Forest Research

Update on *Phytophthora ramorum* and *P. kernoviae*

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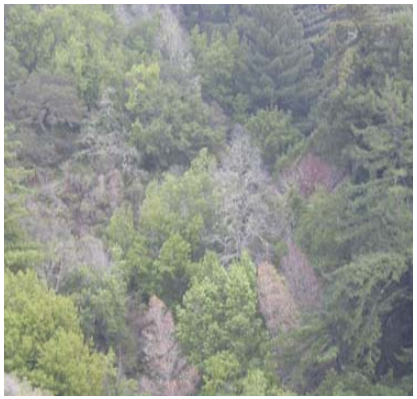
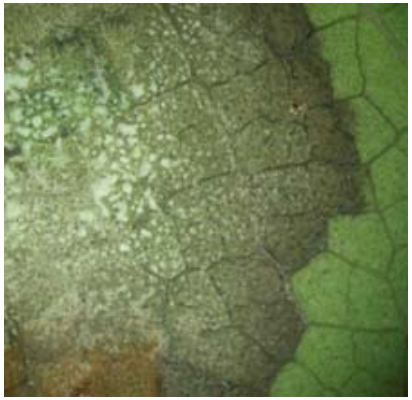
Forest Research

- *Phytophthora ramorum* and *Phytophthora kernoviae*, two recently discovered ‘new’ species, considered to be introduced and potentially invasive in Britain
- *P. ramorum* is the cause of Sudden Oak Death in California, causing widespread mortality of ‘red’ oak species and tan oak (*Lithocarpus densiflorus)*
- Both infect rhododendron and can also cause a potentially lethal disease of trees



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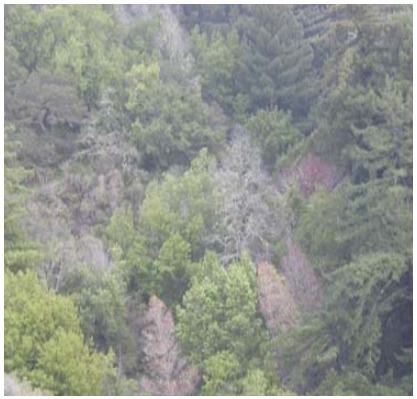
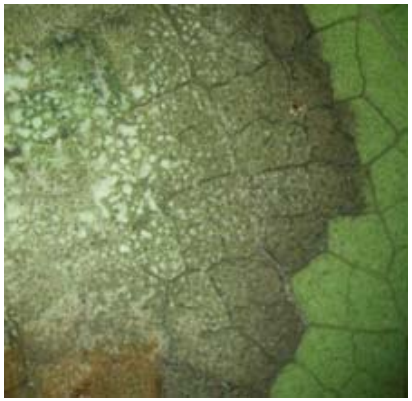
Sudden Oak Death in Europe - 2003

- *Phytophthora ramorum* in Europe since 1990's but only formally named and reported in 2002
- Considered mainly a nursery problem – main hosts *Rhododendron*, *Viburnum*, *Camellia* & *Pieris*
- In 2003 Pr was reported from about 11 countries
- Germany, Netherlands, Belgium, France, Italy, Poland, Sweden, Czech Republic, Spain, Ireland, UK
- In 2003, infected trees reported from Netherlands and England



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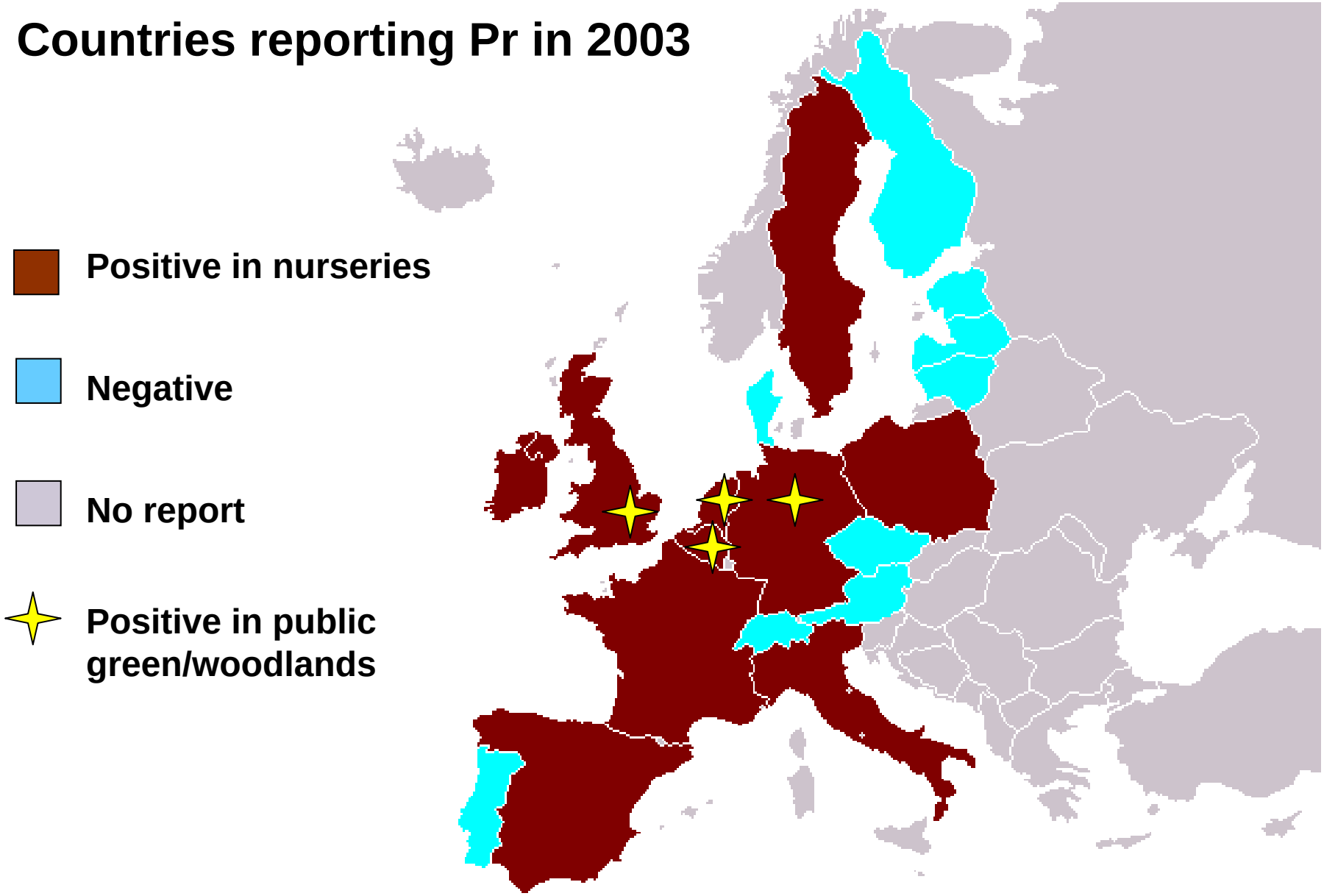
Countries reporting Pr in 2003



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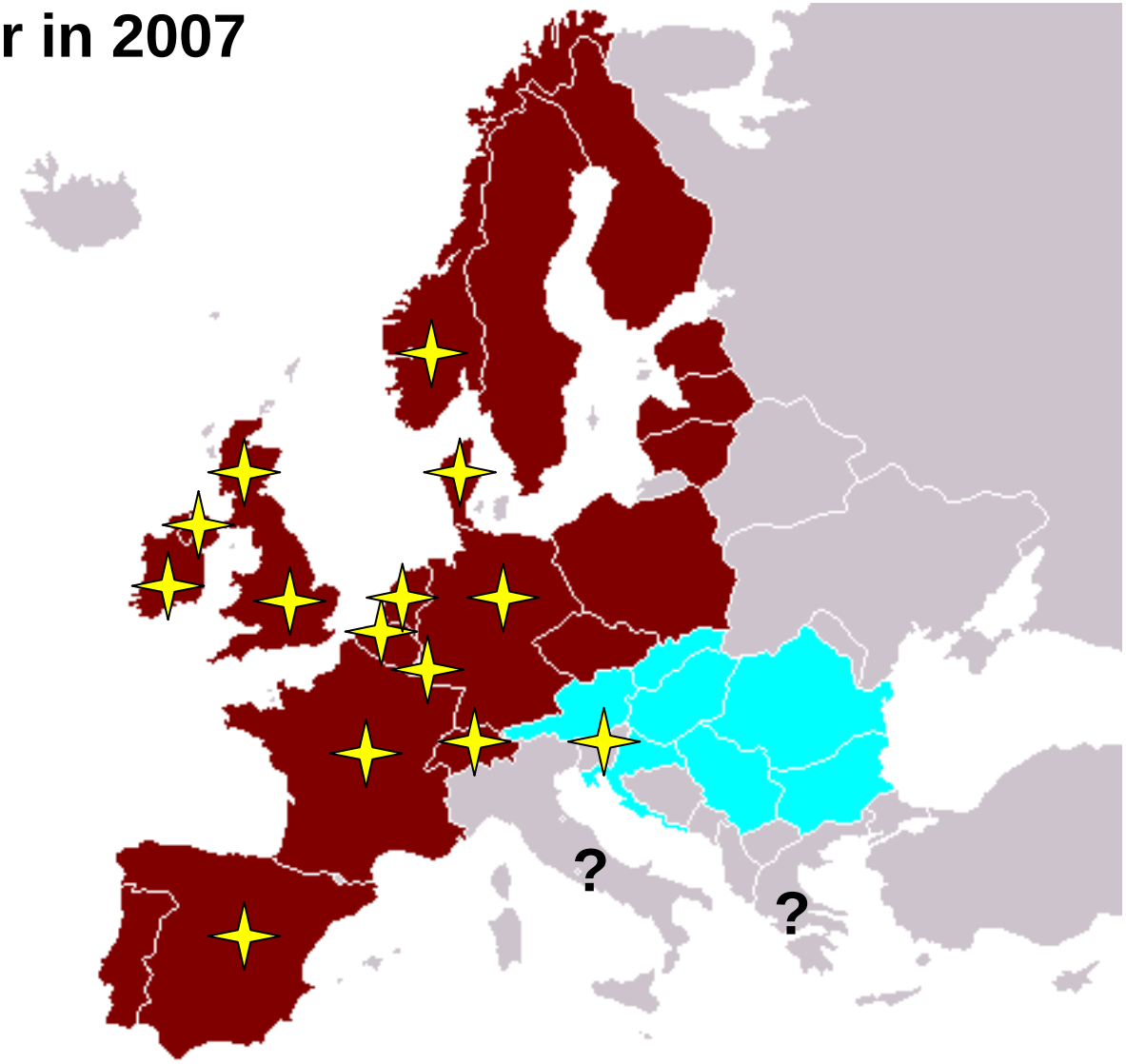
Countries reporting Pr in 2007



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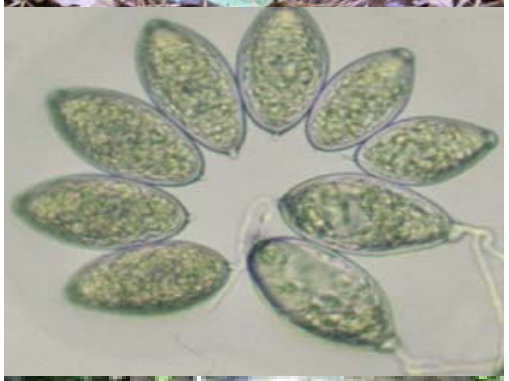
Defining factors for disease on trees…

- Now found in >160 natural/ semi-natural locations in UK
- ‘Sporulating’ foliar host
  - Rhododendron, northern Europe
  - *Umbellularia* (Califonia bay laurel) in USA
- Climatic factors
- Susceptible tree species
  - Beech rather than oak in Europe



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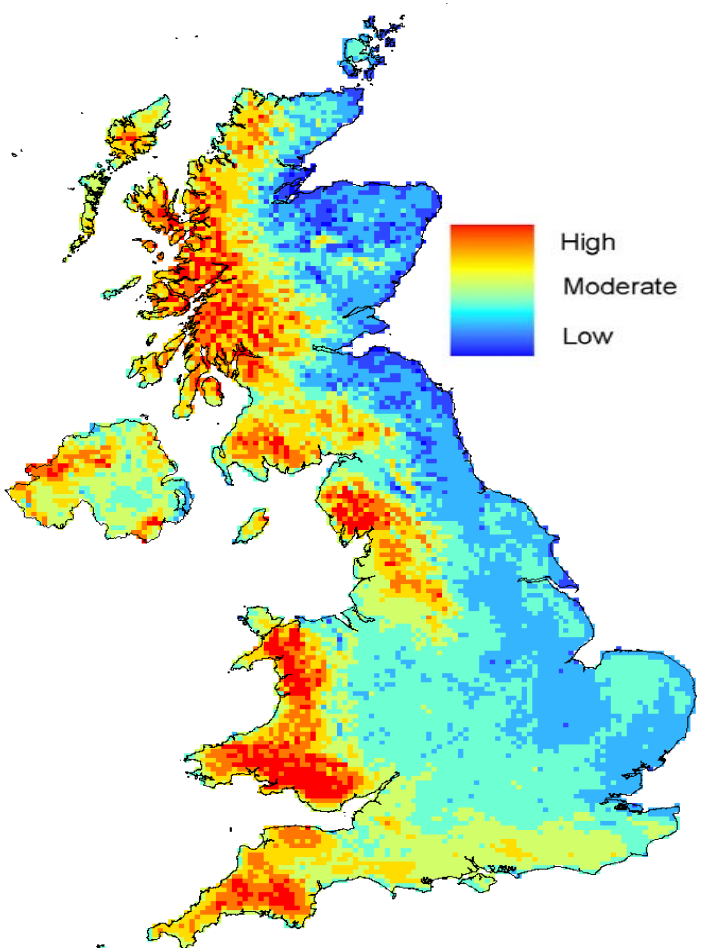
Suitability of the UK climate for *Phytophthora ramorum*



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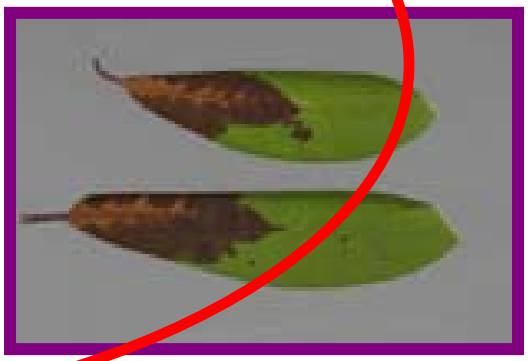
Bleeding lesions on beech

Inoculum from rhododendrons



Surveying sites - south west

- Another new *Phytophthora* pathogen discovered in Nov 2003 – *P. kernoviae*
- Distinct species, not related to *P. ramorum*
- Attacks leaves and stems of rhododendron
- Causes lethal bleeding cankers on beech
- March 2006 reported in New Zealand, now accepted it has been there from at least 1950s

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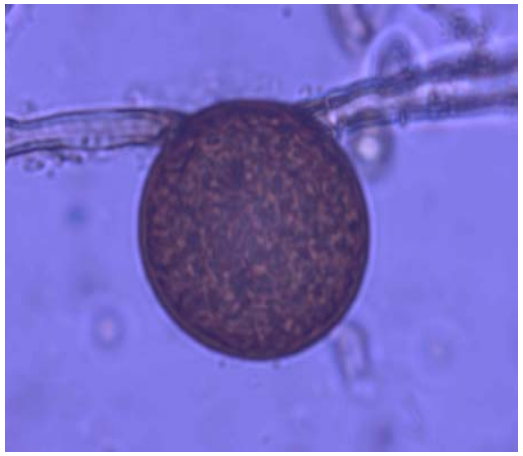
- Two quarantine Phytophthoras (*Phytophthora ramorum* and *P. kernoviae*) in the south west of England, typically infecting rhododendron and some trees. Infected rhododendron foliage produces spores
- Second introduced *Phytophthora*, *P. kernoviae*, almost exclusively found in south west England



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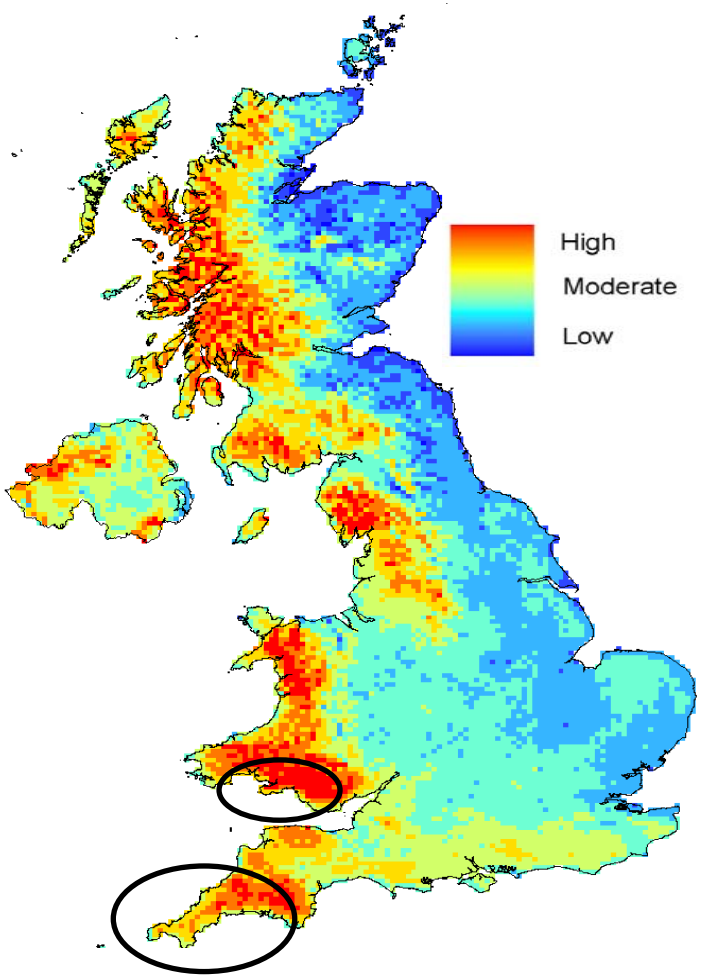
Suitability of the UK climate for *Phytophthora ramorum* and *P. kernoviae*



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Trees with *Pr/Pk* bleeding lesions

Tree	*P. ramorum*	*P. kernoviae*
Fagus sylvatica	9	59
Quercus cerris	6	0
Q. robur/petraea	1	2
Q. acuta/falcata/rubra	3	0
Nothofagus obliqua	3	0
Acer pseudoplatanus	1	0
Aesculus hippocastanum	1	0
Castanea sativa	1	0
Liriodendron tulipifera	0	1
Schima sp.	1	0
Total	**26**	**63**

Nothofagus **(Southern beech)**

Beech (*Fagus*)

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Trees with *Pr/Pk* foliar infections

Tree	*P. ramorum*	*P. kernoviae*
Quercus ilex	25	5
Quercus cerris	1	0
Castanea sativa	4	0
Michelia doltsopa	6	2
Magnolia spp.	9	18
Acer laevigatum	1	0
Castanopsis sp.	1	0
Eucalyptus sp.	1	0
Cinnamomum camphora	3	0
Drimys winterii	7	14
Podocarpus salignum	0	1
Liriodendron tulipifera	0	1
Total	**58**	**41**

Magnolia

Ash

Holm oak

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Felled *Pr* infected beech

Re-sprouting rhodo after top-killing by *P. ramorum* in NL

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Oct 2005

Nov 2005

Mar 2006

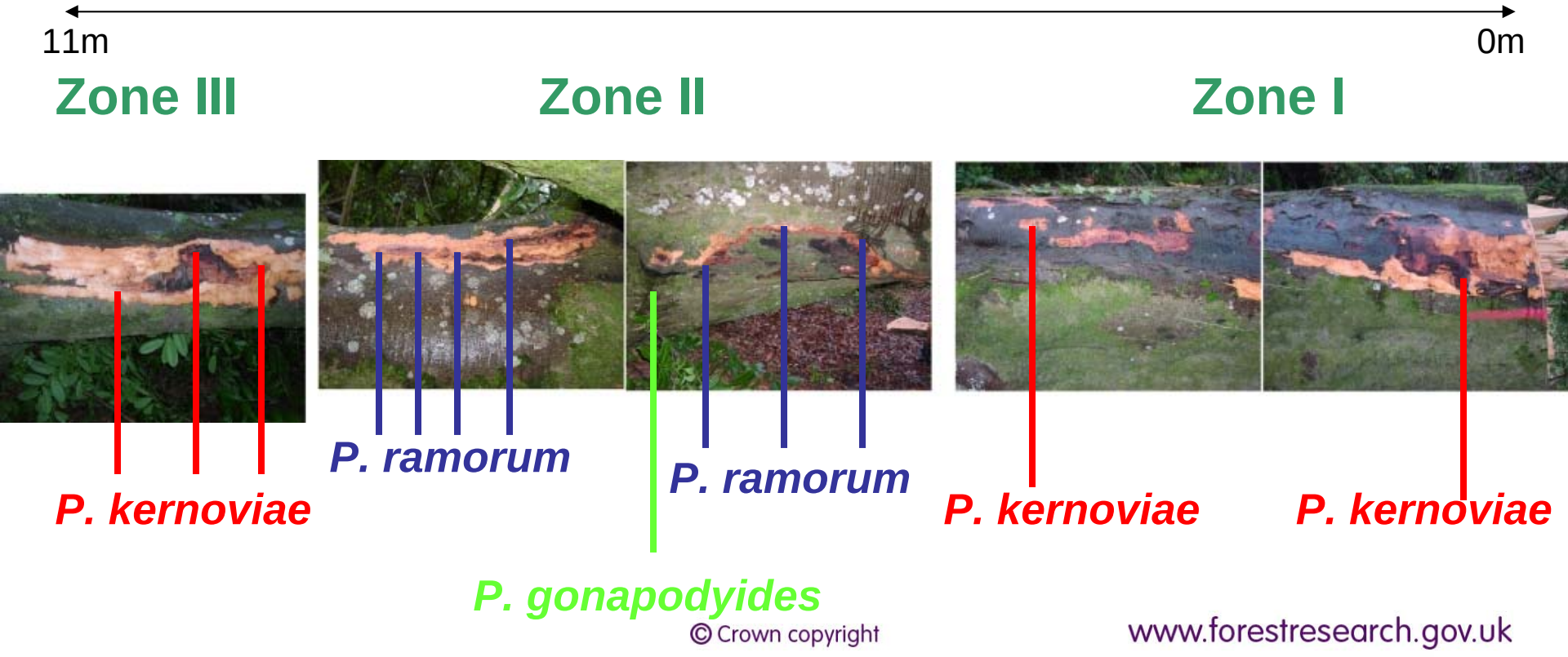
May 2006

June 2006

Oct 2006

One tree - several Phytophthoras

- *Pk* and *Pr* overlap at some sites
- May be found infecting the same rhododendron
- In intimate contact on the same tree stem



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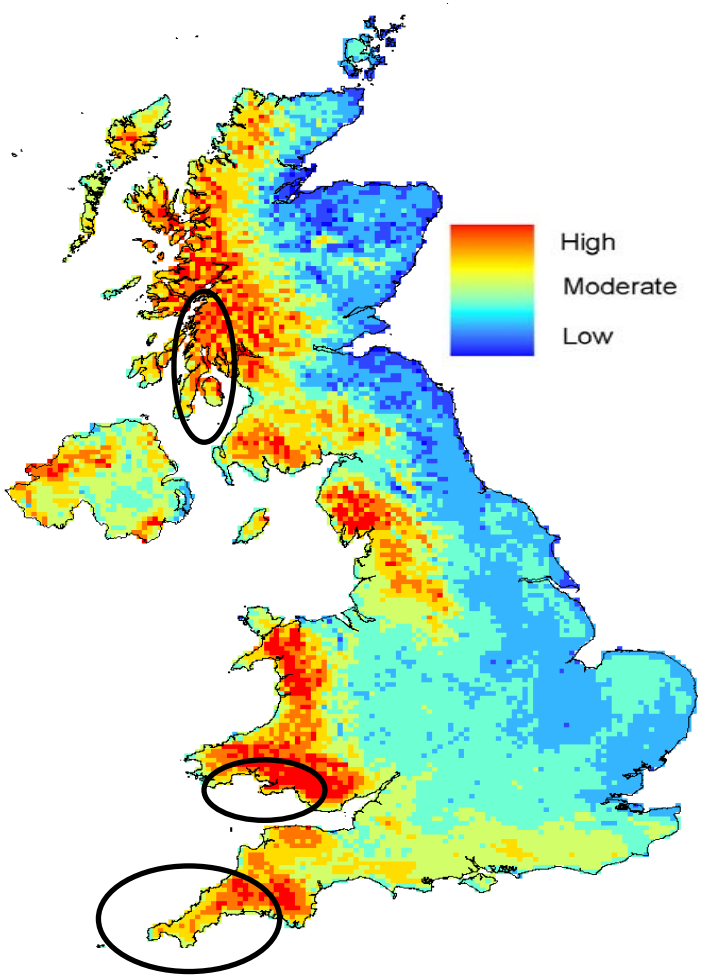
Significant changes in 2007/08

- *P. ramorum* found for the first time in Scotland outside nurseries (at least four gardens, with wide range of ornamental plants with foliar infections)
- *P. kernoviae* found in Scotland in three locations on rhododendron



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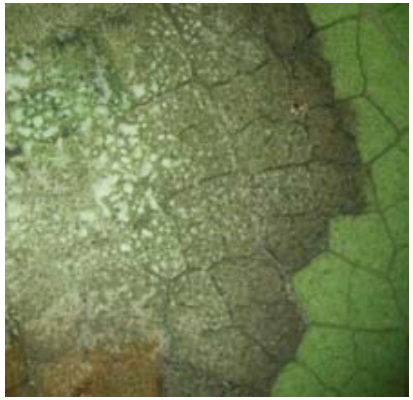
Significant changes in 2007

- *P. ramorum* infected trees outside southern (particularly south west) England
  - North England, midlands
  - N. Ireland
- *P. kernoviae* infection in heathland and woodland without rhododendron host



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Spread of *Phytophthora* pathogens

- Movement of plants
  - plant trade
  - informal movement
- Both pathogens spread via water
  - in rainsplash probably short distances
  - in moist winds, probably much longer distances due to atmospheric turbulance
  - water courses (frequently Pr)
- By people/animals/vehicles

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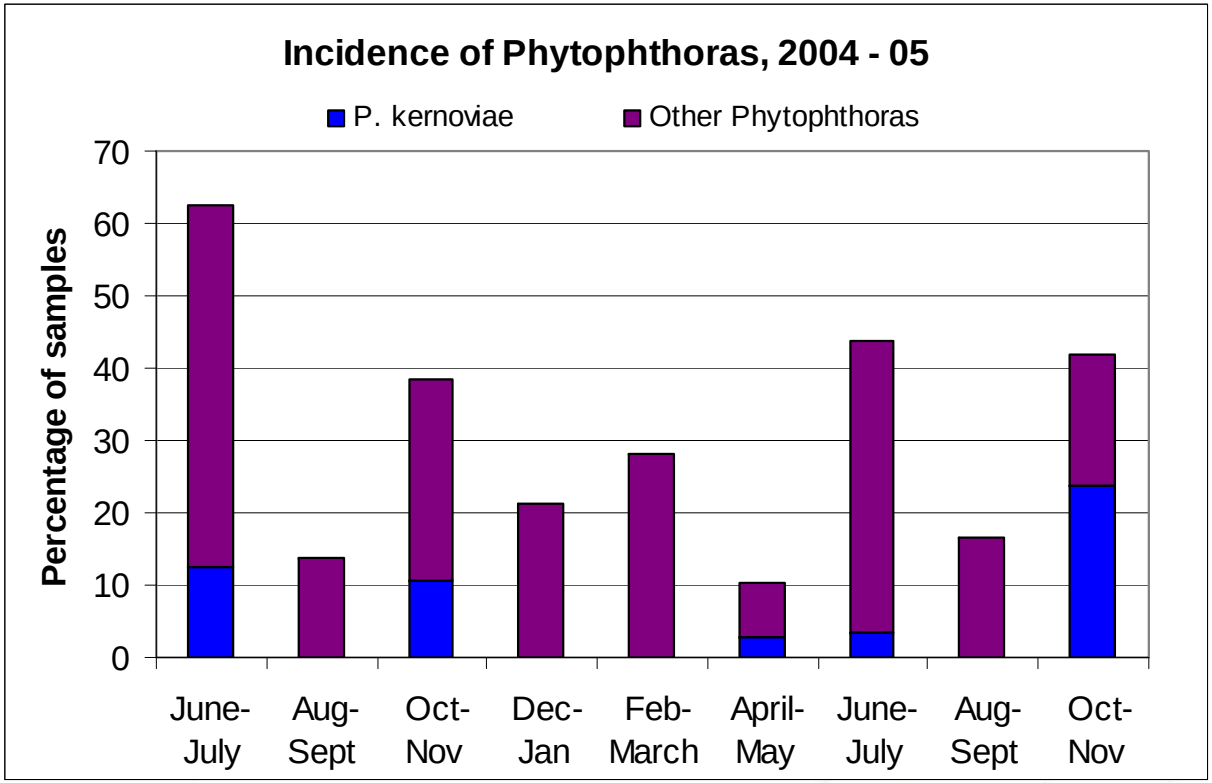
Movement of *Phytophthora* by people

- Collected samples from footwear of people leaving infected woodland
- A third of all samples contained Phytophthora
- Pr and Pk peaks in early summer and autumn



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Is that bleeding canker caused by Pr/Pk?

- Only small number of lethally infected trees have been found
- Its most likely to be caused by some other pathogen, often another *Phytophthora*
- Cankered trees have only been found when
  - there are infected ‘sporulator’ hosts nearby
  - inoculum levels are high (lots of infected foliar host) before trees are placed at significant risk
  - ‘sporulators’ less than 50m away from susceptible trees and usually <2m away from susceptible trees
- Oak is at low risk compared to beech, especially for P. kernoviae

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Aerial *P. cambivora* infections

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Bacterial bleeding canker, HC

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Phytophthora disease of alder

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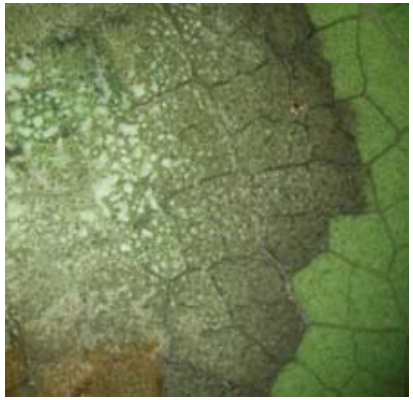
  - *Susan Kirk and Joan Rose*
- Colleagues based in Cornwall
  - *Ben Jones (Forestry Commission)*
  - *Ian Sanders and Ann Payne (PHSI)*



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