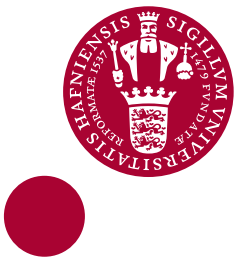

Management of dense sycamore maple (Acer pseudoplatanus) natural regeneration in NATURA 2000 beech forest habitat types

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KØBENHAVNS UNIVERSITET

The Danish Nature Agency

INTERNAL MEMORANDUM

24. SEPTEMBER 2012
ØKOSYSTEMER OG BIOMASSE

SKOV & LANDSKAB

DET NATUR- OG
BIOVIDENSKABELIGE FAKULTET

Title: Management of dense sycamore maple (*Acer pseudoplatanus*) natural regeneration in NATURA 2000 beech forest habitat types

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Purpose of the memorandum:

The purpose of the memorandum is to inform the Danish Nature Agency in its legal administration of Natura 2000 beech forest habitat types challenged by vigorous natural regeneration of sycamore maple (*Acer pseudoplatanus*)

Short description of the background and challenge:

The memorandum describes the background and the forestry approach to managing beech forest with excessive and vigorously growing natural regeneration of sycamore maple to better inform the future management of the challenge as it now becomes apparent in the Natura 2000 Beech Forest Habitat Types. This analysis as is based as far as possible based on international peer-reviewed scientific literature. However, this does not allow for a thorough analysis. Therefore, the analysis is also supported by Danish "grey literature" as well as the expert experience by the author.

It concludes by general recommendations for the management of Natura 2000 Beech Forest Habitat Types for future management and legal administration of such beech forest habitat types.

Best regards

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Senior Researcher Ph.D.

Management of dense sycamore maple (*Acer pseudoplatanus*) natural regeneration in Natura 2000 beech forest habitat types

1. Background

For decades it has been considered a common challenge in Danish forestry that vigorous sycamore maple (*Acer pseudoplatanus*) regeneration in beech (*Fagus sylvatica*) stands may compete and appear invasive relative to natural beech regeneration. This silvicultural challenge has often been addressed in the Danish non-peer-reviewed "grey literature" (e.g. Henriksen 1987; Madsen 1993; Larsen & Møller, 1997). This is not just a Danish phenomenon but is known from several European countries like France, Germany, Belgium and the UK. As such it is very useful that an international author team has managed to compile and review a significant proportion of both the grey and the scientific peer-reviewed literature on sycamore maple stand and growth dynamics and draw implications for silviculture including the invasive characteristics of the sycamore maple in the regeneration phase (Hein et al. 2009).

Recently, the implementation of the EU Habitats Directive and the Natura 2000 Network has brought the well-known silvicultural challenges created by the very competitive sycamore maple regeneration to the surface and into a new perspective. The Natura 2000 Network aims at supporting and securing the "long-term survival of Europe's most valuable and threatened species and habitats" (EU 2012a). To achieve this overall goal lists of "Habitat Sites" or "Sites of Community Importance" have been developed for nine biogeographical regions within the EU. Further, these sites have been registered and designated as "Special Areas of Conservation" by the individual member states and the next steps include taking "the necessary management or restoration measures to ensure the favorable conservation status for those sites" (EU 2012b).

According to a report on the favorable conservation status for Habitat Types in general (Danmarks Miljøundersøgelser 2003) the Beech Habitat Types (9110, 9120, 9230, 9150) requires an perpetual beech dominance. This is only exactly defined for Habitat Type 9110 as a minimum 50% canopy cover at any time. For the three other Beech Habitat Types it is stated that beech does not need to exclusively dominate the forest canopy. The Danish Nature Agency interprets this by a threshold value of 50% canopy cover at any time for all four Beech Habitat Types (Naturstyrelsen, 2012).

Additionally, Danmarks Miljøundersøgelser (2003) does not clearly recommend a particular silvicultural system or silvicultural approach for the management. This may be due to the fact that the authors are not in position of documented experience or competences within applied forest management or forestry research.

The management recommendations for maintaining or expanding the areas in favorable conservation status are generally describing low-intensity forest management and for one of the Beech Habitat Types the close-to-nature silvicultural approach is specifically mentioned. This does include restoration of a more natural forest hydrology by ceasing maintenance of ditches and supporting more uneven aged and heterogeneous forest structures by the choosing appropriate thinning regimes. It is recommended for Habitat Types 9110 and 9120 to apply free or undisturbed succession for the habitat types, which is synonymous with an introduction of unmanaged status for "a representative sam-

ple" of the identified stands. Further, the main threats listed include conversion to other trees species, soil preparation (to stimulate natural regeneration), and fertilization. The concern about fertilizations is somewhat surprising since this method has not been used for the past two decades as far as the author knows, and very rarely in the past before. The recommendation that lists soil preparation as a threat to the Beech Forest Habitat Type must be rooted in concerns for soil fauna biodiversity sensitive to soil disturbance. Soil preparation is a very efficient method to support natural regeneration of beech (Wagner et al. 2010), which may be considered of particular importance for beech in a Danish context where the wild boar (*Sus scrofa*) - which is one of the prime and natural sources of soil surface disturbance - by law is kept out by tracking and culling.

2. The sycamore maple regeneration challenge in beech silviculture

The invasiveness of vigorously growing natural regeneration of sycamore maple in mature beech stands has been described in "grey literature" in Denmark as well as a number of other European countries and lately been reviewed by Hein et al. (2009).

In the Danish context Henriksen (1988) describes how the sycamore maple is able to dominate the regeneration cohort of beech stands just by the presence of a few scattered seed trees. The wind dispersed maple seed is efficiently spread over significant distances (Hein et al. 2009). Further, Henriksen (1988) points out how the relatively strong and commonly used thinning regime in Danish beech silviculture creates favorable conditions for such sycamore maple regeneration to obtain foothold as advance regeneration in beech stands during the last decades before they reach maturity and subsequently the regeneration phase. Once the regeneration phase is initiated and the beech canopy is opened by harvesting mature trees, the advance growth of sycamore maple will grow very fast – almost like a pioneer species.

2.1 Shade as a means to control sycamore maple regeneration?

Usually, the natural regeneration of beech is considered more shade tolerant than the sycamore maple regeneration (Wagner et al. 2010). While true to some extent the differences are so small that this only leaves a rather theoretical opportunity to control the sycamore maple regeneration while supporting the establishment of the natural beech regeneration (Hein et al. 2009). Relative light intensity would need to remain low than approximately 3-4% for a long period, which needs a closed canopy or even a canopy with an understory trees.

No peer-reviewed research publications can clearly describe what will become a likely scenario for such an out shading approach. A possible scenario will probably be like this: Firstly, the mature beech stand must develop a sufficiently closed canopy to out-shade the sycamore maple regeneration and finally the forest owner must wait for the new cohort of natural beech regeneration to establish under low light conditions. This will take many years – probably more than 20 years – to run such a process just to prepare the beech stand for regeneration. In the meantime sycamore maple seed trees need to be removed if possible to avoid new sycamore maple regeneration to establish once the beech stand finally will be opened for regeneration. The problem is not only that it takes long time but also that the mature beech stand is likely to suffer from poor economical return and a drop in economic value since there is a risk that the stand and the timber will start suffering from discoloration, fungal attack, increased risk of blow down and other disadvantages related to over mature stands. Additionally, this will not be a completely predictable scenario. It may for example be more difficult to out shade the sycamore maple regeneration in practice than expected. This approach has not – as far as the author knows – been successfully applied in forestry.

2.2 Control by mechanical or chemical methods?

An alternative scenario would be controlling the sycamore maple regeneration by various means – such as mechanical or chemical methods. Again, these scenarios are not described in peer-reviewed scientific literature, but are based on the experience of the author and the Danish "grey literature". The mechanical methods, which basically are similar to pre-commercial thinnings, are generally described as unrealistically expensive (Henriksen 1988; Madsen 1993), and no successful examples are known by the author. Alternative mechanical methods are based on tractor aided crunchers or rotary cultivators that can remove a large proportion of the smallest dimension sycamore maple regeneration from the stand. If this is assisted by a complete removal of sycamore maple seed trees it may be possible to control the sycamore maple regeneration rather efficiently before the beech regeneration is established. However, this is both an intensive and expensive method that needs rather easy accessibility for the machinery all over the stand. The method is due to its intensity rather far from close-to-nature forestry principles and typical certification standards. Besides, the economic feasibility of the whole operation may be doubtful.

Controlling the sycamore maple by herbicides has been applied to some extent – mainly in the past i.e. more than 10-20 years ago. The exact and present use of pesticides for this purpose is unknown known by the author, but in all publicly owned forests as well as certified privately owned forests it is believed that the use of pesticides for such purpose have ceased. For the rest of the forest area there may be forest administrations that control sycamore maple regeneration in beech by chemical methods; but they are unknown to the author.

2.3 Accepting and managing the sycamore maple regeneration

Hein et al. (2009) describes how the sycamore maple is a tree species that usually is found as an intermixed species at a rather low frequency in European high forests dominated by the shade tolerant beech. As mentioned by Henriksen (1988) the strongly thinned Danish beech forest that are managed in relatively short rotations (90-110 years) to support a rapid diameter growth are likely to offer the sycamore maple regeneration better light conditions than in many other regions of Europe.

The forestry view on sycamore maple has considerably changed during the past four decades. Henriksen (1988) describes how the major windfall in Danish beech in 1967 created large areas of vigorously growing sycamore maple regeneration that was present as advance regeneration before the windfall.

Practical experiences with sycamore maple based on this blow down situation included large plantings with sycamore maple at low stock density (approximately 2,000 per hectare) to achieve inexpensive regeneration of the wind damaged areas. The underlying assumption was that the sycamore maple had the capability of rapidly restoring the forest conditions since it was establishing so well as natural regeneration. However, the lack of silvicultural experience with sycamore maple created large scale failures since it is not a typical pioneer species but rather sensitive to grass competition. As such many of the plantings failed but the wind fall still increased the sycamore maple dominated areas significantly in these damaged regions. The windfall created in its own way a shift in forestry's view on sycamore maple. It is only very briefly described in the literature but sycamore maple was no longer just a weed or an invasive species that should be kept out of the forest. The silvicultural experience was gradually built and developed the following decades.

The author's general impression from excursions and networking with forest managers and owners is that sycamore maple at present produces some of the best paid timber in the Danish forests and is generally regarded a valuable species. Additionally, silvicultural knowledge and experience about how to properly manage the species has greatly been improved.

In conclusion, the forestry approach to the sycamore maple regeneration challenge is today widely based on acceptance and management of the species where it appears. This is very much in accordance with the principles of close-to-nature forestry, where the natural regeneration and stand dynamics generally forms the backbone of the silvicultural practice. This approach is generally viewed as the most economical forestry approach to the species under the assumption that it is supported by proper silvicultural treatments of the regeneration and stands.

Included in this new forestry approach to sycamore maple is an acceptance of shifting dominance of sycamore maple and beech over time at the same area, which is generally seen as an example of a typical close-to-nature forestry approach to sustainable and profitable forestry rather than a problem.

Additionally, beech will often regenerate in mixtures with the sycamore maple regeneration or in the future under sycamore maple canopy (Hein et al 2009; Collet et al. 2008) provided management is conducted to facilitate this outcome.

Based on the authors experiences and networking with forest managers and owners the survival of the beech regeneration under dense and vigorously growing sycamore maple regeneration is probably depending on a rather rapid removal of the mature beech shelterwood. Thereby the beech regeneration will only be shaded by the sycamore maple regeneration which it is likely to survive and establish an understory or become a young shelterwood or nursecrop for the beech regeneration. In case the beech shelterwood is not removed rapidly the beech regeneration will experience a deep shade from both the beech shelterwood and the sycamore regeneration.

Another alternative is to let the sycamore maple form a dense regeneration under the beech canopy or shelterwood for a longer period or even the whole next rotation of sycamore maple. This approach is likely to outshade the beech regeneration due to the two layer canopy present in case the beech shelterwood is removed over 10-20 years. Since it is a general experience that beech easily regenerates under sycamore maple once the stand grows out of the regeneration phase (age > 20 years) keeping scattered mature beech seed trees is viewed as an important measure to support and secure future beech regeneration under the sycamore maple. This approach leads as such into a silvicultural regime of shifting dominance between beech and sycamore maple over the tree generations – which would be a typical example of close-to-nature forestry.

The remaining challenge in forestry is related to the cases where sycamore maple establish as natural regeneration at sites where it is expected not to be well adapted in the longer time perspective of a whole rotation. On such sites managers are usually also ready to welcome the sycamore maple regeneration and then just use it as a nurse crop for the beech or other species that may be better adapted to the site.

3. The sycamore maple regeneration challenge in Natura 2000 Beech Habitat Types

As already described in Section 2 forestry has widely accepted sycamore maple as a valuable and important tree species that mixes well with beech and forms stands of shifting dominance between the two species. This is particularly and appealing approach within close-to-nature forestry. According to Hein et al. (2009) sycamore maple will always be the minor species compared to beech since the shade tolerance of beech in the long term perspective will maintain the overall dominance of beech relative to sycamore maple. This will, however, not guarantee a beech canopy cover exceeding 50% at any given time in the timeline of a specific stand or Natura 2000 designated forest stand. The natural dynamics of forest and the competition among the intermixed tree species does not allow for

such a static and completely foreseeable status – especially not if the preferred management approach is close-to-nature forestry involving native species as beech and sycamore maple.

The situation with sycamore maple regeneration in Natura 2000 Beech Habitat Types is rather new like a number of other recently emerged shifts in management objectives. To what extent the existing management guidelines for more traditional forestry objectives are feasible remains unclear (Hein et al. 2009). However, the objectives of the Natura 2000 Network clearly pose new challenges to forest management. Initially, the Natura 2000 Network aims at supporting and securing the "long-term survival of Europe's most valuable and threatened species and habitats" (EU 2012a), which at the moment is interpreted in ways that has led to a rather static view on natural stand dynamics of managed forest.

In conclusion the author will recommend a more dynamic approach to the management guidelines of Natura 2000 Beech Habitat Types that allows natural stand dynamics to advance trusting that sycamore maple will not threaten the long term dominance of beech at a specific area as long as scattered seed sources of beech are maintained at the site or existing natural beech regeneration is supported by proper canopy opening above a layer of vigorously growing sycamore maple regeneration.

References

1. Collet , C. , Piboule , A. , Leroy , O. and Frochot , H. 2008. Advance *Fagus sylvatica* and *Acer pseudoplatanus* seedlings dominate tree regeneration in a mixed broadleaved former coppice-with-standards forest. Forestry **81:** 135 – 150.

2. Danmarks Miljøundersøgelser 2003. Kriterier for gunstig bevaringsstatus. Naturtyper og arter omfattet af EF-habitatsdirektiv & fugle omfattet af EF-fuglebeskyttelsesdirektiv. Faglig rapport fra DMU, nr. 457, 2. udg.

3. EU 2012a. Natura 2000 network. Online cited 4. Oct. 2012. http://ec.europa.eu/environment/nature/natura2000/index_en.htm

4. EU 2012b. Natura 2000 network. Online cited 4. Oct. 2012. http://ec.europa.eu/environment/nature/natura2000/sites_hab/index_en.htm

5. Hein, S., Collet, C., Ammer, C., Goff, N. le, Skovsgaard, J.P. and Savill, P. 2009. A review of growth and stand dynamics of *Acer pseudoplatanus* L. in Europe: implication for silviculture. Forestry 82: 361-385.

6. Henriksen, H.A. 1988. Skoven og dens dyrkning. Dansk Skovforening, pp. 664.

7. Larsen, J.B., Møller, I.S. 1997. Ær – proveniensvariation og frøkildevalg. I: Larsen, J.B. (red.)Træarts- og proveniensvalget i et bæredygtigts skovbrug. Dans Skovbrugs Tidsskrift 82: 4-252.

8. Naturstyrelsen 2012. Håndtering af ahorn i Natura 2000 skovnaturtyper med bøg illustreret ved aktuel case. Internt Notat J.nr. 001-07175. pp. 2.

9. Wagner, S., Collet, C., Madsen, P., Nakashizuka, T., Nyland, R.D., Sagheb-Talebi, K. 2010. Beech regeneration research: From Ecological to silvicultural aspects. Forest Ecology and Management **259**: 2172–2182.