



## Research article

# Exploring public perceptions of solutions to tree diseases in the UK: Implications for policy-makers



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## ABSTRACT

Tree diseases are on the increase in many countries and the implications of their appearance can be political, as well as ecological and economic. Preventative policy approaches to tree diseases are difficult to formulate because dispersal pathways for pest and pathogens are numerous, poorly known and likely to be beyond human management control. Genomic techniques could offer the quickest and most predictable approach to developing a disease tolerant native ash.

The population of European Ash (*Fraxinus Excelsior*) has suffered major losses in the last decade, due to the onset of *Hymenoscyphus fraxineus* (previously called *Chalara Fraxinea*) commonly known in the UK as ash dieback. This study presents evidence on the public acceptability of tree-breed solutions to the spread of *Chalara*, with the main aim to provide science and policy with an up-stream ‘steer’ on the likely public acceptability of different tree breeding solutions. The findings showed that whilst there was a firm anti-GM and ‘we shouldn’t tamper with nature’ attitude among UK publics, there was an equally firm and perhaps slightly larger pragmatic attitude that GM (science and technology) should be used if there is a good reason to do so, for example if it can help protect trees from disease and help feed the world. The latter view was significantly stronger among younger age groups (Millennials), those living in urban areas and when the (GM)modified trees were destined for urban and plantation, rather than countryside settings. Overall, our findings suggest that the UK government could consider genomic solutions to tree breeding with more confidence in the future, as large and influential publics appear to be relaxed about the use of genomic techniques to increase tolerance of trees to disease.

## 1. Introduction

Tree diseases are a global problem and on the increase in many countries due to a number of reasons including globalisation and climate change (Harper et al., 2016): the implications of their appearance and spread can be political, as well as ecological and economic. This is because certain trees species have a place in culture and in the shaping of national and local identities and as a result the visible manifestation of tree diseases can be aligned and amplified with issues and politics beyond the policy domains of silviculture and biodiversity.

This situation arose in the UK following the arrival of the fungal pathogen *Hymenoscyphus fraxineus* (hereafter, *Chalara*. *The asexual stage of the fungus attacks the bark, twigs and branches of the European Ash tree Fraxinus excelsior causing ‘dieback’*). The reproductive stage grows during the summer on fallen leaves of the previous year and the spores are spread by wind. In the UK the Ash is widely known and valued: it has deep cultural, spiritual and literary associations, is used as a timber and fuelwood source (Rackham, 2014) and contributes to the character of

iconic landscapes in national parks such as Snowdonia and the Peak District. *Chalara* was first identified in the UK on imported ash saplings in a Buckinghamshire nursery in February 2012. Later in 2012, it was confirmed that *Chalara* was the cause of dieback among a group of ash trees in established woodland sites in the eastern counties of Norfolk and Suffolk (Forestry Commission, 2016) which led to media reporting with headlines suggesting dire consequences for the future of ash trees and commentary that suggested that government had ignored warnings of *Chalara* spreading to the UK. This happened in the context of the UK government announcing a policy to ‘self-off’ public woodlands two years earlier, which was then withdrawn due to the intensity of the public outcry. *Chalara* appeared at a time when influential UK publics were still angered by their government’s apparent disregard for the deep connections between woodlands and cultural identity and as a consequence political leaders came under intense pressure to explain the perceived policy failure associated with *Chalara* and to ‘do something’. The name Ash dieback, rather than *Chalara*, for the disease, caught the UK public’s attention. In this article we use the two names

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interchangeably depending on context.

Preventative policy approaches to tree diseases are difficult to formulate because dispersal pathways for pest and pathogens are numerous, poorly known and likely to be beyond human management control (e.g. air borne diseases). Given this, and the fact that trees are located (grown) in many different ownerships, cultural and policy contexts, an adaption-based response of developing disease tolerant trees is being considered. Traditional methods involving propagation and crossing of stock from disease tolerant trees is slow because it produces uncertain outcomes and plants need to reach a particular age before features express. Genomic techniques offer the prospect of a more rapid and certain development of disease tolerant trees and the option to enhance other traits that are considered valuable (e.g. strait trunks for timber). Such techniques take two forms: i) genomic screening (termed accelerated breeding) whereby trees are screened at a young age for molecular markers that predict disease tolerance and other features, and ii) genetic modification where genes conferring tolerance are introduced from other species. This latter technique comprises two approaches with policy relevance: Cis-GM where genes from the same species (in this case *Fraxinus*) are introduced, and Trans-GM where genes from a quite different plant species are introduced e.g. common nettle (*Urtica dioica*). In the case of *F.excellsior* research on identifying markers that predict susceptibility to *Chalara* is at an advanced stage: an annotated whole genome assembly of *Fraxinus excelsior* has recently been published together with transcriptomic and metabolomic work related to ash dieback (Harper et al., 2016; Sollars et al., 2017). The conundrum for policy makers is that whilst genomic science can offer solutions that enable rapid and cost effective breeding, the political controversies surrounding the introduction of agricultural GM technologies in the 1990s inflicted political wounds that have left a legacy of ‘policy fear’ surrounding their adoption.

This paper reports the findings of UK study of public perceptions to different tree-breeding solutions to ash dieback. This study was a component of a wider BBSRC-funded research project that aims to develop new approaches for identifying genes conferring tolerance to *Chalara*. This project is in turn part of a larger programme of research in support of the UK Plant Biosecurity Strategy for Great Britain (DEFRA, 2014), which was a response to the aforementioned public concern over ash dieback. One important insight from the GM controversy in the 1990s was that societal acceptability of new technologies requires an open public dialogue during the development of the technology (Macnaghten et al., 2015). The goal of this study is to provide science and policy with an ‘upstream steer’ (cf. Kearnes et al., 2006) on the public acceptability of different tree-breeding solutions and in particular those involving genomic techniques. Put another way, scientific research to deliver policy solutions can involve significant cost over the long term. Policy makers and scientists need evidence on the public acceptability of the policy options available in order to orientate research and/or design public awareness campaigns to increase the acceptability of policy. Furthermore, policy needs data on the acceptability of solutions among different publics so they can evaluate the degree of support for different positions in a public debate.

To date research on public perceptions of tree diseases and potential solutions is limited. A large-scale survey of the public acceptability of planting transgenic American chestnut (*Castanea dentata*) was conducted in the US in 2015 (Needham et al., 2015). Preliminary findings showed that support for GM is influenced by environmental values, perceptions of risk, and demographic characteristics. The findings reported here and in Jepson and Arakelyan (2017) add to this knowledge base and the ideal of creating trans-national tree health policy that is realistic, cost-effective and attuned to culture and public attitudes.

Our larger study had three sequential components: 1) a questionnaire survey of ‘interested publics’, meaning those actively engaged with countryside-related practices and associated with public groups active in nature-related public policy discourses; 2) focus group discussions with experts from different sectors engaged with tree health

issues and who advise government on policy, and 3) a questionnaire survey of the ‘general’ UK public administered by a commercial survey company. The findings of components 1 and 2 are reported in Jepson and Arakelyan (2017) and Jepson and Arakelyan (2016) respectively. This paper reports the findings of component 3 and compares these with those of the first two. As such it concludes this mixed-method study and our assessment of the extent to which genomic tree breeding techniques might garner public support or opposition.

## 2. Methods

### 2.1. Study design

We adopted an iterative study design that: 1) surveyed the attitudes of informed British publics (N = 1152) likely to be interested in the fate of ash trees and engage discursively and/or politically with tree health issues conducted in July–September 2015 (the rationale for this is provided in Jepson and Arakelyan (2017)); 2) discussed tree health policy, the merits of tree-breeding solutions and preliminary findings of the above survey in three focus group discussions with i) media professionals, ii) foresters and forestry industry representatives including nursery and woodland managers and iii) representatives of the government and major trusts involved in forest research, conducted in November 2015 and, 3) conducted a representative survey of the UK public administered by YouGov in March 2016 that incorporated insights from the first two components whilst maintaining comparability with the first questionnaire survey.

An account of the *Chalara* outbreak in the UK and the methods used in the first survey (Phase 1) are presented in Jepson and Arakelyan (2017). In brief, we developed a questionnaire instrument that measured acceptability of seven tree-breeding solutions to ash dieback and a “no action” option, and administered this at three countryside events that market to distinct publics: namely the Country Landowners Association Game Fair (rural land owners, workers and sports); the British Birdwatching Fair (naturalists); and the Royal Horticultural Society (RHS) Wisley Flower show (gardeners). We adopted a quota and surveyed 400 people at each event based on Dillman et al. (2014) calculation that a sample size of 384 respondents can be projected to a population of  $\geq 1,000,000$  people with a confidence interval of 95%.

The questionnaire from Phase 1 was adapted for on-line administration to a general public and to incorporate insights from the results of the first survey. The key changes made were: a) a Cis-GM and a Trans-GM solution were combined into a single GM option and respondents were asked to check the three options most acceptable to them, from the list of 7 options (Box 1) (in the first survey respondents were asked to rank the three most acceptable options and check the two least acceptable options); b) the online questionnaire had a stronger focus on 3 specific tree breeding solutions, including the use of GM-techniques, planting non-native disease tolerant ash trees, and planting hybrids of native ash tree with non-native ash trees. This was because these options are currently seen by experts as the most feasible options to deal with ash dieback. In particular, respondents were asked how acceptable or otherwise they would find any of these options in urban areas, forestry plantations and natural woodlands. In addition, a new question on respondents’ living location was included because the Phase 1 survey findings suggested that acceptability of different breeding solutions might be influenced by whether the respondent is an urban or rural resident.

The questionnaire was reviewed by experts from YouGov Plc and adjustments made to improve clarity and ease of completion (See annex 1 for survey). It was sent by email on 15 April 2016 to a sample selected at random from the base sample of 800,000+ UK adults who have agreed to take part in YouGov surveys. The profile of the sample is derived from census data or, if not available, from other industry accepted data.

The figures have been weighted and are representative of all GB

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