

## Pinus pinea in Europe: distribution, habitat, usage and threats

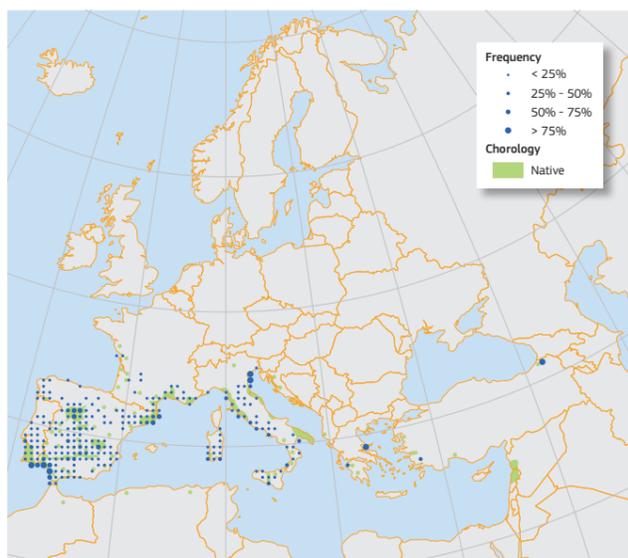
R. Abad Viñas, G. Caudullo, S. Oliveira, D. de Rigo

The stone pine (*Pinus pinea* L.) is a medium-sized tree with an umbrella-shaped, large and flat crown, scattered around the Mediterranean basin, mainly in coastal areas, and particularly abundant in south Western Europe. It occupies a broad range of climate and soil conditions, although it shows a low genetic variation. It thrives in dry weather, strong direct sunlight and high temperatures, tolerating light-shaded conditions at the early stages of its growth. It prefers acidic, siliceous soils but also tolerates calcareous ones. The most important economic products obtained from these pines are the edible seeds (pine nuts), although they are also used for consolidation of sand dunes in coastal areas, for timber, hunting and grazing activities. This pine species is rarely attacked by pests and diseases, despite some fungi diseases that can cause damages to seedlings and young plantations. In the Mediterranean basin, forest fires constitute the major threat to the stone pine, even though its thick bark and high crown make it less sensitive to fire than other pine species.

The stone pine (*Pinus pinea* L.) is a medium sized evergreen coniferous tree, which grows up to 25-30m with trunks exceeding 2m in diameter. The crown is globose and shrubby in youth, umbrella-shaped in mid-age and flat and broad in maturity. The trunk is often short and with numerous upward angled branches with foliage near to the ends. The bark is reddish brown, deeply fissured, with broad, flat-topped, orange-purple plates. The needles last 2-4 years and are bluish-green, in fascicles of two, on average 8-15 cm long, and with an oniony scent. The plant is **monoecious unisexual**. The pollen cones are numerous, and crowded all around the base of new shoots, each 10-20mm long, pale orange-brown. The seed cones are ovoid-globose, 8-12cm long, green when young and reddish brown when mature, ripening in the third year. The seeds are pale brown, covered with a black power, 15-20mm long, heavy, with easily detachable wings and ineffective for wind dispersal. Stone pine presents mast seeding with a significant variation in seeds production across the years<sup>1-4</sup>.

### Distribution

The natural range of stone pine is uncertain and difficult to establish due to a long history of planting. This species was largely distributed in Europe during the last thousand years, as it was introduced throughout the Mediterranean region for its edible seeds<sup>1, 5</sup>. The earliest evidence of the human use of this species were recently found in Gibraltar and dated to 49200 years before present<sup>6</sup>. Currently, the stone pine has a scattered distribution around the Mediterranean basin, from Portugal to Syria, and it is more abundant in south-western Europe (Iberian Peninsula, South France, Italy), where its regeneration is natural. It is also present along the shores of the Black Sea<sup>5, 8-11</sup>. This pine occurs mainly on coastal areas, except in Spain and Portugal where it grows naturally at some distance from the sea<sup>7</sup>. This

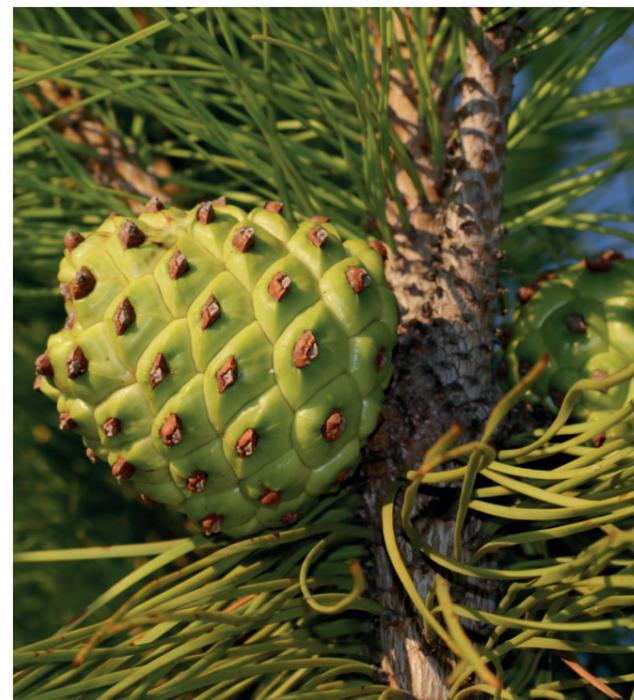


Map 1: Plot distribution and simplified chorology map for *Pinus pinea*. Frequency of *Pinus pinea* occurrences within the field observations as reported by the National Forest Inventories. The chorology of the native spatial range for *P. pinea* is derived after EUFORGEN<sup>25</sup>.

pine has additionally been successfully introduced in Argentina, South Africa and the United States<sup>4, 12, 13</sup>.

### Habitat and Ecology

The stone pine, one of the most characteristic trees of the Mediterranean flora, occupies a broad range of climate and soil conditions along the Mediterranean basin. Despite this, it has been identified as having very low genetic variation and no hybridisation with other pines is known<sup>10, 14, 15</sup>. It is considered a



Large green maturing cone: it takes 3 years to reach the maturity. (Copyright S. Rae, www.flickr.com: CC-BY)

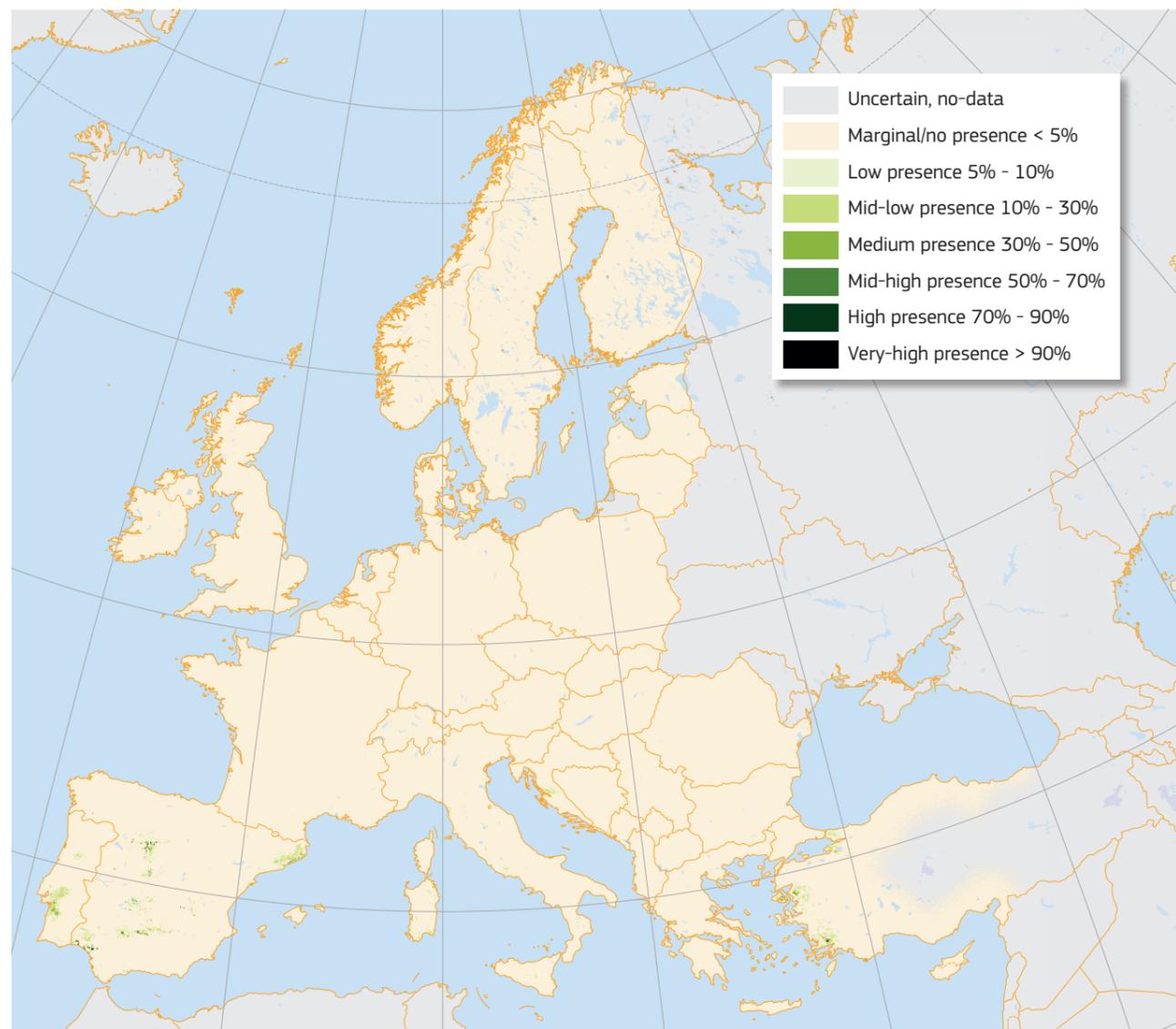
**heliophilous, xerophilous and thermophilous** pine<sup>16</sup>, that can withstand slight shade during its first stages but which requires abundant light for fructification in maturity<sup>17</sup>. Concerning annual average precipitation, the minimum requirement is for around 250 mm but the optimum is considered to be 600 mm<sup>17</sup>. Stone pine is well adapted to coastal thermo-Mediterranean areas where frost damage is not a relevant issue; however it also thrives well in sandy continental areas of central Spain with wide yearly and daily thermal oscillations and where night frosts are frequent for several months of the year<sup>17, 18</sup>. Concerning the soil there are no special requirements; it tolerates calcareous soils<sup>4</sup>, but it prefers siliceous and sandy soils with acid or sub-acid reaction. It also presents limitations in clay soils due to its inability to develop a proper root system in these conditions. The soil pH in its locations can range from 4 to 9<sup>17, 19</sup>.



Reddish brown bark with deeply fissured orange plates. (Copyright Vito Buono, www.actaplantarum.org: AP)

### Importance and Usage

This pine is a multipurpose species, cultivated for the production of timber, pine nuts, resin, bark, protection against soil erosion or for environmental and aesthetic purposes<sup>19, 20</sup>. Concerning timber production, although the wood is of good quality and it has been widely used in the past<sup>17</sup>, its relatively slow growth, as compared with another species of overlapping distribution area, ensure that stone pine is only a minor species in commercial timber plantations<sup>1</sup>. By contrast, due to its frugal behaviour and high tolerance to poor sandy soils, it has been successfully used for the consolidation of sand dunes in Mediterranean coastal areas<sup>17, 19, 21</sup>. However, undoubtedly, the most economically important product is its edible seed, from where the specific Latin name "pinea" is taken<sup>10</sup>. The seeds of the stone pine have been used and traded since ancient times<sup>1, 14</sup> and their demand is increasing. The main producers of this product are Spain, Portugal, Italy, Tunisia and Turkey<sup>10</sup>. Furthermore, in those habitats, where the poor and sandy soils throughout the Mediterranean area represent a limitation for other species, stone pine has great potential as an alternative crop, thanks to



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

the minimal attention required by forest stands or plantations, the increasing demand for pine nuts, and finally the compatibility of the nut production with other timber and non-timber products, such as fuel wood, mushrooms, hunting or grazing<sup>20</sup>.

## Threats and Diseases

The stone pine is not considered a threatened species and, despite its low genetic diversity, it is rarely attacked by pests and diseases. Nevertheless, as is the case with other Mediterranean pines, forest fires constitute the major threat, even though this pine is considerably less fire-sensitive thanks to its thick bark and high crown devoid of low branches<sup>10, 16</sup>. Regarding biotic threats, fungi diseases such as blister rust (*Cronartium flaccidum*), twisting rust (*Melampsora populnea* f.sp. *pinitorqua*) and needle rust (*Coleosporium tussilaginis*) can sometimes cause serious damage to seedlings and young plantations. The Sphaeropsis blight, caused by the fungus *Sphaeropsis sapinea* (syn. *Diplodia pinea*), is generally considered a pathogen of weak trees and it can be responsible for severe attacks after water stress. The fungi of genus *Heterobasidion* can produce sometimes extensive losses through decay and root rot<sup>10, 19</sup>. Economic impacts to the nut production through damage to cones can be caused by boring beetles of genus *Ernobius*, the cone-worms of snout moths (*Dioryctria* spp.), and by the western conifer seed bug (*Leptoglossus occidentalis*) introduced from North America, which withers or misdevelops the cones with its sap-sucking activity<sup>22, 23, 24</sup>.



Stone pine forest on coastal sand dunes near Trafalgar Cape (Cádiz, Andalusia, South-West Spain). (Copyright Alfonso San Miguel: CC-BY)



Ornamental stone pine in urban area (Recco, North-West Italy). (Copyright Alessio Sbarbaro, commons.wikimedia.org: CC-BY)

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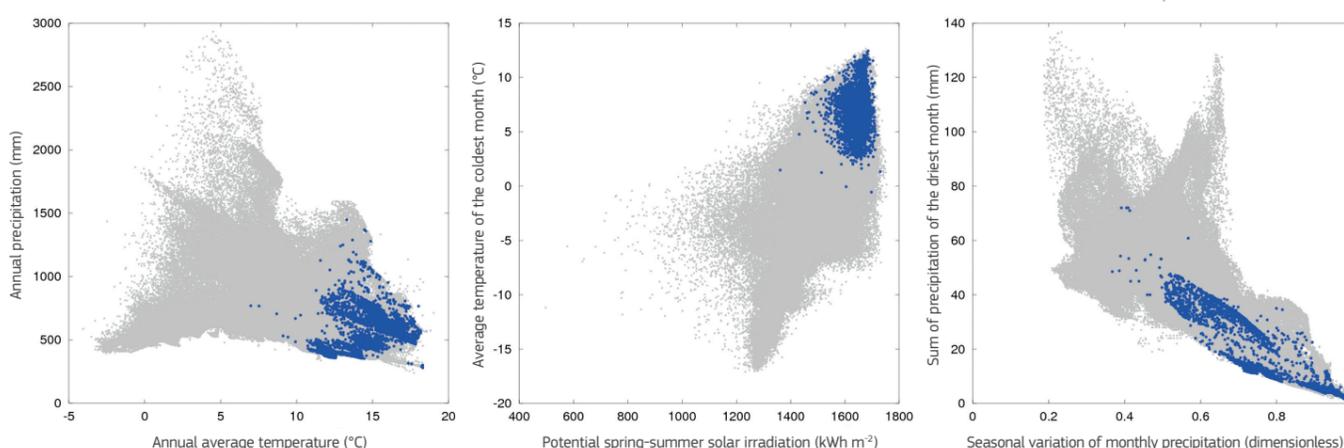
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Pine nuts fresh from the cone are covered with a black powder. (Copyright Eran Finkle, www.flickr.com: CC-BY)

Field data in Europe (including absences) ● Observed presences in Europe ●

Autoecology diagrams based on harmonised field observations from forest plots.



This is an extended summary of the chapter. The full version of this chapter (revised and peer-reviewed) will be published online at <https://w3id.org/mtv/FISE-Comm/v01/e01b4fc>. The purpose of this summary is to provide an accessible dissemination of the related main topics.

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