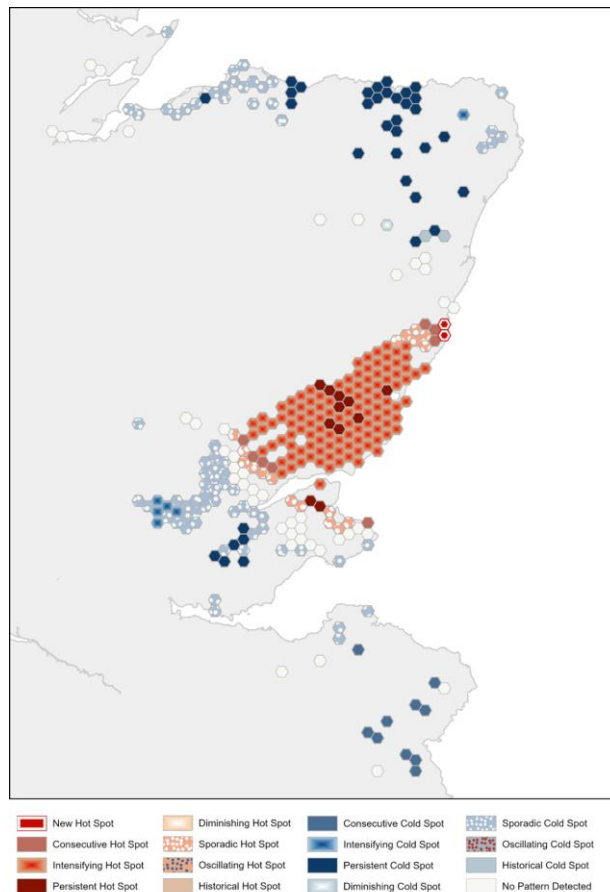


# Modelling the spread of PCN in Scotland

## Policy Summary



[www.planthealthcentre.scot](http://www.planthealthcentre.scot)

Full report is available [online](#)

**Please cite this report as follows:** Skelsey, P. (2022). Modelling the spread of PCN in Scotland. Project Final Report. PHC2020/08. Scotland's Centre of Expertise for Plant Health (PHC). DOI: 10.5281/zenodo.7805729

Available online at: [planthealthcentre.scot/publications](http://planthealthcentre.scot/publications)

**Dissemination status:** Unrestricted

**Copyright:** All rights reserved. No part of this publication may be reproduced, modified or stored in a retrieval system without the prior written permission of PHC management. While every effort is made to ensure that the information given here is accurate, no legal responsibility is accepted for any errors, omissions or misleading statements. All statements, views and opinions expressed in this paper are attributable to the author(s) who contribute to the activities of the PHC and do not necessarily represent those of the host institutions or funders.

# 1 Policy Summary

## 1.1 Background

Potato cyst nematodes (PCN) cost UK agriculture over \$50 million/year and threaten food security in the developed and developing world. Improving our understanding of PCN epidemiology is a priority for the potato industry, with spatial and spatiotemporal modelling identified by the recent PHC PCN Working Group as essential components.

## 1.2 Key Research Questions

- Is the distribution of PCN incidence in Scotland random or are there spatial and spatiotemporal patterns?
- What are the principal drivers of PCN incidence in Scotland?
- Can we derive a model to accurately predict PCN incidence?
- Can we identify promising new management options to reduce PCN incidence across Scotland?

## 1.3 Research Undertaken

- PCN risk mapping using ArcGIS Pro software.
- Machine learning to identify the most important variables for prediction of PCN.
- Machine learning to derive a model for predicting PCN incidence.
- Analysis of potential management scenarios with the model.

## 1.4 Main Findings

- Incidence of *G. pallida* and mixed populations are increasing over time, whereas incidence of *G. rostochiensis* is decreasing.
- There are statistically significant hotspots of *G. pallida* and mixed population incidence in the Dundee postcode area
- *G. rostochiensis* has a more widespread distribution than *G. pallida*, with statistically significant hotspots of incidence extending from the Dundee postcode area, up into Aberdeenshire and down into the Kirkcaldy postcode area.
- Changes in the spatiotemporal incidence of one species were partially mirrored by opposing changes in the other.
- Incidence of *G. pallida* is intensifying over space and time in in the north Kirkcaldy, east Perth, Dundee, and south Aberdeen postcode areas, with statistically significant hotspots of *G. pallida* and mixed population incidence in the Dundee postcode area.
- Incidence of *G. rostochiensis* has been persistently high over space and time in those areas, except for a large swathe of land across the Dundee postcode area where it is diminishing.
- The amount and proximity of surrounding seed and ware potato crops were important drivers of incidence, as were features specific to the infested site, such as the slope and size of the field and the number of years since it was last planted with potato.
- The principal drivers of PCN incidence can potentially be modified by growers or at a strategic national level to reduce risk of infestation.
- A machine learning algorithm was developed to predict PCN incidence to a high level of accuracy.

## 1.5 Recommendations

- *National strategy*: The results of this study provide evidence that cross-contamination between infested fields and healthy potato crops is causing persistent and intensifying hotspots of incidence in densely cropped areas. There is currently little incentive or

accountability for the ware sector to keep land PCN-free, therefore a national PCN strategy that addresses this issue, either through financial incentives or new legislation, could be key to preventing the ongoing loss of land for seed production.

- *Targeted control*: There is a potential role for targeted control methods within a national PCN strategy. The maps produced by this study provide powerful visual aids that can be used to tailor control options, restrictions, and financial incentives according to patterns of PCN incidence. Restrictions on the use of infested land for growing ware and on the disposal of crops, waste and soil could be tightened in hotspots of PCN incidence, and potentially eased or lifted in coldspots of incidence. Similarly, the standard sampling rates for official pre-crop soil testing for PCN could potentially be increased in areas where risk of pest spread is high and lowered elsewhere. In addition, financial incentives could be tailored to the species-level to encourage more widespread cultivation of varieties with moderate or high levels of resistance to *G. pallida* in regions where incidence of *G. pallida* is intensifying.
- *Mapping*: It is recommended that the ArcGIS analyses are repeated each growing season to provide an up-to-date overview of the evolving PCN situation in Scotland.
- *Recording*: Incorporation of additional agronomic variables in SPUDS (e.g., cropping history, soil type and management, irrigation practices) would serve to improve future modelling studies.
- *Modelling*: Improving our ability to forecast when and where PCN will spread in the future is one of the key recommendations of the [Report of the Scottish PCN Working Group](#) (2020). This research provides the foundation to meet that aim, with further work planned under the Scottish Government funded [Strategic Research Programme](#) 2022-2027 and through external funding.

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

Tel: +44 (0)1382 568905

Email: [Info@PlantHealthCentre.scot](mailto:Info@PlantHealthCentre.scot)

Website: [www.planthealthcentre.scot](http://www.planthealthcentre.scot)

Twitter: [@PlantHealthScot](https://twitter.com/PlantHealthScot)



Royal  
Botanic Garden  
Edinburgh



UK Centre for  
Ecology & Hydrology



Scottish Government  
Riaghaltas na h-Alba  
gov.scot