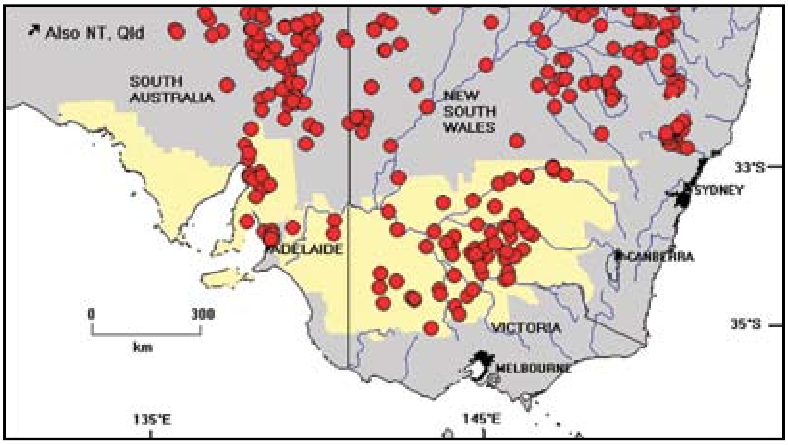
Acacia salicina Lindley

Common Names

Cooba (Standard Trade Name), Native Willow, Broughton Willow, Black Sally Wattle and many more, see Cunningham *et al*. (1981).



Map 65. Distribution of *A. salicina*.

Habit

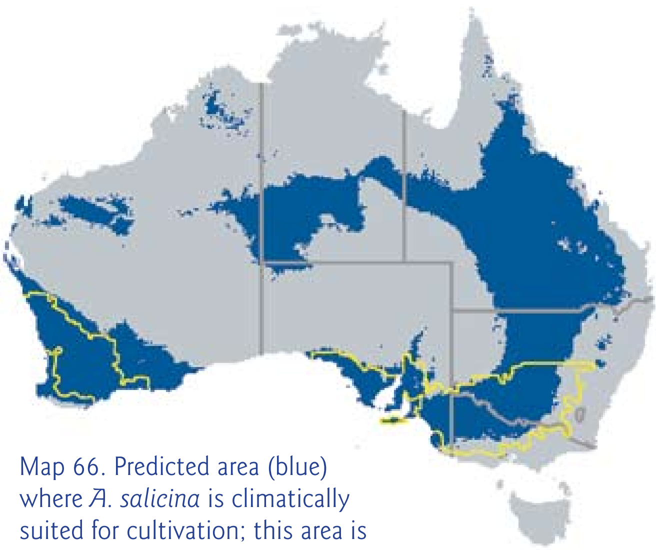
Erect or spreading shrubs or trees 7–13 (–20) m tall, with a well-defined single main trunk or sometimes forked or with several stems at 1–2 m or less above the ground, the main stems are straight to sub-straight, to 40–60 cm dbh and +/- sparingly divided into ascending to erect branches, often clonal due to vigorous suckering habit; crowns dense, often spreading and the branches pendulous. Bark on main stems thin, rough, longitudinally fissured and grey-brown.

Botanical descriptions and illustrations/photographs are provided by Cunningham *et al*. (1981), Costermans (1981), Simmons (1987), Turnbull (1986), Whibley & Symon (1992), Tame (1992), Bonney (1994), Maslin & McDonald (1996), Doran & Turnbull (1997), Chapman & Maslin (2001 & 2001a) and Kodela (2002).

Taxonomy

Acacia salicina is referable to *Acacia* section *Phyllodineae,* a diverse, and probably artificial, group of about 408 species (Maslin 2001) which are characterized by having '1-nerved' phyllodes and flowers arranged in globular heads (see Maslin & Stirton 1998 and Maslin 2001 for discussion).

Acacia salicina is one of 12 species of a group of closely related taxa referred to by Chapman & Maslin (1992) as the '*Acacia bivenosa* group'. *Acacia salicina* and *A. rostellifera* are the only members of this group detailed in the report. There is little information available on provenance variation within this species.

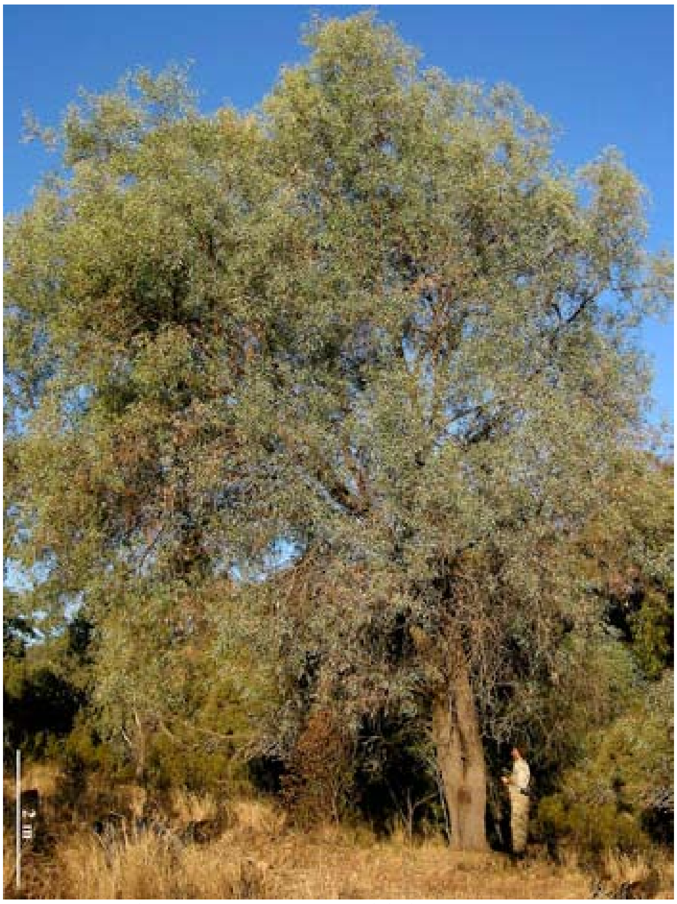


Map 66. Predicted area (blue) where *A. salicina* is climatically suited for cultivation; this area is derived from a bioclimatic analysis of the natural distribution (red circles, Map 65), see also Table 5. Target area shown in yellow.

Distribution and habitat

Widespread in eastern Australia, predominantly in central Queensland and western New South Wales, but extending to Northern Territory, South Australia and Victoria. A flowering collection from near Wiluna, Western Australia, appears to be *A. salicina*, however, pods are needed to confirm the identification and field examination needed to ensure that it is native to the area where it is purported to occur. *Acacia salicina* is widespread and common in the arid zone and reaches the drier regions of the target area (along water courses) in South Australia, Victoria and New South Wales.

Figure 32. *Acacia salicina*



A – Large tree along watercourse near Condobolin, N.S.W. (Photo: B.R. Maslin)

B – Stem base variation, undivided (left) or dividing above ground (right). (Photos: B.R. Maslin)

C – Stem base variation, dividing near ground (left) or undivided (right). (Photos: B.R. Maslin)

D – Habit variation in stand near Yacka, S.A. (Photos: B.R. Maslin)

E – Pod (woody); seeds with red aril. (Photo: B.R. Maslin)

F – Stem sections showing variation in the low density wood, no heartwood on young sucker regrowth (left). (Photos: B.R. Maslin)

Acacia salicina has been planted and is incorporated into trials in a number of countries abroad (see under **Cultivation** below).

Acacia salicina grows mostly along water courses and on flat alluvial plains and floodplains, but extends also to minor drainage areas and sandy tracts in rocky hilly country, and sand dunes. Major soil types are dark cracking clays (black earths) of the floodplains, and acid and neutral red earths (but also it tolerates alkaline situations). Comprehensive summaries of habitat characteristics are given in Turnbull (1986), Doran & Turnbull (1997) and CAB International (2000); see also Pedley (1980), Cunningham *et al.* (1981) and Whibley & Symon (1992) and Marcar *et al.* (1995).

Flowering and fruiting

Has a long but irregular flowering period which appears to peak from April to June. Similarly, it seeds irregularly in the wild and is not reliable in its seed set. In Queensland pods mature in the second half of the year (Pedley 1980), in southern New South Wales December to January (Stelling 1998), while in South Australia February to April is the usual seed-collecting period (Bonney 1994). The irregularity in fruiting can cause problems with seed collection and consequently increase the cost of seed.

Biological features

Acacia salicina is a relatively fast-growing tree (see below under **Yield**) which root suckers vigorously, often forming clonal clumps. Under favourable conditions its roots have the capacity to grow into deeper subsoils to tap water (Lovenstein *et al.* 1991). It coppices well when young (Ryan & Bell 1989). It is moderately drought-, frost- and waterlogging-tolerant, and is moderately to highly salt-tolerant (expect reduced growth at EC_e 10 dS/m and reduced survival at EC_e 15 dS/m) (Marcar *et al.* 1995). It is long-lived (greater than 50 years) according to Thomson *et al.* (1994). For information on growth rates and survival see under **Cultivation** below. An analysis of gum characteristics of *A. salicina* is given in Anderson & McDougal (1988).

Genetics

Many hybrids occur among members of the '*Acacia bivenosa* group' but none involving *A. salicina* have been recorded (Chapman & Maslin 1992). There are no tree improvement programmes underway for this species (CAB International 2000).

Toxicity

Although the phyllodes are eaten to some extent they are not widely used; they contain large amounts of tannins and are suspected of poisoning hungry cattle (Everist 1969). The green pods are rich in saponin (Everist 1969) but according to Cunningham *et al.* (1981) are readily eaten by sheep. The tannin-rich bark was been used by traditional aborigines to poison fish (Hurst 1942).

Cultivation

Acacia salicina has been planted in North Africa for shade and shelter and in the Middle East for fodder production; it has been incorporated into trials in Australia, Cape Verde, India, Israel, Kenya, Pakistan, Philippines, Spain, Thailand and Yemen (see CAB International 2000 for references and summary of details, also for full list of countries where this species is planted).

CAB International (2000) provides an comprehensive summary of the silvicultural characteristics and management of *A. salicina*, and the following information is taken largely from this source.

Establishment

Treating seeds with boiling water as routinely prescribed is usually sufficient to break seed-coat dormancy but it has been suggested by Aveyard (1968) that soaking in concentrated sulfuric acid for 20 minutes is a more effective treatment for fully matured seed (Turnbull 1986). Khajuria & Singh

(1990) report 50% germination by immersion in boiling water for 1 minute. Rehman *et al.* (1999) report that soaking in water at 70°C was the most effective way to break dormancy, with soaking times of 1–100 minutes permitting maximum germination. There are 15,200 viable seeds/kg and germination rate averages 69% (Doran and Turnbull 1997).

Acacia salicina has been found to be a promising species for establishment by direct sowing of seed in arid areas (Singh *et al.* 1991). In laboratory experiments by Rehman *et al.* (1999) the percentage and rate of germination were reduced by 50% at 152–175 and 225–250 mM NaCl respectively, and *A. salicina* was amongst the most salt tolerant of 10 *Acacia* species tested. Hardening by soaking in water for 10 h and then redrying had no effect on germination percentage but did increase germination rate under both saline and non-saline conditions (Rehman *et al.* 1998).

Seedlings establish well from seed directly sown into pots filled with appropriate soil potting mixtures. It takes about 3–5 months to produce seedlings ready for planting depending on climatic conditions. Antitranspirants have been shown to reduce water loss in seedlings of *A. salicina* and they may be useful for safely transporting seedlings from nursery to plantation sites without being watered (Lahiri *et al.* 1986).

A procedure for rapid micropropagation of *A. salicina* was described by Jones *et al.* (1990). Procedures for initiating shoots and roots from callus supplemented by various hormones are provided by Zhao *et al.* (1990).

Good nodulation was observed in soil: manure-filled pots with no inoculation (Khajuria & Singh 1990). However, there are likely to be benefits from inoculation of nursery seedlings with *Rhizobium*. Reports of field nodulation are variable.

In a trial on a saline, sodic soil in Rajasthan (India), gypsum application (1.25 t/ha) slightly improved survival and growth up to 12 months (Hussain *et al.* 1990).

Field experiments in the Negev Desert, Israel, have shown that *A. salicina* can tap moisture in deeper soil profiles when surface water has been harvested and allowed to recharge these depths; this use of water stored at depth permitted intercropping with safflower, which used water in the upper profiles (Lovenstein *et al.* 1991).

Yield

In species evaluation trials, annual growth rates usually fall in the range of 1–2 m (Bell *et al.* 1991, Hafeez 1993, Kimondo 1991, Mitchell 1989, Ryan & Bell 1991, Webb 1973 unpublished cited in Turnbull 1986). However lower growth rates have been recorded. For example: (i) in southern Spain, trees were only 0.7–0.8 m tall after 16 months (Hyde *et al.* 1990); (ii) in southeast Queensland (Burrows & Prinsen 1992; mean annual rainfall was 455 mm during the experimental period) and southeast Spain (Tilstone *et al.* 1998) trees were only about 1 m tall after 3.5 years; and (iii) in Kenya (Jama *et al.* 1989; annual rainfall 700 mm) trees were only 2.6 m tall after 6 years. On a moderately to highly saline site in northeast Thailand, survival was 42% and trees were 1.9 m after 5 years (NE Marcar, unpublished data). On a slightly saline soil irrigated with good quality water in Pakistan, *A. salicina* grew to 5.3 m tall and 5.6 cm d.b.h. in 40 months (Hafeez 1993).

In a rain fed runoff farming system in the arid zone of Israel, the mean annual total fresh biomass was c. 25 kg/tree for the 2-year rotation, and 30 kg/tree for a 4-year rotation (Zohar *et al.* 1988). Total above-ground dry matter after three years was 15 and 19 t/ha for *A. salicina* grown at 625 and 1250 trees/ha under arid zone conditions with surface water harvesting (Lovenstein *et al.* 1991).

Pests and diseases

Acacia salicina suffers moderate levels of damage from bag shelter moth (*Ochrogaster lunifer*) (Marcar *et al.* 1995). It is also damaged, in Australia, by acacia rust (*Uromyces fusisporus*) (Lee 1993).

Weed potential

The species' root-suckering habit and tendency to form dense thickets may possibly lead to some weediness when conditions are favourable.

Wood

The heartwood is dark brown (sapwood much paler) and attractively marked, close-grained, tough and moderately heavy with an air-dry density of 675 kg/m^3 (Cause *et al.* 1974). Ilic *et al.* (2000) provide an estimated basic density from air-dry (12%) MC as 550 kg/m^3. Everist (1969) reports the wood to be dark coloured but fairly soft. Singh & Khanduja (1984) report a density of 1010 kg/m^3 but it is not clear whether this refers to air dry or basic density.

Utilisation

The following information is derived primarily from the comprehensive summaries provided by Turnbull (1986), Doran & Turnbull (1997) and CAB International (2000).

Wood

Acacia salicina wood should make a satisfactory fuel; Singh & Khanduja (1984) report good calorific value (18,900 kJ/kg dry weight) and recommended it for intensive short-rotation fuelwood biomass cultivation. It is reported to take a high polish and has been used for quality furniture for which purpose it rivals the well-known furniture timber *Acacia melanoxylon* (Baker 1913). In the early days of European settlement the wood of this species was used for the manufacture of furniture, bullock yokes and cart shafts (Cunningham *et al.* 1981).

Land use and environmental

According to Turnbull (1986) *A. salicina* is a desirable species for planting in moderately dry country of Australia. In Israel *A. salicina* is reported as being successfully grown under irrigation as an ornamental and for windbreaks (Weinstein & Schiller 1979). In North Africa and the Middle East it is used for shade and is commonly planted in shelterbelts and windbreaks (Heth & Dan 1978, Kaplan 1979, Weinstein & Schiller 1979). Because it suckers freely *A. salicina* can be used to stabilise sandy areas and to control erosion. In its natural environment it is regarded as useful for maintaining the stability of river banks (Anderson 1968) and in mine-site rehabilitation (Langkamp 1987). *Acacia salicina* was one of the most successful species in a tree establishment trial on coal mine spoil in New South Wales in terms of survival and growth (Hannan 1979). It successfully establishes on areas disturbed by open-cut mining in central Queensland, either as volunteer or as part of the broadcast seed mix used in rehabilitation (Grigg & Mulligan 1999). On steep slopes of Cape Verde it is planted as a soil stabiliser (Sandys-Winsch & Harris 1992).

Fodder

Within Australia the phyllodes and pods of *A. salicina* are eaten readily by sheep but are not widely utilised (Everist 1969 and Cunningham *et al.* 1981). It has been planted with other acacias as a fodder species in the arid zone of Libya and shows promise in trials in semi-arid areas of Iran (Webb 1973 unpublished, cited in Turnbull 1986), Israel (Heth and Dan 1978), Kuwait (Firmin 1971) and Tunisia (Le Houerou 2002). Nevertheless, a number of studies in which *A. salicina* has been one of several species tested, have concluded that palatability, intake and digestibility of phyllodes is poor to satisfactory at best (Vercoe 1989 found its protein, nutrient and digestibility levels to be close to maintenance requirements). High levels of tannin are usually deemed responsible for these more unpromising results (Fonolla *et al.* 1992, Degen *et al.* 1997, Kaitho *et al.* 1998), and are also suspected of poisoning hungry cattle (McCosker & Hunt 1966). Low digestibility [33 and 37% for *in vivo* (goats) and *in vitro* organic matter (Ventura *et al.* 1999)] and energy values (0.28 forage units/kg DM – Fernandez-Galvan & Mendez 1989; 3.2 MJ net energy/kg DM – Ventura *et al.* 1999) were found from trials in the Canary Islands. Kaitho *et al.* (1997) point out that although palatability in shortterm studies is generally poor, species such as *A. salicina* may well provide useful fodder in times of feed scarcity. Le Houerou (2002) notes that although the foliage is readily eaten by small stock and camels its feed value is definitely below that of *A. saligna*.

Other uses

Its drooping habit and attractive foliage makes it desirable for amenity planting. Phyllodes reputedly burnt and ash smoked to produce a narcotizing effect (Stelling 1998). The tannin-rich bark was been used by traditional aborigines to poison fish (Hurst 1942).

Potential for crop development

Acacia salicina is the most prospective species for high volume wood production for the dry inland regions of the target area in eastern Australia. It is ranked as a category 1–2 species and would seem suited as both a phase and long duration crop (Table 6). Although young plants are reported to coppice well it is not known if the species resprouts with sufficient vigor to sustain the species as a coppice crop. *Acacia salicina* is a hardy, vigorous, long-lived, relatively drought-tolerant tree that will grow on a wide range of soils (acid and alkaline) and is tolerant of saline conditions. Young plants should be protected from grazing animals. *Acacia salicina* is relatively fast growing (under favourable conditions) and produces excellent quantities of woody biomass. The plants show a good growth form with normally straight or sub-straight boles, main stems and branches. The wood is not dense (estimated basic density is 550 kg/m^3) and is within the range of being suitable for reconstituted wood products; however, density values are likely to vary with plant age and growing conditions. The wood has a good calorific value making it suited as a fuelwood and is also reported to be suited to high value end-products such as furniture. The propensity for *A. salicina* to vigorously root-sucker in nature may or may not be advantageous in cultivation, it depends whether or not this attribute is required (or expressed) for the system in which it is placed. It is presumably root disturbance that induces suckering. It is not known if non- (or low-frequency) suckering provenances exist but if they do then these may well be important in the crop development of this species. Associated benefits from using *A. salicina* are its application in soil conservation, provision of good shade and shelter, and to a lesser extent, the provision of fodder. The difficulty in obtaining range-wide representative seed collections due to sporadic and unreliable seed-set in *A. salicina* will hinder its domestication.

The area predicted to be climatically suitable to for the cultivation of *A. salicina,* based on its natural climatic parameters, but excluding areas with <250mm annual rainfall, is shown in Map 66. This analysis indicates that *A. salicina* could be grown throughout large areas of both the eastern and western target areas. However, its preference for heavy clay soils and high water tables may mitigate against its widespread cultivation in these areas. Natural populations of *A. salicina* occur mainly along watercourses so it remains to be seen how well it will perform under cultivation when ground water becomes a limiting factor. Nevertheless, limited overseas experience shows the species as having a deep root system and this would aid its survival as profiles dry out.

Because of the interest in cultivating *A. salicina* (mainly abroad) there exists a large body of knowledge which should greatly facilitate any attempt to develop it as a crop plant in Australia.