NOBANIS –Invasive Alien Species Fact Sheet

Acer pseudoplatanus

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Species description

Scientific names: *Acer pseudoplatanus* L., Aceraceae.
Synonyms: None
Common names: Sycamore (GB), Berg-Ahorn (DE), ær, ahorn (DK), Mägivaher (EE), Vuorivaahtera (FI), garðahlynur (IS), Platanalapis klevas (LT), Kalnu kļava (LV), Gewone esdoorn (NL), Platanlønn (NO), Jawor (PL), клен ложноплатановый, явор (RU), Tysklönn (SE).

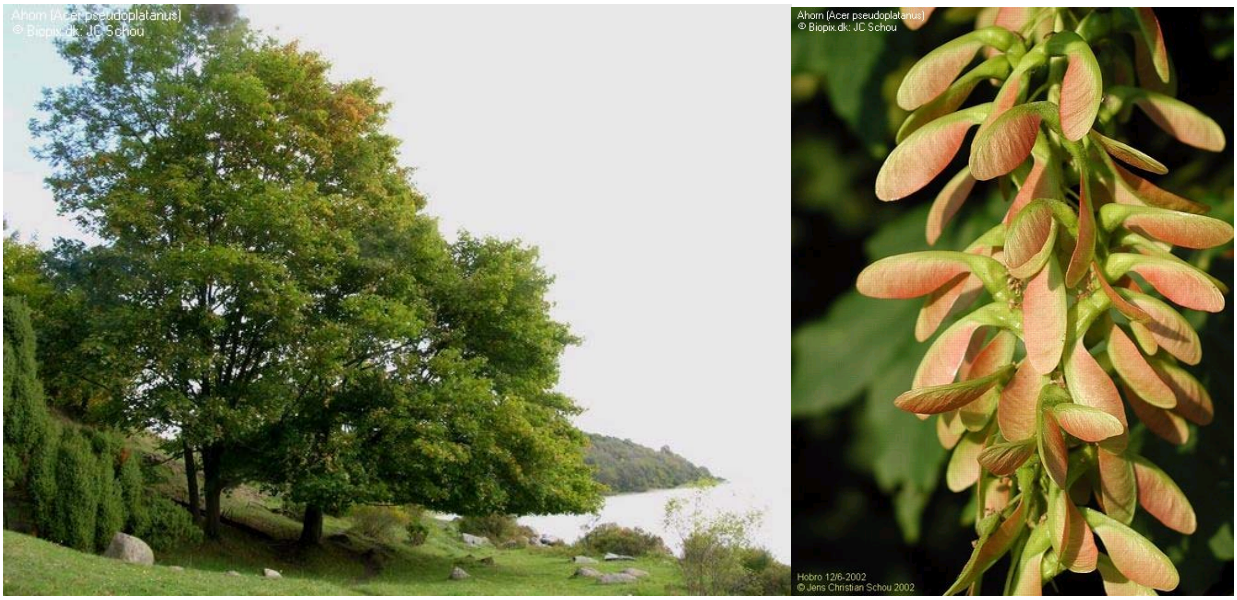

Fig. 1 and 2. Growth form and winged fruits of *Acer pseudoplatanus*, photo by Jens C. Schou, www.BIOPIX.dk.

Fig. 3. Flowers of *Acer pseudoplatanus*, photo by Jens C. Schou, www.BIOPIX.dk.
Fig. 4. Leaves of *Acer pseudoplatanus,* photo by Eli Fremstad.

Species identification
Acer pseudoplatanus is a large deciduous tree (up to more than 35 m tall, and 1 m stem diameter) with a rounded, symmetrical crown. The bark is coarse, grey to reddish-brown and often flakes off in scales, sometimes revealing an orange inner bark. The leaves are dark green, sometimes reddish, palmately five-lobed – in fall they turn yellow. The green to yellow monoecious flowers develop in pendulous racemes during April to May, appearing at the same time as the leaves. The winged fruits mature in the late summer or early fall. *A. pseudoplatanus* may be mistaken for *A. platanoides*, the latter species, however, has lighter green leaves, the five lobes of the leaves are more pointed, it holds the flowers in upright panicles and the bark remains smooth. The flowers appear before the leaves and pollination is done by insects. The species is not identified in pollen studies because the pollen is very similar to *A. campestre* and *A. platanoides*. Pollen production is very low – much lower than for other northern European trees, and the genus *Acer* is systematically underestimated in pollen studies (Andersen 1970).

Native range
A. pseudoplatanus is native in Europe and has been actively spreading since the ice-age. It has not yet managed to fill the potential range on its expansion from ice-age refugia in southern Europe (Svenning & Skov 2004, 2005). The natural speed of range expansion since the ice-age for several tree species in Europe is 100 – 200 km pr 100 years, with even higher speeds during the most rapid expansion phases (Huntley & Birks 1983, Birks 1989, Huntley & Webb 1989). Projects mapping natural distribution have usually tried to delimit natural occurrences from the period 1600-1700 as the natural range and not included any further spread as natural. The natural distribution area of *A. pseudoplatanus* at that time included central, eastern and southern parts of Europe (in the latter case only montane or sub-alpine habitats), with northern limits in the southern parts of Denmark around 55 degrees North (for a distribution map see Meusel *et al.* 1978), Caucasus and north of Minor Asia (Деревья и кустарники СССР 1958). *A. pseudoplatanus* was earlier considered to have its northern distribution limits in Germany, but presence in Denmark has been documented by the famous botanist Joachim Burser in the oldest Danish herbarium made while he was in Denmark 1625-1639 and also from Fyn by Kylling in 1688. This is in line with the oldest Danish botanical works including it as wild in Denmark (Tillisch 2001). The north-eastern part of the natural distribution stretches through north-eastern Poland and south-west of the Kaliningrad Region (Russia). The practice of planting the species for amenity purposes as well as in forests and the resulting naturalisation has today obscured the natural distribution area and cannot be told from the natural

expansion of several hundreds of kilometres, which must also have occurred in the 400 years since 1600. The proposed borderline of the species' natural distribution at the northern limits of the range such as in Poland is therefore dubious (Boratyński 1978). There are many scattered old occurrences beyond this borderline, especially in eastern and northeastern Poland, *e.g.* in Białowieża Forest. These can be populations spread from park and street plantings (Adamowski, Mędrzycki, Łuczaj 1997, Adamowski *et al.* 2001). Two examples of supposed natural distribution maps may be downloaded from the IPGRI page and from Meteorologisches Institut der Universität Bonn. Both maps fail to show the Danish natural occurrences around 1600 in southern Fyn and southern Jutland (from Haderslev down to Als), probably because these have not been internationally published and have also often been overlooked nationally (Tillisch 2001).

Given the pre-historical speeds of northern European tree species expansions one could hypothesise that a spread of 200 km pr 100 years would be a natural dispersal capacity for *A. pseudoplatanus*. This hypothesis implies that in the year 2000 a native range of 800 km more could be added to the original native range of the 1600s, as documented in Denmark by Tillisch (2001). This suggests a native range extending it far into Sweden and Norway. Research into postglacial migrations of trees have shown that seas the size of the Baltic Sea are not a major obstacle for natural spread, probably because occasional strong wind-storms carry seeds much larger distances (Clark *et al.*1998).

Alien distribution

History of introduction and geographical spread
It follows from the chapter on native range that we are dealing with a European species undergoing natural range-expansion parallel to human introductions. It is impossible to tell natural seedlings from the offspring coming from introduced stock.

A. pseudoplatanus is often described as being introduced from Germany to Denmark in 1765 by Johann Georg von Langen, who in his time had a great influence on European forestry (e.g. Vedel 1980). Newer research has shown that von Langen introduced the sycamore to Danish forestry, but that the species was already native to Denmark. The first imports of sycamore seed made by von Langen in 1766 were made from Kolding/Haderslev amter in the south-west of Denmark, where it was native, to Copenhagen area in the northeast of Denmark where it was not known at the time (Tillisch 2001). The following years he imported sycamore seeds from Germany, but also from Slesvig 1771 (then Danish) and Norway (1771-1773: Christiania, Laurvigen and Porsgrund) (Tillisch 2001). Already in 1771 there were fruiting sycamore trees in several places in Norway, although it is not known if they were natural occurrences. It is likely that the species was also transported the other way from Denmark to Norway about 250 years ago, during the period of shared jurisdiction between Norway and Denmark (Fremstad & Elven 1996). In Sweden the species has been recorded since the 1800s (Berg & Nilsson 1997), but may have been present earlier. About 100-150 years ago Scandinavian records of *A. pseudoplatanus* beginning to naturalise appear in the literature (Hylander 1970, Fremstad & Elven 1996). *A. pseudoplatanus* has been introduced in Latvia since the 1800s (Lange *et al.* 1978). In western Lithuania *A. pseudoplatanus* was introduced in forest plantations in the mid-19th century and currently is widespread both in forests and anthropogenic habitats in this part of the country. The first records of the species as being naturalised in this region are from 1950. In other regions of Lithuania it is cultivated and naturalised locally (Gudžinskas 1998). In Estonia it was first mentioned in 1803 (Kull *et al.* 2001). It is cultivated in Russia for a long time, but exact period is unknown. There are documented records of naturalized plants in southern districts of European part of Russia in the mid-20th century: in Voronezh district near arboretum (Григорьевская и др. 2004), in Lipetzk district (Машкин 1971).

A. pseudoplatanus is cultivated in towns and sometimes naturalized (Деревья и кустарники СССР 1958).
From its dispersal history it appears likely that the species will continue to spread in an easterly and north-easterly direction in Northern Europe. *A. pseudoplatanus* is also a successful colonizer in the oceanic parts of New Zealand (Hermann Ellenberg, pers. comm.).

Pathways of introduction
The species has been spread mainly by planting for ornamental purposes, in plantations and for shelter belts and along avenues. Once established in an area dispersal of the species takes place via seeds.

Alien status in region
A. pseudoplatanus is long-time native in many parts of Germany and Poland, as well as in southern Denmark. In parts of northern Germany the status of the species is debated due to plantings in the mid-17th century. However, there are some lowland areas where the species is deemed alien (Sachse 1989), while it is long-time native in *e.g.* Rügen and Slesvig (Meusel *et al.* 1978, Tillisch 2001). Naturalisation has taken place to a large extent in Denmark (Svart & Lyck 1991), Sweden (Berg & Nilsson 1997) and Norway (Fremstad & Elven 1996) as well as in Germany on young moraines with less acidic soils close to the Baltic (Hermann Ellenberg, pers. comm.). Large parts of these areas are within the dispersal potential of natural range-expansion, but the speed of naturalisation has been promoted by human introductions. In Finland the species is rare, but where the species escapes from cultivation some naturalisation takes place, i.a. in the Åland Islands and south-west Finland (Hämet-Ahti *et al.* 1998). In the Faroe Islands the species has been utilised since 1850 as an ornamental tree, and naturalisation is observed in some gardens and plantations (Ødum *et al.* 1989). On Iceland naturalisation has not occurred (Eythór Einarsson, pers. comm.). See also table 1.

Since *A. pseudoplatanus* is of a central European origin the species may be positively affected by future climate warming in the northern parts of the range. The effects of climate change on the dispersal of alien species have been simulated in Britain by the Institute of Terrestrial Ecology (Hill *et al.* 1994). In this survey *A. pseudoplatanus* was listed as one of the top 50 invaders thought likely to increase in warmer climate. However, since the species is already present in all parts of Britain the added effects of climate change were not judged to be severe in Britain. In countries like Norway a development towards a more oceanic climate might, however, support the further dispersal and establishment of *A. pseudoplatanus* in regions where it is not abundant presently (Fremstad & Elven 1996). It is already naturalised in coastal districts up to 68° 40’ N. In Russia *A. pseudoplatanus* is seen as escaped from cultivation, but places of naturalization are rare.

Country	Not found	Not established	Rare	Local	Common	Very common	Not known
Austria						Native	
Belgium						Native	
Czech republic						Native	
Denmark						Native	
Estonia		X					
European part of Russia			X				
Finland		X					
Faroe Islands			X				
Germany						Native	
Greenland	X						
Iceland		X					
Ireland					X		
Latvia				X			
Lithuania					X		
Norway						X	
Poland					Native		
Sweden				X			

Table 1. The frequency and establishment of *A. pseudoplatanus*, please refer also to the information provided for this species at www.nobanis.org/search.asp. Legend for this table: **Not found** -The species is not found in the country; **Not established** - The species has not formed self-reproducing populations (but is found as a casual or incidental species); **Rare** - Few sites where it is found in the country; **Local** - Locally abundant, many individuals in some areas of the country; **Common** - Many sites in the country; **Very common** - Many sites and many individuals; **Not known** - No information was available; **Native** - when a species is native in a country this is indicated in the table under the relevant frequency category.

Ecology

Habitat description

A. pseudoplatanus is found in forests, hedges, around houses and alongside roads. The species thrives on deep, moist soils with a high pH, but is also found on limestone, where the soil layer is not too shallow (Jones 1944), and germination and establishment take place at a wide pH regime. *A. pseudoplatanus* grows well in shaded conditions, particularly in its early years (Jones 1944), and this characteristic helps to explain its success in established old forests. Furthermore, the species tolerates salt sprays and air pollution, which makes the tree species a popular choice in and near towns. The ecological demands of the species are described in more detail in Ellenberg (1996). The species grows in mountain forests up to 1800 m (Деревья и кустарники СССР 1958).

Reproduction and life cycle

A. pseudoplatanus has sweet smelling flowers and is pollinated by a wide array of insects (Hegi 1924). The trees start flowering at an age of 10 to 20 years and some trees have been reported to be more than 350-400 years (Hermann Ellenberg, pers. comm.). Each inflorescence may result in up to 30 fruits and a single tree may have more than 800 inflorescences (Jones 1944).

The wind-dispersed seeds give rise to occasional long distance dispersal, 4 km documented by Hegi (1924), as well as intense dispersal around the maternal individual in a radius of usually about 200 meters (Tillisch 2001). Natural long-distance spread is undoubtedly occurring by strong wind-storms which can carry seeds very large distances, but this can usually not be documented. Seeds do not accumulate in a persistent seed bank, but all germinate the early spring following dispersal (Jones 1944).

Dispersal and spread
In Norway *A. pseudoplatanus* is highly associated with the cultural landscape, growing along roads and human dwellings as well as planted and naturalised in forests (Fremstad & Elven 1996).

A. pseudoplatanus produces an abundant number of seeds and, provided open ground is available, the species may germinate even in the dense shade of woodlands. Under shaded circumstances initial survival may exceed that of species such as beech and ash, and dense undergrowth of *A. pseudoplatanus* is sometimes formed. In the longer run (after 100-120 years) the beech may again outcompete and overshadow the *A. pseudoplatanus* (Hermann Ellenberg, pers. comm.). In western Norway native deciduous forests, some of which are protected as nature reserves, are increasingly being invaded by *A. pseudoplatanus* (Moe 1995, Holten & Breivik 1998). Here it seems likely that *A. pseudoplatanus* locally is able to outcompete some existing native species if no measures are taken.

Recent research indicates that roe deer (*Capreolus capreolus*) browsing in some regions in Denmark is less targeted on *A. pseudoplatanus* as compared to *e.g.* ash (*Fraxinus excelsior*) and beech (*Fagus sylvatica*) (Carsten Riis Olesen, pers. comm.). In other countries, such as Switzerland, Germany, France and Austria, research has demonstrated that *A. pseudoplatanus* is one of the most palatable species for browsing deer (Hermann Ellenberg, pers. comm.). Such selective grazing might shift the balance between competing seedlings of different tree species. A general observation is that *A. pseudoplatanus* does not establish seedlings in woods or pastures with grazing cattle, sheep or horses. It dies when eaten as a seedling. This means that the medieval and earlier landscape of most of Europe with widespread (over-)grazing, wood-cutting *etc.* must have been very detrimental to the survival and spread of *A. pseudoplatanus* and probably gave rise to local or regional exterminations (Tillisch 2001, Svenning & Skov 2005). An example seems to be the Danish Island of Ærø, where the name means "*A. pseudoplatanus* Island" and can be traced back to at least the year 1137. The seal of the shire is from 1442 and shows two trees, but all forest was exterminated on the island long before 1800. The people of Ærø traditionally put an honour in making wooden shoes of *A. pseudoplatanus,* and in the 1800th century imported *A. pseudoplatanus* from neighbouring Fyn for their shoe production (Tillisch 2001). The use of *Acer* for wooden shoes was not normal in the rest of Denmark.

Impact

Affected habitats and indigenous organisms
A. pseudoplatanus seeds have high dispersal ability and they may thus reach new open sites in great numbers. The young *A. pseudoplatanus* plant can survive in the forest undergrowth for an extended period of time until gaps are created in the canopy. With a high growth rate and by their horizontal position of leaves the *A. pseudoplatanus* trees absorb a substantial part of the available light. Apart from affecting the number of tree species the presence of *A. pseudoplatanus* may affect an unknown number of species in the food chain (herbs, animals, fungi etc.) since other tree species may become

displaced. The litter of *A. pseudoplatanus* may improve soil conditions, since the leaves are cherished by the larger earthworms (Hermann Ellenberg, pers. comm.).

Where *A. pseudoplatanus* dominates, fallen leaves may form a rather thick litter layer. At least in the northern part of its distribution area the litter is not fully decomposed during the winter and spring, and it may prevent germination of other species and hamper the vernal flora. Thus, in the long run, *A. pseudoplatanus* may affect species diversity of forest sites (Eli Fremstad, pers. comm.).

A. pseudoplatanus is regarded as introduced in Britain and here it displaces native species such as *Fraxinus excelsior* (refs. in Fremstad & Elven 1996). From Britain it also appears as if *A. pseudoplatanus* has had more success in the oceanic parts of the region. In the Nordic countries *A. pseudoplatanus* at present also dominates in the oceanic parts. *A. pseudoplatanus* is hypothesised to increase both in number at known sites and to establish itself at new sites in the coming years (Fremstad & Elven 1996).

Genetic effects
No genetic effects have been reported.

Human health effects
No human health effects have been reported.

Economic and societal effects (positive/negative)
The opinion as to whether *A. pseudoplatanus* is a problem species varies a lot (Binggeli 1993). Under some circumstances the species may be an important forestry species being used for furniture as well as for saw wood and sometimes pulpwood (Rusanen 1998, Tillisch 2001). In Denmark *e.g.* some foresters have considered *A. pseudoplatanus* to be a problem for forestry and treated it as such by trying to remove the species. But most have now accepted the species and utilise it in a niche production with good economic results (Jørgensen 1998, Tillisch 2001).

Knut Fægri (1970) termed *A. pseudoplatanus* a pest species in certain areas of Norway. So far, it has not been considered as a resource in Norway, although it has some economic potential (Myking & Skrøppa 2001). The Swedish Forestry Agency considers *A. pseudoplatanus* to be a threat and competitor to native deciduous tree species (Almgren *et al.* 1986). In relation to the conservation of natural forest reserves *A. pseudoplatanus* is a potential problem, since the species may displace natural biodiversity (Fremstad & Elven 1996, Møller 1997).

Management approaches

Prevention methods
In Denmark the species is no longer recommended as a species for hedges in the landscape, as experiences from all parts of the country suggest that *A. pseudoplatanus* overtakes the other species in the hedges (John Norrie, pers. comm.). In Germany planting of the species in areas where it has been deemed non-native requires a permit according to the Federal Nature Conservation Act. Although it is considered as an increasing problem, there are no restrictions to further planting of the species in Norway.

Eradication, control and monitoring efforts
Generally, the species is difficult to control due to the high annual production of seeds, which result in a large amount of seedlings. Repeated cutting has been reported to result in starvation and

subsequent death of the individual (Jørgen Stoltze, pers. comm.). This procedure is very labour intensive, since regrowth from the stump will take place. In fact, cutting 3 to 4 times is used in forestry to create an even aged group of trees with straight stems (Bruno Jørgensen, pers. comm.). Cutting followed by application of a herbicide may be more efficient (Hermann Ellenberg, pers. comm.). Grazing is effective to prevent establishment (Tillisch 2001).

Information and awareness
There are no reports of information or awareness campaigns regarding the species as an invasive species, but some information for the public is provided by International Plant Genetic Resources Institute (IPGRI - *Acer pseudoplatanus* summary information page).

Knowledge and research
The regeneration of *A. pseudoplatanus* is being studied in relation to the effects of shelterwood density, light and soil water content as well as the impact of roe deer (*Capreolus capreolus*) and rodents (Carsten Riis Olesen, pers. comm.).

Recommendations or comments from experts and local communities
None.

References and other resources

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Links

Publications by Pierre Binggeli on sycamore
Virtual flora of Sweden
FloraWeb (in German)
IPGRI - *Acer pseudoplatanus* summary information page
Acer pseudoplatanus in Bavaria, Germany

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