

FORESTRY AND FOREST TECHNOLOGY

Rescuing the World Ash Tree

In Norse mythology, the World Ash Tree Yggdrasil is evergreen and indestructible. Deer graze on its leaves, dragons gnaw at its roots. Nevertheless, it stands still, maintains the balance between heaven and earth and only when it falls does the end of the world begin - "Ragnarök", the dawn of the gods. What deer and dragons have failed to do over the ages, now seems to be done by the *Chalara fraxinea* fungus within a few years. The fungus which was introduced through long-distance trade, has such a devastating effect on the tree species throughout Europe that all leaves and roots die off within a very short time and even full-grown specimens simply fall over. Is this the end of Yggdrasil?

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- 1: "Our Ash Rescue Program is probably the most comprehensive of its kind in the world." Thomas Geburek, Federal Research Centre for Forests
- 2: The *Chalara fraxinea* fungus could wipe out all of the native "Common Ash" species.
- 3: After the seedlings are sprouted, they can grow up under protected conditions.

Thomas Geburek carefully lifts the leaves of the young tree "117-31". The plant is just a couple of months old and only grew a few centimetres, yet the expectations that weigh on its branches are already high. Geburek carefully examines growth and leaf colour. He is satisfied: 117-31 is healthy and vital, as are most of its fellow species grown in the experimental garden of the BFW (Bundesforschungszentrum für Wald - the Austrian Federal Research Center for Forests) near Tulln an der Donau. They all are part of an unprecedented rescue program for the conservation of a native tree species that is on the verge of extinction: it is about saving the "common ash" in Austria.

"About 20 years ago, a fungus from Asia was brought into North-East Europe," recalls the head of the BFW Institute of Forest Genetics: "In 2005, it was first detected in Austria. Since then, the pathogen with the sweet-sounding name "Falsches Weißes Stängelbecherchen" has been steadily gaining ground. The disease damages infested ashes to such an extent that it rapidly leads to the death of the trees after initial growth losses. "Infection mainly occurs via formed spores that develop in the summer on the leaf spindles of the ash litter that fell off last year," Geburek explains. Spores spread by wind, then colonize the ash foliage, where the pathogen penetrates the bark and the wood. Another symptom of the disease is the death of the roots. Meanwhile, the fungus has spread throughout Austria with devastating consequences in some cases. Infestation is particularly intense in the Danube region: entire ash stands are bare and sparse in the floodplains, many specimens simply fall over because they are rootless and unstable in the ground. "We soon realized that the fungus is so severely invasive that the existence of the 'common ash' is threatened," says Geburek. Reason enough to launch the most extensive and comprehensive tree species conservation program the country has ever witnessed.

***I know an ash tree called Yggdrasil,
A tall tree covered in white clay;
From it comes the dew that pours into the valleys.
It stands evergreen, over Urd's well.***

Column 2

Just 25 kilometres south-east of Tulln, Michael Nemeth takes a morning tour through his forest district. He pulls up on the road to the Sophienalpe in Vienna. The young district manager of the ÖBf-Forst Weidlingbach examines the ash crowns on his right. "Just a few days ago, only one or two ashes had their first symptoms of illness," he says with a worried look. Now another five along the street have contracted the disease. "And this despite the fact that not a single tree was infested on this street at the beginning of spring," says the young forester. It started a month ago: The first tree lost leaves and soon most of its branches stood bare in the sky. In addition to the dead shoots and twigs, short tufted replacement shoots and water veins were formed. After two weeks the second tree in the row was also infested - "and now this will probably continue until the whole street is bare," Nemeth assumes from experience in other woodlands. However, the speed at which the pathogen spreads is new for him. "A few years ago we had an infested tree here and there and the disease spread rather slowly," he says. "Today this is happening at a tremendous speed - according to the rules of forestry, so to speak in a flash." He also observed the dying of ash shoots in every age group - from the tenderest young trees to 150-year-old specimens.

The worst, however, is the symptom of root shrinkage, complains Nemeth: "Some infested trees are still fully in foliage, but no longer have a root ball". After a windy night, they lie on the forest floor or lean against their neighboring trees the next day without any sign of disease. The fungal infestation first appears on the crown of leaves and sometimes only deep in the root areas, where all micro-parts have died-off, usually leaving behind a stump, which is usually just a few centimetres below the ground. "But no forester in the world can predict such a thing if the tree still looks healthy and vital," says Nemeth. This makes one thing clear to the station manager: even the greenest ash is potentially at risk.

Column 3

***The Yggdrasil Ash suffers anguish
More than humans know of.
The deer bites above, it rots on the side,
Nidhögr (the dragon) gnaws from below.***

Meanwhile, Thomas Geburek has resumed his tour through the Ash plantation. The sprinkler system hisses steadily in the background, while he inspects the larger young trees on the test area, which began sprouting last year. The researcher visits the facility himself two to three times a month. His gaze sweeps across the plantation, revealing his anxiety and the importance that the scientist attaches to this conservation initiative.

"We put a lot of heart and soul into this project," he finally says. And probably no less idealism and perseverance, because the fight for the Ash tree will be long and arduous - just as it began two years ago: "There should be about 106 million Ash trees in Austria," Geburek estimates. In a large-scale search in summer 2015, 1,000 optically resistant mother trees were selected. "Whenever an ash tree stood green and healthy among a large number of damaged ones, we wanted to know why," says

Geburek. Foresters and forest owners informed the researchers. Armed with saws, snares, rubber slings and even rifles, they moved out into all areas of Austria to harvest the seeds of these mother trees. "Each tree was given a number and after its seeds had grown in our experimental garden, each seedling was given an additional serial number at birth," explains Geburek. The young tree 117-31 is therefore "descendant 31" of "mother 117".

After a few weeks, each seedling is replanted in a small pot and can form proper root balls on protected and shaded areas. Once grown into a young tree, it is then placed on the test area. And there awaits it the test of its life: Because in addition to the naturally occurring fungus spores here, the researchers will constantly spread infested material. An artificially created "hammer load", as Geburek calls it. Only the truly resistant individuals will defy the fungus, hopefully. The best 50 of them will be sorted out. It is yet to be seen if 117-31 will make it through. If so, its genetic line will be traced back to the corresponding mother tree and even to the father tree. Offshoots of both parents will then produce the seeds for the Ash trees of the future under controlled conditions.

According to the scientist, the entire process must be carried out with the utmost precision for years to come: "There must be no confusion and the numbers must not be swapped under any circumstances. Otherwise, this elaborate procedure will be completely in vain."

1: On the test area, the first test specimens are about to be exposed to an extreme fungal load.

2: Forestry workers are particularly concerned about the infested ash stands next to roads and in settlement areas.

3: "The security risk of leaving an ash tree standing next to public spaces is too high for me at the moment." Michael Nemeth, Austrian Federal Forests (ÖBf)

Ratatösk is the name of the squirrel, that runs up and down

Along the Yggdrasil Ash:

It hears the eagle's words above

And brings them down to Nidhöggern.

Michael Nemeth's cell phone rings. A resident in the area asks him for a local inspection: "The ash tree behind his garden has bare branches; he wants us to look at it." Nemeth gets in his car and drives off. Thanks to the current media ash hysteria, the forester receives up to three calls a day on this topic from worried residents or hiking clubs or nature conservationists who complain about the "Ash Massacre". But for Nemeth it is clear: "The safety risk posed by leaving an ash tree near public spaces is simply too high for me due to liability reasons." He had once made a mistake and left an optically healthy ash tree standing, two weeks later it was lying in a garden. "Thank God nothing bad happened back then except for a broken fence that had to be repaired, I won't let that happen to me twice."

The Ash trees in the more remote forest areas are not being touched, says Nemeth. "To clear out all specimens from my more than 3,000 hectares of forest would be madness." However, alongside all paths, roads and settlement areas, the station manager will now allow safety strips about ten metres wide to be flattened out, which is quite a delicate task, especially on the Sophienalpe. Located in the immediate vicinity of the federal capital Vienna, this area is a popular recreational area on weekends. Numerous hiking and cycling paths meander through the forest. Almost all of them are lined with Ash trees, a typical marginal tree species. Most of which are green and undamaged, but some also sparse and bald. While Nemeth drives to the local inspection, he repeatedly points out the window to infested treetops and tilted trunks. He reforested and tended to many of the ash stands himself and cleared them of vines every year. Even though his heart sometimes aches, the ash trees have to go. Safety first.

Nemeth has already commissioned a harvesting team with harvesters for the road on Sophienalpe. This means a lot of preparatory work: obtaining permits, blocking roads, dismantling telephone and power lines... only then can the logging squad move in. But even after that, the Ash tree still causes many foresters headaches, as the market flooded with ash wood has completely collapsed at the moment. Many beautiful logs are therefore used as admixtures in pulpwood processing or become firewood or wood chips.

***Heimdall blows mightily into the raised horn,
Odin mumbles with Mimir's head.
The Ash of Yggdrasil trembles, yet it stands;
The old tree rustles as the giant is let loose.***

Press conference of the WKÖ Wood Industry Association at the Cafe Museum in Vienna: Following the presentation on the current situation in the industry, the Q&A session begins. The main topic for the journalists: Ash Dieback. What are the effects? What will happen next?

Herbert Jöbstl, Chairman of the Sawmill Industry Association, understands the concerns: "The scenario shows us that our trees are increasingly confronted with human-introduced pests. Any tree species could theoretically slide into such a catastrophic situation; it would be unthinkable if it were spruce, says Jöbstl. But his colleague Rainer Handl is confident that the Ash can be "preserved in the medium term if countermeasures are taken". For the wood industry however, Ash is of less importance, says Handl: "It is currently only a substitute since light woods are not trendy."

Martin Höbarth sits in the auditorium, as do numerous industry representatives. The head of the forestry department of the Austrian Chamber of Agriculture obviously has a slightly different view of the importance of ash. In forestry terms, the ash tree is actually one of the three most important indigenous deciduous tree species - alongside oak and red beech, he says after the press conference. Sometimes it grew like weeds, but one never had to worry about the growth of the ash. "Now it has become the number one problem child. And for many floodplain forest enterprises, the death of Ash trees is nothing less than a threat to their very existence," warns Höbarth. Ash is also indispensable in some areas of application, such as in the manufacture of tools (for handles) or sports equipment (bows, etc.). "Some of these are very small niches, but they first have to find a substitute raw material," he says. It therefore goes without saying that BFW's rescue program must be fully supported. Half of all necessary funds are provided by the Chamber of Agriculture alone. The remainder is financed by the federal government, the federal states and NGOs. "We lost the elm a few years ago," recalls Höbarth. "We don't want to see another tree species disappear so radically from our forest community. That is why we do our utmost to preserve our Ash trees."

***From Yggdrasil's ash sunk down,
Of alfen race, Idun by name,
She barely endures this descent
Banned under the deciduous tree trunk***

4: "I am now observing Ash dieback in every age group, from the most tender young trees to 150-year-old specimens". Michael Nemeth, ÖBf

5: A symptom of the disease is the death of all fine root parts. Green Ash trees often fall over without warning.

6: There are over 106 million ash trees in Austria, and as classical marginal trees, many line paths or roads.

In the office of the experimental garden manager, Thomas Geburek sits bent over the deployment plans and studies the next steps: Numerous young trees are standing at the test field, others are being cut, the spores have been collected. "We're now all waiting for time X. In a few weeks, a large number of fungal pathogens will be spread in the plantation. We will then discover how many trees can withstand the pathogen and whether the Ash still has a future in Austria."

Geburek knows: Theoretically speaking, almost anything is possible. The fungus could encounter a large number of resistant Ash offspring which could take its legs out from under it, but it would also be possible that hardly any tree would survive the "hammer load". In order to minimize this risk, the population of test trees was set very high. More than 60,000 different specimens are there to ensure the survival of the tree species, making the Austrian Ash rescue program the most comprehensive in international comparison. "Another special aspect is that we select from tested resistant specimens, trace them back to their parents and then breed them," says Geburek.

By 2020, the first clone mixtures should be ready for delivery to selected forestry operations. "However, the seed plantations will certainly need 15 years longer before the first seeds can be passed on," estimates Geburek. Ultimately, however, the entire process is a "work in progress" in which illnesses will still be possible. "However, we are gradually approaching our goal of producing a "Common Ash" that is resistant to the destructive activities of the Chalara fraxinea fungus," says the researcher. Perhaps the experimental garden in Tulln will then become the Garden of Eden for the ancestors of all future Ash populations.

The sun shall be darkened, the earth sinks in the sea

The bright stars fade from the sky.

Glowing vortices swirl around the all-nurturing world tree...

(From the "Edda", based on translations of Karl Simrock 1851)

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