Vikki Bengtsson, Pro Natura, Göteborg (Sweden)

Ash dieback and veteran pollards - some experiences from Sweden

Chalarose du frêne et anciennes trognes : quelques retours d'expériences de Suède

contact of the corresponding author : vikki.bengtsson@pro-natura.net

Abstract

Veteran ash trees have great cultural as well as biological significance in Sweden. Ash dieback (*Hymenoscyphus fraxinus*) is a fungal disease which affects ash across all of Sweden. In order to follow the development of ash dieback, 330 veteran ash trees were surveyed (divided up into pollards cut more than 30 years ago, pollards cut less than ten years ago and maiden trees) in the West of Sweden in 2009, 2011, 2013 and 2015. The study found that 90 % of the ash trees observed were affected by ash dieback disease in 2015 compared with 62 % in 2009. The mortality rate has increased from 1.4% annually between 2009 and 2011 to 2.15 % per year between 2013 and 2015. In total 35 trees have died since the study began in 2009. In 2009 there was no relationship between girth and ash dieback, but in 2015 the correlation between girth and the impact of ash dieback was statistically significant and no trees under 140cm in girth were free of ash dieback.

In the previous analyses, the impact of ash dieback on pollards has varied between the years studied. Analyses carried out in 2015 for all four occasions shows that maiden trees (not pollarded) are more affected by ash dieback than trees which have been pollarded more than 30 years ago. If a large proportion of the population of ash trees die or are felled unnecessarily, then this disease is a great threat to the ancient ash trees. Species associated with ash, in particular lichens and some fungi are also likely to decline in the coming year. There is also a risk that dead ash will be replaced by trees which do not have the same biodiversity value or in the worst case, not replaced at all. We recommend avoiding any tree surgery on old ash trees for the time being, if there is not an acute risk that they will fall apart. Both healthy and sick ash trees which have been pollarded regularly should continue to be pollarded until such time as we know more. If possible avoid pollarding all trees in the same year and start new pollards on young, healthy ash trees.

Résumé

Les anciens frênes ont une grande importance culturelle et biologique en Suède. La chalarose (Hymenoscyphus fraxinus) est une maladie fongique qui affecte les frênes dans toute la Suède. Afin de suivre le développement de la chalarose, 330 anciens frênes ont été recensés (répartis en trognes de plus de 30 ans, en trognes taillés il y a moins de 10 ans et les jeunes arbres) dans l'Ouest de la Suède en 2009, 2011, 2013 et 2015. L'étude a révélé que 90% des frênes observés avaient été touchés par la maladie en 2015, contre 62% en 2009. Le taux de mortalité est passé de 1,4% par an entre 2009 et 2011 à 2,15% par an entre 2013 et 2015. Au total, 35 arbres sont morts depuis le début de l'étude en 2009. En 2009, il n'y avait pas de lien entre la circonférence et le chalarose, mais en 2015, la corrélation entre la circonférence et l'impact de la maladie était statistiquement significatif et aucun arbre de moins de 140 cm n'était dépourvu de symptomes.

Dans les analyses citées plus haut, l'impact de l'infection sur les arbres trognés a varié entre les années étudiées. Les analyses effectuées en 2015 montrent que les jeunes arbres (non taillés) sont plus affectés par la chalarose que les arbres taillés il y plus de 30 ans. Si une grande partie de la population de frênes vient à disparaître ou est abattue, cette maladie représente alors une grande menace pour les anciens frênes. Les espèces associées aux frênes risquent également de diminuer dans les années à venir. Il existe également un risque que les frênes morts soient remplacés par des arbres qui n'ont pas la même valeur de biodiversité ou, dans le pire des cas, ne soient pas du tout remplacés. Nous recommandons d'éviter pour le moment toute intervention sur de vieux frênes s'il n'y a pas de risque aigu de rupture. Les frênes (sains et maladies) trognés régulièrement devraient continuer à l'être jusqu'à ce que nous en sachions plus sur la question. Si possible, nous conseillons d'éviter de trogner tous les arbres au cours de la même année et de créer de nouvelles trognes sur de jeunes frênes sains.

(Fig.1) An old pollard in Sweden

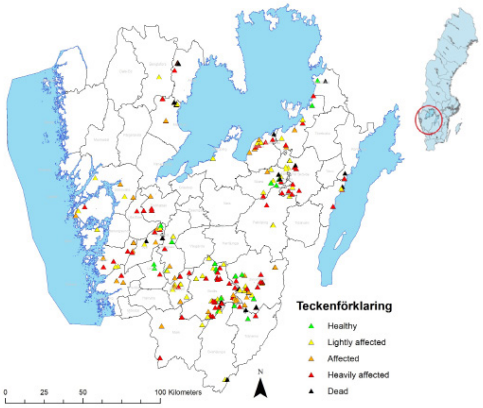
Link to access presentation / Lien vers la présentation : http://www.agroforesterie.fr/colloque_trognes/Vikki-Bengtsson

Introduction

Ash dieback (*Hymenoscyphus fraxinus*) is a fungal disease which affects ash throughout Sweden and the disease was first recorded there in 2001 (Baral, Queloz and Hosova, 2014). In Sweden, a great deal of money is invested in pollarding ash trees (Rural Development Programme) and also for the restoration of old lapsed pollards. In addition, veteran ash trees are important cultural history elements in the Swedish landscape and bearers of a wide range of biodiversity (Fig.1). Ash was put on the Swedish Red List in 2010. Even if some ash trees appear to have a greater level of resistance to ash dieback, the disease remains a great threat to the ash population in Sweden not only as it can kill trees itself, but also because landowners fell ash trees due to a lack of information or because they believe that they then reduce the risk of spread.

A fifth of the ash trees in Sweden are found in Västra Götaland and therefore it is a useful study area. There is relatively little scientific evidence relating to ash dieback and pollards, or indeed the impact of ash dieback on veteran ash trees in general. Due to the lack of data, relating to pollards and veteran ash trees, a monitoring programme was established in 2009 by the County Administrative Board of Västra Götaland (Bengtsson and Stenström, 2009). The aims of the monitoring were to obtain an overview of how ash dieback was affecting the county's veteran ash trees and to be able to follow the development of the disease over the coming years. The same trees were visited in 2009, 2011, 2013 and 2015 (Bengtsson and Stenström, 2017).

Method



(Fig.2) Map showing the location of the ash trees that have been monitored and the location of the County of Västra Götaland in Sweden (Inset)

In 2009 around half of the County of Västra Götaland had been surveyed to record veteran trees and the database contained information on more than 25,000 trees, of which 17% were ash. A random sample of 330 of these trees, both pollards and maidens, were examined in the summer of 2009 and re-visited in the summers of 2011, 2013 and 2015 (Fig.2). Among the group of trees that were recorded as pollards, there was an even spread between those which had been recently pollarded (within the last ten years) and lapsed pollards (more than thirty years since they were last pollarded). The trees were assessed from the ground with the help of binoculars, using field symptoms of ash dieback such as red/brown shoots and necroses as indicators. In this method the trees were scored according to a five-point scale:

0 – completely healthy ;
1 – lightly affected (c.<10 % of the crown affected) ;
2 – affected (c.10-30 % of the crown affected) ;
3 – heavily affected (c.>30% of the crown affected) ;
4 – dead.

The differences between years and the effects of pollarding were analysed using repeated measures ANOVA, after checking for normal distributions and equal variances and correcting the p-values with Huynh-Feldt correction for "sphericity". Relationships between longitude, girth and ash dieback score were assessed using a correlation test. The statistical analyses were carried out using PASW Statistics 18™.

Results

No part of the county was free of the disease and 90% of the veteran ash trees had some symptoms of ash dieback in 2015, compared with 84% in 2013, 77 % and 62% in 2011 and 2009 respectively. The proportion of ash trees that had died since 2013 was 4.3%, which gives a mortality rate of 2.15% per year, which is virtually the same as between 2011 and 2013 when it was 2.1% per year. In total, 35 veteran ash trees have died since the monitoring began (Fig.3).

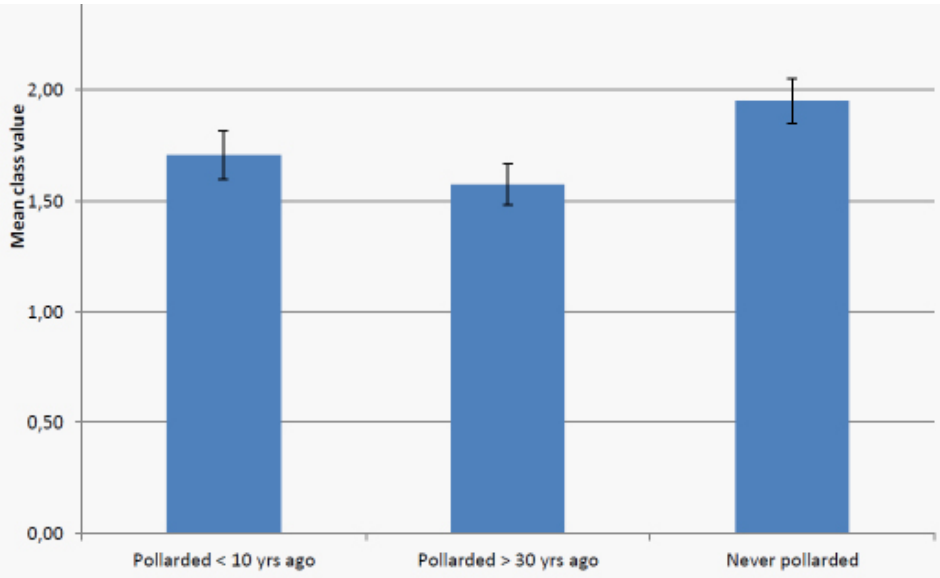
In contrast the health of a number of trees was recorded as having improved which was an unexpected result. This is in line however, with other studies which found that some trees produced lots of new shoots as a response to the disease and potentially resulting in the crown appearing to be in better condition than previously. It can also be explained by the fact that some of the trees in this study have been cut and thus the sick branches may have been removed. Recent years have provided favourable conditions for growth for ash (and thus perhaps the trees have been able to produce more leaves and new twigs) something that could explain a reduction in the amount of crown affected.

In 2009 there was no correlation between girth and ash dieback (Bengtsson & Stenström, 2017) but in 2013 the correlation between girth and the impact of ash dieback was statistically significant where larger ash trees were less affected. The results in 2015 show, that no ash tree under 140 cm in girth (equivalent to 45 cm diameter) was healthy.
In 2013 data was also collected regarding the degree of openness and if the ash trees were in a grazed area. There were no differences in how badly affected the trees were in relation to how shaded they were (woodland, semi-open, open) or if the trees were in a grazed area or not. In 2015 no statistical significance was found either (2-way ANOVA F=1.19, p= 0.315). This suggests that the environment in which the tree is standing plays a smaller part in explaining how badly affected the tree is.

(Fig.3) A few old pollards which were last cut in 2012 and which show different levels of ash dieback. The tree in the middle was alive in 2013, but had died by 2015. The tree furthest away has no symptoms of ash dieback.

The impact of ash dieback appears to some extent to be related to the management history of individual trees, but the relationship is complicated and varied between the years studied. In 2015, a repeated measures ANOVA test with pollarding as a factor was undertaken using data from four separate occasions (2009, 2011, 2013, 2015). Trees which have never been pollarded are more affected by ash dieback than old lapsed pollards (pollards that have not been cut for more than 30 years (F=3.94, p=0.02). Trees which have been pollarded more recently (ten

years ago or less) were however not significantly different from non-pollarded trees (p= 0.222) or old lapsed pollards (p=0.627). This is a different result from previous years when both groups of pollarded trees were healthier than the maiden ash trees (Bengtsson & Stenström, 2017) (Fig.4).



(Fig.4) The impact of ash dieback between the different groups of trees studied where 0=healthy, 1=lightly affected, 2=affected, 3=significantly affected, 4=dead. Repeated measures ANOVA showed that trees pollarded more than 30 years ago, were healthier than trees that have never been pollarded (Year: F=919.6, p<0.0001).

Implications for pollarding

It is interesting that our study showed that trees with a larger girth were not as badly affected by ash dieback. The relationship between tree size and age, and the impact of dieback is not yet well-understood. Skovsgaard et al. (2010) showed that the impact of ash dieback was greater on trees that were of smaller than average size which is consistent with the results from our study, but the reason why ash trees with a larger girth seem to have fewer symptoms is currently unclear. Larger girth may be connected to greater age and one could speculate that older trees have a different community of endophytes that influence the resistance of the tree or the pace of fungal spread. It could also be as simple as that it takes longer for the fungus to move through a larger tree and that the larger trees may have a more complex branch architecture. It may also be because the bark is much thicker at the base in older trees, resulting in less likelihood of infection via the lenticels (Orlikowski et al., 2011).

The results from this study with regard to pollarding are difficult to interpret because they varied between the survey years. It is interesting to note however that old lapsed pollards (not cut for more than 30 years) are showing less symptoms compared with maiden or uncut ash trees in the analysis that compared all years with pollarding as a factor. There was however no statistically significant difference between the group of ash trees that have been pollarded more recently in the analysis done in 2015. Maiden trees were however still the group most affected by ash dieback. The group of trees that have been pollarded more recently (in the last ten years) varies much more widely than either the lapsed pollards or maiden trees, as some of these trees are still in a regular cutting cycle in contrast to the other two groups. However, as the exact date of pollarding for each tree and the time at which the disease arrived at the tree's location are unknown, this may explain why the results have varied between years. It is possible that pollarding removes the affected shoots and thus the fungus, providing temporary respite from the disease. The recent pollards generally have a smaller crown and thus the proportion with symptoms may appear to be more when the new growth has become affected. More research is required in this area. It would be especially useful if pollarding could take place under controlled conditions or more data could be collected from old pollards to allow a more in depth analysis. This might help to gain a greater understanding of the role of pollarding in the pace of development of the disease.

Old pollards (both those in a regular cycle and lapsed) are interesting because they often have a more complex trunk and crown structure compared with maiden trees. Pollards exhibit more often the feature of having separate functional units, which are relatively independent of one another.

separate functional units, which are relatively independent of one another. This is a survival strategy where different parts of the same tree can to some extent behave like separate individuals. Each of these functional units can cater for their own energy requirements and take up water and nutrients from the closest part of the root system. Even if there may be a connection between these units, they can for example respond differently to the same type and amount of pruning (Lonsdale, 2013). This could be one explanation for why pollarded ash trees show fewer symptoms than maiden trees and may be an advantage due to the fact that the fungus has difficulties in moving through a more complex branch structure (Gross et al., 2014) and it can thus not as easily girdle the entire stem.

Recommendations

The variation within the groups of pollarded trees makes it difficult to make any detailed recommendations. It would seem sensible however to continue pollarding ash trees that are in a regular cutting cycle and which are healthy and even if they show symptoms of the disease as it may be possible to remove the fungus through cutting (Marciulyniene et al., 2017). It would be advisable however to avoid pollarding all trees in the same year and to spread the cutting out (and thus any risks) over a longer time period (Bengtsson & Stenström, 2017). With regard to lapsed pollards and maidens, it is important to note that all types of cutting on old trees are a stress for the tree. Cutting old ash trees can have significant consequences even if they are not affected by ash dieback (Lonsdale, 2013). Other studies (Skovsgaard et al., 2010; Bakys et al., 2011, Skogsstyrelsen, 2013) have shown that old ash pollards that have cut hard in an attempt to restore them back into a pollarding cycle after a long period of lapse are weakened and thus may be more at risk from ash dieback. The authors therefore recommend avoiding all types of cutting on old lapsed and maiden ash trees if there is no acute risk of them falling apart. The other issue here is that there is the potential, through cutting, that the distance between the shoots, where infection primarily occurs, and the main stem is shortened, potentially speeding up the rate at which the fungus may enter the main stem of the tree (Stenlid, 2013). It may also be worth considering creating new pollards on young ash trees that are currently symptom-free and monitor their progress.

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