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New pest and pathogen threats to trees and forests and the UK response

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Forest Research

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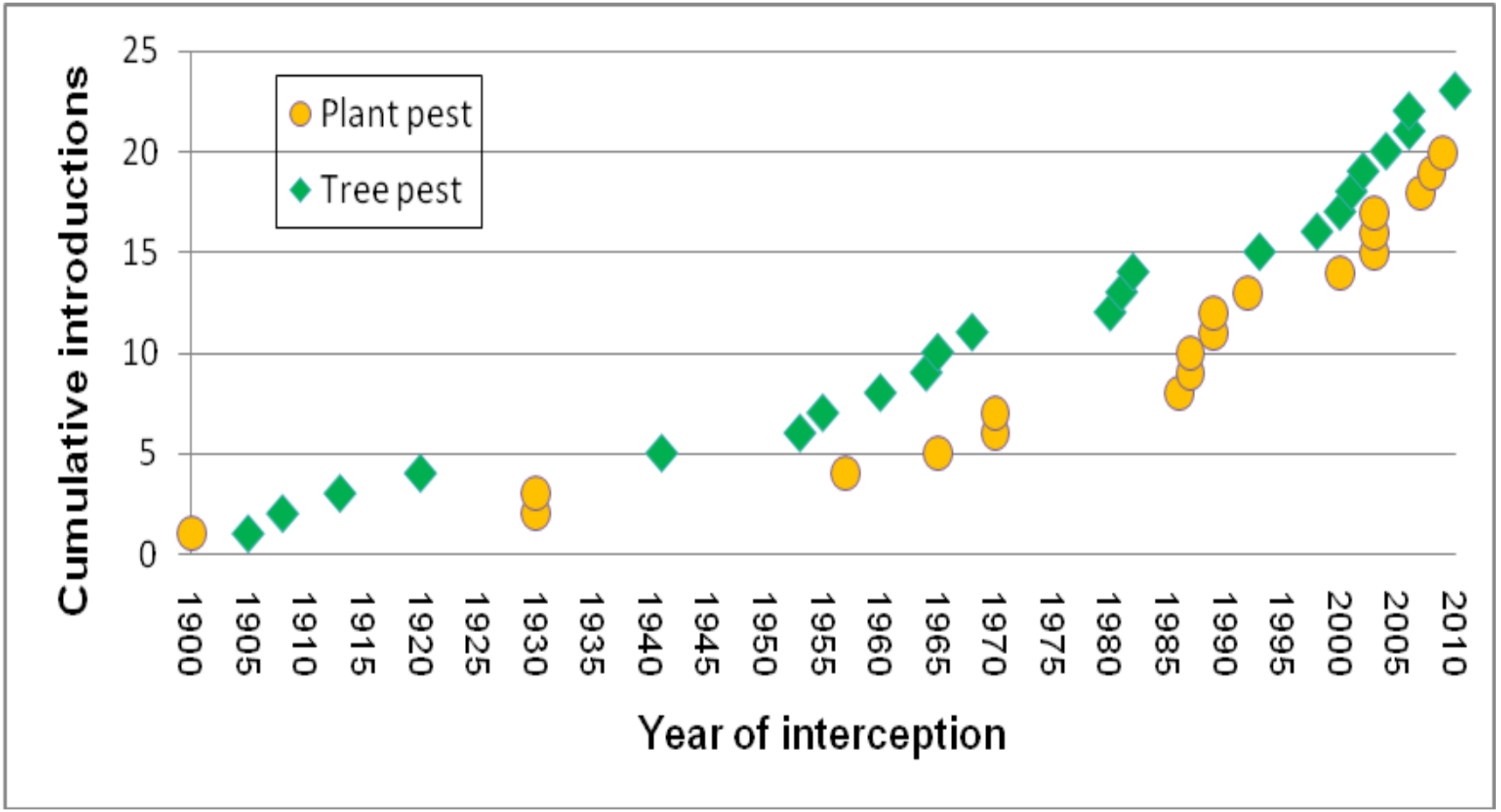
Response to plant pests/diseases

- Complicated landscape in UK for plant health
  - Forestry Commission takes lead for forest trees
  - Department of Food & Rural Affairs (Defra) takes lead for non-forest trees, plants, nurseries
  - Policy is devolved and operates at a country level (Scotland/ Wales/ Northern Ireland have own administrations)
- Plant health regulation operates at European Union level
  - Common market, so unrestricted movement of plants within the 27 EU countries - but can have protected zones for pest-free countries/regions
  - Number of tree pests that are regulated at EU level is very limited (in contrast to EPPO)

Arrival of damaging pests and pathogens in Great Britain



Defra-FC Tree Health Action Plan

- From 2010 onwards -
- Through a process of meetings and consultations, Defra & FC developed an Action Plan to respond to this changing landscape of introduced pest and pathogens
- Plan centres around four main themes
  - Protecting the UK – import controls (also in the context of EU plant health controls)
  - Practical actions (biosecurity practice, local sourcing)
  - Public and stakeholder engagement (awareness, citizen science)
  - Research opportunities and priorities (general resilience, specific targeted topics)

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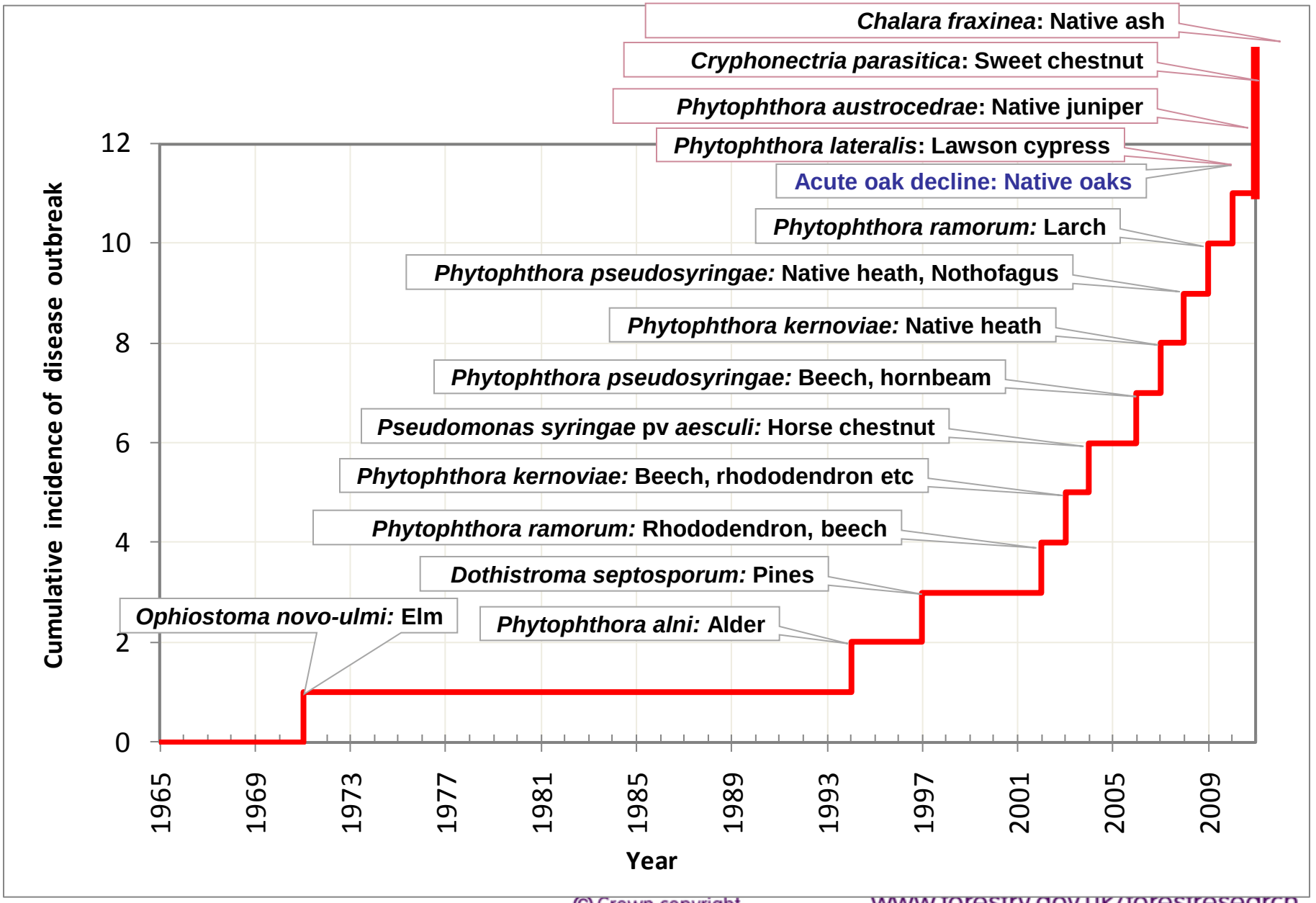
New tree disease outbreaks UK



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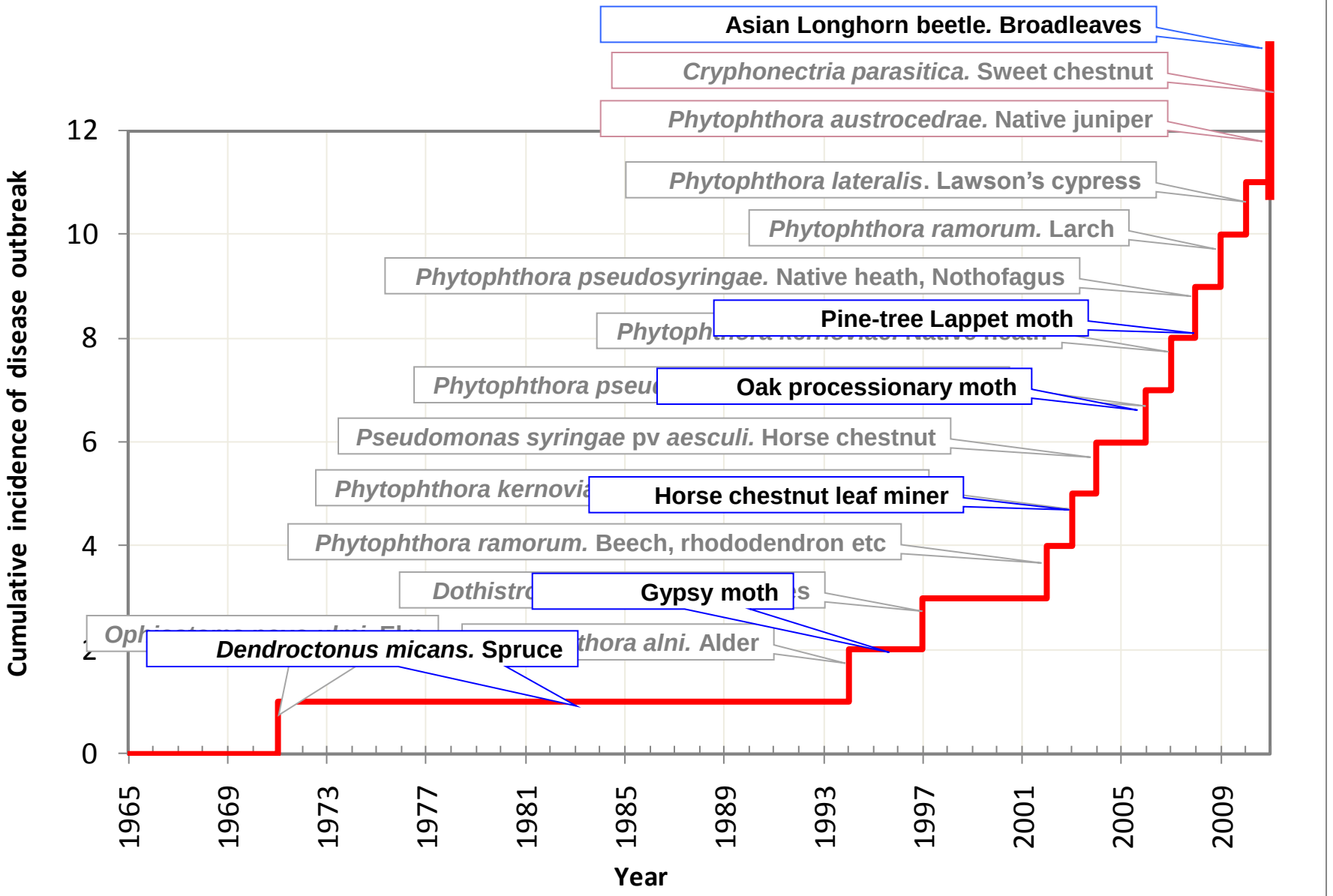
New tree pest outbreaks UK



Response to pests and pathogens in the UK

- Oak processionary moth (native in Europe but was absent from the UK: not regulated)
- *Phytophthora ramorum* (limited distribution in Europe: regulated)
- Asian longhorn beetle (non-native but now established in some parts of Europe: regulated)
- Chestnut blight (non-native but now established in much of Europe: regulated)
- Ash dieback (non-native but now throughout much of Europe: regulated)

Oak Processionary Moth

- In 2006, oak processionary moth, *Thaumetopoea processionea* was found at several London locations
- It is a major defoliator of oak in Europe
- Caterpillars feed on the foliage of many species of oaks, including English, sessile and Turkey oak
- Arrived on 4-8 m tall oak imported for street landscape plantings

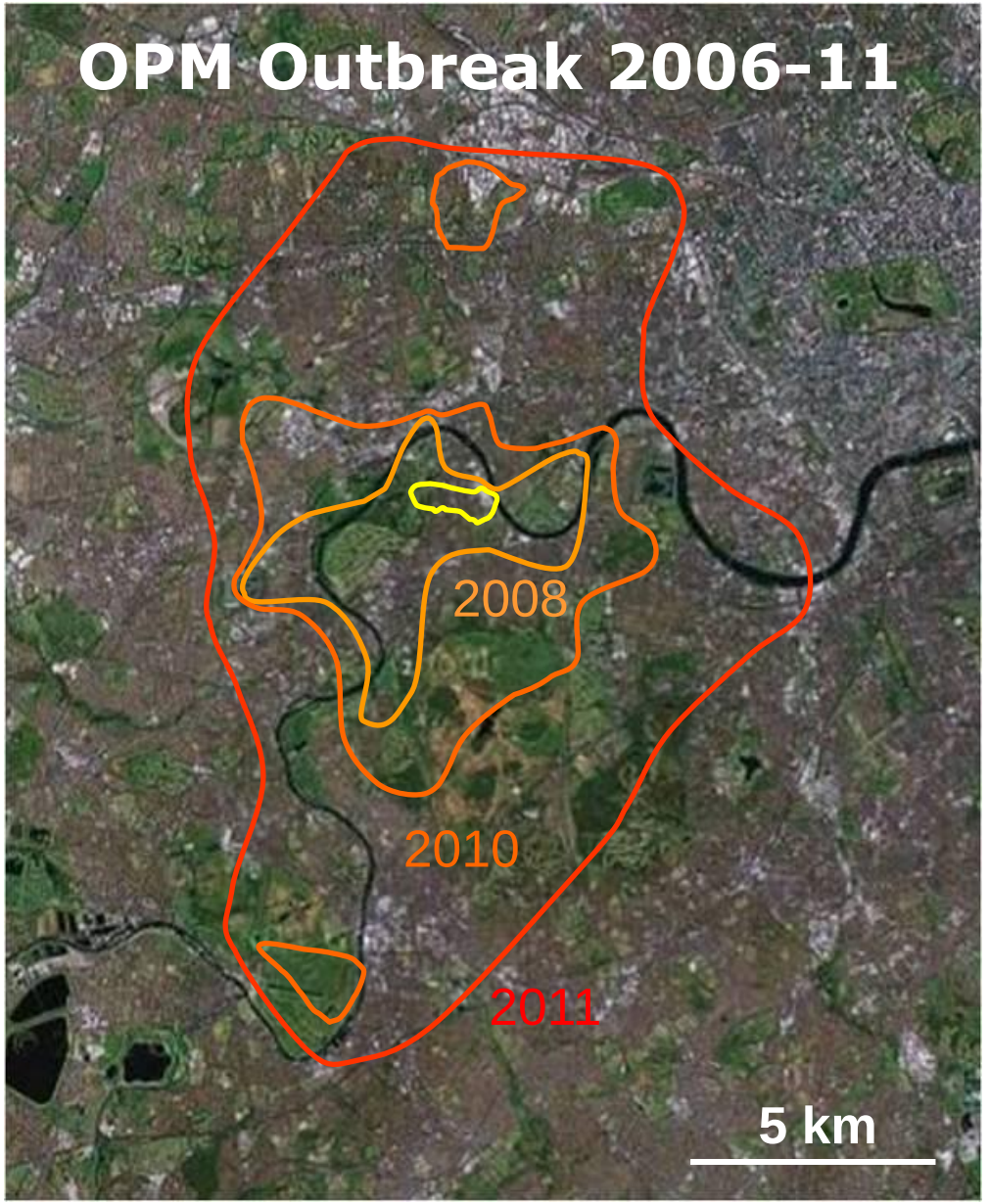
Kitzingen, Germany June 2010

OPM caterpillars carry thousands of tiny irritating hairs that are dislodged on contact. They pose a considerable hazard to public health

0.1 mm

Oak processionary moth

- Changing distribution in Europe, but UK was not a protected zone
- Plant & human health risk
- Eradication efforts since findings in 2006
- Joint response by several 'agencies' Defra, FC, local authorities to the outbreak. Aimed at eradication
- Landowners had to deal with infestations, response was often slow
- On average the population has spread at ~1km/yr, eradication now abandoned but containment ongoing



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Affected *Quercus* species

Nests 2007	Nests 2008	Nests 2009	Nests 2010*	Nests 2011
708	**508**	**2450**	**2176**	**4410**

Quercus species affected	Infested trees	% of total
Q. cerris	144	11
Q. robur v. *fastigiata*	2	0.2
Q. frainetto	1	0.1
Q. x *hispanica*	1	0.1
Q. x *robur*	6	0.5
Q. ilex	9	0.7
Q. petraea	4	0.3
Q. robur	**1141**	**87.2**
Q. turnerii	1	0.1

** 44 OPM nests also found at Pangbourne, Berkshire, in August 2010 (arising from a separate introduction)

- Controlling OPM is difficult and costly
- Off-label approval for use of BT
- Increased efforts at containment

P. ramorum, 2002-09 in UK

Bleeding lesions on beech

Inoculum from rhododendrons

P. ramorum 2002

- EU emergency regulation from 2001
- All EU countries required to survey nurseries and wider environment
- Found in UK in nurseries in 2002, on trees in 2003
- Measures in place to eradicate in nurseries, more difficult to reproduce this in the wider environment due to rhododendron invasion
- Costs of plant destruction from owner
- Defra Phytophthora Programme set up in 2009 (5 years, £5 million/year), including cost of rhododendron removal. Aim was to reduce *P. ramorum* to epidemiological insignificant levels
- Joint Fera/FC response

Emerging findings: Aug-Sept 2009

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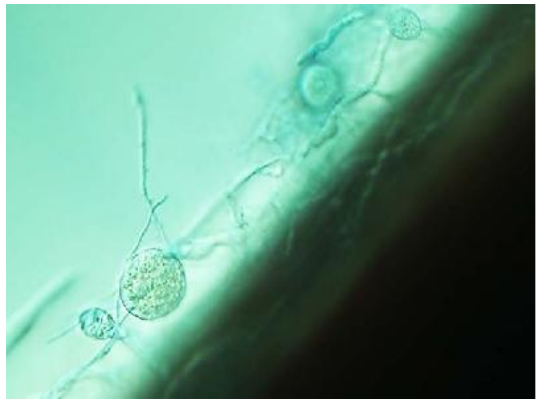
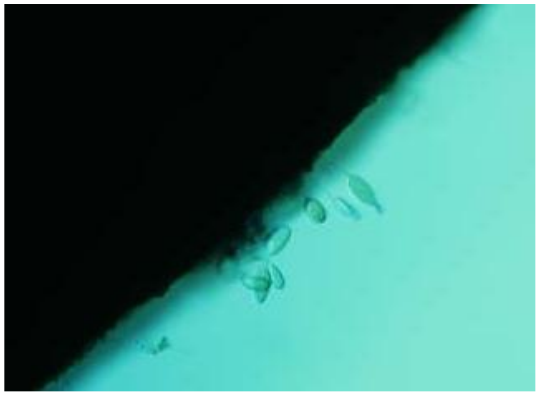
JL foliar symptoms





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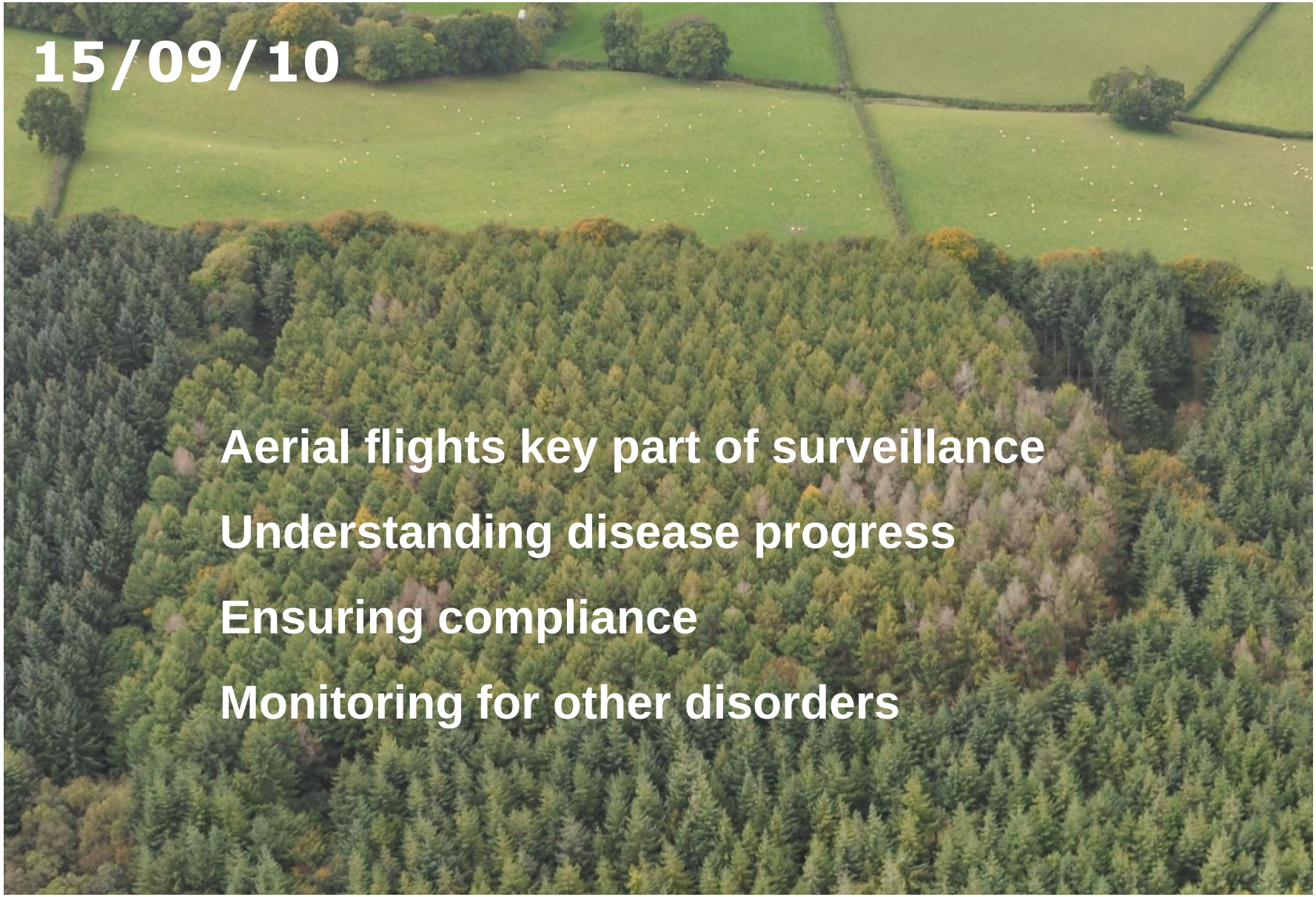
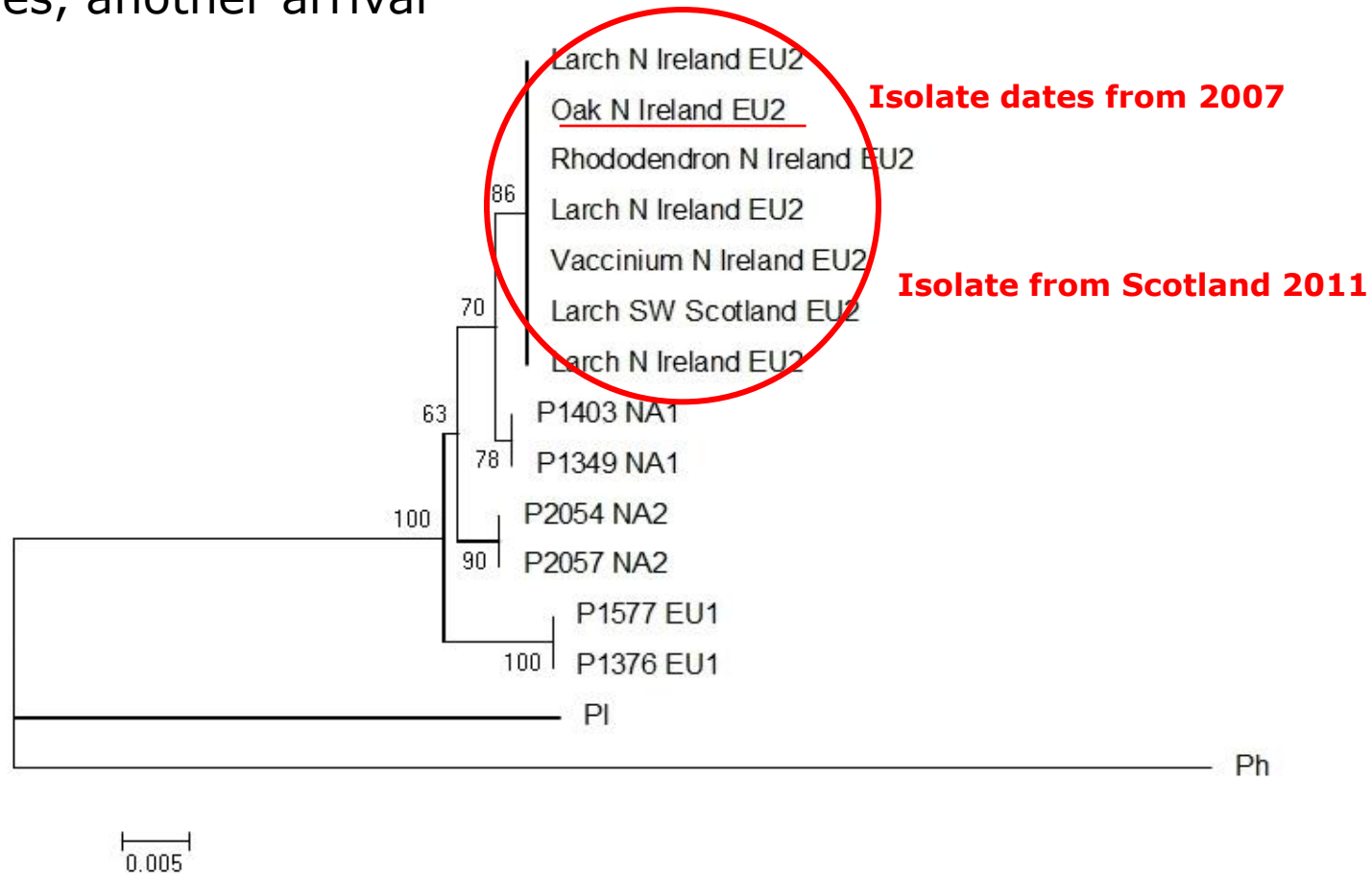
Aerial Surveillance



P. ramorum change?

- Analysis of isolates in the FR culture collection (based on five gene sequences) showed a distinct taxon
- Same grouping detected by microsatellite analysis
- Now designated as EU2, new *P. ramorum* lineage
- Despite measures, another arrival



Developments in 2011-12

- *P. ramorum* distribution on larch – all infected trees felled (4,000 ha)
- >500 Statutory Felling Notices
- Even in worst affected areas (Devon & Cornwall), 70% larch still healthy
- Timber from infected trees goes to certified processors
- New lineage in two areas & so far not found elsewhere in the UK and Europe
- Pose a different risk to trees and the wider environment compared with more widespread lineage?
- Future post programme in 2014?

Asian Longhorn Beetle

- Affects a wide range of broadleaved tree species
- Typically arrives in untreated packaging around stone/slate
- Smaller outbreaks of ALB in France, the Netherlands and Switzerland have been eradicated or are under control

Asian longhorn beetle

- February 2012 an infestation of ALB was discovered in Kent (south east England), first ALB outbreak in the UK
- Preceded by finding of single adult beetle in 2009, thought to originate from stone importers
- Annual follow up surveys detected the infestation

Asian longhorn beetle

- Risk well recognised and analysed, regulated organism
- Joint response by Forestry Commission and Defra to the outbreak
- Surveys: 100m, 500m and 1000m
- Usual requirements for costs of eradication to be met by owner of infested material set aside
- Different expertise of FC and Defra crucial to operation

Felling

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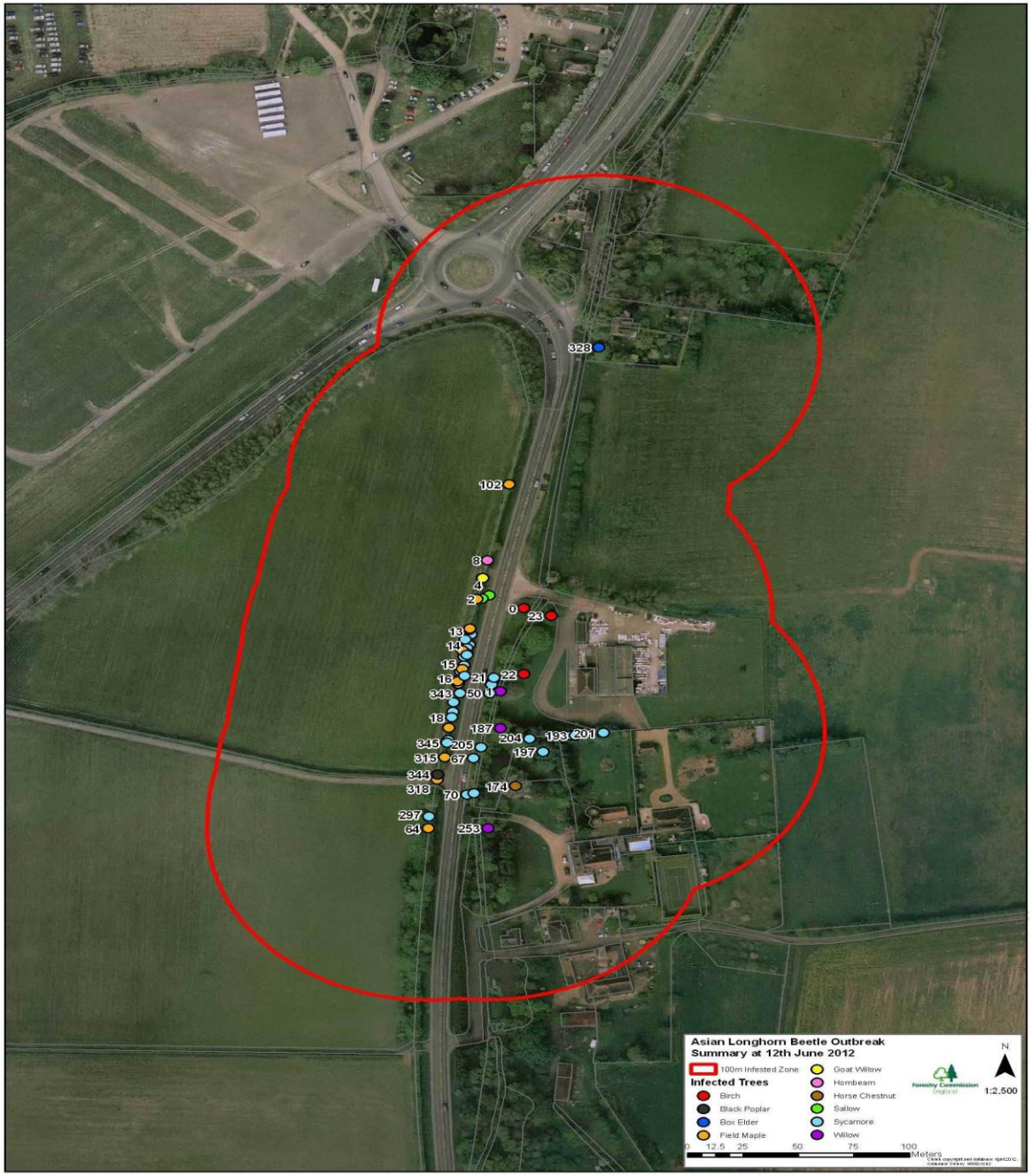
Felling - inspecting

Incineration

ALB eradication: March – August

Most frequently affected trees: sycamore, poplar and willow
All susceptible hosts removed



Discovery of ALB in Field Maple adjacent to roundabout has extended outbreak zone northwards

<u>Within outbreak zone</u>

>2100 trees felled

65 infested trees (10 different tree species)

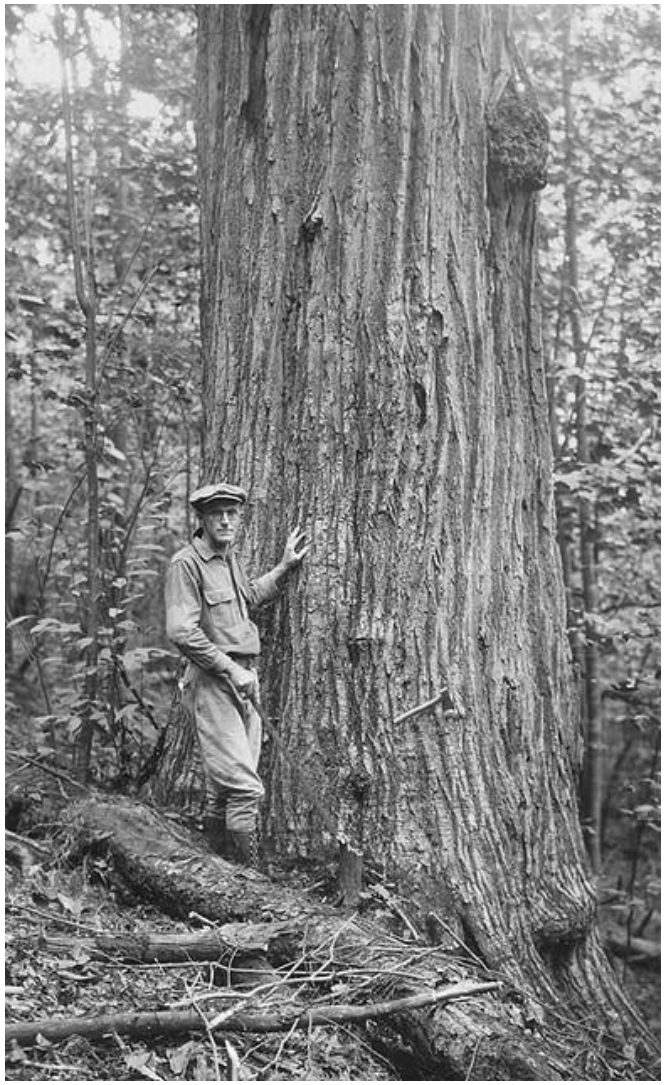
>300 exit holes

>200 larvae found in infested material

Material analysis on-going to date the infestation

Chestnut blight

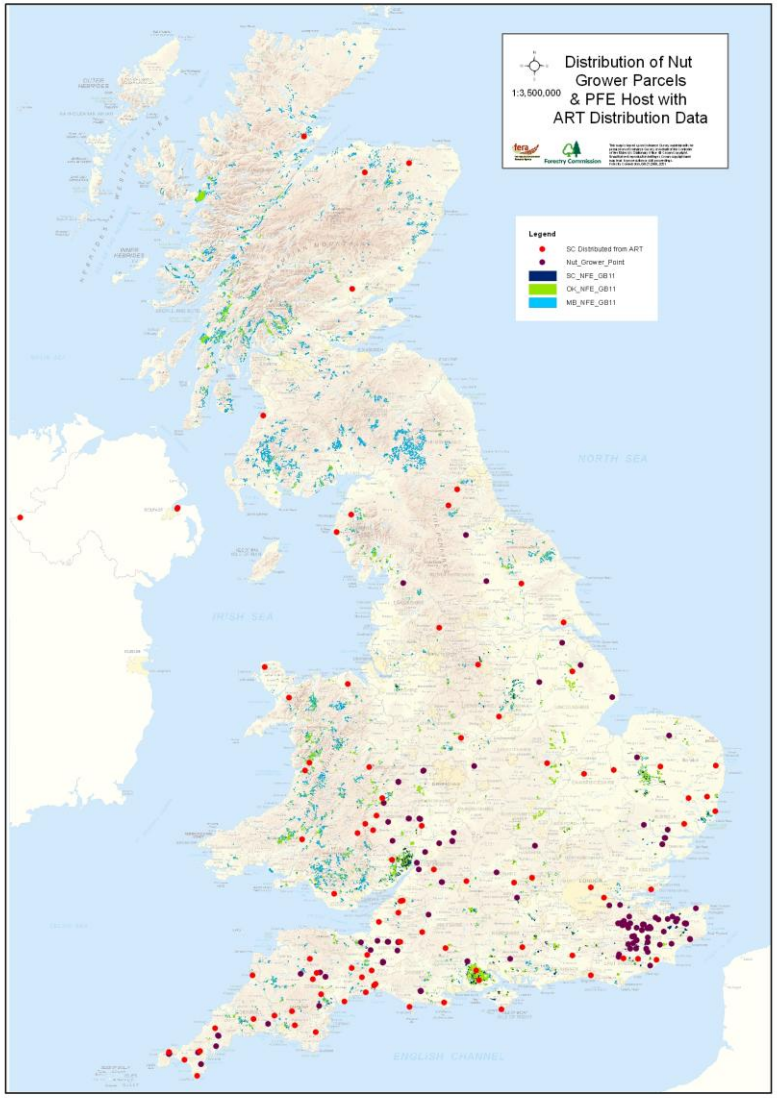
- Causal agent – fungus *Cryphonectria parasitica*
- Quarantine pathogen that has long been regarded as high risk
- EU regulations in place to prevent movement of infected wood/plants to countries free of pest
- Was considered problem of southern Europe, but has spread north
- Only countries free of disease Netherlands, Ireland and UK
- UK equivalent of protected zone



Symptoms

Potential for spread of chestnut blight in GB?

- *Cryphonectria parasitica* – good controls in place for spread in wood (debarking/ inspection)
- But…
  - Increased imports of plants for nut production
  - Lack of awareness about the risks
  - Internet ordering, circumventing controls
- Centralised distribution
- Long latent period before infection shows up
- Since October 2011, nine more outbreaks confirmed (most recent March 2013), all recent plantings



Ash dieback in Europe – *Chalara fraxinea*

- Emerged as an entirely new disease in Europe in the 1990s, initially cause was unknown – frost and drought both implicated in dieback symptoms
- Realisation that a pathogen was involved came in early 2000s
  - causal agent (*Chalara fraxinea*) named in 2006
  - other name – *Hymenoscyphus pseudoalbidus* in 2010
- Early impact Poland, Lithuania, then Scandinavian countries
  - Some countries 60-90% ash **affected** eg Denmark
- Despite impact & spread not designated as quarantine organism

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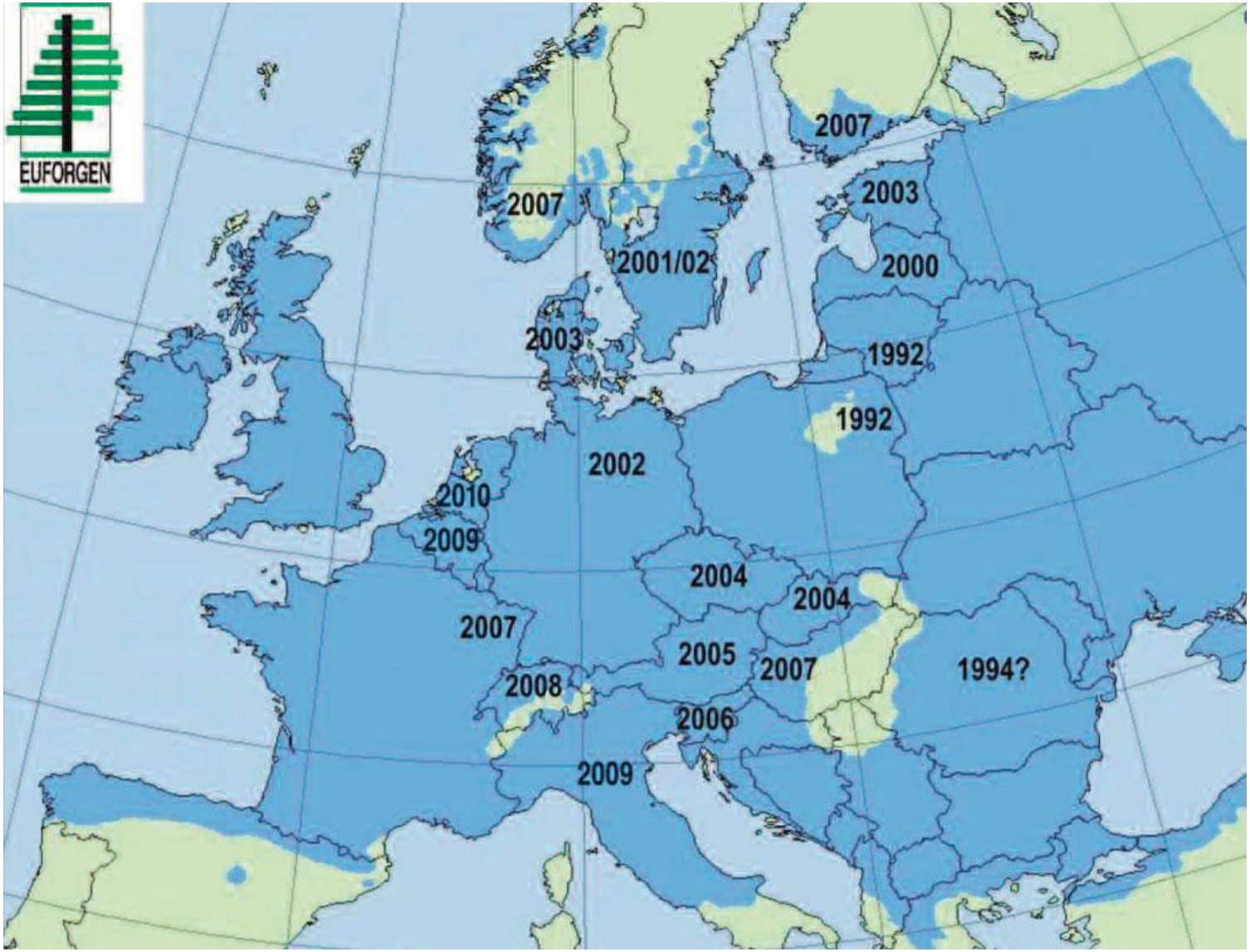
Ash dieback disease – *Chalara fraxinea*



Ash dieback – a foliar disease

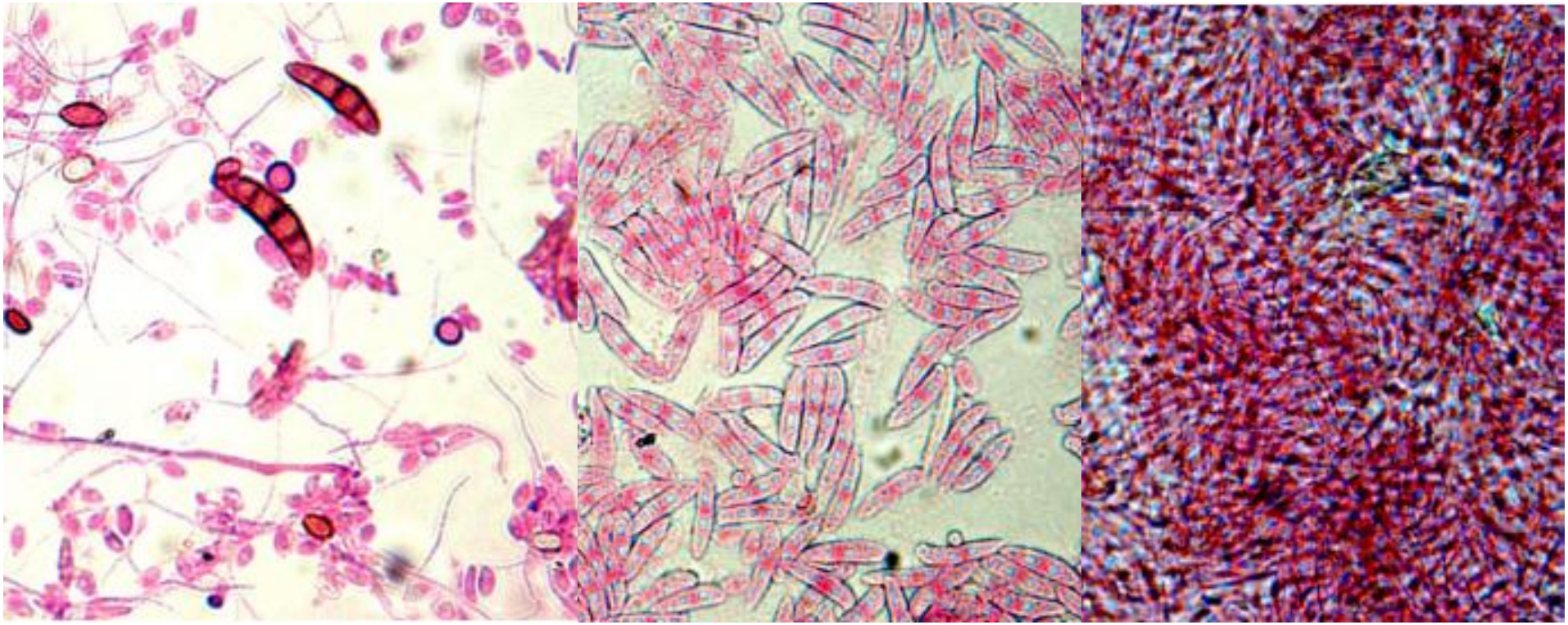
H. pseudoalbidus fruit bodies on fallen ash rachises produce ascospores

Images courtesy of I Thomsen and L McKinney

Spore release of *Hymenoscyphus pseudoalbidus*

Early in the morning peaking between 6-8 am during summer

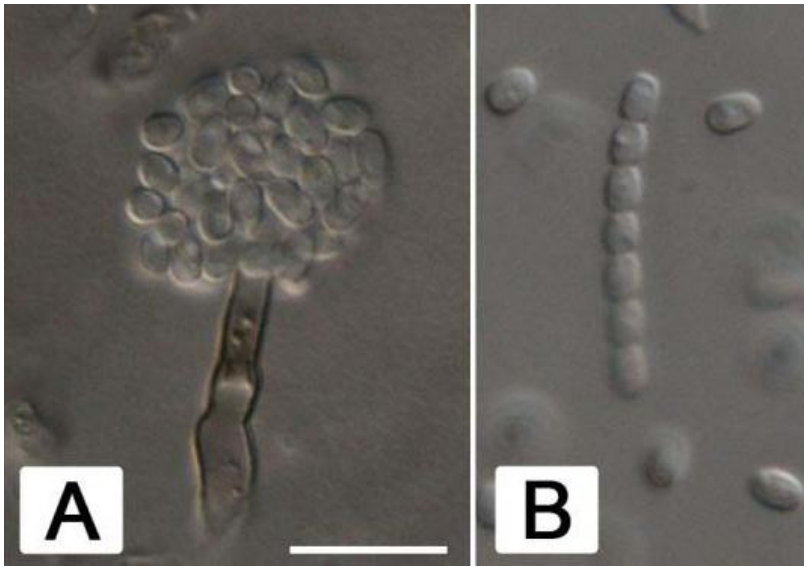
Spore numbers at night **Spore numbers at 5am** **Spore numbers at 7am**



Work of Halvor Solheim, Volkmar Timmermann & Isabella Berja, Skog og Landskap, Norway

Ash dieback disease in UK

- First finding March 2012 in a nursery – trees imported from Netherlands
- Next finding in May – trees planted winter 2011/12 in a car park near Leicester
  - ~ 500 trees planted
  - About half symptomatic
  - Home grown, UK seed source
  - Lack of awareness about the risk from *Chalara fraxinea*

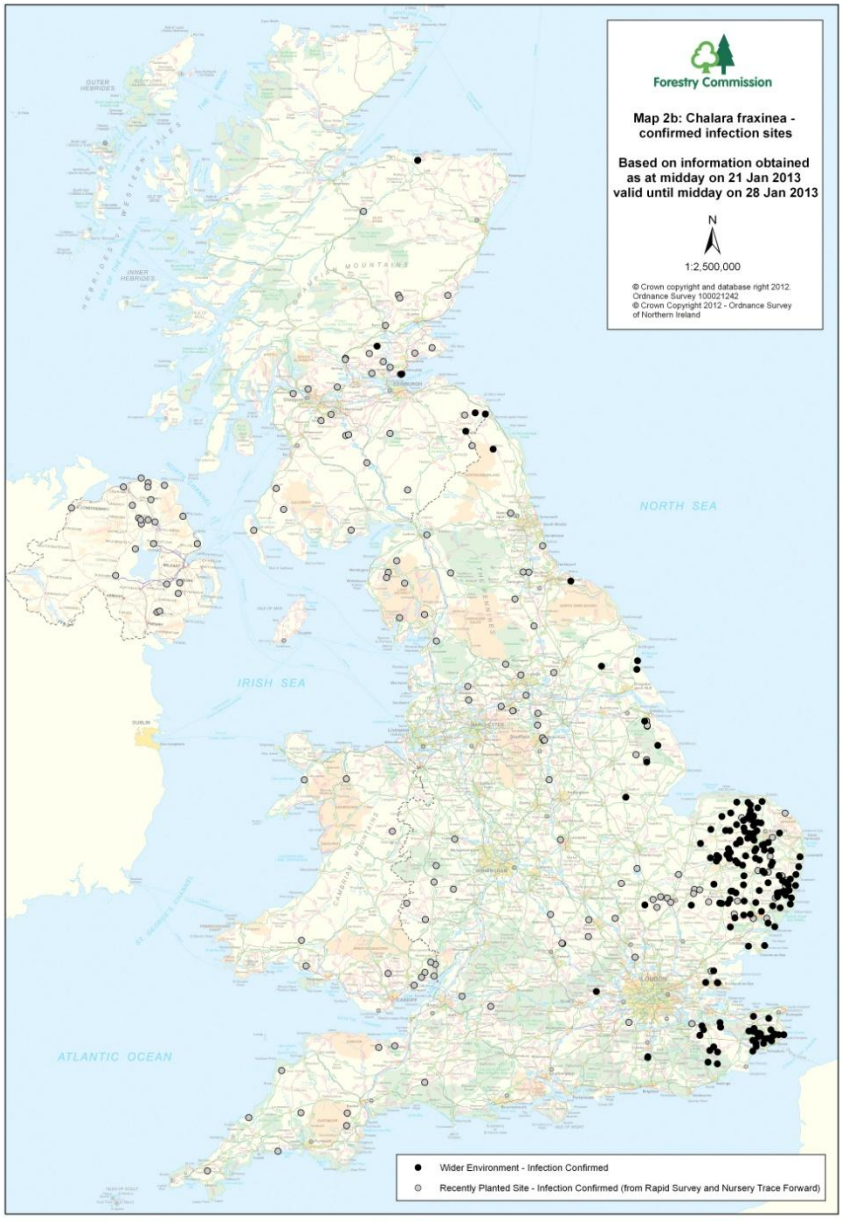


Chalara spores: Photo courtesy of Ogris et al. (2009)

- First evidence suggested Leicester outbreak not directly related to imported plants
- Plants also distributed to around 40 other locations
- Following this, other nursery findings, but also confirmed outbreak in Scotland (woodland planting 3+ years ago)

- Survey in early Nov 2012
- Continued findings of affected sites
- 170 in wider environment
- 202 recently planted sites
- 19 nurseries (not shown)
- **391 Total**

- Findings…
  - Positives mainly in Kent, Norfolk and Suffolk
  - Further north along the east coast into Hull, Middlesborough and Northumberland
  - East Scotland up to Elgin



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Imports of ash into the UK

	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Belgium	30,000	7,800	11,000	400	0	15,000	47,200	32,500	136,000	279,900
France	155,125	7,000	400	22,200	0	0	700	0	1,000	186,425
Germany	553,600	500,700	81,000	196,500	374,500	396,750	0	400,400	250,750	2,754,200
Hungary	0	0	0	0	0	0	4,625	0	0	4,625
Ireland	0	0	0	27,000	180,600	98,600	162,825	500	0	469,525
Netherlands	0	0	196,500	323,300	205,050	461,607	141,100	50,100	172,375	1,550,032
Total	**738,725**	**515,500**	**288,900**	**569,400**	**760,150**	**971,957**	**356,450**	**483,500**	**560,125**	**5,244,707**

- Number of UK imported ash plants (bare rooted) from EU Member States registered on the Forest Reproductive Material database
- Ash is the third most frequently broadleaved species in UK

indicates when disease reported from country

Ash dieback disease

Highly susceptible	*Fraxinus excelsior*
	Fraxinus angustifolia
	Fraxinus niger
Moderately susceptible	*Fraxinus pennsylvanica*
Least susceptible	*Fraxinus americana*
	Fraxinus ornus
	Fraxinus mandschurica

Some signs of some resistance in populations of *F. excelsior* in Europe

Chalara disease

- Imports of ash currently banned, extended PRA
- Long distance spread, plant trade pathway
- Wind borne spores could have allowed spread from mainland Europe, evidenced by location of some affected sites?
- Now discovering infection may date back at least 4 years
- Huge media interest, political challenges
- Defra Chief Scientist has set up Chalara task Force
- Recently revised management plan http://www.defra.gov.uk/publications/2012/12/06/pb13843-chalara-control-plan/
- Much greater focus on plant imports from Europe
- Role of citizen science

Tree A!ert

Chalara Dieback sighting reporter

- App or on-line reporting
- Suspect ash trees can be reported
- Symptom check list, location
- Additional images can be uploaded
- Well evidenced sites will be checked out
- Much more information available on FC website
- http://www.forestry.gov.uk/chalara
- Plan to use more widely for other tree pests and diseases

Summing up

- Based on these experiences much more pro-active review of known threats, both in an out of EU
- Outcome of EU Plant Health Regulations?
- Reviewing and adding to range of PRAs and contingency plans
- More consideration of protected zone status for the UK or parts of the UK
- Highlighted need to consider 'journey' of plants from seed to planting
- Through Chalara Task Force, review of current UK plant health approach with recommendations for wide ranging changes
  - Risk register?
  - More parallels with animal health?
  - Investment in training?

Acknowledgements

- **Forest Research, Centre for Ecology, Society & Biosecurity**
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  - Nigel Straw, Dave Williams (ALB): Alice Holt
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