

**PHC2024/06:** Evaluating the potential of predator diet analysis as a monitoring tool for plant pests of concern

**Background and knowledge gap:** Plant pests have the potential to cause economic and environmental damage to Scotland's plant-based sectors of Forestry, Agriculture, Horticulture and the Natural Environment. Tracking the presence and distribution of plant pests of concern to Scotland is key to the timely and resource-efficient deployment of countermeasures aimed at minimising the impact of these pests to Scotland's natural and cultivated plants and landscapes. However, direct pest population surveillance and monitoring efforts are often costly and therefore not possible for all pests (either those present or that have the potential to arrive), and there are also important pest species for which direct trapping methods currently are not available, such as *Dendroctonus micans*, the great spruce bark beetle, for which western Scotland is currently a Pest Free Area. Novel methods for surveillance and monitoring of plant pests of concern to Scotland could potentially improve the data on which to base pest response actions and, if economically viable, would be welcomed by Scottish stakeholders, including government, industry and academia. Identifying which new methods are likely to be successful, if tested in the Scottish context, requires a synthesis of the information available. One such method that may have the potential to be employed in different settings is the analysis of predator diets via faecal testing, using sequencing methods such as metabarcoding applied to predators of plant pests of concern. Previous research has indicated potential for this approach when applied to birds<sup>1</sup>, bats<sup>2</sup>, and spiders<sup>3,4</sup>, both for plant pests in agricultural and the natural environment. For generalist predators (such as woodpeckers, treecreepers, nuthatches etc.), there is the possibility of simultaneous monitoring of multiple target pest species. As an example: Woodpeckers are generalists that prey on *D. micans*, *Ips* spp., *Xyleborus*, weevils (many *Pissodes* species are on quarantine list), *Agrius* spp. and woodboring longhorn beetles (multiple on quarantine list), as well as sawfly larvae (two on the quarantine list). Several of these aren't directly targeted by the forest trapping network. However, the habitat range of woodpeckers may not make them suitable candidates for certain pests in Scotland, and it is possible that priority pests at very low population levels may be ignored by these birds when other food sources are abundant (as well as diet changing through the seasons).

The purpose of this project is to review the potential feasibility of predator diet analysis as a surveillance and monitoring tool for plant pests of concern in the Scottish context, offering guidance on pest target prioritisation and identifying which predator-prey systems may have a reasonable likelihood of success if deployed as components of novel surveillance strategies. This desk-based review will provide evidence to the PHC and policy stakeholders on the likely practicalities of deployment for select predator-pest scenarios and limitations of the techniques reviewed, with recommendations for pests and their predators identified as potential candidates for future test deployment (including feasibility of developing surveillance strategies based on predator-prey systems highlighted). This will include:

- a) Review of select predator-pest systems that might be of value as a test systems

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- b) Exploring the potential sampling and analytical methods that could be applied to plant pest predator faeces as an approach to determine which plant pest species are present in the vicinity
- c) Determining the practicalities and barriers around predator faeces collection for pest-predator systems in general
- d) Estimating the economics of applying these techniques, and the feasibility of developing surveillance strategies based on selected predator-prey systems

We anticipate that applicants will select a limited number of predator-pest systems to focus on in detail, relevant to their background and experience. These can come from any of our four sectors (Forestry, Agriculture, Horticulture and the Natural Environment), but there is no requirement to offer examples from more than one sector. For the example predator-pests systems identified by applicants for detailed review, we anticipate an exploration of the potential sampling techniques and analytical methods that could be applied to plant pest predator faeces as an approach to determine whether specific or which members of groups/ communities of plant pest species are present in the vicinity. This study will synthesise information on the feasibility of potential pest-predator systems based on faecal analysis and should consider approaches for surveillance and monitoring, faecal testing methods and the practicalities and barriers of proposed methods and systems. The review should also review existing data on pest and predator species presence/abundance or absence (including for pests not currently present in Scotland) that could serve as candidate locations to test methods highlighted by the project.

**Impact:**

This stand-alone project will synthesise relevant literature about plant pest predator diet analysis, creating a report that will serve as an evidence base for consideration by PHC and Scottish policy stakeholders, and should:

- Provide an evaluation of a selection of predator-pest systems from any of our four sectors, to assess their suitability as candidates to test diet analysis methods as surveillance tools, considering their potential for deployment based on factors such as:
  - predator range and priority of pests consumed to Scotland's plant-based sectors
  - practicality/affordability of faecal sampling
  - economics of deployment (sampling and analysis at scale)
  - known presence and distribution data for the plant pests (Forest Trapping Network, for example), including areas from outside Scotland that could act as test sites for pests not yet present
  - feasibility of these systems and techniques for underpinning novel surveillance strategies
- Synthesise the findings to provide a guide to the potential power and practicality of such an approach in novel surveillance strategies in the Scottish context, identifying which predator-

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prey systems should be considered for pilot studies for method testing/development, based on likelihood of success and importance of the pest(s) to Scottish stakeholders.

- Identify what experimental data is required if future assessments are made of the application of diet analysis methods to highlighted pest-predator systems to determine the potential value of this approach in pest surveillance.

### **Objectives and research required for this call:**

The objectives of this project are to:

- Assess a limited selection of plant pest predator systems relevant to one or more of the Scottish sectors of Forestry, Agriculture, Horticulture and the Natural Environment, for the opportunities and barriers to their use in monitoring plant pests of concern.
- Review plant-pest predator diet analysis methods that could be deployed to monitor plant pests important in the Scottish context.
- Provide recommendations on next steps in terms of which pest-predator systems are most likely to be feasible and impactful if explored further to underpin novel surveillance strategies, highlighting geographic areas and complimentary data sets (e.g., current pest population tracking) that would guide potential future projects that directly tested the methods and pest-predator systems identified.
- Produce guidance on the experimental considerations required for potential future investigations into diet analysis for the pest-predator systems highlighted by the project as having potential as practical targets for these methods in the Scottish context.

### **Deliverables required from individual project:**

- Final Report with executive summary on investigations, to contain key sources, analysis, findings and recommendations for implementation or further work. Reports should be a maximum of 20 pages of text (30 pages including figures but excluding appendices and references). Cover image(s) with associated photo credits should also be supplied.
- Brief policy summary (2 pages maximum) explaining how the work has contributed to filling evidence gaps and the context in which the findings can be used by policy makers and practitioners.
- Presentation at Scotland's Plant Health conference and any other relevant stakeholder meeting(s) to disseminate findings and contribution to other KE output such as the PHC virtual poster room or blogs.
- 200 word lay summary for project overview at outset, and of findings at completion (for website and newsletter).
- Slide deck of the key project findings.

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## Meetings

- Project meetings throughout project lifecycle to include PHC manager, PHC Sector Lead, Scottish Government policy contact.
- Meeting/s with relevant PHC Impact Officer and Communications Officer to plan dissemination of project findings and impact strategy.
- Attendance at briefing discussion with PHC Steering group to discuss findings and next steps.

## Indicative key dates:

- Deadline for submission of applications: **12pm on Friday 17<sup>th</sup> January 2025**
- Project start: 1<sup>st</sup> April 2025
- Overview of plans and project start-up meeting with PHC Directorate: 18<sup>th</sup> April 2025
- Final report and policy summary: 30<sup>th</sup> September 2025
- Project outputs signed off by PHC Sector Lead: 30<sup>th</sup> October 2025

Detailed milestones to be confirmed by bidder.

**Date all work needs to be completed by:** 30<sup>th</sup> September 2025

**Maximum funding available exclusive of VAT<sup>1</sup> (where applicable) and including any knowledge exchange activities: £25,000**

<sup>1</sup> Please note that costs should be submitted net of VAT recovered by the applicant. Applicants should seek advice on appropriate VAT treatment of proposed funding.

## Submitting an application form

Applicants should use the PHC Application Form when applying for projects and must ensure they are able to accept the [PHC Funding Terms and Conditions](#) before submitting an application.

It is possible to request a start date or project duration that differs from the project specification. This should be requested in the application form (section 1.4) and is subject to approval and the requirements of individual projects.

Applicants should note that after submission of the Final Report and Policy Summary, there is a review process that includes rounds of assessment by the project's assigned sector lead, policy contact and the PHC Steering Group prior to final sign-off and publication. At each stage there is the potential for revisions to be requested of the project team, and this should be taken into consideration when costing projects

Completed applications should be submitted to [info@planthealthcentre.scot](mailto:info@planthealthcentre.scot) for evaluation by 12pm on 17<sup>th</sup> January 2025. Successful applicants will be notified by 14<sup>th</sup> February 2025 and we may request

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further clarification on any aspect of the application prior to contract award. You should highlight any potential conflicts of interest in your proposal.

Please contact the Centre Manager if you have any queries ([info@planthealthcentre.scot](mailto:info@planthealthcentre.scot)). Answers to any non-confidential questions will be published on our website.

### Review of application

Applications will be reviewed by a panel selected from the PHC Directorate, Scottish Government, PHC partners and/or commissioning stakeholder, as appropriate.

Expectations for section 1 of the application form:

Expectation	Descriptor
Duration	The proposed duration will align closely to the details provided in the anticipated timescales section of the specification.
Staff time and effort	The proposed allocation of staff time and effort is appropriate and includes all deliverables. The proposal must also provide a commitment that named staff members will be available to work on the contract if the bid is successful.
Project costs	The estimated breakdown of project costs is realistic and inclusive of all deliverables.

Expectations for section 2 of the application form:

Expectation	Descriptor
Background	The proposal should include an introduction which demonstrates a clear understanding of the project requirements. This should include the need for this research; the project aim; and how the proposal will address this aim.
Proposed methodology and outcomes	The proposal should demonstrate a high quality and workable methodology, including: how the evidence will be identified, reviewed and assessed, consulting relevant stakeholders and/or experts where appropriate, to address the key questions and produce the deliverables in the timescales required.
Milestones	The project milestones are logical, practical and include all deliverables.
Project Management	The staff, resources and expertise are appropriate for conducting the proposed project. The proposal should name the project lead.
General and specific topic expertise and experience	The proposal should provide details of individual staff members who will work on this project and demonstrate how they will meet the project requirements, specifically: <ul style="list-style-type: none"> <li>- general research experience and expertise</li> <li>- specific experience and expertise relevant to the call</li> </ul>
Risk	The proposal should provide a risk assessment matrix detailing any risks identified in relation to the delivery of this contract, and proposed mitigation measures to minimise their probability and impact, focused particularly on risks to completion on time.

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**References:**

- <sup>1</sup>King, R. A., et al. (2015). *Bulletin of Entomological Research*, 105(3), 261-272. doi:10.1017/S0007485314000935
- <sup>2</sup>Aguiar, L. M. S., et al. (2021). *Plos One*, 16(10), e0258066. doi:10.1371/journal.pone.0258066
- <sup>3</sup>Sint, D., et al. (2015). *Frontiers in Zoology*, 12(1), 3. doi:10.1186/s12983-015-0096-y
- <sup>4</sup>Anđelić Dmitrović, B., et al. (2023). *Diversity*, 15(9), 976. Retrieved from <https://www.mdpi.com/1424-2818/15/9/976>