Fraxinus ornus in Europe: distribution, habitat, usage and threats

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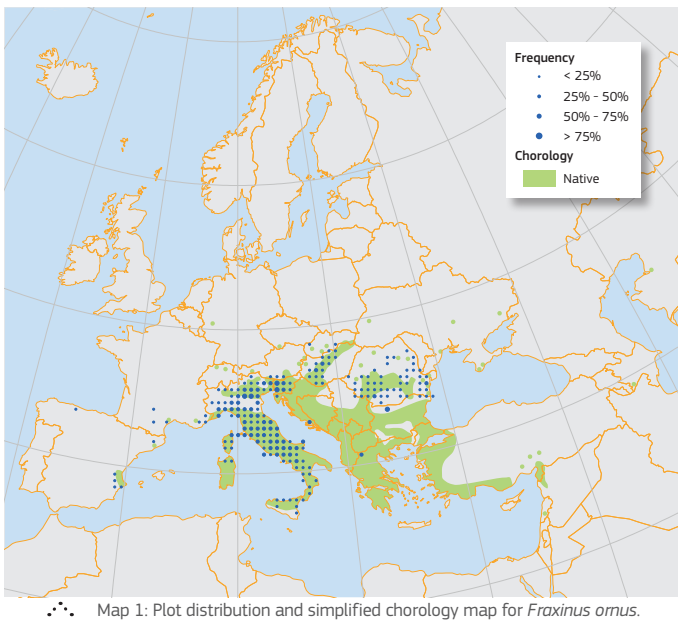
***Fraxinus ornus* L., commonly known as manna ash, is a small-medium deciduous tree, producing abundant large and scented inflorescences which attract several pollinating insects. Its range covers southern-western Europe with isolated population in South Turkey, western Syria and Lebanon, occurring typically in Mediterranean temperate hill and mountain mixed forests. It is a frugal and fast-growing plant, able to colonise open habitats, especially if disturbed by animal browsing, wildfires, landslides and logging. Manna ash forests are managed as mixed coppices for firewood production. In few rural areas of Sicily this ash is still cultivated for the production of manna, the crystallised sap, which has a bitter-sweet taste and it is used as sweetener, laxative and digestive. This plant does not have serious threats.**

The manna ash (*Fraxinus ornus* L.) is a small to medium-sized deciduous tree, growing rarely up to 25 m tall and 1 metre in diameter. The bark is dark grey, usually very smooth even in old trees. The crown is often asymmetrical, hemispherical or flattened with a straight trunk, sinuous branches directed upwards and frequently forked, and abundant root suckers at the base. The buds are grey-brown densely covered by short grey hairs. The foliage is olive-green and changes to yellow and deep pink in autumn. The leaf is compound, 25-30 cm long, odd-pinnate, arranged in 5-9 leaflets, which are **obovate**, acuminate, **serrated**, grooved above and **pubescent** at the joints, 7-10 cm long. The flowers are abundant and grouped in large inflorescences 10-20 cm long, which appear in late spring at the same time as the leaves. Flowers are scented and attract a variety of pollinating insects (mainly bees and beetles), even though they do not produce nectar. Wind pollination can also occur. The single narrow flowers are creamy white with four linear petals, 6 mm long. The manna ash is **androdioecious**: trees can have **hermaphrodite** flowers or have flowers with only functional male organs, so behaving as male plants. The fruits are samaras, 15-25 mm long, slender, green in colour until leaf fall, then brown when ripening in autumn. Their dispersion is driven by the wind and by water along rivers[1-7].

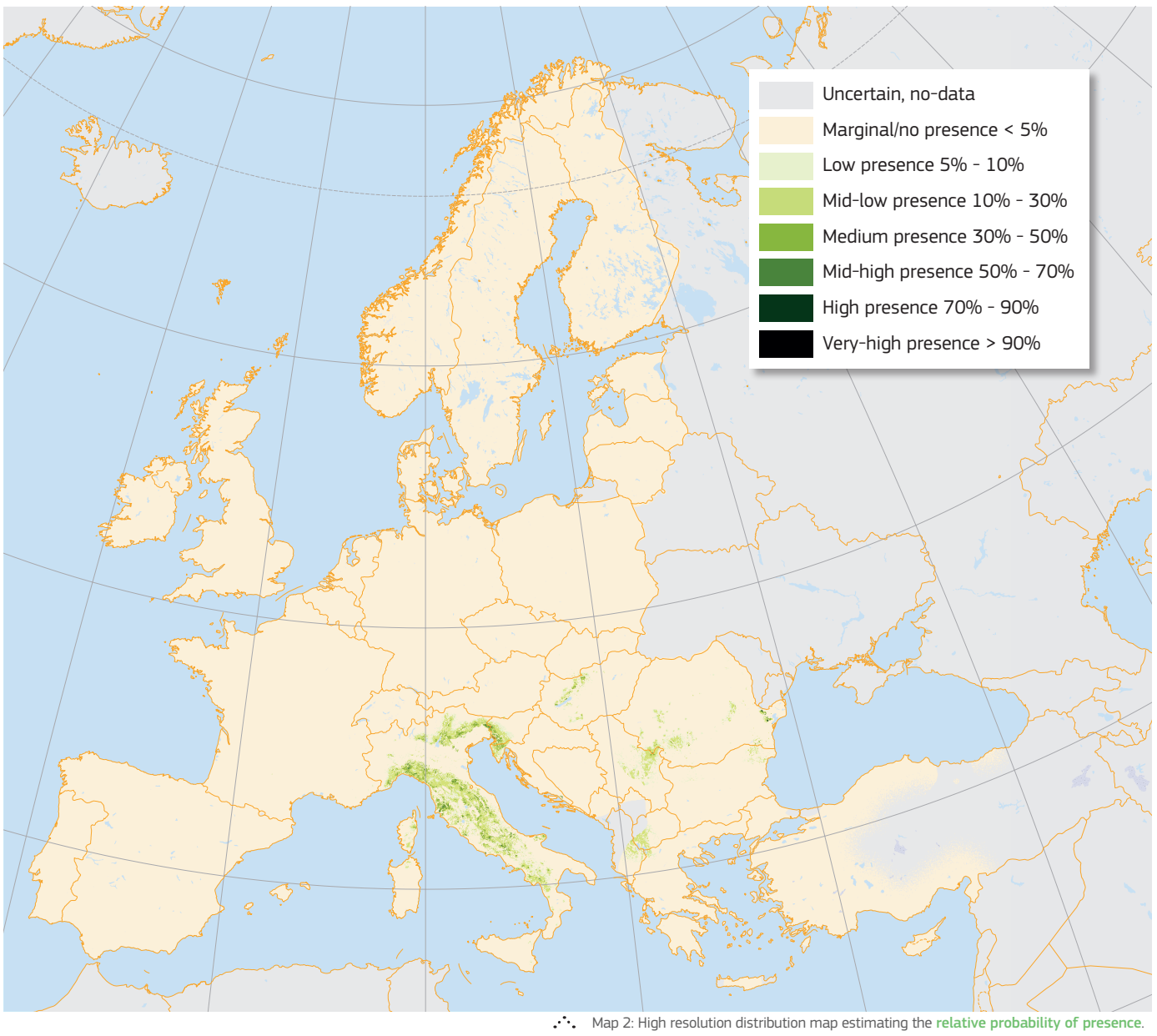


Map 1: Plot distribution and simplified chorology map for *Fraxinus ornus*. Frequency of *Fraxinus ornus* occurrences within the field observations as reported by the National Forest Inventories. The chorology of the native spatial range for *F. ornus* is derived after Meusel and Jäger[8].

Adult flowering tree: this ash is a small tree rarely growing up to 25 m. (Copyright Stefano Zerauschek, www.flickr.com: AP)

Distribution

In comparison with the other two European ashes, common ash (*Fraxinus excelsior*) and narrow-leaved ash (*Fraxinus angustifolia*), the manna ash has the smallest range, which covers southern-western Europe, from South-East France, through Italy, the Mediterranean isles, the Balkan peninsula, up to western Turkey. It is present from sea level up to 1500 m in altitude (South Tyrol). The northern limits of its natural distribution are the southern edge of the Alps and the Hungarian central Transylvanian mountains (Bihar Mountains), but it is also present in more northern countries as an ornamental tree. Outside its natural range it has been widely planted and now is commonly present and naturalised in other European countries up to 50° in latitude. There are isolated populations in eastern Spain and in South Turkey to western Syria and Lebanon[4, 6-9]. Like other ash species, manna ash shows great morphological variations inside its natural distribution and several subspecies and varieties have been described. Two subspecies are actually recognised and accepted: the manna ash (*Fraxinus ornus* subsp. *ornus*) and the Taurus flowering ash (*Fraxinus ornus* subsp. *cilicica*) an **endemic** species with a scattered population in the Taurus Mountains of Southern Turkey[4, 10, 11].



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

Habitat and Ecology

The manna ash occurs typically in Mediterranean temperate colline-mountain forests. In the northern part of its range and in higher elevations it is found commonly on south-facing slopes, where it can find the warmth required to grow. In central and eastern Europe it grows principally on calcareous soils, while in southern areas it also grows on silicate substrates, and does best on soils with a pH around neutral. The mean annual precipitation needed is between 500 and 650 mm, although it has a good drought resistance, storing water in densely branched roots, and reducing transpiration. The root system is widely developed, requiring gravelly, well-aerated and drained soils. It thrives better on poor soil, suffering the competition of other broadleaved trees on richer ones[4, 7, 12]. Thanks to its plasticity, fast germination and fast growth when young, this species easily colonises new habitats. The ability to resprout after cutting makes it also well adapted to grow in areas disturbed by animal browsing, wildfires, landslides and logging[4]. This tree species is not long-lived and rarely reaches 100 years[7]. This ash is found in several forest communities, typically in mixed broadleaved forests as a tree and also as a shrub in the understorey. It is associated with Mediterranean oaks (*Quercus pubescens, Q. cerris, Q. frainetto, Q. coccifera, Q. infectoria*), chestnut (*Castanea sativa*), hornbeams (*Carpinus* spp.), hop hornbeam (*Ostrya carpinifolia*) and maples (*Acer* spp.). In Greece and Turkey it can be found in **maquis** belts with other deciduous or evergreen broadleaved shrubs, and sometimes in mixed conifer forests with Lebanon cedar (*Cedrus libani*), black pine (*Pinus nigra*) and occasionally with Mediterranean firs (*Abies* spp.)[4, 7, 13].

Inflorescences of narrow flowers with four linear petals. (Copyright Ettore Balocchi, www.flickr.com: CC-BY)

Importance and Usage

Compared to the other ashes, the timber quality is similar, although with a lower density. It is good quality, heavy, with narrow annual rings and a small difference between **sapwood** and **heartwood**. However, its timber wood is of low economic interest, as trees develop small and poorly-shaped trunks with many defects, so it is mainly used for small tool handles and household items[4]. Managed manna ash forests usually are coppiced for producing firewood. In southern Mediterranean regions they are also managed by pollarding as a source of fodder for livestock (cattle, goats and sheep)[4, 14]. Several ash varieties are used as ornamental trees in gardens and urban parks, appreciated for the abundance of white scented flowers and the autumnal foliage coloration. For this reason, this tree is also called flowering ash[4, 7]. Manna ash occurs principally on slopes, so it is an important component of protective forests and, thanks to its pioneer habit, it is also used for afforestation of degraded sites[7, 15, 16]. Like the narrow-leaved ash, the damaged bark exudes a bitter-sweet tasting sap, which crystallises in the air into a yellow mass called manna. The main manna component is mannitol, a sugar alcohol, which has higher concentrations in trees planted in warmer regions. Manna was traditionally used in medicine as a laxative and digestive. During the last century manna was produced for extracting the mannitol, which is mainly used as a sweetener and for producing medicine. In southern Italy several ash plantations were established, until manna demand decreased as mannitol was first extracted by other sources (seaweeds, molasses) and then substituted by other synthesised products. Nowadays manna production is still active only in few rural areas of Sicily[4, 17-19].

Mature dry and brown samaras in autumn.
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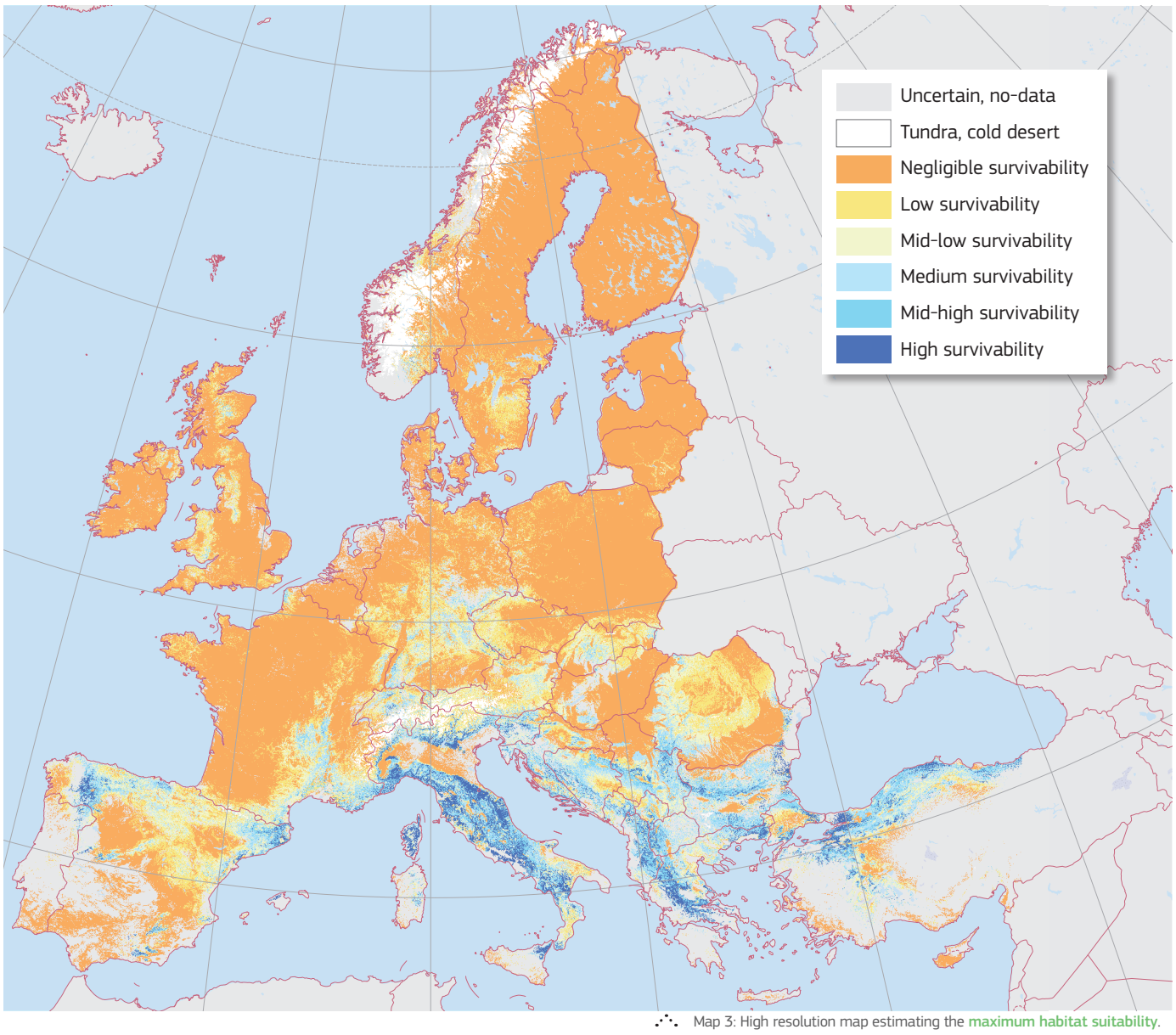
Threats and Diseases

No serious threats have been documented for manna ash. It is susceptible to the fungus *Hymenoscyphus pseudoalbidus*, also known as *Chalara fraxinea*, which causes massive diebacks of common ash and narrow-leaved ash in Europe[20]. However, this ash does not seem to be a natural host of the pathogen, as its vulnerability was tested with artificial inoculations on seedlings[21, 22]. Other generalist and manna ash pathogens have been observed, but in most cases they were in balance with the host, e.g. the cauliflower gall mite (*Aceria fraxinivora*)[23, 24], or in weakened plants for climatic reasons, e.g. the wood cankers caused by the fungus *Diplodia* spp.[25, 26]. During the winter period deer can feed by peeling the bark and causing significant forest damage when the population densities are high. In mixed forests of manna and common ash, this latter is more palatable and is debarked more[7, 28].



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

Compound leaves comprising 5-9 ovate leaflets 7-10 cm long showing red autumn colours.
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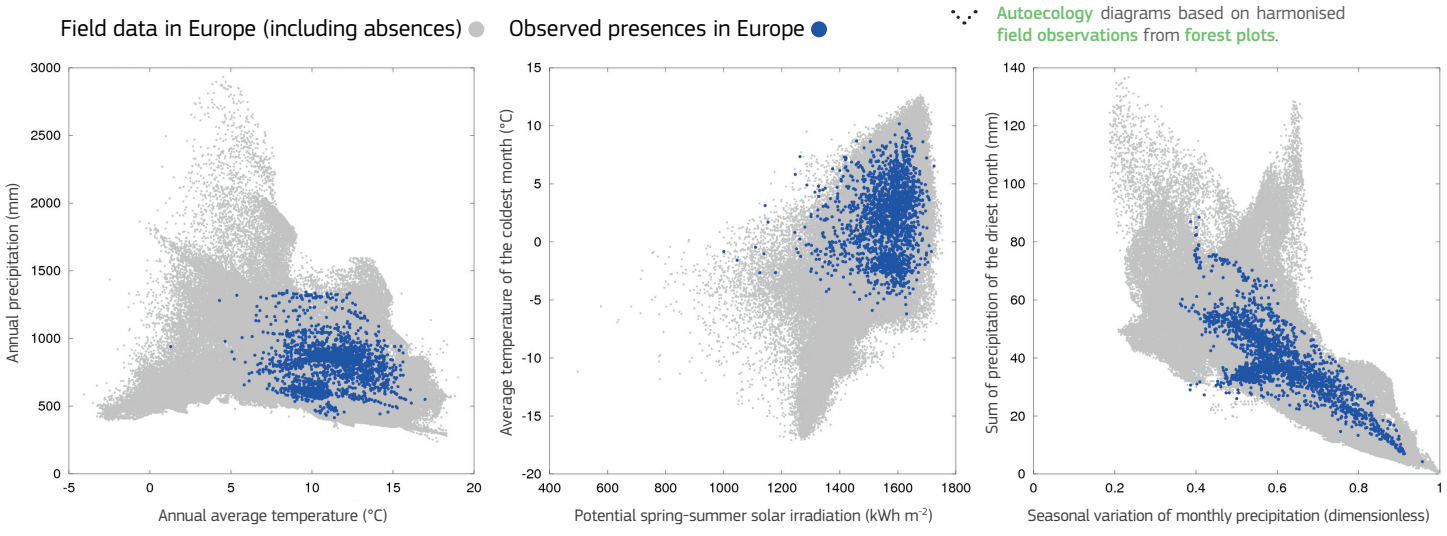
Autoecology diagrams based on harmonised **field observations** from **forest plots**.



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