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# Functional and ecosystem service differences between tree species: implications for tree species replacement

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## The Problem

Trees deliver many functions and ecosystem services in addition to supporting a range of other biodiversity.

Tree diseases are becoming increasingly common due to an increase in international trade and climate change.

Diseased trees are often replaced with a different species, but the replacement tree may not deliver the same functions, ecosystem services and support the same biodiversity.



Ash trees are dying due to the non-native fungus *Hymenoscyphus fraxineus* which causes ash dieback.



Oak trees are dying due to acute oak decline, chronic oak decline, and oak processionary moth.

## The Question

How similar in their functioning are native oaks (sessile and pedunculate) and common ash to six possible replacement tree species:

- Sycamore
- Sweet chestnut
- Beech
- Turkey oak
- Red oak
- Common lime

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## Methods

Using six botanic gardens across the UK, with multiple tree species at each site, we sampled 230 trees to test for functional differences between the nine tree species studied. The variables studied included nitrogen mineralization and decomposition rate, total soil carbon and nitrogen, soil pH, soil temperature and the water holding capacity of the bark.

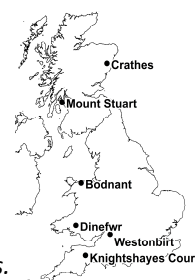


Figure 1. The sites.

## Results

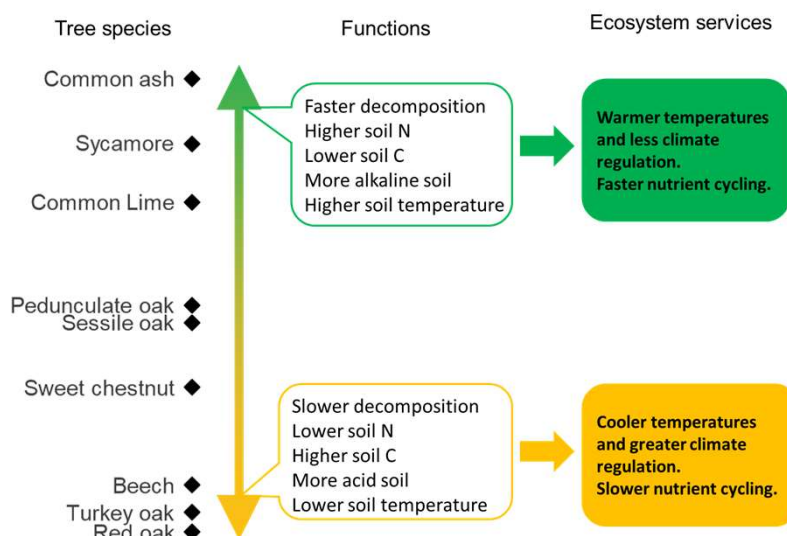


Figure 2. Functional differences between tree species: based on the first axis results from a PCA analysis of the functions measured.

- Replicating the functioning of ash is difficult as it is at one end of the spectrum.
- Replicating the functioning of native oaks may be possible using a mixture of other tree species as they are in the middle of the spectrum of functions studied.
- Non-native oaks were similar to native oaks in some of the functions measured but not all.

## Conclusions

- Differences in functioning between tree species were detected at the scale of the individual tree.
- Which tree species replaces a diseased tree will influence the functioning and hence the ecosystem services delivered, even for single trees outside woodlands.
- Non-native trees of the same genus may not provide similar functioning to the native tree species.