

## The Forest Genetic Resources Trust

### A 10-stage plan for the restoration of ash on the island of Ireland

#### *Current situation and plan outline*

Ash dieback disease (ADB) is endemic and results in severe economic, cultural and environmental losses. Results from Denmark and elsewhere suggests that healthy trees can be produced by conventional breeding for a high level of disease tolerance so that they can be restored to forests, hedgerows and the wider environment.

The basis for breeding is the identification of a stock of ash trees which have demonstrated a durable tolerance to the disease-causing fungus *Hymenoscyphus fraxineus* over a minimum of 3-5 years. Additional identification can be based on variation among the progenies that are derived from healthy trees; this will both verify high level of tolerance in the original mother trees but also allow for further improvement of tolerance. It is essential to mobilise all of the forestry and environmental stakeholders to identify healthy ash trees for utilisation in this programme.

Below, we propose a staged programme for breeding ash trees with a high tolerance to dieback to enable the restoration of this tree species to forests and landscapes. It involves the identification, selection and monitoring of tolerant ash trees, allied to a testing and breeding programme. We envisage this work to be undertaken in collaboration with many forest stakeholders and implementation mainly by Teagasc, Coillte, Forest Service (North and South), AFBI and FGRT, with tasks allocated and agreed to budgets in advance of programme commencement.

#### Stage 1

*Inform* all forest stakeholders about existing work and strategic direction outlined in this programme.

#### Stage 2

*Establish* a secure database and user-friendly procedures to record and archive the locations and health condition of trees in a structured programme for identifying healthy trees.

#### Stage 3

*Identify and select* at least 150 potentially healthy trees among heavily diseased neighbouring trees (typically 1-3% of ash populations). For this set of tasks we propose to collaborate with all stakeholders who currently are engaged in this topic both in Ireland and abroad. The health status of selected trees should be observed and recorded, especially within ash plantations which are severely infected.

Identification of trees for selection may be carried out in the first instance by forestry stakeholders including staff in: forest companies, Forest Service, Teagasc, NPWS, OPW, FGRT among others. Subject to landowners' permission, such trees should be retained and registered

by FGRT in a tolerant ash database (TAD) which will record the location and condition of tolerant trees and give them a unique ID number.

#### Stage 4

*Record* the health status and other relevant features such as stem form, presence or absence of seed and tree vigour and canopy position., of all individual trees in the TAD trees database using a tested and strict operating procedure.

#### Stage 5

*Propagate* all of the healthiest individual trees (including those bearing seeds i.e. mother trees) which have displayed a high level of tolerance to dieback during the monitoring process. Seeds and shoots to be collected from the selected trees with the owners' permission. Seeds should be collected from 30- 40 healthy mother trees and grown in a nursery. The shoots collected from all healthy donor trees should be used to propagate them by grafting. All propagated plant material can then be used in subsequent stages.

#### Stage 6

*Conserve* as many as possible of the trees which are identified as potentially tolerant after the process of monitoring. Propagate these trees by grafting and conserve them in four gene banks (i.e. clonal archives, one in each province). Assess the health status of all trees at least yearly. In cases where mother trees have provided seeds, the tolerance of mothers (clonal archive) can be compared to offspring (stage 7).

#### Stage 7

*Screen* all potentially tolerant trees (and progeny from them) to establish their durable level of disease tolerance. Durable tolerance can only be determined by challenging the selected trees to high levels of disease pressure over at least three years on multiple sites.

For the selected individual trees, their durable disease tolerance can be confirmed by challenging multiple copies of those trees to high levels of disease pressure. This involves the planting and monitoring of all selected trees (as grafted individuals) in at least one site per province where disease pressure for ash dieback is already high and pervasive. Select the most durably tolerant individuals for pilot planting, breeding and vegetative propagation.

For seedling plants which are derived from the selected mother trees, the screening is achieved by planting them in a randomized block design at 3-4 sites where disease pressure for ash dieback is already high and pervasive. Monitor and assess their health status so as to identify those individual seedlings with a durable level of disease tolerance. Estimates of breeding values should be made for the seedling progeny to facilitate the identification of the most useful mother trees for providing material for pilot planting, further selections and breeding.

For both the selected individual trees and for progenies, as specified above, it is essential to observe the levels of dieback symptoms on all trees using a numerical scoring system. Selection of the most durably tolerant individuals, should be made no earlier than 3 years after dieback symptoms have been first observed at the site. For effective screening, the trees should be well maintained (fencing, weeding etc) to ensure rapid growth. In the case of grafted trees, flowering in the field might be expected after 4-5 years or earlier in the case of greenhouse grown trees.

In the case of seedling derived material, the trees will probably start flowering around 8-12 years after planting.

### Stage 8

*Pilot planting* of limited quantities of plant material which will become available throughout the programme from various sources which have shown tolerance to dieback including grafted plants, cutting derived plants and seeds generated within the programme as well as seeds from programmes abroad where appropriate. Monitor and report on the health status of plant materials in stages 6-8 above.

### Stage 9

*Bulking up the production of disease tolerant seeds.* When durable tolerance is established from the screening of selected individual trees in Stage 7, those trees can be propagated further by grafting to establish clonal orchards dedicated to seed production.

Similarly, when the progeny trials are screened in Stage 7 they can be converted into seed orchards by felling all the non-tolerant trees as soon as flowering begins so that the remaining healthy trees can be used for seed collection.

The natural interbreeding of parent trees which have shown durable health, will result in seeds with tolerance to dieback. The initial small quantities of seeds can be used for pilot plantings and commercial quantities can be used by nurseries and deployed to establish new ash forests and woodlands. In addition, the tree stocks in seed orchards can be further developed to breed ash trees with other desirable traits.

### Stage 10

*Bulking up plant production by vegetative propagation.* Ash plants may be produced on a large scale quickly by vegetatively propagating all individuals which have been shown to be durably tolerant of ash dieback disease after careful monitoring on multiple sites in Stages 6 and 7.

Vegetative bulking up can also be applied to limited quantities of seeds which may become available during the early years of stage 7. This involves using established methods such as cutting propagation, and micropropagation with the objective of developing sets of ash trees which remain healthy and well adapted for growing in diverse Irish environments.

The FGRT Trustees

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