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Managing tree pests and diseases in urban settings: The Case of Oak Processionary Moth in London, 2006-2012

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Introduction

Official confirmation that Oak Processionary Moth (OPM: *Thaumetopoea processionea*) had been found in West London in 2006 marked the beginning of a long and difficult campaign to eradicate this insect pest from a largely urban setting. Affecting native oaks in public open spaces, residential gardens and on privately-owned land, OPM has presented a major challenge to plant health authorities charged with controlling the outbreak. This paper examines how OPM was managed in London and asks why eradication proved so difficult. It identifies and analyses three governance and management challenges faced by those involved in the attempted eradication campaign, and assesses the extent to which the specifically urban setting of the outbreak intensified these difficulties.

Urban green space and infrastructure can mitigate some of the detrimental impacts on biodiversity and human well-being of increasing urbanisation (see FC, 2010). The planting of trees is a key component of many greening strategies, with well demonstrated environmental and social benefits (Bowler et al., 2010; Hall et al., 2012; Nowark, 2010). Within the UK there is a supportive policy framework for protecting urban woodlands and promoting the planting of urban trees (Defra, 2013; FC, 2010a), and public tree planting campaigns remain popular (Defra, 2010; GLA, 2011). However, many of the trees planted in urban locations are imported from outside the UK, and thus ‘represent a critical pathway for pest introductions’ (FC, 2011, p3). The role of urban trees in the spread of new pests and

pathogens should be taken seriously, and they may also warn of new threats to the forestry environment (FC, 2011). Urban trees are at particular risk where there is a low diversity of species or where monoculture planting can mean that whole areas can be devastated in a single outbreak (Raupp et al., 2006). They are frequently planted in unfavourable sites where they experience stress, predisposing them to attack and increasing the likelihood that pest populations will successfully establish themselves (Poland and McCollough, 2006; Pauleit et al., 2002).

Growing problem of tree pests and diseases

The OPM outbreak should be considered in a context of growing scientific and public concern about the biosecurity threat posed by pests and pathogens to trees and woodlands in the UK (see Brasier, 2008; Potter, 2013; Tree Health Taskforce, 2013). The reason for this concern is clear. The rate of new introductions of invasive forest pathogens into Europe has increased markedly over the last 200 years, with 27 currently identified as having entered the UK since 1800. For invertebrate plant pests, 114 human-assisted introductions were identified between 1970 and 2004, although there was no increase in the rate of introductions over time (Santini et al., 2013). The plant trade, particularly in ornamental plants, accounts for nearly 90% of these pest introductions, with various studies emphasising the primacy of the ‘plants for planting’ pathway in introducing new plant pests and pathogens into the European Union (EU) mainly from Asia and North America (Smith et al., 2007). Detection is often difficult, pathogens often having lag times of several years between infection and the trees developing external or visible symptoms, meaning there may be no obvious signs at ports of entry to indicate contamination (Brasier, 2008).

Social science approaches to outbreaks

Learning from past experience about the effective management of outbreaks for eradication or containment is crucial (Potter et al., 2011). Although analyses of specific pest outbreaks have been published (e.g. Hack 2010; Poland and McCollough 2006), these have tended to focus on the biological and epidemiological aspects of outbreaks, with few published studies focused on governance and management (though see Gustafsson and Lidskog, 2012 for an analysis of risk governance in relation to tree pest outbreaks). Exceptions in the UK include Dutch Elm Disease, which was the subject of a recent study examining outbreak management over a 40 year period (Tomlinson and Potter, 2010; Potter et al., 2011; Harwood et al., 2011), and the current and on-going outbreaks of *Phytophthora ramorum* and *Phytophthora kernoviae* in the UK, which has also been examined through a plant health governance lens (Potter et al., 2011; Tomlinson et al., 2009). Other social science contributions have focussed on the legislative framework, policy protocols and risk assessment techniques surrounding the regulation of plant and tree pest and disease risks locally and globally (MacLeod et al., 2010; Mills et al., 2011; Outhwaite 2010). However, peer-reviewed research on the governance and management of a tree pest outbreak in a specifically urban context has been lacking until now.

The OPM London Campaign: Background and management strategy

OPM is long established in mainland Europe, where it is known to cause significant defoliation of oaks which, while rarely directly lethal, can significantly weaken affected trees, leaving them vulnerable to further attack and other stressors. OPM also poses a threat to public health through skin and respiratory irritation caused by the poisonous hairs on the caterpillars. These contain an urticating toxin that can affect humans and animals (Maier et al., 2003).

OPM is understood to have first entered the UK in 2006 on a single consignment of amenity ‘cypress oak’ trees (*Quercus robur* 'Fastigiata Koster') that had been grown in Italy, shipped from The Netherlands during 2004 and planted out in two London locations (Potter et al., 2013). Some were used to screen a waste water facility on a new housing development site in Kew, the rest planted alongside the North Circular Hanger Lane gyratory road system in Ealing. A separate outbreak in Pangbourne, Berkshire, in October 2010 was similarly caused by an imported *Quercus robur* planted at a new housing development to replace an existing oak that was likely to be adversely affected by building works.

The initial response to the London outbreak was largely confined to the London Boroughs (LBs) affected, but the FC, the UK government agency with responsibility for safeguarding tree health, became formally involved in May 2007 with the aim of eradicating the pest. The Forestry Commission (FC) conducted a survey, set up an Outbreak Management Team and commissioned a pest-specific contingency plan and a Pest Risk Analysis (PRA) (Townsend 2013). The latter concluded that OPM posed a significant phytosanitary threat. The additional serious threat to human health through reactions to the hairs provides additional reasons for initiation of measures to manage the pest (Evans, 2007). The FC invoked statutory powers under the Plant Health (Forestry) Order 2005 which allows plant health inspectors to enforce any appropriate actions needed to eradicate OPM from specific sites.

By 2010, the infested zone had reached 120km², having expanded steadily since 2006. Following advice from Forest Research (FR), a ministerial decision was taken to abandon attempts to eradicate OPM in favour of containment and a revised strategy was adopted to contain the population and slow its rate of spread on the fringes of a 20 km buffer zone (Potter et al., 2013). Meanwhile, temporary emergency measures were put in place to reduce

the risk from subsequent imports of infested trees while a request to the European Commission (EC) to consider designating GB a 'protected zone' (PZ) was made. PZ status provides measures to prevent further accidental introductions and came into effect in October 2014 (FC, 2013).

Despite a reinvigoration of the OPM campaign in London in the form of a new pilot enhanced control plan for 2013/14, with funding from Department of Environment, Farming and Rural Affairs (Defra) (OPM Advisory Group, 2014), it must be concluded that the original attempt to eradicate the pest has failed. It is likely that the UK government faces an ongoing commitment to OPM control at a significant recurring annual cost: funding from Defra for the 2013 enhanced control plan was estimated at £1.15 million, with an estimated further £0.55 million spent by stakeholders (OPM Advisory Group, 2014), whose continued support in the future will be essential.

Methodology

Many commentators are asking why eradication proved so difficult and how best to take the management effort forward. In order to assess the governance and management challenges faced by those individuals involved in the attempted eradication campaign in the urban context we used a qualitative research methodology.

A series of qualitative semi-structured interviews were carried out in 2012 with 20 individuals who have been involved in the management of OPM in London and Pangbourne between 2006 and 2012. These included representatives of LBs, FC and FR staff, managers and owners of private land with OPM, and managers of public land with OPM present. Semi-structured interviews are useful when seeking information from individuals with specialist or

privileged knowledge (Newing, 2011). An interview schedule was prepared with issues to be discussed. These related to the key aim of the research which was to identify the reasons why the eradication campaign proved so difficult, and the extent to which the particular characteristics of the urban environment contributed to the challenges faced.

A targeted sampling method, which involves intentionally selecting the people most relevant to the study (Newing, 2011), was used. The initial long list of potential interviewees was compiled in consultation with stakeholders involved with the Defra grant TH104 project. From this list, the authors sort to interview as many different perspectives from different organisations as possible within the given time-frame and resources. This selection was confirmed and on occasions expanded using a snow-balling method. This is the process of chain referral (Newing, 2011) where interviewees are asked to suggest other relevant individuals to be included in the study. A key principle in assessing sample size when using semi-structured interviews is the principle of ‘saturation’ (Bryman, 2004) when collecting more data produces little new information of importance and when it is possible to identify areas of consensus or other patterns in the data. The authors believe that the saturation point had been reached in this study.

All the interviews were recorded and transcribed. A thematic analytical method was used. This is “a method for identifying, analysing and reporting patterns (themes) within the data. It minimally organises and describes your data set in [rich] detail” (Braun and Clarke, 2006, p79). Themes capture important aspects of the data in relation to the research question and “represents some level of patterned response or meaning within the data set” (Braun and Clarke, 2006, p82). A deductive or ‘top-down’ approach was used as aspects of the transcript relevant to answering the pre-defined research question were coded. These codes from across

all the interview transcripts were then collated into themes, which corresponded to the three challenges as discussed in the sections that follow. Some of the parts of text coded were chosen as example quotes to support the arguments made. Contributions from particular individuals are anonymised in the subsequent text.

Government policy documents and other published documentary sources on OPM were used to corroborate factual elements of the outbreak with the accounts of the interviewees, particularly in relation to the chronological order of events. These are referenced where necessary in the discussion that follows.

Results/ Discussion

Challenge One: Assigning statutory responsibility for urban trees

The issue of statutory responsibility for urban trees is critical for any discussion of tree pest and disease management in towns and cities as there is an unclear policy remit and lead within Government departments (Tubby and Webber, 2010). The primary legislation governing plant health in Great Britain is the Plant Health Act 1967 (UK Government, 2013) and it prescribes the Forestry Commissioners as the 'competent authority' as regards the protection of forest trees and timber (FC, 2013). Defra has responsibility for nursery trees and imported planting stock (with delivery delegated to the Food and Environment Research Agency) and the FC has responsibility for *forest* trees once they are planted. It is less clear who has responsibility in the case of urban trees. This grey-area of responsibility is acknowledged by the FC in its Tree Health Strategy (2011), which states that 'in the absence of any other body with statutory competence, [the FC] is addressing a number of predominantly urban tree pests, such as OPM and Horse Chestnut Bleeding Canker' (FC, 2011, p3). It also acknowledges the significant time and research resources they require but

argues that the threat is too great to be ignored. Further, the FC goes on to warn that this ‘existing potentially dangerous gap in statutory cover between trees in the forest and those growing elsewhere’ is something that it (FC, 2011, p3) says it will work across central and local government to address and this may involve changes in legislation.

Evidence collected through our interviews with key actors involved in managing the outbreak suggests that confusion about responsibilities may have been a key factor in delaying effective control during the early, critical stages of the outbreak. In the absence of an effective surveillance system for tree pests at this time, it was a local authority environmental health officer (EHO) who reported the first infestation. However, his ability to act quickly was compromised under current Environmental Health legislation (Potter et al., 2013).

Powers had to be invoked under Part Three of The Environmental Protection Act 1990, which allows action to be taken where insects known to be a nuisance or prejudicial to health are found on commercial land. Under this legislation the responsibility for removal lay with the company managing the land, who responded tardily to the eventual Statutory Plant Health Notice that was served on them to deal with the infestation. An attempt to remove the infested trees was unsuccessful because the company delegated to carry out the operation were poorly equipped and had little prior experience of removing insect pests like OPM:

‘..they had the suits on and gloves and masks on, and a load of black bin liners... and as they were removing the nests and putting them in these bags, you could hear the moths emerging, and they were just... flapping about in the bags...they were all over the pavement, they were on the walls of the flats...’ (Interviewee A).

If the outbreak had been on non-commercial land, the options would have been even more limited and the EHO would not have been able to use the legislation he did. There would have been little the local authority could do, except rely on the good will of the landowners.

In the absence of any immediate management response from either of these central government agencies, much of the initial impetus during the summer of 2006 came from different parts of local government, chiefly tree officers employed by the LBs of Richmond and Ealing. The tree officer from Ealing (Interviewee B) describes how, in relation to the outbreak in Ealing, "...the local authority was brought in... as a liaison, so it was before the FC got heavily involved or anything like that... and we were... the only place people could turn to". It seems that local authorities played a much more proactive role in managing the early stages of the outbreak, well beyond their official remit for managing trees in their respective locales. An informal OPM Management Group was convened and then expanded its membership to include Emergency Planning officers from Richmond and Ealing, together with representatives from The Royal Botanical Gardens, Kew (RBGK), Network Rail and some of the other major landowners affected. This met on a weekly or fortnightly basis and worked to motivate the individuals involved (Interviewee B). Attempts were also made to raise the issue through the local resilience forum, (which aim to plan and prepare for localised incidents and catastrophic emergencies) and which involves more senior local authority staff, but it has had limited effect (Interviewee B).

The London Tree Officers Association (LTOA) also played a central coordinating role at this stage and their contribution was acknowledged by a number of interviewees. Interviewee C said that [the LTOA see] "themselves as sort of tree guardians", they know a lot about "the

trees on their patch”, and between them and the [local authority] “planning officers dealing with private trees, you’ve got a whole wealth of knowledge as to where oak trees are”.

It has been difficult to establish at what stage Defra Plant Health, the FC, FR and other plant health professionals eventually became more directly involved in the OPM outbreak, and indeed it is unclear from our interviews *why* they did not become formally involved before May 2007. One reason was that the combined tree and human health impacts of OPM meant that this already complex regulatory landscape was further complicated by the need to bring the Health Protection Agency (HPA) on board. There were serious discussions over the winter of 2006/7 as to whether the FC or the HPA should take statutory responsibility and under what legislative powers they should do so. In the end the FC, rather than the HPA, took the lead role, and the Plant Health Act became the legal framework for action. This was seen largely as a pragmatic solution, as in legal terms there appeared to be limited possibilities for intervention on human health grounds: the limitations of the Environmental Health legislation have been noted previously, whilst the Public Health Act legislation has historically only been used for serious disease events and it was believed it would be difficult to make a case for controlling OPM under it (Interviewee D). Whilst a resolution was finally reached, it is clear that this delay in assigning responsibility had an impact on the speed and overall effectiveness of the response.

Local authorities, as landowners, are required to comply with any notice served on them by the FC using powers under the Plant Health Act. The FC can also require local authorities to carry into effect any order under the Plant Health Act and has used this power twice (DED and Watermark disease of willow). This possibility was posited by the FC in relation to OPM when it mooted the idea that local authorities should be given powers to serve Statutory

Plant Health Notices on landowners with OPM present on their land, requiring them to take action to remove the infestation within a given time frame. However, the LBs of Richmond and Ealing were not keen to take on a new level of responsibility; they did not want such enforcement powers because they felt tree owners within their Boroughs needed someone else to go to for support and advice once they have been served with a Statutory Plant Health Notice. If the local authorities were doing the enforcing, tree owners might be less inclined to report the problem in the first place: “The last thing we wanted to be was the baddie coming along and putting enforcement notices on poor old Mrs Miggins that’s just got a tree in her back garden”. (Interviewee B). They also believed there would be no new resources to deal with it (Interviewee B). The historic case of DED gave such powers to the local authorities who wanted them, but without extra funding to carry out the works needed, the level of actions by local authorities was very low and ultimately largely ineffective (Tomlinson and Potter, 2010). Like all landowners with OPM on their property, local authorities had to meet the cost of managing their trees from existing budgets. For one LB the cost was estimated at £30,000 - £40,000 annually, a monetary and resource cost which is anticipated to reoccur every year into the foreseeable future (Interviewee E). This is obviously an on-going cost to the public purse and has consequences for the level of management action that is taken.

Whilst some local authorities were very proactive in their approach, other Boroughs were much less so. Nevertheless, in the space created by lack of central government or agency direction, this case demonstrates the positive contributions that different local Government departments can make in responding to a tree pest outbreak in an urban area; a network of staff able to work on ‘the ground’ with local residents; staff with specialist knowledge of the location and status of local trees; and institutional structures to prepare and respond to civil emergencies. However, the role of local Government here was hampered by a lack of

resources and inappropriate legal powers. As Tubby and Webber (2010) acknowledge, the formal responsibility for local authority staff only extends to managing the trees on local authority land. In the context of OPM, with no remit beyond their designated boundaries, this prevents them from taking a lead in local management.

Challenge Two: Assessing and managing combined risks to trees and people

As previously noted, OPM was framed from the beginning as a tree health issue, with the FC taking the lead role and the Plant Health Act furnishing the legal framework for action.

However, there is an important distinction to be drawn between the way in which the issue was constructed in terms of legal responsibility and the way in which the risks were understood and actions justified by those involved on the ground. Indeed, whilst most respondents acknowledged combined risks to tree and human health, there continued to be much debate amongst those involved in the West London outbreak as to the relative significance of each, how they are related and thus what the management response should be. Many interviewees suggested that local government staff were more concerned with the public health risk than the risks to tree health. A particular characteristic of the urban London environment is the presence of a sizeable oak tree population in a densely human populated area. As Interviewee F explained, it is the high number of “oak trees in that intense sort of urban matrix” [that occur in some parts of London] that is seen to be a risk factor for the number of people who might be affected “if this [OPM outbreak] takes off in very, very heavily oaked urban areas here.” Thus the urban setting also effects the judgement about relative risk and the seriousness of consequences:

“...the only reason we [as a local authority] manage trees in the way we do is because there are people living under them every day... Infestation to one tennis ball sized nest in a tree will have no impact on the tree... Whereas, if that was in a public park and people sat under that tree, or if, God forbid, that nest fell off and someone picked it up, the implications on that person or those persons would be massive” (Interviewee B)

Indeed, Jim Smith, Urban Forestry Adviser at the FC, has suggested that with regard to tree pests and diseases in urban areas, health and safety considerations will take priority over landscape, amenity and economic concerns (Smith, 2013). This could be problematic if fears over public safety lead to inappropriate and disproportionate management responses that lead to the loss of trees and their benefits, as has been raised in the case of Massaria Disease of Plane (Tibbets, 2013; FC, 2013a).

Tree health problems were seen by some interviewees to be more of an issue for forestry areas, where they can have an impact on commercial production. The approach to managing outbreaks elsewhere in Europe appears to maintain this distinction (Potter et al., 2013). In Holland, the urban setting of many of the outbreaks has led to OPM being largely viewed and managed as a human health problem affecting the general public, with woodland outbreaks often left unmanaged, partly for biodiversity and conservation reasons, and with the hope that natural predators may keep the moth under control. In Germany, the impact has more frequently been seen in large commercial forests. There, management for tree protection has been the focus, prompting large-scale spraying using helicopters, although human health effects are now being seen amongst forest workers.

This dichotomy might not always hold true, however. OPM might pose a threat to already vulnerable trees in urban park settings. Richmond Park and its many mature veteran oaks in decline or already suffering from other problems are a good example, as OPM could lead to a significant loss of trees. Further, in urban areas the two risks are related: Serious threats to trees occur when infestation levels reach plague proportions (unless the tree is already in decline for another reason); it is at this point that the outbreak is also likely to pose the greatest threat to human health due to the abundance of hairs. Thus it is argued that in West London, the management actions so far have meant that that “We haven’t seen any defoliation of trees because the numbers aren’t big enough, so therefore, the plant health issue I don’t think is an issue”, yet “...it’s a tree issue that, if unmanaged, becomes a public health issue, essentially”. (Interviewee E).

Did the disparity between the tree health focus of the Plant Health Act and the public health priorities of many of those involved in responding to the outbreak in this urban area have any material consequences for the London campaign? Many interviewees argued that if it had been framed officially as a public health issue rather than a plant health concern, OPM would have gained greater traction within government, leading to greater allocation of resources. Some interviewees suggested that a human health justification might have been more effective in persuading private residents with infested trees in their gardens to cooperate with management. Instead, the FC and its Plant Health Inspectors were required to make the case for action on plant health grounds and not to use public health arguments when communicating with the public.

Challenge Three: Coordinating the stakeholder and landowner response in a complex urban setting

A key cause of the ineffective response to the OPM outbreak identified by our interviewees was the difficulty of engaging effectively with the wide range and number of stakeholders, particularly public and private landowners with OPM infestation on their land. The urban matrix of “a mosaic of different ownerships and responsibilities” (Interviewee F) over a relatively small area added a particular complexity and challenge to attempts to deal with OPM in West London. As Interviewee J commented:

“I suspect that if you were in the heart of the countryside, where you might have had only been dealing with three or four land managers in an area of a few square miles, it would have been much, much more achievable. I’m sure there’s plenty of people who’ve never heard of OPM that live very close to here”.

Jim Smith, FC’s Urban Forestry Adviser, corroborates this: “Multiple land ownership, tenancy and absentee landlords predicate against swift and effective action via existing legislation” (Smith, 2013). Several interviewees commented on the particular issues this raised for effective control given that an infestation can spread from an un-managed area into uninfested or previously cleared areas:

“You’re in an urban area where you have local authority trees, and next door, you have the railway, ... and then next door to that you have a private business, and then next door to that you have a fairly poor old lady, and every one of those sites has to be cleared of OPM, and if you don’t do all of them, then you’ve all wasted your time” (Interviewee F).

On land identified with an infestation, landowners, their site managers, occupiers or other representatives are served by Inspectors from the FC with a Notice under Article 31(4) of the Plant Health (Forestry) Order 2005 requiring them to use appropriate methods (see Table 1; FC, 2012) and within a prescribed time frame. Decisions by landowners about which treatments to use were made not only on the basis of perceptions of their relative costs and effectiveness, but also in relation to the specific ecological and economic contexts of different outbreak sites. This can be clearly illustrated by the contrasting approaches taken by two significant landowners affected by OPM: RBGK, and Richmond Park. The former, a 121 ha site, initially used nest removal, but then shifted to using Deltamethrin on 400 trees which was reported as much more successful. Diflubenzuron was then tried on subsequent infestations as a way of reducing the impact on biodiversity, as it is specific to caterpillars, whereas Deltamethrin is a broad spectrum pyrethoid and is known to be particularly dangerous to bees (FC, 2012). Chemical treatments are seen as necessary in ensuring public safety whilst keeping the park open but their biodiversity impacts are being monitored (Interviewee K).

Richmond Park is a much larger site of 2,500 ha with 40,000 oak trees, including veteran specimens, and with various conservation designations including a site of national importance for the conservation of invertebrate fauna associated with decaying timber of ancient trees (JNCC, 2013). With the need to balance biodiversity protection with ensuring the safety of the park's visitors, there has been an emphasis on wide scale nest removal using volunteers. However, in 2011 the Park obtained consent from Natural England to conduct a trial spray of *Bacillus thuringiensis* (Bt) on six trees, and in 2012 they had consent to spray 15 trees (Interviewee L). Richmond Park intends to continue using a combination of nest removal and spraying. It has been criticised for not making more use of chemical treatments and potentially contributing to the continued spread of OPM, yet others acknowledge that their

statutory conservation responsibilities prevented such measures being taken and that the Park has actually suffered from its neighbours taking insufficient action (Interviewee G).

Once the Notice had been served, landowners who failed to take action within the required time could in theory be threatened with legal action. However, there have been no legal proceedings recorded to date. Some interviewees speculated that this is because the FC cannot afford to pay to go through the legal processes, and that legal advice has suggested that if they took landowners to court under Statutory Plant Health Notices the cases were unlikely to be successful. For some interviewees, this ‘softly softly’ approach compromised the effectiveness of the Notice system:

“The point is, unless a notice is served, the FC are powerless to take any action. That’s what gives the legal force. But the serving of a Statutory Plant Health Notice for nest removals is basically pointless, I think... because too many people ignore it. They [the FC] serve the notices, full of threats “We will prosecute you”, this, that and the other – well, they haven’t done it. Clearly, it hasn’t been done, and the word has spread” (Interviewee M).

Whilst one interviewee acknowledged that Statutory Plant Health Notices could facilitate land managers in securing funding from their organisations (Interviewee K), it was seen by many others as a flawed system because, in line with standard practice, compensation cannot be offered for the management required and thus the landowner has to bear the costs. This has consequences. It gives an incentive for landowners not to comply with the Statutory Plant Health Notice, particularly, as noted above, as it was widely assumed that legal sanctions

would not be enforced. It was also thought to encourage non-disclosure of infestations, with landowners being reluctant to report for fear of having to shoulder the costs of management.

Once an OPM infestation has occurred, management is on-going. In the absence of any compensation, this means landowners face an annual on-going cost for management. For example, annual spraying at RBGK costs about £10,00 whilst the London Borough of Richmond expect to be spending £20,000 to £40,000 a year, and Transport for London estimates an additional £50,000 annual expenditure on OPM control.

Many interviewees had strong views on how the outbreak could have been better managed, but the issue of paying compensation was critical for many:

“The statutory notice route, without compensation, is doomed to fail. ... [The FC] spend a lot of time finding tree owners. Once [they’ve] found them they may or may not co-operate. If it was just straightforward, look, [the FC are] coming in and we’re doing it, then there would have been a lot more chance of eradication”. (Interviewee M).

The Forestry Commissioners “have no powers to pay compensation, and historically it has been the policy of successive governments not to pay compensation for plants and trees lost through pests and diseases or the measures required to eradicate them. This remains the case today” (FC, 2013b). Historically, trees removed for pest or disease management would still hold value that could be recovered by the owner when the timber was sold (Interviewee G). Due to this, compensation was not paid for action on OPM. However, there is confusion though about the legal grounds of the Government policy as the Plant Health Act stipulates that “The Minister or Secretary of State may pay compensation in respect of any crop, or any

seed, plant or part thereof, which is removed or destroyed by or under the instructions of an inspector authorised by him; and its value shall be taken to be the value which it has at the time of the removal or destruction” (UK Government, 2013). This appears to have little relevance to urban or suburban areas where the trees do not have a timber value.

However, there are two recent cases where the costs of management have been met by the FC and not by landowners. During a recent Asian Longhorn Beetle (ALB) outbreak in Kent, the FC paid ‘all operational costs and did all operational work on the ground’. This was in recognition that many of the garden owners would not have been able to afford to take trees down (Interviewee G) and it was necessary to ensure rapid action to eradicate the outbreak. The second example brings the story of OPM up- to-date with the previously mentioned new pilot enhanced control strategy. Of the just over a million pounds spent by Defra under the new pilot enhanced control plan, a total £411,000 was spent on paying for the prophylactic spraying of 40,000 trees so that the cost did not have to be borne by the landowner. Whilst there is caution towards any analysis of this scheme with only one year’s results, particularly given that the wet summer and late on-set of Spring is likely to have reduced OPM numbers, there was a 53% decrease in the number of nests between 2013/14. Under this scheme, there was an increase in the number of Statutory Plant Health Notices being issued between 2012 (53 issued) and 2013 (275). It is reported that a far higher level of co-operation from landowners enabled the implementation of a thorough control programme: “a key factor supporting this was the control costs not falling upon the Statutory Plant Health Notice recipient” (OPM Advisory Group, 2014, p6). The question remains as to whether this approach can continue into the future given the level of funding required; at the time of publication no public announcement has been made as to whether continued Defra funding has been secured

Conclusions

The OPM London campaign illustrates the challenges - legal, administrative and operational - in managing a tree pest outbreak in an urban setting. Our analysis raises questions about the suitability and effectiveness of the current policy and legal framework for the management of plant and tree pests in an urban context but also highlights the considerable operational challenges of enforcing control measures amongst a diverse community of stakeholders and landowners. In terms of the overall coordination of the eradication effort, the current 'grey area' of responsibility for urban trees emerges as an especially problematic issue.

Administrative ambiguity in the OPM case was further exacerbated by the public health dimension, with different government agencies having to invest time early in the outbreak to establishing where the boundaries of responsibility lay for its overall management. Against this, we found evidence of the positive contribution made by local government officials, particularly tree officers and environmental health staff, during the critical early stages.

Experience with the OPM London outbreak clearly shows that in operational terms, the presence of a wide range of public and private landowners, together with the inaccessibility of infested trees scattered across numerous private gardens, presented significant difficulties in co-ordinating an effective management response. Landowners had different priorities and this was reflected in the varying extent to which they were willing to report new infestations and/or implement management controls. These priorities related primarily to the management strategy of their land in areas with conservation objectives, or financial imperatives based on continuing public access. In urban areas, protecting public health and safety will be a priority and this will need to be balanced with the imperative of protecting tree health.

More broadly, the London campaign raises questions about the applicability of existing plant health legislation and statutory framings, mainly designed with pests and diseases of commercial forestry trees in mind, to urban settings where threats to human health and amenity are much more likely to be present. In the case of OPM, it was the FC that took on the responsibility, using its powers under the Plant Health Act, in the absence of any more suitable policy or legal framework that might have dealt better with the public health implications of the outbreak. The use of the Plant Health Act proved problematic, particularly in relation to the use of Statutory Plant Health Notices and an inability to pay ‘compensation’ to landowners. As discussed above, the cases of ALB and the one-year project for OPM suggest that different funding models could improve landowner compliance. Evidence from the OPM outbreak suggests there is a need for consideration by authorities on how coherent management of future tree pest outbreaks might be best financed to enable a timely and effective response.

Clearly, responding to tree pest outbreaks such as OPM entails an economic cost that needs to be balanced against other demands on the public finances. Furthermore, new ‘known’ and ‘unknown’ pests and diseases are anticipated to occur in the UK and there is clearly much strength in the argument that they should be prevented from arriving in the first place. The risks posed by the global trade in ‘plants for planting’ have been discussed elsewhere, as have the limitations of the existing plant health legislation that exists to minimise such accidental introductions (Tubby and Webber, 2010; Brasier, 2008). Such an imperative should not be at the detriment of urban tree planting schemes and risks can be significantly reduced by sourcing trees entirely grown in the UK.

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References

Bowler, D.E., Buyung-Ali, L., Knight, T.M., Pullin, A.S. (2010). Urban greening to cool towns and cities: a systematic review of the empirical evidence. *Landscape and Urban Planning*, 97, 147-155.

Brasier, C, M. (2008). Letter to the editor: The biosecurity threat to the UK and global environment from international trade in plants. *Plant Pathology*, 57, 792–808.

Bryman, A (2004) *Social Research Methods*, 2nd, edn, Oxford: Oxford University Press.

Department of the Environment, Food and Rural Affairs (2013). *Government Forestry and Woodlands Policy Statement Incorporating the Government's response to the Independent Panel on Forestry's Final Report*. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/181809/pb13871-forestry-policy-statement.pdf.pdf (accessed 15/11/13).

Department of the Environment, Food and Rural Affairs (2010). Press release; The Big Tree Plant: new partnership to plant one million trees. Available at <https://www.gov.uk/government/news/the-big-tree-plant-new-partnership-to-plant-one-million-trees> (accessed 15/11/13).

Evans, H.F. (2007). *Oak Processionary Moth Pest Risk Analysis*, European and Mediterranean Plant Protection Organisation. Available at <http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/documents/processionary.pdf> (accessed 6/6/14).

Forestry Commission (2013) *Oak Processionary Moth*
<http://www.forestry.gov.uk/oakprocessionarymoth> Available at <http://www.forestry.gov.uk/opm> (accessed 15/12/13).

Forestry Commission (2013a). *Massaria disease*. Available at <http://www.forestry.gov.uk/fr/massaria> (accessed 18/11/13).

Forestry Commission (2013b). *Dothistroma Needle Blight: Questions and Answers*. Available at <http://www.forestry.gov.uk/forestry/INFD-7L6E57#4.5> (accessed 18/11/13).

Forestry Commission (2012). *Survey and intervention in relation to different phases of the oak processionary moth (OPM) lifecycle*. Available at [http://www.forestry.gov.uk/pdf/oak_processionary_moth_control_options_May2012.pdf/\\$file/oak_processionary_moth_control_options_May2012.pdf](http://www.forestry.gov.uk/pdf/oak_processionary_moth_control_options_May2012.pdf/$file/oak_processionary_moth_control_options_May2012.pdf) (accessed 18/11/13).

Forestry Commission (2011). *Protecting Britain's Forest and Woodland Trees against Pests and Diseases – The Forestry Commission's Strategy*. Available at [http://www.forestry.gov.uk/pdf/TreehealthStrategyMinisters.pdf/\\$FILE/TreehealthStrategyMinisters.pdf](http://www.forestry.gov.uk/pdf/TreehealthStrategyMinisters.pdf/$FILE/TreehealthStrategyMinisters.pdf) (accessed 15/11/13).

Forestry Commission (2010). *Benefits of Green Infrastructure: A report by Forest Research*, Defra research contract number WC0807. Available at [http://www.forestry.gov.uk/pdf/urgp_benefits_of_green_infrastructure.pdf/\\$FILE/urgp_benefits_of_green_infrastructure.pdf](http://www.forestry.gov.uk/pdf/urgp_benefits_of_green_infrastructure.pdf/$FILE/urgp_benefits_of_green_infrastructure.pdf) (accessed 15/11/13).

Forestry Commission (2010 a). *The Case for trees in development and the urban environment*. Available at [http://www.forestry.gov.uk/pdf/eng-casefortrees.pdf/\\$FILE/eng-casefortrees.pdf](http://www.forestry.gov.uk/pdf/eng-casefortrees.pdf/$FILE/eng-casefortrees.pdf) (accessed 15/11/13).

Greater London Authority (2011). *The London Plan*. Available at <http://www.london.gov.uk/priorities/planning/london-plan> (accessed 15/11/13).

Gustafsson, K and Lidskog, R. (2012). Acknowledging Risk, Trusting Expertise, and Coping With Uncertainty: Citizens' Deliberations on Spraying an Insect Population. *Society & Natural Resources*, 25(6), 587-601.

Hack, R.A., Herard F.H., Sun, J., and Turgeon J.J. (2010). Managing Invasive Populations of Asian Longhorned Beetle and Citrus Longhorned Beetle : A Worldwide Perspective. *Annual Review of Entomology*, 55, 521–46.

Hall, J. M., Handley, J. F., and Ennos A. R. (2012). The potential of tree planting to climate-proof high density residential areas in Manchester, UK. *Landscape and Urban Planning*, 104, 140–417.

Harwood, T.D., Tomlinson, I., Potter, C.A. and Knight, J.D. (2011). Dutch elm disease revisited: past, present and future management in Great Britain. *Plant Pathology*, 60, 545–555.

Joint Nature Conservancy Council (2013) SAC Selection: Richmond Park. Available at <http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0030246> (accessed 18/11/13).

MacLeod, A., Pautasso, M., Jeger, M.J. and Haines-Young, R. (2010) Evolution of the international regulation of plant pests and challenges for future plant health. *Food Security*, 2, 49–70.

Maier, H., Spiegel W., Kinaciyan, T., Krehan, H., Cabaj, A., Schopf, A. and Honigsmann, H. (2003). Contact Dermatitis and Allergy: The oak processionary caterpillar as the cause of an epidemic airborne disease: survey and analysis, *British Journal of Dermatology*, 149, 990–997.

Mills, P., Dehnen-Schmutz, K., Ilbery, B., Jeger, M., Jones, G., Little, R., MacLeod, A., Parker, S., Pautasso, M., Pietravalle, S. and Maye, D. (2011). Integrating natural and social science perspectives on plant disease risk, management and policy formulation. *Philosophical Transactions of the Royal Society B, Biological Sciences*, 366, 2035–2044.

Newing, H. (2011). *Conducting Research in Conservation: A Social Science Perspective*, Oxon: Routledge

Nowark, D. (2010). Urban Biodiversity and Climate Change. In Muller, N., Werner, J., and Kelcey, G. (Eds.), *Urban Biodiversity and Design* (p101-117). Hoboken, NJ: Blackwell Publishing.

OPM Advisory Group (2014) *Oak Processionary Moth: 2013 Control Programme Review Report*. Available at [http://www.forestry.gov.uk/pdf/140110-OPM-2013-REPORT-for-publication.pdf/\\$FILE/140110-OPM-2013-REPORT-for-publication.pdf](http://www.forestry.gov.uk/pdf/140110-OPM-2013-REPORT-for-publication.pdf/$FILE/140110-OPM-2013-REPORT-for-publication.pdf) (accessed 29/5/14)

Outhwaite, O. (2010). The International Legal Framework for Biosecurity and the Challenges Ahead. *Review of European Community & International Environmental Law* (RECIEL), 19 (2), 207-206.

Pauleit, S, Jones, N, Garcia-Martin, G., Garcia-Valdecantos, J.L, Riveries, L.M., Vidal-Beaudet, Bodson, M. and Randrup, T.M. (2002). Tree establishment practice in towns and cities – Results from a European survey. *Urban Forestry and Urban Greening*, 1, 83–96.

Poland, T.M and McCollough, D.G. (2006). Emerald Ash Borer: Invasion of the Urban Forest and the Threat to North America’s Ash Resources. *Journal of Forestry*, April/May, 118-124.

Potter, C. (2013). Saving Britain’s Trees: Countering the threat from invasive pests and diseases. *Ecos: A Review of Conservation*, 34, 25-30.

Potter, C., Bayliss, H., Tomlinson, I., Leather, S. (2013) *Oak processionary moth in the UK: Lessons from the London outbreak*. Report to the Department of Environment, Food and Rural Affairs.

Potter, C., T. Harwood, J. Knight, and Tomlinson, I. (2011) Learning from history, predicting the future: the UK Dutch elm disease outbreak in relation to contemporary tree disease threats. *Philosophical Transactions of the Royal Society B*, 366 (1573), 1966-1974.

Raupp, M. J., Buckelew Cumming A., and Raupp, E.C. (2006). Street Tree Diversity in Eastern North America and Its Potential for Tree Loss to Exotic Borers. *Arboriculture & Urban Forestry*, 32 (6), 297–304.

Santini, A., Ghelardini, L. De Pace, C., Desprez-Loustau, M.L., Capretti, P., Chandelier, A., Cech, T., Chira, D., Diamandis, S., Gaitniekis, T., Hantula, J., Holdenrieder, O., Jankovsky, L, Jung T., Jurc, D., Kirisits, T., Kunca, A., Lygis, V., Malecka, M., Marcais, B. Schmitz, S., Schumacher, J., Solheim, H., Solla, A., Szabo, I., Tsoelas, P., Vannini, A., Vettraino, A.M., Webber, J., Woodward, S., and Stenlid, J. (2013). Biogeographical patterns and determinants of invasion by forest pathogens in Europe. *New Phytologist*, 197, 238-250.

Smith, R., Baker, R., Malmumphy, C., Hockland, S., Hammon, R., Ostoia-Starzewski, J and Collins D. (2007). Recent non-native invertebrate plant pest establishments in Great Britain : origins, pathways, and trends. *Agricultural and Forest Entomology*, 9, 307–326.

Smith, J. (2013). *Biosecurity in Urban Areas*. Presentation given at “Tackling the threats to London's trees” 24th January 2013, Guildhall, City of London. Available at

[http://www.forestry.gov.uk/pdf/England_London_Biosecurity_JSmith_24Jan13.pdf/\\$FILE/England_London_Biosecurity_JSmith_24Jan13.pdf](http://www.forestry.gov.uk/pdf/England_London_Biosecurity_JSmith_24Jan13.pdf/$FILE/England_London_Biosecurity_JSmith_24Jan13.pdf) (accessed 6/6/14).

Tree Health and Plant Biosecurity Expert Taskforce (2013) Final Report, May 2013.

Available at

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/200393/pb13878-tree-health-taskforce-final-report.pdf (accessed 10/2/14)

Tibbets, J. (2013). Massaria Disease of Plane. Presentation given at “Tackling the threats to London's trees” 24th January 2013, Guildhall, City of London. Available at

[http://www.forestry.gov.uk/pdf/England_London_MassariaofPlane_JTibbets_24Jan13.pdf/\\$FILE/England_London_MassariaofPlane_JTibbets_24Jan13.pdf](http://www.forestry.gov.uk/pdf/England_London_MassariaofPlane_JTibbets_24Jan13.pdf/$FILE/England_London_MassariaofPlane_JTibbets_24Jan13.pdf) (accessed 18/11/13).

Tomlinson, I., and Potter, C., (2010). “Too little, too late”? Science. Policy and Dutch Elm Disease in the UK. *Journal of Historical Geography*, 36 (2), 121-131.

Tomlinson, I., Harwood, T., Potter, C and Knight, J. (2009). *Review of Joint Inter - Departmental Emergency Programme to Contain and Eradicate Phytophthora ramorum and Phytophthora kernoviae*. Defra, London.

Townsend, M. (2013). Oak processionary moth in the United Kingdom. *Outlooks on Pest Management*, 24, 32-38.

Tubby, K. and Webber, J. (2010). Pests and diseases threatening urban trees under a changing climate. *Forestry*, 83(4), 451-459.

UK Government (2013). *Plant Health Act 1967*. Available at
<http://www.legislation.gov.uk/ukpga/1967/8> (accessed 18/11/13).