, CDZ2 and the DLZ is available from NRW.

The new CDZ aims to slow the rate of infection into the DLZ as there is still a large amount of known larch in the North-West and East of the country which has relatively low levels of infection. A quick response to infections may prove to be effective in slowing the rate of spread in the DLZ and retaining the remaining larch in Wales.

Map 1. Delimitation of the Core Disease Zone boundaries.



Phytophthora ramorum
Disease Management Zones (DMZs)

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Date: 2019.01.31

Table 2. A breakdown of areas of known larch in the 3 different disease zones*

Disease Management Zone	Approximate area of larch (ha)
CDZ1	7164
CDZ2	5053
DLZ	10888
Total	23105

*Data has been utilised from a number of sources to create this dataset. It is currently the best estimate of the amount of larch in Wales.

6.5.1 Core Disease Zone 1 (CDZ1)

This area of Wales replaces the current CDZ which has been designated as a CDZ since 2014. It has a high rate of infection; large contiguous stands of larch in woodlands, an extensive proportion of woodland situated in the high risk area according to the Cambridge climatic risk model and has a high proportion of Wales’ infected larch.

Operations

In the CDZ1 there will be limited aerial and ground surveys undertaken, those which are done will concentrate largely on other species and habitats to monitor any change in disease spread behaviour. The onus for managing the larch will rest largely with the landowners and land managers. Larch will be inspected where felling licence applications are received and for infected sites a SPHN(m) or Notification Letter will be issued before operations can take place. **Note there will be no time limit for treatment operations imposed.** It is estimated that SPHN’s have been issued to the majority of larch woodlands contained within the CDZ1. Following the publication of the 2014 Phytophthora strategy, surveillance and treatment of larch was targeted on the CDZ1 boundary in an attempt to reduce the risk of spread from infected stands in the CDZ1. The amount of larch in the CDZ1 and on it's boundary has been reduced, but the intensity of the disease and available resources has impacted the ability to manage the spread of the disease. When operating in this zone current biosecurity guidance should be followed. Most management operations that occur in the CDZ1 will be harvesting of infected material. Movement of the material from site and processing is regulated for biosecurity purposes and to prevent the spread of *P. ramorum* through this pathway.

6.5.2 Core Disease Zone 2 (CDZ2)

This area of Wales was designated a CDZ in May 2019. Like the CDZ1 it contains contiguous stands of larch in woodlands in private and public forests as well as on farmland and is situated in the high risk areas according to the Cambridge climatic risk model.

Operations

In the CDZ2 there will be targeted aerial surveys undertaken, which will concentrate mainly on areas adjacent to the DLZ boundary. The onus for managing the larch will rest largely with the landowners and land managers. Larch will be inspected where felling licence applications are received and for infected sites the SPHN or Notification Letter will be issued and operations can take place. **Note there will be a 3 year time limit imposed for the treatment operations to take place.** This allows enough time for appropriate planning, stakeholder engagement and operations to be carried out in a way which will reduce the impact on local communities and businesses, the environment, as well as respecting ongoing operational commitments to managing the spread of the disease. Movement of the material from site and processing is regulated for biosecurity purposes and to prevent the spread of *P. ramorum* through this pathway. Most operations that will occur in the CDZ2 will be harvesting of material although there may be limited use of other treatment methods to fulfil specific issues at individual sites.

6.5.3 Disease Limitation Zone (DLZ)

This area covers the remainder of Wales which has limited levels of infection compared with the CDZs. A large portion of this area is deemed low risk according to the Cambridge University climatic model. Although there are plantations of larch in this area it is hoped less suitable climatic conditions coupled with swift management of infected stands will mean much disease spread through the DLZ. The stands of larch are often more sporadically located in the countryside e.g. Farm shelterbelts, this reduces the potential spread of infection.

Operations

The aerial surveys will be concentrated in the DLZ targeting possible pathways from larger infections in the CDZs. Local knowledge, existing disease spread data and meteorological data will all be utilised by NRW, followed by ground-based surveys. **If sites are confirmed to be infected NRW regulatory staff in consultation with the landowner will issue an SPHN or Notification Letter which will prescribe the required treatment operations to be carried out within a specific time frame.**

Felling Licence Applications submitted in winter for all areas of Wales

NRW will inspect all larch stands prior to approval for felling. During winter, the symptoms are not visible and cannot be inspected. For applications submitted after the 30th September and before 1st April, the land owner/manager will be offered the choice to:

1. Delay the application until the larch can be inspected when symptoms are visible
2. Request a movement restriction Notice (SPHN(mr))
3. Remove the larch from the application

If none of the options are agreed, the application will be refused. During the summer, applications will be fast-tracked and will be assessed as soon as possible. Where larch is the dominate species on felling licence applications, there will be no 'Public Register' requirement.

6.6 Mechanisms/Grants

The Welsh Government Rural Communities and Rural Development Programme for Wales 2014-2020 contains a range of financial support to rural businesses including the Glastir Woodland Restoration scheme. This Scheme offers support to woodland owners with larch on their land to encourage pre-emptive felling of larch and subsequent restocking after harvest. It also offers grants for capital works such as fencing, restocking and associated operations where there is standing larch and up to 50% non-larch species.

6.7 Secondary pests

P. ramorum also provides an opportunity for secondary pests such as *Ips cembrae*, the larch bark beetle, and other organisms that attack dead or dying trees and plants. Forest Research is maintaining vigilance as to how *P. ramorum* may increase the potential for an outbreak or an opportunity for the development of another pest or disease.

7. Bibliography

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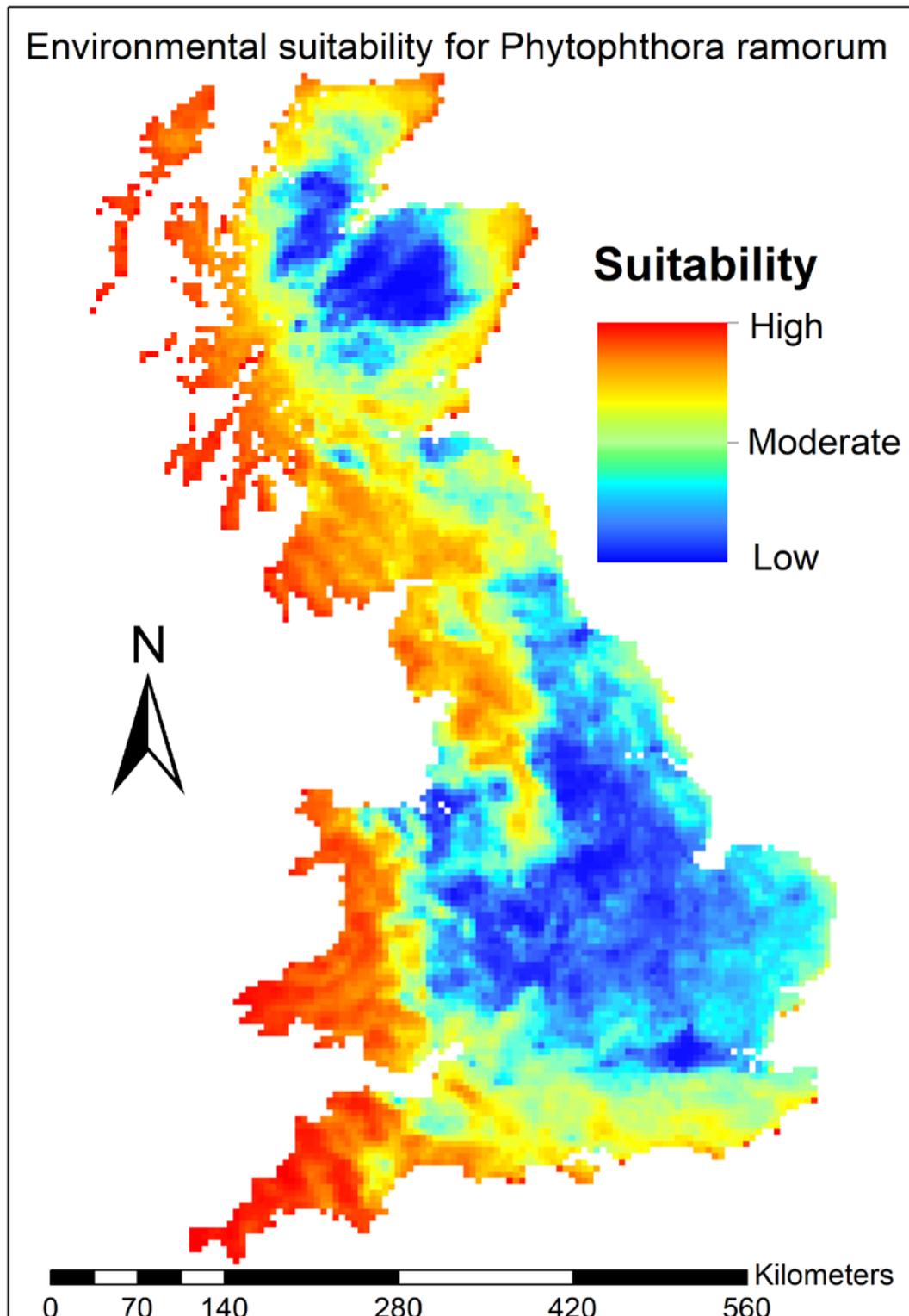
Annex A Table of Host Species Sporulation Levels and Management Treatments.

This management strategy has concentrated on larch for the reasons outlined in the strategy. However, aerial and ground surveillance programmes will also monitor other species if individuals are expressing symptoms of *P. ramorum*. The table below summarises the hosts ability to sporulate (McDermott, Et al., 2017).

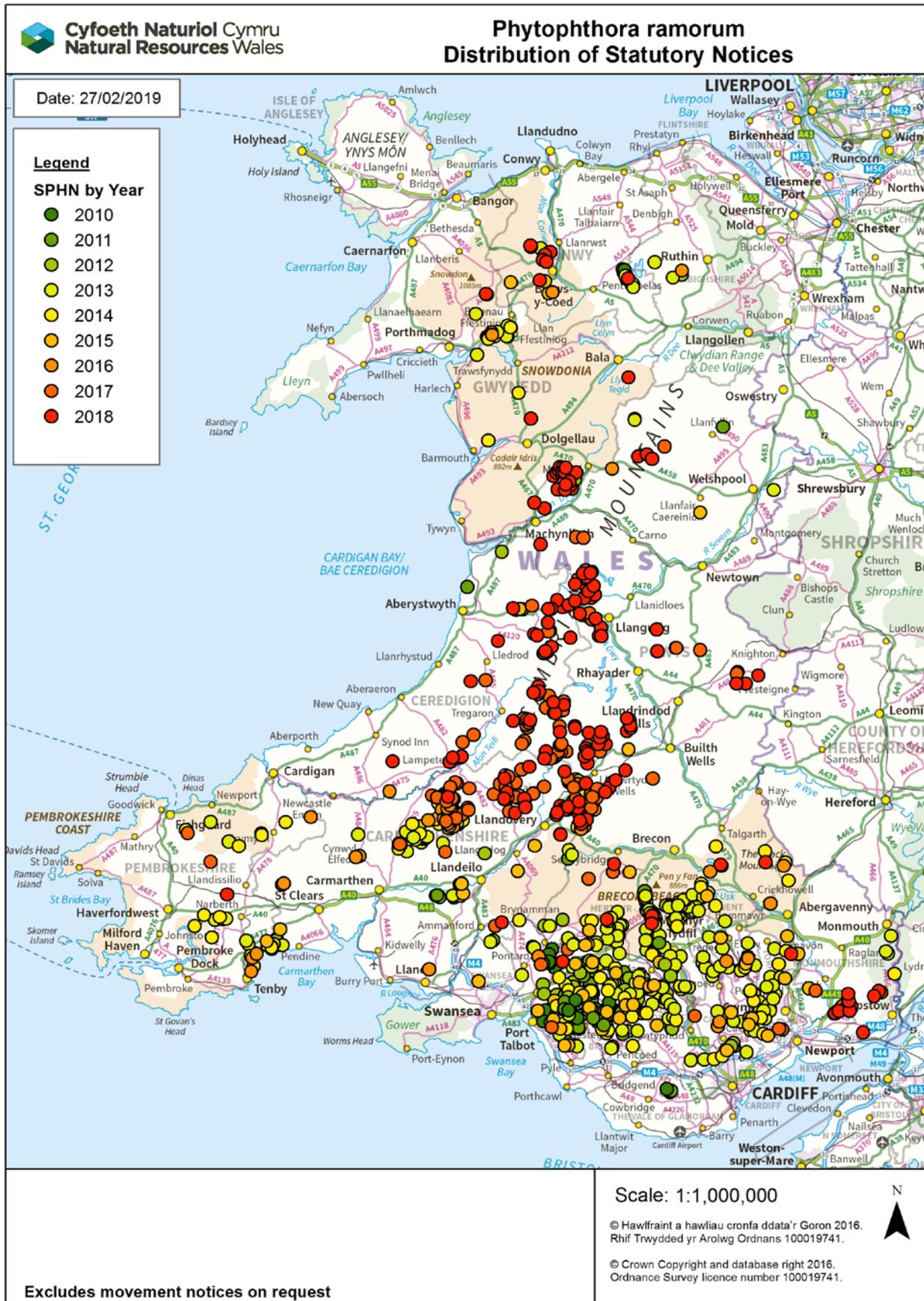
Species	Type of Host	Sporulation levels
BROADLEAVES		
<i>Acer pseudoplatanus</i>	Sporulating	Low
<i>Aesculus hippocastanum</i>	Sporulating	Low-mod
<i>Castanea sativa</i>	Sporulating	Mod-high
<i>Corylus avellana</i>	Sporulating	Very low
<i>Fagus sylvatica</i>	Terminal	-
<i>Fraxinus excelsior</i>	Sporulating	Moderate
<i>Nothofagus obliqua</i>	Terminal	-
<i>Quercus cerris</i>	Sporulating	Moderate
<i>Quercus ilex</i>	Sporulating	Moderate
<i>Quercus petraea</i>	Sporulating	Moderate
<i>Quercus robur</i>	Sporulating	Moderate
<i>Salix caprea</i>	Terminal	-
CONIFERS		
<i>Abies grandis</i>	Sporulating	Moderate
<i>Abies procera</i>	Sporulating	Moderate
<i>Chamaecyparis lawsoniana</i>	Terminal	-
<i>Larix decidua</i>	Sporulating	High
<i>Larix kaempferi</i>	Sporulating	Very High
<i>Larix x marschlinsii</i>	Sporulating	High
<i>Ilex aquifolium</i>	Terminal	-
<i>Picea sitchensis</i>	Sporulating	Low
<i>Pseudotsuga mensiezii</i>	Sporulating	Very Low
<i>Taxus baccata</i>	Sporulating	Low
<i>Tsuga heterophylla</i>	Sporulating	Low
PLANTS		
<i>Rhododendron ponticum</i>	Sporulating	Moderate
<i>Umbellularia californica</i>	Sporulating	Low
<i>Vaccinium myrtillus</i>	Sporulating	Low

Annex B. 5-year average of environmental suitability for *P. ramorum*, based on humidity and temperature, and experimental data.

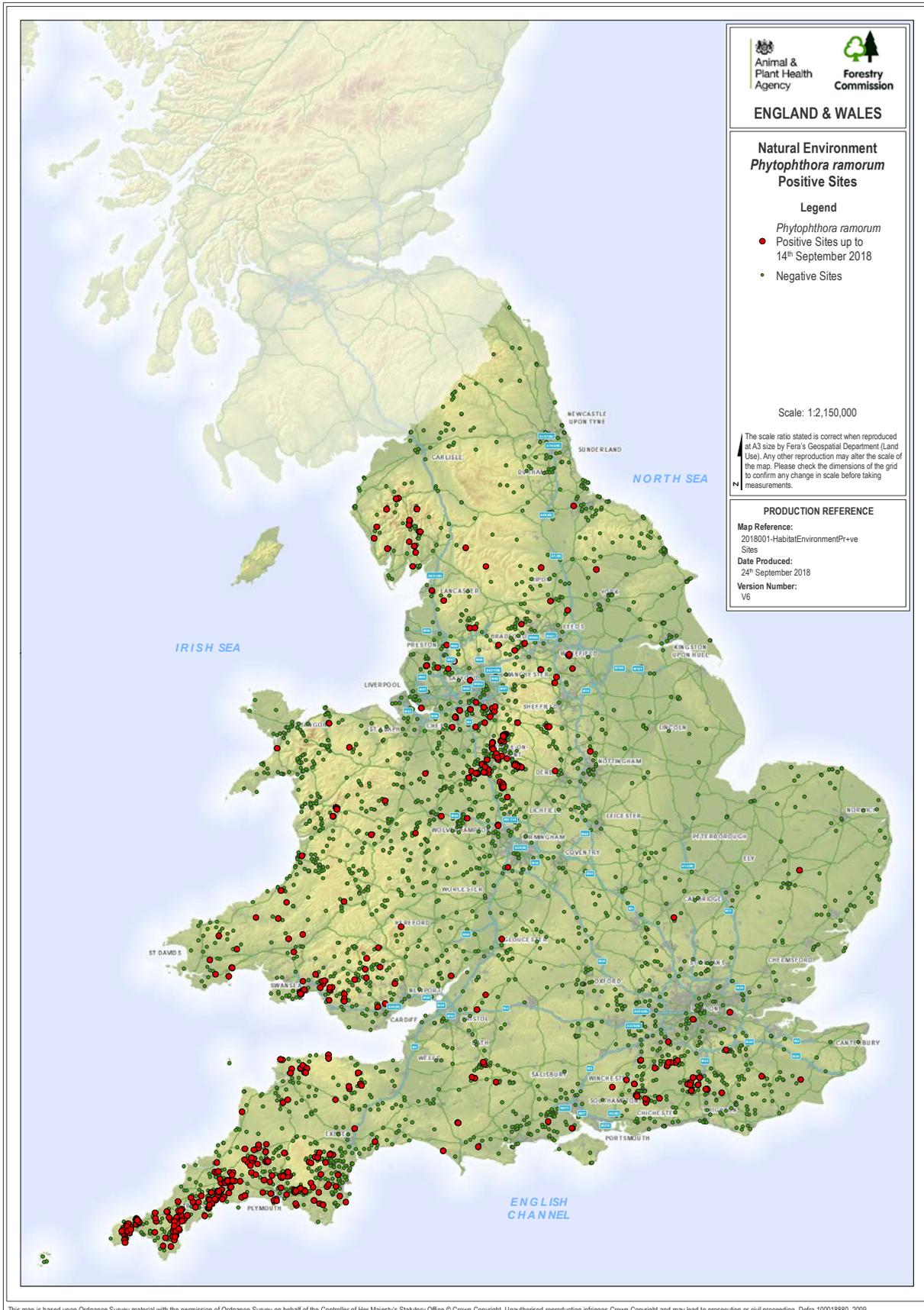
This map was commissioned by the Department for Environment, Food and Rural Affairs and produced by the Cambridge Epidemiology and Modelling Group.



Annex C. The locations of all the Statutory Plant Health Notices issued in Wales.



Annex D. The location of non-forestry *P.ramorum* sites in the wider environment across England and Wales.



Annex E. *Phytophthora ramorum* outside of Wales.

England

England's *Phytophthora* Strategy is currently being updated by DEFRA. Currently the DEFRA Tree Health Management Plan, 2014 outlines the broad tree health strategy and goes into more detail regarding *P. ramorum* management in England. Forestry Commission England and APHA conduct the ground and aerial surveys in England at present.

England, relatively, has the smallest amount of land classified as high risk according to the Cambridge University model and has proportionally the lowest amount of larch to total woodland cover at approximately 3.6% (National Forest Inventory, 2011). They have not adopted a Management Zone or Core Disease Zone as in Scotland or Wales. The majority of infection has been located in South-West England but there are significant areas of diseased larch in the Lake District and Cumbria.

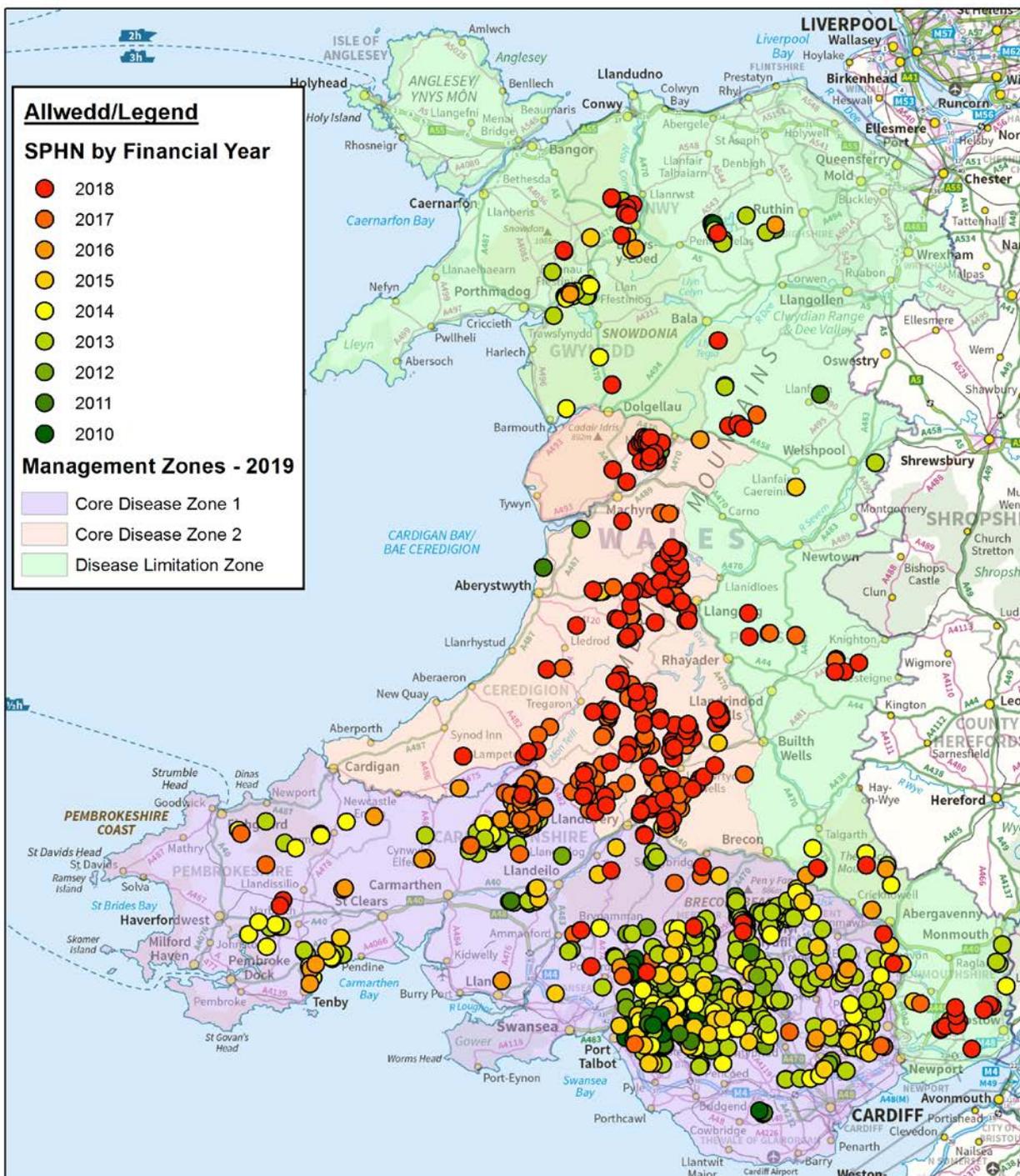
Scotland

The Strategy for *Phytophthora ramorum* in Scotland for 2015-17 was written and published by the Scottish Government. Forestry Commission Scotland created the Action Plan for *P. ramorum* which outlines the management operations currently taking place in Scotland to slow the spread of the disease.

P. ramorum was first detected on Japanese larch in 2010 in West Scotland. The disease was localised mainly in the Dumfries and Galloway area but after 2012 the scale of the infection increased. This led to the creation of the Management Zone which restricts the movement of infected material. Forestry Commission Scotland Tree Health Inspectors no longer issue SPHNs for infected trees discovered within the management zone. In 2018 the disease developed significantly outside of the management zone and along the West coast up to the Highlands which reflects predictions in the climatic risk model created by Cambridge University.

Annex F. Location of SPHNs in Wales and the disease management boundaries.

Phytophthora ramorum Disease Management Zones and Statutory Notices



Key Priority	Actions	Mechanism	How	Priority (H, M, L)	Risks	Timing	Lead	Considerations
Research	Further modelling of epidemiology	Cambridge University have developed a dynamic model with many variable based on scientific knowledge and data collected from the field.	DEFRA contract with Cambridge University	H	Availability of data Communication	All year	DEFRA	Wales to be fully involved with the annual review of the model
	Remote sensing Masters Projects	Masters thesis in remote sensing from Aberystwyth University	Aberystwyth University	M	Quality of aerial photography Budget	All year	WG/ Aberystwyth University	If accurate this could provide a cost effective way of analysing the area of larch still standing and its location
	Trialling different treatment methods	Experimental plot to measure the efficacy of stem injection	NRW project	M	N/A	Completed	NRW	Proved efficacy of stem injection in the context of disease management
	Identify possible new surveillance and identification techniques	Watching brief on research/commercial developments	Networking with FR and Devolved Administrations	M	N/A	All year	All parties	New technology often has a high cost. Need to produce cost risk analysis for WTPHSG.
	Pre-symptomatic ID of <i>P. ramorum</i> in larch and bilberry	2 KESS PhD projects	Aberystwyth University	M	N/A	2019/20	WG/ Aberystwyth University	Students will have to present their work. Is there any more research to be done in this field.

Key Priority	Actions	Mechanism	How	Priority (H, M, L)	Risks	Timing	Lead	Considerations
Prophylactic measures	Encourage preparedness <ul style="list-style-type: none"> • Forestry professionals • Woodland owners • Nurseries 	Raise awareness of <i>P. ramorum</i> in Public forums, trade pathways and prepare guidelines and best practice for industry	NRW/FCE web based guidance Advice from NRW	H	Limited resources Budget	All year	FCE	Based on cross-border intelligence
	Grant support	Glastir Woodland Restoration Scheme	Welsh Government Rural Communities Rural Development Programme 2014-2020	H	Limited resources available	Opens through windows publicised on WG website	WG	Tied to set application windows
	Maintain biosecurity awareness	Reinforce clear guidance and NRW/WG stance	NRW web based guidance Advice from NRW	H	Limited resources Budget	All year	FCE/WG	International Year of Plant Health 2020 'Leave it in the forest' and 'Keep it Clean' campaigns' New UK plant biosecurity strategy to be published in 2020
	Timber marketing	Enable the market to react to changes in production	Production forecasting	M	Limited resources Data accuracy	All year	NRW	Capacity to react prophylactically depends on the spread of the disease and whether it is in CDZ1, CDZ2 or DLZ

Key Priority	Actions	Mechanism	How	Priority (H, M, L)	Risks	Timing	Lead	Considerations
Reactive measures	Prevent new infections via infected plants	Certification scheme and inspections at nurseries and ports	Statutory action and APHA Plant Health Inspectors	H	Limited resource Detection systems	All year	APHA	The Statutory Instrument has led to a reduction in the amount of larch being grown in UK nurseries
	Containment action	Order the destruction of infected larch trees	Statutory action and guidance	H	Limited resource	Mar-Sep	NRW	3 different management zones in Wales, see strategy above for information
		Restriction of movement of infected larch to registered processors	Statutory action and guidance	H	Limited resource	All year	FCE	Approximately 70 processors are registered by FC cross border plant health service to accept infected material (Standard Operating Procedure, Plant Health 10)
		Glastir Woodland Restoration Scheme	Welsh Government Rural Communities Rural Development Programme 2014-2020	H	Limited resources available	Opens through windows publicised on WG website	WG	Tied to set application windows

Key Priority	Actions	Mechanism	How	Priority (H, M, L)	Risks	Timing	Lead	Considerations
Communications	Ensure written information is 'current'	NRW and WG website updates	Regular situation reports updated on NRW Website. Ongoing review of Welsh Government website	H	Limited resource	All year	NRW/WG	Need to feed information on the latest situation in Wales into the rest of GB and conversely receive regular updates on the situation in the rest of GB to provide context
	Enhance forestry, arboricultural and horticultural sectors awareness of <i>P. ramorum</i> and its management	Use of trade press	Syndicated articles	M	Limited resource	All year	WG	Particular focus as and when situation changes
		Face-to-Face updates	Trade shows, Agricultural shows, society meetings	M	Limited resource	All year	NRW/WG/APHA	Particular focus as and when situation changes
	Enhance public awareness of <i>P. ramorum</i>	Face-to-Face updates	Articles	L	Limited resource	All year	NRW/WG	GB wide
	Tree Health seminars	Annual Public and trade information event	Series of lectures given by experts at two locations in Wales	L	Budget	All year	NRW/WG/APHA	GB wide