

FUTURE PROOFING Plant Health

A Defra Network partnership delivering interdisciplinary plant health research to improve biosecurity and build capability



Health impacts of OPM among contractors and practitioners

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Executive Summary

Health impacts of OPM among contractors and practitioners

- The online survey of contractors undertaking general arboricultural work, aimed to assess the awareness and scale of occupational health impacts of OPM, as well as the related training needs in the sector.
- Recruitment of contractors to participate in the survey was undertaken by Arboricultural Association (AA), using their contact database of over 3,500 members, each of whom received an email link to the online survey. Members were also asked to share the link within their networks (including colleagues and employees) and the survey was promoted by AA on social media. The survey was open March 13th to April 17th 2020, and resulted in 210 unique responses. This was during the implementation of COVID-19 movement restrictions, which may have had an impact on the response rate.
- The survey had a total of 54 questions addressing: contractors' knowledge of OPM and training needs; undertaking of OPM contracts; frequency of OPM encounters (if any); frequency and severity of any health impacts resulting from OPM exposure; reporting of health impacts; and how health impacts have affected the business and working practices.
- Contractors and practitioners surveyed were knowledgeable about OPM and its potential health impacts, but felt they required more training both to prevent health impacts when encountering OPM, and to deal with any health impacts if they occur. Preferred organisations to deliver this training were similar to those from which contractors and practitioners were already receiving their OPM information – namely AA and Forestry Commission.
- Just over half of all the contractors and practitioners surveyed had encountered OPM, with a similar proportion of encounters across most roles and employer / organisation types. Most encounters in the last 12 months were planned rather than incidental.
- Just under a third of those who encountered OPM suffered health impacts, of which a rash or skin irritation was the most common and severe. However, this rarely corresponded to affected individuals missing time off work. Reporting by individuals with health impacts occurred less than half the time, mostly because they themselves judged the symptoms too mild to report.
- Over 70% of those who had encountered OPM reported that health impacts had no impact on their business. Impacts that were reported included direct financial costs from loss of work, and increased amount of work dealing with nests, despite health impacts.

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1. Introduction

Oak processionary moth (OPM), *Thaumetopoea processionea* L. was introduced to the United Kingdom in 2006 and then first reported within two boroughs of London (Forestry Commission, 2016b). The likely method of introduction of the pest was via infected oak trees and a number of UK oak species are susceptible to infestations. While evidence for severe effects on tree health in the UK has been limited, defoliation does occur. In addition, humans and animals may experience respiratory, ocular and dermatological problems from exposure to urticating hairs on caterpillars of the species (Forestry Commission, 2016a; ICF, 2016).

Since 2011 the policy focus has been to limit the impacts on human, animal and tree health that result from its presence (Forestry Commission, 2016b), by controlling the rate of spread of OPM from known areas of infestation. The Department of Environment, Food and Rural Affairs (Defra) plant health team and the Forestry Commission have coordinated control activities through the OPM Control Programme (OPMCP). The OPMCP has undertaken a number of activities to manage and contain the pest. OPMCP undertakes surveillance and monitoring to locate the furthest spread of the pest from known areas of infestation. Informed by this surveillance process, the containment policy has operated according to the limits of geographical spread and known severity. As such, control activities have been targeted according to three areas. The Core Zone - where no government-supported control activities are undertaken - is the main infestation and outbreak area. In the Core Zone statutory plant health notices (SPHN) are issued, and advice is offered to land managers for their own control programs. Around the Core Zone is the Control Zone, where government control activities take place to manage OPM largely through a control service provided by the OPMCP. Regions thought to be free of OPM infestation at present form the Protected Zone. The OPMCP also responds to incidents outside the Control zone where OPM may be reported, for example by being imported in new planting stock. Nonetheless, control activities are not without their impacts and concerns have been raised about the impact on other species from some agents used to manage OPM by nest spraying (*Bacillus thuringiensis var kurstaki* (BT), diflubenzuron and deltamethrin).

In 2017 – 2018 DEFRA began to develop a risk-based approach to controlling OPM. This approach moves the focus of policy to prioritising the management of impacts based on an assessment of critical risks among stakeholders. These risks may include public, occupational or animal health, financial or reputational risks and potential impacts on local biodiversity or landscape. This is a shift in focus from policy aims seeking to mitigate the spread of OPM, or indeed the early attempts to eradicate the pest (ICF International, 2016). Also in 2017-2018 Forest Research was commissioned to undertake social research that would inform the development and piloting of a risk-based approach to managing OPM. This research focused on two case study areas of London – Fulham located in the Core Zone and West Hampstead in the Control Zone. The two case study areas had similar geographic characteristics with respect to the mix of land uses, stakeholder types and levels of OPM infestation on oak trees.

Mixed methods research used a public survey alongside land manager interviews to gather information about attitudes and perceptions of stakeholders concerning OPM. The research focused on behavioural insights around how and why land managers control OPM, and whether the public would support this control. Pilot work was also conducted to monitor the incidence of health problems via surveys of local pharmacies and medical practices.

The 2018 – 2019 research focussed on the planning responses to OPM amongst stakeholders at two different scales, investigating the key concerns around resource allocation, communication, and the management of risk that emerged from the previous work. This investigation into risk perception had two primary goals: Firstly, to understand the perceived risks among land managers dealing with OPM at specific sites within the core and control zones; and secondly to gather more robust evidence from local authority stakeholders regarding their strategic level assessment of risk around OPM and how this affects their responses across their areas of responsibility.

The research used a series of workshops bringing together site managers and Local Authority representatives, to discuss:

- Risk assessment and the tools required to develop site-based management plans for OPM
- Risk assessment and the tools required to develop strategic planning within a Local Authority and to help with communication with other audiences.

Amongst site managers, public health was the biggest concern for the majority of participants regardless of management objectives and this is closely linked to reputational risks. Other reported concerns relate to occupational health, legal liabilities of landowners relating to ill-health and the financial costs of managing OPM. Participants highlighted a need to study the long-term impacts of control measures on biodiversity, specifically other Lepidoptera and parasitoids. Some of the key challenges raised by site managers in relation to the development of site-based plans include identifying numbers and distribution of oak and wide-ranging resource constraints. At the strategic workshops with local authorities, public health was the most frequently named risk. Control costs and Tree health were also frequently reported. In general across the local authority participants, likelihood and impact scores were similar within any one category of risk. Across the three workshops, Public health and Control cost emerged as the most likely and impactful risks to local authorities.

The findings from research thus far fed into the design of the RBA research approach for 2019-2020 which focussed on selected 'early adopter' land managers willing to complete test management plans and local authorities. The main objectives of the 2019-2020 research reported here was to:

- To evaluate the process and outputs of engagement between the OPMCP and ‘early adopter’ landowners to develop site-based OPM risk management plans and understand support requirements.
- To evaluate the process and outputs of engagement between the OPMCP and ‘early adopter’ local authorities to understand requirements for guidance and tools to support strategic planning for a RBA to OPM management.
- Understand the most effective mechanisms to engage with, and support the needs of, private residents with oak trees.
- Uncover evidence about the occupational health impacts and associated issues amongst arboricultural contractors and sector stakeholders.
- Develop a plan for engagement with a broader range (i.e. not early adopter) of landowners and local authorities to ‘cascade’ learning from early adopter work and to improve understanding of opportunities and barriers to OPM risk management planning and support requirements as basis for expansion of RBA trials in 2020-21.
- Develop a draft evaluation framework for the RBA based on 1st year of 3 year iterative evaluation design process.

1.1. Health impacts of OPM among contractors and practitioners

The occupational health impacts of Oak Processionary Moth (OPM) amongst arboricultural contractors and other sector stakeholders is largely anecdotal. However, contractors engaged in OPM management and control in Greater London and the surrounding area are in the higher risk category of occupational health impacts from OPM. For example, contractors undertaking other general arboricultural work may accidentally be exposed to health risks, if the presence of OPM was not known at the start of works.

Research undertaken by Forest Research (Marzano et al, 2018, 2019) has involved a small number of formal interviews with contractors, a tree officer and a sector representative, as well as workshops involving local authority tree officers and land managers, which included discussion of health impacts on contractors and practitioners. Data collection was focussed in London and the South East of the UK, where experience of OPM management related occupational health impacts is higher than elsewhere in the UK.

The research indicated land managers and contractors themselves believed OPM was a considerable risk, despite the use of PPE. Contractors reported severity of symptoms increased with incidence of exposure, and there was minimal reporting of health impacts due to a culture of not reporting what are perceived as minor symptoms, compounded by no official reporting processes. Training needs were also identified and these related to reacting and managing OPM incidents, clarifying responsibilities with regard to OPM and potential health risks of OPM waste disposal. Land managers shared concerns for the capacity of contractors to manage OPM and dispose of waste safely. Training on how to attend to health

impacts was also highlighted, particularly if impacts could have an effect on the contractors' ability to work.

Interviews with contractors and an individual from a representative organisation suggested that contractors may not be willing to discuss health impacts in interviews, but that an anonymous survey may elicit better a better response. Using the reach of representative organisations to recruit contractors and practitioners into such a survey was recommended (Marzano et al, 2018).

The work in 2019-20 aimed to build on this initial understanding by incorporating the views of a greater number of arboricultural contractors across the UK, including those who have encountered OPM as well as those who have not. Capturing the views of those not currently dealing with OPM is important since they may need to respond to incursions of OPM in the future.

The research aimed to increase the understanding of occupational health impacts of OPM on contractors and practitioners. Particularly we aimed to determine the degree to which health impacts from OPM exposure are felt by this group, whether the impacts are adequately addressed, and what support could be put in place to ameliorate these impacts. There key objectives were to:

- Obtain a representative understanding of the occupational health impacts of OPM in the UK, from the perspective of contractors themselves
- Understand the OPM knowledge and experience of contractors, particularly their awareness of occupational health impacts
- Record how frequently contractors have encountered OPM (if at all) and if encounters were purposeful or incidental
- Record the frequency and severity of any health impacts which have resulted from OPM exposure, and the specific symptoms suffered
- Understand how the health impacts of contractors have affected their businesses and working practices
- Capture how the health impacts of OPM are recorded at business level (if at all)
- Understand the information and training needs of contractors with respect to the intersection between OPM and occupational health

2. Methodology

2.4. Health impacts of OPM amongst contractors and practitioners

2.4.1. Survey design

An online questionnaire comprising of 54 questions covering: contractors' knowledge and experience of OPM; frequency of OPM encounters (if any); frequency and severity of any health impacts resulting from OPM exposure; how health impacts have affected the business and working practices; the reporting of health impacts; and OPM training and information needs (Appendix 1: OPM contractor survey). The questionnaire was developed by Forest Research, with input on structure, questions and industry terminology from partners at Arboricultural Association (AA) and Defra. Partners from AA also piloted the online questionnaire to ensure the logic structure of the online survey. No piloting was conducted by participants. The questionnaire was open from March 13th to April 27th 2020. Participant consent was gained through the first question of the questionnaire (Appendix 1: OPM contractor survey) and was required to continue the survey.

2.4.2. Recruitment

The AA distributed the survey link to its membership in the monthly email newsletter (17th March 2020), with a reminder in the middle of the open survey period (newsletter issue 61, April 2020). Recipients of the email were encouraged to share the survey link with others in the arboricultural sector, including colleagues and employees. The AA mailing list consists of around 3,500 members. An article containing the link was hosted on the AA website for the duration of the survey period (www.trees.org.uk), and a link to the article was also shared on twitter by the AA Twitter account (@ArbAssociation). The recruitment period coincided with the implementation of COVID-19 movement restrictions, which may have had an impact on the response rate. Following removal of responses without consent and duplicates, a total of 210 unique responses were received (Table 1). Completed and partially completed responses were pooled for analysis.

Table 1 - Survey responses

Response status	Number of responses
A Completed	136
B Partial (did not finish survey)	128
C Total [A + B]	264
D Removed as stated location outside UK	3
E Removed due to lack of consent	45
F Removed due to duplication	6
Unique responses [C-(D+E+F)]	210

2.4.3. Participants

Participant characteristics are summarised in section 3.1.1. Not all questions were compulsory so number of responses for each question may not add up to 210. In all cases the number of participants who gave an answer (n) is shown alongside counts for each question response, and percentages calculated as proportion of n.

Briefly, 161 participants (93%, n=173) were male and 8 participants (5%) female. 163 participants (94%, n=174) were white. This reflects a 2019 survey of those working in the private sector of UK arboriculture (Pye Tait Consulting, 2019) which shows the workforce to be majority white (98% British, Irish, or other white background) and male (80%).

Participants were most commonly *Climbing arborists* (45 responses, 21%, n= 171), followed by *Consultants* (36 responses 17%) and *Owner, proprietors* (32 responses, 15%). Participants' businesses were mostly *Self-employed /Sole-trader* (45 responses, 21%, n=170), followed by *Small arb contractor (1-9 employees)* (33 responses, 16%) and local authority (32 responses, 15%). Eleven participants in the *Self-employed /Sole-trader* group also ticked one or more other category, but as five of these also identified as *small arb contractors, self-employed /sole-traders* and *small arb contractors* remain the two most numerous groups represented in the sample.

2.4.4. Data management and analysis

The survey was built and hosted on SmartSurvey (www.smartsurvey.co.uk), and data was held on the site until the survey closed, after which it was downloaded to a Forest Research secure server. Data management, descriptive statistics and plotting were carried out in R Studio Version 1.1.463 (RStudio, Inc.) running R version 3.5.2 (R Core Team 2015).

3. Results

3.1. Health impacts of OPM among contractors and practitioners

Of the 146 participants who answered whether they had encountered OPM whilst at work, 54.8% responded that they had, meaning the survey recruitment method had achieved the aim of collecting responses both from those with experience of OPM, and from those without.

In total 210 people gave their consent to participate in the online survey. Not all questions were compulsory so the number of responses for each question may not add up to 210. In all cases the number of participants who gave an answer (n) is shown alongside counts for each question response, and percentages calculated as proportion of n.

Full survey data are shown in Appendix 2: OPM contractor survey results.

3.1.1. Participant characteristics

Participants were majority male (93%) and white (94%). Responses were mostly from organisations based in England (91.5%), with smaller numbers from Wales (5.1%) and Scotland (3.4%). No responses were received from organisations based in Northern Ireland. Age and gender of participants, and the number of years spent working in arboriculture are shown in Figure 1 and Figure 2, respectively.

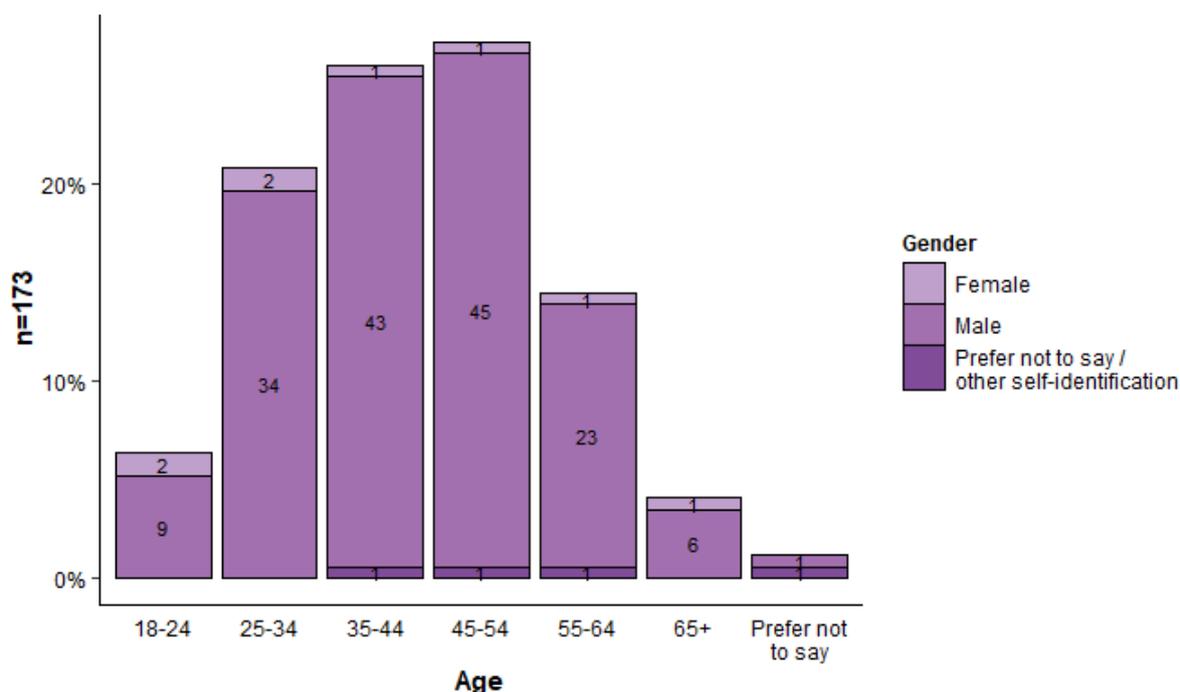


Figure 1 Age and gender of participants, n=173

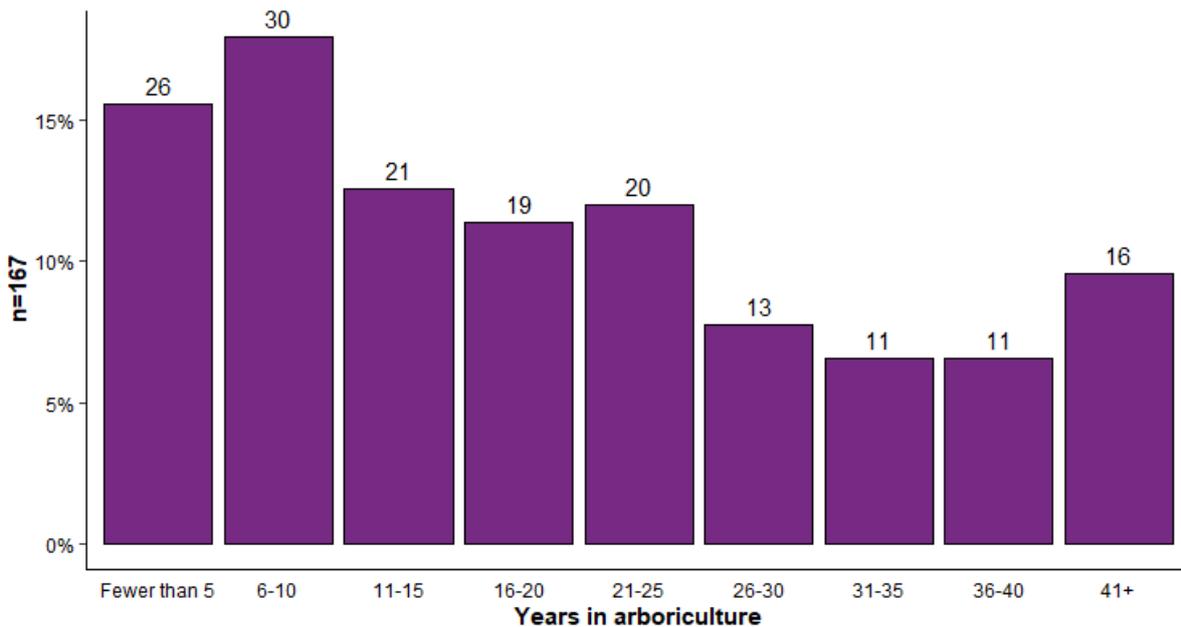


Figure 2 Number of years working in arboriculture, n=167

Participants came from a wide range of professional roles, the vast majority of which involved onsite work. Some roles mostly involved practical work (climbing arborists and arb-based ground workers) and others did not (tree officer) (Figure 3). It would be expected that roles which comprised of onsite practical work would be more likely to come into physical contact with OPM, either on purpose or incidentally, and thus result in health impacts. All roles were broadly equally split between those who had encountered OPM and those who had not (Figure 4)

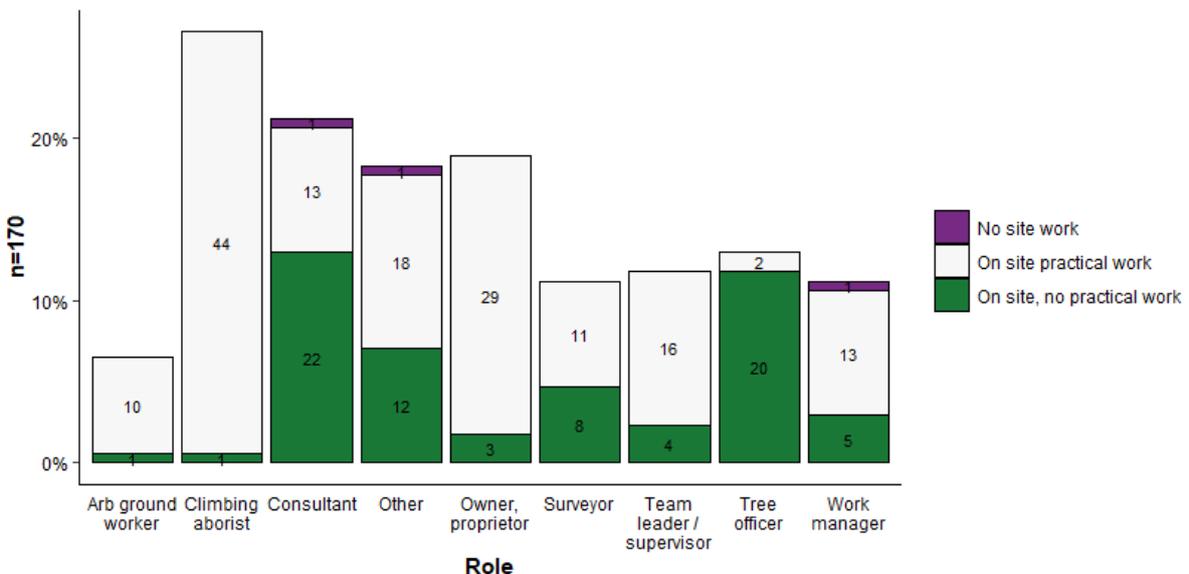


Figure 3 Professional role of participants and if they visit site or carry out practical work, n=170

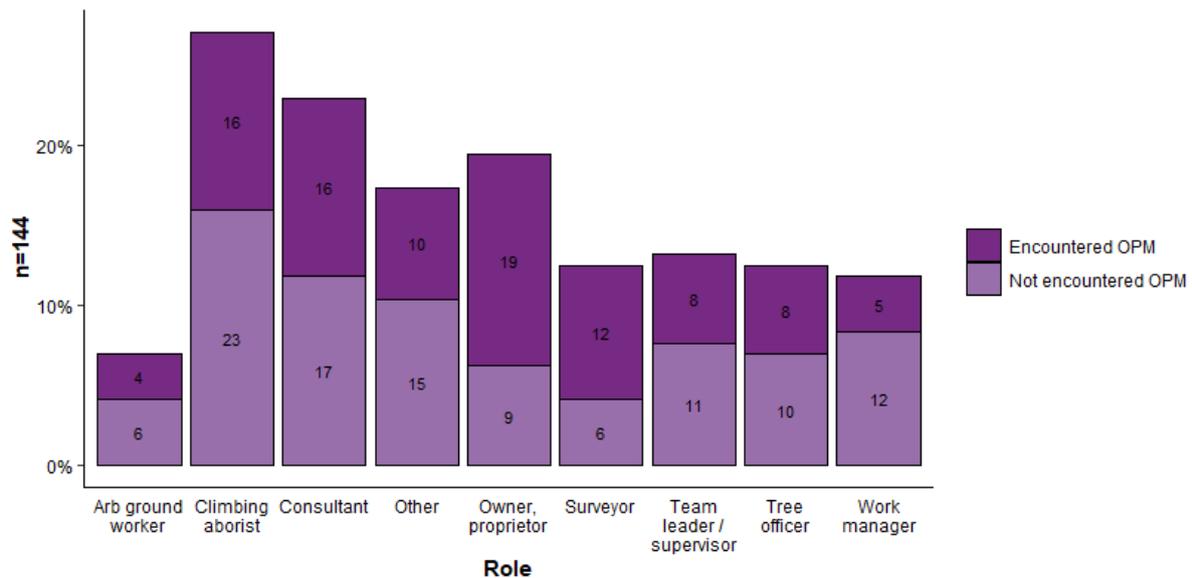


Figure 4 Professional role of participants and whether they have encountered OPM at work, n=144

The two largest categories of employer were self-employed /sole-traders and small arb contractors (1-9 employees) (Figure 5). Eleven participants in the self-employed group also ticked one or more other category, but as five of these also identified as small arb contractors, self-employed /sole-traders and small arb contractors remain the two most numerous groups represented in the sample. Most organisation types were broadly split between those who had encountered OPM and those who had not. Those which were not broadly equally split were large and medium sized arb contractors, which both showed a majority who had not encountered OPM.

Around half of participants had not worked at all within the 2019 Core Area (53.3%), or within the 2018 infestation outer area (47.3%) (Figure 6 & Figure 7. See also Figure 4).

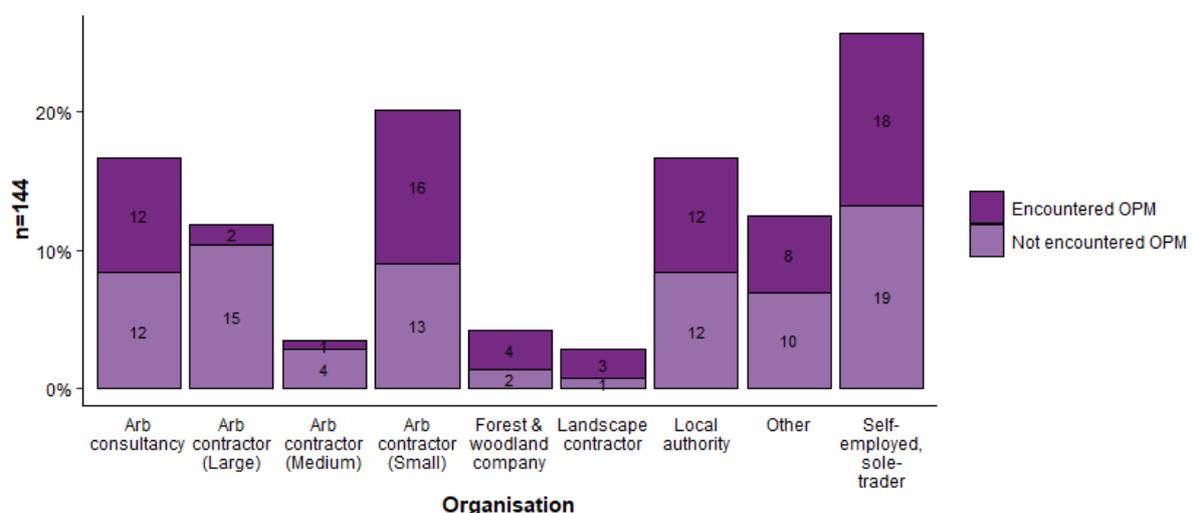


Figure 5 Employer type and whether participants have encountered OPM at work, n=144

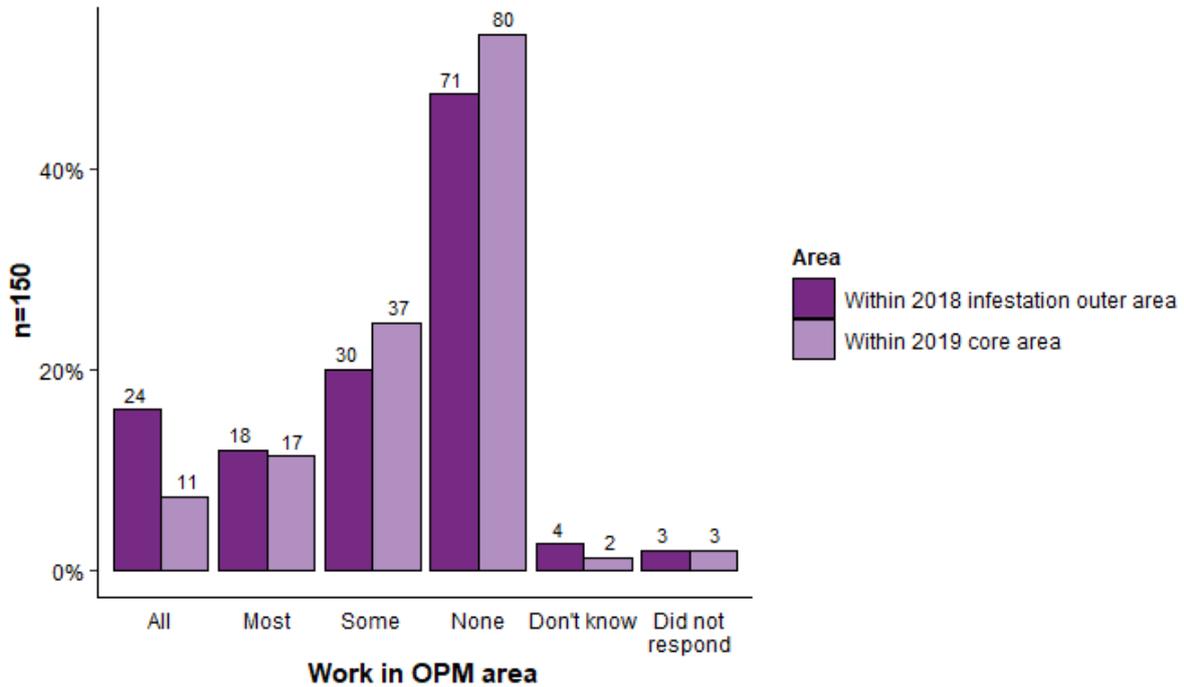


Figure 6 Do participants work in the 2019 core or 2018 infestation outer core areas, respectively, n=150

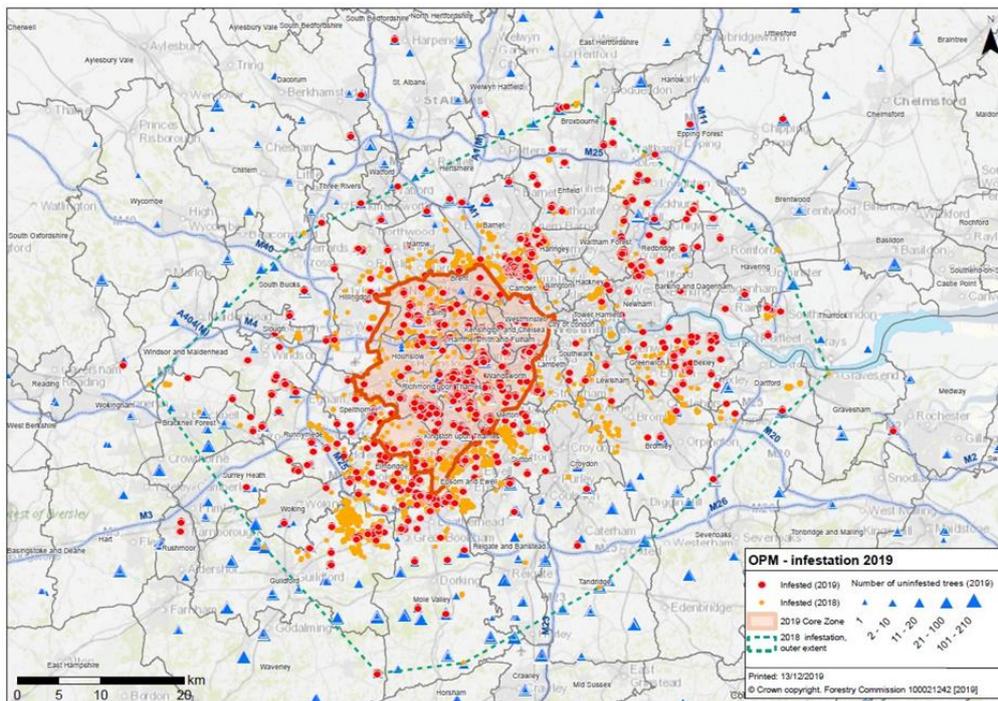


Figure 7 Map of Greater London and surrounding area, indicating 2018 infestation outer area and 2019 core area

3.1.2. Knowledge of OPM and training needs

Participants reported a high level of awareness and knowledge of OPM. A majority (55.6%) of participants responded that they were very aware of OPM and its potential health impacts. Only 1.3% responded that they had never heard of OPM. Of those participants who could

recognise at least one characteristic of OPM, a majority said they would recognise nests (89.9%), caterpillar processions (89.9%), or larvae (63.3%). A minority would recognise adult moths (43.8%) or egg-plaques (41.7%).

The most commonly reported sources of information on OPM were Arboricultural Association, Forestry Commission, and from personal experience of OPM (Figure 8). Further sources mentioned in the “Other” category of Figure 8 included formal education (e.g. further/higher education) and continued professional development (e.g. in-house courses).

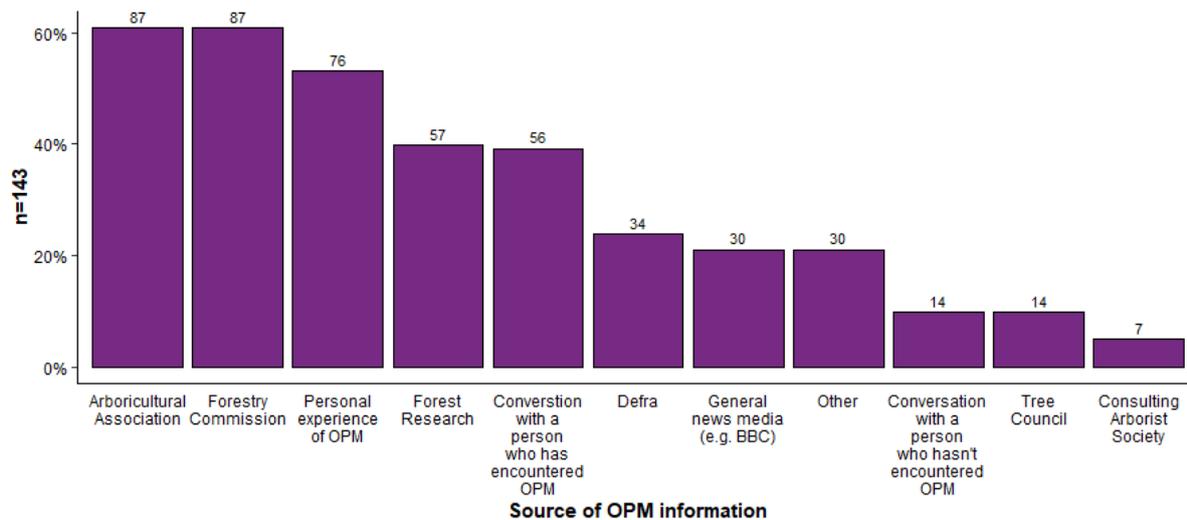


Figure 8 Source of information for understanding OPM, n=143

Participants gave details of a wide range of OPM training they had received (see Appendix 2: OPM contractor survey results). Training cited was most often provided by Forestry Commission or was in-house and has occurred mostly in the last 5 years, although on one occasion OPM training was recalled from 1995.

The needs identified as “critical” by participants are shown in Table 2, Figure 9 and Figure 10. Training needs are similar between those who have encountered OPM and those who have not. Both groups identify an apparent need for training regarding a) preventing health impacts of OPM encounters and b) dealing with any health impacts of exposure (Table 2).

Participants identified the Arboricultural Association as the preferred provider of OPM training delivery, followed by Forestry Commission (Figure 11). These preferences mirror the top current sources of OPM information (Figure 8), suggesting participants are at least satisfied with the OPM information they receive from these sources. Recruitment was undertaken via the Arboricultural Association mailing list of its members, so it would be expected that Arboricultural Association features highly as preferred provider.

Table 2 - Top OPM training needs (in rank order), based on those identified by participants as Critical. Left-hand column shows all participants, and remaining two columns show differences between those who have encountered OPM and those who have not. Orange boxes indicate training related to practically work with OPM; blue boxes indicate dealing with health impacts of OPM

All participants (n=123)	Those who have encountered OPM (n=62)	Those who have not encountered OPM (n=61)
Effect of repeated exposure (32.5%)	Effect of repeated exposure (32.3%)	Disposal of OPM contaminated material (36.1%)
Protocols for working with OPM (31.7%)	Protocols for working with OPM (30.6%)	Identification and treatment of health impacts (34.4%)
Identification and treatment of health impacts (30.9%)	Personal protective equipment for working with OPM (29.0%)	Protocols for working with OPM (32.8%)
Disposal of OPM contaminated material (30.9%)	Identification and treatment of health impacts (27.4%)	Effect of repeated exposure (32.8%)

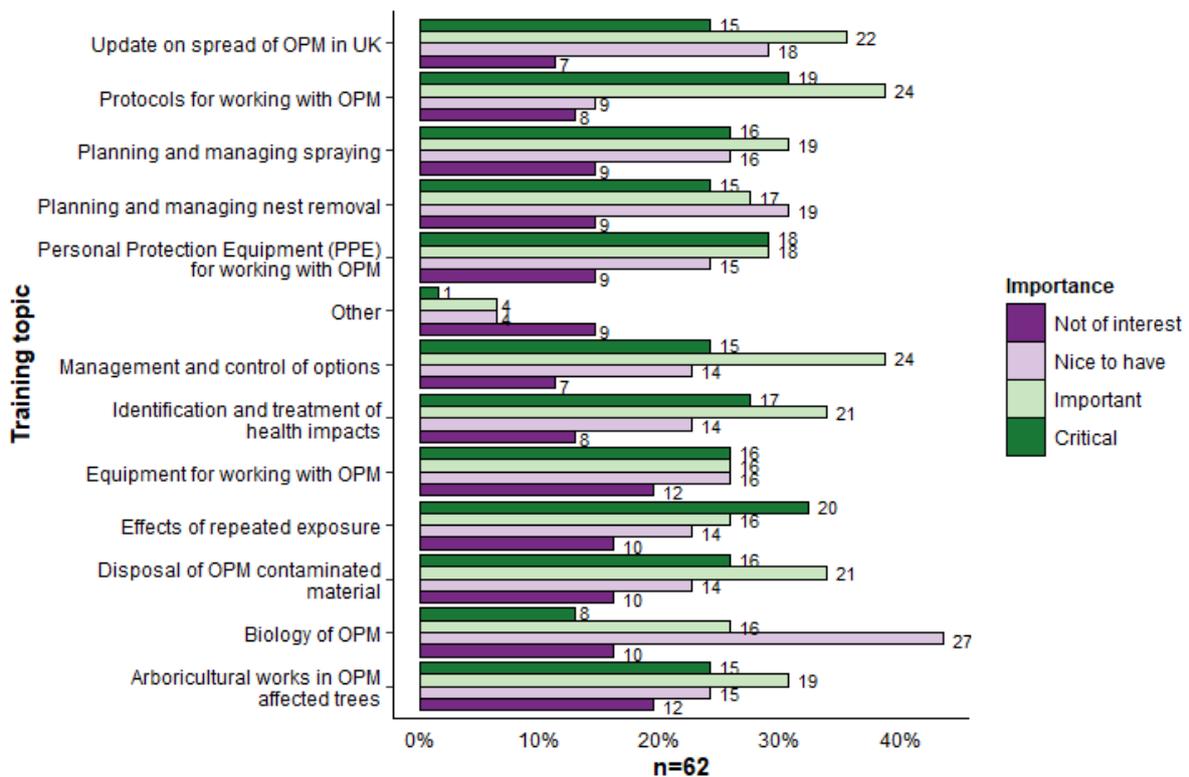


Figure 9 OPM training needs (those who have encountered OPM), n=62

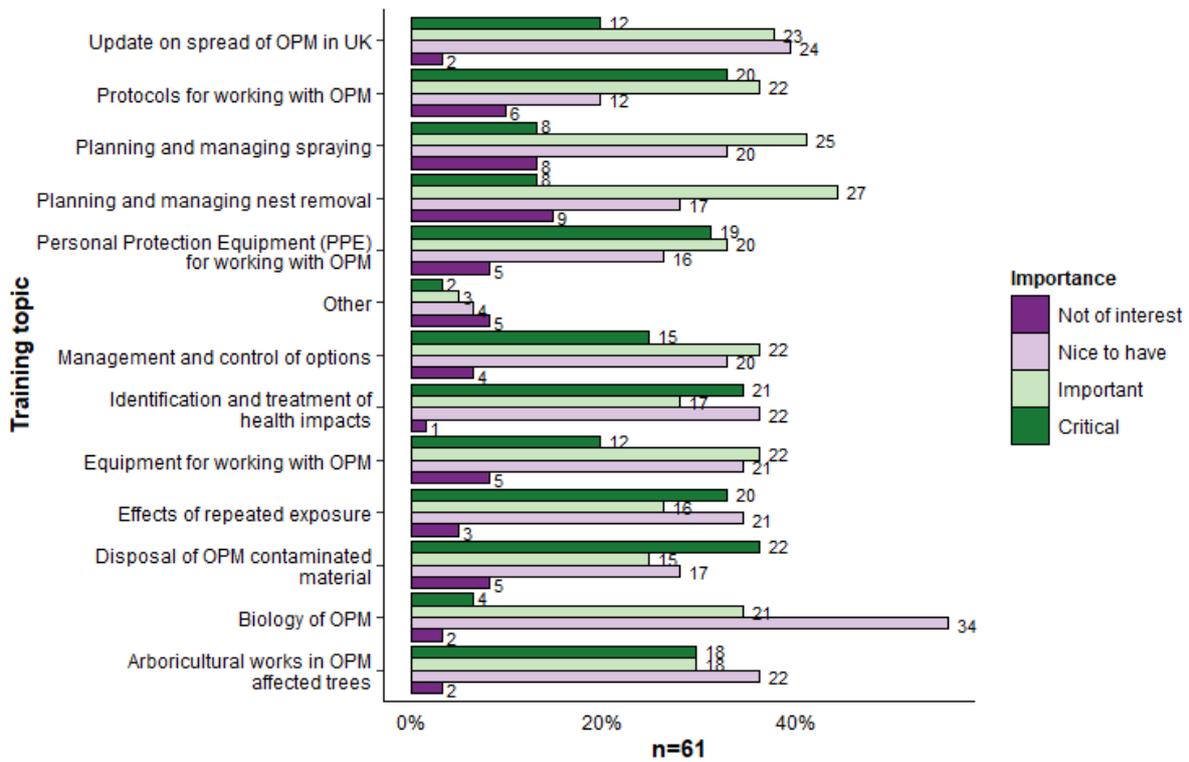


Figure 10 OPM training needs (those who have not encountered OPM), n=61

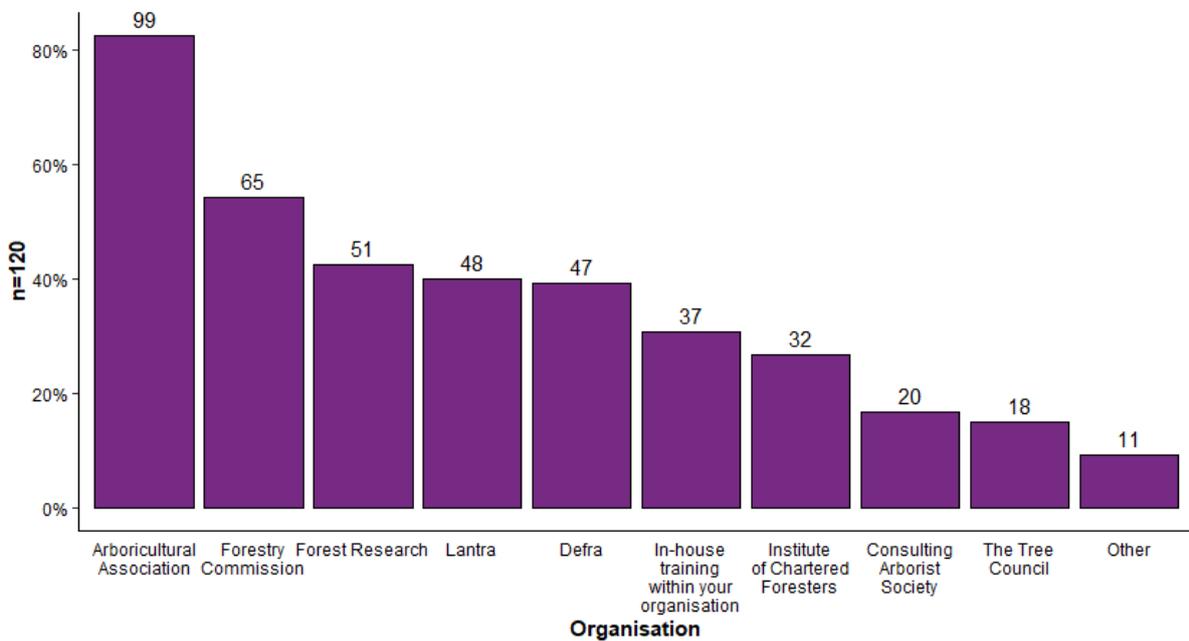


Figure 11 Who should deliver OPM training, n=120

Over half of participants (53.2%) wished only to receive communications about OPM when there is a major change in the situation, with 29.8% preferring a regular monthly update. Direct email was the preferred method of communication for OPM information (86.6%), but

leaflets through the post and information passed via employer were still popular methods (22.7% and 17.6%, respectively).

3.1.3. Undertaking of OPM contracts

Just under a quarter of participants (24.4%, n=135) have undertaken contracts specifically to manage OPM, with only 3.8% (n=130) turning down contracts for OPM management. Individual reasons given for turning down contracts included lack of equipment or training (2 responses, n=5), lack of time, organisation not offering OPM management service, and thinking the work itself was terrible. Time period when contracts were first undertaken is shown in Table 3.

Table 3 When participants first took on contracts to manage OPM, n=38

Time when OPM contracts were first undertaken	Number of respondents (n= 28)
2014 or before	5 (17.9%)
2015 - 2018	15 (53.6%)
2019 to present	7 (25.0%)
Upcoming	1 (3.8%)

3.1.4. Contractor encounters with OPM

Just over half of participants had encountered OPM while at work themselves (54.8% encountered; 45.2% had not encountered, n=146). For contractor encounters by professional role or organisational type see Figure 4 and Figure 5, respectively. Similarly, slightly more participants responded that others in their organisation (e.g. colleague, employee) had encountered OPM, than had not (42.9% encountered; 41.4% had not encountered; 10.0% not applicable; 5.7% don't know, n=140). Most participants who have encountered OPM themselves also indicated others in their organisation have as well (74.7%, n=75). Few who hadn't encountered OPM themselves, indicated others in their organisation had (6.2%, n=65).

A greater number of encounters with OPM have occurred in the last five years than 5+ years ago, but there is apparently little change between the last 12 months and the period 1-5 years ago (Figure 12). A greater proportion of encounters were planned (rather than incidental) in the last 12 months compared to the periods 1-5 years ago, and 5+ years ago (Figure 13). This could reflect the increase in the spread of OPM and an increase in the number of contracts to deal with the pest, or a combination of both.

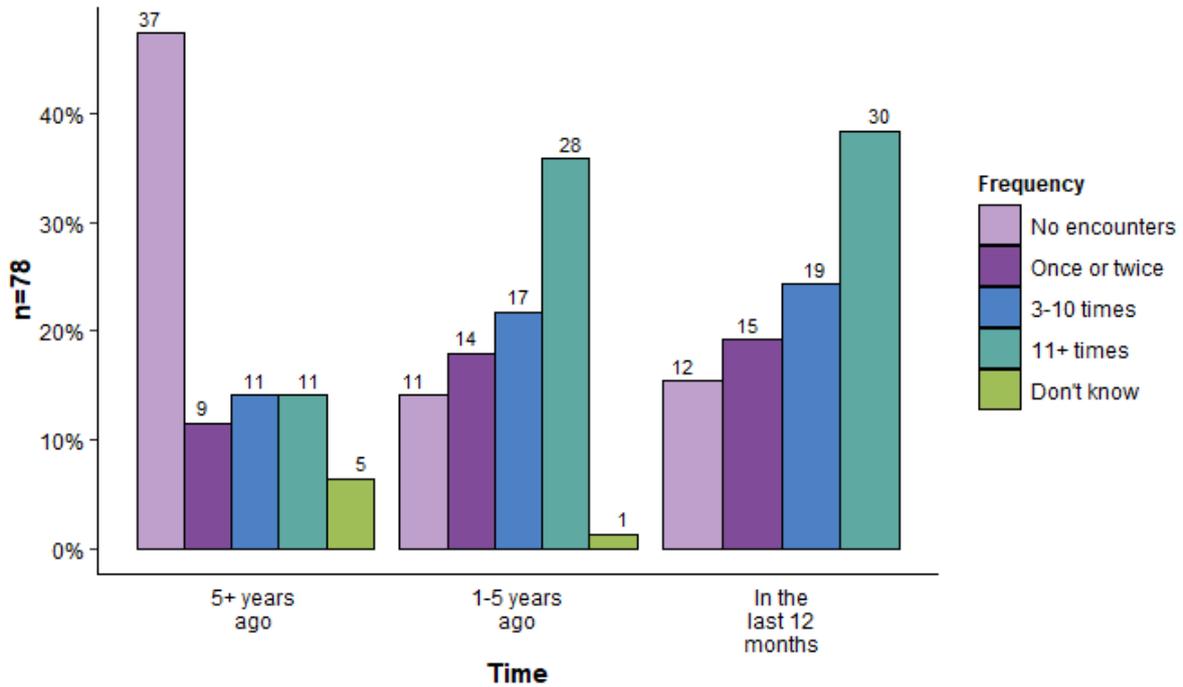


Figure 12 When and how often have participants encountered OPM, n=78

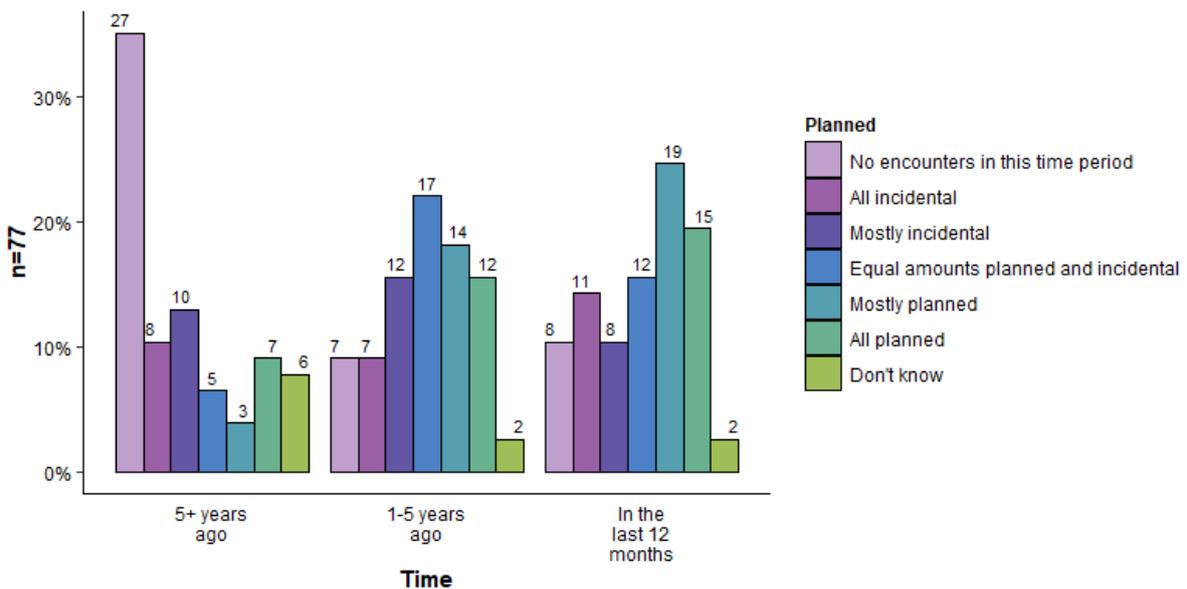


Figure 13 Were encounters with OPM incidental or planned, n=77

3.1.5. Health impacts of OPM

Most participants who encountered OPM did not suffer any related health impacts (64.1%, n=78). The frequency of health impacts is shown in Figure 14. The three main symptoms of OPM exposure are skin irritation or rash, eye complaints and breathing difficulties. Of those who suffered health effects, 96.4% (n=28) reported suffering skin irritation or rash, with the largest number of participants rating the symptom as severe (Figure 15). Eye complaints and breathing difficulties were reported by 35.7% and 18.5% of those who experienced health

effects, respectively (Figure 15). Participants who did seek attention mostly (80%, n=5) gave the reason that symptoms were severe. Upon repeated exposure, participants indicated the severity of symptoms generally stayed the same or became more severe (Table 4). However, only 19.2% (n=26) of those showing symptoms reported having sought medical attention. The majority (73.7%, n=19) of those who did not seek medical attention felt that their symptoms were not severe enough to warrant this action.

Participants' reports of health impacts of OPM exposure on others in their organisations are shown in Appendix 2: OPM contractor survey results.

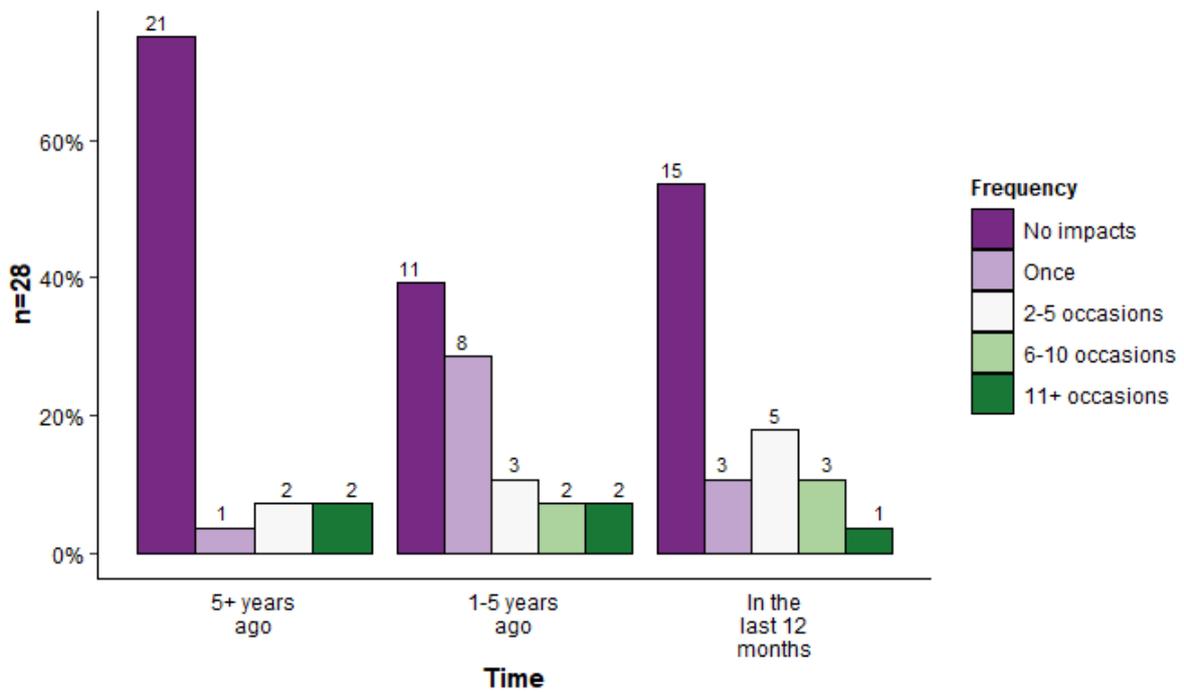


Figure 14 Frequency of health impacts due to OPM exposure, over time, n=28

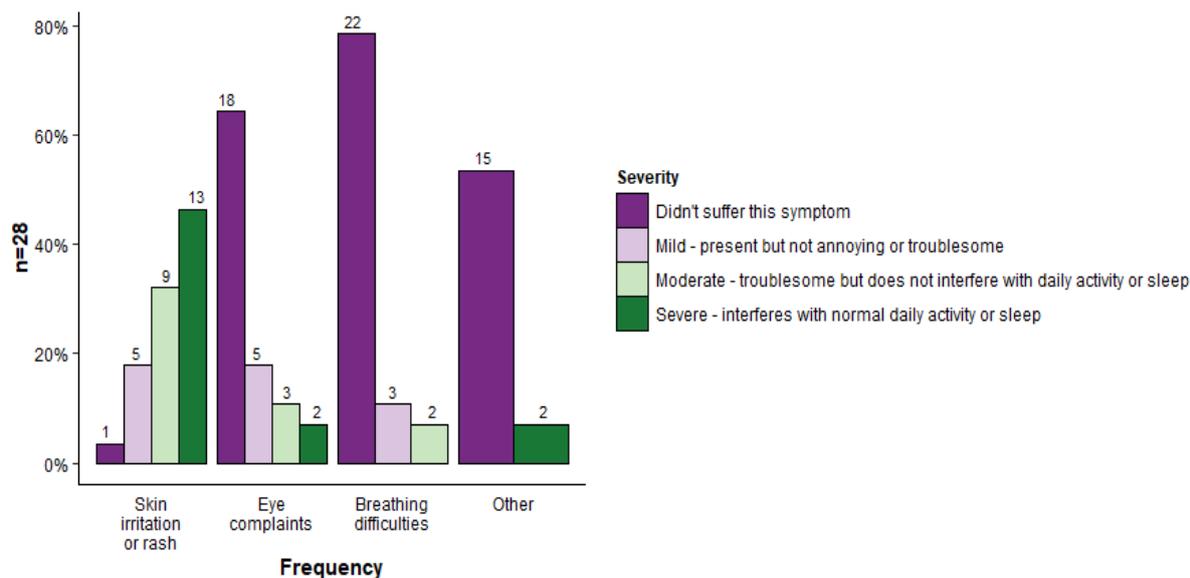


Figure 15 Severity of symptoms suffered, n=28

Table 4 Change in symptoms with repeated exposure

Change in symptoms upon repeated exposure	Number of responses (% , n=24)
Generally, become less severe with every exposure	2 (8.3%)
Been about the same every time	11 (42.8%)
Generally, become more severe with every exposure	6 (25.0%)
Not been the same every time, but not following a trend	2 (8.3%)
Not applicable (not had OPM health impacts on more than one occasion)	5 (20.8%)

Of those participants who had suffered a large number of wasp or bees stings in recent years, or who were particularly susceptible to wasp or bee stings, the proportion who suffered health impacts due to OPM exposure, was similar to those who didn't (Table 5).

Table 5 Health effects and relationships to bee or wasp stings

Health impacts due to OPM exposure	Large number of bee or wasp stings in recent years, n= 71		Susceptibility to bee or wasp stings, n= 76	
	Yes	No	Yes	No
Yes	8 (11.2%)	18 (25.4%)	7 (9.2%)	19 (25.0%)

No	9 (12.6%)	36 (50.7%)	7 (9.2%)	43 (56.6%)
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3.1.6. Reporting of OPM health impacts

Almost half of participants (47.7%, n=128) indicated that reporting of health impacts due to OPM was compulsory in their organisation. Of those who suffered health impacts of OPM exposure, 39.3% (n=28) reported it in some way. Where the report was made is shown in Table 6. 64.3% (n=14) of those who didn't report their health impacts, indicated it was because they didn't think the symptoms were severe enough.

Table 6 Process for reporting health impacts of OPM exposure, n=11

Where was OPM reported to	Number of responses (% , n=11)
Occupational health	1 (9.1%)
Health & Safety	4 (36.4%)
Line manager	7 (63.6%)
Accident book or system	4 (36.4%)
Other	1 (9.1%)

3.1.7. Business consequences of OPM health impacts

The majority (91.7%, n=24) of participants who reported suffering health impacts of OPM exposure reported that they did not miss a day of work because of it, and 72.0% (n=50) of participants responded that the health impacts of OPM had no consequences on their business (Figure 16). Business consequences in the "Other" category of Figure 16 include direct financial costs due to loss of work and increased amount of work due to extra business dealing with nests.

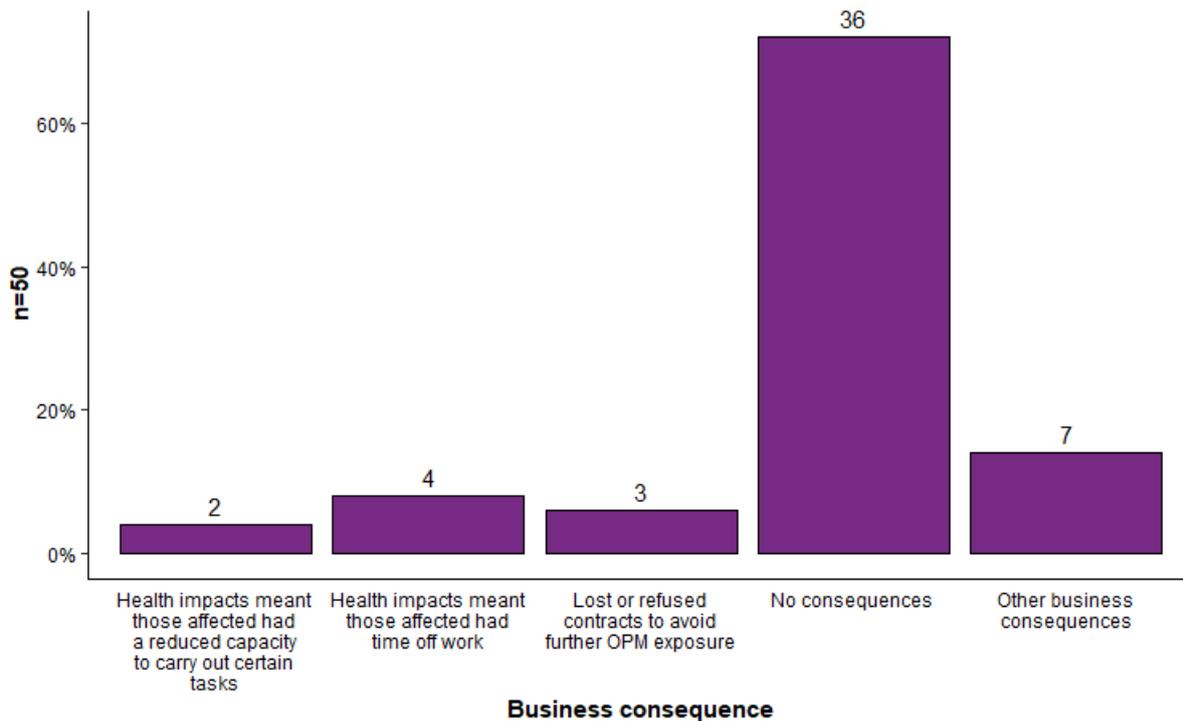


Figure 16 Business consequences of health impacts of OPM exposure, n=50

3.1.8. Working practices

Various Personal Protective Equipment (PPE) is recommended for use when working with OPM or in areas where OPM is likely to be (for example see Forest Research OPM manual <https://www.forestresearch.gov.uk/tools-and-resources/pest-and-disease-resources/oak-processionary-moth-thaumetopoea-processionea/opm-manual-8-occupational-health/>).

PPE worn by respondents when encountering OPM is shown in Figure 17.

Mitigation methods taken by organisations to reduce of the risk of health impacts due to OPM exposure are shown in Figure 18, with the most common being staff training (80.0%, n=30), followed by providing PPE (70.0%).

When asked if working practices have changed regarding OPM, participants mentioned checking new planting stock and working sites more thoroughly, changing stock suppliers, and writing new risk assessments. Full list of working practices is shown in Appendix 2: OPM contractor survey results.

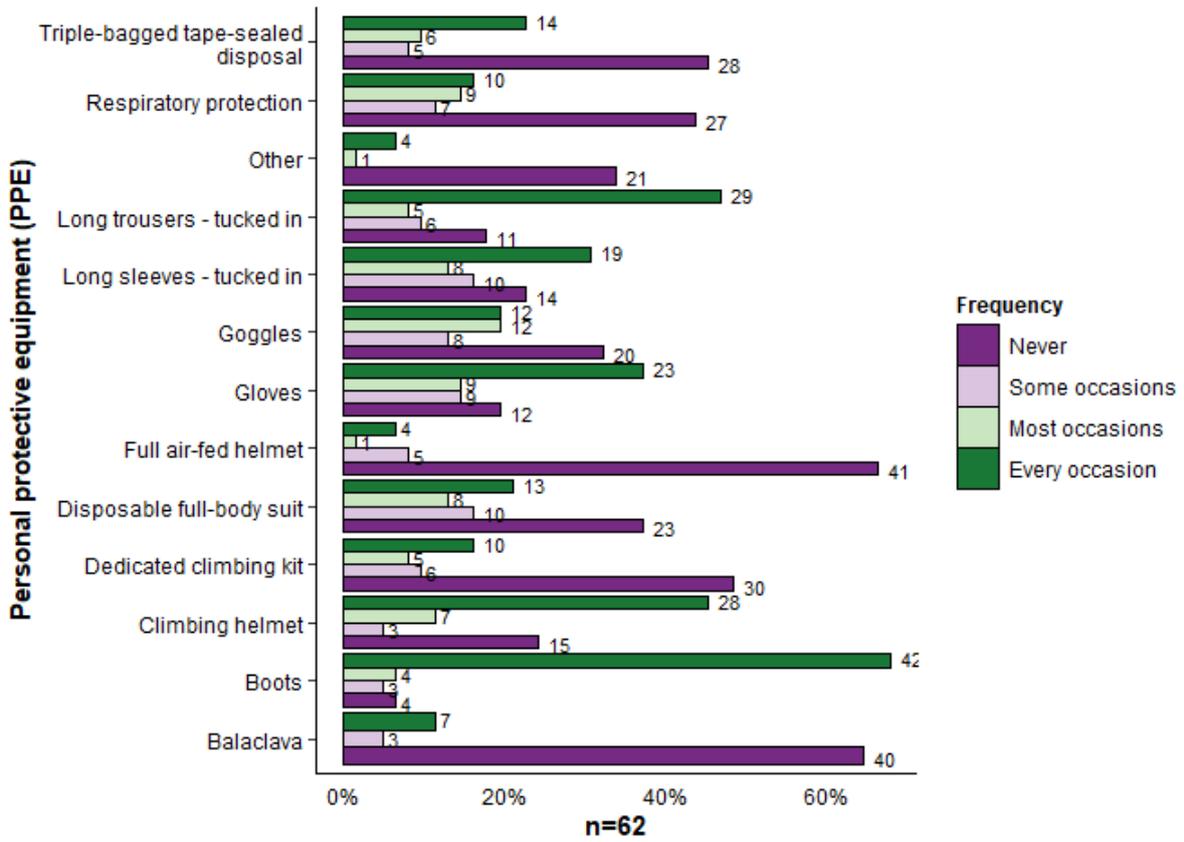


Figure 17 Personal Protective Equipment (PPE) used when encountering OPM, n=62

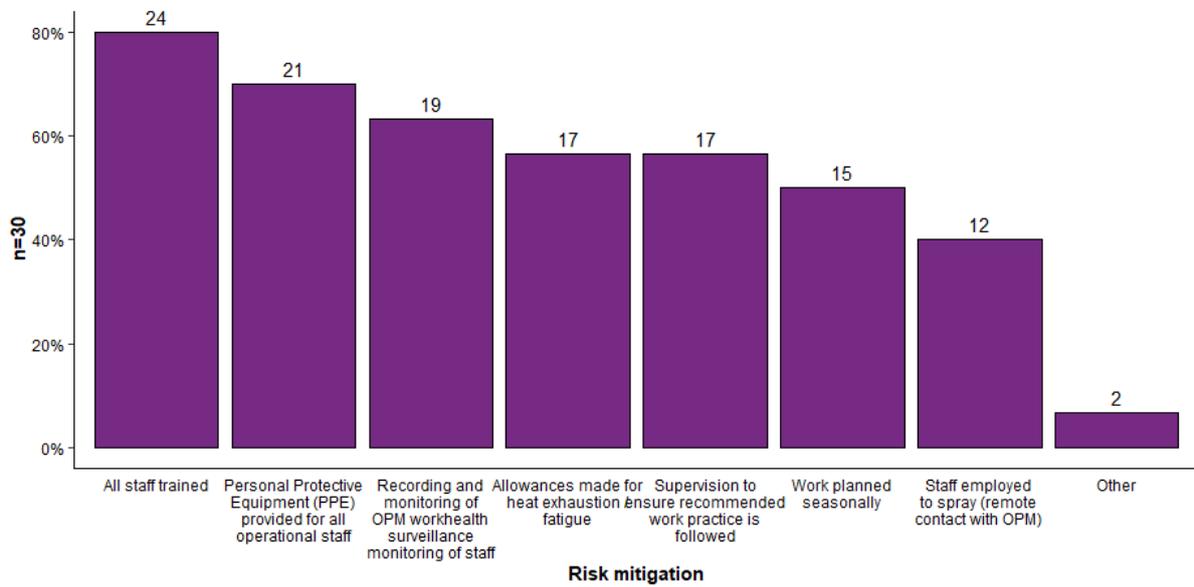


Figure 18 Actions taken to mitigate risks of health impacts of OPM. Error in online survey clumped two categories together resulting in a category "Recording and monitoring of OPM workhealth surveillance monitoring of staff". Category is included in figure for completeness, n=30

4. Key messages in using a Risk Based Approach to OPM

Training for contractors and practitioners is desired, particularly in the areas of preventing health impacts of OPM exposure and in dealing with health impacts if they occur. Health impacts which individuals judged as too mild were not reported within organisations, which may lead to an underestimation of the overall health burden of OPM work. A requirement to collect health impact and PPE data alongside reports of OPM work would help fill this data gap, allowing predictions to be made on likelihood of health impacts occurring under different work conditions (e.g. using different forms of PPE). Risk could then be better assessed by practitioners prior to undertaking OPM contracts.

5. References

ICF (2016) 'Evaluation of the Oak Processionary Moth Control Programme: Final Report', *Report to Defra*.

Marzano, M., Ambrose-Oji, B., Moseley, D., Atkinson, M, Stokes, J. and Rix, H. (2019) *Understanding tactical and strategic approaches to the future management of Oak Processionary Moth (OPM)*. Internal report, Forest Research, unpublished.

Marzano, M., Moseley, D., Ambrose-Oji, B., Atkinson, M., Hall, C. and Sing, L. (2018) *Understanding landowner risk perception and behaviours for future management of Oak Processionary Moth (OPM)*. Internal report, Forest Research, unpublished.

Pye Tait Consulting (2019) *2019 Horticulture Sector Skills Survey – Sub-Sector Report : Arboriculture A report for the Ornamental Horticulture Roundtable Group*.

6. Appendices

Appendix 1: OPM contractor survey

Please read the following statements carefully: I understand that my responses will be confidential, which means my answers to survey questions will not be shared outside of the research team. I give permission for these individuals to have access to this data .I understand that data that is used in any reports and other documents produced will be anonymised; meaning the research team will not identify individuals or organisations who have taken part in the survey. The final report will be made available to Defra, the Forestry Commission and others with an interest in the results. I understand that the information collected today will be treated, stored and analysed in line with the requirements of the General Data Protection Regulation (2016).

Q1) I give consent for my responses of this survey to be used as described

- Yes
- No [end survey]

Q2) Gender

- Male (including transgender men) / female (including transgender women) / prefer not to say / prefer to self-describe (comments box)

Q3) Age group

- Under 18 / 18-24 / 25-34 / 35-44 / 45-54 / 55-64 / 65+ / Prefer not to say

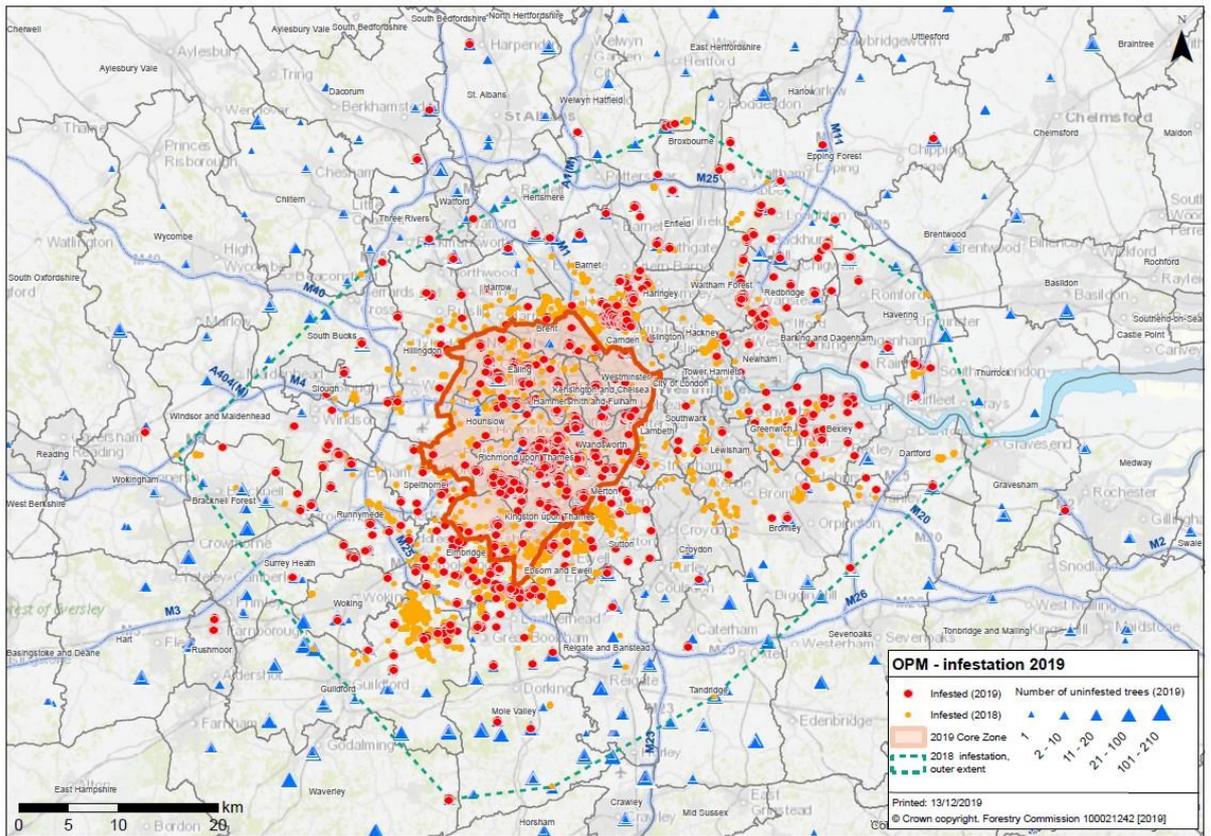
Q4) Ethnicity

- Arab / Asian/Asian British / Black/African/Caribbean/Black British / Latino/Hispanic / Mixed/Multiple ethnic groups / White / prefer not to say / Other ethnic group (comments box)

Q5) Which of the following best describes your occupation and your business or employer? (tick all that apply)

- Climbing arborist
- Arb ground worker
- Team leader/ supervisor
- Works manager
- Owner/ proprietor
- Tree Officer
- Consultant
- Surveyor
- Other > Please state

- Q6) Which of the best describes your business or employer? (tick all that apply)
- Self-employed/ Sole trader
 - Small arb contractor (1-9 employees)
 - Medium arb contractor (10-19 employees)
 - Large arb contractor (20+ employees)
 - Arboricultural consultancy
 - Local Authority
 - Landscape contractors
 - Forest and woodland management company
 - Other > Please state
- Q7) How many years in total have you worked in arboriculture? (numerical; units = years)
- Q8) Do you personally work on site as part of your job?
- Yes – I carry out practical work myself on site / Yes – I visit sites, but don't carry out practical work / No – I don't visit sites in my job
- Q9) We are hoping to better understand how OPM affects businesses in different parts of the country. Where is your business or your employer based?
- Postcode of head office
 - Postcode of local office where you are based (if different from head office)
- Q10) How much of your organisation's work occurs in areas affected by OPM? (see map)



- All / most / some / none / don't know

Q11) What are your experiences of OPM?

- I have never heard of it [end survey]
- I have heard of OPM but I don't know much about it, or the potential health impacts
- I have heard of OPM and have a reasonable understanding of it and the potential health impacts
- I am very aware of OPM and understand a lot about it and the potential health impacts

Q12) Would you recognise these characteristics of OPM if you saw them? (tick all that apply)

- Egg plaques
- Larvae
- Nests
- Procession
- Moths

Q13) Where has your understanding of OPM come from up until now? (tick all that apply)

- Arboricultural Association
- Consulting Arborist Society
- Defra

- Forestry Commission
- Forest Research
- Tree Council
- General news media (e.g. BBC)
- Personal experience of OPM
- Conversation with a person who has encountered OPM themselves (e.g. colleague, client, employer, friend)
- Conversation with a person who hasn't encountered OPM themselves (e.g. colleague, client, employer, friend)

Q14) Have you encountered OPM at work?

- Yes / no

Q15) How many times have you encountered OPM?

	Number of sites with OPM present (tick one per row)				
	No encounters	Once or twice	3-10	11+	Don't know
In the last 12 months					
1-5 years ago					
5+ years ago					

Q16) Were these encounters planned (you knew OPM was likely to be present) or incidental (you first learned OPM was present when the job had started)?

	Number of sites with OPM present (tick one per row)						
	All planned	Mostly planned	About the same	Mostly incidental	All incidental	No encounters during this period	Don't know
In the last 12 months							

1-5 years ago							
5+ years ago							

Q17) On those occasions you have been exposed to OPM, have there been any negative health effects?

- No
- Yes
 - On a small number of occasions / on several occasions / on every occasion

Q18) What were the symptoms and how would you describe the severity of those symptoms? If you have suffered symptoms on more than one occasion, please record the most severe level you have suffered.

Symptom	Severity (tick one per row)			
	Mild (present but not annoying or troublesome)	Moderate (troublesome but does not interfere with daily activity or sleep)	Severe (interferes with normal daily activity or sleep)	Didn't suffer this symptom
Skin irritation or rash				
Eye complaints				
Breathing difficulties				
Other (please describe)				

Q19) Have any of these symptoms persisted long after the end of exposure?

- No
- Yes

Q20) Which symptoms persisted (tick all that apply)

- Skin irritation or rash
- Eye complaints
- Breathing difficulties
- Other (describe symptoms)

Q21) Can you estimate how many (if any) days you have missed work due to health impacts of OPM? (numerical; units = days)

Q22) How many times has an OPM exposure led to you suffering health impacts?

	Number of times you have suffered any health impacts				
	No impacts	Once	2-5 occasions	6-10 occasions	11+ occasions
In the last 12 months					
1-5 years ago					
5+ years ago					

Q23) If you have suffered health impacts of OPM exposure on more than one occasion, have the symptoms:

- Generally become less severe with every exposure
- Generally become more severe with every exposure
- Been about the same every time
- Not been the same every time, but not following a trend with every exposure
- Not applicable (not had OPM health impacts on more than one occasion)
- Do you know why the health impacts are different on different occasions? (free text)

Q24) On those occasions you have suffered health impacts due to OPM exposure, did you report / record it?

- Yes / no

Q25) Did you report it / record it on:

- some occasions / most occasions / every occasion

Q26) Why did you record it? (free text)

Q27) Who did you report it to, or how was it recorded?

- Occupational health
- Health & Safety
- Line manager
- Accident book
- Other (please detail)

- Q28) Have you ever suffered health impacts of OPM but not reported it?
- Yes / no
- Q29) What were your reasons for not reporting / recording your health impacts? (free text)
- Q30) Have you ever sought medical attention due to OPM exposure?
- Yes / no
- Q31) What made you seek medical attention?
- Severity of symptoms
 - Didn't know what was wrong
 - Needed confirmation for work absence
 - Other (please specify)
- Q32) Who did you go to?
- Accident & Emergency
 - General Practitioner / family doctor
 - First aider (at work)
 - First aider (outside of work)
 - Other (please state)
- Q33) What kind of treatment did you receive?
- Referral
 - Prescription medication
 - Recommend time off work to recover
 - Recommend change in behaviour (e.g. stop working with OPM completely)
 - Other (give details)
- Q34) What were your reasons for not seeking medical attention? (free text)
- Q35) Are you aware of any negative consequences of not seeking medical attention? (free text)
- Q36) Have you had a large number of bee and/or wasp stings in recent years?
- Yes / no
- Q37) Are you particularly susceptible to bee and/or wasp stings?
- Yes / no

Q38) Has anyone else in your organisation (colleague, employee) ever encountered OPM at work?

- Yes / no / don't know / NA (e.g. sole trader)

Q39) How many times have other people in your organisation (e.g. colleague, employee) encountered OPM while working with your organisation?

	Number of sites with OPM present				
	0	Once or twice	3-10	11+	Don't know
In the last 12 months					
1-5 years ago					
5+ years ago					

Q40) On those occasions other people encountered OPM, did they suffer any of the following symptoms? (tick all that apply)

Symptom	No	Yes - a small number who encountered OPM had this impact	Yes - most who encountered OPM had this impact	Yes - all who encountered OPM had this impact	Don't know
Skin irritation or rash					
Eye complaints					
Breathing difficulties					
Other (please describe)					

Q41) On the occasions you or others in your organisation have suffered health impacts due to OPM exposure, what PPE was being used?

PPE	Frequency of use			
	Never	Some occasions	Most occasions	Every occasion

Long-sleeves, tucked in				
Long trousers, tucked in				
Gloves				
Goggles				
Balaclava				
Climbing helmet				
Boots				
Respiratory protection				
Full air-fed helmet				
Disposable full body suit				
Dedicated climbing kit				
Triple bagged, tape sealed disposal				
Other (please give details in the box below)				

Q42) What, if any, have been the business consequences of OPM health impacts in your organisation? (tick all that apply)

- No consequences
- Health impacts meant those affected had time off work (please enter typical number of days off per person per exposure in the comments box)
- Health impacts meant those affected had a reduced capacity to carry out certain tasks (please enter which tasks in the comments box)
- Lost or refused contracts – due to reduced workforce
- Lost or refused contracts – to avoid further OPM exposure
- Lost or refused contracts – other reasons (please enter reasons in comments box)
- Other business consequences (give specify)

- Q43) Do you or your organisation take on contracts to specifically manage OPM?
- Yes / no / don't know
- Q44) Regarding contracts to deal with OPM
- When was the first time you undertook one of these contracts? (free text)
 - How many of these contracts have you taken on in the past 12 months (including ongoing work)? (free text)
- Q45) What management actions are taken to mitigate occupational health risks for staff?
- All staff trained
 - Work planned seasonally
 - Staff employed only to spray (remote from contact with OPM)
 - Full Personal Protective Equipment (PPE) provided for operational staff
 - Allowances made for heat exhaustion/fatigue
 - Supervision to ensure recommended work practice is followed
 - Recording and monitoring of OPM workhealth surveillance monitoring of staff
 - Other (please specify)
- Q46) Has your organisation turned down contracts for OPM work?
- No
 - Yes (please give reasons in box below)
- Q47) Has OPM changed any working practices (leave blank if no changes):
- For you individually
 - Details (free text)
 - Within the organisation
 - Details (free text)
- Q48) In your organisation, is reporting of health impacts caused by OPM exposure:
- Compulsory / requested but not compulsory / voluntary but not requested / don't know / Not applicable (e.g. sole trader)
- Q49) Have you ever received training about OPM and its potential health impacts?
- No
 - Yes
- Q50) Regarding the training you received:
- Who delivered the training? (free text)
 - When did you receive the training? (free text)
 - What was included? (free text)

- How long was the training (e.g. 1 hour, half-day)

Q51) Would you like to receive training on the following aspects of OPM?

Content	Priority			
	Nice to have	Important	Critical	Not of interest
Biology of OPM				
Update on spread of OPM in UK				
Management and control options				
Planning and managing spraying				
Planning and managing nest removal				
Arboricultural works in OPM affected trees				
Equipment for working with OPM				
Personal Protection Equipment (PPE) for working with OPM				
Protocols for working with OPM				
Disposal of OPM contaminated material				
Identification and treatment of health impacts				
Effects of repeated exposure				
Other (please state)				

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Q52) Who do you think would be best placed to deliver such training?

- Arboricultural Association
- Consulting Arborist Society
- DEFRA
- Forest Research
- Forestry Commission
- Institute of Chartered Foresters
- In-house training (within your organisation)
- Lantra
- Tree Council
- Other (please state)

Q53) Information on OPM can change as we learn more about the pest and its impacts:

- How often would you like to have update information sent to you? Weekly / Fortnightly / Monthly / only when there is major change in the situation / Never

Q54) How would you like to receive updates?

- Hard copy (paper leaflet) to you through the post / email to you / through your organisation / other (please specify)

Appendix 2: OPM contractor survey results

Not all participants answered all questions, so percentages calculated for each question are proportions of those who did provide an answer. The sample size is shown in each figure and table. Percentages in tables are rounded to one decimal place, so sums may not add up to exactly 100.0%. Some questions allowed selection of more than one answer, so sums may add up to greater than 100.0%. For categories marked “Other” participants were invited to specify in comments box – some responses were given in the box without ticking “Other”, hence for any particular question, n numbers in table and figure may not match. Survey questions numbers (see appendix 1 for survey) are shown in square brackets in each figure and table caption, e.g. [Q2, Q3].

Participant characteristics

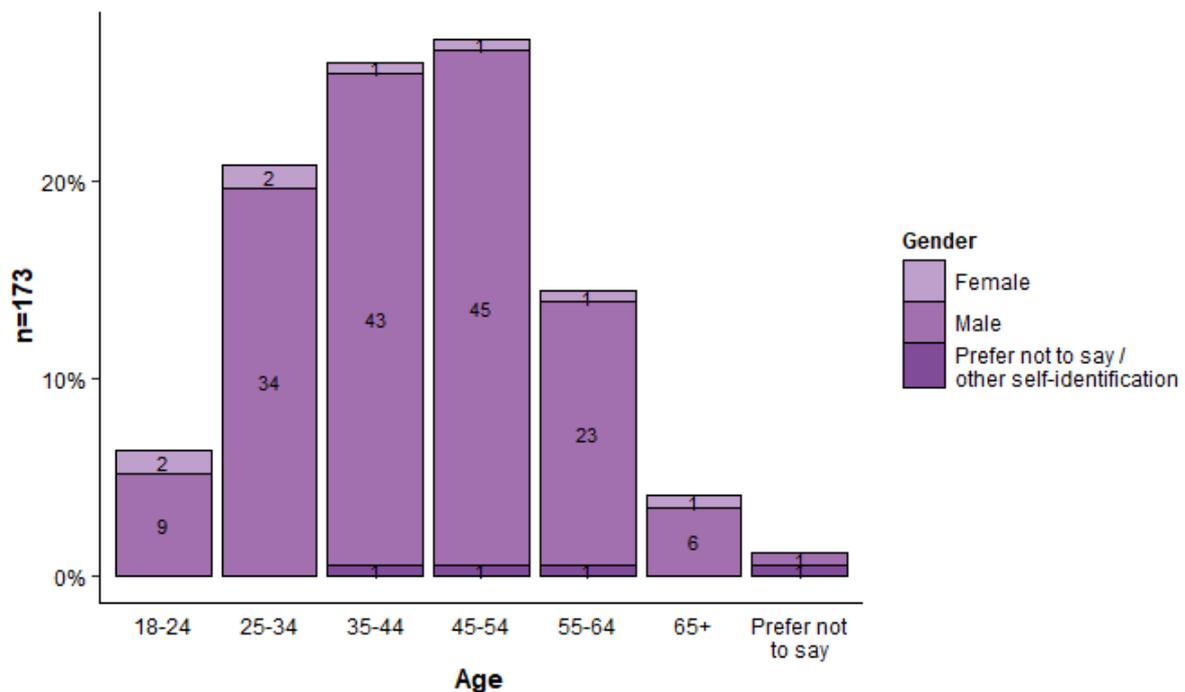


Figure 19 Age and gender of participants, n=123 [Q2&Q3]

Table 7 Ethnicity of participants, n=174 [Q4]

Q4 Ethnicity	Number of responses (% , n=174)
Arab	1 (0.6%)
Black / African / Caribbean / Black British	1 (0.6%)
Asian / Asian British	1 (0.6%)
Latin / Hispanic	0

Mixed / Multiple ethnic groups	1 (0.6%)
White	163 (93.7%)
Prefer not to say	7 (4.0%)

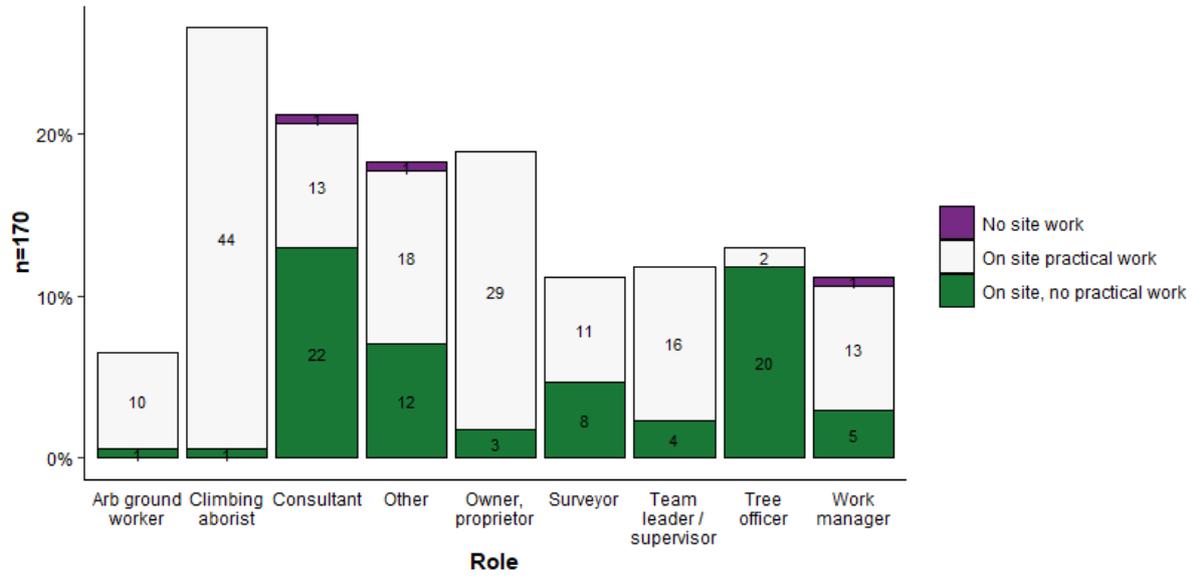


Figure 20 Professional role of participants and if they visit site or carry out practical work, n=170 [Q5&Q8]

Table 8 Role “Other” categories, n=31 [Q5]

Q5 – “Other” roles	
Assistant warden at nature reserve	Local Authority Manager
civil servant	Owner/arborist/consultant
Climber, team leader, tree inspector	Parks Operations Manager
educator	previously arb ground worker
Forester	Ranger
Forester/Greenwood worker	retired biologist
Forestry manager.	retired former NHS Deputy Head Gardener, with AA Tech Cert. Active volunteer in local woodland conservation group, including as Arb consultant. Participant/attendee in 4 ATF local groups
gardener	Retired tree officer but do occasional tree surveys
Gardener	Sales executive
Gardener	Senior Arboricultural Manager
Head Gardener	Student
Highway Engineer	Teacher
HSEQ Manager	Tree healthcare technician
Landscape Contractor	Tree spraying
Landscaper	woodland manager
layperson	

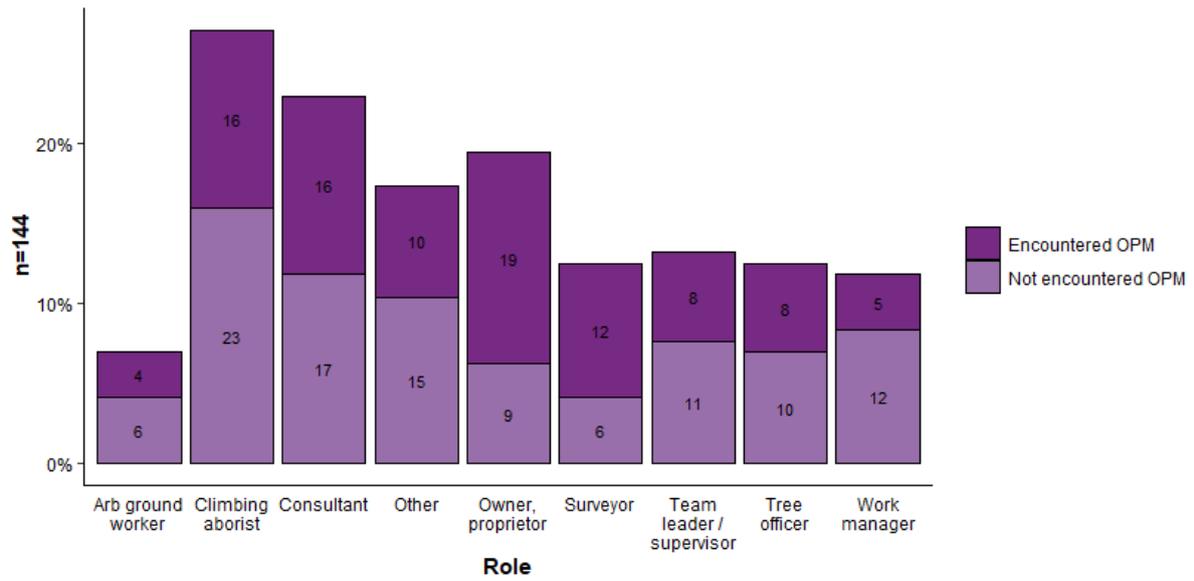


Figure 21 Professional role of participants and whether they have encountered OPM at work, n=144 [Q5&Q14]

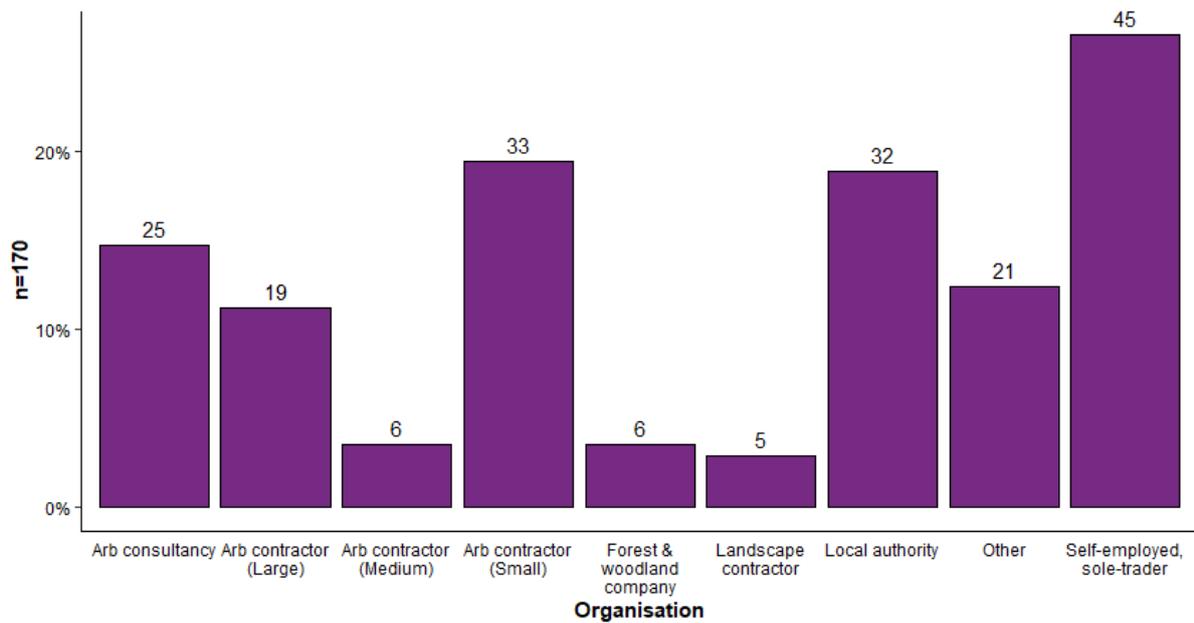


Figure 22 Employer type, n=170 [Q6]

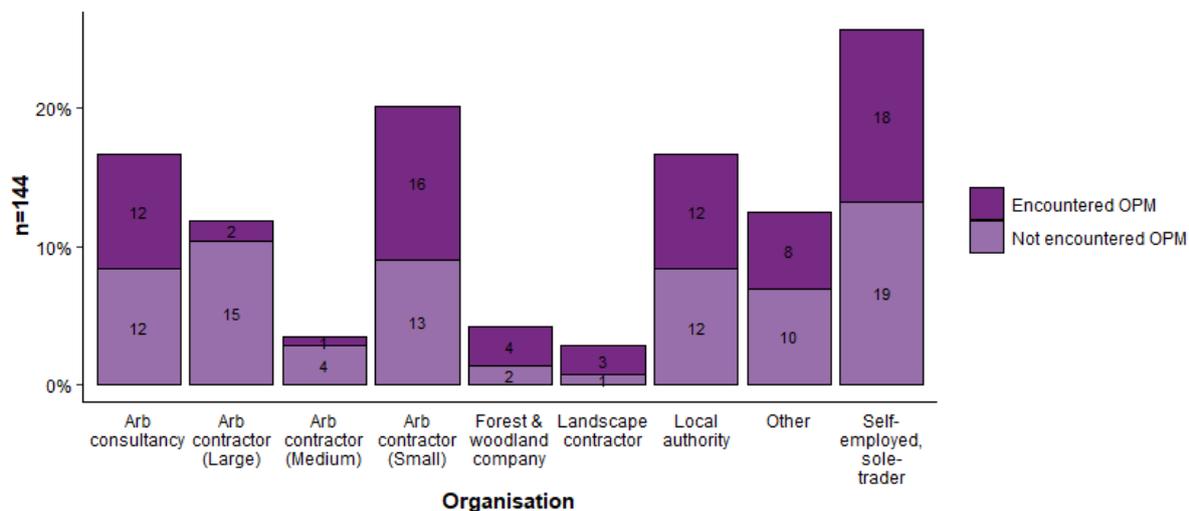


Figure 23 Employer type and whether participants have encountered OPM at work, n=144 [Q6&Q14]

Table 9 Organisation "Other" categories, n=20 [Q6]

Q6 – "Other" organisations	
And a conservation charity	I spend 9 hours a day up a tree every day
borough council	Local college
Botanic Garden (Public)	Nursery
Education	Partnership working as 2 person team
Environmental Consultancy	Rail Projects and Facilities Management
Estate Management - MOD	retired
Formerly supervisor of team of 7 in an NHS Trust of 2500 employees. Local "Friends of" group manages small [11Ha] ASNW wood including chalk grassland	Retired but do occasional tree surveys
gardens and parks historic estate management	Royal Parks
government	Supplier OPM trap
Housing association with ownership of approx 30,000 trees across parks, canals & housing estates	Utility company

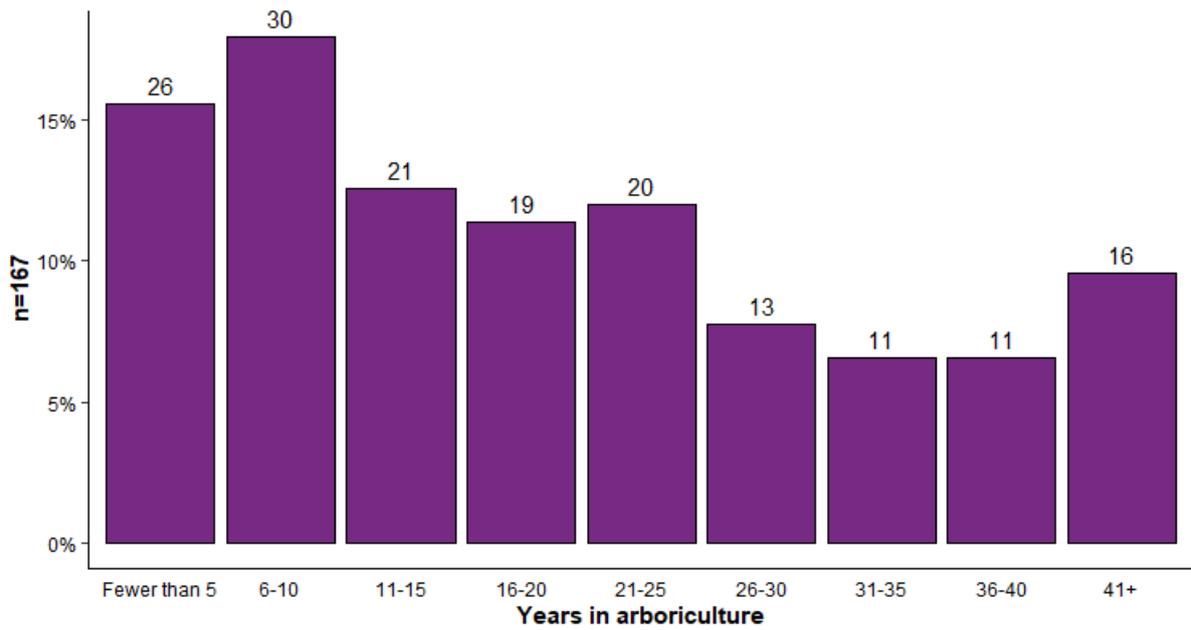


Figure 24 Number of years working in arboriculture. Responses grouped into 5-year bins, n=167 [Q7]



Figure 25 Location of participants' office, by postcode. Red crosses =England, green=Wales, blue= Scotland. Participants asked to give location of head office and local office if different to head office. The plot shows head office locations, unless no head office location was given, in which case local office is plotted n=117 [Q9]

Table 10 Location of participants' office, by postcode. Participants asked to give location of head office and local office if different to head office. Table shows head office locations in each country of the UK, unless no head office location was given, in which case local office is plotted n=117 [Q9]

Q9 Where is your business or your employer based?	Number of responses (% , n=117)
England	107 (91.5%)
Northern Ireland	0
Scotland	4 (3.4%)
Wales	6 (5.1%)

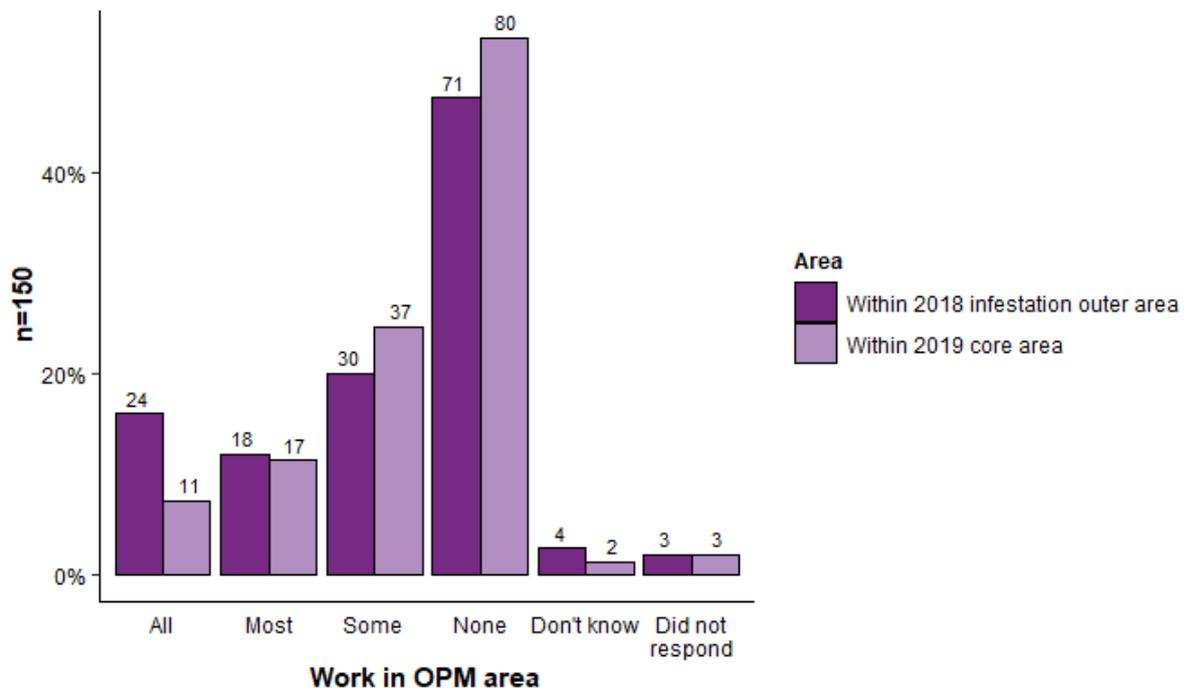


Figure 26 Do participants work in the 2019 core or 2018 infestation outer core areas, respectively, n=150 [Q10]

Knowledge of OPM and training needs

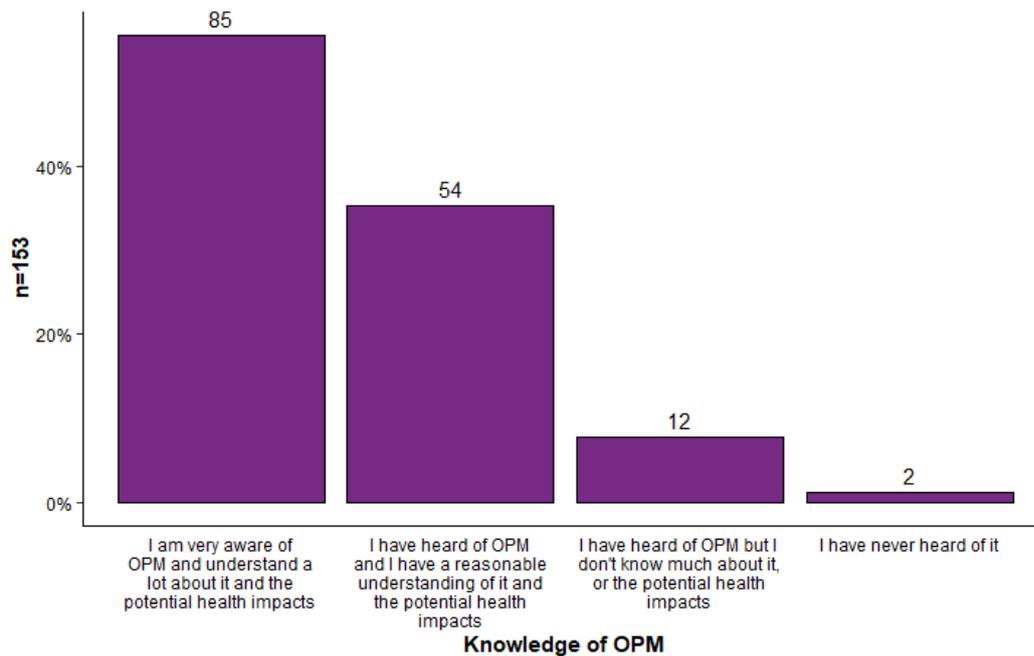


Figure 27 Knowledge of OPM and its health impacts, n=153 [Q11]

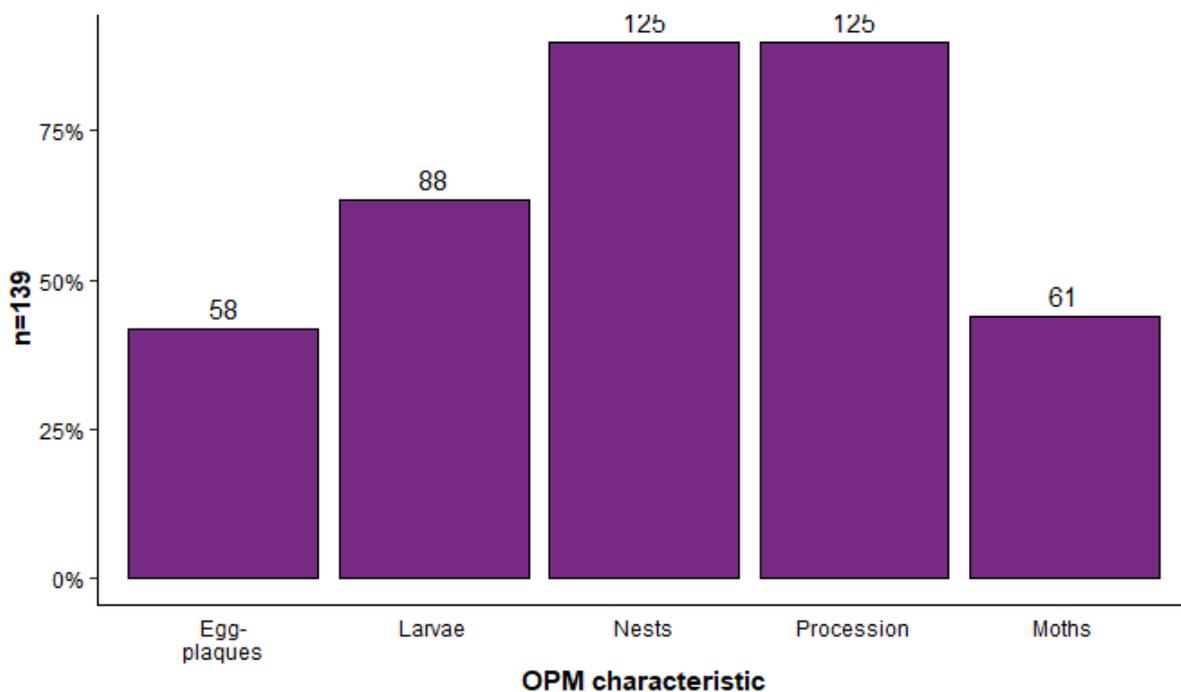


Figure 28 Would participants recognise different characteristics of OPM. The structure of the online survey tool meant there was no distinction in data output between participants who didn't answer the question, and participants who could not recognise any characteristic. Sample size (n=139) is therefore all participants who recognised at least one characteristic [Q12]

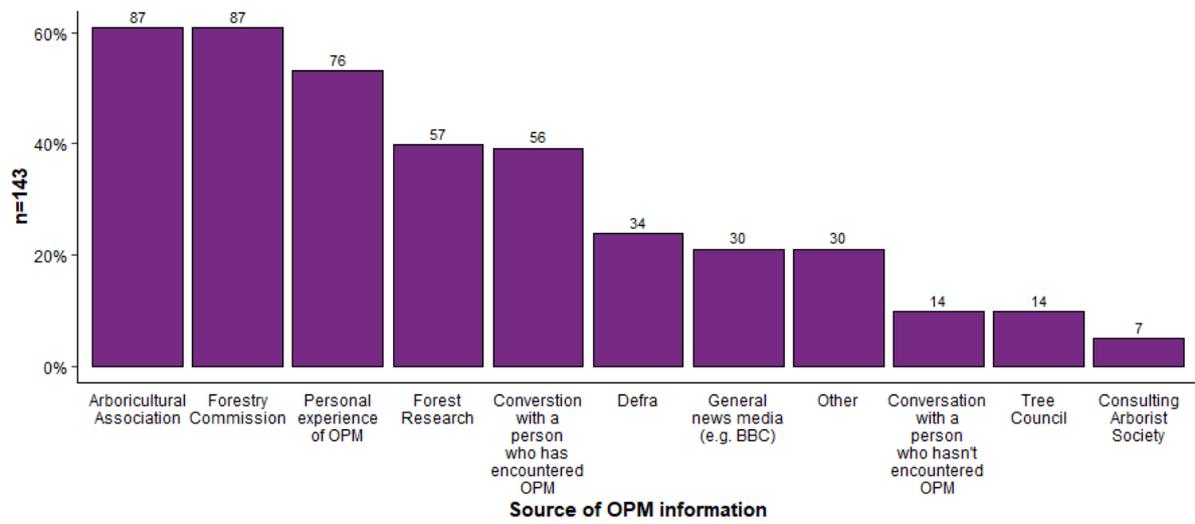


Figure 29 Source of information for understanding OPM, n=143 [Q13]