

Research needed to identify the impact *Phytophthora* might have on the biodiversity of England and Wales

Background

Phytophthora is a genus of plant-damaging water moulds that are responsible for a number of notorious plant diseases, such as potato blight. Two new species, named *ramorum* and *kernoviae*, have recently been identified in the UK. They are believed to be non-native, and may have been introduced *via* international horticultural trade.

The two new species of *Phytophthora* can affect a wide range of native and garden plants. Until recently, 'wild' findings were restricted to infections of the non-native invasive species *Rhododendron ponticum*, however it has now spread to infect native *Vaccinium myrtillus*. Laboratory testing shows that other native species such as *Calluna vulgaris*, *Vaccinium vitis-idaea* and *Arctostaphylos uva-ursi* may also be highly susceptible.

Once infections occur, they can spread very rapidly through other susceptible species, as infected *Vaccinium* or *Rhododendron* produce very high numbers of spores. Some spores also remain in the soil and can infect germinating plants. Trees are also affected by *Phytophthora ramorum* / *kernoviae*, and they can be killed by the infection. However, most species of infected trees do not produce spores, and will normally only become infected if they are in close contact with other infected plant species.

Objectives

A phased approach to the research is proposed, with the following objectives those to be included in Phase 1.

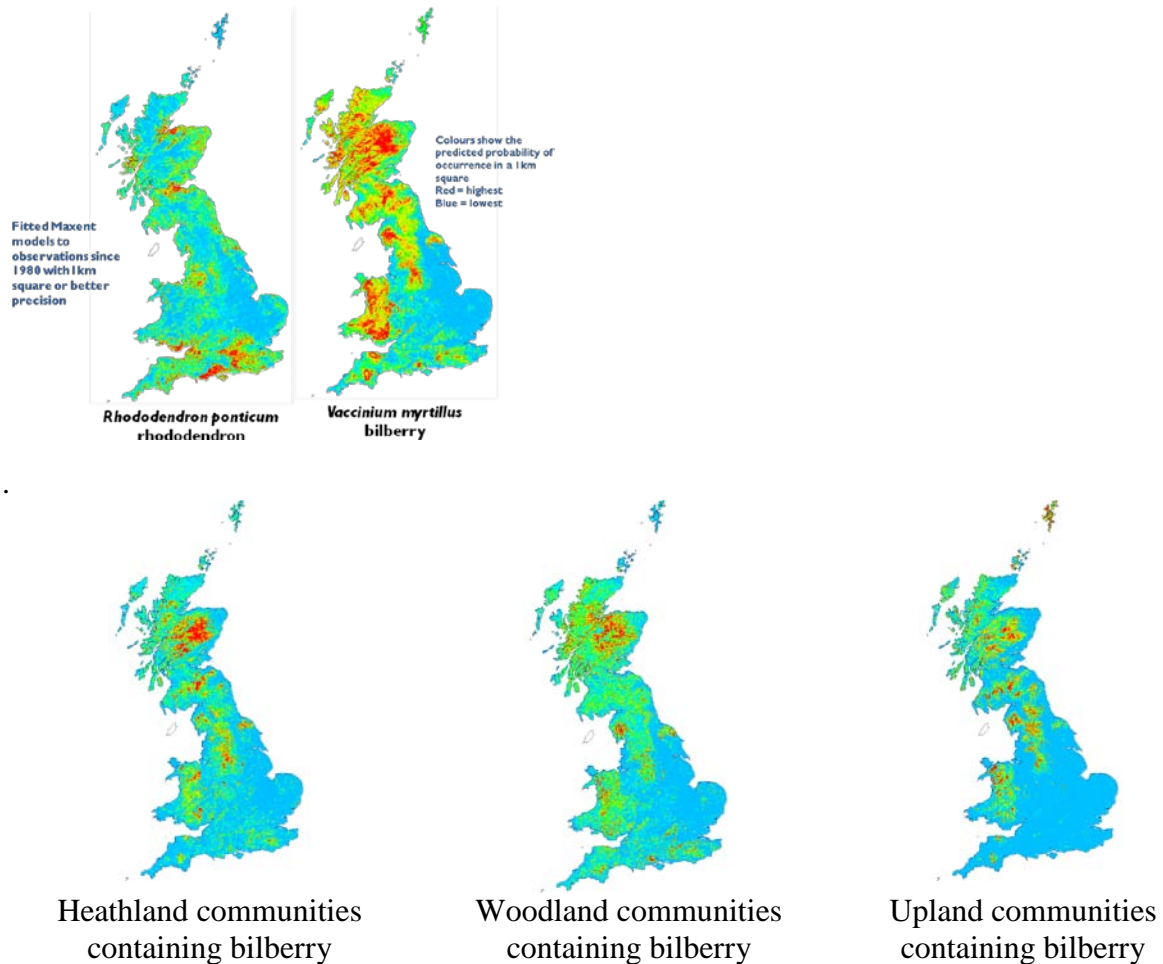
1. Identification of biodiversity impacts
 - a. Review the known and potential biodiversity impacts of *Phytophthora* assuming different ranges of spread and destruction of host species.
 - b. Relate the identified impacts to SAC features, SSSI features, BAP habitats and species.
2. Identification of impacts on ecosystem services
 - a. Identify which ecosystem services will be affected by *Phytophthora* infection.
 - b. Assess the likely level of impact on services.
3. Evaluation of control measures
 - a. Set up a range of plots to measure the impacts of control measures.
 - b. Determine baseline conditions in selected plots.

Detailed requirements

1. Identification of biodiversity impacts
 - a. Review the known and potential biodiversity impacts of *Phytophthora* assuming different ranges of spread and destruction of host species.

JNCC have been undertaking modelling work to provide detailed mapping of both *Vaccinium myrtillus* and *Rhododendron ponticum*. The results of this can be used to further understand the likely biodiversity impacts that would result from spread of *Phytophthora* throughout the

Vaccinium myrtillus population. The *Vaccinium* models can also be subdivided into different NVC communities. Some of the results of this work are shown below.



Additionally, a preliminary analysis of the insects which feed on bilberry, and which might therefore be impacted by a change in its distribution has been undertaken. The Phytophagous Insect Data Bank lists 113 species as feeding on bilberry, cowberry, bearberry and crowberry. 42 appear to be entirely or mainly associated with the ericaceous shrubs known to be highly susceptible, and three of these are BAP species. Two more have British Red Data Book statuses.

This work should be further built on to:

- Extend the analysis to include *Vaccinium vitis-idaea*, *Arctostaphylos uva-ursi* and *Calluna vulgaris* (species shown to have high susceptibility)
- Consider how the rate and extent of spread will affect the impact, utilising different scenarios related to the risk
- Consider how different degrees of host destruction will affect the impact
- Assess more fully the numbers of dependent species, the range of these species, and the likely impacts
- Use UKCP09 climate projections to assess likely future ranges of *Phytophthora* species and susceptible host species, and hence the projected disease level if no intervention occurs

- b. Relate the identified impacts to SAC features, SSSI features, BAP habitats and species.

A number of habitat types listed on Annex I of the Habitats Directive contain *Vaccinium myrtillus* as a major, often dominant, component. These include: European dry heaths, Alpine and boreal heaths, Blanket bogs, and the ground flora of Old acidophilous oak woods, Old sessile oak woods, Sub-arctic *Salix* species scrub, and Caledonian forest. All of these habitat types are currently listed as Unfavourable – Bad in the Article 17 reporting. Widespread loss of *Vaccinium* from these habitats would lead to further habitat deterioration. Additionally, there are a considerable number of SSSIs with lowland and upland heath types as interest features. Heathland has among the highest proportion of unfavourable habitat features. Loss of *Vaccinium* would lead to these features being in an unfavourable condition, not least because they would almost certainly fail in the dwarf shrub cover and composition attributes.

Further work is required to:

- More fully assess the likely impacts to SAC features and SSSI features
- Assess the likely impacts on BAP habitats and species
- Consider which biodiversity targets will not be achievable given a range of *Phytophthora* extent of spread and the possibility of spread in different host species

2. Identification of impacts on ecosystem services

- a. Identify which ecosystem services will be affected by *Phytophthora* infection.

A number of ecosystem services would be likely to be impacted by the loss of a dominant habitat component such as bilberry or heather. Recreational services would be particularly affected. Additionally, soil stability and hence water quality could be affected, as well as primary production, nutrient cycling and food provision.

- b. Assess the likely level of impact on services.

A qualitative assessment of the likely level of impact on the identified ecosystem services should be made. If it is possible to quantify this, this should also be undertaken both in degree of impact and the economic costs.

3. Evaluation of control measures

- a. Set up a range of plots to measure the impacts of control measures.

Both FERA and Natural England are planning or undertaking control measures on natural sites. Most current control measures involve the removal of infected plants, either *Rhododendron ponticum* or *Vaccinium myrtillus*. A valid experimental design should be developed to measure the biodiversity impacts of a range of control measures.

- b. Determine baseline conditions in selected plots.

Further research work may be commissioned to monitor changes in plots where control measures have taken place. Baseline conditions need to be measured to set these changes in context. Species composition, cover percentages and structural attributes should be included in the baseline measures.