Scientific name : *Pinus taeda* L.

Local names :

loblolly pine (UK, USA),
pin à l'encens (FR),
pino de incensio (SP),
? (PT)

Botanical aspects :

Source : CABI forestry compendium (http://www.cabi.org/compendia/fc/)

Habit, size and stem form : *P. taeda* is a medium to large tree that reaches a height of 34 m (110 feet) and 75 cm (30 inch) dbh (Harlow et al., 1996) that self-prunes well and develops a straight trunk and an oval, somewhat dense crown.

Important characteristics : *P. taeda* tends to develop a tap root, especially on sandy soils. On wet sites or on sites dominated by heavy clay the tap root is generally shorter. The bark is variable. When young, it appears brown and scaly. Older trees are ridged and furrowed, with somewhat apparent blocks. Very old trees have red-brown scaly plates.

Foliage : Evergreen, 15 to 23 cm (6 to 9 inches) long, with (usually) three yellow-green, stiff needles per fascicle.

Inflorescences, flowers and fruits : Monoecious; male strobili are long, cylindrical, red to yellow, in clusters at branch tips. Mature strobili (cones) are ovoid to cylindrical and red-brown in colour, 7.5 to 15 cm (3 to 6 inches) long. The umbo is armed with a short spine. Seeds are small, 5 to 8 mm long, dark brown and rough. Seed wings 15 to 20 mm long and light brown.

Phenology : Height and branch growth usually begin before the last frost in the spring. Young trees produce one to five growth flushes during the growing season. Resting buds between successive flushes are generally produced in response to drought. Height and branch growth usually cease in late summer. Needles are retained until the end of the second growing season. Pollen is shed in early Spring (mid-February to mid-April). Cones ripen September to October and seed is dispersed from October to December (Young and Young, 1992). Seed germination occurs the following Spring, after overwintering on the forest floor.

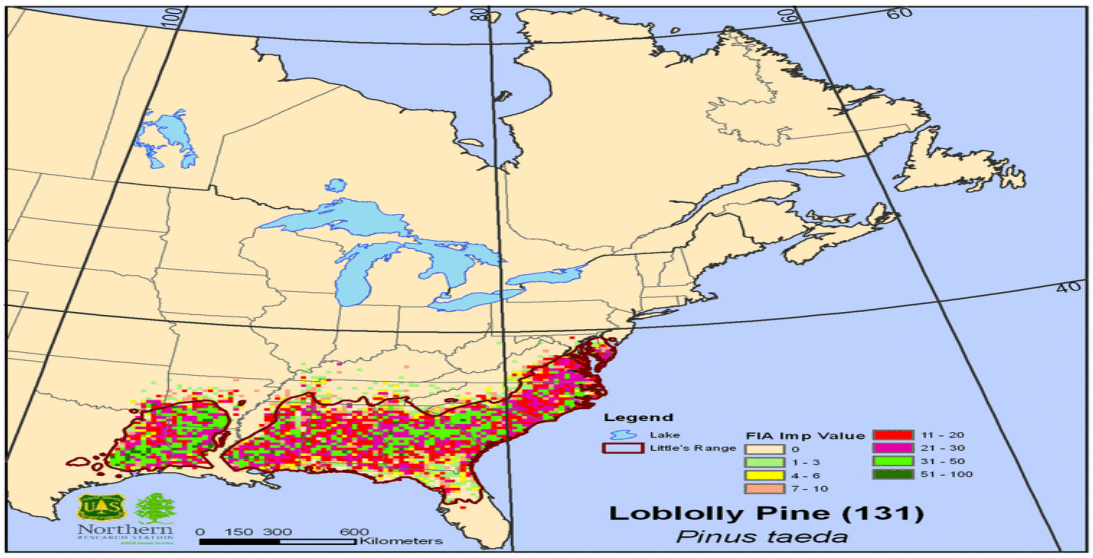
(figures : Flora of North America, http://www.efloras.org/ ; http://www.plants.usda.gov/)

Genetical aspects : 2n=24. *Pinus taeda* frequently forms natural hybrids with *P. echinata* and *P. palustris* (*P. taeda* x *palustris* = *P sondereggeri* H.H. Chapman).

Distribution

P. taeda is one of the most important of the « southern yellow pines » of the USA. Originally most races of *Pinus taeda* were in the lowlands. Following disturbance of the natural vegetation after settlement by Europeans, the species spread to fine-textured, fallow, upland soils, where it now occurs intermixed with *P . echinata* and *P . virginiana* . In the Southeast *P . taeda* is commonly used in plantation forestry, along with *P . elliottii* and *P . echinata* .

The natural range of *P. taeda* extends from southern New Jersey to central Florida and west to eastern Texas. *P. taeda* is found on the Coastal Plain, the upper and lower Piedmont, in the southern portion of the Ridge and Valley region, on the Highland Rim, and on the Cumberland Plateau. Notable exclusions in its native range include the Mississippi River Valley and the very dry sandhills of North and South Carolina. The range of *P. taeda* has been extended north and west by planting.



Source : USDA New Climate Change Tree Atlas : http://www.nrs.fs.fed.us/atlas/tree/tree_atlas.html
(Little's range : 1971 and 1977).

As an exotic, it is used in Africa (particularly South Africa and Zimbabwe), South America, China and Australia.

Intra specific variation

Source : Southern Pine Seed Sources, R.C. Schmidtling, 2001, USDA Forest Service, Southern Research Station, General Technical Report SRS-44.

Within its natural range, which extends from southern New Jersey to southeast Texas, loblolly pine occupies a great diversity of sites. It grows faster than any of the other southern pines on well-drained, productive sites. It is not the best choice, however, on poor sites such as very dry sands or on wet flatwoods (Shiver and others 2000).

Geographic variation in loblolly pine is more complex than in the other southern pines because of important differences between eastern and western seed sources. Geographic variation has been well documented for growth rate, disease resistance, cold tolerance, drought resistance (Dorman 1976), and stem form (Schmidtling and Clark 1989).

Loblolly pines from west of the Mississippi River are usually slower growing than east coast varieties, but they are more resistant to fusiform rust and drought (Wells 1985) and more tolerant of crowding (Schmidtling 1988, Schmidtling and Froelich 1993). The slower growth of the western sources is undoubtedly part of an evolved drought-avoidance tactic. The slower relative growth of shortleaf (*P. echinata*) and longleaf (*P. palustris*) pines may also be a manifestation of this tactic, as those two species often grow on droughty sites (deep sand in the case of longleaf, shallow and rocky soils for shortleaf). The natural ranges of shortleaf and longleaf pines, however, do not extend as far west into the drought-prone regions of Texas as loblolly pine, explaining why loblolly has a higher drought tolerance. Dendrochronological analyses of loblolly provenance tests have shown that the western seed sources cease growth immediately at the onset of a drought, whereas the eastern varieties tend to keep growing (Grissom and Schmidtling, 1997).

Loblolly pines from west of the Mississippi River and from the northeastern extremity of their range (Maryland and Virginia) are the most resistant to fusiform rust. Seed sources from just east of the Mississippi River, in southeast Louisiana and southwest Mississippi, centered around Livingston Parish, LA (Wells and others 1991), are moderately resistant. All other loblolly populations are generally susceptible, with the exception of resistant families (McKeand and others 1999). Of the rust-resistant seed sources, only Livingston Parish produces loblolly pines that grow as fast as the populations from the Atlantic and gulf coasts. Livingston Parish seedlings are prone to cold and ice damage, however, and tend to exhibit poor form if planted north of the 10°F (-12° C) minimum temperature isotherm (Wells 1985, Wells and Lambeth 1983).

Ecological characteristics

The loblolly pine planting areas have been divided into three districts to reflect the complexity of that species' geographic variation (fig. 2). The eastern district is east of the Mississippi

River, and the Texas and or Louisiana-Arkansas border separates the western and far-western districts somewhat arbitrarily. Because it is more likely to experience drought, the far-western district produces seedlings that are more drought tolerant (Long 1980).

Climate

P. taeda grows in the temperate climatic zone, and can be planted in the subtropics and tropics. Within its native range, rainfall is evenly distributed throughout the year; heavy downpours and mild summer droughts are relatively common occurrences. Climate is generally considered mild in its native range, with hot summers and cool winters. On the edges of its range, growth and reproduction are generally limited by late frosts that hinder flowering and by inadequate rainfall during the growing season (Baker and Langdon, 1990). A modified description of climatic requirements (see climatic data table of this data sheet) was prepared by CSIRO (see Booth and Jovanovic, 2000).

Climatic amplitude (estimates)

- Altitude range: 0 - 900 m
- Mean annual rainfall: 900 - 2200 mm
- Rainfall regime: summer; uniform
- Dry season duration: 0 - 6 months
- Mean annual temperature: 14 - 24ºC
- Mean maximum temperature of hottest month: 20 - 35ºC
- Mean minimum temperature of coldest month: 1 - 18ºC
- Absolute minimum temperature: > -23ºC

Soil and physiography

P. taeda is generally associated with ultisols and alfisols, but can grow on a wide variety of soil types, textures, moisture levels, and acidity. *P. taeda* exhibits very slow growth on infertile soils.

Soil descriptors

- Soil texture: light; medium; heavy
- Soil drainage: free; impeded; seasonally waterlogged
- Soil reaction: very acid; acid; neutral
- Soil types: acid soils; alfisols; alluvial soils; vertisols; bog soils; clay soils; colluvial soils; fluvisols; gleysols; gravelly soils; peat soils; loess soils; ferralsols; podzols; sandstone soils; sandy soils; silty soils; swamp soils; ultisols; volcanic soils

Pests, diseases and other perturbations

Diseases

Hepting (1971) reviews the diseases associated with *P. taeda*. Seedlings in nurseries are susceptible to several fungi that cause black root rot. These include *Fusarium* spp., *Macrophomina* spp., and possibly others.

The most damaging stem disease of *P. taeda* is fusiform rust, caused by the fungus *Cronartium quercuum* f. sp. *fusiforme*. This disease causes formation of fusiform shaped

cankers on the stems and can severely weaken or kill trees. The alternate host for this fungus is various species of oaks, *Quercus* spp. This disease can also affect seedlings in nurseries.

Annosus root rot, caused by the fungus *Heterobasidium annosum*, is another damaging disease of *P. taeda*. Infections begin when spores germinate on the surface of fresh stumps. The fungus then spreads to adjacent trees via root grafts. Diseased or dying trees typically occur in groups especially following thinning. This disease causes negligible losses in natural stands or in the absence of cutting.

The fungus *Phaeolus schweinitzii* causes a root and butt rot, usually after basal injuries. Red heart rot, caused by *Phellinus pini*, enters trees via dead branch stubs and causes heart rot in older trees, generally over age 60.

Insects

P. taeda is one of the preferred hosts of the southern pine beetle, *Dendroctonus frontalis*. This tree-killing bark beetle is considered one of the most destructive insects in the south-eastern USA, Mexico and Central America. *D. frontalis* can complete 3 to 7 generations per year in the south-eastern USA. Outbreaks can build rapidly and kill large numbers of trees (Thatcher and Barry, 1982).

Other bark beetles that attack *P. taeda* include several species of engraver beetles: *Ips avulsus*, *I. grandicollis* and *I. calligraphus*. These beetles usually attack weakened, dying or recently felled trees and fresh logging debris. They may also build to epidemic proportions in windthrow following severe storms (Conner and Wilkinson, 1983). The black turpentine beetle, *Dendroctonus terebrans*, attacks freshly cut stumps or the lower bole of *P. taeda* and other southern yellow pines. This insect is attracted to fresh wounds following road construction or timber harvesting operations (Drooz, 1985).

P. taeda is one of many pine hosts of the pales weevil, *Hylobius pales*. This insect is considered the most damaging insect pest of pine reproduction on cutover pinelands. Adults feed on the tender young bark of pine seedlings and kill them. Weevil caused mortality among first year seedlings of 30 to 60% is not uncommon and mortality exceeding 90% has been reported. Two related species that cause similar damage to *P. taeda* are the southern pine root weevil, *H. aliradicis* and the pitch eating weevil, *Pachylobius picivorus* (Drooz, 1985).

The larvae of the Nantucket pine tip moth, *Rhyacionia frustrana* bore into the tender young shoots of *P. taeda* and other pines. This insect is a major pest of young plantations and seed orchards. Feeding damage retards height growth, causes crooks or forks in the main stems, reduces cone crops and, occasionally, kills trees (Drooz, 1985).

The larvae of several species of sawflies, *Neodiprion* spp. feed on the foliage of *P. taeda*. Larvae feed in colonies and during outbreaks can strip trees of their older foliage. The red headed pine sawfly, *N. lecontei* feeds on young trees, 0.3 to 4.6 m in height. The spotted loblolly pine sawfly *N. taedae taedae* is found in eastern Virginia, USA, where it feeds on open grown trees that have retained their lower branches. *N. taedae linearis* and *N. exitans* feed on medium or large trees in mature forests (Drooz, 1985).

The loblolly pine scale, *Oracella acuta* attacks several species of pines within its geographic range in the southeastern USA. It tends to appear in large numbers in loblolly pine seed orchards following heavy use of chemical insecticides (Clark et al., 1990).

The Texas leaf cutting ant, *Atta texana*, is a serious pest of young loblolly pine plantations in portions of western Louisiana and eastern Texas, USA. Ants clip the foliage from pines, which is used as a growth medium for a fungus that is grown in subterranean nests (Drooz, 1985).
The larvae of the pine caterpillar, *Dendrolimus punctatus* feed on the foliage of *P. taeda* in plantations established in China (Ciesla, 2001).

P. taeda plantations established in Argentina, Uruguay and Brazil are subject to attack by the European wood wasp, *Sirex noctilio*, which was introduced into the region during the 1980s. The larvae of this insect bore in the wood and a toxic mucus and fungus, *Amylostereum areolatum*, injected into the trees by the females during oviposition can kill trees (Ciesla, 2003; Iede, et al., 1998).

Abiotic Factors

Windthrow caused by hurricanes or severe thunderstorms can cause significant damage, especially on coarse textured, shallow soils. Recently thinned stands are more susceptible to windthrow.

Direct losses due to lightning are small, averaging about 5 trees per 100 ha per year. Large, dominant, open grown trees are most vulnerable to lightning strikes. Lightning strikes often serve as focal points for bark beetle attacks.

P. taeda can suffer severe damage from ice storms, which result in stem breakage, severe bending and uprooting. Ice damage is most severe in recently thinned plantations and heavily stocked stands made up of slender, small-crowned trees (Baker and Langdon, 1990).

Research efforts

The genetics of *P. taeda* have been studied in depth. A south-wide *P. taeda* improvement programme, the North Carolina State University - Industry Cooperative Tree Improvement Programme, was established in 1956. Currently, most state agencies and major timber producers in the southeastern USA produce improved seed used for the establishment of *P. taeda* plantations. Perhaps the most successful efforts have been in the areas of fusiform rust resistance, increased growth and yield, and tree form.

P. taeda readily hybridizes with most southern yellow pines. There has been a great deal of interest in the development of pitch (*Pinus rigida*) x *P. taeda* hybrids, with the potential for extending the plantable range further north and west. Sonderegger pine (*Pinus x sondereggeri*), is a cross between longleaf (*Pinus palustris*) and *P. taeda* that has a great deal of potential for its combination of early height growth and more favourable wood properties.

Provenances proposal

To be continued …

Reference bibliography

CABI forestry compendium (http://www.cabi.org/compendia/fc/)

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