

Taxus baccata in Europe: distribution, habitat, usage and threats

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Taxus baccata L., known as European or English yew, is a conifer native to Europe. It is an unusual conifer in that it does not actually bear cones, but berries. Unlike other conifers it is also non-resinous and is tolerant to repeated pruning. It has a very large environmental tolerance but is susceptible to waterlogging. Extremely long lived but very slow growing, yew's strategy is that of survival. It is highly shade tolerant, normally found within the forest singularly or in small groups. European yew is extremely toxic, which has led to its removal in many locations, resulting in one of the largest declines of any European species. It is now protected: forests harbouring yew have been designated as special protection areas by the European Community (Habitats Directive 92/43/EEC). In recent times its importance as a source of taxane alkaloids for the manufacture of cancer-treating pharmaceuticals has come to the fore.

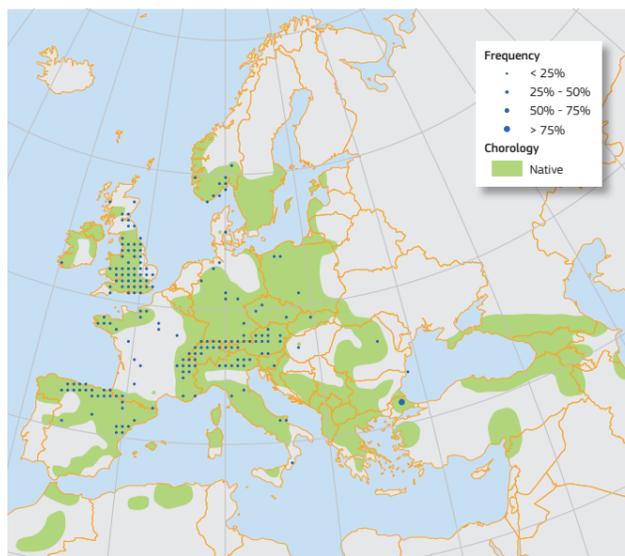
The European or English yew (*Taxus baccata* L.) is native to most of Europe. It is an extremely long-living tree, with reports of some specimens of up to 5000 years old¹. However, since it is very difficult to determine age accurately as the oldest specimens are almost always hollow² making tree ring-based age estimation impractical, opinion is divided about the exact age of the oldest specimens³. Yew is often multi-stemmed and its height rarely exceeds 20 m, but its longevity means that trunks can be very large: up to 4 m diameter. Root systems are shallow with extensive horizontal roots³. A non-resinous conifer, the needles are very dark green above and yellow to matt green below; they are 2-3 cm long and 3 mm wide and linear in shape with a sharp point. Needles are set spirally around the shoot in two ranks and are not whorled². Yew is mainly **dioecious**; although examples of **monoecious** trees exist this is rare and usually consists of separate sexed branches. Male flowers are small green globes along the underside of last year's shoots, whilst the female flowers are minute green flowers borne in the leaf axils of the previous year's growth. After wind pollination scarlet berries approximately 7 mm in diameter are produced with a red fleshy aril (the only non-toxic part of the tree⁴) surrounding the dark central seed. Seeds are dispersed by birds which feed on the red flesh and pass the seeds. The yew is also capable of vegetative reproduction.

Distribution

The yew is native to most of Europe, the Atlas Mountains and Asia Minor. In Europe, yew woodland can be found over most areas, but it grows best in oceanic climates with moderate temperatures³. Its distribution is limited in northern Europe beyond Britain, Ireland and southern Scandinavia by low temperatures and waterlogging and in the south by drought and high temperature^{5, 6}. Elevation increases from north to south with moisture demand for this reason and in the Mediterranean area, yew is usually restricted to higher elevations on northern slopes^{3, 7}. It is thought to be the oldest tree genus in Europe; the oldest fossil record for *Taxus* in Europe dates to the Lower Miocene⁸.



Old multi-stemmed yew in Kingstone Wood (West Midlands, England). (Forestry Commission, www.forestry.gov.uk © Crown Copyright)



Map 1: Plot distribution and simplified chorology map for *Taxus baccata*. Frequency of *Taxus baccata* occurrences within the field observations as reported by the National Forest Inventories. The chorology of the native spatial range for *T. baccata* is derived after Meusel and Jäger, and Jalas and Suominen^{21, 22}.

Habitat and Ecology

The yew normally appears as individuals or small groups of trees within the understorey, but natural stands can be found across its entire range. It normally occupies the mid to lower tier of a forest³. Yew can grow on almost all soil types with adequate drainage, typically on humus and base-rich soils, but also on dry **rendzina** and sandy soils with adequate moisture⁷. The yew is intolerant of prolonged frost and cold although its tolerance varies by region and season. They are moderately drought tolerant and can cope with temporary flooding but are susceptible to long-term poor drainage. The temperature range for photosynthesis is greater than any other European tree species, allowing the yew to photosynthesise in winter when deciduous trees are bare of leaves; this contributes towards the yew's extreme shade tolerance⁹, which is almost comparable to that of silver fir (*Abies alba*) and beech (*Fagus sylvatica*), the two most shade tolerant tree species of Europe¹⁰. The yew's root system is capable of penetrating the most compressed soils meaning they are able to survive under extreme conditions such as rocky terrain and vertical cliff faces¹¹.

Importance and Usage

The properties of yew timber, heavy but elastic, made it historically important. One of the world's oldest wooden artefacts is a wooden spear dating from the Palaeolithic era (around 150000 years ago)¹². In the Middle Ages it was used for a wide variety of items including musical instruments, furniture and longbows, and the wood was in such demand that it was felled almost to extinction across much of Europe¹³. Today it is not considered to be a commercial crop due to its extremely slow growth rate. However, it is highly valued as an amenity tree for hedging and topiary. In recent years yew has become important due to the taxane **alkaloids** found in its foliage which have been developed as an anti-cancer drug^{7, 14}.



Male yellow globose flowers at the base of the leaves. (Copyright Michael Wunderli, www.flickr.com: CC-BY)

Threats and Diseases

Yew has experienced one of the sharpest declines of all European tree species. Historically it was felled to provide wood for longbows and destroyed to prevent the poisoning of livestock¹⁵; yew is now endangered in many parts of its range where intensive land-use has caused a decline in numbers^{5, 15, 16} and regeneration rates are too slow to replace the existing populations⁵. Additional pressure is now being put on the species from harvesting for the extraction of taxanes for pharmaceutical use¹⁷. Despite being poisonous, it is also frequently damaged by browsing and bark stripping by wild and domestic animals. The thin bark means it is intolerant to fire although it has a lower combustibility than other conifers. Relatively few insects attack it compared to other tree species because of its toxicity¹⁸, but seedlings can be killed by pathogenic fungi¹⁷, stem canker has been seen in Switzerland¹⁹ and has been identified as the cause of death of some yews in Great Britain²⁰. Yew mite (*Cedidophopsis psilaspis*), whose attacks cause bud mortality⁷, is considered a serious pest of yew in northern and central Europe³.



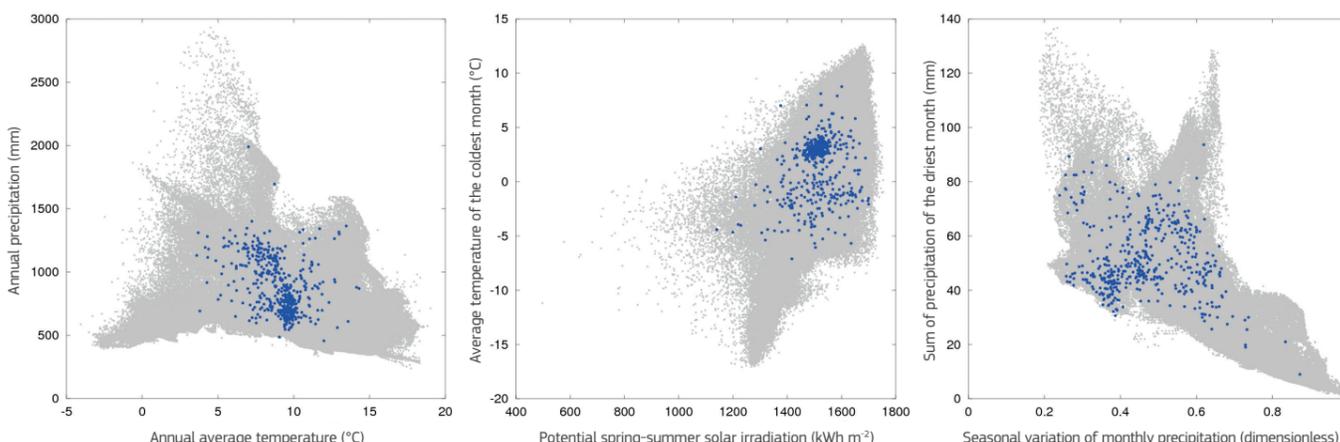
Red fleshy berry-like fruits surrounding the dark central seed. (Copyright Roberto Verzo, www.flickr.com: CC-BY)

References

- J. E. Milner, *The tree book: the indispensable guide to tree facts, crafts and lore* (Collins & Brown, 1992).
- J. E. Eckenwalder, *Conifers of the World: The Complete Reference* (Timber Press, 2009).
- P. A. Thomas, A. Polwart, *Journal of Ecology* **91**, 489 (2003).
- C. R. Wilson, J.-M. Sauer, S. B. Hooser, *Toxicol* **39**, 175 (2001).
- J. C. Linares, *Forest Ecology and Management* **291**, 119 (2013).
- A. Farjon, D. Filer, *An Atlas of the World's Conifers: An Analysis of their Distribution, Biogeography, Diversity and Conservation Status* (Brill, 2013).
- F. Hageneder, *Yew: A History*, History Press Series (History Press Limited, 2011).
- Kunzmann, Mai, *Palaeontographica Abteilung B: Palaeophytologie* **272**, 67 (2005).
- U. Pietzarka, *Zur ökologischen Strategie der Eibe (Taxus baccata L.): Wachstums- und Verjüngungsdynamik*, Ph.D. thesis, Technischen Universität Dresden (2005).
- H. H. Ellenberg, *Vegetation Ecology of Central Europe* (Cambridge University Press, 2009), fourth edn.
- D. W. Larson, *et al.*, *Journal of Biogeography* **27**, 319 (2000).
- K. P. Oakley, P. Andrews, L. H. Keeley, J. D. Clark, *Proceedings of the Prehistoric Society* **43**, 13 (1977).
- H. R. Hartzell (CRC Press, 1995), chap. 2, pp. 27-34.
- M. Suffness, *et al.*, *Taxol: science and applications* (CRC Press, 1995).
- H. Ruprecht, *et al.*, *European Journal of Forest Research* **129**, 189 (2010).
- A. Dhar, H. Ruprecht, H. Vacik, *Forest Ecology and Management* **255**, 2835 (2008).
- A. Lewandowski, J. Burczyk, L. Mejnartowicz, *Forest Ecology and Management* **73**, 221 (1995).
- W. M. Daniewski, *et al.*, *Phytochemistry* **49**, 1279 (1998).
- J. Hassler, W. Schoch, R. Engesser, *Swiss Forestry Journal* **155**, 400 (2004).
- R. G. Strouts, T. G. Winter, *Diagnosis of ill-health in trees* (H.M.S.O., 1994).
- H. Meusel, E. Jäger, eds., *Vergleichende Chorologie der Zentraleuropäischen Flora - Band I, II, III* (Gustav Fischer Verlag, Jena, 1998).
- J. Jalas, J. Suominen, *Atlas Florae Europaeae: distribution of vascular plants in Europe Vol. 2 Gymnospermae (Pinaceae to Ephedraceae)* (Committee for Mapping the Flora of Europe and Societas Biologica Fennica Vanamo, Helsinki, 1973).

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

Autecology 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/e015921>. The purpose of this summary is to provide an accessible dissemination of the related main topics.

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