

## The Living Ash Project

### A new breeding programme for ash

Following the outbreak of Chalara ash dieback in October 2012, a consortium of researchers has come together to form The Living Ash Project. Their aim is to secure the future of resilient, productive ash trees in Britain. **Jo Clark** reports on this new Defra-funded five year programme of research.

In October 2013 the Living Ash Project was launched, led by Earth Trust and working with Forest Research, Future Trees Trust and the Sylva Foundation. The project, funded by Defra with in-kind contributions from the partners, has the overall aim of finding trees tolerant of Chalara ash dieback and to bring them together in a breeding programme.

The partners have been working on ash breeding for over twenty years. Ash was the first species that the Future Trees Trust started work with in 1993, when they established four progeny trials for ash of British origin. Forest Research planted provenance trials in 1995 of UK and European origins, and an EU funded project called RAP (Realising Ashes Potential) established a Europe-wide provenance collection from across the geographic range of ash in 2003. In addition, in 2007 Forest Research established trials from each of the 24 UK native seed zones under their genetic conservation programme. Five trials looking at adaptation to climate change were planted from Inverness to the Pyrenees in 2009 by Earth Trust. More recently, the Future Trees Trust have selected over 400 trees of outstanding phenotype for timber characteristics, showing superb form and superior growth traits. These have been grafted and established in

clonal seed orchards and archives. In all, there are 23 trials and orchards of ash in the UK, representing over 40,000 distinct genotypes from across the entire natural range for the species, many of which have been selected for improved timber traits.

It was tragic that after twenty years of work, and finally having the first 'tested' seed (the highest category of seed available under Forest Reproductive Material (FRM) regulations) for a hardwood species ready to launch to the industry in 2012, Chalara ash dieback was confirmed in the UK in that year. However, the genetic resource amalgamated by the partners now represents a unique opportunity to screen for trees that may be tolerant to Chalara ash dieback and start a new resistance breeding programme.

The Living Ash Project has a number of Work Programmes aimed at finding resistant trees. First, we will monitor all orchards and trials for evidence of Chalara ash dieback. Research in Denmark has shown that although no trees are truly resistant, about 10% show some degree of tolerance to the disease, and 1% show a good level of tolerance – that is less than 10% crown dieback (Kjear et al., 2011). It is these trees that we are particularly interested in finding. As tree breeders, it is important that at least some of the individuals that are selected for a new breeding programme as tolerant are also trees with good timber characteristics, so that we ensure ash remains a viable timber species.

Trees in our research trials fall under higher categories of FRM – mostly 'source selected' and 'qualified'. However, it is equally important to screen 'source identified' material, which is the lowest category and forms a large proportion of all

**Note:** Ash dieback is caused by a fungus which was first isolated in 2006 and named *Chalara fraxinea* (Kowalski 2006). This is in fact the asexual stage of the fungus, and further research has meant that it was reclassified and the correct name is *Hymenoscyphus pseudoalbidus*. For ease of reference, we refer to the disease as Chalara ash dieback, in line with the Forestry Commission.

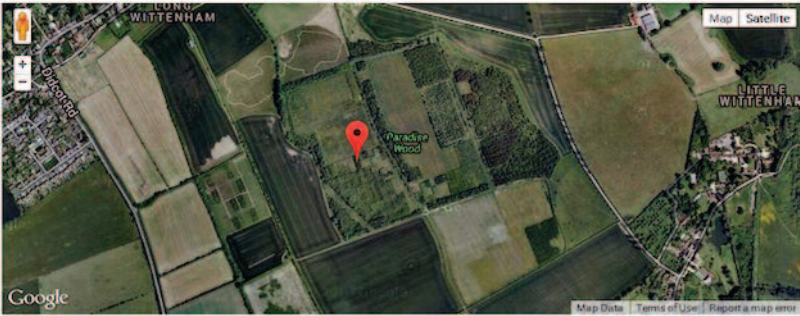
# Features

Tag Number (if present)  
eg. 12345

Select a photo  
Choose File **No file chosen**

*Have multiple photos? Just submit a sighting for each.  
Need help identifying ash trees? See our [identification guide](#).*

Tree location  
Drag the pin (or click elsewhere) to move the location. The more accurately you position the pin, the easier it will be for others to find the tree again later.



In your opinion, how likely is this tree to have Ash Dieback Disease?

Uncertain / I don't know

Likely

Unlikely

We recommend forwarding likely cases of ash dieback to the Forestry Commission for further review and verification. See their [Chalara page](#) or [contact them](#) if you have specific concerns.

Take part in an additional survey to help scientists breed healthy ash trees for the future. Simply answer a few more questions about your tree

Living Ash Project survey

Data entry screen of Ashtag.

trees (not just ash) planted in the UK. We are using citizen science to help us search this broader population. Working closely with Ashtag ([www.ashtag.org](http://www.ashtag.org)), we hope to locate trees in woodlands all over the country by getting the public to help, by identifying a tree and then monitoring it over time.

First, the tree needs to be registered online via the Ashtag website. This is a simple process, requiring the person to put a pin on a map to indicate the tree's location and to report whether they think their tree is currently infected or not. After this stage, if they wish to help with finding tolerant trees, they can answer five additional questions for the Living Ash Project survey that is on the same webpage, regarding the tree's diameter, its environment and proximity to other ash trees. Tags can be purchased in packs of five from Ashtag. The Living Ash Project is also giving away a limited number of free packs for anyone interested in tagging a tree. You can order a pack from the project website [www.livingashproject.org.uk/tags](http://www.livingashproject.org.uk/tags)

Another work programme is concerned with the mass screening of the seed collected in 2012 from our tested seed orchards. This programme is being led by Forest Research. The seed will enter stratification summer 2014 with the expectation of establishing seedling trials spring 2016. Forest Research will be looking for three sites each of 2.5ha in the east of England where Chalara ash dieback is already present. Anyone interested in offering a planting site should contact Steve Lee ([steve.lee@forestry.gsi.gov.uk](mailto:steve.lee@forestry.gsi.gov.uk)). All establishment costs are covered by the Living Ash Project, but obviously, we are expecting the vast majority of seedlings to die.

In another work programme we are carrying out extensive phenological observations. Research, again from Denmark, has shown a correlation between early senescence (leaf shed) and tolerance to dieback (McKinney et al., 2011). Several provenance trials, progeny trials and clonal seed orchards are being assessed for budburst and

## Sources of Forest Reproductive Material

- 1. Source identified:** trees have are produced from seed collected from a known location. No improvement.
- 2. Source selected:** seed collected from selected individuals e.g. from plus trees or registered seed stands, selected for specific traits such as better form or growth rate.
- 3. Qualified:** seed collected from individuals that have been brought together in a unit for breeding but have not undergone testing e.g. a clonal seed orchard
- 4. Tested:** trees that have gone through a rigorous testing period for genetic quality of specific traits and shown to be superior in comparison to accepted standards.





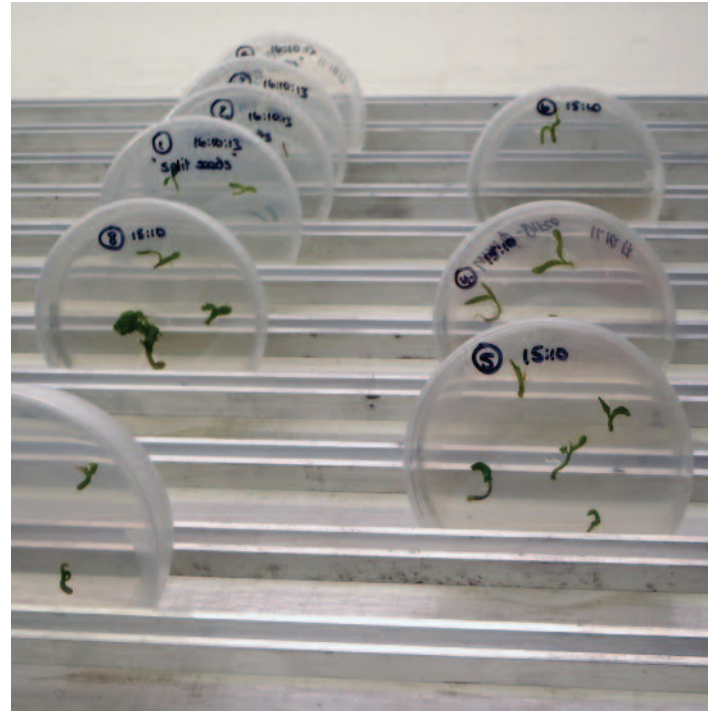
A tagged ash tree with a close-up of the tag.

senescence to ascertain baseline data. Once Chalara ash dieback reaches these trials, we hope that we will also find evidence of altered phenology to aid us in locating trees with a genetic resistance to the disease.

A final work programme is concerned with developing tissue culture techniques to enable the rapid amplification of tolerant material for deployment to the forest industry. While grafting scion material of a desirable tree on to rootstock is a well-established method of bulking up material, it is slow and relatively expensive. The development of tissue culture techniques will allow for rapid amplification of tolerant genotypes for further research work. Micropropagated shoot cultures are being established from seed embryos to produce highly standardised rooted clonal (not GM) plants.

The overall objective of this major project is to identify up to 400 putatively tolerant trees from which to start a new breeding programme of ash that is tolerant to Chalara ash dieback. However, because a tree appears to be healthy when others around it are clearly infected, does not necessarily equate to a tolerant tree. It is possible that the tree simply has not been infected yet.

Work through another Defra funded project is looking for DNA markers for resistance as a tool for screening individuals. Should this prove successful, we will screen all selected trees for these DNA markers to ensure the next generation of ash trees are tolerant to Chalara ash dieback. All trees that we find to be putatively tolerant will be grafted



Two week old excised ash embryos growing on media.  
(Photo: Trevor Fenning, Forest Research)

and the trees planted on the public forest estate and the resource made available to anyone interested in grafting their own seed orchard. Seedlings arising from this resource are not expected to be totally resistant to Chalara ash dieback, but will display a range of tolerance from which further breeding and selections may be made in the future.

Although 400 unrelated individuals is an adequate number from which to start a new breeding programme, the larger this sample is, the greater genetic diversity we will maintain, so we encourage landowners and the public to look at ash trees and report those that they think may be showing tolerance to Chalara ash dieback.

## References

- Kjaer, E.D., McKinney, L.V., Nielsen, L.R., Hansen, L.N. & Hansen, J.K. (2011) Adaptive potential of ash (*Fraxinus excelsior*) populations against the novel emerging pathogen *Hymenoscyphus pseudoalbidus*. *Evolutionary Applications*, 5: 219-228.
- Kowalski, T. (2006) *Chalara fraxinea* sp. nov. associated with dieback of ash (*Fraxinus excelsior*) in Poland. *Forest Pathology*, 36: 264-270.
- McKinney, L.V., Nielsen, L.R., Hanesen, J.K. & Kjær, E.D. (2011) Presence of natural genetic resistance in *Fraxinus excelsior* (Oleraceae) to *Chalara fraxinea* (Ascomycota): an emerging infectious disease. *Heredity*, 106: 788-797.

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[www.earthtrust.org.uk](http://www.earthtrust.org.uk) [www.livingashproject.org.uk](http://www.livingashproject.org.uk)