Chapter 7. The social amplification of tree health risks: The case of ash dieback disease in the UK

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1. Introduction

Risk experts have long observed that newly emerging diseases generate complex and sometimes contradictory interactions between attempts by governments to manage disease outbreaks, media coverage of those events and the diverse risk perceptions of stakeholders and publics. The difficulty for policymakers is that the technical risk assessment tools and methodologies they rely on to set priorities, recommend and justify preventative actions and target scarce resources may not always be well attuned to often rapidly evolving public risk understandings and the social and cultural processes which shape these. In the case of pest and disease threats to trees, woods and forests, the identification of ash dieback in the UK in 2012 elevated tree health from an issue predominantly of expert and high-level stakeholder concern to a major focus of public scrutiny and media attention over a period of just a few weeks, bringing in its train widespread criticism of the Government's ability to ensure effective biosecurity in the live plant trade (Urquhart et al. under review-b, Mumford 2013). The resulting social intensification of public risk concern, if sustained, seemed likely to have profound implications for the way tree pest and disease threats would need to be handled and communicated by government, its agencies and stakeholders. It posed reputational risks for government if a more risk-aware and critical public perceived disease prevention efforts to be 'too little, too late', control programmes poorly designed and risk communications confused and inconsistent.

Clearly, if government and stakeholder efforts to safeguard tree health in the UK are to be effective, it is essential that policymakers and risk managers have a better understanding of how both experts and publics view future risks to tree health. Evidence-based research is, therefore, needed to analyse the emerging nature of

public risk concerns and to suggest ways in which policymakers and risk managers can better engage with these based on an understanding of formative processes and underlying values. We need to know which publics are affected by or engaged with tree health risks. We also need to know how their respective understandings of risk develop over the course of outbreaks through exposure to official risk communications, public debate and/or personal experience. Further work is then needed to characterise the implications of this for public engagement, risk communication, priorities for action and risk analysis more broadly. A particular concern here is how uncertainty should be captured and characterised within policy and public databases, such as the UK Plant Health Risk Register.

Stakeholder and public engagement and participation is integral to the process of environmental policy-making in order to help formulate the problem and enable more effective decision-making (e.g. Gormley, Pollard, and Rocks 2011, COA 2013). However, we know from previous work in the human and animal health fields that public risk understandings do not develop in isolation but are influenced by cultural associations, social interactions, personal experience, assessments of institutional competence and the historical benchmarking of previous disease risk events (Lewis & Tyshenko 2009, Selbon et al. 2005). A useful way to conceptualise these interacting influences is provided by the Social Amplification of Risk Framework (SARF), developed in the late 1980s in order to integrate technical analyses of risk with the social, cultural and individual factors influencing how publics experience it (Kasperson et al. 1988). The SARF emphasises the socially constructed nature of all risk perceptions and lays stress on the dynamic processes through which risk is communicated and interpreted by many different social agents. It draws attention to the complex nature of risk perceptions and understandings and as such may offer

scope for constructive dialogue between risk assessors, risk communicators, policymakers and publics.

This chapter draws on social research undertaken as part of the UNPICK (Understanding public risk in relation to tree health) research project (2015-2017), designed to investigate how UK publics perceive, understand and make sense of the growing threats to tree health from invasive pests and diseases. The risks posed by tree pests and pathogens have been widely recognised in expert circles but the degree to which this awareness is shared by publics and some stakeholders is still unclear. There is potential conflict between government attempts to manage the risks, media coverage about their importance and likely impact and the different ways in which various publics and stakeholders make sense of the threats. A key aim of the project was to explore the inter-relationships of media representation, expert assessments and public perceptions of tree pest and disease outbreaks in an integrated way using the SARF as an analytical lens. The research adopted a variety of social science approaches, including interviews with policymakers, managers and scientists involved in making decisions about how to deal with ash dieback; content analysis of traditional and social media related to the outbreak; an online national survey of public attitudes to tree health; Q Methodology interviews with members of the public in areas affected by ash dieback; and an analysis of helpline contacts.

In this chapter, we focus on the ash dieback outbreak in the UK to exemplify how SARF can help us to understand how risk issues associated with an outbreak may be 'intensified' or 'attenuated', the knock-on effects of these processes and how discrepancies between 'expert' and public assessment of the risk may arise. The chapter proceeds with, firstly, an outline of the SARF, followed by an explanation of the methods adopted in the study. This is followed by a synthesis of the findings from

the various methods adopted by the project, and a discussion of the implications of the study. Detailed results from each method are beyond the scope of this chapter, and readers are directed to the published outputs of the project for a more in-depth presentation of the findings from this work (Urquhart et al. 2017a, b, Fellenor et al. 2017, Urquhart et al. under review-a, b, Fellenor et al. under review, a, b).

2. Social Amplification of Risk Framework (SARF)

SARF was first introduced in 1988 by Kasperson, Renn, Slovic and colleagues (Kasperson et al. 1988) in response to a perceived need for a broader understanding of risk and how it is perceived by different social actors. In its original conception, the framework was presented as an overarching approach designed to integrate the 'technical' assessment of risk alongside the 'social or perceptual' analysis of hazards (Renn et al. 1992, Kasperson 1992). The primary rationale was to try to understand why some risks or events assessed by experts as not significant sometimes elicit strong public concerns and result in substantial impacts upon society and economy (e.g. the bovine spongiform encephalitis (BSE) outbreak in the 1990s), while others, deemed by experts to pose a significant risk by experts (e.g. smoking) are associated with a more graduated or even 'attenuated' response from publics and society (Kasperson 2012a).

SARF recognises that responses to risk are not only determined by exposure to the physical impacts (or harms) caused by a hazard event itself, but are also shaped by interactions between the transfer of information about hazard events and the responses of individuals and social groupings to these 'risk signals'. Critically, because responses are mediated through a variety of psychological, social, institutional and cultural processes, the result can be to intensify or attenuate individual and collective

perceptions of risk and shape risk behaviour. This is defined by the authors as ‘social amplification’ (Kasperson et al. 1988, Renn et al. 1992, Renn 1991) (see Figure 7.1).

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Figure 7.1. The Social Amplification of Risk Framework (from Kasperson 2012a).

The framework borrows the metaphor of amplification from classical communications theory (Lasswell 1948, Shannon and Weaver 1949) to analyse how social agents generate and translate ‘risk signals’ (Bakir 2005). Risk signals are both transmitted and processed by individuals and social entities called ‘amplification stations’, with social amplification most likely to occur when risks are serious and the situation is fraught with uncertainties (Kasperson 2012a). These agents of amplification may include scientists, risk management institutions, the media, activists, peer groups, social networks and public agencies. One of the key insights of the framework is that amplified risk perceptions can lead to behavioural responses that, in turn, result in secondary impacts described by Kasperson and colleagues as ‘ripple effects’ (Kasperson et al. 1988, p.181) (Figure 7.1). These ripples are the secondary and tertiary impacts that may extend far beyond (geographically, temporally and socially) the direct harms of the hazard event and include: enduring changed mental perceptions and sensitivities; economic impacts for particular sectors and throughout the economy, increased pressure for policy reform; changes in the physical nature of the hazard (feedback mechanisms) and repercussions for other technologies and activities (for instance, by changing public willingness to accept

potentially hazardous technologies) (Kasperson et al. 1988, Renn et al. 1992, Kasperson and Kasperson 1996).

A key part of the communication process is that risks and risk events are portrayed through various risk signals (i.e. images, signs and text involved in the transfer of information about the risk) which interact with a range of psychological, social, institutional or cultural processes in ways that intensify or attenuate perceptions of the risk and its manageability (Kasperson 2012b). SARF, therefore, suggests that alongside consideration of the risk signal it is important to understand the social response mechanisms through which information about the event is interpreted (Burns et al. 1993). How the public responds to the risk signal is tempered by factors such as the perceived seriousness of the 'risk event' and by what the event signifies. Understanding these processes requires appreciation of the role played by the heuristics, mental models and short-cuts people use to make sense of, and evaluate, complex risk information, alongside levels of trust and the potential for stigmatization.

In her use of social representation theory, Moscovici (1984) examined how individuals or groups may compare a new or emerging risk to a previous risk event via the linked mental processes of 'anchoring' and 'objectification'. Anchoring involves comparing the unfamiliar to existing knowledge and enables new information to be interpreted in terms of existing beliefs and memories of previous hazards. Objectification refers to the heuristic devices that people use to transform unfamiliar and abstract notions into concrete common-sense realities. Heuristic mechanisms are influenced by the extent to which the public perceives a risk to be catastrophic, deadly and uncontrollable (dread risks) and the extent to which the risk is poorly understood, unknown to those exposed and has delayed effects (unknown

risk) (Slovic 1987). For example, when the media attributes specific storms or floods to climate change they are objectifying an abstract phenomenon (Höijer 2010). This can often involve the use of images, metaphors, tropes or symbols. The importance of various 'availability heuristics' - the mental shortcuts to judgement that people use to assess risks - has been widely studied. Kuhar et al. (2009), for instance, found that those respondents who had personally observed (and drawn conclusions about) 'red tides' affecting the Florida coast had much higher awareness of the health risks of eating seafood than those only exposed to official health advisories.

Further, the nature of social and political groups influence the responses of its members and represents an ideological interpretation of risk (Kasperson et al. 1988). Renn et al.'s (1992) concept of 'social stations of amplification', for instance, recognises that individuals act as members of larger social units and cultural groups that co-determine the social processing of risk (Kasperson 2012a). Thus, individuals may perceive risk through the lens of values of the organisation or group to which they belong and its cultural biases (Dietz & Stern 1996).

A key element here is the degree to which there is trust in the institutions responsible for managing and communicating about the risk. Burns et al. (1993) concluded that when an event is perceived as improperly managed, there are high levels of uncertainty about the risk, or that future risk is great, the public are likely to perceive a greater threat. In this context, there are reputational risks for government if risks are inadequately communicated and a more critical public perceives risk managers as incompetent.

The following section sets out how the SARF can help to inform understanding on public attention to tree health issues and outlines the methods that were adopted to explore the ash dieback case study.

3. Methodology and methods

The methods adopted in this study represent a layered, sequential analysis of the assessment, communication and public understanding of tree health risks by (i) offering a critical analysis of how ash dieback has been framed by scientists, policymakers and risk managers over time; (ii) exploring how communications about ash dieback from these expert sources have been deliberated on and interpreted via an increasingly complex set of traditional and social media channels, at how the public, as a form of 'citizen media', may act as a 'social amplification station'; (iii) examining how various publics perceive, understand and act on the risks associated with ash dieback; and (iv) integrating the three streams of work through the SARF. Our contention here is that there is not one 'risk' waiting to be identified, but that different actors will construct their own socio-spatial perceptions of risk. These may change over time as information, knowledge and direct experience of the outbreak develops.

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Figure 7.2. Conceptualisation of response to ash dieback outbreak using the SARF.

Drawing on SARF, Figure 7.2 illustrates how the framework was applied as an analytical tool to integrate the assessment of expert, policy maker and public responses to the ash dieback outbreak. Firstly, for any given tree pest or disease outbreak, experts and risk managers will assess the nature of and degree of risk involved. Notifications about the outbreak may be released by government agencies or others responsible for outbreak management, based on expert assessments of the

risk. These notifications may be picked up by the news media, who in turn will translate the risk signals and present their own interpretation of the outbreak. Wider publics and stakeholders respond to these risk signals through a range of social, psychological and cultural filters to construct their own perception of the risk. This in turn leads to 'ripple effects', or changed behaviours or ways of thinking about tree health issues. SARF also recognises that risk perception is rarely a linear process and feedback processes occur which further influence how publics' and other actors' perceive the risk over time. For instance, policy makers and risk managers may adapt their management or communication strategy in response to the public and media response to an outbreak (see for instance, Tomlinson 2016).

3.1 The ash dieback outbreak

Ash dieback is a disease caused by the fungal pathogen *Hymenoscyphus fraxineus.* It affects many species of ash, but in particular the Common ash (*Fraxinus excelsior*) and Narrow-leaved ash (*Fraxinus angustifolia*) (Kowalski 2006, FR 2012). The disease causes leaf loss, bark lesions and dieback of the crown and usually results in tree death over a period of years. In Europe, the disease was first identified in Poland in 1992 (Kowalski 2006) and is now widespread across the continent. It was discovered in the UK in 2012 at a tree nursery in Buckinghamshire on ash saplings that had been imported from the Netherlands, but it is also believed that spores of the pathogen may have blown in from continental Europe (Heuch 2014). Ash dieback has been identified across the UK, but its impact is currently the greatest in eastern regions, such as East Anglia and Kent, where both young and mature trees in woodlands and the wider landscape and visibility affected by the disease.

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Figure 7.3. Methods adopted to explore the interactions between expert assessment, media attention and public concern about ash dieback in the UK.

3.1 Investigating scientists, policymakers and high level stakeholders as risk amplification stations

The idea that expert judgements about risk may be subject to social processes and contestation just as much as expressions of public concern frames the first stage of the analysis. Firstly, a documentary analysis was undertaken to review academic, policy and grey literature to outline the technical risk assessment process and the official management response to ash dieback (see Figure 7.3). The second stage was semi-structured interviews with a range of experts, including scientists, policymakers and key stakeholders (e.g. NGOs, nursery sector, foresters) (Figure 7.3). A total of 21 individuals were interviewed between March-November 2015. Interviews lasted between 45 and 90 minutes, and were audio recorded and transcribed verbatim. A thematic analysis was undertaken on the transcripts, involving both manual and digital (Nvivo 12.0) coding, in order to identify the sources of information that respondents' drew on to form their perceptions, the affective and cognitive filters through which the outbreak was viewed, and the role of their interactions with others in shaping those perceptions. For a detailed overview of the method adopted, see Urquhart et al. (2017).

3.2 Assessing the impact of traditional media coverage and social media feedback

The second stage of analysis involved examining how the risk framings and communications about ash dieback from scientists and various biosecurity

professionals have been filtered and interpreted in traditional and social media (Figure 7.3). First, an analysis of traditional media was undertaken. British newspaper articles from 2002 to 2015 were analysed using LexisNexis to assess how the media described events associated with ash dieback and the extent to which previous tree health issues or other risk events were referenced in relation to the ash dieback outbreak (Fellenor et al. under review).

An important additional layer of analysis was to examine how the social media coverage of ash dieback developed over the course of the early stages of the outbreak. Analysis focused on the social media platform Twitter to consider the social amplification of risk in relation to ash dieback disease. An empirical analysis was made on 25,600 tweets to see what people said about ash dieback on Twitter, who was talking about it and how they talked about it (see Fellenor et al. 2017 for a full account of analytical approach).

3.3 Understanding the drivers of public attention to tree health risks

This stage of the research involved three levels of analysis (Figure 7.3). Firstly, a nationally-representative survey was undertaken in April 2016 to assess broad public awareness and concern about tree health issues, as well as willingness to adopt biosecure behaviours (see Urquhart et al. 2017). The questionnaire was deployed by a professional panel survey company (http://www.respondi.com) using an online survey tool, resulting in 1334 responses suitable for analysis. Questions in the survey sought to elicit respondents' awareness of tree health risks, their concern and interest in these issues and their willingness to adopt biosecure behaviours. Cross-tabulations, factor analysis and ordinal logistic regression modelling was used to identify variables likely to influence respondents' awareness and concern. A further

analysis compared the results of this survey with a prior survey undertaken in 2013 to investigate change over time in public attention to tree health risks.

Secondly, interviews were undertaken with a sample of 22 residents and stakeholders in East Kent, using Q Methodology. A full explanation of Q Methodology and how it was applied is provided in Urquhart et al. (under review-a). In short, it involved asking respondents to sort a series of 44 statements relating to attitudes and beliefs about ash dieback and tree health more broadly according to the extent the statements aligned to their personal views. The resulting 'Q sorts' were factor analysed to identify clusters of respondents with similar points of view.

Thirdly, we investigated direct expressions of concern from observing publics by examining a database of 1282 email and telephone enquiries to Forest Research's Disease and Diagnostics Advisory Service (FRAS) over the last 5 years (Fellenor et al. under review). This allowed us to track the nature of public attention to ash dieback in a naturally emerging dataset, as opposed to being elicited via a research survey. The dataset was analysed using Textometrica[i], a free online tool for visualising and exploring short texts. See Fellenor et al. (under review) for a full account of the analysis method.

In order to integrate the empirical findings from across the different datasets, the research team met for a series of group analysis sessions in which the data were considered as a whole using the SARF. These were further presented and deliberated on at a workshop with high-level policy makers across relevant government departments in October 2017 to validate the findings and to further integrate and synthesise the results across the various streams of work.

Reflecting our aim of describing perceptions of tree health risks through a SARF lens, the following sections discuss the processes identified in Figure 7.2 in

light of the empirical findings. We provide insight into the socially constructed nature of experts' and policy makers' risk assessments, evidence of social amplification (or not) in both traditional and social media, a spatially and temporally nuanced exploration of public attention to tree pest outbreaks, and the interaction between experts, policy makers, media and publics to create a dynamic, evolving and complex tree health 'riskscape'.

4. The objective expert?

The original framing of SARF as a communication-reception process implies that expert risk assessment, and any communication and signalling of risk that results, constitutes the 'real' or benchmark risk against which the public's 'perceived' risk is either amplified or attenuated (Merkelsen 2011). There is an implicit assumption that expert risk perceptions are based on objective technical assessments. This conceptualision is empirically problematic when there are high levels of scientific uncertainty and where experts may disagree about the nature of the risk they are trying to communicate, as in the tree health case (Busby et al. 2009, Busby & Onggo 2012, Pidgeon & Barnett 2013). It further downplays the extent to which experts may themselves socially construct risk on the basis of shared worldviews, subjective beliefs and institutional affiliations (Duckett et al. 2015, Urquhart et al. 2017).

The analysis of the data from the interviews with scientists, policy makers, practitioners and high-level stakeholders suggests that expert risk perceptions are heterogeneous and dynamic, and they draw on a wide range of evidence to construct their understanding of the risks posed by a tree pest or disease outbreak. Along with official notifications and technical risk assessments, they also rely on their own experience, anecdotal evidence, interactions with stakeholders and media accounts. Heuristic devices used by our respondents included a reference to past outbreaks in

order to explain or contextualise their perceptions about the current risk. For instance, Dutch elm disease was drawn on to justify their own framing of the risks posed by ash dieback, as expressed by one tree nursery owner:

> "There's reckoned to be 60 million ash trees in the country … so it far outweights the cataclysm that was Dutch elm disease, in my view."

It was also cited as they tried to make sense of why ash dieback was taken up by the media, with one scientist respondent suggesting:

> "I think it is actually probably because of Dutch elm disease, whenever there's anything that affects trees in this country, I think the 'Great British Public' are, you know, nature lovers."

Similarly, the Government's aborted sell off of England's public forest estate[ii] was used to contextualise the government's response to the disease, as described by representative of a landowners' association:

> "I think it kind of all goes back to they [the Government] found themselves just incredibly vulnerable after the disaster of trying to sell off the public forest estate. They just did not expect that kind of response. … It galvanised quite a lot of influential public opinion … and I think they were just very nervous of anything to do with trees and woods, and was a disease."

In many instances respondents indicated high levels of concern in the early stages of outbreaks when there is often limited scientific evidence, a lack of clarity on management responsibilities or regulatory mechanisms, making effective management and control very difficult to plan, justify and implement. The issue of uncertainty poses one of the greatest challenges facing policy makers in making objective risk assessments for tree health outbreaks. For many tree pests and diseases, there is uncertainty about the likelihood of introduction and spread but also about the effectiveness of any attempts to control, manage or contain an outbreak once it is underway. Inevitably, under conditions of uncertainty, policymakers and decision-makers may feel particularly exposed to risks to their reputation. Indeed, in the ash dieback case, much of the initial government response to the outbreak arguably reflected concerns about reputational risks related to intense media scrutiny during the early stages of the outbreak in 2012, as one government policy maker indicated:

> "Right from the word go, officials at number ten were involved in the policy and media handling of what the government's response was going to be. So, there was strong pressure right from the very top for the government to be seen to be doing something about this."

Tree health managers, regulators and policy makers may therefore respond both to the hazard event itself ('A' on Figure 7.2) but also to what they perceived as public concern ('D' on Figure 7.2). Our analysis suggests that where there are concerns over uncertainty and reputational risk, decision makers are particularly likely to be sensitive to what they believe the public is thinking and often see messages disseminated in the media ('C' on Figure 7.2) as a proxy for public concern.

One policy maker suggested that “In my view, the main driver was the media, and then the government response to the media. It didn’t have as much to do with the science or the practicalities of it at all.”

Risk managers may therefore attribute risk perceptions to wider publics and other stakeholders in their efforts to ensure the social acceptability of any interventions. Indeed, the analysis suggests the response to institutional or reputational risks in public bodies is often driven by how risk managers and policy makers assume the public feel about a particular pest or disease rather than on the basis of any empirical evidence of public concern. This highlights a need for a better understanding of public perception of risk as well as recognition of the importance of reputational drivers for government action. An understanding of levels of public knowledge, what prompts their interest and attention and how they access information about pests and diseases would help in designing risk communication strategies. It would also help risk managers address both institutional risks and societal risks associated with tree pest and disease outbreaks.

The findings from the analysis of the interview transcripts concurs with Busby and Onggo (2012) and implies that experts are social actors just as much as publics, interacting, observing and being influenced by others’ judgements in different settings. In this dynamic interaction, cultural context likely influences the strategies that different actors (e.g. policy makers, publics, institutions, media) use to frame risk debates, as outlined by Renn (2003): “All actors participating in the communication process transform each message in accordance with their previous understanding of the issue, their application of values, worldviews, and personal or organizational norms, as well as their own strategic intentions and goals” (p. 377). Different individuals and groups will thus assess risk differently because they attach

systematically different values to what is being harmed and may view the consequences of that harm differently (Jackson et al. 2006). Thus, rather than seeing divergences between expert and lay views as evidence of amplification, social risk amplification may best be understood as an attribution or judgement that one individual or group of individuals makes of the risk assessments or judgements of another or others.

5. The media as a 'social station of amplification' for tree pest outbreaks

Our analysis of the traditional media coverage of ash dieback revealed that early reporting featured risk signals such as 'killer', 'disease' and 'spread', highlighting the spread of the disease across Europe and blaming the government for preventing its incursion into the UK (Fellenor et al. under review-a). As SARF notes, risk events are rarely seen in isolation, and the media attention referenced previous tree health outbreaks such as Dutch elm disease in the 1970s and more recent outbreaks such as OPM, *Phytophthora ramorum* and Horse chestnut leaf miner (*Cameraria ohridella*). It further warned of potential new invaders not yet present in the UK, but on the watch-list of future risks, such as Emerald ash borer (*Agrilus planipennis*) and Xylella (*Xylella fastidiosa*).

According to SARF, traditional media (newspapers, radio and television) are ascribed a "pivotal role as a 'station' relaying 'signals' and constructing public representations of risk" (Murdock et al. 2003, p. 156). The role that news media play as 'risk articulators' has always been given prominence in studies of risk communication and awareness within a social amplification framework. However early critics took issue with the linear representation within SARF of media reporting of risk events as merely information transmission, positing instead a much more interactive involvement by journalists and media editors as they react to the storylines

that their initial reporting may have set in motion. Furthermore, the media may also seek to 'shape' risk perceptions through adopting particular positions or stances in order to promote a particular agenda. A number of scholars have looked at how key actors use the media (Rayner 1988, Petts et al. 2001, Bakir 2005), such as institutions and lobby groups seeking to influence media coverage in order to convey a particular message or draw attention to their own interests and agendas. Indeed, our expert interviews (Section 4) suggested that a number of environmental NGOs and industry groups used the early media attention on ash dieback as an opportunity to raise tree health on the political agenda by actively amplifying the risks in their briefings to journalists. A representative of a landowners' association said:

> "We very quickly decided that this was an opportunity for us to raise the whole profile of tree health within government circles. So we were very happy to brief the press and make it as big a story as possible, and as threatening."

Less well studied has been how social media may influence, often very rapidly, public views on hazard events. As far as we are aware, there has been no consideration of social media and SARF, although there are a small number of studies of social media and risk perception (e.g. Gaspar et al. 2014). With increasing use of a range of platforms, such as social networking sites, blogs, online video, text messages and portable digital devices (Smith 2010), publics are becoming more actively involved than ever before in shaping risk stories (Veil et al. 2011). By posting first-hand accounts and images of emerging hazard events, the public operates in effect as a 'citizen media' platform and as a 'social amplification station'. In addition, social

media presents an important communication tool for risk communicators for both disseminating risk information and engaging in dialogue with the public in order to best manage the risk issue.

Analysis of Twitter showed several waves of interest in tree health, suggesting that a majority of information tweeted was resending (retweeting) what was already available in official or traditional media. Moreover, assessing the tweets for particular synonyms for risk revealed that they largely reflected what was said in specific traditional media stories, which were then repeated on Twitter, rather than as original content created by users. Given the limited character count available for tweets, fragments of the original media stories were transported to the Twitter platform, reflecting how certain features of media messages are emphasised and amplified. Our analysis revealed tweets pertaining to initial concerns with its 'spread' and the 'fight' against the disease. Later, these themes fell in prominence and themes of 'blame', and then finally, 'too late', were most common. A further observation was how information is tailored in line with group identities and individual interests. For example, information on tree health can piggyback onto other interests circulating on Twitter. For instance, for users with a primary interest in countryside recreation, tree pests may be of interest in the context of whether it may or may not diminish their recreational experience. Thus, Twitter users may have an active role in re-presenting risk to a wider audience, but the intention is often to reshape the risk within their own worldview or in relation to core interests. For some this involves a call for official action, a response to their personal sense of responsibility to help, or may be seen as just another example of natural events.

6. Are the public concerned about tree health risks?

As outlined above, assumptions are often made by policy makers and risk managers about how publics view risk issues, often on the basis of media coverage of the risk event concerned. But to what extent does this align with actual public opinion? The first point to stress, perhaps obviously, is that public opinion about tree pests and diseases is not homogenous, as demonstrated in our national survey and the East Kent case study. Different individuals have different views about the seriousness of tree pest outbreaks and their likely impacts and many are unaware of tree health issues (21% of respondents had never heard of the issue, and a further 57% indicated they knew very little about it).

Around one in three respondents indicated they were either extremely concerned or very concerned about tree health issues, and around half indicated a willingness to adopt biosecure behaviours, such as avoiding bringing plants and wood products to the UK, buying from trusted locally-grown sources and cleaning footwear and bike tyres. Members of environmental organisations and those who feel a strong sense of identity with a place (home, village, park, etc) are likely to have higher awareness and levels of concern about tree pests and diseases. Further, those who visit woodlands regularly are likely to be more aware than non-visitors, and gardeners are more likely to be concerned than non-gardeners. Women, older respondents, those with a strong sense of affinity with a place, members of environmental organisations, woodland visitors and gardeners were most likely to express a willingness to adopt biosecure behaviours.

The national survey results suggest that the public's various concerns about tree health are rooted in wider interests, such as access to the countryside, aesthetic values, recreation and gardening. Concerns about the ecological and landscape

impacts of tree diseases appear to be greater than economic concerns (such as the cost of treating or removing diseased trees) or human health impacts (see Figure 7.4).

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Figure 7.4. Stated concerns about impacts of tree pests and diseases.

A comparison with results from a survey conducted in 2013 showed a decline over the three-year period in awareness, concern and willingness to take actions that prevent tree health problems occurring. The 2013 survey was undertaken shortly after the period of intense media scrutiny on the ash dieback outbreak when it was identified in the autumn of 2012 (Fuller et al. 2016). This may explain the higher level of awareness and concern at that time, but as no baseline of public perceptions prior to the ash dieback outbreak exists, it is difficult to be clear whether the interest in 2013 represented a peak in attention at the time. Although our study suggests that individuals with higher levels of knowledge about invasive tree pests and diseases are more likely to be concerned about the issue, it also suggests that a primary source of information for awareness is the media. The frequently cited source of information about tree pests and diseases was traditional media such as TV, newspapers and radio. Thus, the way the issue is framed in media accounts is likely to influence public opinion, at least in the initial phases of an outbreak when it is relatively unknown, perhaps skewing more longer-term attention to tree health issues.

In the Q Methodology analysis conducted in East Kent, a diverse set of five narratives on public perceptions about ash dieback (*Hymenoscyphus fraxineus*)

emerged (Figure 7.5), typified as Disinterested (a lack of concern or interest in tree); Pro-active citizens (locally aware and active); Call for better biosecurity (concerned about preventing future outbreaks); Resilient nature (belief that nature is resilient and, with help from science, will cope); and Fatalistic (pessimistic about future tree health) (Urquhart et al. under review-a). Opinions varied greatly between the narratives on what, if anything, should be done about tree health and who should be blamed for tree pest and disease outbreaks. A key factor in shaping public attitudes was people's beliefs about how the disease arrived in the UK and if anyone was to blame (Figure 7.5). Attitudes also reflected broader worldviews about the vulnerability or resilience of nature and cultural perspectives, independent of the actual events around ash dieback.

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Figure 7.5. Narratives associated with beliefs about pathways of introduction for ash dieback.

While the survey and the East Kent case study represent a research intervention that involves eliciting data from respondents, we also undertook an analysis of naturally occurring data in the form of emails and calls to Forestry Commission and Defra's helpline during the early phase of the ash dieback outbreak (Figure 7.6). Interestingly, the analysis indicated that the helpline contacts generally had few media references and did not relate to ash dieback in a way that was typical of the media coverage. The surge in emails and calls appears mainly to reflect interest in obtaining more information and offering to help (for example, to give the location

of infected trees), rather than showing panic or concern. Most significantly, the content of emails reflected a rational and reasonable public response to dieback and not one which might have otherwise have reflected an 'irrational' public. Correspondents and callers generally wanted to help, for example by reporting a case.

INSERT FIG 7.6 ABOUT HERE

Figure 7.6. Emails and calls to Defra and the Forestry Commission helpline during the ash dieback crisis in 2012.

5. Conclusions

Viewing a tree health outbreak through the lens of SARF allows us to consider the interactions between experts, policy makers, publics and the media in the construction of tree health risks. By exploring the dynamic interrelationships between these different actors and the social, psychological and cultural processes through which they determine risk, we have provided a more nuanced understanding of tree health risks that can inform risk communication strategies. We suggest that such strategies need to be sensitive to different cultural perspectives on public risk perceptions and that notifications that merely present scientific data, without consideration of how calls for behaviour change, for instance, may threaten underlying cultural values and beliefs and thus be unlikely to succeed (Urquhart et al. under review-a).

This section sets out a number of implications that emerged from the integrated analysis presented in this chapter. Firstly, it is important to recognise that there is no single public to address on tree health, nor any simple way to capture the

degree of attention, interest or concern shown by these publics. Typically, there are many different publics, with varying degrees of concern about a given issue. This makes measurement using conventional survey methods difficult. Specific worldviews, experiences and interests of different publics can reinforce positive, relevant and personalised responses aimed at managing tree health issues.

Secondly, tree health events or outbreaks are not seen in isolation but are assessed by both publics and experts in the light of earlier experiences and events. In anticipation or response to a 'tree health event' or issue, the event should be seen in broader historical, social and political terms, not just through the biology and ecology of the threat in question. Further, risk assessment has traditionally focused on the environmental and economic consequences of potential pests and diseases. The assessments should be broadened and problem definitions of tree health issues should incorporate wider dimensions relevant to the public, such as how specific groups and their needs or interests will be affected.

Thirdly, there may be a gap (or mismatch) between communication undertaken in the early stages of an outbreak and longer-term communications required to bring about changes in behaviour. There could be benefits in linking the short- and longer-term communications more directly. This will need to take into account consistency between tree health advice and other messages, such as to enjoy nature or visit the countryside (for example, by ensuring that increased use is mindful of biosecurity). The distinction perceived between traditional and social media communication campaigns may be underestimating the flow between these media. Understanding how traditional and social media influence each other and how this interaction shapes the potential to communicate and amplify positive messages and responses will help to improve tree health management.

Empirically, the study reported in this chapter contributes to our understanding of what drives public risk concerns and how far this is differentiated across groups with different exposures to tree pests and diseases. It provides an analysis of the public and media response to the ash dieback outbreak through an integrated analysis of the historical, social and risk communication influences at work. Furthermore, the research has generated important insights into the ways individuals are encountering tree pests and diseases in different settings and the extent to which they are able to relate the associated risks to their own actions and behaviours. Using SARF as an analytical tool allowed us to consider the interactions between expert and policy risk assessment, media attention and public opinion. Rather than a linear process of expert assessment informing policy decisions, leading to notifications that are amplified in the media and absorbed by the public, our analysis revealed a dynamic relationship whereby policy and expert risk assessments are reassessed in light of media and public scrutiny. Meanwhile, media and public attention will evolve in response to the degree to which they perceive the government as handling the outbreak in an appropriate manner. SARF also allows us to consider the 'ripple effects' from a risk event ('E' in Figure 7.2). In the ash dieback case, as well as the biological, ecological and landscape impacts of widespread decline of ash, there were significant institutional ripple effects. The government's response represents a step-change in policy attention to tree health issues more broadly, with biosecurity and tree health being higher on the political agenda, additional funding and resources being made available for scientific research and improvement to contingency planning and coordination of working across government departments and their partners.

In summary, the empirical evidence generated by this project contributes to the policy evidence base by specifically addressing expert and policy risk perceptions alongside media and public attention. Analysing these different datasets through the lens of SARF allowed us to not only delineate the nature of public concern, but better understand how policy makers and risk makers may attribute 'concern' to the public by responding to media coverage of an outbreak. Finally, in a policy domain (tree health) previously dominated by operational risk analyses, the work contributes to a broader framing of disease risks, building social science capacity while integrating technical and social perspectives. The need for further work that seeks to develop a better understanding of the underlying cultural determinants of tree health risk perceptions is crucial if societal expectations are to be managed and behavioural change encouraged as new and emerging tree pest and disease outbreaks arise.

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