Plant Health Centre
Scotland's Centre of Expertise

Scottish Government
Riaghaltas na h-Alba

Improved preparedness for *Phytophthora* prevention in Scotland

Policy Summary

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UK Centre for Ecology & Hydrology

The James Hutton Institute

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1 Policy Summary

1.1 Background

Introduced pests and diseases pose a serious threat to Scotland's agriculture, forests and horticultural sectors and to native plants and habitats. The United Kingdom has experienced a series of damaging invasions by *Phytophthora* pathogens, with many linked to global horticultural trade pathways and large-scale planting or restoration activities. In Scotland, 45 *Phytophthora* species have been detected to date. A further 50 known *Phytophthora* species have global source regions connected to the UK through horticultural trade but are yet to arrive. Enhanced preparedness depends on early identification and prioritisation of threats. Rapid action to eradicate or control new outbreaks improves outcomes for plant health, especially where significant impacts on plant health in Scotland are anticipated.

1.2 Aims and Objectives

This project aimed to support horizon-scanning and enhance preparedness for priority *Phytophthora* threats in Scotland with models and databases co-produced with cross-sectoral decision makers in forestry, horticulture and nature conservation to:

i. Identify key *Phytophthora* threats to priority plants and habitats in Scotland at risk from *Phytophthora*.
ii. Update and translate the existing models and global databases into tools to support horizon-scanning, spatial risk assessment analysis, and awareness of disease threats in Scotland.
iii. Validate project outputs and assessment of potential impacts on decision-making with stakeholders.

1.3 Research Undertaken

Project output	**Method(s)**	**Description**	**Stakeholder-identified value for decision making**	**Link to access**
Interactive online global database of *Phytophthora* hosts and distributions	Collate and update cross-sectoral data on *Phytophthora*	Species descriptions, geographical distribution, and ecological traits	Improving awareness of threats and ideally linking to existing tools (e.g. Plant Health Portal).	https://kattur.github.io/Phytophthora-and-Hosts-in-the-UK-and-Globally/
Ranked list of *Phytophthora* threats to Scotland's priority plants, habitats and forest estate	Analyses of existing models and updated databases	Scoring *Phytophthora* species arrival, introduction, establishment and spread risks	Informing UK plant Health Risk Register rankings, targeting limited surveillance resources and identifying regulatory gaps for trade routes and traded products, ideally linking to existing tools.	https://doi.org/10.5285/72e8f817-01a6-42d2-b187-a5ebf43853a1
Spatial analyses of *Phytophthora* risks to priority host plants and habitats in	Self-completion questionnaire (April 2024, 9 responses) First workshop (June 2024, 9 participants)	Framing with cross-sectoral decision makers: identify key risk factors and co-design risk scoring protocol	Listed below	Listed below

Project output	Method(s)	Description	Stakeholder-identified value for decision making	Link to access
Scotland (listed below).	Second workshop (November 2024, 10 participants)	Assess value for decision-making, adequacy of risk factors/scoring and pathways for dissemination		
• *P. ramorum* risks to Larch fragments	New model development	Collation of spatial data on risk factors and at-risk habitats and hosts. Incorporation of feedback on risk framework scoring, tailoring of outputs (after second workshop) and format for transfer to agencies.	Guiding decisions about planting of new Larch in areas of Scotland at lower predicted risk from *P. ramorum* and supporting the review of existing legislation and regulatory control (*P. ramorum* Action Plan)	https://doi.org/10.5285/f6809e00-91cb-494d-babd-5d60d938ad97
• *P. ramorum* risks to heathland			Environmental surveillance for *P. ramorum*, especially in heathland	https://doi.org/10.5285/00601c2a-ac86-467d-8696-689cf20e35d3
• *P. x alni* risks to Alder fragments			Integrating *P. x alni* risk into riparian planting and landscape planning decisions in the conservation sector (though care is needed to avoid discouraging planting by other actors).	https://doi.org/10.5285/824f9ba8-7d1c-4a82-b5ec-a4f850f1d370
• *P. pluvialis* infection risks to Douglas fir and Western hemlock fragments			Not discussed	https://doi.org/10.5285/921fcc2e-7491-4058-a21b-3d1de0be1507
• *P. pinifolia* establishment in Caledonian Pinewood Inventory			Understand which CPI areas are at highest risk of *P. pinifolia* establishment following arrival (Highlands and Islands conservancy, South West and North East seed zones) and to reduce potential spread from moving planting material between seed zones.	https://doi.org/10.5285/ddee75ae-2ad0-4d16-81a9-20928d89e872

1.4 Main Findings and Recommendations

Finding 1: Global *Phytophthora* species are likely to continue to arrive through trade, with the potential to establish and spread in Scotland and impact priority species and habitats. For example, a high proportion of heathland within Scotland's protected areas is predicted to be at risk of *P. ramorum* establishment. Cross-sectoral stakeholders reported high levels of concern about threats from *Phytophthora* species.
Recommended action 1: Retain *Phytophthora* within the UK Plant Health Risk Register and enhance horizon-scanning and risk assessment to prioritise threats across the genus. To support the Scottish Biodiversity Strategy, surveillance and interception efforts may need to be strengthened for woodlands, scrub and heathland habitats, for host plants on the Scottish Biodiversity List (e.g. *Salix, Juncus, Juniperus, Poa, Rosa* and *Trifolium*), and for *Quercus*, *Salix* and *Alnus* species within forestry. Establishing responsibility for plant health in protected areas and the wider environment, outside of forests and woodlands, should be a priority, as highlighted in the Scottish Plant Health Strategy 2024-2029.

Finding 2: Knowledge of global source regions and *Phytophthora* behaviour in different environments is still very limited, with 89 exotic *Phytophthora* species having no records of distribution pre-dating 2005, making it difficult to predict the impacts of emerging species. Integrating data across sectors substantially increases knowledge of pathogen species distributions and host ranges.
Recommended action 2: Support enhanced research efforts to (i) discover and map *Phytophthora* species diversity in different global regions to enhance rapid screening for climate suitability and arrival risks for Scotland; (ii) develop and maintain (long-term) global and national cross-sectoral databases on *Phytophthora* species distributions, climate responses, hosts ranges, and sectoral impacts to improve horizon-scanning, surveillance and awareness of threats.

Finding 3: Stakeholders identified what they considered to be important risk factors for *Phytophthora* establishment and spread, including climate suitability for growth and infection, and host distribution and susceptibility. Water-related factors such as soil moisture levels or specific land uses were considered important for selected species. Despite there being very few interceptions in trade and enhanced biosecurity checks on known hosts, some stakeholders hold the assumption that businesses involved in plant trade, propagation and permanent plantings were higher-risk routes for the introduction and spread of new *Phytopthora*. Others acknowledged improved availability of biosecurity guidance for nursery managers.
Recommended action 3a: Enhance the existing assessment and scoring of *Phytophthora* risks among species and locations, integrating the following key risk factors into spatial risk frameworks for priority *Phytophthora* species; (i) distribution of susceptible hosts, habitats or premises of interest; (ii) climate suitability for growth/infection; (iii) proximity to sources of infection; (iv) proximity to relevant spread pathways; (v) pathogen-specific water/vegetation effects on establishment; with higher weighting given to climate suitability and alternate host distributions.
Recommended action 3b: Consider the following factors not addressed in this project as key research priorities i) the development of more generalisable spatial risk frameworks relevant to a wider group of pest and pathogen threats to habitats and hosts, ii) the overlay of risks with a broader range of habitats and premise types (e.g. public and private gardens, trade premises), iii) further and ongoing validation of risk factors against pathogen outbreak data to enhance the credibility and uptake of model-based tools and iv) the extension of climate suitability models for *Phytophthora* species to include projections of risk under future climate conditions (5 to 50 years' time).
Recommendation 3c: Improve understanding of *Phytophthora* risks linked to different social factors influencing pathways of introduction and local spread as a key future research need. This research would require integration and collaboration of actors, data and expertise across sectors (horticulture, forestry, conservation) to understand and predict pathogen

impacts, including collection of potentially sensitive data from premises on business types, management and biosecurity practices, host supply chains and relevant planting/restoration activities as well as pathogen detections by governmental agencies.

Finding 4: The collaborative approach allows for greater insights into decision making priorities across plant health sectors and regions.
Recommended action 4: Develop tailored risk and prioritisation tools for Scotland exploiting existing knowledge and promote integration with data sources already used by different agencies (e.g. the UK Plant Health Risk Register, planting guidelines). Balance plant health risks against other considerations when managing for desired outcomes (e.g. planting decisions). The flexible, mixed-methods co-production approach adopted in this study provides one model for such co-design.

Plant Health Centre
c/o The James Hutton Institute
Invergowrie,
Dundee, DD2 5DA

Tel: +44 (0)1382 568905

Email: Info@PlantHealthCentre.scot
Website: www.planthealthcentre.scot
Twitter: @PlantHealthScot
LinkedIn: https://uk.linkedin.com/company/plant-health-centre