

Southern African Plant Invaders Atlas (SAPIA) with particular reference to invasive Australian species

Lesley Henderson

ARC-Plant Protection Research Institute, stationed at National Botanical Institute, Private Bag X 101, Pretoria 0001, South Africa

Summary The Southern African Plant Invaders Atlas (SAPIA) is a mapping project, launched in 1994, to collate information on the distribution, abundance and habitat types of alien invasive plants in southern Africa. The SAPIA database is a computerised catalogue of some 48 000 locality records of 500 naturalised alien plant species. The database incorporates records from roadside surveys by the author (1979–1993) and the SAPIA project (1994+).

Thirty-one Australian species are included within the top 200 environmental weeds invading natural or near-natural habitats. All have been declared as weeds or invaders and their control is subject to legislation. Half the species are invasive in the unique and threatened fynbos of the Western Cape. The most important genera are *Acacia*, with thirteen species and *Eucalyptus* with seven species. The most widespread and abundant species owe much of their success to large historical plantings for driftsand stabilisation, tannin, timber, hedging and screens. Some species continue to be cultivated on a large scale. Other species planted on a much smaller scale for ornament, shade or shelter, are less abundant but equally invasive.

Keywords Alien invasive plants, southern Africa, mapping project, computerised database, Australian species.

INTRODUCTION

A precursor to the Southern African Plant Invaders Atlas (SAPIA) project commenced in 1979 with the roadside survey of alien invasive woody plants in Gauteng Province (formerly central Transvaal), South Africa (Wells *et al.* 1980). These surveys were later extended to the remainder of South Africa and were completed in 1993 (Henderson and Musil 1984, Henderson 1989, 1991a,b, 1992, 1998a).

The SAPIA project was launched in January 1994 for a first phase of five years, ending in December 1998 (Henderson 1998b). The first phase of SAPIA was confined to South Africa, Swaziland and Lesotho. Extensive use was made of volunteers who submitted information on standardised recording forms. A second phase of SAPIA may be extended to include all countries of the Southern African Development region (SADC).

MATERIALS AND METHODS

SAPIA is primarily aimed at the collection of basic information such as distribution, abundance and habitat types of naturalised alien plants on a fifteen minute square basis. Provision is also made for more precise grid references. Information for the first phase of SAPIA was recorded on two standardised recording sheets, with different species lists, covering the western and eastern halves of the atlas region. Plant species were selected for inclusion in the atlas primarily because they are important or potentially important invaders of natural or semi-natural areas, but excluding cultivated lands. One hundred taxa were listed on each sheet with a combined total of 161 species. Provision was also made for additional species. A pocket field guide was designed to assist identification of all the listed species (Henderson 1995).

The SAPIA database is computerised using Microsoft Access and currently contains 48 000 locality records of 500 naturalised alien plant species in 1500 fifteen minute squares. The database incorporates records from roadside surveys done by the author (1979–1993) and the SAPIA project (1994–1998), as well as records collected on an *ad hoc* basis from 1999 onwards.

RESULTS AND DISCUSSION

At least 1000 alien plant species are known to be naturalised in southern Africa. A catalogue of problem plants in southern Africa (Wells *et al.* 1986) lists 789 species that are generally agreed to be both alien and naturalised plus a further 195 whose origin and naturalisation are uncertain. Five hundred species are catalogued in the SAPIA database, 200 of which are not listed by Wells *et al.* (1986).

About 200 species are regarded as important environmental weeds invading natural or near-natural habitats. They represent 53 families and 113 genera. The plant families Fabaceae, Asteraceae, Myrtaceae, Solanaceae and Cactaceae contribute the most species, followed by Pinaceae, Poaceae, Rosaceae and Convolvulaceae. These nine families contribute 61% of the species. *Acacia*, with thirteen species, is the most important genus, followed by *Eucalyptus* and *Pinus* with seven and eight species respectively. Sixty-five

per cent of the major environmental weeds are trees or shrubs, and 90% of species are perennials. Most species originate from South and Central America (38%), Europe and Asia (32%) and Australia (15%).

Thirty-one Australian species are included within the top 200 environmental weeds (see list). The most important genera are *Acacia*, with thirteen species (Figure 1) and *Eucalyptus* with seven species (Figure 2). Other genera are *Atriplex*, *Casuarina*, *Grevillea*, *Hakea* (Figure 3), *Leptospermum*, *Myoporum* and *Paraserianthes*. Half of these species are invasive in the unique and threatened fynbos of the Western Cape. All the species are declared weeds and invaders according to the Conservation of Agricultural Resources Act (CARA), Act 43 of 1983, and amended in 2001. Eleven species are prohibited; the remainder either require permits for their cultivation or may no longer be cultivated.

The most abundant and widespread species owe much of their success to large historical plantings for driftsand stabilisation (e.g. *Acacia cyclops* A.Cunn. ex G.Don and *A. saligna* (Labill.) H.L.Wendl.), tannin and wood chips (e.g. *Acacia mearnsii* De Wild.), timber (e.g. *Eucalyptus grandis* W.Hill ex Maiden), hedging and screens (e.g. *Hakea sericea* Schrad. & J.C.Wendl.). Other species planted on a much smaller scale for ornament, shade or shelter, are less abundant but equally invasive. These include *Acacia baileyana* F.Muell. and *A. podalyriifolia* A.Cunn. ex G.Don.

Rivers have provided routes for invasion of many species. Out of a total of 300 species documented as riverine invaders in the SAPIA database, *Acacia mearnsii* and *A. dealbata* Link are the third and sixth most frequently recorded. *Acacia mearnsii* is the most widespread and abundant Australian species and is one of the top ten invasive species in the fynbos, forest, grassland and savanna biomes. It continues to be cultivated on a grand scale and is the basis of a multi-million rand tannin and wood chip industry in South Africa.

Fifteen invasive Australian species are recognised as having commercial or utility value and have been listed as Category 2 plants according to CARA. These plants, belonging to the genera of *Acacia*, *Atriplex*, *Casuarina* and *Eucalyptus*, may continue to be cultivated by permit holders in demarcated areas under controlled conditions. These species are prohibited outside demarcated areas and the land user is responsible for their control. In addition a demarcated area exceeding 10 hectares requires a water use license for stream flow reduction according to the National Water Act.

Casuarina cunninghamiana Miq. and *C. equisetifolia* L., which have been used as windbreaks and for soil stabilisation may no longer be used for dune

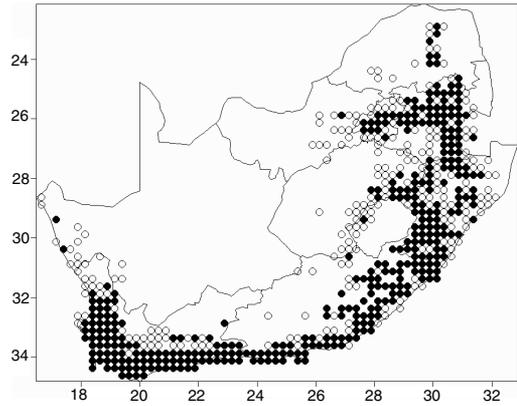


Figure 1. Distribution of invasive *Acacia* spp. Bold dots indicate where they are abundant, forming stands.

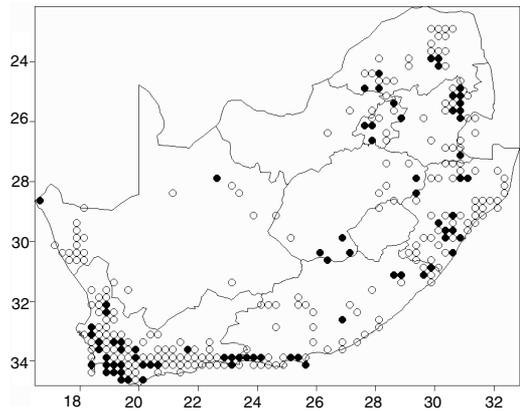


Figure 2. Distribution of invasive *Eucalyptus* spp. Bold dots indicate where they are abundant, forming stands.

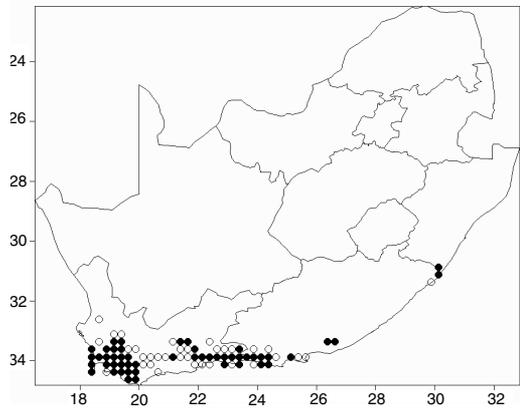


Figure 3. Distribution of invasive *Hakea* spp. almost exclusively within the fynbos. Bold dots indicate where they are abundant, forming stands.

stabilisation. They invade coastal dunes, sandy sea-shores and riverbeds.

Other Australian species that are a cause for concern include *Syzygium paniculatum* Gaertn., *Calistemon rigidus* R.Br., *Melaleuca hypericifolia* Sm. and *Schefflera actinophylla* (Endl.) Harms. All have been cultivated as ornamentals and are spreading beyond the confines of cultivation. The SAPIA project discovered a single farm garden in the Western Cape's unique fynbos that had ten new naturalised Australian species, belonging to the genera of *Hakea*, *Banksia* and *Grevillea*. This underlines the role of gardeners and plant collectors in the introduction and dispersal of alien invasive plants in South Africa.

Australian plant species listed as declared weeds and invaders according to the Conservation of Agricultural Resources Act[†]:

Declared weed, Category 1 (prohibited; must be controlled, or eradicated where possible): *Acacia dealbata* (only in W Cape), *A. implexa* Benth., *A. longifolia* (Andr.) Willd., *A. paradoxa* DC., *A. pycnantha* Benth., *Eucalyptus lehmannii* (Schauer) Benth., *Hakea drupacea* (C.F.Gaertn.) Roem. & Schult., *H. gibbosa* (Sm.) Cav., *H. sericea*, *Leptospermum laevigatum* (Gaertn.) F.Muell., *Paraserianthes lophantha* (Willd.) Nielsen.

Declared invader, Category 2 (allowed only in demarcated areas under controlled conditions; prohibited within 30 m of the 1:50 year floodline of watercourses or wetlands): *Acacia cyclops*, *A. dealbata* (excluding W Cape), *A. decurrens* (Wendl.) Willd., *A. mearnsii*, *A. melanoxylon* R.Br., *A. saligna*, *Atriplex nummularia* Lindl. subsp. *nummularia*, *Casuarina cunninghamiana*, *C. equisetifolia*, *Eucalyptus camaldulensis* Dehnh., *E. cladocalyx* F.Muell., *E. diversicolor* F.Muell., *E. grandis*, *E. paniculata* Sm., *E. sideroxylon* A.Cunn. ex Woolls.

Declared invader, Category 3 (no further planting or trade of propagative material allowed; existing plants may remain but must be prevented from spreading; prohibited within 30 m of the 1:50 year floodline of watercourses or wetlands): *Acacia baileyana*, *A. elata* A.Cunn. ex Benth., *A. podalyriifolia*, *Atriplex lindleyi* Moq. subsp. *inflata* (F.Muell.) P.G.Wilson, *Grevillea robusta* A.Cunn. ex R.Br., *Myoporum tenuifolium* G.Forst. var. *montanum* (R.Br.) Domin.

[†] The regulations concerning Categories 1, 2 and 3 are briefly summarised here. The full regulations and complete list of species are given in Henderson (2001).

ACKNOWLEDGMENTS

Financial assistance for the SAPIA project has been gratefully received from Directorate: Agricultural Land Resource Management, National Department of Agriculture, South Africa, and the Department of Environmental Affairs and Tourism, South Africa. All SAPIA participants are thanked for their contributions.

REFERENCES

- Henderson, L. and Musil, K.J. (1984). Exotic woody plant invaders of the Transvaal. *Bothalia* 15, 297-313.
- Henderson, L. (1989). Invasive alien woody plants of Natal and the north-eastern Orange Free State. *Bothalia* 19, 237-261.
- Henderson, L. (1991a). Invasive alien woody plants of the Orange Free State. *Bothalia* 21, 73-89.
- Henderson, L. (1991b). Invasive alien woody plants of the northern Cape. *Bothalia* 21, 177-189.
- Henderson, L. (1992). Invasive alien woody plants of the eastern Cape. *Bothalia* 22, 119-143.
- Henderson, L. (1995). Plant invaders of southern Africa. (Plant Protection Research Institute Handbook No. 5, Agricultural Research Council, Pretoria).
- Henderson, L. (1998a). Invasive alien woody plants of the southern and southwestern Cape region, South Africa. *Bothalia* 28, 91-112.
- Henderson, L. (1998b). Southern African plant invaders atlas (SAPIA). *Applied Plant Sciences* 12, 31-32.
- Henderson, L. (2001). Alien weeds and invasive plants. (Plant Protection Research Institute Handbook No. 12, Agricultural Research Council, Pretoria).
- Wells, M.J., Balsinhas, A.A., Joffe, H., Engelbrecht, V.M., Harding, G. and Stirton, C.H. (1986). Catalogue of problem plants of southern Africa. *Memoirs of the Botanical Survey of South Africa* 53.
- Wells, M.J., Duggan, K.J. and Henderson, L. (1980). Woody plant invaders of the central Transvaal. Proceedings of the Third National Weeds Conference of South Africa, p. 11-23.