Atmospheric Environment 74 (2013) 110–111

Contents lists available at SciVerse ScienceDirect

Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv

New Directions: Ash dieback and British carbon stocks☆

Confirmation of ash dieback caused by *Hymenoscyphus pseudoalbidus* (the sexual stage of the fungus *Chalara fraxinea*) in Great Britain in 2012 (Cromier, 2012) was a devastating blow for an arboreal stalwart of the British countryside and the many species that depend upon it. The full repercussions of widespread ash dieback for our woodland ecosystems remain to be seen, but the sheer number of ash trees (*Fraxinus excelsior*) across Britain means that a high infection rate (90%) (EPPO, 2010; Bakys, 2013) coupled with the mortality rate already reported in Lithuania (60%) (Vasaitis and Lygis, 2008) would represent a major disturbance to national carbon stocks.

The Forestry Commission estimate that there are some 126 million ash trees in Great Britain's woodlands, the bulk of these being in England. Together, they comprise 11% of total stocked area and have an estimated wood volume of more than 33 million cubic metres (Forestry Commission, 2012a). If 90% of British ash trees become infected, a 60% mortality rate would result in a disturbance to British woodland carbon stocks of around 5 million tonnes C (Fig 1). This is equivalent to >4% of the total vegetation C stock in Great Britain, or the entire vegetation C stock of Northern Ireland (Ostle et al., 2009).

Wind-blown spores allow natural spread of the disease by between 20 and 30 km per year, but more rapid spread may occur through transport of infected plants and wood products (Forestry Commission, 2012b). As of March 4th 2013, there were 391 confirmed infection sites in the UK, the bulk being in eastern England but with numerous infection sites also reported in Scotland, Wales and Northern Ireland (Forestry Commission, 2013). Infected trees under 10 years of age are likely to die within 2–10 years, with trees under 40 years old that are also infected with honey fungus dying within 3–5 years. As yet, there are insufficient data on ash dieback-induced death in trees more than 40 years old (Forestry Commission, 2012b).

Clearly, any actual net change will depend upon the rate at which ash cover is replaced by other vegetation and the form this regrowth takes (Pautasso et al., 2013). For woodland carbon stocks as a whole, the pathway of deadwood C cycling will be crucial in determining this net effect – increased input to litter and soil carbon stocks can be expected, while in some areas an increase in wood extraction for fuel use may occur.

As already called for in North America (Hicke et al., 2012), more research is urgently required to assess the potential impacts of such diseases on carbon stocks and net carbon fluxes in Britain and its regions. If impact projections for major biotic disturbances, such as ash dieback, can be improved, then future policy and woodland management responses will be all the more effective.

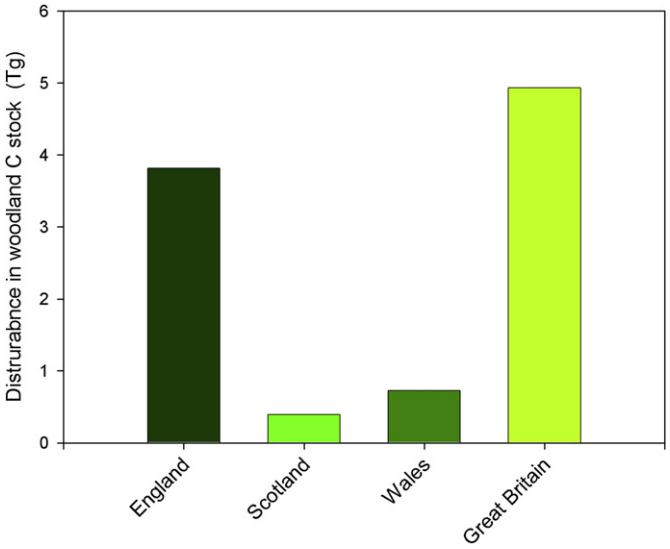

Fig. 1. Projected magnitude of carbon stock disturbance (Tg C) caused by ash dieback in Great Britain and its regions. Assumes 90% infection rate (Bakys, 2013) and 60% mortality rate (Vasaitis and Lygis, 2008). Values estimated using an ash wood density of 0.6 g cm^{-3} and a carbon content of 0.45 gC g^{-1} (Le Goff et al., 2004).

References

Bakys, R., 2013. Dieback of *Fraxinus excelsior* in the Baltic Sea Region. Diss. Sveriges lantbruksuniv., Acta Universitatis agriculturae Sueciae, Uppsala, ISBN 978-91-576-7767-9, 1652–6880; 2013:10.

Cromier, Z., 2012. UK unveils plan to fight deadly ash disease. Nature. http://dx.doi.org/10.1038/nature.2012.11790.

EPPO, 2010. Workshop on *Chlara fraxinea*, Oslo, Norway, 30 June to 2 July 2010.

Forestry Commission, 2012a. NFI Preliminary Estimates of Quantities of Broadleaved Species in British Woodlands, with Special Focus on Ash. National Forest Inventory, p. 115.

Forestry Commission, 2012b. Chalara Dieback – Key Scientific Facts. http://www.forestry.gov.uk/forestry/INFD-8ZSS7U.

Forestry Commission, 2013. Chalara Dieback of Ash (*Chalara fraxinea*). http://www.forestry.gov.uk/chalara.

Hicke, J.A., Allen, C.D., Desai, A.R., Dietze, M.C., Hall, R.J., Hogg, E.H., Kashian, D.M., Moore, D., Raffa, K.F., Sturrock, R.N., Vogelmann, J., 2012. Effects of biotic disturbances on forest carbon cycling in the United States and Canada. Global Change Biology 18, 7–34.

Le Goff, N., Granier, A., Ottorini, J.-M., Peiffer, M., 2004. Biomass increment and carbon balance of ash (*Fraxinus excelsior*) trees in an experimental stand in northeastern France. Annals of Forest Science 61, 577–588.

☆ Something to say? Comments on this article, or suggestions for other topics, are welcome. Please contact: new.directions@uea.ac.uk, or go to atmos_env@uea.ac.uk. http://www.elsevier.com/wps/find/journaldescription.cws_home/246/authorinstructions for further details.

1352-2310/$ – see front matter
http://dx.doi.org/10.1016/j.atmosenv.2013.03.049

Ostle, N.J., Levy, P.E., Evans, C.D., Smith, P., 2009. UK land use and soil carbon sequestration. Land Use Policy 26S, S274–S283.
Pautasso, M., Aas, G., Queloz, V., Holdenrieder, O., 2013. European ash (*Fraxinus excelsior*) dieback – a conservation biology challenge. Biological Conservation 158, 37–49.
Vasaitis, R., Lygis, V., 2008. Emerging Forest Diseases in South-eastern Baltic Sea Region. Network of Climate Change Risks on Forests (FoRisk). SNS Workshop Umea Sweden, pp. 14–15.

Dave S. Reay*
School of GeoSciences, University of Edinburgh, High School Yards, Edinburgh EH8 9JX, UK

* Tel.: +44 0131 6507723.
E-mail address: David.Reay@ed.ac.uk