

# Species Profile

## *Cedrus*, True Cedars

### Silviculture and properties

**Peter Savill** and **Scott McG. Wilson** continue our series looking at individual tree species.

Most taxonomists (e.g. Farjon, 2012) describe the cedars (*Cedrus* spp) as a genus of two or four species, of which the Indian *Cedrus deodara* (Deodar) is generally agreed to be sister to a clade that contains the other three taxa: *Cedrus atlantica* (Atlantic or Atlas cedar), *Cedrus libani* v. *brevifolia* (Cyprus cedar) and *Cedrus libani* (cedar of Lebanon). No distinguishing gene marker can be found that separates them (Pijut, 2000). Natural populations of *Cedrus* spp are restricted to mountainous regions of India/Nepal, Morocco/Algeria, Cyprus and Lebanon/Turkey respectively. These species are

often referred to as 'the true cedars', to distinguish them from numerous other trees, both broadleaved and coniferous, that are customarily referred to as 'cedars', such as western red cedar (*Thuja plicata*), incense cedar (*Calocedrus decurrens*), yellow cedar (*Chamaecyparis nootkatensis*) and Japanese red cedar (*Cryptomeria japonica*). Wikipedia lists 27 such species, including several species in the mahogany family (*Meliaceae*).

True cedars are quite often cultivated in Britain as ornamental specimen trees in landscaped parks and large gardens, most notably at Highclere Castle in Berkshire (as



A cedar of Lebanon, planted in 1866, in the graveyard of Clifton Hampden church, Oxfordshire. Most people believe cedars look like this, having 'an air of antiquity'.

seen frequently on ITV's Downton Abbey). Mabberley (1990) states that part of their attraction is that they rapidly develop 'an air of antiquity' as compared with native trees such as oaks. There is rather little experience of them as plantation or forest trees in Britain, but as climate change proceeds they may come to have a place as productive species on drier sites.

It can be difficult to distinguish visually between the *Cedrus* species, but the following may help: the branch tips and leader of *Cedrus deodara* droop noticeably, in a similar way to western hemlock. Cyprus cedar (*Cedrus brevifolia*) has, as the scientific name implies, short needles, up to 1.5cm long and the other species have much longer needles. According to Mitchell (1974) the old adage of ascending = Atlantic, level = Lebanon, and drooping = Deodar works quite well when applied only to the tips of the branches.

## ***Cedrus atlantica* (Endl.) Carr.**

### **- Atlantic cedar, Atlas cedar**

#### **Origin and introduction**

The Atlas cedar is indigenous to Morocco and Algeria in the Atlas and Riff Mountains, at elevations between 1000 and 2000m, where it can form pure stands or occur more locally in association with Spanish fir (*Abies pinsapo*) or Algerian fir (*Abies numidica*). It is one of few African trees that thrives in Britain and was introduced here in 1841.

#### **Climatic and site requirements**

Forest Research (2015) states that the species appears to be frost hardy to at least -20°C in Britain, but growth and survival are poor in higher rainfall areas, so planting should be confined to regions with less than 1500mm of rainfall. Use is considered in warm, dry lowland areas with less than 800mm, but there may be emergent issues with drought sensitivity in such situations (Courbet, 2012), depending on soil conditions. It does not withstand climatic exposure well and will suffer considerably from needle burn and injury during cold winters when established in windy places, but is not sensitive to late spring frosts. It will tolerate urban pollution better than most conifers but not salt-laden sea winds.

Atlas cedar grows best on lighter soils that are moderately dry to fresh in terms of their soil moisture regime (SMR) and it can tolerate periods of moisture deficit. Peats and heavy or wet soils should certainly be avoided based on the French experience. The species appears to tolerate a rather wide range of soil nutrient regimes (SNR), excluding only the very



*Mature mixed stand of Cedrus atlantica with Abies pinsapo, Mt. Ventoux, Vaucluse, SE France.*

poor class (Rameau et al, 2008; Wilson, 2014). According to Mitchell and Wilkinson (1989) it grows well on dry calcareous soils, for example in France over limestone parent material.

#### **Other silvicultural characteristics**

The tree occasionally grows to about 30-40m tall in Britain and particularly rapidly when young. Macdonald et al. (1957) believed that it would make a productive species on good sites in the south of England. Growth starts slowly but eventually becomes quite vigorous. It is moderately shade tolerant, but said to grow faster than the cedar of Lebanon. Like all the true cedars, bare-rooted *C. atlantica* is difficult to transplant successfully due to the formation of extensive tap-rooting.

#### **Pests and diseases**

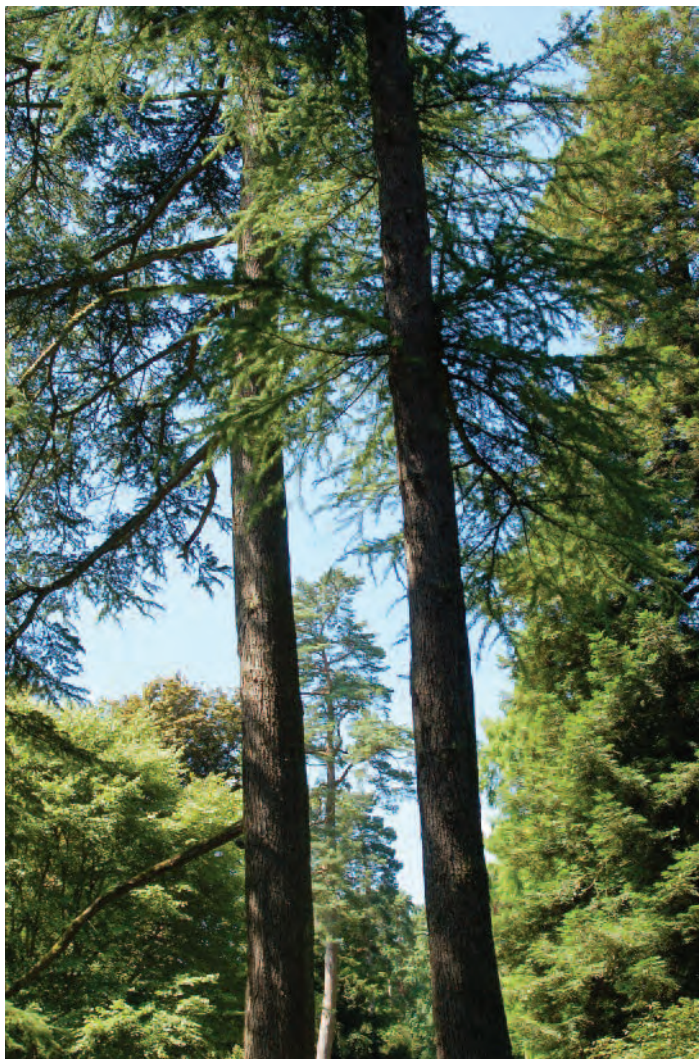
The Atlantic cedar is susceptible to a similar range of pests and diseases to Lawson's cypress and Leyland cypress. These include cypress canker, *Seiridium cardinale*, as well as the cypress aphid, *Cinara cupressivora*. Peace (1962) records that *Phomopsis pseudotsugae* (now called *Phacidiopycnis pseudotsugae*) is associated with premature needle fall and sometimes death of whole trees quite commonly. The root fungi, *Armellaria mellea* and *Heterobasidion annosum* (*Fomes*) occur occasionally on cedars.

#### **Flowering, seed production and nursery conditions**

The tree seldom flowers copiously before it is 40 or 50 years old. Flowers appear in September or October and the seeds take two years to mature. Cones should normally be



# Species Profile



*Mature Cedrus specimens, Forestry Commission Westonbirt Arboretum, Gloucestershire.*

collected in April before they begin to disintegrate, and the seed should be sown immediately, otherwise viability will be lost quickly, especially if they become too dry.

## Provenance

No provenance testing has been carried out in Britain and there are no established forest plots on which to base information. The current recommendation from Forest Research (2015) is that seed should be sourced from the native range or from French selected stands.

Using examples drawn from research carried out at INRA, Avignon on *Cedrus* species, Fady (2003) demonstrated that introduced tree species experience rapid and quite considerable ecological and genetic changes. They seem to evolve quickly into new landraces as a result of selection, genetic drift, population admixture and changes in spatial structure of their mating system.

## Silviculture

The species has been established in parts of France and Italy as a plantation timber tree since the 1860s (Courbet, 2012). It can either be deployed in pure stands or locally in mixture with other Mediterranean conifers such as pine or fir. The rotation length varies with the site quality and intended timber usage, but would typically be rather longer than that for pine species, at 80-130 years. A target diameter of 45-55cm is suggested and a target basal area for regular thinning interventions of 28-32m<sup>2</sup>/ha, reflecting moderate tolerance. A regime of pruning is recommended to produce high-value, finely-branched final crop trees.

## Timber and utilisation

The wood of Atlas cedar is renowned for its strong and persistent fragrance caused by oleoresins. The wood and cedar oil are known to be a natural repellent to moths, hence cedar is a popular lining for chests and wardrobes in which woolens are stored. The timber remains the primary building construction timber within Morocco (Ramsay and Macdonald, 2013)

Heartwood is light brown and distinct from the lighter-coloured narrow sapwood. Growth rings are very distinct. The wood is straight grained, rather resinous and the texture is medium to fine. It is easy to work and finishes well. It is durable and suitable for outdoor uses. The density at 15% moisture content is about 560kgm<sup>-3</sup>. There is a tendency for the wood to warp when drying. It tends to be soft, brittle and not very strong, lacking shock resistance and toughness. (See also: Ramsay and Macdonald (2013) re. timber properties.)



*Productive Cedrus atlantica stand, Cedraie de Marcelly (Villeneuve-Minervois), Aude, SW France.*



## Place of Atlas cedar in British forestry

The Atlas cedar is a tree that might be suitable for wider cultivation in plantations if climate change proceeds as predicted, particularly on drier, warmer sites in southern and eastern Britain. It is one of very few conifers that will grow well on calcareous soils although finely-divided topsoil carbonate may cause problems. One potential use for this species might be in mixed coniferous stands in those areas where Corsican pine is currently the preferred crop, for example in lowland heathland forests. Atlas cedar is successfully operated in silvicultural mixture with *Pinus nigra* (both Austrian and Corsican pines) and Spanish fir (*Abies pinsapo*) in southern France, as at Mt. Ventoux. There is a possibility that such mixed stands reduce the impacts of *Dothistroma* and similar fungal infections on susceptible pines by a 'host dilution' effect. This should be explored through research for



Mature *Cedrus atlantica* specimen amidst *Sequoia* spp stand, Kyloe Wood, Northumberland.

British forestry, as it might allow the current moratorium on Corsican pine establishment to be relaxed, where the species was to be used in suitable mixtures (Wilson, 2014). Where an *Abies* species is being used in mixture in lowland Britain, Greek fir (*Abies cephalonica*) or Turkish fir (*Abies bornmuelleriana*) may be better choices than Spanish fir in terms of growth rate.

## *Cedrus libani* A. Rich - Cedar of Lebanon

Although this species has been grown as a landscape specimen tree for over three centuries, practically no systematic trials have been carried out into its potential as a forest tree in Britain. Two varieties are recognized by some authorities: cedar of Lebanon and Turkish cedar, although the distinction would probably be considered by Farjon (1998) to be "botanical nationalism".

## Origin and introduction

The cedar of Lebanon is native to the mountains of Asia Minor, Syria and Lebanon. Farjon (2012) states that it grows naturally between 1300m and 2100m elevation. Quite hardy, this light-demanding and calciphile species grows rather slowly. This was the first cedar to be introduced to Britain, in around 1638. According to the Royal Botanic Gardens, Kew, it was partly due to the efforts of the 18th-century landscape gardener, 'Capability' Brown, that the species was popularized. He designed more than 170 parks and gardens in England, planting cedars in many of them.

## Climatic and site requirements

In common with the Atlas cedar, this species appears to be frost hardy to -20°C in Britain. However, most trees were killed during the exceptionally harsh winter of 1739/40. Almost all of the huge and ancient-looking cedars of Lebanon on lawns of stately homes date from after that year. It has been hardy since then, though young trees are sometimes killed by severe frosts. It is not especially particular about soil fertility, but according to Brown and Nisbet (1894) it needs a dry, deep, open soil with a permeable subsoil. It may be somewhat more drought-tolerant than Atlas cedar and hence relevant to lowland sites.

## Other silvicultural characteristics

The species is a light-demander (perhaps more so than Atlas cedar) and has a wide-branching habit, which some writers say may be detrimental in plantation-grown trees unless grown in mixture with other species. However, Brown and

# Species Profile

Nisbet (1894) stated that: "...if it be at all confined among other trees, it rises with an upright stem like any other coniferous tree". They also say that it is much too slow growing to be recommended as a timber tree.

## Pests and diseases

This species is largely free of major pathogens, except that it is reported to have some susceptibility to root rot caused by honey fungus, *Armillaria* spp. It can also suffer from various aphid infestations (Forest Research, 2015). Others are listed under *C. atlantica*.

## Flowering, seed production and nursery conditions

Believed similar to Atlantic cedar.

## Provenance

There have been very few forest plots and there are no known provenance trials with this species in Britain. The current recommendation from Forest Research (2015) is, as for Atlas

cedar, that seed should be sourced from the native range. In practice, this is likely to be very difficult for political and conservation reasons. A conservation propagation programme has been pursued recently by the International Conifer Conservation Programme in collaboration with the Forestry Commission National Pinetum, Bedgebury.

## Timber and utilisation

Similar to that of the Atlas cedar, except that Brown and Nisbet (1894) said that, although the wood is of great durability when grown in its native mountains, it is soft and of inferior quality when grown in Britain. However, some older British trees that have been occasionally harvested have attracted high timber prices.

This was a major timber production species in the Mediterranean and Near East in antiquity, being used for heavy construction, aspects of ship-building and carpentry (Grove and Rackham, 2003). The timber was reportedly used for the construction of Solomon's Temple (Evans, 2013) and there are sculptural depictions in Assyria and Egypt

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suggesting harvest and transport of the timber from Lebanon for high-status building construction. There is evidence of organised compartmental management in the Lebanese groves by Roman times (Meiggs, 1982; Thirgood, 1981). After the end of the Classical period the condition of the groves suffered due to over-exploitation and a failure of natural regeneration due to the intensity of browsing by goats under extensive pastoral systems (Grove and Rackham, 2003). Recent years have seen deliberate conservation efforts, despite civil war.

## Place of cedar of Lebanon in British forestry

In common with the Atlantic cedar, this species could increase in importance if climate change proceeds as predicted, particularly on drier, warmer sites in southern and eastern Britain. For timber production, it might be rather less attractive than the Atlantic cedar, which grows faster and possibly with less of a tendency to produce large branches.

## ***Cedrus deodara* (Roxb.) G. Don - Indian/Himalayan Cedar/Deodar**

Despite familiarity in British India, this species has seen very little attention in British forestry. Specimen trees in arboreta and tree collections typically appear very slow grown. Courbet (2012) reports the species to be of little interest for wood production in France due to its drought sensitivity and vulnerability to late frosts as compared to the Atlas cedar.

## ***Cedrus libani* v. *brevifolia* Hook f. - Cyprus cedar**

Courbet (2012) reports the species to be of little interest for wood production in France due to slow rates of growth and vulnerability to late frosts. This would be likely to hold good in Britain also.

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Since retiring from Oxford University in 2006, **Dr Peter Savill** has been involved as a Trustee of three charities: Woodland Heritage, the Future Trees Trust and the Sylva Foundation. He has also written *The Silviculture of Trees used in British Forestry* (CABI, 2013) and edited *Wytham Woods – Oxford's ecological laboratory* (OUP, 2010).

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