



Collapsing foundations: the ecology of the British oak and ash, implications of its decline and mitigation options

Ruth Mitchell

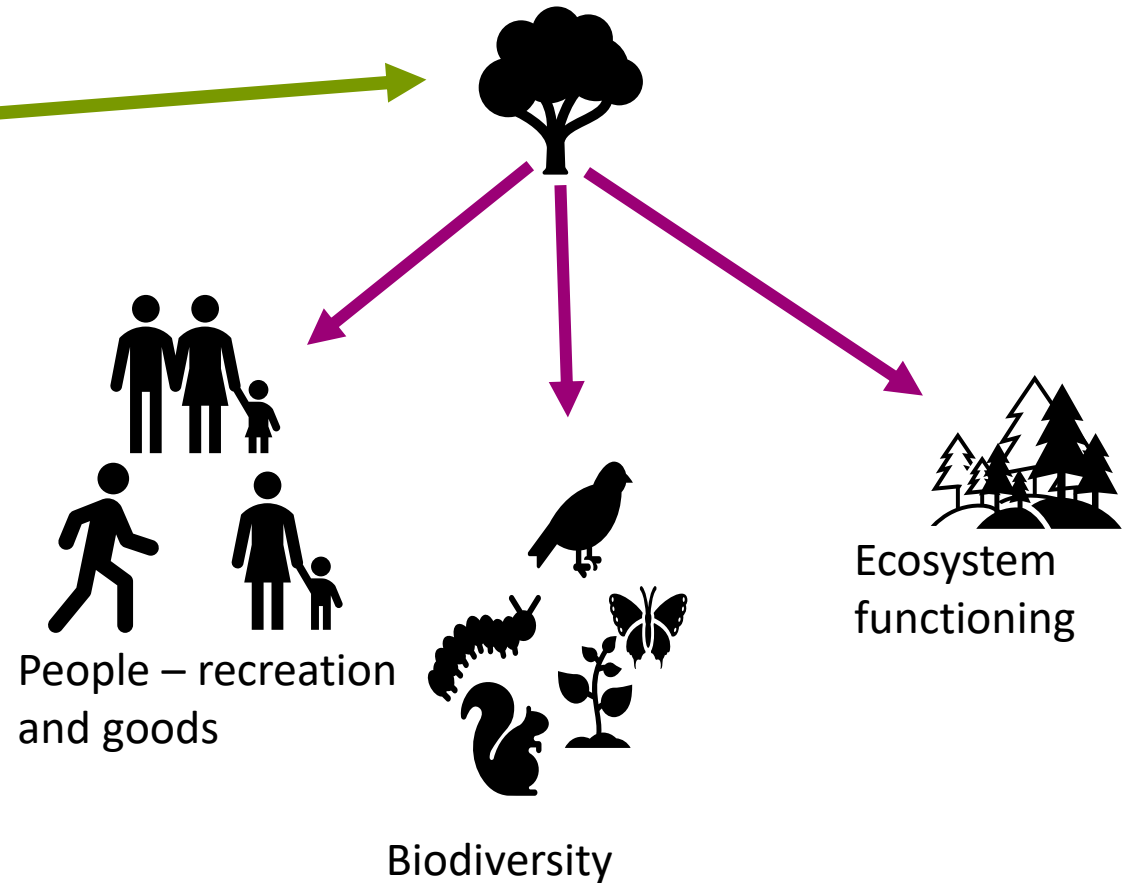
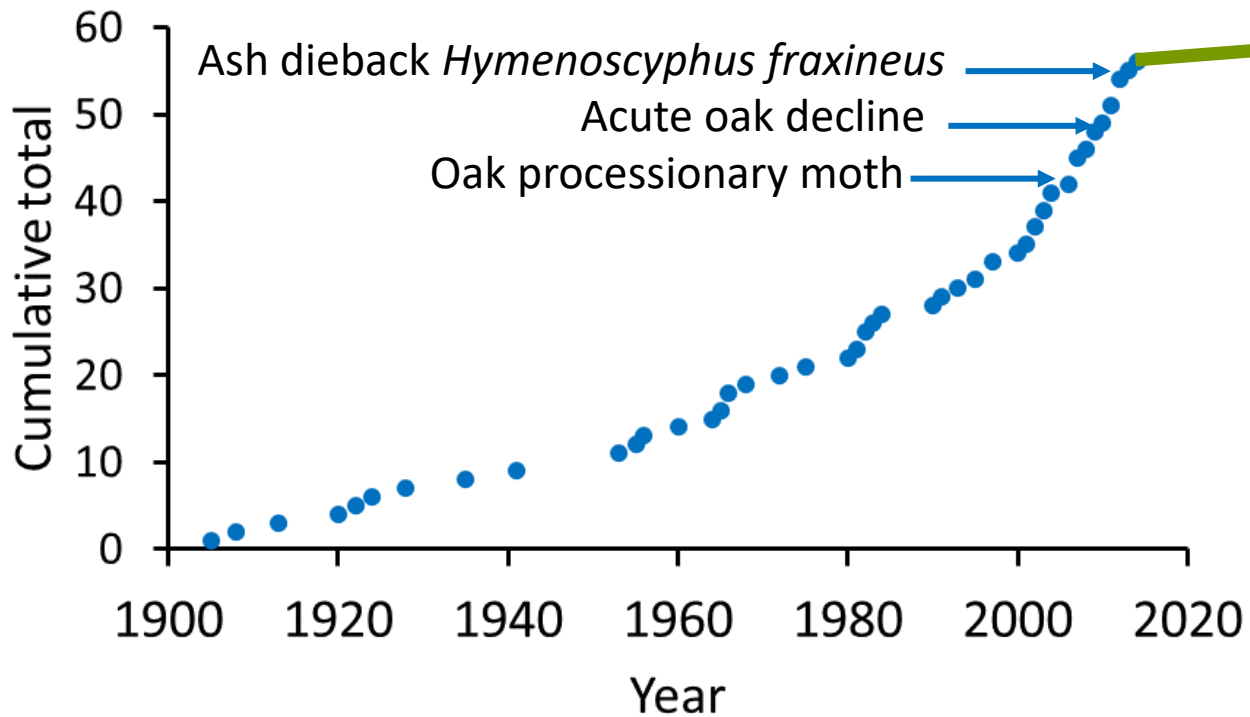
Small Woods and Action Oak 26th February 2021



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Tree diseases and cascading consequences

Cumulative number of new tree pests
and pathogens



Data taken from Freer-Smith et al. 2017 Biodivers. Conserv.
26:3167-3181

**Each pest/pathogen has cascading effecting on
more than just one tree species**

Objectives

1. Identification of oak/ash associated biodiversity
2. Assessment of alternative tree species:
 - 2.1 Biodiversity
 - 2.2 Ecosystem function
3. Tools and case studies



Objectives

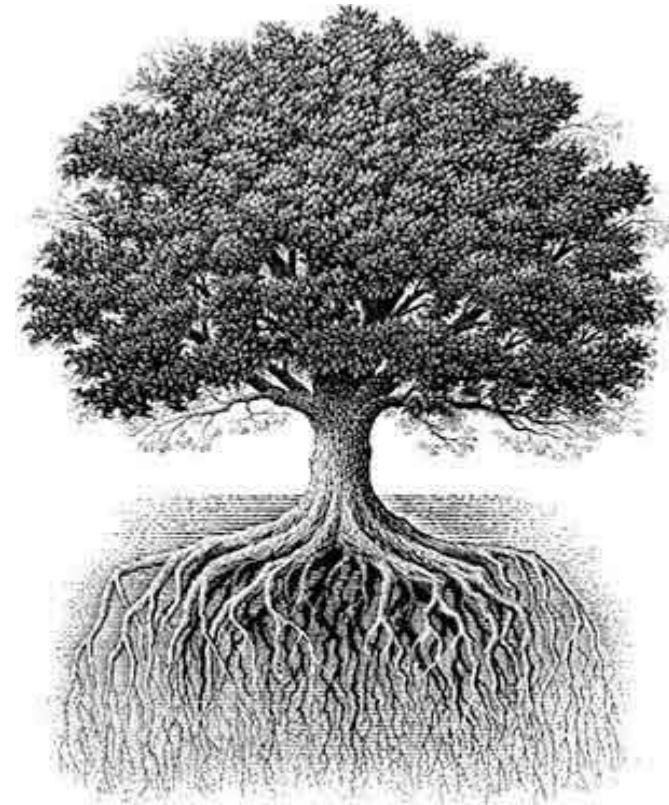
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How associated species uses a tree



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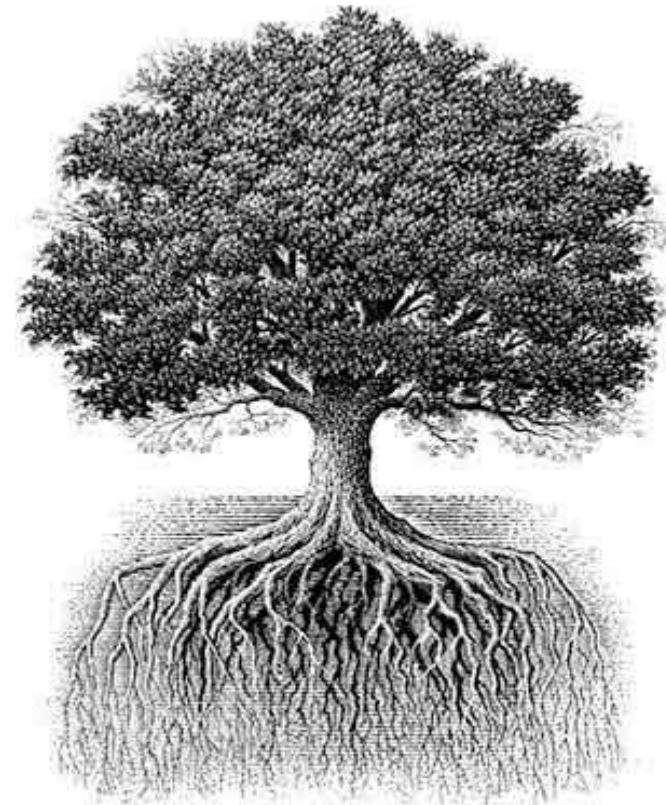
Food
Nesting/breeding
Habitat

Woodland
environment- ground
flora

How associated species uses a tree



Level of association with host



Food
Nesting/breeding
Habitat

Woodland
environment- ground
flora

Association	Definition
Obligate	Only found on the host
High	Rarely uses tree species other than the host
Partial	Uses the host more frequently than its availability
Cosmopolitan	Uses the host as frequently as, or less than, its availability

The host = oak or ash

Biodiversity supported

*Note: does not include all fungi or bacteria and other micro-organisms

2300 oak-associated species*:

- 38 birds
- 229 bryophytes
- 108 fungi
- 1178 invertebrates
- 716 lichens
- 31 mammals

955 ash-associated species*:

- 12 birds
- 58 bryophytes
- 68 fungi
- 241 invertebrates
- 548 lichens
- 28 mammals

Level of association

- 326 obligate species:
57 fungi, 257 invertebrates, 12 lichens
- 229 highly associated:
51 fungi, 104 invertebrates, 74 lichens

Level of association

- 45 obligate species:
11 fungi, 30 invertebrates, 4 lichens
- 62 highly associated species:
6 bryophytes, 19 fungi, 24 invertebrates, 13 lichens

Species not previously at risk now at risk:

290

Species not previously at risk now at risk:

67



Birds
Dr Paul Bellamy
RSPB



Lichens
Dr Chris Ellis
Royal Botanic
Garden Edinburgh



Mammals
Dr Glenn Iason
Dr Scott Newey
JHI



Fungi
Dr Andy Taylor
JHI



Invertebrates
Dr Jenni Stockan
Dr Nick Littlewood
JHI



Bryophytes
Mr Nick
Hodgetts
Hodgetts
Botanical
services

Impact of loosing oak and ash

Obligate oak associated species

326

141

45

Obligate ash associated species

Species only use oak and ash



Ground flora

- Light demanding species increase due to increase light
- Similar to coppicing
- Ash: long-term loss of species due to increased shade
- Oak: depends on replacement tree species



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Assessment of alternative tree species for mitigation



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- Tree species already present with oak/ash woodlands
- Non-native tree species that will grow in the same climatic and soil conditions as oak/ash

- Alternative trees ≠ replanting but could do
- Encourage natural regeneration of species already present

Oak

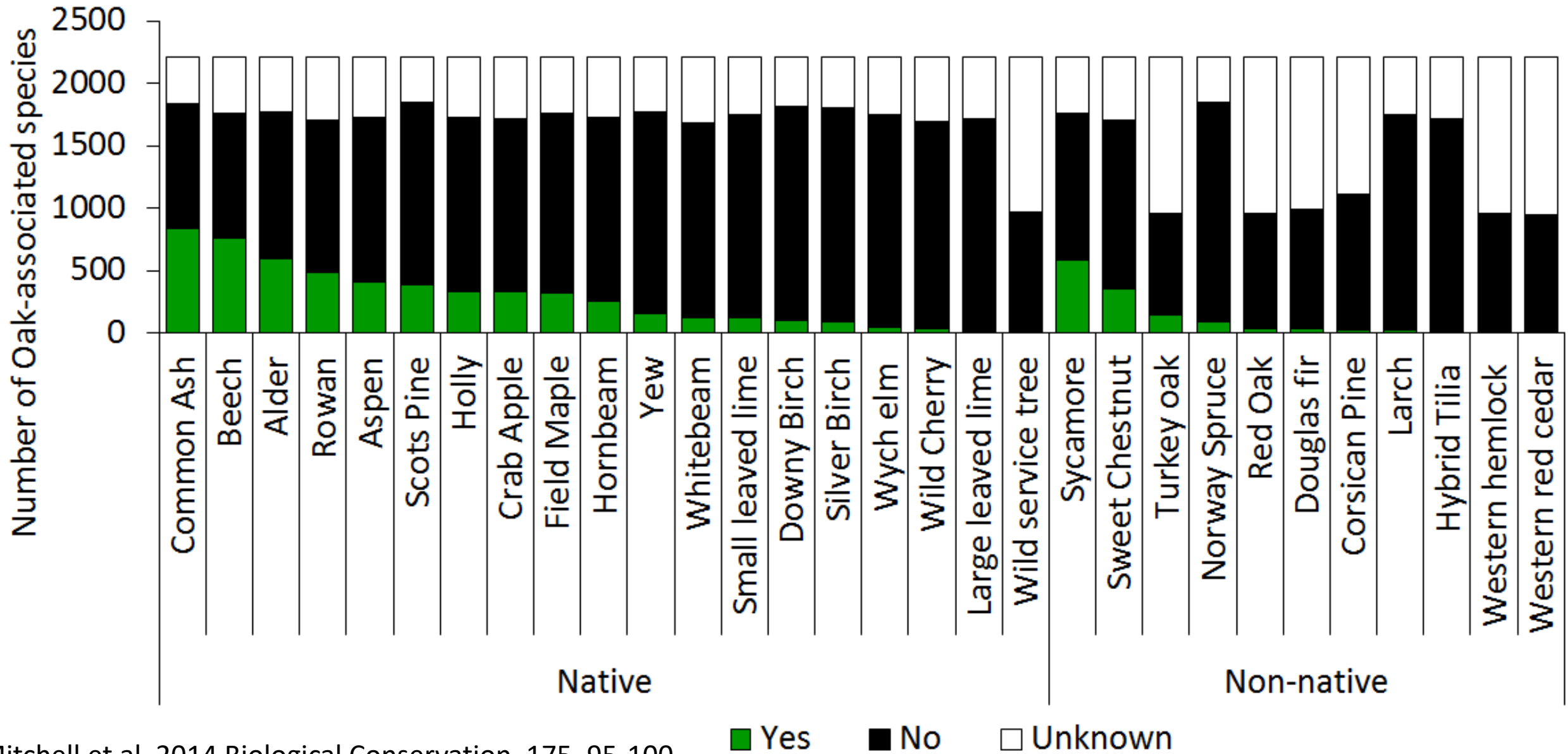
- 30 alternative tree species assessed
- 2300 oak-associated species
- 69000 assessments!

Ash

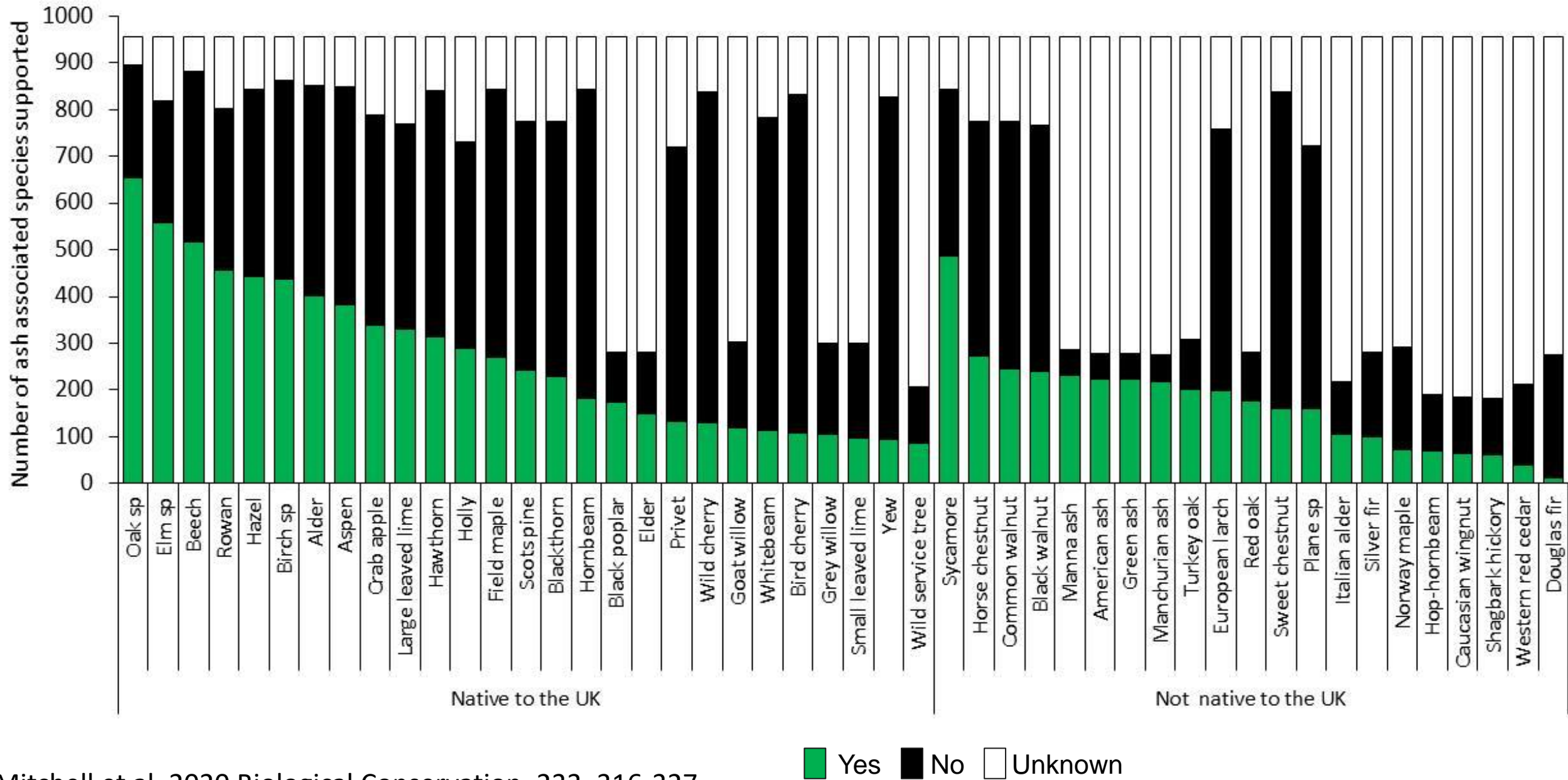
- 48 alternative tree species assessed
- 955 ash-associated species
- 45840 assessments!



Suitability of other tree species to replace oak



Suitability of other tree species to replace ash



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Testing functional differences between tree species

- 6 botanic gardens
- 9 tree species: 2 native oaks, red oak, turkey oak, ash, beech, sycamore, lime, sweet chestnut
- Functions: decomposition,
- Soil temperature,
- Soil: total C and N, mineralizable N and pH





Tree species

Functions

Ecosystem services

Common ash ◆

Sycamore ◆

Common Lime ◆

Pedunculate oak ◆
Sessile oak ◆

Sweet chestnut ◆

Beech ◆

Turkey oak ◆
Red oak ◆

Faster decomposition
Higher soil N
Lower soil C
More alkaline soil
Higher soil temperature

**Warmer temperatures
and less climate
regulation.
Faster nutrient cycling.**

Slower decomposition
Lower soil N
Higher soil C
More acid soil
Lower soil temperature

**Cooler temperatures
and greater climate
regulation.
Slower nutrient cycling.**

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OakEcol and AshEcol Databases



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Databases contain:

- Lists of all oak and ash associated species
- Level of association with oak/ash
- Conservation status
- How the species uses the tree
- If the species will or will not use any of the alternative tree species

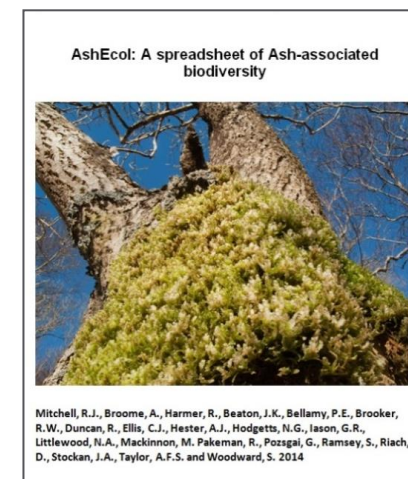
C	D	E	F
Species - English	Tree alternative - Latin	Tree Alternative - English	Association
Mothball Crust	<i>Abies alba</i>	Silver fir	No
Mothball Crust	<i>Acer campestre</i>	Field maple	No
Mothball Crust	<i>Acer platanoides</i>	Norway maple	No
Mothball Crust	<i>Acer pseudoplatanus</i>	Sycamore	No
Mothball Crust	<i>Aesculus hippocastanum</i>	Horse chestnut	Likely
Mothball Crust	<i>Alnus cordata</i>	Italian alder	Likely
Mothball Crust	<i>Alnus glutinosa</i>	Alder	No
Mothball Crust	<i>Betula pubescens/pendula</i>	Birch sp (silver and downy)	No
Mothball Crust	<i>Carpinus betulus</i>	Hornbeam	No
Mothball Crust	<i>Carya ovata</i>	Shagbark hickory	Likely
Mothball Crust	<i>Castanea sativa</i>	Sweet chestnut	No
Mothball Crust	<i>Corylus avellana</i>	Hazel	No
Mothball Crust	<i>Crataegus monogyna</i>	Hawthorn	No
Mothball Crust	<i>Fagus sylvatica</i>	Beech	Yes
Mothball Crust	<i>Fraxinus americana</i>	American ash	Likely
Mothball Crust	<i>Fraxinus mandshurica</i>	Manchurian ash	Likely
Mothball Crust	<i>Fraxinus ornus</i>	Manna ash or south	Likely
Mothball Crust	<i>Fraxinus pennsylvanica</i>	Green ash or red ash	Likely
Mothball Crust	<i>Ilex aquifolium</i>	Holly	Unknown

Databases are:

- User-friendly version for **woodland managers** to assess impact of ash dieback on biodiversity and plan interventions.
- OakEcol available at: <https://www.hutton.ac.uk/oak-decline>
- AshEcol Available on Natural England web site

<http://publications.naturalengland.org.uk/publication/527393127>

[9761408](http://publications.naturalengland.org.uk/publication/527393127)



Impact assessment and management response

1. Assess biodiversity potentially present
2. Short list oak/ash-associated species for conservation – using **OakEcol/AshEcol** databases
3. Identify alternative trees and shrub species are needed to maintain these – using **OakEcol/AshEcol** databases
4. Assess site – which alternative trees are present?
5. Determine management



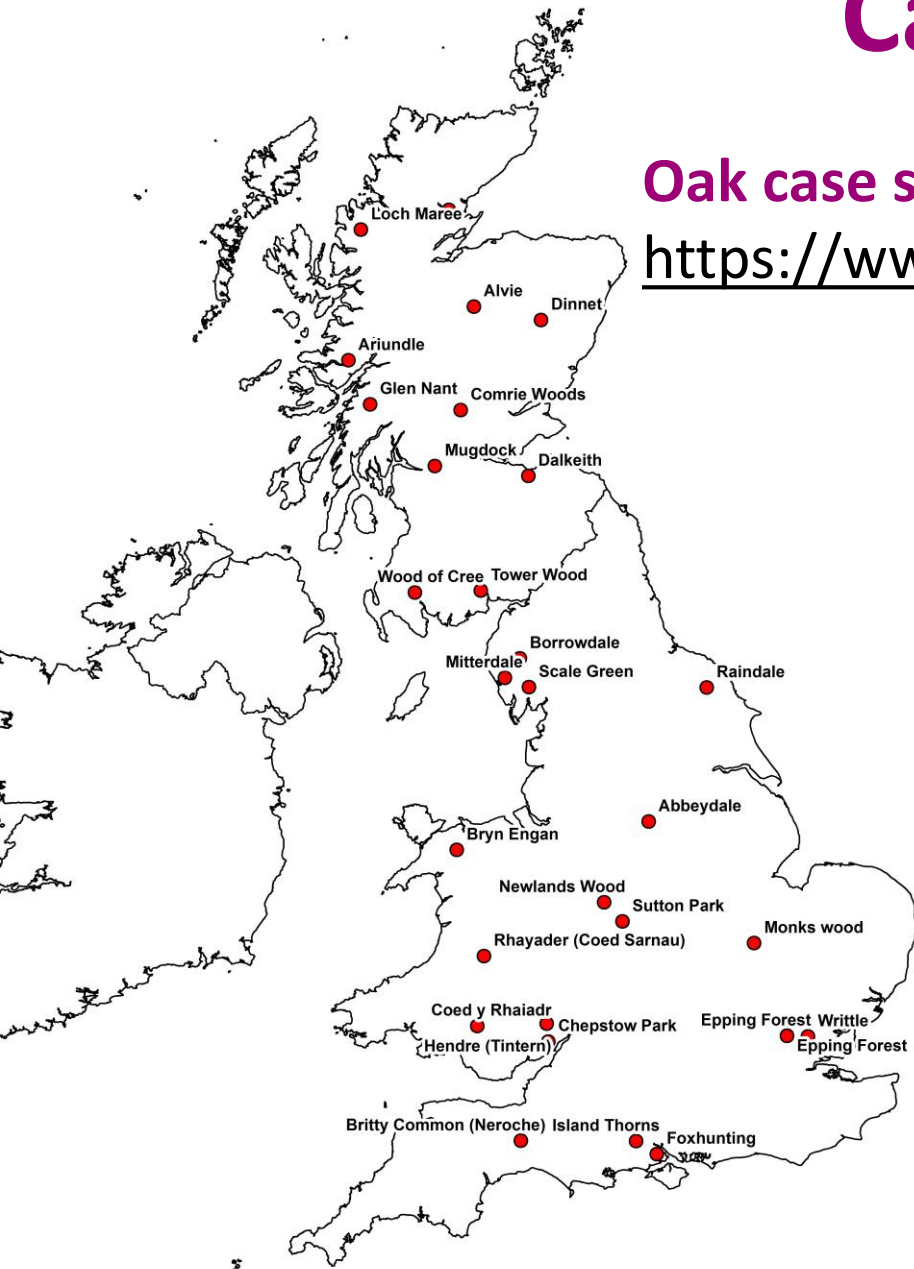
30 oak woodlands

Case studies

15 ash woodlands

Oak case studies available

<https://www.hutton.ac.uk/oak-decline>



Ash case studies available on
Natural England website

<http://publications.naturalengland.org.uk/publication/5273931279761>

408

Key messages from case studies

- Mitigation not possible for obligate species
- Mitigation possible for many highly and partially associated species BUT depends on diversity of woodland
- Intervention often required – herbivore control, increase regeneration
- Potential for establishing additional tree species at the sites?
- *Alternative hosts often lacking in scenarios of loss of oak and ash*



Summary



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- Cascading effect putting many additional species at risk of decline
- Mitigation possible for some species, but not obligates, may depend if replacement tree species present on site
- Functional differences and biodiversity supported should be taken into account
- Lack of data of the suitability of non-natives
- Cumulative impact assessments required for multiple tree diseases?

For more information:

www.hutton.ac.uk/oak-decline

www.hutton.ac.uk/ash-dieback

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Thank you for listening and thanks to:

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