Impact assessment and analysis of sixty-six priority invasive weeds in south-east Queensland

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Summary

A reference panel of 13 professional scientists estimated the current level of impact and future impact of 66 priority environmental weeds in south-east Queensland. Impact scores did not significantly change the order of importance of most species relative to a previously published ranking based on invasiveness scores. The ten species ranked highest on impact, in descending order, were lantana (*Lantana camara*), cat's claw creeper (*Macfadyena unguis-cati*), Chinese celtis (*Celtis sinensis*), Madeira vine (*Anredera cordifolia*), camphor laurel (*Cinnamomum camphora*), green panic (*Panicum maximum*), broad-leaf pepper tree (*Schinus terebinthifolius*), asparagus ground fern (*Asparagus aethiopicus*), cabomba (*Cabomba caroliniana*) and ornamental asparagus (*Asparagus africanus*).

Future impact data indicate that the reference panel believe that most species will be more problematic in the future than they are at present. Priority arboreal weeds have been naturalized in the region for longer than the herbaceous weeds. Humans were responsible for the introduction of all 66 priority weeds in south-east Queensland, with 7% accidentally introduced and 93% deliberately introduced. The origins of these deliberately introduced plant species were ornamental (67%), agricultural (17%) and aquarium (9%). Humans (including use of roadside machinery), animals and water are the most important dispersers of these weeds. Roadsides are generally important habitats for exotic plants, including some priority environmental weeds (31% of these weeds are common on raodsides). However, the presence of environmental weed on roadsides has frequently been trivialized. Landscape managers need to be aware of this problem.

Introduction

Over the last 25 years weed invasions and resulting damage to the environment have been an increasing feature in Australian landscapes (Groves *et al.* 1998). Impacts of invasive species are difficult and costly to measure, and comparisons between the impacts of different species are problematic, particularly for diverse landscapes (Panetta 2000, Panetta *et al*. 2001, Randall *et al*. 2001, Williamson 2001). The concept of environmental weed impact arises from contemporary human values in relation to conservation and well-being. As time and/or human values change the impact criteria may also change. Impact values of environmental weeds are inherently more difficult to quantify than agricultural weeds (Panetta and James 1999, Groves *et al*. 2000, Randall 2000, Williamson 2001).

Current indications are that the impact of invasive weeds could include extinction of some rare plant species in Australia (Leigh *et al*. 1984, Leigh and Briggs 1992). Increasingly detrimental impacts of weeds are considered as one of the major factors that diminish natural habitat values for conservation (Groves *et al.* 2000, Randall 2000, Panetta *et al*. 2001). The extent of damage caused by environmental weeds is not just limited to natural ecosystems. For example, loss of native species not only results in loss of species, materials and products but also loss of benefits for life-fulfilling human values (Panetta 2000). From environmental, economic and social viewpoints, impact categorization of environmental weeds helps to prioritize research and control efforts.

South-east Queensland is a region of high species richness and ecosystem diversity. The region represents about 5% of Queensland's area but supports 53% (4150 species) of the State's native vascular flora and about 80% (1060 species) of the State's naturalized flora. In south-east Queensland, naturalized exotic plants account for 20% of the total vascular flora. This has been increasing by about nine species per year over the last 90 years (Batianoff *et al.* 2001). It is suggested that this region supports the largest number of naturalized plants of any similar sized region in Australia. Some two hundred exotic plant species are currently posing a serious threat to native vegetation in this region (Batianoff and Butler 2002a). Landscape managers have a pressing need for practical assessments of the environmental weed impact in this area.

The first comprehensive assessment and prioritization of environmental weeds in south-east Queensland was based on invasiveness and frequency (Batianoff and Butler 2002a). This prioritization did not consider the relative impact of the exotic species on natural ecosystems. According to Rejmánek (2000) invasiveness is considered to be a more objective criterion than impact, particularly for assessment of large numbers of naturalized plants. The aim of this paper is to examine perceptions of impact on 66 priority weed species in south-east Queensland. Relationships between some biological plant characters, invasiveness and impact will also be discussed.

Methods

This paper re-examines the top 66 priority environmental weeds listed in Batianoff and Butler (2002a) evaluating their perceived detrimental impacts on the environment in south-east Queensland. Factors considered in the evaluation of impact included effects of exotic plant populations on wildlife recruitment; fire regimes, nutrient cycling, water oxygenation, poisoning or movement of wildlife, water or people, aesthetics, community structure and social well-being (adapted from Thorpe and Lynch 2000). However, current impact ranking does not include economic values derived from weedy plants. Only the top 66 of the 200 weeds listed by Batianoff and Butler (2002a) were considered because we believed that our understanding of the remaining 134 species was insufficient for this study. It should be noted that *Sporobolus natalensis* and *Sporobolus pyramidalis* were treated as a single entry in Batianoff and Butler (2002a) but are differentiated here. The study area is the same as that used by Batianoff and Butler (2002a).

Specimens from the Queensland Herbarium provided dates of first recorded naturalizations with the exception of *Chrysanthemoides monilifera* ssp. *rotundata, Lantana camara* and *Pinus elliottii*, for which the literature provided solid evidence of earlier naturalization than the specimen record suggested. Five life form categories (aquatic herb, terrestrial herb, vine, shrub and tree) and four categories for origin of introduction (agricultural, ornamental, aquarium, accidental/contaminant), as well as three diaspore types (dry, fleshy and vegetative) and four dispersal categories (animals, water, wind and humans) were used (Batianoff and Butler 2002b).

Perception of impact was assessed some twelve months after the completion of the invasiveness paper (Batianoff and Butler 2002a). The impact ranking used a single score independently applied by an expert reference panel (botanists and weed scientists). Panel members were Dane Panetta and Tom Anderson (Alan Fletcher Research Station, Department of Natural Resources and Mining), Bryan Hacker (CSIRO), John Swarbrick (consultant), Mike Olsen (consultant), and the following Queensland Herbarium (Environment

Protection Agency) botanists, George Batianoff, Tony Bean, Rod Fensham, Gordon Guymer, Ailsa Holland, Sue Phillips, Sandy Pollock and Kathy Stephens. Panel members were asked to place each invasive species into one of five classes based on their perceived impact upon natural habitats in the south-east Queensland region. Examples of impact scores for weedy species were provided to panel members (Table 1) but referred to northern Australia so as not to unduly influence them. Panel members also estimated the likely 'future trend' of impact for each species over the next ten years using three categories 'up' (1), 'down' (-1), and 'same' (0).

The panel scores were averaged to produce a 'perceived impact score' and 'future trend' score for each species. In the first instance the species were ranked according to perceived impact scores. Followed by adjustments of species with an equal rank (ties in impact), by assigning higher ranks to species with the greater score in the future trend ranking. The results are compared with previous results presented by Batianoff and Butler (2002a) in two ways. Species ranks were compared between the two lists and perceived impact scores were compared with invasiveness scores (Batianoff and Butler 2002a) using linear regression. The resulting linear model of the relationship between impact and invasiveness was used to predict impact score for each species based on their invasiveness score. Analysis of Variance (ANOVA) was used to compare the perceived impact scores and the differences between the predicted impact and the perceived impact score between life form categories. Linear regression was used to examine the relationship between period of naturalization and impact scores. Period of naturalization was compared between life forms using ANOVA.

Results and discussion

A list of 66 species ranked in order of decreasing perceived impact score and future trend with life forms, origins, period of naturalization, diaspore and dispersal data is presented in Appendix 1. The ranking based on perceived impact is similar to the order developed from invasiveness in our earlier work (Batianoff and Butler 2002a). According to Batianoff and Butler (2002a) the assessment of weediness is related to 'apparent' and/or 'perceived' biomass of plant material. Distribution of life forms within impact categories of severe (4 to 5), moderate (>3 and <4) and low (<3) is illustrated in Figure 1. The data indicate that all five life form classes occur in the low to moderate impact levels, but only trees, shrubs and vines are part of the severe impact category.

Five species (7.6%) received average impact scores that indicated severe to very severe impact (≥4). These weeds were *Lantana camara, Macfadyena unguis-cati, Celtis sinensis, Anredera cordifolia* and *Cinnamomum camphora.* Twenty-six species (39%) received average scores indicating moderate impacts and 35 species (53%) fell in the range of low impacts. Arboreal weeds (large plants) generally received higher impact ranking than smaller terrestrial herbs (Figure 1).

The rank order based on impact scores is different from the previous order based on invasiveness. Figure 2 shows the frequency distribution of classes of absolute change in rank between invasiveness prioritization (Batianoff and Butler 2002a) and impact prioritization (Appendix 1). Sixty-eight percent of species moved less than 14 ranks. However, some 13 (20%) species moved rank between 20 to 14 places and eight (12%) species moved rank by 27 to 21 places. Changes of ranking were 48% up, 48% down and only 4% no change to ranking position. Species that changed their ranking position by more than ten places are listed in Table 2. This table provides some explanations as to why impact categorizations may greatly change the order of some species based on invasiveness ranking. We suggest that high similarity between invasiveness and impact rank order is because perceptions of weediness are largely based on invasiveness and plant biomass (Table 1, Figures 1 and 3).

Impacts of environmental weeds on natural habitat are very complex (Rejmánek 2000, Panetta *et al*. 2001). Consequently the reference panel was asked to consider many factors such as impacts on wildlife recruitment, species richness, aesthetics, fire regimes, nutrient cycling and water quality. Notes in Table 2 highlight the ability of the reference panel to use factors other than invasiveness and biomass as they changed ranking order between the current impact prioritization and the Batianoff and Butler

Table 1. Categorization of impacts scores of environmental weeds.

Score	Level of impact
5	Very severe (e.g. hymenachne[A] (*Hymenachne amplexicaulis*) or prickly acacia (*Acacia nilotica*).
4	Severe (eg. grader grass (*Themeda quadrivalvis*) or pond apple (*Annona glabra*).
3	Moderate (e.g. castor oil plant[A] (*Ricinus communis*), chinee apple (*Ziziphus mauritiana*) or mission grass (*Pennisetum polystachion*).
2	Low (e.g. Noogoora burr[A] (*Xanthium occidentale*) or Mexican poppy (*Argemone mexicana*).
1	Unknown (e.g. bulbil watsonia[A] (*Watsonia meriana*) or golden rain tree (*Koelreuteria elegans*).

[A] Indicates northern Australian example.

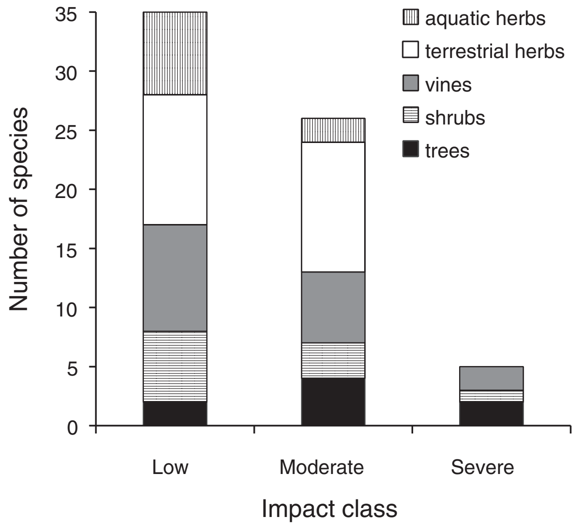

Figure 1. Distribution of life forms across impact classes for sixty-six species of south-east Queensland weeds in five life forms.

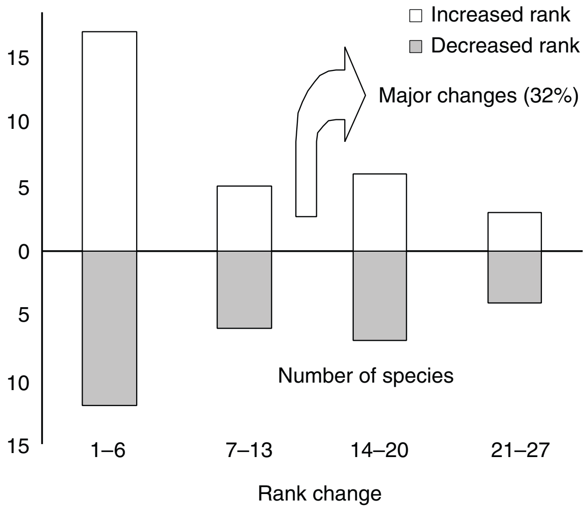

Figure 2. Frequency distribution of change in rank between invasiveness prioritization (Batianoff and Butler 2002a) and impact prioritization, the arrow indicating direction of major rank changes.

Table 2. List of species affected by impact ranking changes >10 places, with values listed and notes of possible reasons for the changes.

Plant names	Impact rank changes	Comments and notes
Desmodium uncinatum (silverleaf desmodium)	+27	Invasive and increasing along creek lines, roadsides and forest reserves.
Salvinia molesta (salvinia)	-26	Highly invasive aquatic weed. Populations reportedly decreasing due to successful biological and other control/containment measures (Anderson personal communication 2002).
Cryptostegia grandiflora (rubber vine)	-26	Invasive vine but reported low populations in SEQ possibly due to successful control/containment measures.
Bryophyllum delagoense (mother of millions)	-26	Highly invasive but patchy distribution, mainly coastal and neglected rural lands.
Ipomoea indicia (blue morning glory)	+25	Highly invasive, conspicuous and increasing along creeks, roadsides and small remnants particularly in built up areas.
Melinis repens (red Natal grass)	+24	Invasive and widespread in remnants and roadsides on wide range of soils.
Brachiaria mutica (para grass)	+23	Highly invasive and more visible along creeks, seashore and in remnant wetlands.
Passiflora suberosa (cork passionflower)	-23	Widespread but not as dominant as high impact vines such as cat's-claw creeper.
Chrysanthemoides monilifera ssp. *rotundata* (bitou bush)	-20	Highly invasive but perceived to be successfully contained in SEQ.
Baccharis halimifolia (groundsel bush)	-19	Invasive but decreasing populations due to control measures and closer human settlement.
Gymnocoronis spilanthoides (Senegal tea)	-18	Highly invasive, patchy distribution possibly perceived successful control/ containment measures in place?
Parthenium hysterophorus (parthenium weed)	-18	Invasive but uncommon in SEQ, draws strong control measures when found.
Ageratina adenophora (crofton weed)	-16	Old naturalization (familiarity), possibly population reduction?
Eragrostis curvula (African love grass)	-16	Thought of as pastoral/disturbance weed more than environmental weed problem in SEQ.
Cardiospermum grandiflorum (balloon vine)	+16	Invasive and increasing populations along drainage lines and waterways e.g. Brisbane River.
Pinus elliottii (slash pine)	+16	Invasive and conspicuously increasing on roadsides and heathlands in Sunshine Coast areas particularly near plantations.
Tradescantia fluminensis (wandering Jew)	+16	Invasive and increasing distribution, mainly in urban areas due to garden dumping.
Asparagus aethiopicus (asparagus ground fern)	+15	Highly invasive and increasing populations along the coast on sand dunes and Moreton Bay Islands.
Chloris gayana (Rhodes grass)	+15	Invasive and recognizable weed of creek lines, roadsides and small remnants.
Panicum maximum (green panic and guinea grass)	+14	Highly invasive, conspicuous and increasing populations along transport routes, waterways, coastal dunes and conservation reserves.
Eichhornia crassipes (water hyacinth)	-14	Highly invasive but overall population decrease, due to biological control and other containment measures (Anderson personal communication 2002).
Bryophyllum daigremontianum × *B. delagoense* (hybrid mother of millions)	-13	Invasive with patchy distribution, mainly coastal and neglected rural lands problem, subject to containment.
Alternanthera philoxeroides (alligator weed)	-11	Highly invasive with patchy distribution and subject to vigorous control/ containment measures.

(2002a) prioritizations. Importantly some panel members were adjusting impact ranking on some species due to perceived weed control practices.

Melinis repens, *Desmodium uncinatum*, *Chloris gayana* and *Panicum maximum* (green panic and/or guinea grass) were given much higher rankings than in the previous publication due to environmental concern (Table 2). These pasture species are currently widely dispersed along transport corridors and their invasion of the study area has been noticeably increasing. Twenty-one of the priority environmental weeds (31%) are listed as an important weeds of roadsides (Appendix 1). The importance of transport corridors as a source of environmental weed invasion has arguably been underestimated. The tolerance of *Lantana camara* and *Panicum maximum* as 'trivial' roadsides weeds along many south-east Queensland roads is a good example. Strategies for management of many serious environmental weeds must include roadside control and containment measures.

Highly invasive species such as *Salvinia molesta*, *Cryptostegia grandiflora*, *Bryophyllum delagoense*, *B. daigremontianum* × *B. delagoense* and *Chrysanthemoides monilifera* ssp. *rotundata* were assigned lower ranks, possibly due to perceived decrease in populations and/or successful containment measures (Table 2). The downgrading of *Baccharis halimifolia,* from position 2 to 21, reflects the effectiveness of this impact prioritization in integrating current species population trends. *Baccharis halimifolia* is a very invasive species and is a problem in south-east Queensland lowlands, particularly some Moreton Bay Islands. However, under current conditions the overall *B. halimifolia* population is decreasing as a consequence of change in land use and control efforts.

Impact and invasiveness scores were correlated (Figure 3, linear regression $r^2 = 0.46$, $P < 0.0001$). When the linear regression model was used to predict impact ('predicted impact' = 1.0706 (invasiveness) -1.658, Figure 3), the difference between predicted impact and the perceived impact scores suggested that trees attracted relatively high impact ratings (above line in Figure 3), particularly compared to aquatic herbs (below line in Figure 3). However, ANOVA found no significant difference between life forms for perceived impact scores ($F_{4,64} = 1.06$, $P = 0.38$) or for difference between predicted and perceived impact ($F_{4,64} = 2.19$, $P = 0.08$). Species with perceived impact scores higher than the predicted impact scores by the largest margin were *Asparagus aethiopicus, Lantana camara, Macfadyena unguis-cati, Panicum maximum* and *Celtis sinensis.* Species with the largest negative difference were *Alternanthera philoxeroides, Gymnocoronis spilanthoides, Thunbergia alata, Salvinia molesta* and *Passiflora suberosa.*

Future impact data indicate that the reference panel believe most species will be more problematic in the future than they are at present (Appendix 1, Figure 4). Only six species had average trend scores of zero or less, thereby suggesting panel members expected their impacts in the region would be similar or lower in the future. These species were *Solanum mauritianum, Passiflora subpeltata*, *Eichhornia crassipes*, *Salvinia molesta*, *Pistia stratiotes* and *Baccharis halimifolia.* The ten species that were predicted to show the greatest increase in impact over time were

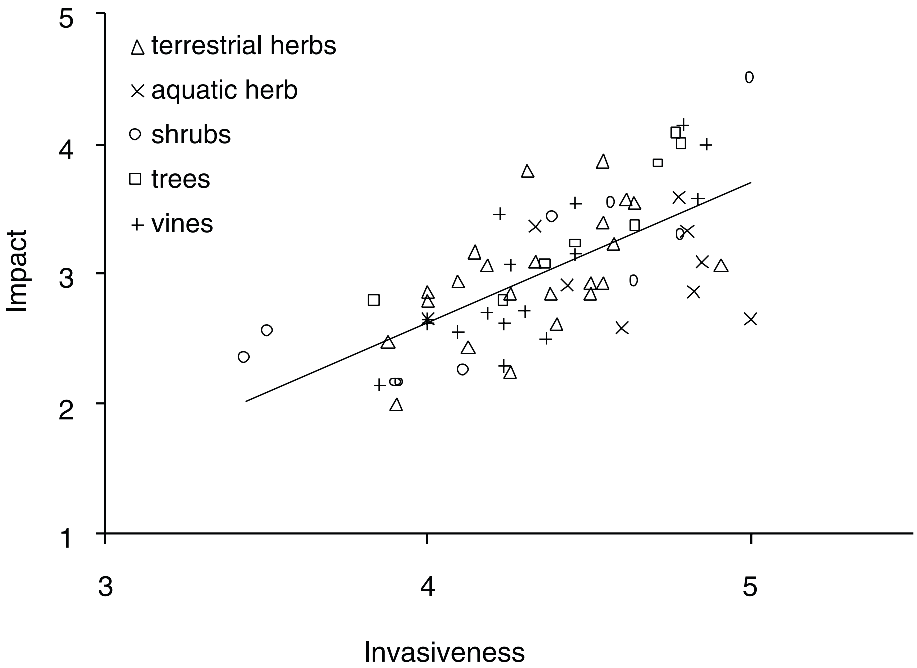

Figure 3. Correlation between invasiveness prioritization (Batianoff and Butler 2002a) and impact rankings for the sixty-six species of south-east Queensland weeds within five life form groups.

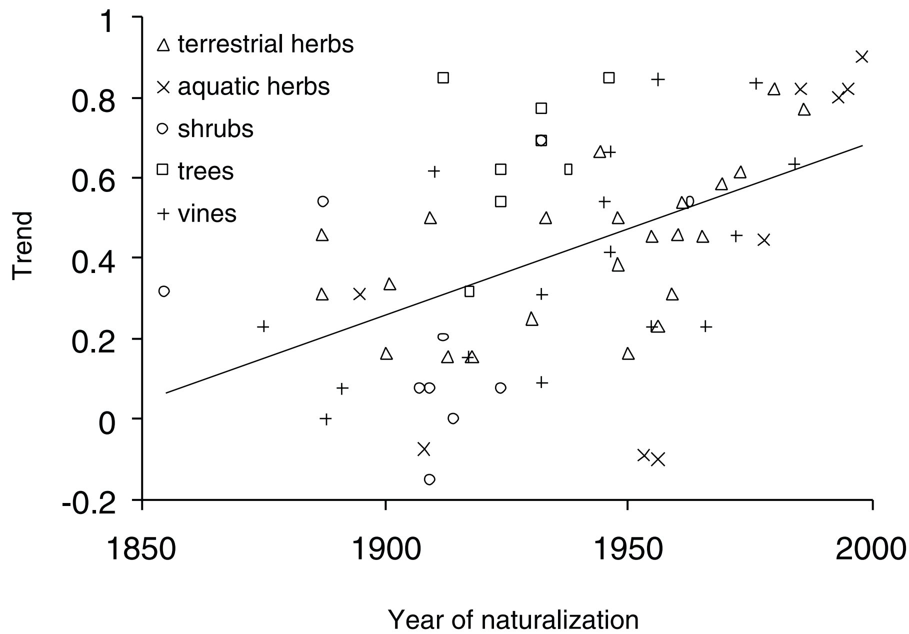

Figure 4. Correlation between year of naturalization (based on Queensland Herbarium specimen dates) and average 'future impact trend' responses for the sixty-six species of south-east Queensland weeds within five life form groups.

Alternanthera philoxeroides, Macfadyena unguis-cati, Celtis sinensis, Pinus elliottii, Asparagus africanus, Cabomba caroliniana, Sporobolus pyramidalis, Gymnocoronis spilanthoides, Hygrophila costata and *Schinus terebinthifolius.* Trees were assigned relatively high 'future trend' scores (mainly above the regression line in Figure 4), as were newly naturalized aquatics that are highly invasive.

Kowarick (1995) reported that in Germany 75% of woody invaders were cultivated for more than 100 years before beginning to invade. In this study there was a small but significant correlation between life forms and period of naturalization (ANOVA, $F_{4,61} = 3.28$, $P = 0.017$). Slower maturing life forms such as arboreal weeds (shrubs 89 years, trees 70 years) have generally been naturalized in the region for longer than vines (67 years), terrestrial herbs (60 years) and particularly aquatic herbs (44 years). The dates of first collected herbarium specimens are somewhat subject to botanical interest. As a result the periods given above should not be used as absolutes dates but as a trend. It would be logical to expect invasive species with longer periods of residency to have greater impact than newer less-adapted weedy species. Linear regressions found no significant correlation between perceived impact and period of naturalization among the sixty-six species studied for any life form.

Data on source or origin of plant introduction indicate that 59 (93%) of the 66 invasive weeds were deliberately brought to the study area (Appendix 1). Forty-four species (67%) were introduced as ornamentals, eleven (17%) for agriculture, six (9%) for aquaria and five (7%) are of unknown origin and possibly arrived as contaminants. Importance of humans in the introduction and ongoing dispersal of environmental weeds in south-east Queensland was reported by Batianoff *et al*. (2001). Data on dispersal vectors indicate that humans are important dispersers of environmental weeds. According to Armstrong (personal communication 2002) all roadside maintenance machinery, particularly mowers, are important means by which weeds are rapidly spread by humans. Other important vectors spreading weeds are animals (43%), water (39%) and wind (15%). The three diaspore types differentiated, in order of decreasing frequency were dry seeds, fleshy fruit and vegetative material. The majority of species are capable of vegetative propagation (41%), some (29%) have more than two dispersal vectors and 15% only produce vegetative diaspores. High priority weed species with mostly and/or only vegetative dispersal include *Alternanthera philoxeroides, Anredera cordifolia*, *Bryophyllum* spp., *Cabomba caroliniana*, *Ipomoea indicia*, *Salvinia molesta* and *Tradescantia fluminensis*. With the exception of the short lived *Salvinia molesta* and an annual *Parthenium hysterophorus*, all remaining species examined are long-lived perennials, of which *Melinis repens* has the shortest life span of 3–4 years.

Conclusion

The ranking systems based on invasiveness (Batianoff and Butler 2002a) and the current impact ranking were correlated. This correlation is likely to be primarily a consequence of the invasiveness criterion being incorporated in all indices of weediness. Plant biomass is also important to perception of both impact and invasiveness. Given the complexity of using impact as a measure of damage to the environment, the use of an expert reference panel provides a pragmatic approach to assess the impacts of environmental weeds. The use of a simple scoring method assisted the panel to effectively combine complex and abstract weediness issues into a single measure.

The list of sixty-six highly invasive environmental weeds ranked according to impact is another tool for land managers to rationalize weed problems in south-east Queensland. The most important advantage of this list over the published list based on invasiveness (Batianoff and Butler 2002a) is that the reference panel ranked environmental weeds according to perceived damage to the current environment. It also reflects contemporary human values in relation to conservation of natural vegetation and environmental weeds in south-east Queensland. Most impact levels stated in this paper are dependant on current weed control practices. If levels of weed controls are to change then we argue that the impact of many invasive species will also change.

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Appendix 1. List of sixty-six priority invasive weeds in south-east Queensland weeds, ranked according to impact with information on rank changes, life forms, source, impact values, probable trend, year of first Queensland records and reproduction.

Rank/#	Name	LF/SO	Impact	Trend	Year	Diaspore	Dispersal
1/1	*Lantana camara* var. *camara* (lantana)[DR]	s/o	4.50	0.31	1855?	f, v	z, w, h
2/4	*Macfadyena unguis-cati* (cat's claw creeper)	v/o	4.14	0.85	1956	d, v	a, w, h
3/7	*Celtis sinensis* (Chinese celtis)	t/o	4.08	0.85	1912	f, v	z, w, h
4/5	*Anredera cordifolia* (Madeira vine)	v/o	4.00	0.67	1946	v	w, h
5/8	*Cinnamomum camphora* (camphor laurel)	t/o	4.00	0.62	1924	f	z, w, h
6/20	*Panicum maximum* (green panic and guinea grass)[DR]	h/A	3.86	0.46	1887	d	w, h
7/9	*Schinus terebinthifolius* (broad-leaf pepper tree)[DR]	t/o	3.85	0.77	1932	f	z, w, h
8/23	*Asparagus aethiopicus* cv. *sprengeri* (asparagus ground fern)	h/o	3.79	0.62	1973	f, v	z, h
9/11	*Cabomba caroliniana* (cabomba, fanwort)	ha/f	3.58	0.82	1985	v	w, h
10/6	*Asparagus africanus* (ornamental asparagus, asparagus fern)	v/o	3.57	0.83	1976	f, v	z, h
11/16	*Sphagneticola trilobata* (Singapore daisy)	h/o	3.57	0.77	1986	v, d	w, h
12/18	*Lantana montevidensis* (creeping lantana)[DR]	s/o	3.54	0.54	1888	f, v	z, w, h
13/29	*Cardiospermum grandiflorum* (balloon vine)	v/o	3.54	0.54	1945	d	w, a, h
14/19	*Neonotonia wightii* (glycine)[DR]	v/A	3.54	0.46	1960	d	w, h
15/40	*Ipomoea indica* (blue morning glory)	v/o	3.46	0.31	1932	v	h
16/22	*Ochna serrulata* (ochna)	s/o	3.43	0.69	1932	f/d	z, w, h
17/25	*Ageratina riparia* (mistflower)	h/o	3.38	0.33	1901	d	a, w
18/15	*Ligustrum lucidum* (tree privet)	t/o	3.36	0.69	1932	f	z, w, h
19/42	*Brachiaria mutica* (para grass)	ha/A	3.36	0.31	1895	v, d	w, h
20/14	*Hygrophila costata* (glush weed)	ha/f	3.33	0.80	1993	v, d	w, h
21/2	*Baccharis halimifolia* (groundsel bush)[DR]	s/o	3.29	-0.15	1909	d	a, w, h
22/24	*Sporobolus pyramidalis* (giant rat's tail grass)[DR]	h/u	3.23	0.82	1980	d	z, h
23/21	*Ligustrum sinense* (Chinese privet)	t/o	3.23	0.62	1938	f	z, w, h
24/31	*Rivina humilis* (baby pepper)	h/o	3.17	0.17	1900	f	z, h
25/28	*Ipomoea cairica* (mile-a-minute)[DR]	v/o	3.14	0.23	1875	d, v	w, h
26/24	*Sporobolus natalensis* (giant rat's tail grass)[DR]	h/u	3.08	0.58	1969	d	z, h
27/13	*Eichhornia crassipes* (water hyacinth)	ha/f	3.08	-0.08	1908	v, d	w, h
28/44	*Pinus elliottii* (slash pine)	t/A	3.07	0.85	1936/1946	d	a, w, h
29/3	*Bryophyllum delagoense* (mother of millions)	h/o	3.07	0.54	1961	v, d	w, h
30/26	*Araujia sericifera* (moth plant)	v/o	3.07	0.42	1946	d	a, h
31/46	*Chloris gayana* (Rhodes grass)[DR]	h/A	3.07	0.15	1913	d	w, h
32/12	*Chrysanthemoides monilifera* ssp. *rotundata* (bitou bush)	s/o	2.93	0.54	1963?	f	z, w, h
33/17	*Ageratina adenophora* (crofton weed)	h/o	2.92	0.25	1930	d	a, w, h
34/38	*Melinis minutiflora* (molasses grass)[DR]	h/A?	2.92	0.23	1956	d	z, a, w, h
35/43	*Egeria densa* (egeria waterweed)	ha/f	2.91	0.44	1978	v, d	w, h
36/10	*Salvinia molesta* (salvinia)	ha/f	2.85	-0.09	1953	v	w, h
37/64	*Desmodium uncinatum* (silver-leaf desmodium)[DR]	h/A	2.84	0.31	1959	d	z, w, h
38/32	*Sporobolus africanus* (Parramatta grass)[DR]	h/u	2.83	0.50	1909	d	z, h
39/33	*Sporobolus fertilis* (giant Parramatta grass)[DR]	h/u	2.83	0.50	1948	d	z, w, h
40/27	*Bryophyllum daigremontianum* × *B. delagoense* (hybrid mother-of-millions)	h/o	2.83	0.45	1965	v	w, h
41/65	*Melinis repens* (red Natal grass)[DR]	h/A	2.81	0.15	1918	d	a, w, h
42/58	*Tradescantia fluminensis* (wandering Jew)	h/o	2.79	0.38	1948	v	h
43/41	*Leucaena leucocephala* (leucaena)[DR]	t/A	2.77	0.54	1924	d	w, h,
44/45	*Senna pendula* var. *glabrata* (Easter cassia)	t/o	2.77	0.31	1918	d	w, h
45/39	*Aristolochia elegans* (Dutchman's pipe)	v/o	2.71	0.09	1932	d	a, h

46/49	*Lonicera japonica* (Japanese honeysuckle)	v/o	2.69	0.62	1910	f, v	z, w, h
47/36	*Alternanthera philoxeroides* (alligator weed)	ha/u	2.64	0.90	1998	v	w, h
48/55	*Solanum seaforthianum* (Brazilian nightshade)	v/o	2.64	0.15	1917	f	z, h
49/56	*Pistia stratiotes* (water lettuce)	ha/f	2.64	-0.10	1956	v	w, h
50/34	*Eragrostis curvula* (African lovegrass)[DR]	h/A	2.62	0.67	1944	d	w, h
51/53	*Gloriosa superba* (glory lily)	v/o	2.62	0.45	1972	f, v	z, h
52/51	*Macroptilium atropurpureum* (siratro)[DR]	v/A	2.62	0.23	1966	d	w, h
53/35	*Gymnocoronis spilanthoides* (Senegal tea)	ha/f	2.58	0.82	1995	v, d	w, h
54/57	*Asparagus plumosus* (asparagus fern)	v/o	2.55	0.64	1984	f, v	z, w, h
55/60	*Senna septemtrionalis* (smooth cassia, was *S. floribunda*)	s/o	2.54	0.08	1907	d	w, h
56/30	*Cryptostegia grandiflora* (rubber vine)	v/o	2.50	0.23	1955	d	a, w, h
57/47	*Bryophyllum pinnatum* (resurrection plant)	h/o	2.46	0.50	1933	v	w, h
58/54	*Phyla canescens* (lippia)[DR]	h/o	2.43	0.17	1950	d, v	w, h
59/59	*Cestrum parqui* (green cestrum)[DR]	s/o	2.36	0.08	1924	f	z, w, h
60/37	*Passiflora suberosa* (cork passionflower)	v/o	2.29	0.08	1891	f	z, h
61/52	*Rubus ellipticus* (yellow raspberry)	s/o	2.25	0.20	1912	f	z, h
62/50	*Thunbergia alata* (black-eyed Susan vine)	v/o	2.23	0.31	1887	d, v	w, a, h
63/61	*Solanum mauritianum* (wild tobacco tree)	s/o	2.15	0.00	1914	f	z, w, h
64/62	*Catharanthus roseus* (pink periwinkle)	s/o	2.14	0.08	1909	d	z, h
65/63	*Passiflora subpeltata* (white passion flower)	v/o	2.14	0.00	1888	f	z, h
66/48	*Parthenium hysterophorus* (parthenium weed)[DR]	h/u	2.00	0.45	1955	d	a, w

Information on source, life form, dates (year) of first recorded naturalizations and dispersal (Batianoff and Butler 2002b).
rank based on invasiveness (Batianoff and Butler 2002a).
[DR] Disturbance and roadside weed.
Life Form (LF): t – tree, s – shrub, v – vine, h – terrestrial herb, ha – aquatic herb.
Source/Origin (SO): A – agriculture, o – ornamental, f – fish/aquaria, u – accidental/contaminant.
Diaspore: d – dry, f – fleshy, v – vegetative.
Dispersal; z – animals, w – water, a – wind, h – humans.