Is ash doomed in Britain?

Dr Peter Thomas
Keele University, UK &
Harvard Forest, Harvard University, USA

Is ash doomed in Britain?

Scaremongering?

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Scaremongering?

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Ash tree set for extinction in Britain unless urgent measures taken now

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Ash tree set for extinction in Europe

By Claire Marshall
BBC Environment Correspondent

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Bright green beetle will wipe out Britain's ash trees, scientists warn

Tom Feilden
@TomFeilden

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If Ash dieback takes 95% of our Ash trees over the next 20 years the Emerald Ash Borer may take the rest - Dr Peter Thomas on #r4today

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European ash tree "likely to be wiped out"

Ash trees in Europe face double threat of chronic fungal disease and an invasive beetle

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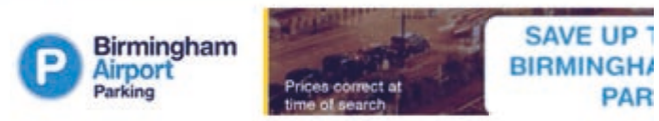

Beetle 'will wipe out British ash trees': Emerald ash borer set to hit the UK after laying waste to species across Europe

- **The emerald ash borer will have 'potentially devastating effect' on ash trees**
- **The beetle, from Asia, has been recorded in Moscow and is spreading West**
- **Deadly insect killed millions of ash trees in North America back in 2002**
- **The trees also face destruction due to fungal disease called ash dieback**

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Ash dieback

Ash dieback and beetle attack likely to 'wipe out' ash trees in UK and Europe

A double whammy of an emerald borer beetle and the fungus causing ash dieback disease could kill millions of ash trees on the continent, study warns

Damian Carrington

Ash – why does it matter?

- Commonest standard hedgerow tree in GB
- 2nd most abundant species in small woodlands (<0.5 ha)
- 3rd most abundant species in high forest (FC 2003)

Jon Stokes, Tree Council

- 60 million ash >4 cm dbh + 400 million seedlings *outside* woodland
- 1.7 billion trees >4 cm bdh + 1.6 billion seedlings *inside* woodlands

Ash – why does it matter?

Strong cultural history

- Norse mythology (Yggdrasil, the world ash tree)
- Used since Neolithic for firewood, building, feeding animals
- Used in herbal medicine since Hippocrates' time

Ash – why does it matter?

Tree Council: distinct character of 40% of England would be impacted by loss of non-woodland ash

Moccas Park
Herefordshire

The problem

Ash has been expanding in Europe

- Nitrogen pollution acting as fertiliser
- Expansion into agriculturally marginal land
- Good response to climate change (drought tolerant, sensitive to spring frosts)
- Was predicted to become more important in our landscape

But

- Ash dieback
- Emerald ash borer

nhpr.org

Ash dieback - the cause

- Fungus: *Hymenoscyphus fraxineus*
  - *Chalara fraxinea* - asexual stage
  - *Hymenoscyphus pseudoalbidus* - older name
- Native to eastern Asia
- Susceptible: *Fraxinus excelsior* Ash

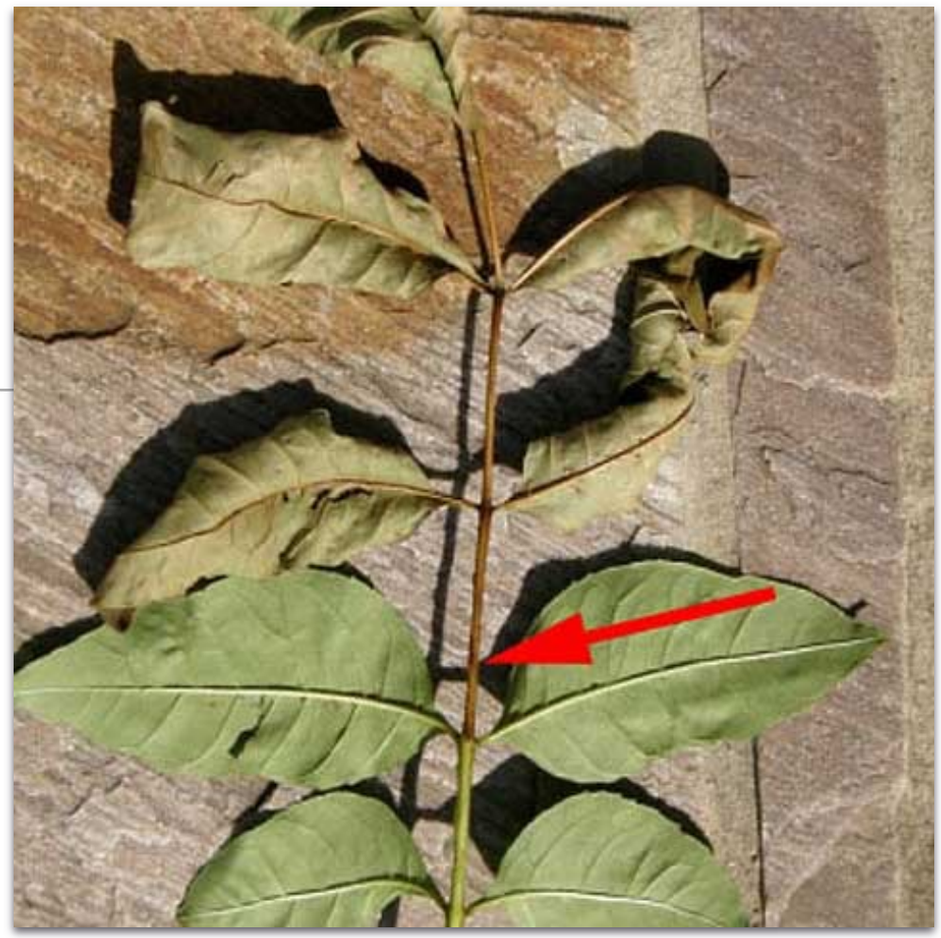
F. angustifolia Narrow-leaved ash

‘Raywood’

Ash dieback - the problem

Symptoms

- Tips of leaves become black and shrivelled [frost damage]
- Veins and stalks turn brown
- Dark lesions at base of dead side shoots
- Staining of wood under lesions



www.forestry.gov.uk

Ash dieback - the problem

- Dead tops and side shoots
- Growth slows
- Mature trees, new shoots develop further down branches

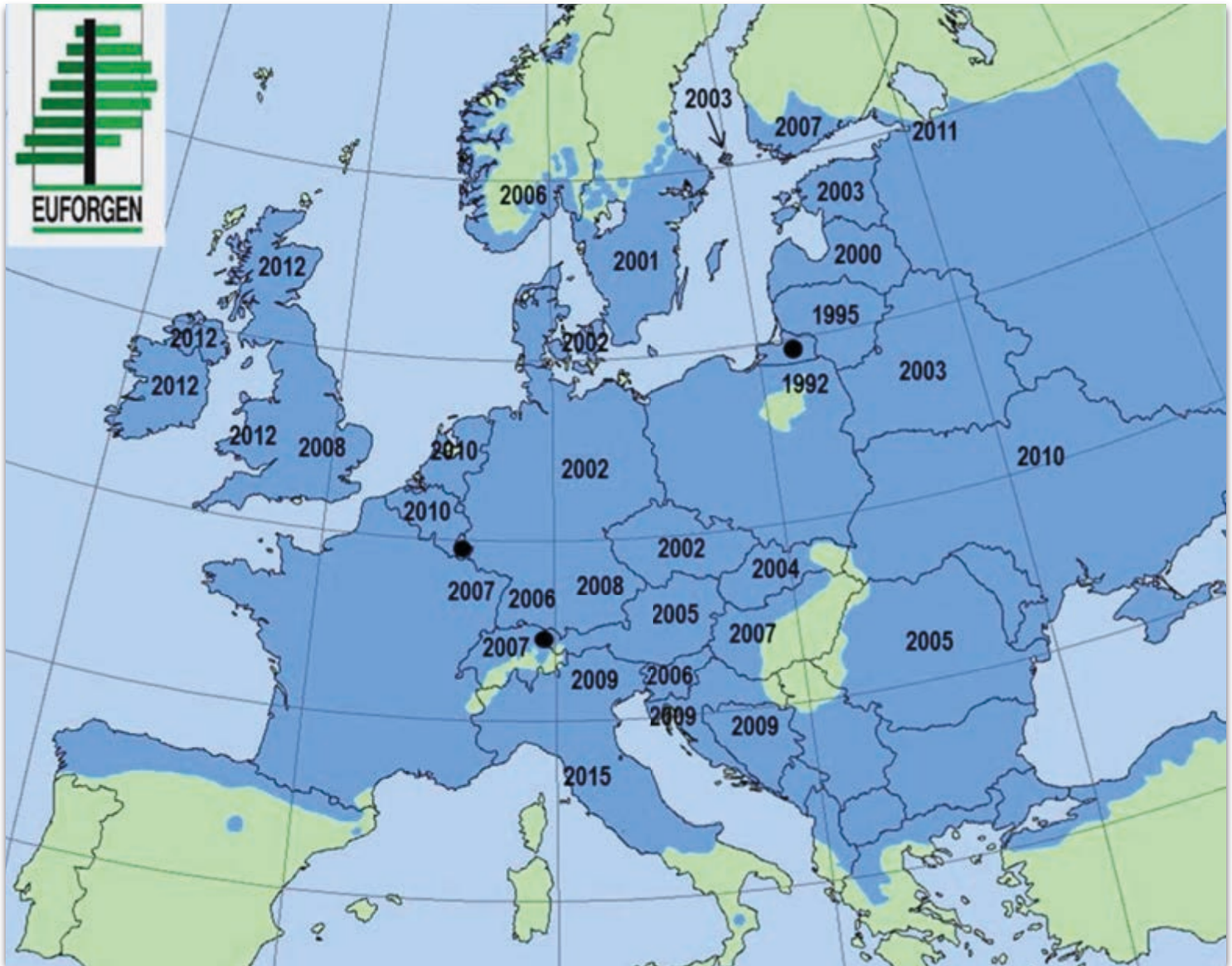
www.forestry.gov.uk

Ash dieback - the problem

- Young trees die quickly
- Older trees die over a number of years
- Trees in dense stands more susceptible
- Trees weakened by dieback, can die from secondary effects
  - *Armillaria* spp
  - Environmental stresses

Ash dieback - the problem

- 1992 First found in NE Poland & Lithuania
- 2012 Found in Britain in Buckinghamshire nursery
- 2 million km^2 affected

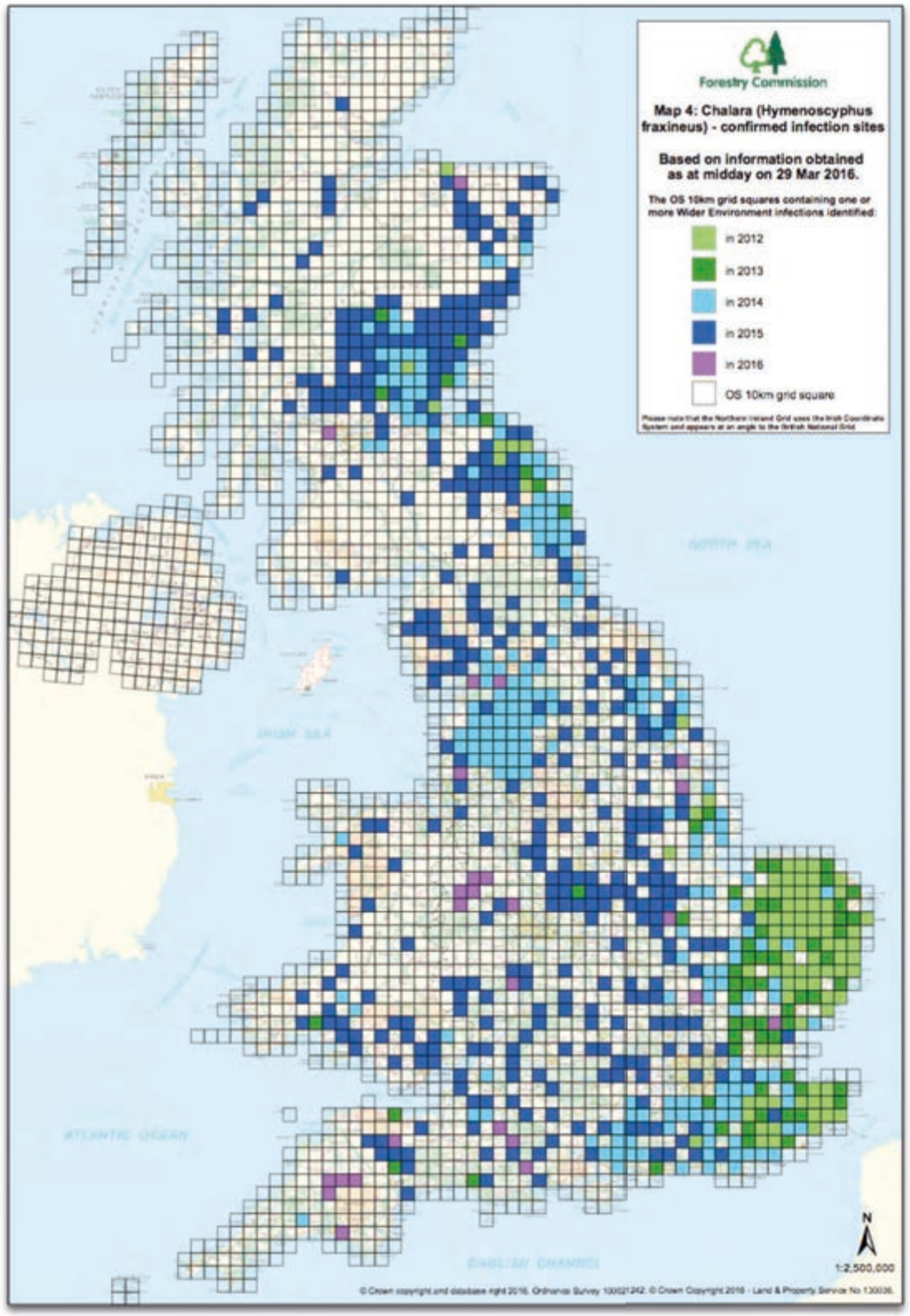


Ash dieback - the problem

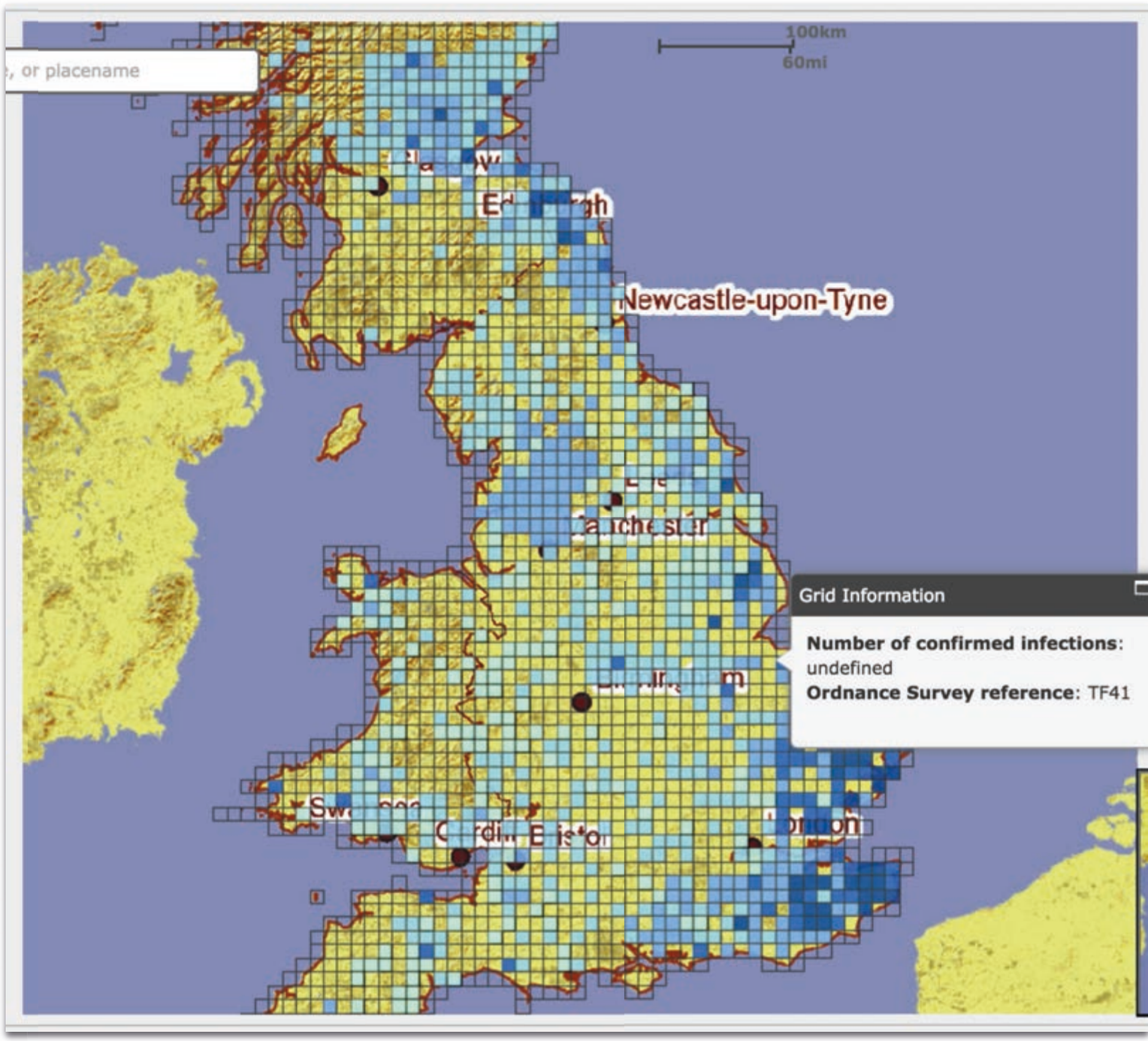
How is it spread?

- Before a ban in October 2012, movement of ash trees
- July-October fruiting bodies on blackened leaf stalks
- Spores
- <50 m downwind
- But produced over 1-5 years
- Crossed the Channel?

March 2016



3 August 2016

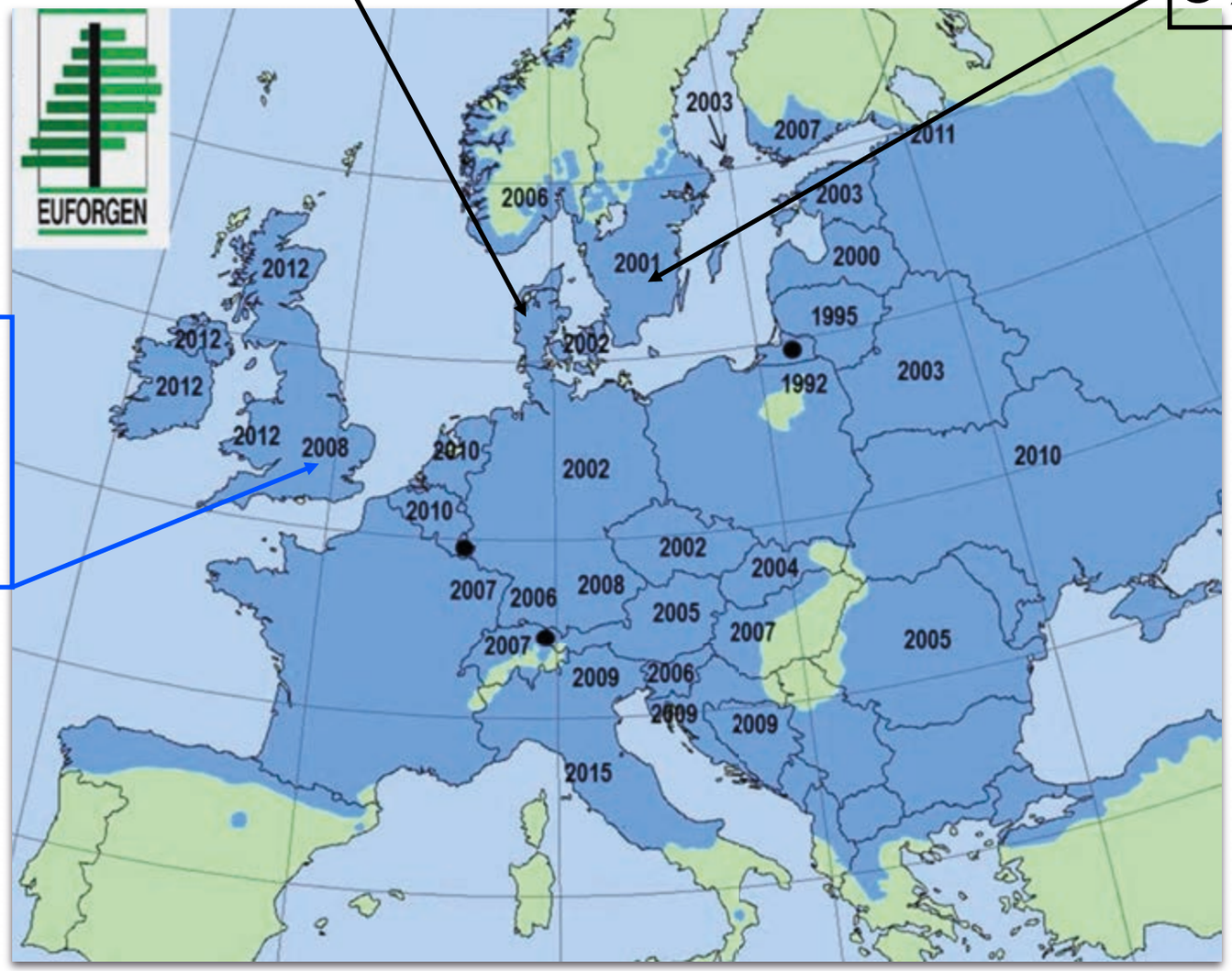


chalaramap.fera.defra.gov.uk

Ash dieback - the problem

60–90% of ash stands in Denmark affected

Sweden:
63% trees infected 2009
76% 2011
3% died over 2 yrs

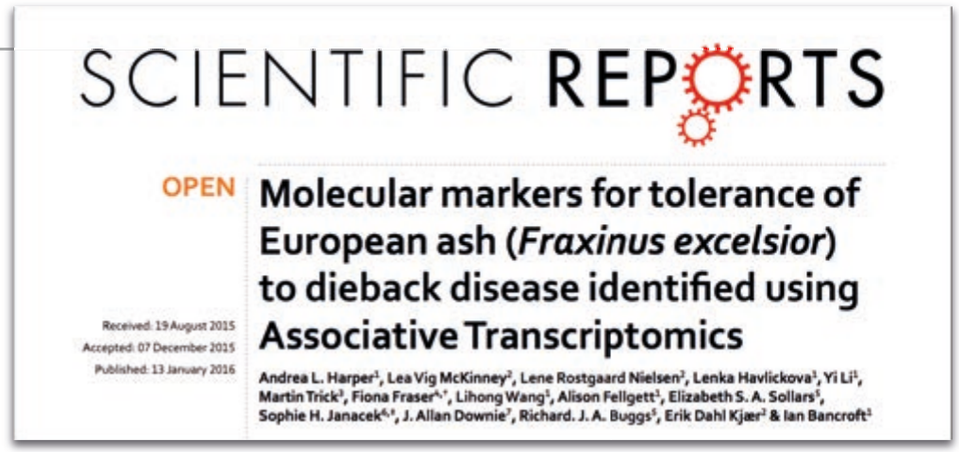


Worst-case scenario 95% mortality

Ash dieback - the management options

Resistance and tolerance

- 1-5% of populations resistant
- Genetic markers found for tolerance
- ‘Betty’ is useful but not the whole answer
- Need a broad-genetic base in population
  - To withstand changes in the disease…
  - …resist climate change and other pests and diseases
  - Ash resistance trials
    - Early flushers better


SCIENTIFIC REPORTS

OPEN

Molecular markers for tolerance of European ash (*Fraxinus excelsior*) to dieback disease identified using Associative Transcriptomics

Received: 19 August 2015
Accepted: 07 December 2015
Published: 13 January 2016

Andrea L. Harper[1], Lea Vig McKinney[2], Lene Rostgaard Nielsen[2], Lenka Havlickova[3], Yi Li[3], Martin Trick[3], Fiona Fraser[4,*], Lihong Wang[1], Alison Fellgett[1], Elizabeth S. A. Sollars[1], Sophie H. Janacek[4,†], J. Allan Downie[1], Richard. J. A. Buggs[5], Erik Dahl Kjær[2] & Ian Bancroft[1]


Chalara ash dieback resistance screening trials

Identify inherent resistance in common ash (*Fraxinus excelsior)* trees from a range of provenances across Britain, Ireland and near-continent all sourced from tree nurseries located in the UK . Field trials have been set up at 14 locations in south-east England where Chalara is known to be present. Around 155,000 trees have been planted and will be monitored for signs of infection, tolerance and survival over the five year period of the contract.

Forestry Commission
2013-2018
155,000 trees in SE


'Betty' the ash tree offers hope against deadly dieback disease

Scientists identify first tree to show strong tolerance to the disease raising hopes of developing a resistant strain

Ash dieback - the management options

Resistance and tolerance

Breeding with resistant ashes

- *F. chinensis* Chinese ash
- *F. bungeana*
- *F. latifolia* Oregon ash
- *F. velutina* Arizona ash

Ash dieback - the management options

Arboricultural options

- Removal of litter
- Open-up stands
- Fell trees only when necessary

Brockhill Country Park, Kent

Ash dieback - the management options

Arboricultural options

- Removal of litter
- Open-up stands
- Fell trees only when necessary
- Fungicide
- Myxoviruses (parasites of the fungus)
- Hot water treatment of seeds and seedlings
  - Seedlings 36°C for 5 hours (100% survival)
  - Samaras 44°C for 5 hours (60% survival)
- Replacing lost trees with home-grown stock
- Replacement species: *F. americana* American ash
  - Ecologically: alder, small-leaved lime, rowan
  - Biodiversity: oaks, beech

Emerald ash borer - the cause

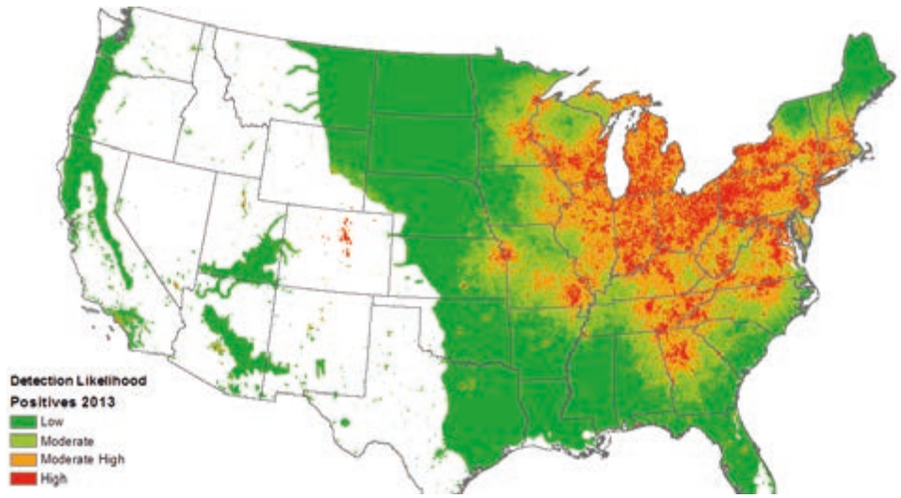
Beetle: *Agrilus planipennis*

- Native to Asia
- 8.5-14.0 mm long, metallic green
- Lays 60-90 eggs, larvae tunnel 20-30 cm

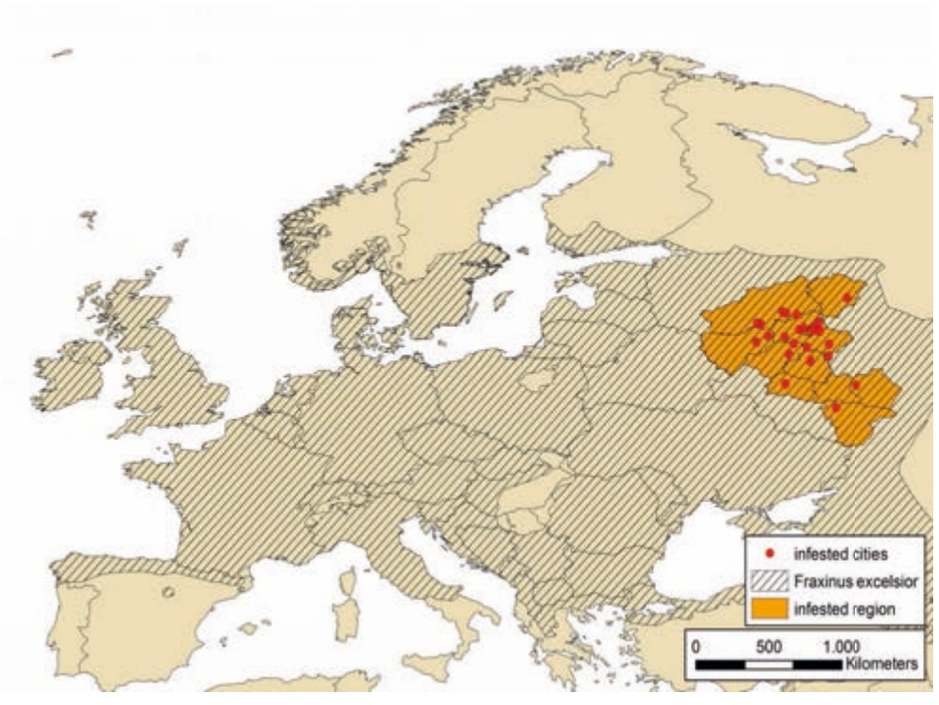
wikipedia.org/wiki

Emerald ash borer - the problem

- 2002 Introduced to N. America
  - 10's millions of dead ash
  - 99% mortality rate
- 2003 Recorded in Moscow
  - Moving west 25 miles per year
- 2011 reported in Sweden
- Not yet in the British Isles
  - But spread primarily as larvae in wood and even wood chips
- Worst-case scenario: all ash surviving ash dieback in GB will be killed



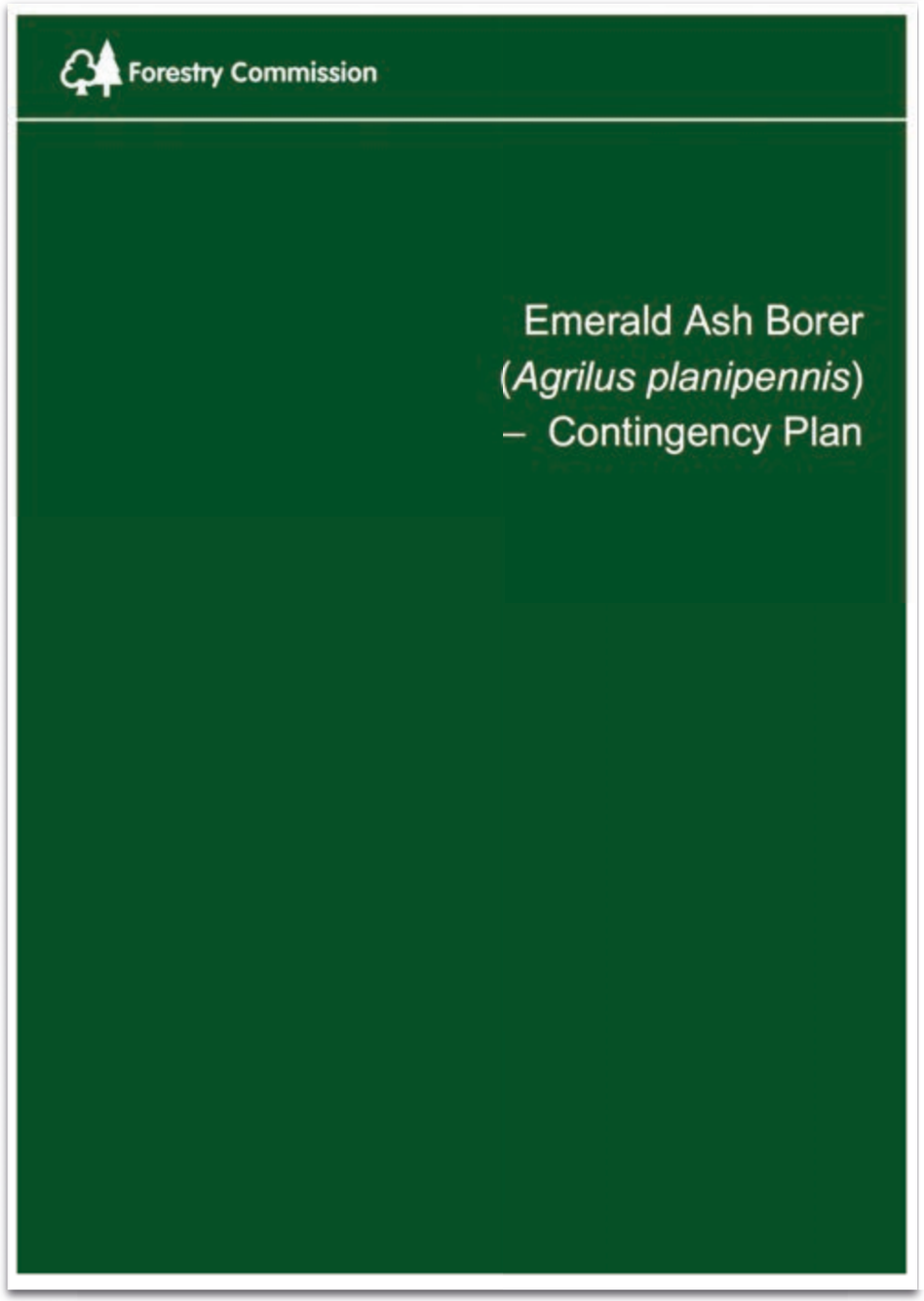
www.fs.fed.us



Valenta *et al*. 2015

Emerald ash borer - the management options

- Vigilance
- Surveillance
- Eradication



UK Plant Health Risk Register

Department for Environment, Food & Rural Affairs

secure.fera.defra.gov.uk

UK Risk Register Details for *Hymenoscyphus fraxineus*

Common Names show / hide

- Ash dieback

PRA Document show/hide

PRA: (2013)

Scenario and Pathways

Scenario for Risk Register show / hide

- Pest spreads to maximum extent

Pathway Assessed for Entry to UK show / hide

Common Pathways show / hide

This section is currently being developed as part of the next phase of the Risk Register.

Risk Ratings and Current Mitigations

Unmitigated Risks show / hide

Likelihood [1 - 5]	4
Spread [1 - 5]	4
Impact [1 - 5]	5
Value at Risk [1 - 5]	5
Likelihood x Impact [1 - 25]	20
UK Relative Risk Rating [1 - 125]	100

Current Mitigations show / hide

Regulation	✔
Surveillance	✔
Industry Scheme	✖
Contingency Plan	✔
Awareness	✔
Research	✔

Mitigated Risks show / hide

Likelihood [1 - 5]	4
Spread [1 - 5]	4
Impact [1 - 5]	4
Value at Risk [1 - 5]	5
Likelihood x Impact [1 - 25]	16
UK Relative Risk Rating [1 - 125]	80

Ash dieback

Unmitigated Risks

show / hide

Likelihood [1 - 5]				4	
Entry [1 - 5]					
Establishment [1 - 5]					
Spread [1 - 5]				4	
Impact [1 - 5]					5
Impact - Economic [1 - 5]					5
Impact - Environmental [1 - 5]					5
Impact - Social [1 - 5]			3		
Value at Risk [1 - 5]					5
Likelihood x Impact [1 - 25]	20				
UK Relative Risk Rating [1 - 125]	100				

Mitigated Risks

show / hide

Likelihood [1 - 5]				4	
Entry [1 - 5]					
Establishment [1 - 5]					
Spread [1 - 5]				4	
Impact [1 - 5]				4	
Impact - Economic [1 - 5]				4	
Impact - Environmental [1 - 5]				4	
Impact - Social [1 - 5]			3		
Value at Risk [1 - 5]					5
Likelihood x Impact [1 - 25]	16				
UK Relative Risk Rating [1 - 125]	80				

Emerald ash borer

Unmitigated Risks

show / hide

Likelihood [1 - 5]	5
Entry [1 - 5]	5
Establishment [1 - 5]	5
Spread [1 - 5]	4
Impact [1 - 5]	5
Impact - Economic [1 - 5]	5
Impact - Environmental [1 - 5]	5
Impact - Social [1 - 5]	4
Value at Risk [1 - 5]	5
Likelihood x Impact [1 - 25]	25
UK Relative Risk Rating [1 - 125]	125

Mitigated Risks

show / hide

Likelihood [1 - 5]	3
Entry [1 - 5]	3
Establishment [1 - 5]	5
Spread [1 - 5]	4
Impact [1 - 5]	5
Impact - Economic [1 - 5]	5
Impact - Environmental [1 - 5]	5
Impact - Social [1 - 5]	4
Value at Risk [1 - 5]	5
Likelihood x Impact [1 - 25]	15
UK Relative Risk Rating [1 - 125]	75

Ash dieback + EAB

Ash dieback

Resistant trees

Disease spread

Emerald ash borer

Prevent introduction

Ash dieback

Unmitigated Risks	
Likelihood [1 - 5]	4
Entry [1 - 5]	
Establishment [1 - 5]	
Spread [1 - 5]	4
Impact [1 - 5]	5
Impact - Economic [1 - 5]	5
Impact - Environmental [1 - 5]	5
Impact - Social [1 - 5]	3
Value at Risk [1 - 5]	5
Likelihood x Impact [1 - 25]	20
UK Relative Risk Rating [1 - 125]	100

Mitigated Risks	
Likelihood [1 - 5]	4
Entry [1 - 5]	
Establishment [1 - 5]	
Spread [1 - 5]	4
Impact [1 - 5]	4
Impact - Economic [1 - 5]	4
Impact - Environmental [1 - 5]	4
Impact - Social [1 - 5]	3
Value at Risk [1 - 5]	5
Likelihood x Impact [1 - 25]	16
UK Relative Risk Rating [1 - 125]	80

Emerald ash borer

Unmitigated Risks	
Likelihood [1 - 5]	5
Entry [1 - 5]	5
Establishment [1 - 5]	5
Spread [1 - 5]	4
Impact [1 - 5]	5
Impact - Economic [1 - 5]	5
Impact - Environmental [1 - 5]	5
Impact - Social [1 - 5]	4
Value at Risk [1 - 5]	5
Likelihood x Impact [1 - 25]	25
UK Relative Risk Rating [1 - 125]	125

Mitigated Risks	
Likelihood [1 - 5]	3
Entry [1 - 5]	3
Establishment [1 - 5]	5
Spread [1 - 5]	4
Impact [1 - 5]	5
Impact - Economic [1 - 5]	5
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Ash trees in Europe face double threat of chronic fungal disease and an invasive beetle

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Ash dieback

Ash dieback and beetle attack likely to 'wipe out' ash trees in UK and Europe

A double whammy of an emerald borer beetle and the fungus causing ash dieback disease could kill millions of ash trees on the continent, study warns

Damian Carrington
@dpcarrington

2,641 643