

## Weeds of Australian rangelands

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**Abstract.** Despite recognition that non-native plant species represent a substantial risk to natural systems, there is currently no compilation of weeds that impact on the biodiversity of the rangelands within Australia. Using published and expert knowledge, this paper presents a list of 622 non-native naturalised species known to occur within the rangelands. Of these, 160 species (26%) are considered a current threat to rangeland biodiversity. Most of these plant species have been deliberately introduced for forage or other commercial use (e.g. nursery trade). Among growth forms, shrubs and perennial grasses comprise over 50% of species that pose the greatest risk to rangeland biodiversity. We identify regions within the rangelands containing both high biodiversity values and a high proportion of weeds and recommend these areas as priorities for weed management. Finally, we examine the resources available for weed detection and identification since detecting weeds in the early stages of invasion is the most cost effective method of reducing further impact.

**Additional keywords:** biodiversity impact, exotic, management, non-native, pastoral.

### Introduction

The emphasis on non-native plant species as forage has come at a high cost to Australian rangelands in terms of weeds (Parsons and Cuthbertson 1992; Lonsdale 1994). In addition, many ornamental plants have found their way from botanical gardens, nurseries and suburban backyards to rangelands. Australian rangelands constitute about 70% of the Australian continent (Fisher *et al.* 2004; Grice 2006, this issue) and currently support hundreds of non-native plant species including a diverse range of trees, shrubs, grasses, forbs and aquatic plants, all of which are at various stages of invasion and many of which were deliberately introduced. There is, however, presently no specific compilation of weeds that impact on the biodiversity of rangelands within Australia, either currently or potentially.

Using published reports, journal papers, national priority lists (e.g. Thorp and Lynch 2000) and floristic reference texts we compiled a list of non-native naturalised species relevant to the rangelands. From this list we applied an evidence based approach to identify weeds that pose the greatest threat to rangeland biodiversity. Evidence was based on published material as well as the opinion of relevant experts

(see Acknowledgments). We reviewed current information on weed distribution and identified gaps in knowledge with regards to the current and potential extents of rangeland weeds. The distribution of these species is explored in relation to Grazing Land Management Zones (GLMZ; Fisher *et al.* 1994), Interim Biogeographic Regionalisation of Australia (IBRA; Thackway and Cresswell 1995) and National Biodiversity Hotspots (Department of the Environment and Heritage 2005).

In doing so, we identify regions where the greatest gains in biodiversity conservation may occur in relation to weed management. Characteristics of rangeland weeds are examined. Finally, we review recent developments in weed identification and detection in Australian rangelands.

### Determining the weeds of Australian rangelands

Weeds of relevance to rangelands have been identified by prioritisation processes undertaken for other purposes (Table 1), such as the identification of Australia's top environmental weeds (Humphries *et al.* 1991) and 'weeds of significance to the grazing industries of Australia' (Grice 2006, this issue), determination of the 'Weeds of

**Table 1. List of resources used to compile the rangeland weed list (Table 2 and Appendix 1)**  
Ref. No. corresponds to references in Table 2 and Appendix 1

Ref. No.	Source	Description
1	Thorp and Lynch (2000)	Identification of the need for a list of Weeds of National Significance (WONS) was a direct outcome of the National Weeds Strategy, released in 1997 (ARMCANZ 1999). The National Weeds Strategy Executive Committee formed soon after and had the responsibility of overseeing the implementation of the strategy. They concluded that the greatest impact from weeds within Australia was related to the effect and spread of individual species. A process was put in place to prioritise weeds over a range of land uses at the national level. The criteria used to assess weeds were based on their invasiveness, impacts, and potential for spread and socio-economic and environmental values. In total 71 weed species were assessed, with the top 20 becoming officially recognised as 'Weeds of National Significance'.
2	National Environmental Alert List	In 2000, the Department of the Environment and Heritage worked with experts to identify plant species that were in the early stages of establishment and had the potential to become a significant threat to biodiversity if they were not managed. 28 non-native naturalised weeds were placed on the National Environmental Alert List (Department of the Environment and Heritage 2006).
3	Grice (2002)	Weeds of significance to the grazing industries in Australia. This prioritisation process was commissioned by Meat and Livestock Australia to better guide future investment in weed research and development. 119 weed species were listed as relevant to Australian grazing lands. A large portion of them occurred in rangelands. While most were of concern to the grazing industry due to their unpalatability, toxicity and competitive ability, some were also significant environmental weeds.
4	Humphries <i>et al.</i> (1991)	A list of Australia's top environmental weeds was identified on the basis of their potential to destroy large areas or acutely threaten an ecosystem over its continental range. Within the rangelands, 31 species are identified as requiring particular attention.
5	Cunningham <i>et al.</i> (2003)	This report identifies 117 species of sleeper weeds, defined as 'invasive plants that have naturalised in a region but not yet increased their population size exponentially' (Groves 2000). 17 species from this list are regarded as high priority for management/eradication, five of which occur in rangelands.
6	The Noxious Weed List	Prepared by John R Thorp for the Australian Weeds Committee and Australian Government, the noxious weed list for Australia contains all species recognised within specific legislation of the States and Territories. The list is based on the botanical name used in the legislation for each jurisdiction. In many instances, a plant may be known by several scientific names and common names or synonyms (Australian Weeds Committee 2004).
7	Landsberg and Crowley (2004)	This study includes significant environmental weeds present in the rangelands of the Cape York Peninsula (CYP).
8	Smith (2002)	Lists 82 non-native species from the wet/dry tropics.
9	Jessop (1981)	Contains 110 non-native species from central Australia.
10	Cunningham <i>et al.</i> (1981)	Lists over 400 non-native species from western New South Wales.
11	Cox (2005)	Prepared for Meat and Livestock Australia, this report identifies four non-native species trialled by DPI and CSIRO at plant evaluation sites, which have a high potential to become invasive.
12	Groves <i>et al.</i> (2003)	This report assesses the status of 2700 naturalised species in natural and agricultural systems and provides a ranking for each species based on their perceived negative impact on natural systems.

National Significance' (Thorp and Lynch 2000) and collation of the Department of the Environment and Heritage's 'National Environment Weed Alert List (Department of the Environment and Heritage 2006).

Each State and Territory also has legislation to protect its natural resources from the impacts of weeds. Particular weeds are identified and categorised within this legislative framework based on their likely impacts (including economic, environmental and social) and current and potential distributions. This information has been collated

into a Noxious Weed List for Australian States and Territories (Australian Weeds Committee 2004). In some states, local government authorities can declare additional species under their respective local laws.

Weeds of relevance to rangelands have also been identified within specific studies focused on particular groups of weeds or localities. For example Paynter *et al.* (2003) examined the risk that legumes pose for biodiversity and in doing so developed a list of 'Australian noxious leguminous weeds'. Similarly, Landsberg and Crowley (2004) developed

a list of weeds that pose a threat to Cape York Peninsula (CYP).

Groves *et al.* (2003) presented a list of all naturalised flora consisting of about 2700 species. The perceived negative impact of these species on natural systems was assessed using a scoring system ranging from a score of 0 ('reported as naturalised but only naturalised population now removed or thought to be removed') to 5 ('naturalised and known to be major problem at 4 or more locations with a State or Territory').

Several floristic texts relevant to rangelands included information on the geographical origins of species (e.g. Cunningham *et al.* 1981; Jessop 1981) and in some instances publications have concentrated on the weeds present within specific locations (e.g. Smith 2002).

Using these resources (Table 1) we developed a list of non-native naturalised species which are known to occur in Australian rangelands. This list comprises 622 species (Appendix 1). From this list, species which were reported in the literature or by experts to have a negative impact on biodiversity were identified. Through this process, 160 non-native plant species, grouped into 94 taxa that are considered to pose the greatest threats to rangeland biodiversity, were identified (Appendix 1, Table 2). Where possible, nomenclature follows the Australian Plant Name Index (APNI),<sup>1</sup> otherwise Index Kewensis<sup>2</sup> is used.

### Rangeland weed characteristics

Of the 94 taxa listed in Table 2, 27% are shrubs, 26% perennial grasses, 10% perennial forbs (largely legumes), and 10% trees (Fig. 1). Most of the perennial grasses and forbs were deliberately introduced as forage plants (Lonsdale 1994). Features that made these species successful forage plants included being self-sustaining, quick growing, drought tolerant and prolific seeders (Low 1999). A desirable attribute of legumes was that they were of only moderate palatability allowing them to establish a competitive advantage over co-occurring native species (Paynter *et al.* 2003). The correlation between attributes associated with successful pasture plant introductions and a plant's potential to be weedy has been identified in numerous studies (e.g. Lonsdale 1994; Paynter *et al.* 2003; McIntyre *et al.* 2005).

Studies attempting to link particular traits of plant species, such as growth form, to their potential to be 'weedy' have met with varied success (Holzner and Numata 1982; Sutherland 2004). McIntyre *et al.* (2005), in a study of herbaceous vegetation of grazed landscapes in the subtropics, found that when considering broad traits relating to growth

form (forb, grass, low shrub) and life form (perennial, biennial, obligate annual) there was little to distinguish the native and naturalised assemblages. However, when the ecological (riparian *v.* upland) and management context (grazing, soil disturbance) was taken into account there were significant links between plant species' traits and their potential to impact native plant species richness, suggesting that attributes of invaders are highly habitat dependant and context specific (Thompson *et al.* 1995). For example, in the subtropics, being a perennial, tall tussock or rhizomatous grass with a C<sub>4</sub> photosynthetic pathway (summer growing) was a guarantee of having a high impact on native herbaceous species richness (McIntyre *et al.* 2005).

### Current and potential distribution of rangeland weeds

Information on current and potential weed distributions is required to determine the extent of the impact, assess the benefit of controlling the weed relative to it expanding throughout its potential range and to inform weed management programs (Virtue *et al.* 2001). Weed distribution data are generally poor in quality and quantity, which poses significant limitations on weed mapping efforts. The most comprehensive mapping effort is that of Parsons and Cuthbertson (1992) who mapped the known presence of over 200 of Australia's noxious weeds using 0.5 degree latitude by 0.5 degree longitude grid units (about 50 by 50 km).

In addition to information compiled by Parsons and Cuthbertson (1992), published data from small-scale field surveys, point location data (e.g. herbaria records) and expert opinion were used to produce the 'current distribution' maps for WONS (Thorp and Lynch 2000).

The potential distributions of weed species are generally inferred from knowledge of their environmental requirements, namely climate and soil type, as well as the land use associated with its invasion (Virtue *et al.* 2001). Climate is generally the driving factor used in most distribution prediction software (Kriticos and Randall 2001), whereas the use of soil data to refine predicted distributions is not well developed due to limited understanding of weed soil tolerances (e.g. drainage, water-holding capacity, pH, chemical fertility), particularly for non forage weed species.

The 'potential distribution' maps for WONS were prepared by employing the program CLIMATE which uses climatic information from the weed's native range to match against Australian climatic conditions (Virtue *et al.* 2001). This heavy reliance on climatic factors alone has led to some unrealistic predicted distributions of WONS (J. Thorp, pers. comm.). Since Thorp and Lynch's (2000) publication of 'current and potential' distribution maps for weeds considered for WONS listing, 'current distribution'

<sup>1</sup> APNI [www.anbg.gov.au/cpbr/databases/apni.html](http://www.anbg.gov.au/cpbr/databases/apni.html) (accessed 20 March 2006).

<sup>2</sup> IK accessed via the International Plant Names Index [www.ipni.org/copyright.html](http://www.ipni.org/copyright.html) (accessed 20 March 2006).

**Table 2. Non-native plant species which pose a threat to rangeland biodiversity**

This list has been compiled using references described in Table 1. The Grazing Land Management Zones (GLMZ; Fig. 2) in which each species occurs or has the potential to occur are listed. n/a denotes data are not available, '0' denotes species not currently present in GLMZ and a dash (—) denotes the species is predicted to spread within the same GLMZ that it currently inhabits. The National Biodiversity Hotspots (Fig. 4) in which a species is known to occur are listed

Preferred scientific name	Preferred common name	Growth form <sup>A</sup>	Current GLMZ	Potential GLMZ	Biodiv. hot-spot	Ref. B
<i>Acacia catechu</i>	Cutch tree	Tree	2	n/a	None	2, 6, 12
<i>Acacia currasavica</i>	n/a	Shrub/tree	1, 2, 3, 4, 5, 10	n/a	1, 15	11, 12
<i>Acacia karroo</i>	Karoo thorn	Tree	5, 10	n/a	None	2, 6, 12
<i>Acacia nilotica</i>	Prickly acacia	Shrub/tree	2, 3, 4, 5, 10	6, 7, 8	1, 2, 15	1, 3, 4, 6, 8, 12
<i>Achnatherum caudatum</i>	Speargrass	Perennial grass	10	n/a	None	3, 6, 12
<i>Aeschynomene paniculata</i>	Panicle jointvetch	Shrub	2	n/a	None	5
<i>Agave spp. C</i>	Century plant	Perennial forb	2, 3, 8, 9, 10	n/a	1, 2	4, 3, 10
<i>Agrostis capillaris</i>	Brown top bent grass	Perennial grass	4, 5, 8	n/a	None	3, 12
<i>Alliathera philoxeroides</i>	Alligator weed	Aquatic	8	9	2	1, 3, 6, 12
<i>Andropogon gayanus</i>	Gamba grass	Perennial grass	1, 2, 4, 6	n/a	2, 14	3, 4, 7, 8, 12
<i>Annona glabra</i>	Pond apple	Tree	4	1, 2, 10	None	1, 4, 6, 7, 12
<i>Asphodelus fistulosus</i>	Onion weed	Perennial forb	4, 6, 8, 9, 10	n/a	2, 13, 14	3, 6, 9, 10, 12
<i>Azadirachta indica</i>	Neem tree	Tree	2, 4, 5	n/a	None	3, 8, 12
<i>Barleria prionitis</i>	Barleria	Shrub	2, 4, 5, 10	n/a	None	2, 6, 7, 8, 12
<i>Brachiaria mutica (Urochloa mutica)</i>	Para grass	Perennial grass	1, 2, 3, 4, 10	n/a	1	4, 8, 12
<i>Bryophyllum daigremontianum</i> × <i>Bryophyllum delagoense</i>	Mother-of-millions hybrid	Perennial forb	2, 3, 4, 6, 9, 10,	1, 5, 7, 8	None	1, 3, 6, 7, 12
<i>Cabomba caroliniana</i>	Cabomba	Aquatic	4	1, 2, 8, 9, 10	None	1, 3, 4, 6, 8, 12
<i>Calotropis gigantea</i>	Giant rubber bush	Shrub	1, 2, 6	n/a	2, 15	8, 12
<i>Calotropis procera</i>	Calotrope	Shrub	2, 4, 5, 6	3, 7, 8, 9, 10	1	1, 3, 4, 6, 8, 12
<i>Carrichtera annua</i>	Wards weed	Annual forb	5, 6, 7, 8, 9	n/a	None	3, 4, 9, 10
<i>Cascabela thevetia</i>	Captain cook tree; yellow oleander	Tree	1, 2, 4, 9, 10	n/a	15	4, 8, 9, 10
<i>Cenchrus ciliaris</i>	Buffel grass	Perennial grass	1, 2, 3, 4, 5, 7, 10	6, 8, 9	1, 2, 13, 14, 15	4, 8, 9, 10, 12
<i>Cestrum parqui</i>	Green poisonberry	Shrub	9, 10	n/a	1, 2	3, 6, 12
<i>Chromolaena odorata</i>	Siam weed	Shrub	3, 4, 8, 10	n/a	1, 2	2, 6, 12
<i>Cirsium vulgare</i>	Spear thistle	Annual forb	3, 4, 8, 9, 10	n/a	1, 2	3, 4, 6, 9, 12
<i>Citrullus lanatus</i>	Afghan melon	Annual forb	2, 3, 4, 8, 9, 10	n/a	1, 2, 14, 15	3, 9, 10, 12
<i>Coronopus didymus</i>	Lesser swinecress	Annual forb	2, 7, 8, 9, 10	n/a	2	3, 10, 12
<i>(Lepidium didymum)</i>						
<i>Cryptostegia grandiflora</i>	Rubber vine	Climber/shrub	2, 3, 4, 6, 8, 10	5, 7, 9	1, 2, 15	1, 3, 4, 6, 7, 8, 12
<i>Cuscuta planiflora</i>	Small-seeded alfalfa dodder	Annual forb	8, 9, 10	n/a	13	3, 6, 12
<i>Datura ferax</i>	Fierce thorn-apple	Annual forb	2, 6, 9, 10	n/a	2	JP, 12
<i>Echinochloa polystachya</i>	Aleman grass	Perennial grass	1, 2, 4, 10	n/a	2	3, 4, 8, 12
<i>Eichhornia crassipes</i>	Water hyacinth	Aquatic	1, 2, 4, 9, 10	3, 5, 6, 7, 8	None	1, 3, 4, 7, 8
<i>Eragrostis curvula</i>	African lovegrass	Perennial grass	8, 9, 10	—	2, 13	1, 3, 4, 6, 9, 12
<i>Gmelina elliptica</i>	Badhara bush	Shrub	2	n/a	n/a	5, 12
<i>Grewia asiatica</i>	Phalsa	Shrub	2, 3, 4	n/a	None	SL, 12
<i>Gymnocoronis spilanthoides</i>	Senegal tea	Perennial forb	0	1, 2, 4, 10	None	2, 6, 12
<i>Harrisia martinii</i>	Harrisia cactus	Shrub	10	n/a	2	3, 6, 12
<i>Heteracium caespitosum</i>	Hawkweed	Annual forb	2	n/a	None	3, 6
<i>Holcus lanatus</i>	Yorkshire fog	Annual grass	2, 6, 8, 10	n/a	2	3, 10, 12
<i>Hymenachne amplexicaulis</i> Nees	Olive hymenachne	Perennial grass	4, 10	5, 8	1, 2	1, 4, 6, 7, 8, 12
<i>Hyparrhenia hirta</i>	Coolatai grass, tampoookie grass	Perennial grass	1, 2, 6, 8, 10	n/a	2	3, 4, 12
<i>Hyparrhenia rufa</i>	Thatch grass	Perennial grass	2, 10	n/a	1, 2	4, 8, 12
<i>Hyptis suaveolens</i>	Hyptis	Annual forb	1, 2, 4, 10	3	1, 2	1, 3, 6, 7, 8, 12
<i>Ibicella lutea</i>	Yellow-flowered devil's claw	Annual forb	2, 3, 4, 8	n/a	2	3, 6, 10, 12
<i>Ipomoea indica</i>	Purple morning glory	Climber	9, 10	n/a	2, 13	4, 6, 10, 12
<i>Jatropha curcas</i>	Physic nut	Shrub	2	n/a	1	SL, 12

(Continued next page)

Table 2. (continued)

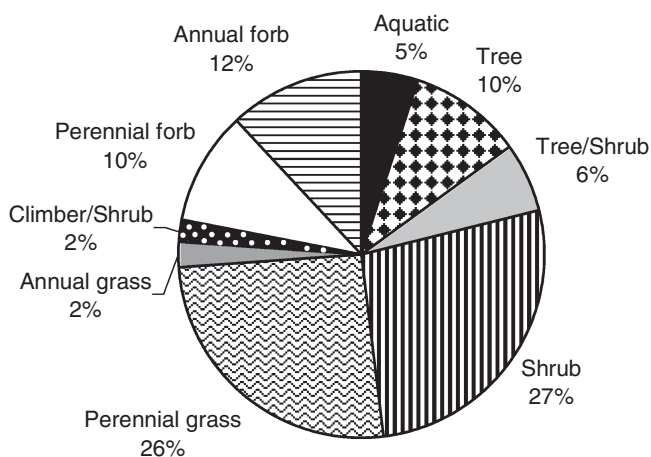
Preferred scientific name	Preferred common name	Growth form <sup>A</sup>	Current GLMZ	Potential GLMZ	Biodiv. hot-spot	Ref. <sup>B</sup>
<i>Jatropha gossypifolia</i>	Cotton-leaf physic nut	Shrub	2, 3, 4, 5, 10,	1, 7	1	1,3,6,7,8,12
<i>Juncus acutus</i> ssp. <i>acutus</i>	Spiny rush	Perennial forb	9	n/a	1	3,6,10, 12
<i>Koeleria elegans</i>	Chinese rain tree	Tree	10	n/a	None	2,12
<i>Lantana camara</i>	Lantana	Shrub	2, 4, 10	8, 9	1, 2, 14	1,3,6,7,8,12
<i>Lantana montevidensis</i>	Creeping lantana	Shrub	10	1, 2, 4	2	1,3,6,12
<i>Leucaena leucocephala</i>	Leucaena	Tree	1, 2, 3, 4, 10	n/a	1, 2, 13, 14, 15	4,7,8,12
<i>Lycium ferocissimum</i>	African boxthorn	Shrub	3, 8, 9, 10,	5, 6	2, 13	1,3,4,6,9, 10,12
<i>Marynia annua</i>	Devil's claw	Annual forb	1, 2, 4, 10	n/a	1, 2	3,6,8,12
<i>Melinis minutiflora</i>	Molasses grass	Perennial grass	1, 2, 3, 4, 5	n/a	2	4,12
<i>Mimosa pigra</i>	Giant sensitive tree	Shrub	1, 2	4	None	1,3,4,6,8,12
<i>Nassella charruana</i>	Lobed needlegrass	Perennial grass	0	n/a	None	2,5,6,12
<i>Nassella hyalina</i>	Cane needlegrass	Perennial grass	0	n/a	None	2,6,12
<i>Nassella tenuissima</i>	Mexican feathergrass	Perennial grass	0	n/a	None	3,6
<i>Nassella neesiana</i>	Chilean needlegrass	Perennial grass	8, 10	9	2	1,3,6,12
<i>Nassella trichotoma</i>	Serrated tussock	Perennial grass	10	8, 9	None	1,3,6,12
<i>Opuntia</i> spp. <sup>C</sup>	Prickly pear	Shrub	3, 5, 6, 8, 9, 10	n/a	2, 14	3,6,12
<i>Parkinsonia aculeata</i>	Parkinsonia	Shrub	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	—	1, 2, 14	1,3,4,6,7,8,10, 12
<i>Parthenium hysterophorus</i>	Parthenium weed	Annual forb	2, 4, 8, 9, 10	3, 5	1, 2	1, 3, 6, 7, 8
<i>Paspalum notatum</i>	Bahia grass	Perennial grass	2, 10	n/a	2, 15	3,12
<i>Pegunum harmala</i>	African rue	Perennial forb	9	n/a	None	JP, 12
<i>Pennisetum polystachion</i>	Mission grass	Perennial grass	1, 2, 4, 10	—	14	1,3,4,6,8,12
<i>Pennisetum setaceum</i>	African fountain grass	Perennial grass	2, 4, 5, 6, 7, 8, 9, 10	n/a	2, 14	3,6,10, 12
<i>Pereskia aculeata</i>	Leaf cactus	Shrub	0	n/a	None	2,12
<i>Phylla</i> spp. <sup>C</sup>	Lippia	Aquatic/perennial forb	10	—	1, 2, 14	1,3,6, 10, 12
<i>Praxelis clematidea</i>	Praxelis	Perennial forb	2, 4	n/a	1	2,3,7,12
<i>Probovicia louisianica</i>	Purple-flowered devil's claw	Annual forb	8, 9, 10	n/a	13	3,6,10, 12
<i>Prosopis</i> spp. <sup>C</sup>	Mesquites	Shrub/tree	2, 3, 4, 6, 7, 8, 9, 10	1	1, 2, 14	1,3,4,6,8,9, 12
<i>Retama raetam</i>	White weeping broom	Shrub	0	n/a	None	2,12
<i>Rubus fruticosus</i> sp. agg.	Blackberry	Shrub	8, 9, 10	—	None	1,3,6, 10,12
<i>Salvinia molesta</i>	Salvinia	Aquatic	4, 10	1, 2, 3, 5, 6, 7, 8, 9	1, 14	1,3,4,6,7,8,12
<i>Schinus molle</i>	Peruvian peppertree	Tree	4, 6, 8, 9, 10	n/a	2	JP,12
<i>Senna obtusifolia</i>	Sicklepod	Shrub	1, 2, 4, 10	3	None	1,3,6,7,8,12
<i>Senna occidentalis</i>	Coffee senna	Shrub	1, 2, 3, 4, 5, 6, 10	n/a	1, 2, 14, 15	3,6,8, 12
<i>Senna tora</i>	Java bean	Shrub	1, 2, 4, 10	3	None	1,6,12
<i>Sida acuta</i>	Spiny-head sida	Perennial forb/shrub	1, 2, 4, 5, 6, 10	n/a	1, 14, 15	1,3,6,7,8,12
<i>Sida cordifolia</i>	Flannel weed	Shrub	1, 2, 3, 4, 5, 6, 10	7, 8, 9	1, 2, 15	1,6,8,12
<i>Sida rhombifolia</i>	Paddy's lucerne	Shrub	1, 2, 3, 4, 5, 6, 10	7, 8, 9	1, 2, 14	1,6,8,12
<i>Sporobolus fertilis</i>	Giant Parramatta grass	Perennial grass	2	n/a	1, 2	1,3,6,12
<i>Sporobolus jacomontii</i>	American rat's tail grass	Perennial grass	2	n/a	1, 2	3,6,12
<i>Sporobolus natalensis</i>	Giant rat's tail grass	Perennial grass	2, 4, 10	—	None	1,6,8,12
<i>Sporobolus pyramidalis</i>	Giant rat's tail grass	Perennial grass	4, 6, 10	—	1, 2	1,3,6,7,8,12
<i>Sporobolus africanus</i>	Parramatta grass	Perennial grass	8, 10	n/a	1	3,6,12
<i>Stylosanthes scabra</i>	Stylo	Perennial forb	1, 2, 3, 4, 10	n/a	1, 13	1,3,4,6,9,12
<i>Tamarix aphylla</i>	Athel pine	Tree	5, 6, 8, 9	3, 4, 10	None	JP,12
<i>Tamarix ramossissima</i>	Salt cedar	Shrub/tree	6,9	n/a	1, 2, 15	4,12
<i>Themeda quadrivalvis</i>	Grader grass	Annual grass	1, 2, 4, 10	—	1, 2, 15	1,3,4,6,7,8, 12
<i>Xanthium occidentale</i>	Noogoora burr	Annual forb	2, 3, 4, 5, 6, 8, 9, 10	1, 7	1, 2, 13, 14, 15	1, 3, 6, 7, 9, 10
<i>Ziziphium mauritianum</i>	Indian jujube, Chinese apple	Shrub/tree	3, 4, 10	5, 8, 9	1, 2, 15	1,3,4,6,7,8, 12

<sup>A</sup> Growth form was determined from the following databases: US Dept of Agriculture Plants Database, plants.usda.gov/index.html; International Legume Database and Information Service, www.ildis.org/LegumeWeb; FloraBase: The Western Australia Flora, florabase.calm.wa.gov.au/search. <sup>B</sup>References are described in Table 1. Initials indicate listing based on the expert opinion of Sandy Lloyd (SL), John Pitt (JP). <sup>C</sup>There are several species within this genus that pose a risk to biodiversity and are listed in Appendix 1.

maps for several rangeland species [e.g. cabomba (*Cabomba caroliniana*), Chilean needle grass (*Nassella neesiana*), hymenachne (*Hymenachne amplexicaulis*), and pond apple (*Annona glabra*)] and ‘potential distribution’ maps for parkinsonia (*Parkinsonia aculeata*), prickly acacia (*Acacia nilotica*) and Chilean needle grass have been revised and published by the Cooperative Research Centre for Australian Weed Management (Weeds CRC) in its management guides for the 20 WONS.<sup>3</sup> Mapping the potential distribution of 28 Alert List species, 16 of which occur in the rangelands, has also been undertaken (J. Weber, pers. comm.) through the Weeds CRC.

Individual states have instigated their own weed mapping programs. For example, the Queensland Department of Natural Resources and Mines has used CLIMATE and CLIMEX (Sutherst and Maywald 1998) to create maps of predicted distributions of Class 1, 2 and 3 weeds [Land Protection (Pest and Stock Route Management) Act 2002]. CLIMEX examines the association between weed species’ geographical, seasonal and inter-annual performances, using ‘survival thresholds’ to generate potential distributions (Kriticos and Randall 2001).

Approximately 30% of the species listed in Table 2 have been mapped at the national scale. A further 60% have been mapped by state and national herbaria. However, these maps are not comprehensive and only indicate where specimens have been collected and lodged with the herbaria. The current distributions of the remaining 10% of species have not been mapped. Maps of ‘potential distribution’ exist for only 30% of species in Table 2.

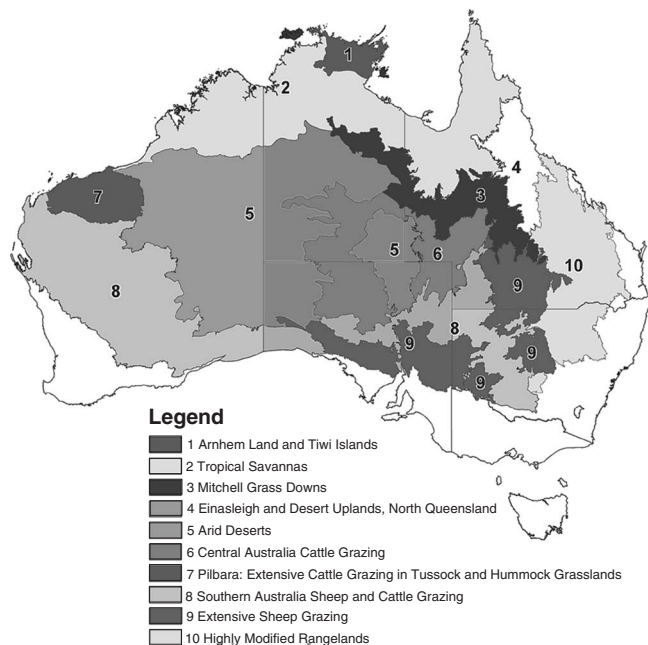


**Fig. 1.** Proportion of different growth forms among the 94 taxa which pose the greatest threat to Australian rangeland biodiversity (Table 2).

## Distribution of rangeland weeds

The Australian continent is divided into 85 Interim Biogeographic regions (IBRAs), 53 of which occur in the rangelands. IBRAs form the basis of reporting units for assessing the status of Australia’s native ecosystems (Thackway and Cresswell 1995). Grazing Land Management Zones (GLMZ) are amalgamations of IBRAs based on biophysical characteristics, land uses, land modification, and stocking characteristics within the rangelands (Fisher *et al.* 2004; Fig. 2; Table 3) and provide a useful framework for the management of rangelands. The distributions of weeds that pose a threat to biodiversity in relation to GLMZ (Table 2) are shown in Fig. 3. Overall GLMZ 10, Highly Modified Rangelands 2, Tropical Savannas and 4, Einasleigh and Desert Uplands contain the highest numbers of weed species that threaten biodiversity (Fig. 3a). The number of species relative to the area occupied by each GLMZ is shown in Fig. 3b. GLMZ 1, Arnhem Land and Tiwi Islands 4, Einasleigh and Desert Uplands and 10, Highly Modified Rangelands contain the most species relative to their area. GLMZ 5, Arid Deserts and 8, Southern Australia Sheep and Cattle Grazing, however, contain relatively few species per unit area.

Although the number of weed species within a GLMZ provides an indication of the severity of weed impact, it is only one measure of likely or actual impact. For example, in the Top End of the Northern Territory two species alone, *Mimosa pigra* and gamba grass (*Andropogon gayanus*),



**Fig. 2.** Distribution of Grazing Land Management Zones (GLMZ) throughout rangeland Australia (shades of grey). Source: Fisher *et al.* (2004).

<sup>3</sup>[www.weeds.crc.org.au/publications/weed\\_man\\_guides.html](http://www.weeds.crc.org.au/publications/weed_man_guides.html) (accessed 20 March 2006).

**Table 3. Grazing Land Management Zones (GLMZ) and the Interim Biogeographic Regionalisation of Australia (IBRA) and National Biodiversity Hotspots of which they are made up**

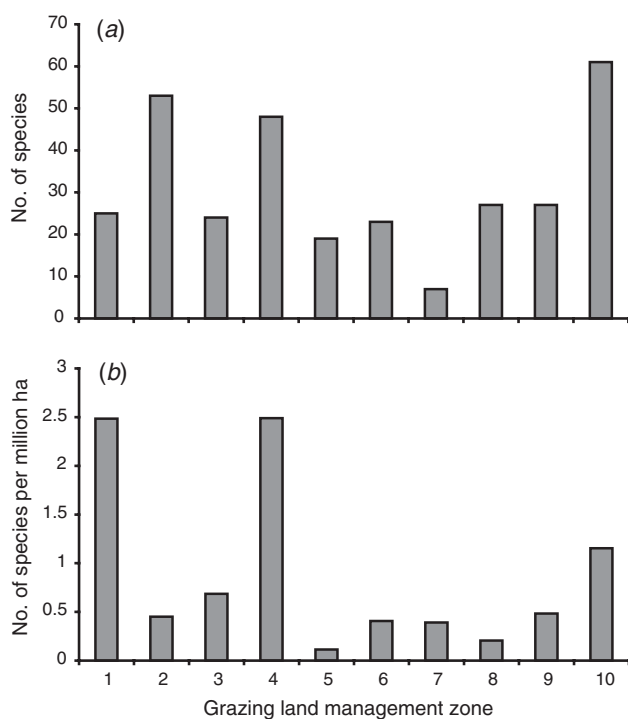
Grazing Land Management Zone (GLMZ)	Corresponding IBRA regions <sup>A</sup>	Biodiversity hotspot
1. Arnhem Land and Tiwi Islands	ARC, CA	—
2. Tropical Savannas	ARC, CK, CYP, DAB, DAG, DL, GFU, GUC, GUP, MII, NK, OVP, PCK, STU, VB	15, North Kimberley
3. Mitchell Grass Downs	MGD	—
4. Einasleigh and Desert Uplands	EIU, DEU	1, Einasleigh and Desert Uplands
5. Arid Deserts	CR, GD, GSD, GVD, l.s.d., SSD, TAN	—
6. Central Australia Cattle Grazing	BRT, CHC, FIN, MAC, STP	—
7. Pilbara, Extensive Cattle Grazing in Tussock and Hummock Grasslands	PIL	14, Hamersley/Pilbara
8. Southern Australia Sheep and Cattle Grazing	CAR, COO, GAS, HAM, MDD, MUR, NUL, RIV, YAL, RIV	13, Carnarvon basin
9. Extensive Sheep Grazing	BHC, CP, FLB, GAW, GVD, MDD, ML	—
10. Highly Modified Rangelands	BBN, BBS, DRP	2, Brigalow North and South

<sup>A</sup>Refer to Appendix 2 for IBRA code definitions.

are having an enormous impact on biodiversity (Braithwaite *et al.* 1989; Rossiter *et al.* 2003).

Australian Biodiversity Hotspots (Fig. 4) are regions rich in plant and animal species and under immediate

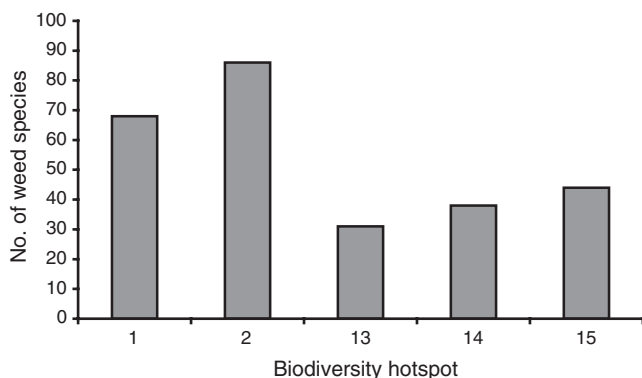
threat from impacts such as land clearing, development pressures, salinity, weeds and feral animals (Department of the Environment and Heritage 2005). Fifteen biodiversity hotspots were announced in 2003; five of these occur in the rangelands (Fig. 4). The North and South Brigalow and the Einasleigh and Desert Uplands contain the highest numbers of weed species, 42% of which are found in both regions. Half as many species occur in the Carnarvon Basin (Fig. 5).



**Fig. 3.** Distribution of weeds that pose a threat to biodiversity (Table 2) across Grazing Land Management Zones (GLMZ, Fig. 2), *a*) Number of weed species in each GLMZ, and *b*) Number of weed species within each GLMZ per million ha, where 1, Arnhem Land and Tiwi Islands; 2, Tropical Savannas; 3, Mitchell Grass Downs; 4, Einasleigh and Desert Uplands; 5, Arid Deserts; 6, Central Australia Cattle Grazing; 7, Pilbara, Extensive Cattle Grazing in Tussock and Hummock Grasslands; 8, Southern Australia Sheep and Cattle Grazing; 9, Extensive Sheep Grazing; 10, Highly Modified Rangelands.



**Fig. 4.** Australian Biodiversity Hotspots. Five of Australia's fifteen hotspots occur in the rangelands: 1: Einasleigh and Desert Uplands; 2: Brigalow North and South; 13: Carnarvon Basin; 14: Hamersley/Pilbara; 15: North Kimberley. Source: Commonwealth Australia, Department of Environment and Heritage, Canberra, August 2003. [www.deh.gov.au/biodiversity/hotspots/map.html](http://www.deh.gov.au/biodiversity/hotspots/map.html) (accessed 24 March 2006).



**Fig. 5.** Number of weed species that pose a threat to biodiversity that occur across five national biodiversity hotspots (Fig. 4) in the rangelands. 1: Einasleigh and Desert Uplands; 2: Brigalow North and South; 13: Carnarvon Basin; 14: Hamersley/Pilbara; 15: North Kimberley.

### 'Potential' threats to rangeland biodiversity

There are hundreds of non-native species that potentially threaten Australian biodiversity. Some of these species are listed in Appendix 1. Others of high risk have not yet arrived in Australia. Species such as *Aeschynomene paniculata*, *Azadirachta indica*, *Brillantaisia lamium*, *Crupina vulgaris* and *Echinochloa polystachia*, although currently having little or no impact on biodiversity, have the potential to impact greatly if not managed.

### Weed identification resources relevant to Australian rangelands

Preventing weeds from establishing in new areas is widely recognised as the most cost effective method of reducing further impacts of weeds (Vitelli 2000). In order to do this, weeds have to be detected and correctly identified while in the early stages of invasion. The most appropriate course of action can then be implemented based on the existing information known about the plant.

Information to assist land managers with the detection and identification of non-native weeds, including those present within rangelands is increasingly available in both hardcopy and electronic formats via the World Wide Web. Much of this information has traditionally been provided through textbooks and from the departments responsible for weed management within the respective States and Territory.

A range of books provide pictures and illustrations to help with identification of weeds. Some of these are specific weed publications (e.g. Sainty and Jacobs 1988; Auld and Medd 1992; Muyt *et al.* 2001), while others are descriptions of the flora of specific regions and include the non-native species that are present (e.g. Cunningham *et al.* 1981; Jessop 1981).

The quantity of information provided by respective State and Territory departments varies markedly and is dependant

on the level of resources allocated within these organisations to weed related issues. In some jurisdictions there is a critical mass of dedicated staff working solely on weeds, while for others, weed management is just one of several activities undertaken as part of the day-to-day work program of a small group (Martin and van Klinken 2006, this issue). The level of information provided is significantly greater for those where extension specialists and desktop publishing expertise are available (e.g. Queensland, Northern Territory).

The production of information brochures on key weed species is the most common extension tool (e.g. Agfacts in New South Wales, Agnotes in the Northern Territory and Pest Facts and Warning Brochures in Queensland) used by State and Territory agencies to educate the community about what these plants look like, how and where they grow and what control methods are available. If hard copy material is not produced it is generally available electronically at their respective websites.

In recent times, several local Government Authorities and Regional Natural Resource Management Bodies have employed staff members who can offer assistance in identification and management of weeds within their areas of jurisdiction. Where such staff have been appointed, there appears to have been a marked increase in the level of detection of new outbreaks and this is probably most directly linked to the smaller areas for which these officers are responsible.

The Australian Quarantine and Inspection Service (AQIS) has also been proactive in undertaking surveillance activities for new introductions. AQIS staff training involves travelling to neighbouring countries to examine first hand the species that might enter Australia. Identification information on these species is collated and then used as a reference guide as they travel within Australia undertaking surveillance activities.

Since the implementation of the National Weeds Strategy in 1997 several National programs have been initiated to minimise the impacts of weeds in Australia (Martin and van Klinken 2006, this issue). Many of these have either directly or indirectly resulted in improved detection and identification of weeds and include the Weeds of National Significance Program, the establishment of a National Environmental Weed Alert List, the production of a series of National Weed Identification Cards, the production of a Weed Australia Web Site and associated Weed Identification and Information Web Tool, a CD-ROM based identification and information system for the declared plants of Australia and a Pilot National Weed Detection Project. The following sections briefly summarise each of these in terms of their impacts on improving weed identification.

#### *Weeds of National Significance*

The establishment of 20 Weeds of National Significance (WONS) has seen a marked increase in availability of



information to assist in their identification (Thorp and Lynch 2000). A range of extension products has been developed for individual species, including weed management guides for all 20 WONS<sup>4</sup> and Best Practice Manuals for prickly acacia, parkinsonia, mesquite (*Prosopis* spp.), lantana (*Lantana camara*), parthenium (*Parthenium hysterophorus*) and rubber vine (*Cryptostegia grandiflora*). Some multi-species extension material has also been produced where there has been an identified need to distinguish between species with similar growth forms or species within the same genera. For example, the woody weeds prickly acacia, mesquite and parkinsonia and, to a lesser extent, giant sensitive plant (*Mimosa pigra*) are sometimes confused with each other. People located within the regions where these weeds are found can generally readily identify them based on some key attributes, but it is more difficult for people who are less familiar and are trying to detect them as part of surveillance activities.

As well as using extension material, a successful activity has been to show relevant people what weeds look like in the field. In some instances this has involved interstate travel for small groups but it has usually paid immediate dividends upon their return, with new infestations being found in some states. For example, in Western Australia there were no known infestations of prickly acacia before 2002. A visit by the Queensland based coordinator for the National Prickle Bush Management Group (prickly acacia, mesquite and parkinsonia) resulted in the positive identification of a plant just inside the Western Australia/Northern Territory Border. Soon after, another plant was found in a holding paddock at the Kununurra quarantine yards. Before destroying the plant, government officers involved in weed management inspected it to get a better understanding of what to look for when travelling around their regions of responsibility. Not long after, one of the officers found a large infestation (greater than 1000 ha) near Wyndham in the East Kimberley Region. Similar incidents have occurred in New South Wales, with several new parthenium, mesquite and parkinsonia infestations being found following the training of weeds officers (N. March, pers. comm.).

#### *National Environmental Weed Alert List*

The National Environmental Weed Alert List is a compilation of 28 plant species in the early stages of establishment, but which have the potential to become significant threats to biodiversity if they are not managed. For all of these weeds, management guides, similar to those for the Weeds of National Significance, have been produced.<sup>5</sup>

<sup>4</sup>[www.deh.gov.au/biodiversity/invasive/publications/#weeds](http://www.deh.gov.au/biodiversity/invasive/publications/#weeds) (accessed 24 March 2006).

<sup>5</sup>[www.deh.gov.au/biodiversity/invasive/publications/#weeds](http://www.deh.gov.au/biodiversity/invasive/publications/#weeds) (accessed 24 March 2006).

#### *National Pocket Guide for Weed Identification*

There are several weed related textbooks available to assist with identification, but they are generally cumbersome and unsuitable for field situations. To enhance the detection of weeds by on ground land managers, small durable booklets that can be easily transported and carried in vehicles, have been produced. Often referred to as pocket guides, these booklets are aimed at field identification of weeds with textbook quality pictures and key identification traits customised for specific areas. This material does not replace formal identification methods but should improve early detection of serious weed problems. Examples of guides produced include Plants of the New South Wales Rangelands (Brooke and McGarva 1998), the Burdekin Dry Tropics (Department of Natural Resources and Mines 2003), Cape York Peninsula (Department of Natural Resources and Mines 2001a), and Agricultural and Environmental Weeds of Far North Queensland (Department of Natural Resources and Mines 2001b).

To make the compilation of these guides easier and to give consistent information, a 'National Pocket Guide for Weed Identification Project' was initiated by the National Weeds Executive. The consultancy group, Sainty and Associates Pty Ltd, were given the responsibility of producing individual weed identification cards for species considered to be important in Australia. Presently there are in excess of 170 species for which cards have been prepared and these are being used to produce identification decks of temperate, sub-tropical and tropical weeds. For a fee, any organisation can now request identification booklets be produced that are specific to their region, catchment or local government authority requirements. This product is marketed as 'WEEDeck'.

#### *Weeds Australia Web Site*

A Weeds Australia Website<sup>6</sup> has been created by the Australian Weeds Committee to promote access to key weed policies, regulations, current issues, national initiatives, research, extension, training and personnel. On this site, a weed identification tool has been provided and is based on the WEEDeck card series. Users first select the State or Territory of interest and then delve further by pin pointing an 'area of interest' on the map provided. This allows the major weeds that are of current or potential importance to be listed for any Biogeographic (IBRA) region. The weeds can be grouped into growth forms, such as, herbs, grasses, shrubs, trees, vines or water plants. For each weed listed, identification photos, current and potential distributions, descriptions of plant attributes and distinguishing features such as dispersal mechanisms, are provided.

<sup>6</sup>[www.weeds.org.au/weedident.htm](http://www.weeds.org.au/weedident.htm) (accessed 24 March 2006).

### *Declared Plants of Australia: an identification and information system*

Declared Plants of Australia (Navie 2004) is an interactive CD-ROM that helps with the identification of over 300 declared species and an additional 500 species that occur in Australia. Declaration of pest plants under state legislation imposes legal responsibility for control on landholders and landholding agencies, and so it is important that tools are available for identification of relevant weeds. Using the proprietary Lucid<sup>TM</sup> identification system, users can navigate through the CD content in any way that suits their specific information or identification needs. It is not necessary to have an extensive taxonomic or botanical background, because illustrations of plants and key plant features are provided to assist the identification process. Once the plant has been identified information is provided on aspects such as distribution, legislation and management.

### *Establishing a National Weed Detection Network*

Traditionally, most new weed incursions have been found by a small number of people skilled in taxonomy and/or botany. If more people were proactively looking for eradicable weeds it is likely that infestations would be found earlier and at stages when they may be more manageable and perhaps eradicable. This is happening to a degree with many landholders being encouraged to look out for plants that 'don't belong' and to seek their identification.

The Weeds CRC, in collaboration with the Queensland Herbarium (Environmental Protection Agency) and the Queensland Department of Natural Resources, Mines and Water, is currently piloting a 'National Weed Detection Project'. The main objective of the project is to build a better incursion detection capability in regional Australia by harnessing and fostering community interest and skills in invasive plants, and assisting herbaria to play a supporting role.

### **Conclusion**

The biodiversity of Australia's rangelands are under threat from a large number of non-native naturalised plant species. We report on 622 non-native naturalised species in the rangelands, of which twenty-five percent are considered to pose a serious threat to rangeland biodiversity. Of these, over half comprised perennial grasses and shrubs. Several of rangeland Australia's most serious environmental weeds are non-native, perennial pasture grasses [e.g. buffel grass (*Cenchrus ciliaris*); Fairfax and Fensham 2000] that have not been included in national prioritisation lists due to conflicting views regarding the benefits and costs of these species. This has in turn reduced the opportunities for government funding for research, extension and control activities through programs such as the National Heritage Trust (Martin and van Klinken 2006, this issue).

To date, the current and potential distributions of only 30% of species that pose a threat to biodiversity (Table 2) have been mapped comprehensively at the national scale. There is an urgent need to map the current and potential distributions of all remaining species. Based on the maps that are available, we identified areas containing the most weeds and the most susceptible locations in terms of biodiversity. The Grazing Land Management Zones (Fig. 2) Einasleigh and Desert Uplands, Highly Modified Rangeland (Brigalow North and South), Tropical Savannas, and Arnhem Land contain the most weeds that pose a threat to biodiversity. The two former GLMZs are also national biodiversity hotspots. These areas should be considered priorities for weed management, although the number of species is only one measure of the potential impact of non-native species on biodiversity.

Fortunately, there is an increasing suite of tools and initiatives being implemented to improve the ability to detect and identify weed infestations across rangeland Australia. However, some jurisdictions are more advanced than others in their development and adoption of tools (Martin and van Klinken 2006, this issue) and there is an urgent need to improve capacity across the extent of Australia's rangelands if further biodiversity impacts are to be mitigated.

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### **References**

- ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand, Australian and New Zealand Environment and Conservation Council) (1999). 'The national weeds strategy: a strategic approach to weed problems of national significance.' (Commonwealth of Australia: Canberra.)
- Auld, B. A., and Medd, R. W. (1992). 'Weeds: an illustrated botanical guide to the weeds of Australia.' (Inkata Press: Melbourne.)
- Australian Weeds Committee (2004). 'Noxious weed list for Australian states and territories.' Available online at: [www.weeds.org.au/noxious.htm](http://www.weeds.org.au/noxious.htm) (accessed 20 March 2006).
- Braithwaite, R. W., Lonsdale, W. M., and Estbergs, J. A. (1989). Alien vegetation and native biota in tropical Australia: the impact of *Mimosa pigra*. *Biological Conservation* **48**, 189–210. doi: 10.1016/0006-3207(89)90118-3

- Brooke, G., and McGarva, L. (1998). 'The glove box guide to plants of the NSW rangelands.' (New South Wales Agriculture: Orange.)
- Cox, K. (2005). 'MLA NBP.327 Protection of northern grasslands from rejected forage plants of high weed potential.' (Meat and Livestock Australia and Department of Primary Industries and Fisheries: Brisbane.)
- Cunningham, D. C., Woldendorp, G., Burgess, M. B., and Barry, S. C. (2003). 'Prioritising sleeper weeds for eradication.' (Commonwealth of Australia: Canberra.)
- Cunningham, G. M., Mulham, W. E., Milthorpe, P. L., and Leigh, J. H. (1981). 'Plants of Western New South Wales.' (Soil Conservation Service of NSW, NSW Government Printing Office: Sydney.)
- Department of the Environment and Heritage (2005). 'National biodiversity hotspots. Canberra.' Available online at: [www.deh.gov.au/biodiversity/hotspots/national.html](http://www.deh.gov.au/biodiversity/hotspots/national.html) (accessed 20 March 2006).
- Department of the Environment and Heritage (2006). 'Weeds on the national environmental alert list.' (Commonwealth of Australia: Canberra.) Available online at: [www.deh.gov.au/biodiversity/invasive/weeds/alert-list.html](http://www.deh.gov.au/biodiversity/invasive/weeds/alert-list.html) (accessed 20 March 2006).
- Department of Natural Resources and Mines (2001a). 'Cape York Peninsula weed pocket guide.' (Web and Publishing Services, Department of Natural Resources and Mines: Brisbane.)
- Department of Natural Resources and Mines (2001b). 'Weed pocket guide of agricultural and environmental weeds in far North Queensland.' (Web and Publishing Services, Department of Natural Resources and Mines: Brisbane.)
- Department of Natural Resources and Mines (2003). 'Weed pocket guide for the Burdekin Dry Tropics.' (Web and Publishing Services, Department of Natural Resources and Mines: Brisbane.)
- Fairfax, R. J., and Fensham, R. J. (2000). The effect of exotic pasture development on floristic diversity in central Queensland, Australia. *Biological Conservation* **94**, 11–21. doi: 10.1016/S0006-3207(99)00169-X
- Fisher, A., Hunt, L., James, C., Landsberg, J., Phelps, D., Smyth, A., and Weston, I. (2004). 'Review of total grazing pressure management issues and priorities for biodiversity conservation in rangelands: a resource to aid NRM planning. Desert Knowledge CRC Project Report No. 3.' (Desert Knowledge CRC and Tropical Savannas Management CRC: Alice Springs.)
- Grice, A. C. (2002). Weeds of significance to the grazing industries of Australia. Final report, Meat and Livestock Australia, North Sydney.
- Grice, A. C. (2006). The impacts of invasive plant species on the biodiversity of Australian rangelands. *The Rangeland Journal* **28**, 27–35.
- Groves, R. H. (2000). Sleeper weeds. In: 'Proceedings of the twelfth Australian Weeds Conference'. (Eds A. C. Bishop, M. Boersma and C. D. Barnes.) pp. 632–636. (Tasmanian Weed Society Inv.: Hobart.)
- Groves, R. H., Hoskings, J. R., Batianoff, G. N., Cooke, D. A., Cowie, I. D., et al. (2003). 'Weed categories for natural and agricultural ecosystem management.' (Commonwealth Australia: Canberra.)
- Holzner, W., and Numata, M. (1982). 'Biology and ecology of weeds.' (W. Junk: The Hague.)
- Humphries, S. E., Groves, R. H., and Mitchell, D. S. (1991). 'Plant invasions: the incidence of environmental weeds in Australia.' (Australian National Parks and Wildlife Service: Canberra.)
- Jessop, J. (1981). 'Flora of Central Australia.' (Australian Systematic Botany Society: Sydney.)
- Kriticos, D. J., and Randall, R. P. (2001). A comparison of systems to analyse potential weed distributions. In: 'Weed risk assessment'. (Eds R. H. Groves, F. D. Panetta and J. G. Virtue.) pp. 61–79. (CSIRO Publishing: Melbourne.)
- Landsberg, J., and Crowley, G. (2004). Monitoring rangeland biodiversity: plants as indicators. *Austral Ecology* **29**, 59–77. doi: 10.1111/j.1442-9993.2004.01357.x
- Lonsdale, W. M. (1994). Inviting trouble: Introduced pasture weeds in northern Australia. *Australian Journal of Ecology* **19**, 345–354.
- Low, T. (1999). 'Feral future.' (Penguin Books Australia Ltd: Ringwood.)
- Martin, T. G., and van Klinken, R. D. (2006). Value for money? Investment in weed management in Australian rangelands. *The Rangeland Journal* **28**, 63–75.
- McIntyre, S., Martin, T. G., Heard, K. M., and Kinloch, J. (2005). Plant traits predict impact of invading species: an analysis of herbaceous vegetation in the subtropics. *Australian Journal of Botany* **53**, 757–770. doi: 10.1071/BT05088
- Muyt, A., Richardson, R. G., and Richardson, F. J. (2001). 'Bush invaders of south-east Australia: a guide to the identification and control of environmental weeds found in south-east Australia.' (R.G. and F.J. Richardson: Meredith.)
- Navie, S. (2004). 'Declared plants of Australia [electronic resource]: an identification and information system.' (University of Queensland, Centre for Biological Information Technology: Brisbane.)
- Parsons, W. T., and Cuthbertson, E. G. (1992). 'Noxious weeds of Australia.' (Inkata Press: Melbourne.)
- Paynter, Q., Csurhes, S. M., Heard, T. A., Ireson, J., Julien, M. H., Lloyd, J., Lonsdale, W. M., Palmer, W. A., Sheppard, A. W., and van Klinken, R. D. (2003). Worth the risk? Introduction of legumes can cause more harm than good: an Australian perspective. *Australian Systematic Botany* **16**, 81–88. doi: 10.1071/SB01025
- Rossiter, N. A., Setterfield, S. A., Douglas, M. M., and Hutley, L. B. (2003). Testing the grass-fire cycle: exotic grass invasion in the tropical savannas of northern Australia. *Diversity and Distribution* **9**, 169–176. doi: 10.1046/j.1472-4642.2003.00020.x
- Sainty, G. R., and Jacobs, S. W. L. (1988). 'Waterplants in Australia.' (Australian Water Resources Council: Darlinghurst.)
- Smith, N. M. (2002). 'Weeds of the wet/dry tropics: a field guide.' (Environment Centre NT Inc.: Darwin.)
- Sutherland, S. (2004). What makes a weed a weed: life-history traits of native and exotic plants in the USA. *Oecologia* **141**, 24–39. doi: 10.1007/s00442-004-1628-x
- Sutherst, R. W., and Maywald, G. F. (1998). 'CLIMEX [electronic resource]: predicting the effects of climate on plants and animals.' (CSIRO Publishing: Melbourne.)
- Thackway, R., and Cresswell, I. (1995). 'An Interim Biogeographic Regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program, Version 4.' (Australian Nature Conservation Agency: Canberra.)
- Thompson, K., Hodgson, J. G., and Rich, T. C. G. (1995). Native and alien invasive plants: more of the same? *Ecography* **18**, 390–402.
- Thorp, J. R., and Lynch, R. (2000). 'The determination of weeds of national significance.' (National Weeds Strategy Executive Committee: Launceston.)
- Virtue, J. G., Groves, R. H., and Panetta, F. D. (2001). Towards a system to determine the national significance of weeds in Australia. In: 'Weed risk assessment'. (Eds R. H. Groves, F. D. Panetta and J. G. Virtue.) pp. 124–150. (CSIRO Publishing: Melbourne.)
- Vitelli, J. S. (2000). Options for effective weed management. *Tropical Grasslands* **34**, 280–294.

**Appendix 1. List of 622 non-native plant species that occur in the rangelands, including 153 species, representing 94 taxa (Table 2), which pose a threat to rangeland biodiversity**

Species known to have an impact on rangeland biodiversity are noted (Y). The list was compiled using published literature (Table 1) and expert knowledge (see *Acknowledgments*). Where possible, nomenclature follows the Australian Plant Name Index (APNI)<sup>A</sup>, otherwise Index Kewensis<sup>B</sup> is used

No.	Scientific name	Common name	Biodiversity threat
1	<i>Abutilon theophrasti</i> Medik.	Swamp Chinese lantern	—
2	<i>Acacia catechu</i> (L.f.) Willd.	Cutch tree	Y
3	<i>Acacia curassavica</i> (Britton & Killip) Stehle	—	Y
4	<i>Acacia erioloba</i> E.Mey	Giraffe thorn	—
5	<i>Acacia karroo</i> Hayne	Karoo thorn	Y
6	<i>Acacia nilotica</i> Delile	Prickly acacia	Y
7	<i>Acacia paradoxa</i> DC.	Kangaroo thorn, hedge wattle, prickly wattle	—
8	<i>Acacia tortilis</i> (Forssk.) Hayne	—	—
9	<i>Acacia xanthophloea</i> Benth.	—	—
10	<i>Acanthospermum hispidum</i> DC.	Goat's head, star burr	—
11	<i>Acetosa vesicaria</i> (L.) A.Love	—	—
12	<i>Acetosella vulgaris</i> Fourr.	—	—
13	<i>Achnatherum caudatum</i> S.W.L.Jacobs & J.Everett	Speargrass	Y
14	<i>Acroptilon repens</i> (L.) DC.	Creeping knapweed	—
15	<i>Adonis microcarpa</i> DC.	Pheasant's eye	—
16	<i>Aerva javanica</i> Juss.	Aerva, kapok bush	—
17	<i>Aeschynomene brasiliana</i> DC.	—	Y
18	<i>Aeschynomene paniculata</i> Willd. Ex Vog.	Panicle jointvetch	Y
19	<i>Agave americana</i> L.	Century plant	—
20	<i>Agave americana</i> var. <i>americana</i> L.	Century plant	Y
21	<i>Agave americana</i> var. <i>expansa</i> Gentry	Century plant	—
22	<i>Agave sisalana</i> Perrine ex Engelm	—	Y
23	<i>Agave vivipara</i> L.	—	Y
24	<i>Ageratina adenophora</i> R.M.king & H.Rob.	—	Y
25	<i>Ageratina riparia</i> (Regel) R.M.king & H.Rob.	Mistflower	Y
26	<i>Agropyron elongatum</i> (Host) P.Beauv.	—	—
27	<i>Agropyron repens</i> (L.) P.Beauv.	—	—
28	<i>Agrostis capillaris</i> L.	Browntop bent grass	Y
29	<i>Ailanthus altissima</i> (Mill.) Swingle	Tree of heaven	—
30	<i>Aira cupaniana</i> Guss.	Silvery Hairgrass	—
31	<i>Alhagi maurorum</i> Medik.	Camel thorn	—
32	<i>Allium triquetrum</i> L.	Three-cornered garlic	—
33	<i>Alopecurus geniculatus</i> L.	—	—
34	<i>Alternanthera philoxeroides</i>	Alligator weed	Y
35	<i>Alternanthera pungens</i> H.B. and K.	Khaki weed	—
36	<i>Alyssum linifolium</i> Griseb.	Flat-leaf alyssum	—
37	<i>Amaranthus albus</i> L.	—	—
38	<i>Amaranthus hybridus</i> L.	—	—
39	<i>Amaranthus retroflexus</i> L.	—	—
40	<i>Amaranthus viridis</i> L.	—	—
41	<i>Ambrosia confertiflora</i> DC.	—	—
42	<i>Ambrosia psilostachya</i> DC.	Perennial ragweed	—
43	<i>Ambrosia tenuifolia</i> Spreng.	Lacy ragweed	—
44	<i>Ammi majus</i> L.	—	—
45	<i>Ammi visnaga</i> (L.) Lam.	—	—
46	<i>Amsinckia calycina</i> (Moris) Chater	—	—
47	<i>Amsinckia hispida</i> (Ruiz & Pav.) I.M.Johnst.	—	—
48	<i>Amsinckia intermedia</i> Fisch. & C.A.Mey	—	—
49	<i>Anagallis arvensis</i> L.	Pimpernel	—
50	<i>Andropogon gayanus</i> Kunth.	Gamba grass	Y
51	<i>Annona glabra</i> L.	Pond apple	Y
52	<i>Anthemis cotula</i> L.	Stinking mayweed	—

(Continued next page)

## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
53	<i>Apium graveolens</i> L.	Celery (wild form)	—
54	<i>Apium leptophyllum</i> F. Muell.	—	—
55	<i>Araujia sericifera</i> Brot.	Moth vine	—
56	<i>Arctium minus</i> Bernh.	—	—
57	<i>Arctotheca calendula</i> (L.) Levyns	Capeweed, African marigold	Y
58	<i>Argemone mexicana</i> L.	Mexican poppy	Y
59	<i>Argemone ochroleuca</i> Sweet	Mexican poppy	—
60	<i>Argyreia nervosa</i> Bojer	Elephant creeper	—
61	<i>Artemisia arborescens</i> L.	—	—
62	<i>Artemisia verlotorum</i> Lamotte	—	—
63	<i>Asparagus asparagoides</i> (L.) W.Wright ( <i>Myriophyllum asparagoides</i> )	Bridle creeper	—
64	<i>Asparagus officinalis</i> L.	Asparagus	—
65	<i>Asphodelus fistulosus</i> L.	Onion weed	Y
66	<i>Aster subulatus</i> Michx.	—	—
67	<i>Astragalus hamosus</i> L.	—	—
68	<i>Astragalus sesameus</i> L.	—	—
69	<i>Avellinia michelii</i> (Savi) Parl.	—	—
70	<i>Avena barbata</i> Link	Slender oat	—
71	<i>Avena fatua</i> L.	Wild oat	—
72	<i>Avena ludoviciana</i> Durieu	—	—
73	<i>Avena sativa</i> L.	Common oat	—
74	<i>Azadirachta indica</i> A.Juss.	Neem tree	Y
75	<i>Barleria prionitis</i> L.	Barleria	Y
76	<i>Bauhinia monandra</i> Kurz	—	—
77	<i>Bellardia trixago</i> (L.) All.	—	—
78	<i>Bidens bipinnata</i> L.	—	—
79	<i>Bidens pilosa</i> L.	Broomstick, grab-a-leg-, teasers, farmer's friend	—
80	<i>Bidens subalternans</i>	—	—
81	<i>Brachiaria mutica</i> ( <i>Urochloa mutica</i> ) (Forsk.) Stapf	Para frass	Y
82	<i>Brachiaria texana</i> DC.	—	—
83	<i>Brassica juncea</i> (L.) Czern.	India mustard	—
84	<i>Brassica rapa</i> L.	Field mustard	—
85	<i>Brassica tournefortii</i> Gouan	Mediterranean turnip, wild turnip	Y
86	<i>Brillantaisia lamium</i> Benth.	—	Y
87	<i>Briza maxima</i> L.	Big quaking grass	—
88	<i>Briza minor</i> L.	—	—
89	<i>Bromus alopecuroides</i> Poir.	—	—
90	<i>Bromus diandrus</i> Roth	—	—
91	<i>Bromus hordeaceus</i> L.	—	—
92	<i>Bromus macrostachys</i> Desf.	—	—
93	<i>Bromus madritensis</i> L.	—	—
94	<i>Bromus molliformis</i> Lloyd	—	—
95	<i>Bromus rubens</i> L.	—	—
96	<i>Bromus tectorum</i> L.	—	—
97	<i>Bromus unioloides</i> Kunth	—	—
98	<i>Bryophyllum daigremontianum</i> A. Berger × <i>Bryophyllum delagoense</i> (Eckl. & Zeyh.) Schinz	Hybrid mother-of-millions	Y
99	<i>Bryophyllum delagoense</i> (Eckl. & Zeyh.) Schinz	Mother-of-millions (WONS), lizard plant	—
100	<i>Cabomba caroliniana</i> A.Gray	Cabomba	Y
101	<i>Caesalpinia gilliesii</i> Wall. ex Hook.)	Bird of paradise flower	—
102	<i>Calandrinia menziesii</i> (Hook.) Torr. & A.Gray	—	—

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## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
103	<i>Calendula arvensis</i> L.	—	—
104	<i>Calendula palaestina</i> Boiss.	—	—
105	<i>Calicotome spinosa</i> (L.) Link	Spiny broom	—
106	<i>Callitriche stagnalis</i> Scop.	—	—
107	<i>Calopogonium mucunoides</i> Desv.	Calopogonium	—
108	<i>Calotropis gigantea</i> (L.) W.T.Aiton	Giant rubber bush	Y
109	<i>Calotropis procera</i> W.T.Aiton	Calotrope, rubber bush	Y
110	<i>Capsella bursa-pastoris</i> (L.) Medik.	—	—
111	<i>Cardaria draba</i> (L.) Desv.	Hoary cress, white weed	—
112	<i>Carduus nutans</i> L. ssp. <i>nutans</i>	Nodding thistle	Y
113	<i>Carduus pycnocephalus</i> L.	Slender winged thistle, slender thistle	Y
114	<i>Carduus tenuiflorus</i> W.M.Curtis	Slender thistle	Y
115	<i>Carrichtera annua</i> (L.) DC.	Ward's weed	Y
116	<i>Carthamus lanatus</i> L.	Saffron thistle	—
117	<i>Carthamus tinctorius</i> L.	—	—
118	<i>Caryota mitis</i> Herb.	Fishtail palm	—
119	<i>Cascabela thevetia</i> H.Lippold	Captain Cook tree, yellow oleander	Y
120	<i>Cassinia arcuata</i> R.Br.	Chinese shrub	—
121	<i>Catapodium rigidum</i> (L.) C.E.Hubb. ex Dony	—	—
122	<i>Cenchrus ciliaris</i> L.	Buffel grass	Y
123	<i>Cenchrus echinatus</i> L.	Mossman River grass	—
124	<i>Cenchrus incertus</i> M.A.Curtis	Spiny burr grass	—
125	<i>Cenchrus longispinus</i> Fernald	Spiny burr grass	—
126	<i>Cenchrus setiger</i> Vahl	—	—
127	<i>Centaurea calcitrapa</i> L.	Star thistle	Y
128	<i>Centaurea maculosa</i> Lam.	Spotted knapweed	Y
129	<i>Centaurea melitensis</i> L.	—	Y
130	<i>Centaurea nigra</i> L.	Black knapweed	Y
131	<i>Centaurea solstitialis</i> L.	St Barnaby's thistle	Y
132	<i>Centaurium tenuiflorum</i> (Hoffmanns. & Link) Fritsch ex E.Jansen	Slender centaury, branched centaury	—
133	<i>Cerastium glomeratum</i> Thuill.	—	—
134	<i>Ceratophyllum demersum</i> L.	Hornwort	—
135	<i>Cestrum parqui</i> L'Her.	Green poisonberry	Y
136	<i>Chamaecytisus proliferus</i> (L.f.) Link	—	—
137	<i>Chenopodium album</i> L.	Fat hen, white goosefoot	—
138	<i>Chenopodium ambrosioides</i> L.	—	—
139	<i>Chenopodium murale</i> L.	Nettle-leaf goosefoot, green fat hen	—
140	<i>Chenopodium punilio</i> R.Br.	Small crumbweed, clammy goosefoot	—
141	<i>Chloris gayana</i> Kunth	Rhodes grass	—
142	<i>Chloris inflata</i> Link	Feather top Rhodes grass	—
143	<i>Chloris virgata</i> Sw.	Feather finger grass	—
144	<i>Chondrilla juncea</i> L.	Skeleton weed	—
145	<i>Chromolaena odorata</i> (L.) R.M.King and H.Rob.	Siam weed	Y
146	<i>Chrozophora tinctoria</i> (L.) A.Juss.	—	—
147	<i>Cicendia quadrangularis</i> (Lam.) Griseb.	Square cicendia	—
148	<i>Cichorium intybus</i> L.	—	—
149	<i>Cirsium arvense</i> (L.) Scop.	Perennial thistle	Y
150	<i>Cirsium vulgare</i> (Savi) Ten.	Spear thistle	Y
151	<i>Citrullus colocynthis</i> (L.) Schrad.	Colocynth	—
152	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	Wild melon, camel melon, bitter melon, Afghan melon	Y
153	<i>Conium maculatum</i> L.	Hemlock	—
154	<i>Convolvulus arvensis</i> L.	Field bindweed	—

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## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
155	<i>Conyza albida</i> Spreng.	—	—
156	<i>Conyza bonariensis</i> (L.) Cronquist	Cobbler's pegs	—
157	<i>Coronopus didymus</i> (L.) Sm. ( <i>Lepidium didymum</i> )	Lesser swinecress, swinecress	Y
158	<i>Cotula australis</i> (Spreng.) Hook.f.	Cotula	—
159	<i>Cotula bipinnata</i> Thunb.	—	—
160	<i>Cotula coronopifolia</i> L.	—	—
161	<i>Cotula cotuloides</i> (Streetz) Druce	—	—
162	<i>Crotalaria goreensis</i> Guill. & Perr.	Gambia pea	—
163	<i>Crotalaria spectabilis</i> Roth	—	—
164	<i>Crupina vulgaris</i> Pers. ex Cass.	Common crupina	Y
165	<i>Cryptostegia grandiflora</i> R.Br.	Rubber vine	Y
166	<i>Cryptostegia madagascariensis</i> Bojer	Purple rubber vine	—
167	<i>Cucumis myriocarpus</i> Naudin	Paddy melon	—
168	<i>Cuscuta planiflora</i> Ten.	Small-seeded alfalfa dodder	Y
169	<i>Cylindropuntia imbricata</i> (Haw.) F.M.Kunth	Devil's rope pear	—
170	<i>Cynara cardunculus</i> L.	Artichoke thistle	Y
171	<i>Cynodon dactylon</i> (L.) Pers.	Couch	—
172	<i>Cynodon incompletus</i> Nees	—	—
173	<i>Cyperus aromaticus</i> Mattf. & Kük.	Navua sedge	—
174	<i>Cyperus eragrostis</i> Vahl	—	—
175	<i>Cyperus rotundus</i> L.	Nutgrass	—
176	<i>Cyperus teneristolon</i> Mattf. & Kük.	—	—
177	<i>Cytisus multiflorus</i> (Aiton) Sweet	White Spanish broom	—
178	<i>Datura ferox</i> L.	Fierce thorn-apple, longspine thornapple	Y
179	<i>Datura innoxia</i> Mill.	Downy thornapple	—
180	<i>Datura leichhardtii</i> Benth.	Native thornapple	—
181	<i>Datura metel</i> L.	Hindu thornapple	—
182	<i>Datura stramonium</i> L.	Cemetery flower, Cranky flower, common thornapple	—
183	<i>Datura wrightii</i> Regel	Hairy thornapple	—
184	<i>Digitaria ciliaris</i> (Retz.) Koeler	—	—
185	<i>Digitaria sanguinalis</i> (L.) Scop.	Crabgrass	—
186	<i>Diplotaxis muralis</i> (L.) DC.	—	—
187	<i>Diplotaxis tenuifolia</i> (L.) DC.	Sand rocket, Lincoln weed	Y
188	<i>Dittrichia graveolens</i> (L.) Greuter	Stinkwort	Y
189	<i>Ecballium elaterium</i> (L.) A.Rich.	Squirting cucumber	—
190	<i>Echinochloa colona</i> (L.) Link	—	—
191	<i>Echinochloa crus-galli</i> (L.) P.Beauv.	—	—
192	<i>Echinochloa crus-pavonis</i> (Kunth) Schult.	—	—
193	<i>Echinochloa frumentacea</i> Link	—	—
194	<i>Echinochloa microstachya</i> Rydb.	—	—
195	<i>Echinochloa oryzoides</i> (Ard.) Fritsch	—	—
196	<i>Echinochloa polystachya</i> (H.B.andK.) Roberty	Aleman grass	Y
197	<i>Echinochloa utilis</i> Ohwi & Yabuno	—	—
198	<i>Echium plantagineum</i> L.	Paterson's curse, salvation Jane	Y
199	<i>Echium vulgare</i> L.	Viper's bugloss	—
200	<i>Egeria densa</i> Planch.	Dense waterweed	—
201	<i>Ehrharta calycina</i> Sm.	—	—
202	<i>Ehrharta longiflora</i> Sm.	—	—
203	<i>Eichhornia crassipes</i> (Mart.) Solms	Water hyacinth	Y
204	<i>Eleusine indica</i> (L.) Gaertn.	—	—
205	<i>Eleusine tristachya</i> (Lam.) Lam.	—	—
206	<i>Elodea canadensis</i> Michx.	Elodea	—
207	<i>Emex australis</i> Steinh.	Spiny emex	Y
208	<i>Emex spinosa</i> (L.) Campd.	Lesser Jack	—

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## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
209	<i>Eragrostis barrelieri</i> Daveau	—	—
210	<i>Eragrostis cilianensis</i> (All.) Vignolo ex Janch.	Stink grass	—
211	<i>Eragrostis curvula</i> Nees	African lovegrass	Y
212	<i>Eragrostis japonica</i> (Thunb. Trin.	—	—
213	<i>Eragrostis pilosa</i> (L.) P.Beauv.	—	—
214	<i>Eragrostis poaeoides</i> P.Beauv.	—	—
215	<i>Eragrostis tef</i> (Zuccagni) Trotter	Teff	—
216	<i>Erodium aureum</i> Carolin	—	—
217	<i>Erodium botrys</i> (Cav.) Bertol.	—	—
218	<i>Erodium brachycarpum</i> Thell.	Shortfruit stork's bill	—
219	<i>Erodium cicutarium</i> (L.) L'Her. ex Aiton	—	—
220	<i>Erodium malacoides</i> (L.) Willd.	—	—
221	<i>Erodium moschatum</i> (L.) Aiton	Musky stork's bill	—
222	<i>Euphorbia hirta</i> L.	—	—
223	<i>Euphorbia marginata</i> Pursh	—	—
224	<i>Euphorbia peplus</i> L.	—	—
225	<i>Euphorbia terracina</i> L.	—	—
226	<i>Foeniculum vulgare</i> Mill.	Fennel	—
227	<i>Froelichia floridana</i> (Nutt.) Moq.	Snake cotton	—
228	<i>Fumaria bastardii</i> Boreau	Tall ramping-fumitory	—
229	<i>Fumaria capreolata</i> L.	—	—
230	<i>Fumaria densiflora</i> DC.	—	—
231	<i>Fumaria indica</i> (Hauskn.) Pugsley	—	—
232	<i>Fumaria muralis</i> W.D.J.Koch	—	—
233	<i>Galenia pubescens</i> Druce	Coastal galenia	—
234	<i>Galenia secunda</i> (L.f.) Sond.	—	—
235	<i>Galium aparine</i> L.	Cleavers	—
236	<i>Galium murale</i> All.	—	—
237	<i>Galium spurium</i> L.	False cleavers	—
238	<i>Galium tricornutum</i> Dandy	Three-horned bedstraw	—
239	<i>Genista linifolia</i> L.	Flax-leaf broom	—
240	<i>Glaucium corniculatum</i> (L.) Rudolph	—	—
241	<i>Glyceria declinata</i> Breb.	—	—
242	<i>Glyceria maxima</i> Holmb.	—	—
243	<i>Gmelina elliptica</i> Sm.	Badhara bush	Y
244	<i>Gomphocarpus fruticosus</i> (L.) Spreng.	Narrow leaf cotton bush	Y
245	<i>Gomphrena celosioides</i> Mart.	—	Y
246	<i>Grewia asiatica</i> L.	Phalsa, phassa	Y
247	<i>Gymnocoronis spilanthoides</i> DC.	Senegal tea	Y
248	<i>Gynandris setifolia</i> (L.f.) R.Foster	Thread iris	—
249	<i>Harrisia martinii</i> Britton	Harrisia cactus	Y
250	<i>Hedypnois cretica</i> (L.) Willd.	—	—
251	<i>Hedypnois rhagadioloides</i> (L.) F.W.Schmidt	—	—
252	<i>Helianthus annuus</i> L.	—	—
253	<i>Heliotropium amplexicaule</i> J.Vahl	Blue heliotrope	Y
254	<i>Heliotropium europaeum</i> L.	Common heliotrope	Y
255	<i>Heliotropium supinum</i> L.	—	—
256	<i>Herniaria hirsuta</i> L.	—	—
257	<i>Hieracium caespitosum</i> Dahlst.	Hawkweed	Y
258	<i>Hirschfeldia incana</i> (L.) Lagr.-Foss.	Hairy brassica, buchan weed	—
259	<i>Holcus lanatus</i> L.	Yorkshire fog	Y
260	<i>Homeria flaccida</i> Sweet	Cascade onion	—
261	<i>Hordeum glaucum</i> Steud.	—	—
262	<i>Hordeum hystrix</i> Roth	—	—

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## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
263	<i>Hordeum leporinum</i> Link	—	—
264	<i>Hordeum marinum</i> Huds.	—	—
265	<i>Hordeum vulgare</i> L.	—	—
266	<i>Hydrilla verticillata</i> (L.f.) Royle	Hydrilla	—
267	<i>Hydrocotyle verticillata</i> Thunb.	Shield pennywort	—
268	<i>Hymenachne amplexicaulis</i> (Rudge) Nees	Olive hymenachne	Y
269	<i>Hyparrhenia hirta</i> (L.) Stapf	Coolatai grass, tambookie grass	Y
270	<i>Hyparrhenia rufa</i> (Nees) Stapf	Thatch grass	Y
271	<i>Hypericum androsaemum</i> L.	Tutsan	—
272	<i>Hypericum perforatum</i> L.	St John's wort	Y
273	<i>Hypochaeris glabra</i> L.	—	—
274	<i>Hypochaeris radicata</i> L.	—	—
275	<i>Hyptis capitata</i> Jacq.	Knobweed	—
276	<i>Hyptis suaveolens</i> (L.) Poit.	Hyptis	Y
277	<i>Ibicella lutea</i> (Lindl.) Van Eselt.	Yellow-flowered devil's claw	Y
278	<i>Indigofera schimperi</i> Jaub. and Spach	—	—
279	<i>Ipomoea indica</i> (Burm.) Merr.	Purple morning glory	Y
280	<i>Ipomoea purpurea</i> (L.) Roth	—	—
281	<i>Jatropha curcas</i> L.	Physic nut	Y
282	<i>Jatropha gossypifolia</i> L.	Bellyache bush	Y
283	<i>Juncus acutus</i> L. ssp. <i>acutus</i>	Spiny rush	Y
284	<i>Juncus articulatus</i> L.	—	—
285	<i>Juncus capitatus</i> Weigel	—	—
286	<i>Kalanchoe tubiflora</i> Raym.-Hamet	—	—
287	<i>Kickxia sieberi</i> (Rchb.) Dorfl.	—	—
288	<i>Koelreuteria elegans</i> ssp. <i>formosana</i> (Seem.) A.C.Sm.	Chinese rain tree, Flame gold, Golden rain tree	Y
289	<i>Lactuca saligna</i> L.	—	—
290	<i>Lactuca serriola</i> L.	Prickly lettuce	—
291	<i>Lamarckia aurea</i> (L.) Moench	—	—
292	<i>Lamium amplexicaule</i> L.	Dead nettle	—
293	<i>Lantana camara</i> L.	Lantana	Y
294	<i>Lantana montevidensis</i> (Spreng.) Briq.	Creeping lantana	Y
295	<i>Leonotis nepetifolia</i> (L.) R.Br.	Lion's tail	—
296	<i>Leontodon taraxacoides</i> (Willd.) Merat	—	—
297	<i>Lepidium bonariense</i> L.	Argentine pepperweed	—
298	<i>Lepidium hyssopifolium</i> Desv.	—	—
299	<i>Leucaena leucocephala</i> Lam.	Leucaena	Y
300	<i>Ligustrum sinense</i> Lour.	Chinese privet	Y
301	<i>Limonium sinuatum</i> (L.) Mill.	Statice	—
302	<i>Limonium thouinii</i> Kuntze	—	—
303	<i>Linum usitatissimum</i> L.	—	—
304	<i>Lithospermum arvense</i> L.	—	—
305	<i>Lolium loliaceum</i> (Bory & Chaub.) Hand.-Mazz.	—	—
306	<i>Lolium perenne</i> L.	—	—
307	<i>Lolium rigidum</i> Gaudin	Wimmera ryegrass	—
308	<i>Lolium temulentum</i> L.	—	—
309	<i>Lophochloa cristata</i> (L.) H.Hyl.	—	—
310	<i>Lophochloa pumila</i> (Desf.) Bor	—	—
311	<i>Ludwigia peruviana</i> (L.) H.Hara	Ludwigia	—
312	<i>Lupinus angustifolius</i> L.	Narrow-leaved lupin	—
313	<i>Lupinus cosentinii</i> Guss.	Blue lupin	—
314	<i>Lycium ferocissimum</i> Miers	African boxthorn	Y
315	<i>Lycopsis arvensis</i> L.	—	—

(Continued next page)

## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
316	<i>Macroptilium atropurpureum</i> (DC.) Urb.	—	—
317	<i>Malva parviflora</i> L.	Mallow, small flowered mallow	Y
318	<i>Malvastrum americanum</i> (L.) Torr.	—	—
319	<i>Malvella leprosa</i> (Ortega) Krapov.	—	—
320	<i>Marrubium vulgare</i> L.	Horehound, white horehound	Y
321	<i>Martynia annua</i> L.	Devil's claw	Y
322	<i>Medicago arabica</i> (L.) Huds.	—	—
323	<i>Medicago laciniata</i> Mill.	—	—
324	<i>Medicago lupulina</i> L.	—	—
325	<i>Medicago minima</i> (L.) L. ex Bartal.	—	—
326	<i>Medicago orbicularis</i> (L.) Bartal.	—	—
327	<i>Medicago polymorpha</i> L.	—	—
328	<i>Medicago praecox</i> DC.	—	—
329	<i>Medicago sativa</i> L.	—	—
330	<i>Medicago tornata</i> (L.) Mill.	—	—
331	<i>Medicago truncatula</i> Gaertn.	—	—
332	<i>Melia azedarach</i> L.	Cape lilac, chinaberry, Persian lilac	—
333	<i>Melilotus alba</i> Desr.	—	—
334	<i>Melilotus indica</i> (L.) All.	—	—
335	<i>Melinis minutiflora</i> P.Beauv.	Molasses grass	Y
336	<i>Melinis repens</i> (Willd.) Zizka	Natal grass	—
337	<i>Mentha pulegium</i> L.	Pennyroyal, pudding grass	—
338	<i>Merremia dissecta</i> (Jacq.) Hallier f.	—	—
339	<i>Mesembryanthemum aitonis</i> Jacq.	Angled ice-plant	—
340	<i>Mesembryanthemum crystallinum</i> L.	Common ice-plant	—
341	<i>Mesembryanthemum nodiflorum</i> L.	Small, ice-plant, slender ice-plant	—
342	<i>Mimosa diplotricha</i> Wright var. <i>diplotricha</i>	Giant sensitive plant	—
343	<i>Mimosa invisa</i> Colla	—	—
344	<i>Mimosa pigra</i> L.	Mimosa	Y
345	<i>Mimosa pudica</i> L.	Common sensitive plant	—
346	<i>Modiola caroliniana</i> (L.) G.Don	—	—
347	<i>Moenchia erecta</i> (L.) G.Gaertn., B.Mey. & Scherb.	—	—
348	<i>Momordica balsamina</i> L.	Balsam pear	—
349	<i>Monerma cylindrica</i> (willd.) Coss. & Durieu	—	—
350	<i>Monolepis spathulata</i> A.Gray	—	—
351	<i>Moraea miniata</i> Andrews	Two-leaved cape tulip	—
352	<i>Myagrum perfoliatum</i> L.	Musk weed	—
353	<i>Myosurus minimus</i> L.	—	—
354	<i>Nassella charuanna</i>	Lobed needlegrass	Y
355	<i>Nassella hyalina</i>	Cane needlegrass	Y
356	<i>Nassella neesiana</i> (Trinius & Ruprecht) Barkworth	Chilean needle grass	Y
357	<i>Nassella tenuissima</i>	Mexican feathergrass	Y
358	<i>Nassella trichotoma</i> (Nees) Hack. ex Arechav.	Serrated tussock	Y
359	<i>Nephrolepis cordifolia</i> (L.) C.Presl	Fishbone fern, herringbone fern, sword fern	—
360	<i>Nicotiana glauca</i> Graham	Tree tobacco	—
361	<i>Nothoscordum inodorum</i> (Aiton) G.Nicholson	—	—
362	<i>Nymphaea alba</i> L.	—	—
363	<i>Oenothera affinis</i> Cambess.	—	—
364	<i>Oenothera indecora</i> Cambess.	—	—
365	<i>Oenothera mollissima</i> L.	Argentine evening-primrose	—
366	<i>Oenothera stricta</i> Link	—	—
367	<i>Olea europaea</i> L.	Olive	Y
368	<i>Olea europaea</i> L. ssp. <i>cuspidata</i>	Wild olive, African olive	—
369	<i>Oncosiphon suffruticosum</i> (L.) M.Kallerjo	Calomba daisy	—

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## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
370	<i>Onopordum acanthium</i> L.	Scotch thistle	Y
371	<i>Onopordum acaulon</i> L.	Stemless thistle	Y
372	<i>Opuntia aurantiaca</i> Lindl.	Tiger pear	Y
373	<i>Opuntia dejecta</i> Salm-Dyck	—	—
374	<i>Opuntia elatior</i> Mill.	—	Y
375	<i>Opuntia ficus-indica</i> (L.) Mill.	Indian fig	Y
376	<i>Opuntia lindheimeri</i> Engelm.	—	—
377	<i>Opuntia lindheimeri</i> var. <i>lindheimeri</i>	—	—
378	<i>Opuntia lindheimeri</i> var. <i>linguiformis</i>	—	—
379	<i>Opuntia paraguayensis</i> K.Schum.	—	Y
380	<i>Opuntia puberula</i> Hort.Vindob. ex Pfeiff.	—	Y
381	<i>Opuntia robusta</i> Pfeiff.	Wheel cactus	Y
382	<i>Opuntia schickendantzii</i> A.Web.	—	—
383	<i>Opuntia streptacantha</i> Lemaire	Cardona pear, white-spined pear, gracemere pear, westwood pear	—
384	<i>Opuntia stricta</i> Haw.	Common prickly pear	Y
385	<i>Opuntia stricta</i> var. <i>dillenii</i>	—	Y
386	<i>Opuntia stricta</i> var. <i>stricta</i>	—	Y
387	<i>Opuntia sulphurea</i> Loudon	—	—
388	<i>Opuntia tomentosa</i> Salm-Dyck	Velvet tree pear	Y
389	<i>Opuntia tunicata</i> Hort.Berol. ex Pfeiff	—	—
390	<i>Oryzopsis miliacea</i> (L.) Benth. & Hook.f. ex Asch. & Schweinf.	—	—
391	<i>Osteospermum muricatum</i> E.Mey.	—	—
392	<i>Oxalis bowiei</i> Lindl.	—	—
393	<i>Oxalis corymbosa</i> DC.	—	—
394	<i>Oxalis pes-caprae</i> L.	Soursob	—
395	<i>Panicum antidotale</i> Retz.	—	—
396	<i>Panicum bulbosum</i> Kunth	—	—
397	<i>Panicum capillare</i> L.	—	—
398	<i>Panicum coloratum</i> L.	—	—
399	<i>Panicum maximum</i> Jacq.	Guinea grass, green panic	—
400	<i>Panicum miliaceum</i> L.	—	—
401	<i>Papaver dubium</i> L.	—	—
402	<i>Papaver hybridum</i> L.	—	—
403	<i>Papaver somniferum</i> L.	Opium poppy	—
404	<i>Parapholis incurva</i> (L.) C.E.Hubb.	—	—
405	<i>Parapholis strigosa</i> (Dumort.) C.E.Hubb.	—	—
406	<i>Parentucellia latifolia</i> (L.) Caruel	Broadleaf glandweed	—
407	<i>Parkinsonia aculeata</i> L.	Parkinsonia	Y
408	<i>Paronychia brasiliiana</i> DC.	—	—
409	<i>Parthenium hysterophorus</i> L.	Parthenium	Y
410	<i>Paspalum dilatatum</i> Poir.	—	—
411	<i>Paspalum notatum</i> Flugge	Bahia grass	Y
412	<i>Passiflora fetida</i> L.	Stinking passion flower	—
413	<i>Peganum harmala</i> L.	African rue	Y
414	<i>Pelargonium alchemilloides</i> L'Herit.ex	—	—
415	<i>Pennisetum alopecuroides</i> (L.) Spreng.	—	—
416	<i>Pennisetum clandestinum</i> Hochst. Ex Chiov.	—	—
417	<i>Pennisetum polystachion</i> (L.) Schult.	Mission grass	Y
418	<i>Pennisetum setaceum</i> (Forssk.) Chiov.	African fountain grass	Y
419	<i>Pennisetum villosum</i> R.Br. ex Fresen.	Feathertop	—
420	<i>Pentaschistis airoides</i> (Nees) Stapf	Annual pentaschistis	—
421	<i>Pereskia aculeata</i> Mill.	Blade cactus, leaf cactus	Y

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## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
422	<i>Petrorhagia nanteuilii</i> (Burnat) P.W.Ball & Hetwood	—	—
423	<i>Phalaris aquatica</i> L.	—	—
424	<i>Phalaris canariensis</i> L.	Annual canarygrass	—
425	<i>Phalaris coerulescens</i> Desf.	—	—
426	<i>Phalaris minor</i> Retz.	—	—
427	<i>Phalaris paradoxa</i> L.	—	—
428	<i>Phleum pratense</i> L.	—	—
429	<i>Phyla canescens</i> Greene	Lippia	Y
430	<i>Phyla nodiflora</i> (L.) Greene	—	Y
431	<i>Physalis lanceifolia</i> Nees	—	—
432	<i>Physalis micrantha</i> Link	—	—
433	<i>Physalis minima</i> L.	Wild gooseberry	—
434	<i>Physalis viscosa</i> L.	Sticky cape gooseberry	Y
435	<i>Phytolacca americana</i> L.	—	—
436	<i>Phytolacca octandra</i> L.	—	—
437	<i>Picris echioides</i> L.	Bristly oxtongue	—
438	<i>Picris hieracioides</i> L.	Hawkweed oxtongue	—
439	<i>Pinus halepensis</i> Mill.	Aleppo pine	—
440	<i>Pistia stratiotes</i> L.	Water lettuce	—
441	<i>Pithecellobium dulce</i> (roxb.) Benth.	Madras thorn	—
442	<i>Pittosporum undulatum</i> Vent.	Mock orange, white holly	—
443	<i>Plagiobothrys canescens</i> Benth.	—	—
444	<i>Plantago coronopus</i> L.	—	—
445	<i>Plantago lanceolata</i> L.	Plantain	—
446	<i>Poa annua</i> L.	Annual bluegrass	—
447	<i>Poa bulbosa</i> L.	—	—
448	<i>Poa pratensis</i> L.	Kentucky bluegrass	—
449	<i>Podospermum resedifolium</i> (L.) DC.	—	—
450	<i>Polycarpon tetraphyllum</i> (L.) L.	Four-leaf allseed	—
451	<i>Polygonum aviculare</i> L.	—	—
452	<i>Polygonum convolvulus</i> L.	—	—
453	<i>Polygogon monspeliensis</i> (L.) Desf.	—	—
454	<i>Potentilla supina</i> L.	—	—
455	<i>Praxelis clematidea</i> (Griseb.) R.M.King & H.Rob.	Praxelis	Y
456	<i>Proboscidea louisianica</i> (Mill.) Thell.	Purple-flowered devil's claw	Y
457	<i>Prosopis glandulosa</i> Torr.	Mesquite	Y
458	<i>Prosopis glandulosa</i> var. <i>glandulosa</i>	Mesquite	Y
459	<i>Prosopis glandulosa</i> × <i>Prosopis velutina</i>	Mesquite	Y
460	<i>Prosopis juliflora</i> (Sw.) DC.	Mesquite	Y
461	<i>Prosopis juliflora</i> var. <i>glandulosa</i>	Mesquite	Y
462	<i>Prosopis limensis</i> Benth.	Algaroba, mesquite	Y
463	<i>Prosopis pallida</i> H.B. and K.	Algaroba	Y
464	<i>Prosopis velutina</i> Wooton	—	Y
465	<i>Psilocaulon tenue</i> (Haw.) Schwantes	Wiry noon-flower, match-head plant	—
466	<i>Pyracantha angustifolia</i> C.K.Schneid.	Firethorn	—
467	<i>Ranunculus muricatus</i> L.	—	—
468	<i>Ranunculus sceleratus</i> L.	Celery-leaf buttercup	—
469	<i>Ranunculus trilobus</i> Desf.	—	—
470	<i>Raphanus raphanistrum</i> L.	Wild radish, jointed charlock	Y
471	<i>Rapistrum rugosum</i> (L.) All.	Turnip weed, giant mustard, brassica	Y
472	<i>Reichardia tingitana</i> (L.) Roth	—	—
473	<i>Reseda lutea</i> L.	Cut-leaf mignonette	—
474	<i>Reseda luteola</i> L.	Weld, wild mignonette	Y
475	<i>Reseda odorata</i> L.	Mignonette	—

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## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
476	<i>Rhynchelytrum repens</i> (Willd.) C.E.Hubb.	—	—
477	<i>Ricinus communis</i> L.	Castor oil plant	—
478	<i>Robinia pseudoacacia</i> L.	False acacia	—
479	<i>Romulea minutiflora</i> Klatt	Small flowered onion grass	—
480	<i>Romulea rosea</i> (L.) Eckl.	Guildford grass, onion grass	Y
481	<i>Rosa canina</i> L.	Dog rose	—
482	<i>Rosa rubiginosa</i> L.	Sweet briar	Y
483	<i>Rubus fruticosus</i> sp. agg.	Blackberry	Y
484	<i>Rumex conglomeratus</i> Murray	—	—
485	<i>Rumex crispus</i> L.	Dock	—
486	<i>Rumex pulcher</i> L.	—	—
487	<i>Sagina apetala</i> Ard.	Pearlwort	—
488	<i>Sagittaria montevidensis</i> Cham. & Schitdl.	Arrowhead	—
489	<i>Salpichroa origanifolia</i> (lam.) Thell.	Pampas lily-of-the-valley	—
490	<i>Salvia reflexa</i> Hornem.	Mintweed	—
491	<i>Salvia verbenaca</i> L.	Wild sage	—
492	<i>Salvinia molesta</i> D.S.Mitch	Salvinia	Y
493	<i>Sanguisorba minor</i> Scop.	—	—
494	<i>Schinus areira</i> L.	—	—
495	<i>Schinus molle</i> L.	Pepper tree, Peruvian peppertree	Y
496	<i>Schinus terebinthifolius</i> Raddi	Broad-leaf pepper tree, Brazilian pepper	Y
497	<i>Schismus arabicus</i> Nees	—	—
498	<i>Schismus barbatus</i> (L.) Thell.	—	—
499	<i>Schkuhria pinnata</i> (lam.) Thell.	—	—
500	<i>Scirpus hystrix</i> Thumb.	—	—
501	<i>Scleranthus annuus</i> L.	—	—
502	<i>Sclerolaena birchii</i> (F.Muell.) Domin	Galvanised burr	—
503	<i>Scolymus hispanicus</i> L.	Golden thistle	—
504	<i>Scolymus maculatus</i> L.	Spotted thistle	Y
505	<i>Senecio madagascariensis</i> Poir.	Fireweed	—
506	<i>Senna alata</i> (L.) Roxb.	Ringworm shrub	—
507	<i>Senna hirsuta</i> (L.) H.S.Irwin & Barneby	Sicklepod	—
508	<i>Senna obtusifolia</i> (L.) H.S.Irwin & Barneby	Sicklepod	Y
509	<i>Senna occidentalis</i> (L.) Link	Coffee senna	Y
510	<i>Senna pendula</i> (willd.) H.S.Irwin & Barneby	Easter cassia	—
511	<i>Senna siamea</i> (Lamarck) H.S.Irwin & Barneby	Siamese cassia	—
512	<i>Senna tora</i> (L.) Roxb.	Sicklepod	Y
513	<i>Sesbania punicea</i> Benth.	Red sesbania	—
514	<i>Setaria geniculata</i> (Lam.) P.Beauv.	—	—
515	<i>Setaria glauca</i> (L.) P.Beauv.	—	—
516	<i>Setaria italica</i> (L.) P.Beauv.	—	—
517	<i>Setaria verticillata</i> (L.) P.Beauv.	Whorled pigeon grass	—
518	<i>Setaria viridis</i> (L.) P.Beauv.	—	—
519	<i>Sida acuta</i> Burm.f.	Spiny-head sida	Y
520	<i>Sida cordifolia</i> L.	Flannel weed	Y
521	<i>Sida rhombifolia</i> L.	Big Jack, paddy's lucerne	Y
522	<i>Silene apetala</i> Willd.	—	—
523	<i>Silene gallica</i> L.	—	—
524	<i>Silene nocturna</i> L.	—	—
525	<i>Silybum marianum</i> (L.) Gaertn.	Variagated thistle	Y
526	<i>Sinapis alba</i> L.	Mustard	—
527	<i>Sinapis arvensis</i> L.	—	—
528	<i>Sisymbrium altissimum</i> L.	Brassica	—
529	<i>Sisymbrium erysimoides</i> Desf.	Smooth mustard	—

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## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
530	<i>Sisymbrium irio</i> L.	London rocket	—
531	<i>Sisymbrium officinale</i> (L.) Scop.	—	—
532	<i>Sisymbrium orientale</i> L.	—	—
533	<i>Sisymbrium thellungii</i> O.E.Schulz	African turnip weed	—
534	<i>Solanum elaeagnifolium</i> Cav.	Silver-leaf nightshade	Y
535	<i>Solanum hoplopetalum</i> Bitter & Summerh.	Afghan thistle	—
536	<i>Solanum linnaeanum</i> Hepper & P.-M.L.Jaeger	Apple of sodom, poison weed, poison bush	—
537	<i>Solanum nigrum</i> L.	Blackberry nightshade, nightshade	—
538	<i>Solanum pseudocapsicum</i> L.	Madeira winter cherry	—
539	<i>Solanum rostratum</i> Dunal	Pincushion nightshade, buffalo burr	—
540	<i>Solanum sodomaeum</i> L.	—	—
541	<i>Solanum triflorum</i> Nutt.	Three-flowered nightshade	—
542	<i>Soliva anthemifolia</i> (Juss.) R.Br. ex Less	Dwarf Jo-jo, button burweed	—
543	<i>Soliva pterosperma</i> (Juss.) Less.	—	—
544	<i>Sonchus asper</i> Vill.	—	—
545	<i>Sonchus oleraceus</i> L.	—	—
546	<i>Sorghum bicolor</i> (L.) Moench	—	—
547	<i>Sorghum halepense</i> (L.) Pers.	Johnson grass	—
548	<i>Spergula pentandra</i> L.	—	—
549	<i>Spergularia diandra</i> (Guss.) Boiss.	—	—
550	<i>Sphagneticola trilobata</i> (L.) Pruski	Singapore daisy	—
551	<i>Sporobolus fertilis</i> Clayton	Giant Parramatta grass	Y
552	<i>Sporobolus jacquemontii</i> Kunth	American rat's tail grass	Y
553	<i>Sporobolus natalensis</i> T.Durand & Schinz	Giant rat's tail grass	Y
554	<i>Sporobolus pyramidalis</i> P.Beauv	Giant rat's tail grass	Y
555	<i>Sporobolus africanus</i> (Poir.) Robyns & Tournay	Parramatta grass	Y
556	<i>Stachytarpheta cayennensis</i> (Rich.) J.Vahl	Snake weed	—
557	<i>Stachytarpheta dichotoma</i> (Ruiz & Pav.) J.Vahl	Snake weed	—
558	<i>Stachytarpheta jamaicensis</i> (L.) J.Vahl	Snake weed	—
559	<i>Stachytarpheta mutabilis</i> (Jacq.) J.Vahl	Snake weed	—
560	<i>Stellaria media</i> (L.) Cirillo	Chickweed	—
561	<i>Striga curviflora</i> (R.Br.) Benth.	Witchweeds	—
562	<i>Striga parviflora</i> (R.Br.) Benth.	—	—
563	<i>Striga squamigera</i> W.R.Barker	—	—
564	<i>Stylosanthes humilis</i> Kunth	Stylo	—
565	<i>Stylosanthes scabra</i> Vogel	Stylo	Y
566	<i>Stylosanthes scabra</i> var. <i>seca</i>	Stylo	Y
567	<i>Tagetes minuta</i> L.	—	—
568	<i>Tamarix aphylla</i> Karst.	Athel pine, tamarisk	Y
569	<i>Tamarix ramosissima</i> Ledeb.	—	Y
570	<i>Taraxacum officinale</i> (L.) Weber	—	—
571	<i>Tecoma stans</i> Juss.	Yellow bells	—
572	<i>Themeda quadrivalvis</i> (L.) Kuntze	Grader grass	Y
573	<i>Thunbergia laurifolia</i> Lindl.	Laurel clock vine	Y
574	<i>Tragopogon porrifolius</i> L.	—	—
575	<i>Tribulus cistoides</i> L.	Caltrop	—
576	<i>Tribulus terrestris</i> L.	Caltrop	Y
577	<i>Trifolium angustifolium</i> L.	Clover	—
578	<i>Trifolium arvense</i> L.	—	—
579	<i>Trifolium campestre</i> Schreb.	—	—
580	<i>Trifolium cernuum</i> Brot.	—	—
581	<i>Trifolium dubium</i> Sibth.	—	—
582	<i>Trifolium glomeratum</i> L.	—	—
583	<i>Trifolium striatum</i> L.	—	—

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## Appendix 1. (continued)

No.	Scientific name	Common name	Biodiversity threat
584	<i>Trifolium subterraneum</i> L.	—	—
585	<i>Trifolium tomentosum</i> L.	—	—
586	<i>Trigonella ornithopodioides</i> (L.) DC.	—	—
587	<i>Trisetum flavescens</i> (L.) P.Beauv. ( <i>Lophochloa flavescens</i> )	Yellow oat-grass	—
588	<i>Triumfetta rhomboidea</i> Jacq.	Chinese burr	—
589	<i>Typha domingensis</i> Pers.	Cumbungi, narrow-leaved cumbungi, bulrush, narrow-leaved bulrush	—
590	<i>Ulex europaeus</i> L.	Gorse	—
591	<i>Urochloa panicoides</i> P.Beauv.	—	—
592	<i>Urtica urens</i> L.	Dwarf nettle, stinging nettle	—
593	<i>Vaccaria pyramidata</i> Medik.	—	—
594	<i>Verbascum thapsus</i> L.	Great mullein, shepherd's blanket	—
595	<i>Verbascum virgatum</i> Stokes	Twiggy mullein, green mullein	—
596	<i>Verbena bonariensis</i> L.	—	—
597	<i>Verbena hispida</i> Ruiz & Pav.	—	—
598	<i>Verbena officinalis</i> L.	Vervain	—
599	<i>Verbena supina</i> L.	—	—
600	<i>Verbena tenuisecta</i> Briq.	—	—
601	<i>Verbesina encelioides</i> (Cav.) A.Gray	Golden crown-beard	—
602	<i>Veronica arvensis</i> L.	Wall speedwell	—
603	<i>Veronica catenata</i> Pennell	Chain speedwell	—
604	<i>Veronica peregrina</i> L.	Wandering speedwell	—
605	<i>Vetiveria elongata</i> (R.Br.) C.E.Hubb.	Vetiver grass	—
606	<i>Vetiveria filipes</i> C.E.Hubb.	—	—
607	<i>Vetiveria pauciflora</i> S.T.Blake	—	—
608	<i>Vetiveria rigida</i> B.K.Simon	—	—
609	<i>Vicia hirsuta</i> (L.) Gray	—	—
610	<i>Vicia monantha</i> Retz.	—	—
611	<i>Vicia sativa</i> L.	—	—
612	<i>Vulpia bromoides</i> (L.) Gray	Six-week's fescue	—
613	<i>Vulpia megalura</i> (Nutt.) Rydb.	—	—
614	<i>Vulpia myuros</i> (L.) C.C. Gmel. var. <i>myuros</i>	—	—
615	<i>Xanthium ambrosioides</i> Hook. & Arn.	—	—
616	<i>Xanthium italicum</i> Moretti	Italian cocklebur	—
617	<i>Xanthium occidentale</i> Bertol.	Noogoora burr	Y
618	<i>Xanthium orientale</i> L.	Californian burr	Y
619	<i>Xanthium spinosum</i> L.	Bathurst burr	Y
620	<i>Xanthium strumarium</i> sp. agg.	Noogoora burr complex	—
621	<i>Zinnia peruviana</i> (L.) L.	—	—
622	<i>Ziziphus mauritiana</i> Lam.	Indian jujube, Chinese apple	Y

<sup>A</sup>The Australian plant name Index (APNI) [www.anbg.gov.au/databases/apni-about/index.html](http://www.anbg.gov.au/databases/apni-about/index.html) (accessed 24 March 2006).

<sup>B</sup>Index Kewensis (IK) via the International Plant Names Index [www.ipni.org/copyright.html](http://www.ipni.org/copyright.html) (accessed 24 March 2006).

**Appendix 2. Interim Biogeographic Regionalisation of Australia (IBRA) regions that occur in the rangelands**  
 Of the 85 IBRA regions, 53 contain rangelands and are listed below along with the state/territory in which they occur.  
 Victoria and Tasmania do not contain rangelands and hence are not listed below

Bioregion name and code	State/Territory			
Arnhem Coast (ARC)		NT		
Arnhem Plateau (ARP)		NT		
Brigalow Belt North (BBN)			QLD	
Brigalow Belt South (BBS)	NSW		QLD	
Broken Hill Complex (BHC)	NSW			SA
Burt Plain (BRT)		NT		
Cape York Peninsula (CYP)			QLD	
Carnarvon (CAR)				WA
Central Arnhem (CA)		NT		
Central Kimberley (CK)		NT		WA
Central Ranges (CR)		NT		
Channel Country (CHC)	NSW	NT	QLD	SA
Cobar Penplain (CP)	NSW			
Coolgardie (COO)				WA
Daly Basin (DAB)		NT		
Dampierland (DL)				WA
Darling Riverine Plains (DRP)	NSW		QLD	
Darwin Coastal (DAC)		NT		
Davenport Murchison Ranges (DMR)		NT		
Desert Uplands (DEU)			QLD	
Einiasleigh Uplands (EIU)			QLD	
Finke (FIN)		NT		SA
Flinders Lofty Block (FLB)				SA
Gascoyne (GAS)				WA
Gawler (GAW)				SA
Geraldton Sandplains (GS)				WA
Gibson Desert (GD)		NT		WA
Great Sandy Desert (GSD)		NT		WA
Great Victoria Desert (GVD)				SA
Gulf Coastal (GUC)		NT	QLD	
Gulf Falls and Uplands (GFU)		NT	QLD	
Gulf Plains (GUP)		NT	QLD	
Hampton (HAM)				SA
Little Sandy Desert (l.s.d.)				WA
MacDonnell Ranges (MAC)		NT		
Mitchell Grass Downs (MGD)		NT	QLD	
Mt Isa Inlier (MII)		NT	QLD	
Mulga Lands (ML)	NSW		QLD	
Murchison (MUR)				WA
Murray–Darling Depression (MDD)	NSW			SA
Northern Kimberley (NK)		NT		WA
Nullarbor(NLL)				SA
Ord-Victoria Plains (OVP)		NT		WA
Pilbara (PIL)				WA
Pine Creek (PCK)		NT		
Riverina (RIV)	NSW			SA
Simpson-Strzelecki Dunefields (SSD)				SA
Stony Plains (STP)		NT		SA
Sturt Plateau (STU)		NT		
Tanami (TAN)		NT		WA
Tiwi Cobourge (TIW)		NT		
Victoria Bonaparte (VB)		NT		WA
Yalgoo (YAL)				WA

Source: Australian Land and Water Audit, Commonwealth of Australia [audit.deh.gov.au/ANRA/rangelands/rangelands\\_frame.cfm?region\\_type=AUSandregion\\_code=USandinfo=description](http://audit.deh.gov.au/ANRA/rangelands/rangelands_frame.cfm?region_type=AUSandregion_code=USandinfo=description) (accessed 24 March 2006).