

Acer pseudoplatanus in Europe: distribution, habitat, usage and threats

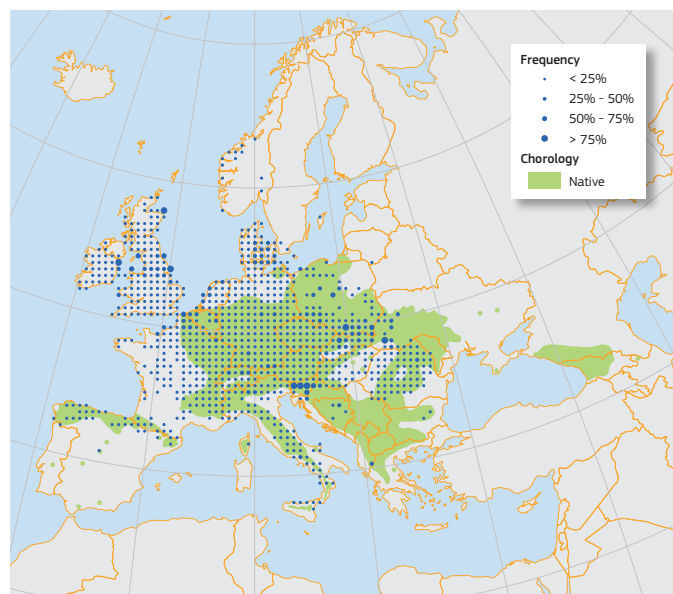
S. Pasta, D. de Rigo, G. Caudullo

The sycamore maple (*Acer pseudoplatanus* L.) is a large fast-growing deciduous tree with a broad, domed crown. Its primary range includes central, eastern and southern Europe, Caucasus and northern Minor Asia, but since the seventeenth century it started to be naturalised north of its native range both in Europe and in the other temperate regions of the world. It is rarely found in pure stands but often dominates mixed softwood deciduous forests and typically occurs on nutrient-rich soils that often accumulate in the shady micro-climates. Sycamore maple is tolerant to a variety of stresses including pollution and salt winds, making it suitable for urban and coastal planting. Its timber is useful for a variety of purposes including furniture, joinery, indoor flooring and musical instruments.

The sycamore maple (*Acer pseudoplatanus* L.) is a large deciduous tree that can live for more than 350-400 years. It grows up to 30-35m in height with a diameter of 60-80cm and a very broad domed crown whose diameter can sometimes exceed the height of the tree^{1,2}. However, it also has a strong root system making it quite wind-firm despite the large crown¹. It has large **palmate** opposite leaves with five pointed lobes that vary considerably in shape and size depending on the age and vigour of the shoot, but which may reach 18 × 26 cm in young vigorous trees. The leaves are dark green above with a slightly **glaucous** underside and a scarlet **petiole**^{2,3}. The bark is smooth and grey in young trees, later becoming rougher and cracked into scaly squares that curl away at the edges². It is a **monoecious** species, producing yellow-green flowers on hanging **racemes** 6-12cm long in mid-April when the tree is 10-20 years old. There is a wide array of pollinating insects⁴; each **inflorescence** may result in up to 30 fruits and a single tree may have more than 800 inflorescences⁵. The seeds mature in the autumn and are double **samaras** set in a V shape, which catch the wind and spin as they fall^{3,6}. These wind-dispersed seeds give rise to occasional long-distance dispersal (distances of up to 4km have been recorded⁴), as well as to intense dispersal around the mother plant in a radius of about 200m⁷. Its seeds do not accumulate in a persistent seed bank, but germinate in the early spring following dispersal⁵.

Distribution

The natural distribution range of sycamore includes Central and Eastern Europe and the mountain systems of Southern Europe (i.e. Apennines and Dinaric Alps), Caucasus and North of Minor Asia. Its northern limit is South Denmark at around the 55° North parallel⁸. Although it has not yet managed to fill all of its potential range on its expansion from Ice-Age refugia in southern Europe⁹, after its intensive plantation in the 18th century, it



Map 1: Plot distribution and simplified chorology map for *Acer pseudoplatanus*. Frequency of *Acer pseudoplatanus* occurrences within the field observations as reported by the National Forest Inventories. The chorology of the native spatial range for *A. pseudoplatanus* derived after EUFORGEN⁹.

has become naturalised north of its native range in Europe: e.g. United Kingdom and Scandinavia¹⁰, and even in other continents: i.e. North and South America, New Zealand, Australia and India¹¹.

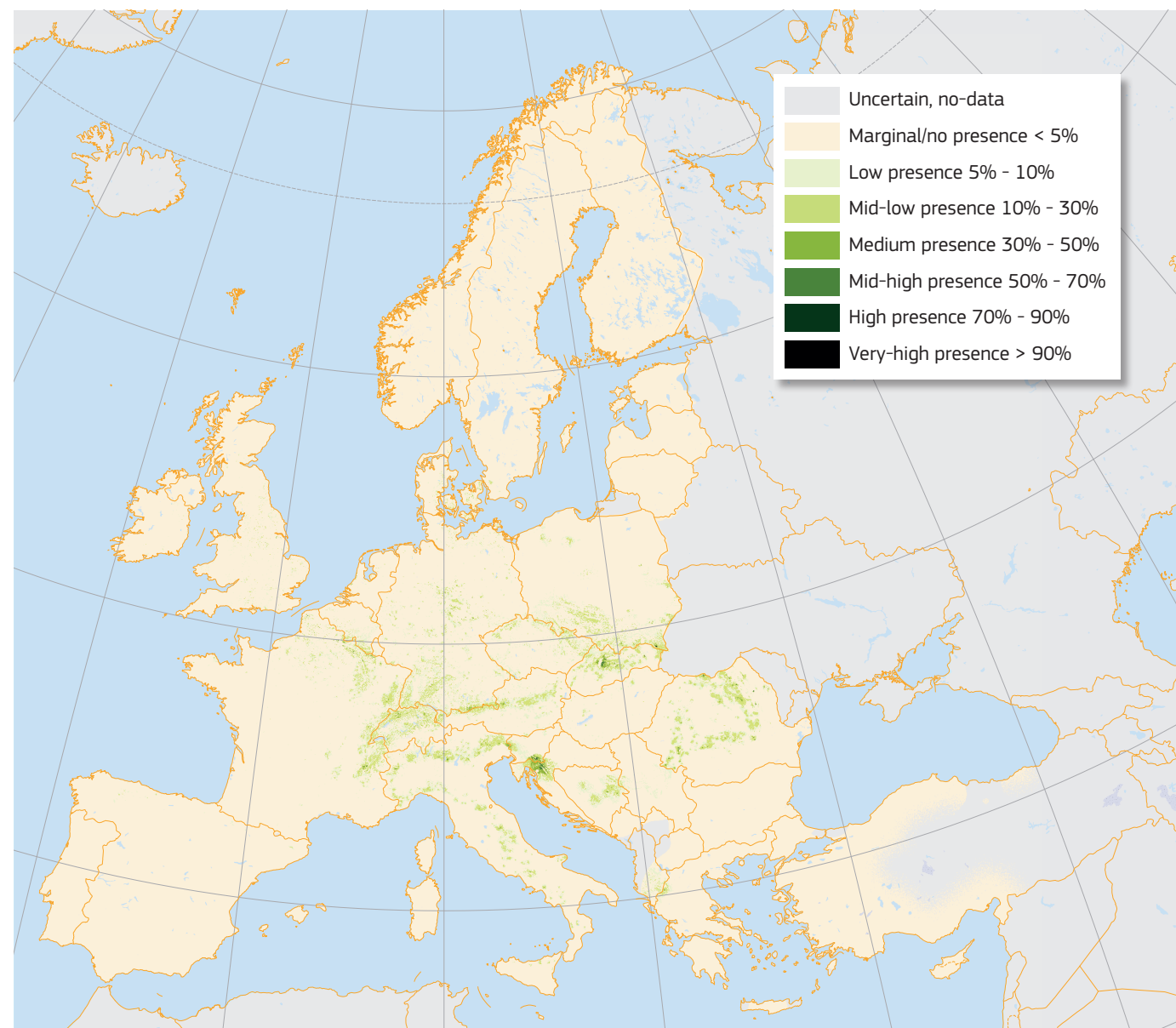
Habitat and Ecology

The sycamore maple is not able to thrive in drought-prone regions^{12,13}. Both germination and establishment take place under a wide pH range. It grows well in shaded conditions, particularly in its juvenile stage⁵ and this explains its ability to succeed within established forests¹⁴. Nonetheless, seedlings and saplings



The Sycamore Gap, iconic tree growing along Hadrian's Wall near Northumberland (UK). (Copyright Sarah Millar, www.flickr.com: CC-BY)

tolerate very well forest clearing practices¹⁵. It typically occurs on nutrient-rich soils that often accumulate in the shady micro-climates towards the bases of slopes and ravines. Therefore it is found on calcareous substrates associated with coarse scree, cliffs, steep rocky slopes and ravines, where inaccessibility has reduced human impact, forming a series of scattered patches grading into other types of woodland on level valley floors and on slopes above, or as narrow strips along stream-sides. More extensive stands occur on limestone and other base-rich rocks, but it may be encountered also on acidic soils⁵. Sycamore maple rarely forms forests on its own, but generally dominates the cooler and more humid environments (shade-tolerant forests), where it supports a wide range of **epiphytes**, herbivores and a rather varied ground flora¹⁶. The literature concerning the forest communities of Central Europe¹⁷⁻²⁴, the Alpine region²⁵⁻²⁸ and the more recent papers focused on those of Southern European peninsulas and Sicily²⁹⁻³⁸ points out that *Acer pseudoplatanus* is often a dominating species within mixed deciduous forests corresponding to the maple-lime forest type, also designated as protected priority habitat 9180 "Tilio-Acerion forests of slopes, screes and ravines"³⁹. This forest type is referred to the phytosociological class *Querco-Fagetea* Br.-Bl. & Vlieger in Vlieger 1937, and it hosts secondary species such as ash (*Fraxinus excelsior*), wych elm (*Ulmus glabra*) and limes, mainly small-leaved lime (*Tilia cordata*), more rarely large-leaved lime (*Tilia platyphyllos*)⁴⁰.



Map 2: High resolution distribution map estimating the **relative probability of presence**.



Maturing double samaras set in a V shape. (Copyright Wendy Cutler, www.flickr.com: CC-BY)



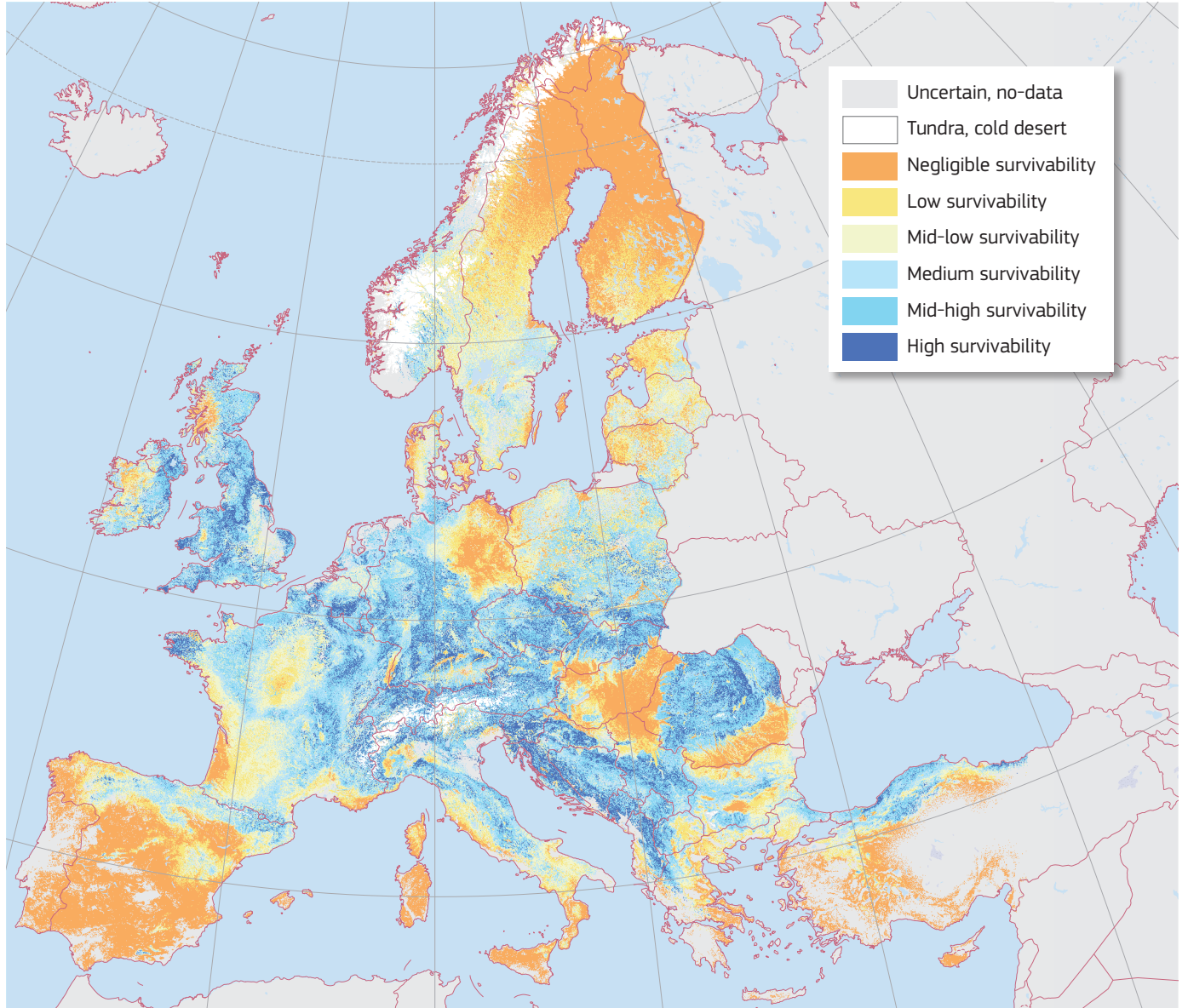
⋯ Bark cracked into plates curling away.
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Importance and Usage

The sycamore maple is tolerant to pollution, exposed sites including salt winds and low summer temperatures. Together with its striking and attractive appearance, this makes it a popular choice as an ornamental tree in urban and coastal locations¹. Its litter improves humus formation and nutrient cycling^{41, 42} and thus contributes to landscape diversity^{43, 44}. Its seeds contain large amounts of **hypoglycin A**, which may induce atypical myopathy on horses grazing under their canopies⁴⁵. On the other hand, some parts of sycamore maple can be consumed by men: for instance, in Poland fresh tree sap was drunk as a beverage, leaf buds were eaten raw by shepherds, and leaves were put in the oven under baking bread both to prevent it from sticking and to give it a special flavour⁴⁶. The leaves are still used to wrap local cheese in Northern Spain²⁹. Moreover, some promising chemical compounds which could be used against several types of cancer have been recently isolated in several *Acer* species⁴⁷. The sycamore maple distribution range overlaps with many areas in Europe with high erosion rates such as the European mountain systems⁴⁸. Its adventitious roots are very suitable to be exploited for soil bioengineering to increase the stability of slopes and mitigate erosion⁴⁹. The species shows a high efficacy against rockfall⁵⁰. Sycamore is also one of the fastest growing broadleaved species when grown on suitable sites. Its timber is soft but tough and light with an attractive colour, and is used for turnery, furniture making, joinery, indoor flooring and musical instruments^{1, 51}. Its rapid growth and potentially high timber prices make it economically attractive⁵², but despite its economic interest, the ecological services provided and its adaptability to a wide range of site conditions, sycamores only occupy a small proportion of European forest areas⁵³.

Threats and Diseases

The sycamore maple and other species of genus *Acer* are highly vulnerable⁵⁴ to the Asian longhorn beetle (*Anoplophora glabripennis*) which is a large wood-boring beetle native of Asian countries, such as Japan, Korea and China. Bark stripping by grey squirrels and damage by other browsing animals can reduce the amount of valuable timber^{52, 55}. The leaves may be severely



⋯ Map 3: High resolution map estimating the maximum habitat suitability.

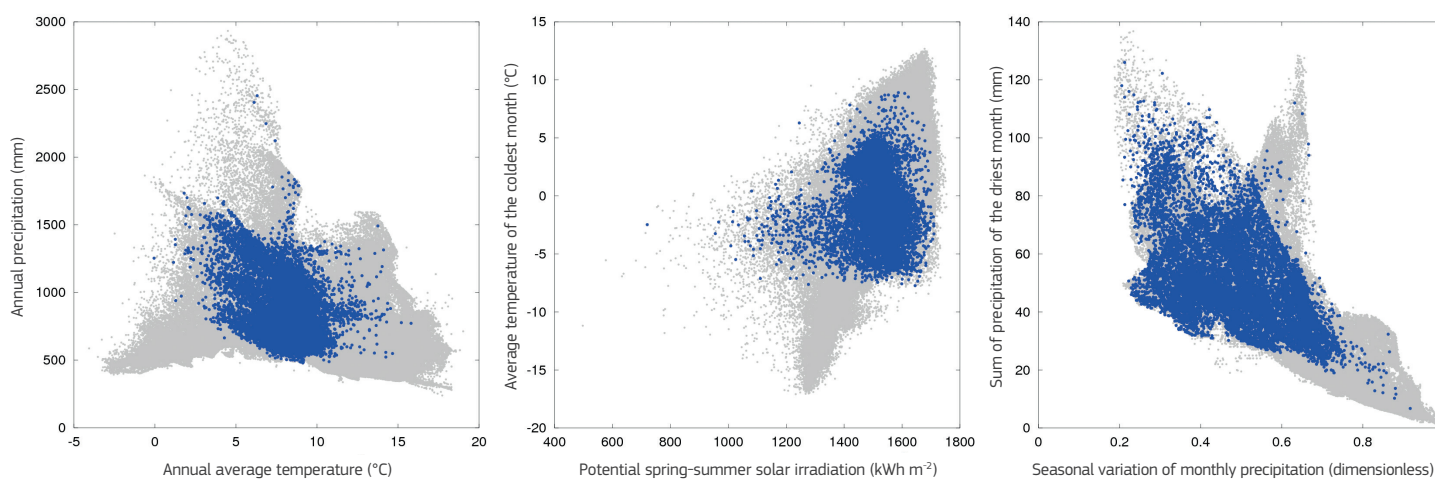


⋯ Group of sycamores in a forested area near Hockenheim (Baden-Württemberg, Germany).
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⋯ Ovoid bud with greenish scales in winter.
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Field data in Europe (including absences) ● Observed presences in Europe ●



⋯ Reddish leaves on young seedling with five deep lobes and long stalks.
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Ornamental sycamores with yellow autumn foliage in a park (Gloucestershire, UK).
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affected by ascomycete fungi such as *Rhytisma acerinum*^{56, 57}, *Pleuroceras pseudoplatani*⁵⁸ and *Petrakia echinata*^{59, 60} or by the imperfect fungus Deuteromycete *Cristulariella depraedans*. Several bark diseases are caused by fungi such as *Nectria cinnabarina*, *Verticillium* spp. (*Verticillium dahliae*, *Verticillium alboatrum*) and *Cryptostroma corticale*. The latter is harmful also for human beings^{61, 62} and causes the so-called 'sooty bark disease', whose fatal attacks are triggered by high summer temperatures and drought, so that predicted climate change is likely to increase its incidence at lower altitudes and latitudes and in more continental sites^{63, 64}. Moreover, the North American **ascomycete** *Eutypella parasitica* may cause severe damage due to stem cankers; since its first record in Europe⁶⁵ it has been spreading from Slovenia and Croatia towards Austria⁶⁶. The future possible response of sycamore maple to global warming is still under debate^{64, 67, 68}.



Inflorescence of green flowers with yellow anthers and no petals.
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Grey squirrel (*Sciurus carolinensis*), an alien species in Europe that damages the tree by stripping the bark.
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Sycamores are appreciated ornamental trees for their attractive autumnal leaf colour.
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