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The ecological impact of ash dieback

Ash dieback is a serious disease of ash trees caused by the fungus *Chalara fraxinea* (C. fraxinea) (it has since been renamed but it is OK just to describe it as Chalara).

The disease causes leaf loss, crown dieback and bark lesions and is usually fatal.

Ash is the second most common tree species in Great Britain. Scientists have recorded the presence of plant species in 10km by 10km squares right across Great Britain; ash occurs in 88% of those squares.

Ash trees make up 30% of the UK's wooded landscape so landscape and ecological effects could be disastrous. Widespread death of ash trees will change populations of those other plant and animal species that use ash trees for feeding/breeding or as a habitat e.g. lichens, bryophytes, specialist invertebrates and birds as well as soils, nutrient recycling and succession.
Origins of Chalara

The disease was first reported in Poland in 1992 but has since spread rapidly across Europe.

European trees now believed to have been infected with this newly identified pathogen (an organism that causes disease) were first reported dying in large numbers in Poland in 1992 and it spread rapidly to other European countries.

In February 2012 it was found in trees sent from a nursery in the Netherlands to a nursery in Buckinghamshire. It has now spread, via wind dispersal of spores or movement of infected trees across the UK.

Government monitoring

Scientists are monitoring the spread of Chalara using over 400 10-kilometre grid squares (Table 1)

Table 1. 10km × 10km grid squares with one or more Chalara infections

	2012	2013	2014	2015	Total	% of all 10k squares in country
Scotland	7	5	29	54	95	8.7
England	82	60	162	3	307	20.9
Wales	0	1	6	1	8	3.0
N Ireland	0	0	0	0	0	0.0
UK (total)	**89**	**66**	**197**	**58**	**410**	**14.5**

Ecological impacts

Scientists are investigating the impact of ash dieback on food chains and webs, soils, rates of recycling of nutrients and succession.

Species associated with ash

1,058 species were identified as being associated with ash:

- 12 birds
- 55 mammals -28 using the ash trees themselves and the rest using the ash woodland habitat
- 78 vascular plants
- 58 bryophytes
- 68 fungi
- 239 invertebrates
- 548 lichens

44 species **only** occur on either living or dead ash (obligate ash-associated species) but more species that are rare or under threat are further threatened by ash dieback so the loss of ash is likely to result in major ecological changes.

The IUCN Red data Book defines Red-coded species as:

(a) those that are obligate or highly associated with ash and already of conservation importance. These species are considered to be in danger of either going extinct or their populations severely declining because of ash dieback

(b) those species that are highly associated with ash but of unknown conservation importance

Amber-coded species are those that are highly associated with ash but currently of no conservation importance. These species may decline in abundance following ash dieback.

Table 2. Impact of ash dieback on Red and Amber species

Impact of Ash dieback		
Species group	Red	Amber
Bird	0	3
Bryophyte	6	42
Fungi	13	18
Invertebrate	37	89
Lichen	17	224
Mammal	0	47
Vascular plant	0	7

Q. Which species group is most likely to be affected by ash dieback?

A. Lichens

If we simply left the spaces where the ash were growing it is likely that invasive species such as shrubs, followed by trees such as sycamore (in England) and birch (in Scotland) would become dominant.

Decomposition and soils

Ash produces leaf and twig litter that compared to most other species is quick to decompose. Relatively high in magnesium and calcium, ash litter forms soil organic matter with a high pH.

Table 3 compares the effect of ash and other common species on the rate of decomposition and nutrient recycling.

Table 3. Effect of ash on decomposition and recycling

Process/factor	Order
Litter pH, high Ca, Mg	Ash>Lime = Maple > Beech
Leaf decomposition rate	Ash > Beech
Litter decomposition rate	Ash > Lime = Hornbeam
Soil respiration rates	Ash > Maple = Pedunculate Oak

Typical Exam Questions

Q1. What do the decomposition rates of ash leaves and litter the soil and respiration rates suggest about the biotic content of ash soils?

Q2. What are the implications of the data for the relative usefulness of ash in sequestering carbon?

Answers

1. Greater densities of bacteria, fungal mycelia, protozoa and nematodes (by factors of 4–15)

2. Faster recycling rates mean that less C will be locked up in ash litter and more CO2 will be released from ash litter than from most other species

Overall, the loss of ash and its replacement by other species will affect the biotic and abiotic characteristics of the soil which will, in turn, affect invertebrate, bird and subsequent tree species.

Effect on succession

Ash is both an important **pioneer** and **climax** forest species.

Exam Hint
Make sure that you can define these terms

Q. Suggest factors that make ash a successful pioneer species

A. Produces large quantities of seed
Seed wings enable wide dispersal

http://commons.wikimedia.org/wiki/File:EurAshSeeds.jpg
Farbenfreude

- Seedlings can regenerate in light or heavy shade e.g. that cast by oak or beech
- Seeds will germinate in very shallow soil
- Seeds build up into rich seed banks, quickly germinating when conditions become suitable

The removal of ash is likely to result in the slow acidification of soils which will affect those tree species that colonise the gaps. Leaf litter decomposition will slow so litter depth may increase. The colonising tree species will favour different species of invertebrates, lichens and ground vegetation.

Management scenarios

So how should we manage those woodlands with many dead or dying ash? The Forestry Commission have considered 6 scenarios:

1. non-intervention i.e. do nothing
2. no felling but encourage ***natural regeneration*** i.e. prepare the ground to receive tree seeds from surrounding species
3. felling
4. felling and replanting
5. thinning – taking out selected individuals
6. felling and encourage natural regeneration

Overall, options 1 (non-intervention) and 2 (no felling with natural regeneration) are predicted to be best for ash-associated biodiversity.

The Forestry Commission have evaluated 22 tree species as replacements for ash: field maple, norway maple, sycamore, alder, silver birch, downy birch, hornbeam, sweet chestnut, hazel, hawthorn, beech, aspen, wild cherry, bird cherry, Douglas fir, sessile oak, pedunculate oak, goat willow, grey willow, whitebeam, yew, and small-leaved lime.

These species were chosen to cover a range of management objectives and as being likely to regenerate naturally or be planted by woodland managers because of their ecological, aesthetic or economic value.

Whilst oak supported 69% of the ash-associated species, no single tree species would make a good overall alternative to ash. It is likely that a mix of oak, alder, beech and aspen, that are most similar to ash, would support a greater variety of ash-associated species

The future

Scientists are trying to identify the genetic factors which enable some ash trees to tolerate or resist infection so that they can be used to breed new generations of tolerant ash trees for the future. This will clearly take decades.

References

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