Acacia karroo Hayne (Mimosaceae), a potentially serious weed in Australia

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Summary

Attention is drawn to the presence of a localized population of *Acacia karroo* Hayne (Mimosaceae) in Western Australia. This spiny, small tree is an important invader of natural pasture in its region of origin, southern Africa, where it is subject to weed control legislation. The plant has a wide climatic tolerance, and could become established in pastoral areas over most of southern Australia and be a threat to parts of south-eastern Australia. Eradication of this plant in Australia is strongly recommended, given its potential to become a serious weed.

Acacia karroo in Australia

Acacia karroo Hayne (Mimosaceae) is one of 254 southern African plants naturalized in Australia (Scott and Delfosse unpublished). It is only known from one locality but, as I intend showing here, it is potentially a serious threat to agriculture and the environment of Australia.

Specimens in the Western Australian Herbarium show that *A. karroo* was first collected in December 1963, and again as recently as 1989. The specimens are from the "banks of the Swan River, Midland", which is part of the Perth metropolitan area (Marchant *et al.* 1987). Thus naturalization of *A. karroo* appears to be very recent as plants are still highly localized.

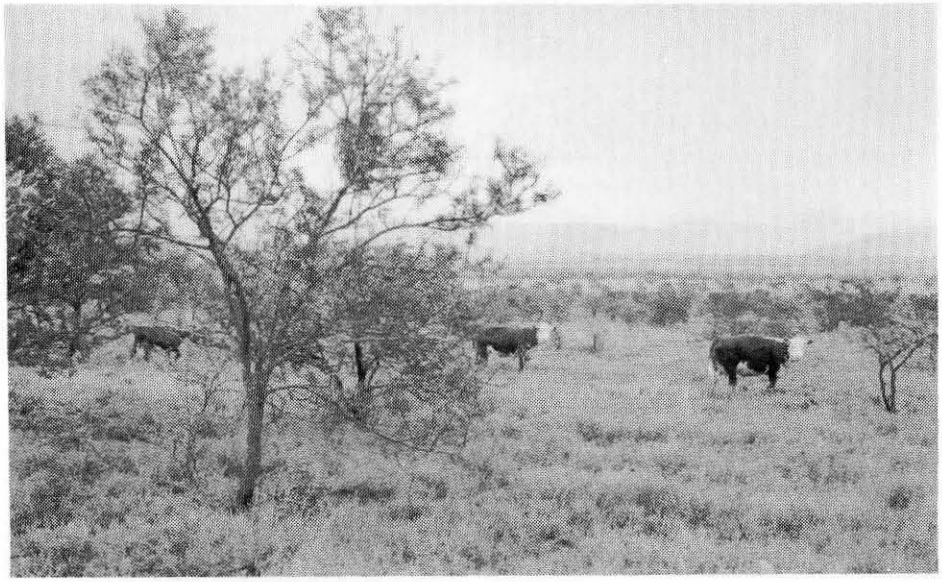

Figure 1. *Acacia karroo* in eastern Cape Province, South Africa.

Figure 2. *Acacia karroo* branch showing thorns.

Biology in South Africa

Acacia karroo is a shrub or tree up to 12 m high (Figure 1). It has abundant paired thorns that are usually up to 10 cm long (Figure 2), but 25 cm thorns have been recorded (Ross 1979). Considerable morphological variation is found throughout its range which has lead to the description of a number of synonyms and varieties (Ross 1971, 1979). Descriptions and illustrations of the plant are given in Carr (1976) and Ross (1971, 1979).

Acacia karroo is the most widespread *Acacia* in southern Africa. It is abundant in South Africa, but also occurs in southern Angola, Zambia, Zimbabwe and Mozambique (Ross 1971, 1979).

Acacia karroo is an important constituent of a number of vegetation types in southern Africa (Acocks 1975). In areas with less than 400 mm rainfall, it is mainly restricted to water courses (Story 1952). In the Great Karoo (rainfall 150 - 200 mm) and Little Karoo (rainfall 150 - 300 mm) of the central Cape Province, *A. karroo* forms a dominant part of river bed vegetation. It is virtually absent, except in main river beds, from the drier regions of northern Cape Province and Namibia (Ross 1971). Eastern Cape Province (uniform rainfall 400 - 900 mm) is the region principally affected by *A. karroo* where it forms a major part of the dominant thornveld vegetation and has invaded grasslands (Acocks 1975). In Natal (summer rainfall 750 - 900 mm) *A. karroo* forms part of the coastal dune forest and Zululand thornveld. It is reputably invasive in the Springbok Flats thornveld of north eastern Transvaal (summer rainfall 450 - 750 mm) and is one of the main trees along rivers in northern and western Transvaal (Acocks 1975). *Acacia karroo* is absent from areas that have a combination of high frequency of frost (more than 100 days a year), rainfall of more than 750 mm, and an altitude above 1500 m (Brain 1989). Consequently, the plant encircles the Drakensberg Mountains, over which there is no gene flow (Brain 1989).

Initial growth is rapid and plants reach 2 m in the first year. Bryant *et al.* (1989) measured the inherent growth rate of nine South African savanna species including *A. karroo*. It grew faster than three other *Acacia* spp. including *Acacia nilotica* (L.) Del. (probably ssp. *kaussiana* (Benth.) Brenan), whose close relative, *A. nilotica* ssp. *indica* (Benth.) Brenan is invasive in northern Australia (Bolton 1989). A deep root system is developed, and plants have been recorded to live for 22 years (Carr 1976). Plants coppice readily (Ross 1971), and

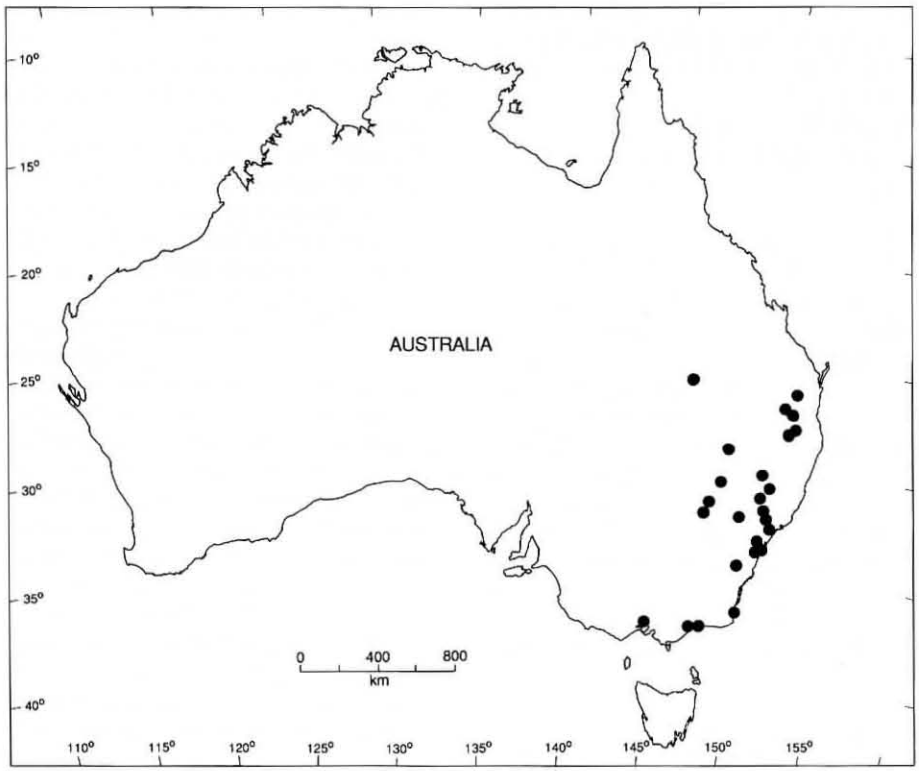

Figure 3. Area under threat by *Acacia karroo* in Australia. The area is indicated by dots marking sites in Australia with a high similarity, equal to or more than 0.70 (range 0 - 1) (Sutherst and Maywald 1985), with the climate of Fort Beaufort and Grahamstown in South Africa.

plant densities of 1000 - 2000 trees/ha have been recorded in eastern Cape Province (Aucamp 1976).

Reproduction is by seed. Seed production and dispersal have not been precisely documented (Ross 1979). Story (1952) estimated that large trees produce up to 19,000 seeds per year and claimed that seeds are wind dispersed but the latter is unlikely given their shape. There is evidence that buried seed remains viable for up to seven years (du Toit 1972).

Acacia karroo is able to establish and form dense thickets in native vegetation used for grazing. Grass productivity is low at high tree densities, but improves markedly when all trees are removed (du Toit 1972). Indeed, trees suppress grass growth up to 9 m away, even when they are frequently defoliated (Stuart-Hill and Tainton 1989). Moreover, burning and grazing treatments do not prevent *A. karroo* seedling establishment (du Toit 1972).

Acacia karroo is palatable, but the foliage is well protected by thorns. In the eastern Cape Province of South Africa the farming of cattle is made possible when the abundance of goats is regulated to reduce bush encroachment by *A. karroo* and by maintaining a stand density of about 500 *A. karroo* plants/ha, above which grass production declines (Aucamp 1976, Aucamp *et al.* 1983, Aucamp *et al.* 1984). The beneficial effect on grass production at low *A. karroo* densities may be because the plant is a legume, but the presence of nitrogen fixation has not been established (Stuart-Hill and Tainton 1989).

Acacia karroo is the only indigenous southern African plant naturalized in Australia that is subject to weed control legislation in South Africa. It is classified as a "declared invader plant" against which landholders are obliged to use weed control methods (Republic of South Africa 1984). Three herbicides (bromacil, ethidimuron and tebuthiuron) are registered for this purpose (Vermeulen and Grobler 1986).

Weed potential in Australia

There is no certain way of predicting whether a recently established plant will become a weed of importance. However *A. karroo* has attributes that suggest that this plant has considerable potential to become a pernicious weed. It is a known invader of established vegetation over a wide climatic range. The plant has a persistent seed bank, is resistant to fire, is fast growing, and is protected from browsing by its thorns.

The widespread distribution of *A. karroo* in southern Africa indicates that it could become established over most of subtropical and southern Australia. The main limiting factors to its distribution would be inland rainfall and frost in the uplands. The region of potential weed infestation is given in Figure 3. It was determined by matching the climate of Fort Beaufort (32°47'S; 26°38'E) and Grahamstown (33°18'S; 26°32'E) in the eastern Cape Province (Anon. 1986), to that of meteorological stations in Australia using the CLIMEX (Version 4.2) climate comparison program (Sutherst and Maywald 1985). Fort Beaufort (average annual rainfall 493 mm) and Grahamstown (average annual rainfall 681 mm) occur in the region where *A. karroo* is most common.

In Australia, the pastoral areas most threatened are the native grasslands of temperate short grass and southern xerophytic mid grass (Commonwealth of Australia 1982) in central New South Wales to southern Queensland (the area encompassing Dalby, Narrabri, Dubbo to Griffith). The western part of this area already has a problem with bush encroachment (Burgess 1987) which would be aggravated if the fast growing, spiny, thicket forming *A. karroo* became established. Along the coastal side of the eastern mountainous regions, *A. karroo* is likely to be less of a problem due to the intensity of cultivation. In regions of less than 400 mm rainfall *A. karroo* would be expected to be found only along water courses (as is the case in southern Africa), and may thus be detrimental to the most productive habitat in these areas. The region where *A. karroo* is established near Perth represents a climate type which is marginal for *A. karroo* (the climate match of Perth with that of Grahamstown and Fort Beaufort was very low, 0.42 and 0.28 respectively), and fortuitously this may have prevented its spread.

The evidence given here shows that the potential distribution of *A. karroo* is likely to include a large area of Australia. It appears likely that physical conditions in part of Australia, especially central and coastal New South Wales, are suitable for population growth which could lead to the formation of dense infestations. The noxious weeds, *Prosopis* spp., *A. nilotica* and *Mimosa pigra* L. (Mimosaceae) (Bolton 1989, Lonsdale *et al.* 1989, Panetta and Carstairs 1989) are good examples of the problems that can be caused by exotic spiny legumes once they become widespread in Australia. Given the present limited area of establishment of *A. karroo* it is recommended that the plant be eradicated. It is also recommended that noxious weed control authorities be on the look-out for this plant which might have escaped attention elsewhere.

Acknowledgements

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Note added in proof:

A program for controlling *A.karroo* is underway in Western Australia. A second occurence of *A. karroo,* in the Kings Park Botanical Gardens, Perth, has been made known to the author. I thank J. Dodd for this information.

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