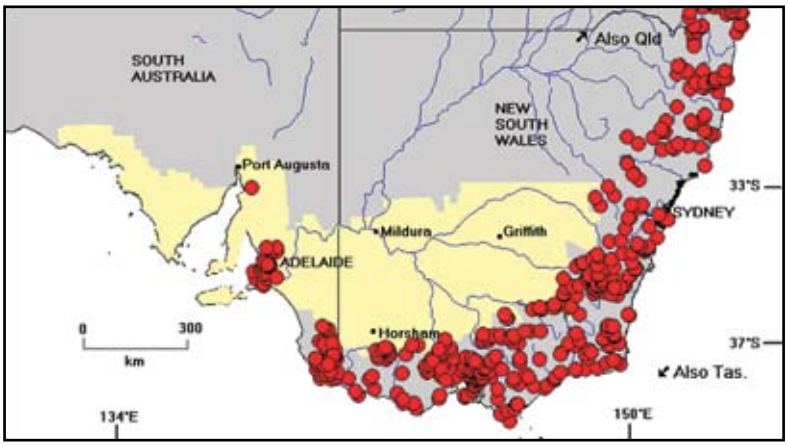
Acacia melanoxylon R. Br.

Common Names

Blackwood (Standard Trade Name), Hickory, Sally Wattle, Mudgerabah; sometimes Tasmanian Blackwood or Swamp Blackwood.



Map 39. Distribution of *A. melanoxylon*.

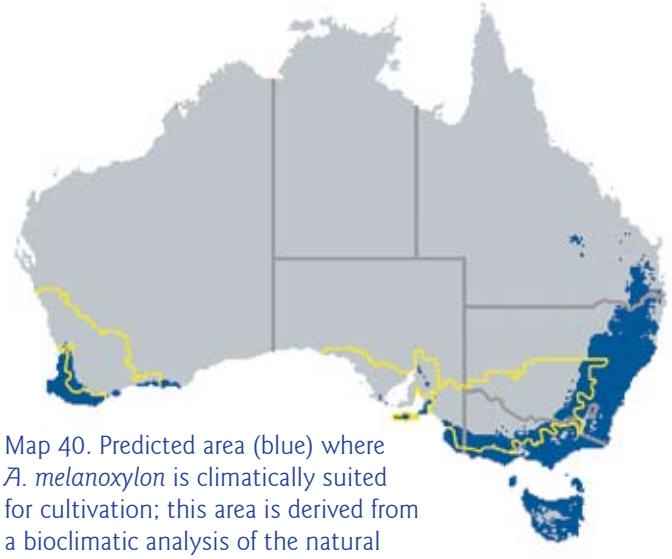
Habit

Trees often 10–20 m tall and 0.5 m dbh, but varies from small shrubs to one of the largest acacias in Australia, attaining heights up to 40 m and diameters of 1–1.5 m on lowlands in northwestern Tasmania, and in southern Victoria. In open situations the smaller and medium-sized Blackwood trees are freely branched from near ground level, but the largest plants have a well-developed trunk which is usually fairly cylindrical but may be shortly buttressed or flanged at the base. Crowns dense. May spread by root suckers. Juvenile bipinnate leaves often persist on young plants. Bark hard, rough, longitudinally furrowed and scaly, brownish grey to very dark grey. This description is adapted from Doran & Turnbull (1997).

Botanical descriptions and illustrations/photographs are provided in Maiden (1905), Costermans (1981), Stanley & Ross (1983), Boland *et al.* (1984), Simmons (1987), Floyd (1989), Fairley & Moore (1989), Whibley & Symon (1992), Tame (1992), Maslin & McDonald (1996), Cowan (1996), Cowan & Maslin (2001 & 2001a) and Kodela (2002).

Taxonomy

Acacia melanoxylon is referable to *Acacia* section *Plurinerves* a diverse, and probably artificial, group of about 212 species (Maslin 2001) which are characterized by having plurinerved phyllodes and flowers arranged in globular heads (see Maslin & Stirton 1998 and Maslin 2001 for discussion). Species of section *Plurinerves* are widespread in Australia with the main centres of richness located in the inland areas of the southwest and southeast of the continent (Hnatiuk & Maslin 1988, Maslin & Pedley 1988). Five species of section *Plurinerves* are detailed in this report, namely, *A. cyclops*, *A. implexa*, *A. melanoxylon*, *A. stenophylla* and *A.* aff. *redolens*.



Map 40. Predicted area (blue) where *A. melanoxylon* is climatically suited for cultivation; this area is derived from a bioclimatic analysis of the natural distribution (red circles, Map 39), see also Table 5. Target area shown in yellow.

Acacia melanoxylon is one of the most wide ranging tree species in eastern Australia and considerably variable, particularly in phyllode size and shape where the variation appears to be continuous. As discussed by Boland *et al.* (1984), Farrell & Ashton (1978) found considerable variation among populations in phyllode and fruit shape and size, and in the age of change from bipinnate to phyllodinous foliage. Phyllodes tended to be smaller and more symmetric in drier inland areas. Pods tended to be much smaller and more coiled and twisted in northern

Figure 19. *Acacia melanoxylon*

A – Tree with straight erect stem in forest site at Otway Ra., Victoria. (Photo: S. Searle)

B – Tree in open site (Major's Point, N.S.W.) showing wide-spreading crown. (Photo: M. McDonald)

C – Pods with seeds encircled by red aril. (Photo: P. Macdonell)

D – Plantation. (Photo: S. Midgley)

E – Stem core showing wood from 5 year old plant. (Photo: P. Macdonell)

F – Branch showing pale-coloured heads (in racemes) & multinerved phyllodes. (Photo: M. O'Leary)

localities, and the change from bipinnate to phyllodinous foliage occurred much earlier in the progeny of trees from wetter areas. Similarly, Playford *et al.* (1991, 1993) demonstrated considerable allozyme variation (see under **Genetics** below). There is also variation in growth traits (Jennings 1991), frost resistance (Franklin 1987) and in certain anatomical features of the wood (Wilkins & Papassotiriou 1989).

Acacia melanoxylon is related to *A. frigescens* (alpine areas of Victoria) and seemingly also to *A. oraria* (northeast Queensland). It is also related to the two extra-Australian species *A. koa* (Hawaiian Islands) and *A. heterophylla* (Mascarene Islands). *Acacia melanoxylon* is sometimes confused with *A. implexa* (see species profile above).

Distribution and habitat

Widespread, often common in eastern Australia, extending from the Atherton Tableland in northern Queensland, south through tablelands and coastal escarpments of southeast Queensland, New South Wales, Australian Capital Territory and Victoria to Tasmania and South Australia (as far west as the Mount Lofty Ranges). Disjunctions occur throughout the range of the species, especially in Queensland and South Australia (see map in Cowan & Maslin 2001). The main area of occurrence of this species is to the south and east of the target area but it reaches the temperate periphery of the region in New South Wales, Victoria and South Australia. Maiden (1905) provides an informative account of the distribution, habit and habitat of this species in New South Wales and Victoria.

The species is grown as an exotic in a number of countries abroad (see under **Cultivation** below) and it has become weedy in places (see **Weed potential** below).

Acacia melanoxylon grows in a diversity of habitats, but favours fertile soils in high rainfall areas. It occurs in valleys and on flats in mountainous areas, often growing in wet sclerophyll forest and cooler rainforest (in areas receiving 750–1500 mean annual rainfall). The best growth is on slightly acidic, forest podsols and alluvia of high nutrient status, but as a smaller tree, the species grows on a wide range of podsols, sandy loams, kraznozems and even the residue from tin sluicing operations (Doran & Turnbull 1997).

Comprehensive summaries of habitat characteristics are given in Boland *et al.* (1984), Jennings (1991), Doran & Turnbull (1997) and CAB International (2000). A summary of its climatic requirements under both natural and cultivation conditions is given in Marcar *et al.* (1995).

Flowering and fruiting

Doran & Turnbull (1997) report that Blackwood flowering times vary over the geographic range of the species, tending to be in late winter–spring in the north and spring–summer in the south. However, this does not accord well with flowering times given by some other authors, for example, Pedley (1978) gives November to March (late spring–early autumn) as the main flowering period in Queensland while Cowan (1996) and Whibley & Symon (1992) give flowering as August to October (late winter–spring) in Victoria and South Australia respectively. To some extent these apparent discrepancies might be accounted for by the fact that, according to Pedley (1978), 'flowering and fruiting seems to occur throughout the year' in this species. Blackwood may flower from as early as 2 years of age (Ryan & Bell 1989). Ripe seed is available during summer–autumn (December to March) with a mid-February peak. According to Jennings (1991) little seed is retained on branches beyond April in the southern part of the distribution, however, Stelling (1998) reports that in southern New South Wales a large proportion of seed may be retained as late as August–September, although seed-eating insects may consume large amounts. There is some evidence to suggest that soil-stored seed is viable for at least 50 years (Whibley & Symon 1992).

Biological features

As summarised by Doran & Turnbull (1997) Blackwood is a hardy species that is considered both moderately drought and frost resistant (Anon. 1980) and tolerant of periodic waterlogging and slightly saline soils (but reduced growth can be expected at EC e less than 5 dS/m according to Marcar *et al.* 1995). Blackwood is a long-lived species; the oldest known plant was 210 years old when harvested near Smithton, Tasmania (Mesibov 1980, cited in Jennings 1991). Blackwood plantings in New Zealand withstand severe frosts down to about –7 °C. Below this temperature trees may be killed back to ground level but many recover by coppicing. In trials in southeastern Queensland, a tropical and subtropical provenance coppiced best when cut at 1 m and both displayed abundant root suckering (Ryan & Bell 1989). In Sri Lanka Blackwood is reported to vary in its coppicing ability and is considered an indifferent coppicer when compared to the eucalypts (Midgley & Vivekanandan 1987). As might be expected in a species with such a wide geographic range this species varies in a number of its morphological, biological, genetic and other attributes (see under **Taxonomy** above). This species is fire tolerant and young plants are shade-tolerant (Stelling 1998).

Genetics

Isozyme analysis of 27 provenances covering the distribution of *A. melanoxylon* showed a distinct genetic separation between populations occurring north and south of the Hunter River in New South Wales (Playford *et al.* 1991, 1993). Populations to the north of the Hunter River were much less heterozygous than the southern populations, although mean heterozygosity levels were high. This separation coincided with a disjunction in the distribution of the species indicating that the species has evolved separately in the two regions for a considerable time. Southern populations were further divided in northern Victoria. Most of the genetic diversity as assessed by allozyme variation was found within populations but there was an unusually high level of variation between populations (37.7%). This study also indicated that a population from Ebor (New South Wales, north of the Hunter R.) was atypical. The above information is taken from Doran & Turnbull (1997).

Toxicity

Bark and twigs reputedly used by aborigines to stupefy fish (Stelling 1998).

Cultivation

As an exotic *A. melanoxylon* has been most extensively grown in India and South Africa and shows promise in New Zealand and several countries in South America (Gleason 1986, Nicholas & Gifford 1995). It is also common in the hill country of Sri Lanka (Midgley & Vivekanandan 1987) and east Africa (e.g. in Ethiopia, Kenya and Tanzania) (Streets 1962). It is regarded as good or promising in parts of China (Wang *et al.* 1994). See CAB International (2000) for full list of countries where this species is planted.

The following information on the silviculture of Blackwood is taken from the summaries provided by Doran & Turnbull (1997) and CAB International (2000).

Establishment

Immersion in water at 90 °C for 1 minute will break seedcoat dormancy (CAB International 2000 provides a summary of seed pretreatment techniques). Treated seed is usually sown directly into polythene containers and seedlings reach plantable size in under six months. Seedling development is poor without rhizobia, so young seedlings may need to be innoculated if propagated in sterilised or new soil (Zwaan 1982). Studies in progress in Australia are showing some strains of rhizobia to be much more effective in stimulating growth of *A. melanoxylon* than others (A. Gibson, pers. comm., cited in Doran & Turnbull 1997). Phosphate fertilizers are usually beneficial in the nursery and in the field (see Darrow 1995 and Neilsen & Brown 1996 for details).

Vegetative propagation of selected trees using root cuttings has been applied successfully in Australia (Fielding 1948), New Zealand (Cornell 1994) and South Africa (Department of Forestry, South Africa 1971). Propagation of *A. melanoxylon* by tissue culture has been reported in New Zealand and South Africa (Jones and Smith 1988).

In Sri Lanka Blackwood has been established from seedlings or direct sowing (Streets 1962), however, direct sowing has been a failure in times of unseasonal drought (Anon. 1921, cited in Midgley & Vivekanandan 1987).

Care must be taken in site selection and silviculture in order to grow good timber trees of *A. melanoxylon*. While tolerant of a wide range of environmental conditions including soils of low fertility, it produces good timber only where it is sheltered from wind by topography, nurse-vegetation or mutual protection. Best results are achieved where trees grow in light-wells or gaps in an established canopy of other trees. Topsoil properties have proved important in the selection of suitable sites for Blackwood in South Africa; the preferred soils have a texture range from a sand to silt loam, high humus content, at least 0.7 m deep and of good drainage (Grey & Taylor 1983). Neilsen and Brown (1996) give details of site preparation procedures in Tasmania.

Although Blackwood is tolerant of very moist conditions and survives waterlogging for several months of the year in the swamps of Tasmania, it is important that the water is moving, however slowly, as Blackwood will not grow in stagnant, waterlogged areas (Jennings 1991). Blackwood is shallow-rooted and is susceptible to windthrow, particularly in wet soils.

Growth

In Tasmania, Blackwood is planted with *Pinus radiata* or eucalypts, especially *E. nitens*, at stockings of 62.5 Blackwood seedlings/ha and 1250 nurse crop trees/ha (Hickey 1988). The tree can be grown in single-species plantations but, because it will develop forks and heavy branches at wide spacing, close initial spacing (e.g. 2. 5 x 2. 5 m) followed by intensive pruning and thinning is necessary to produce timber trees. Final crop numbers should be about 100 stems/ha (Anon. 1978). In Tasmania Blackwood is managed as a 70-year rotation aiming at logs with a minimum diameter of 50 cm and a stocking of 200 stems/ha. In New Zealand, a stocking of 1600 trees per hectare is recommended with three or four thinnings to a density of 100–400 trees per hectare by the age of 10 years. Darrow (1995) reviews contemporary thinning and pruning practices.

Single bole, can sucker (especially with disturbance), coppices well after (severe) fire or if cut at about 15 cm above ground (if cut lower will revert to root suckering).

Yield

Over a wide range of sites in New Zealand, diameter growth of Blackwood averages 10–15 mm per year and rotations of 40 years are expected to produce trees of 50–60 cm dbh with an acceptable amount of heartwood and about 25 m tall. Similar growth rates are reported in South Africa where mean annual increment averages about 16 m^3/ha (Esterhuyse 1985, Zwaan & Sijde 1990). The species showed poor early development on seasonally dry lowland sites in Thailand (Pinyopusarerk & Puriyakorn 1987). In Tanzania Kessy (1987) reports that *A. melanoxylon* grows best at altitudes between 1220 m and 2140 m with a rainfall of 1000 mm or more on deep and fairly fertile soils. In trials at Mamba 20 year old trees attained heights ranging between 24 m and 32 m with 10–11 m of clean bole, and a girth at breast height of about 1.5 m; a total of 6.3 cubic meter log volume over bark was obtained from five trees. In Australia, a MAI of 15 m^3/ha is obtained on good quality sites in Tasmania. At this growth rate it is uneconomic to grow Blackwood unless combined with a nurse crop of clear wood *Pinus radiata* or eucalypt pulpwood (Allen 1992). Tropical provenances have been little tested. In species trials on subtropical and tropical sites in Queensland, subtropical provenances grew more vigorously than a Victorian provenance and had annual height growth exceeding 2 m (Ryan & Bell 1991). Four provenances of *A. melanoxylon* were represented in trials involving 16 acacias at two sites in Victoria

(Bird *et al.* 1998). All four provenances were amongst the worst performing provenances in terms of mean stem volume. Both trial sites were in the 700 mm mean annual rainfall zone.

Pests and diseases

Allen (1992) provides a summary of pests and diseases of Blackwood. In natural stands, Blackwood is attacked by a wide range of insects but none is seen as being of economic consequence (Jennings 1991). Seedlings may be defoliated by moths or grasshoppers, and larger trees attacked by wood borers, leaf eaters, psyllids and scale insects. Susceptibility to fungal diseases such as *Armillaria* and *Phytophthora* appears to be minimal. Significant pests in New Zealand are the ghost moth (*Aenetus virescens*) and pinhole borers (*Platypus* spp.). Various fungal diseases have been reported on young plants of *A. melanoxylon* in southern India including *Fusarium semitectum* which causes shoot dieback in two-year-old plants (Mohanan & Sharma 1988). Whilst relatively free of significant insect attack and pathogens, Blackwood is subject to a substantial number of vertebrate pests (see Allen 1992). The above information is taken from Doran & Turnbull (1997).

Weed potential

Within Australia *A. melanoxylon* is not generally considered a weed, however, in the high rainfall areas of southwest Western Australia it has become naturalized and is now spreading (Wheeler *et al.* 2002). It is not likely to be a problem in the drier areas encompassed by the target area as defined in this report. The species is also naturalized in South Africa where it is invading and displacing the indigenous vegetation in some areas (Ross 1975) where bird dispersal of the seed could be an exacerbating factor. Blackwood is difficult to control because of its fast growth rate and its vigorous regrowth from root suckers and regeneration from seed (Stirton 1980). In South Africa attempts at control of *A. melanoxylon* include both the use of herbicides and biocontrol agents (seed-feeding weevils) (Dennill *et al.* 1999). Blackwood is now naturalized in New Zealand (Webb *et al.* 1988) and is locally established in southern Europe and occasionally in California (Whibley & Symon 1992).

Wood

The heartwood is golden-brown to darker brown, sometimes with reddish tints and streaks. Sapwood is white, up to 10 cm wide and susceptible to attack by *Lyctus* borer. The grain is usually straight but is sometimes attractively figured with stripes, mottled, raindrop, birdseye and fiddleback patterns together with a beautiful surface lustre. The wood is only moderately hard and has a moderately low basic density, 465–670 kg/m^3 for 72-year-old trees and 390–576 kg/m^3 for 46-year-old trees in New Zealand (Harris & Young 1988); the basic density is given as 520–566 kg/m^3 by Ilic *et al.* (2000)* and 502 kg/m^3 by Clark *et al.* (1994). This latter paper summarizes the wood and kraft pulping properties of *A. melanoxylon* along with a number of other temperate and tropical acacias. Maiden (1905) provides a good discussion of the characteristics and uses of *A. melanoxylon* wood.

Utilisation

The following information on the utilisation of *A. melanoxylon* is taken largely from the summary provided in Doran & Turnbull (1997).

Wood

Blackwood is recognised as an outstanding cabinet timber in Australia. Formerly exported, supplies have dwindled and the annual production of about 10 000 m^3 is now used within Australia. Most timber comes from the natural forests of Tasmania where the resource is actively managed. Blackwood is prized for cabinet work, panelling, inlays, bent work and staves. Availability of sound large logs is limited and today the timber is mainly used for sliced veneer, especially on particle board for cabinet work and furniture, with 'scrap ' sizes for small fancy articles. The wood has good acoustic qualities and is suitable for violin backs. Small diameter, fast-grown logs do not develop the growth stresses

* The density range cited here represents a compilation of the Basic Density and the Estimated Basic Density from Air-dry (12%) MC values that are cited in Ilic *et al.* (2000).

of some eucalypt species and good sawn conversion can be expected from trees grown on 40–50-year rotations.

Blackwood has good pulpwood potential giving acceptable pulp yields and paper properties favourable for fine papers (Clark *et al.* 1994).

Because air dry wood of *A. melanoxylon* has relatively low density it ignites easily and burns quickly and quietly with large flame and little smoke but does not form hot embers (Groves & Chivuya 1989). The wood is used for fuelwood in India and Sri Lanka, although it would be considered of poor quality for certain cooking requirements and for room heating.

In South Africa the wood/sawdust of this species is reported to cause skin irritations (Henderson 2001).

Land use and environmental

Open-grown specimens retain their lower branches for many years and form excellent single-row shelterbelts. It grows well on some exposed sites, without attaining sawlog sizes. It also has a useful role in plantings for windbreaks, shade and screening in cool to mild climates with an adequate rainfall.

The food value of this species to wildlife is discussed in Bonney (1994).

Tannin

Not considered of value as a source of tannin by Maiden (1905).

Fodder

The foliage is harvested for cattle fodder in the Nilgiri Hills region of India, although tests in Australia show predicted *in vivo* digestibility at 40–50% or below animal maintenance levels (Vercoe 1987). It was classed as highly palatable in sheep grazing trials in Ethiopia (Kaitho *et al.* 1996).

Other uses

Useful for amenity planting (parks and large gardens) on account of its good growth form and dense crown. Aborigines reported to have used Blackwood for weapons (spear throwers and shields), fishing lines (from inner bark fibre), food (from gum) and as a fish poison (Stelling 1998).

Potential for crop development

Blackwood is regarded as having only reasonable prospects as a crop plant for high volume wood production in the target area. This species performs best in cool, moist conditions and it is likely to have only limited application for the target area. It is therefore ranked as a category 3 species (see Table 6). Blackwood is a long-lived, relatively slow growing species and is best suited to development as a long cycle crop (on a 20 years plus rotation) for high value solid wood products. It produces good quantities of low density woody biomass and has for many years been a source of timber of commerce both within Australia and abroad. Consequently there exists a large body of knowledge which should facilitate any attempt to develop it as a crop plant within the cropping zone.

Blackwood does not perform well on clay soils subject to prolonged waterlogging. Furthermore, its shallow root system predisposes it to windthrow. In cultivation *A. melanoxylon* needs to be managed properly to ensure that it does not become invasive. Also, its propensity to sucker (especially the northern provenances) may possibly present management problems in plantings of the species. Young plants need protection from grazing stock and wildlife.

The area predicted to be climatically suitable for the cultivation of *A. melanoxylon,* based on its natural climatic parameters, is shown in Map 40. This analysis indicates that *A. melanoxylon* is not particularly well suited to climatic conditions well beyond its natural distribution. This combined with its moderate growth rates suggests it does not have potential to be widely cultivated throughout either

the eastern or western target areas. Within these regions *A. melanoxylon* could be considered a 'fringe species'. Acceptable growth rates will probably only be obtained on the most favourable sites such as valley soils or on mesic upland areas where the mean annual rainfall is in the vicinity of 600–650 mm. However, there are some indications that Blackwood might perform acceptably in some slightly lower rainfall areas. For example, it grows naturally near Naracoorte in South Australia (annual rainfall about 550 mm) where it displays a moderate growth rate, the plants attaining 7–10 m in height with boles 2.5–3 (–4.4) m long and 30–40 cm dbh; plants grown at Mt Gambier (annual rainfall about 800 mm) using seed from Naracoorte attained 20 cm dbh in 15 years (Neville Bonney, pers. comm.). If trials of Blackwood are established in the cropping zone then it would be advantageous to use seed provenances from the drier parts of the species range.

Provenance variation is highly likely to be substantial, particularly for attributes such as form and biomass production.