Assessment of invasive naturalized plants in south-east Queensland

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Summary

A list of 200 invasive naturalized species was prepared as a working document for the compilation of an environmental weed list for south-east Queensland. Species were selected from the 1060 naturalized taxa and were ranked based upon invasiveness and frequency in non-agricultural areas and/or remnant natural areas. The list was compiled using records of 1413 vegetation sites, 10 163 herbarium specimens and ranking scores of thirteen members of an expert assessment panel.

One third of the 200 species listed were categorized as highly invasive. Ninety percent were intentionally introduced for landscaping, agriculture and aquariums. One half of the list consist of herbs, including 34 species (17%) of grasses and 19 species (9%) of aquatic weeds. Woody weeds (shrubs and trees) are a problem in south-east Queensland, representing 37% (75 species). The ten highest ranked invasive species in descending order were lantana (*Lantana camara*), groundsel bush (*Baccharis halimifolia*), mother-of-millions (*Bryophyllum delagoense*), cat's claw creeper (*Macfadyena unguis-cati*), Madeira vine (*Anredera cordifolia*), ornamental asparagus (*Asparagus africanus*), Chinese celtis (*Celtis sinensis*), camphor laurel (*Cinnamomum camphora*), broad-leaf pepper tree (*Schinus terebinthifolius*) and salvinia (*Salvinia molesta*).

Introduction

Risk assessments and development of methodologies for prioritizing weedy species are recognized as useful weed management tools (Thorp and Lynch 2000, Randall 2000, Groves *et al.* 2001, Tye 2001). Because information on distribution, frequency, autecology and impact is often anecdotal or inadequate, ranking systems need to be pragmatic and utilize botanical information currently available. The object of this project was to identify which of the 1060 plant species the Queensland Herbarium has recorded as naturalized in south-east Queensland could be categorized as 'environmental' weeds. This list provides a working base from which the Southeast Queensland Environmental Weeds List will be compiled in consultation with the wider community.

Environmental weeds are defined as invasive plants occurring in relatively undisturbed, mostly native vegetation. The Australia-wide weed prioritization Weeds of National Significance (WONS) identified and used two criteria, invasiveness and impact (Thorp and Lynch 2000). In this assessment, evidence of invasiveness or potential invasiveness was the primary criterion for selection, and frequency data used as a secondary criteria. Invasiveness is related to a plant's vigour, ability to establish and colonize existing vegetation and to develop substantial populations (Randall 2000). Assessment of all 1060 species for environmental impact was considered to be impractical because of insufficient data.

In this study 'natural' vegetation is defined as plant communities where more than 70% of the cover of vegetation is comprised of indigenous species and vegetation structure approaches that of remnant communities. Natural areas threatened by invasive species include remnant vegetation in nature reserves, natural wildlife corridors, wetlands, waterways, seashore and roadside native communities. Rejmánek (1989) suggested that 'there seems to be no community without some degree of natural disturbance' and few without signs of human disruptions. In south-east Queensland, most natural areas have experienced some form of disturbance (e.g. grazing, altered fire regimes, nutrient enrichment and partial clearing) and therefore the list includes some species which benefit from disturbance. Also, some invasive plants are 'broad spectrum' weeds. For example, lantana (*Lantana camara*) and green panic (*Panicum maximum*) can be categorized as suburban, agricultural and environmental weeds.

Methods

Relevant literature (Kleinschmidt and Johnson 1977, Hobbs and Huenneke 1992, Parsons and Cuthbertson 1992, Crawley *et al.* 1996, Kleinschmidt *et al.* 1996, Lazarides *et al.* 1997, Anon 2000, Thorp and Lynch 2000, Groves *et al.* 2000, Randall 2000, Groves *et al.* 2001 and Williamson 1999, 2001) was consulted to assist our understanding of naturalized plant invasiveness and current categorizations of weeds. Common names used mostly follow Shepherd *et al.* (2001).

The study area (Figure 1) was defined by the Southeast Queensland Environmental Weeds Strategy Working Group and was based on Local Government Areas. The task of distinguishing weeds of disturbance (ruderal) from weeds of natural areas (environmental) was addressed by categorizing species invasiveness and referring to a panel of thirteen weed scientists and field botanists. The expert assessment panel included members of four organizations. Tom Anderson, Trevor Armstrong and Dane Panetta are weed scientists at Alan Fletcher Research Station, Department of Natural Resources and Mining. George Batianoff, Anthony Bean, Paul Forster, Ailsa Holland, Bill McDonald, Sue Phillips and Kathy Stephens are botanists at Queensland Herbarium, Environmental Protection Agency. Michael Olsen and John Swarbrick are environmental consultants representing private enterprise. Paul Grimshaw is a technical officer representing Queensland Parks and Wildlife Service.

The panel members were presented with a list of 1060 naturalized species based on specimens held at the Queensland Herbarium. The questionnaire included four effective categories of invasiveness, plus a category for early records as outlined in Table 1. The weed scientists

Table 1. Categories of plant invasiveness offered to the assessment panel.

Score	Description	Notes
5	highly invasive, forms monocultures	e.g. *Lantana camara, Celtis sinensis, Cabomba caroliniana*
4	generally invasive	escaping from cultivation and spreading to natural areas e.g. *Asparagus* spp., *Ochna serrulata, Pinus elliottii*
3	common, invasive? (needs disturbance)	weeds of suburban and agricultural disturbance e.g. *Alternanthera pungens, Conyza* spp., *Medicago polymorpha*
2	infrequent, poorly invasive	e.g. *Aloe arborescens*
1	poorly known and/or early records only	scores of 1 were not included in calculation of average scores

and botanists in the panel estimated plant invasiveness based on field observations and understanding of the biological performance of the species. The scores were averaged and species with average scores of 3.0 or less were not considered further, leaving 443 species.

Three aspects of distribution were also considered: (i) frequency as specimens collected from the study area (HERBRECS = Queensland Herbarium Records Database System), (ii) frequency in detailed vegetation sites from the study area (CORVEG = Queensland Herbarium ecological site database, sites with comprehensive species lists only) and (iii) number of south-east Queensland sub-regions (ten divisions, as per Young and Dillewaard 1999) within which a species had been recorded in HERBRECS or CORVEG. Site data was predominantly restricted to native vegetation. Whereas Queensland Herbarium specimen data also included records from heavily disturbed areas.

Invasiveness and the three aspects of distribution were combined into a single prioritization. The three aspects of distribution were combined into a frequency index by summing the three ranks and dividing the sum for each species by the largest value for any species. A similar index was developed for invasiveness by ranking all species in ascending order for their average invasiveness scores and once again dividing each rank by the largest rank for any species. The two indices were summed, after 'weighting' them by multiplication, to produce a final score by which species could be ranked. The final prioritization was based 90% on invasiveness and 10% on frequency (0.9 × Invasiveness index + 0.1 × Frequency index). As a result, if two species had similar invasiveness scores the most widespread was placed higher in the final prioritization, for example, cork passionflower (*Passiflora suberosa*) is ranked higher than blue morning glory (*Ipomoea indica*) as it is more widespread in the study area and was frequently recorded in remnant mapping sites although *I. indica* had a slightly higher invasiveness score (4.3 vs. 4.2 for *P. suberosa*).

The final prioritization does not strictly follow the formula due to some shortcomings identified in the herbarium data (Hosking *et al.* 1996). The formula provided a provisional order after which some priorities were adjusted according to field knowledge and anecdotal evidence. Most attention was paid to the top half of the list. Ranking of some species such as kudzu (*Pueraria lobata*), was adjusted by consulting with more recent publications, particularly Anon. (2000). Two pairs of species (*Sporobolus pyramidalis* and *S. natalensis*; *Psidium guajava* and *P. guineense*) were treated as equivalent due to confusion in their identification.

Water weeds were poorly represented in vegetation sites and therefore their ranking was primarily based upon the opinions of four experts. Prickly and large plants (e.g. palms) were also under-represented in the specimen data.

Results and discussion

Distribution of naturalized species records presented in Figure 1 indicates a pattern of high density of records within areas of high development e.g. around Beaudesert, Toowoomba, Brisbane and Nambour and coastal areas. The sub-coastal areas from Esk to Mundubbera and further north are poorly sampled and / or represent areas with relatively low numbers of weed species. Similarly, taxa records in one degree grids across Queensland identified strong correlation between high number of naturalized species records and high density of people (Batianoff *et al.* 2000).

The 200 more invasive species and their ranks are presented in the Appendix. Investigations of the source of introduction indicate that 64% of the 200 listed species were ornamental garden plants, 21% were agricultural plants, 5% were aquarium plants and 10% were of unknown source. Relatively few species were considered extremely invasive by the assessment panel. Table 2 illustrates that about one third of the 200 species had average scores greater than 4, and only 27 species (13.5%) were regarded as 'highly invasive' (>4.5). Table 2 indicates that woody weeds (shrubs and trees) are a problem in south-east Queensland, representing 37% (75 species) of the 200 listed invasive species. However, the largest life form category of 100 species (50%) belonged to herbs. These herbs include 34 (17%) species of grasses and 19 species (9%) of aquatic herbs. The frequency of the life forms was broadly similar to that of the combined native and naturalized flora of the neighbouring area of Port Curtis District (Batianoff and Dillewaard 1988).

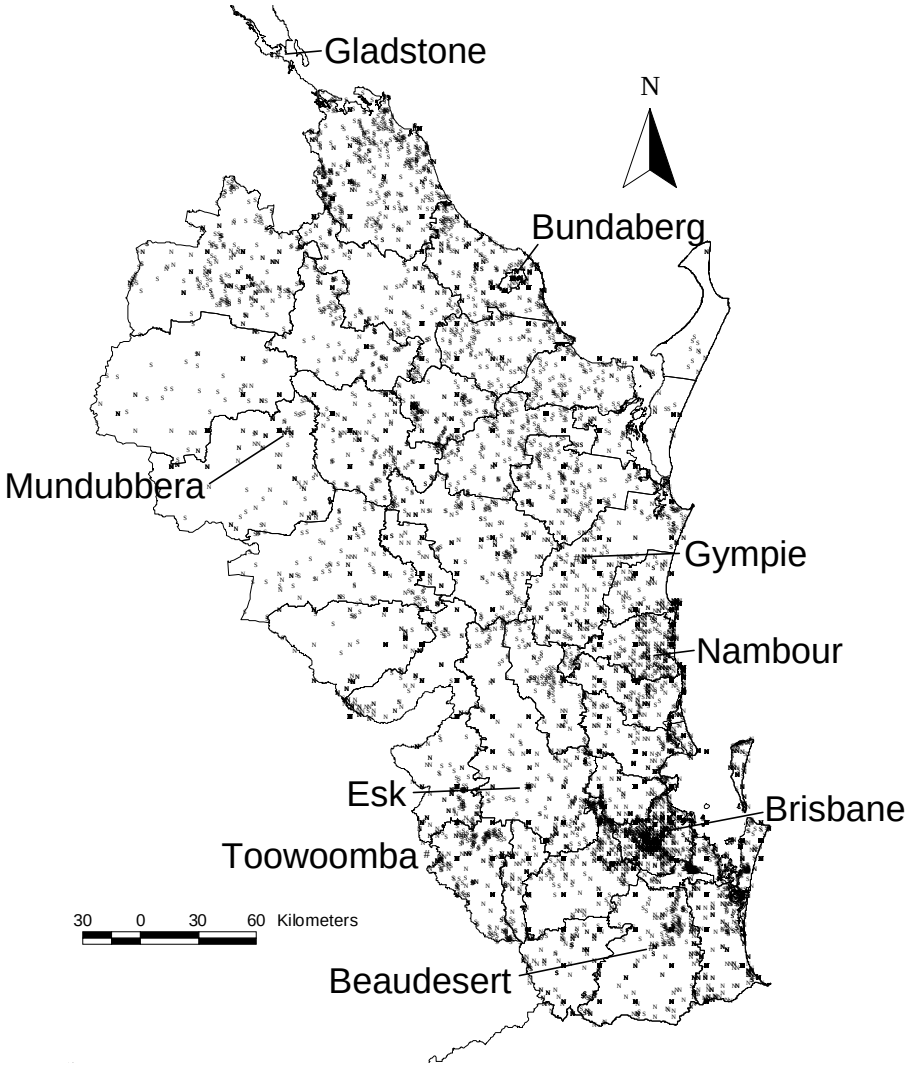

Figure 1. Distribution of Queensland Herbarium naturalised plant records (N = herbarium specimen and S = vegetation site) in study area. Local Government Authority boundaries are shown.

Table 2. Distribution of species among categories of invasiveness scores and life form.

Life form	Plant invasiveness score				
	5-4.6	4.5-4.1	4.0-3.6	3.5-3.1	Total
Trees	5	4	13	14	36 (18%)
Shrubs	4	4	26	5	39 (19.5%)
Vines	4	11	8	2	25 (12.5%)
Herbs	8	15	32	26	81 (40.5%)
Aquatic herbs	6	4	8	1	19 (9.5%)
Total	27 (13.5%)	38 (19%)	87 (43.5%)	48 (24%)	200

The naturalized flora defined here contains a larger number of vines (12.4% vs 4.6%) and fewer trees (18% vs. 23%) than in the Port Curtis District.

The invasive naturalized flora is taxonomically diverse, representing 161 genera and 66 families. The ten most important families based on number of species were Poaceae (35), Asteraceae (20), Fabaceae (8), Acanthaceae (7), Cactaceae (7), Solanaceae (7), Bignoniaceae (6), Mimosaceae (6), Rosaceae (6) and Agavaceae (5). The Poaceae, Asteraceae, Mimosaceae and Fabaceae are also among the ten most species rich native plant families in the region (Batianoff and Dillewaard 1988). The success of the Cactaceae is notable since it is not represented in the native Australian flora.

The ten most highly ranked invasive species with their estimated residency years (since naturalization / cultivation), based on Queensland Herbarium naturalization records, in descending order are lantana (*Lantana camara*, 120 years), groundsel bush (*Baccharis halimifolia*, 85 years), mother-of-millions (*Bryophyllum delagoense*, 38 years), cat's claw creeper (*Macfadyena unguis-cati*, 45 years), Madeira vine (*Anredera cordifolia*, 55 years), ornamental asparagus (*Asparagus africanus*, 25 years), Chinese celtis (*Celtis sinensis*, 89 years), camphor laurel (*Cinnamomum camphora*, 77 years), broad-leaf pepper tree (*Schinus terebinthifolius*, 77 years) and salvinia (*Salvinia molesta*, 48 years). This short list of ten includes two species, lantana and salvinia, which were included in the final 20 weeds of national significance (Thorp and Lynch 2000, WONS).

The five arboreal plants (trees and shrubs) in this list have an average period since the first naturalized specimen was collected of 90 years. Whereas average period since first specimen record for five non-arboreal plants (herbs and vines) is 42 years. This suggests that introduced shrubs and trees may take twice as long as herbs and vines to reach significant weedy status. Many current environmental weeds such as camphor laurel, broad-leaf pepper tree, Chinese celtis, tree privet, Chinese privet and jacaranda were widely planted during the Arbor Days in south-east Queensland in the 1890s (McLean 1891). According to Batianoff *et al.* (2001), plants held in cultivation in the study area are the main source of present and future weed infestations.

The ten most frequently collected and sighted (site data) species, based on Queensland Herbarium records (as at June 2000) in descending order are lantana (*Lantana camara*, 455 records), groundsel bush (*Baccharis halimifolia*, 168 records), cork passionflower (*Passiflora suberosa*, 166 records), Indian weed (*Sigesbeckia orientalis*, 148 records), red Natal grass (*Melinis repens*, 134 records), balloon cotton bush (*Gomphocarpus physocarpus*, 132 records), cobbler's pegs (*Bidens pilosa*, 110 records), blue billygoat weed (*Ageratum houstonianum*, 81 records), Queensland blue couch (*Digitaria didactyla*, 70 records) and Paddy's lucerne (*Sida rhombifolia*, 69 records). Frequently recorded species include not only the highly ranked but also plants that take full advantage of disturbance such as cobbler's pegs.

The main difficulty encountered in this study was the range of the assessment panel scores. Individual field experience associated with plant invasiveness accounted for major variations. We suspect that the invasiveness scores were also influenced by a predominance of roadside sightings. Some panel members used general information on Queensland's weeds rather than the specific regional knowledge required for this assessment. For example *Acacia nilotica* subsp. *indica* is one of the WONS and is a problem in inland Queensland but it is not a current problem in south-east Queensland. It is also suspected that the majority of the members of the expert panel interpreted high biomass as an index for plant invasiveness and capacity to colonize. Nevertheless, given the incomplete data, our panel's determinations provided a useful interim categorization.

Weeds that occupy the ground stratum, particularly grasses, are very difficult to categorize even though one half of all invasive species are herbs. Unpalatable ground covers are likely to have an economic impact e.g. giant rat's tail grasses (*Sporobolus natalensis* and *S. pyramidalis*) and African lovegrass (*Eragrostis curvula*). Ground cover biomass and invasiveness is frequently overlooked and underestimated in non-agricultural areas. Natural areas with dense infestations of naturalized exotic ground cover species face an uncertain future (Batianoff and Franks 1997). The changes to seedling establishment of the overstorey, potential alteration of fire regimes and nutrient cycling caused by these weed infestations may have a long-term effect on native forests (Williams and West 2000). Naturalized aquatic species include some of the most invasive and damaging weeds within wetland environments. We had only a few sites and an insufficient number of specimens, to provide an objective assessment of aquatic weeds.

The process of weed invasion is ongoing, with an average of 87 new naturalizations recorded per decade in south-east Queensland (Batianoff *et al.* 2001). In recent decades the number of plant naturalizations appear to have increased (Hosking, personal communication). As the number of plant naturalizations is increasing, so is the number of invasive species that colonize available areas (Batianoff *et al.* 2001). The list should be treated as a current or point-in-time inventory and a useful monitoring tool for weed managers over time. Improvements in prediction of problematic species will depend on continual input of new information and the advances in the understanding of plant invasion processes (Batianoff *et al.* 2001). In this study, the most valuable frequency data came from herbarium specimens and site recordings. *Lantana camara* is ranked as the number one invasive and most frequent weed of natural areas in south-east Queensland. According to Groves *et al.* (2000), widespread invasive plants such as *Lantana camara* are having a direct impact on rare and threatened native plant species rated by the Australian and New Zealand Environment and Conservation Council (ANZECC).

Socio-economic and environmental values are also important. The fact that 85% of all invasive plants originated from either ornamental or agricultural sources is now acknowledged. The current codes of practice within the responsible sectors of the horticultural and agricultural industries are being reviewed to avoid further introductions and spread of highly invasive plant species (Donald Scotts and Bruce Cook personal communication, May 2001).

Without environmental weed prioritization, weed managers are overwhelmed by the large number of naturalized plant species. According to Rejmánek (2000), successful management of invasive weeds requires active attempts to prevent new introductions and persistent efforts to eradicate the worst invaders. The Australian Quarantine and Inspection Service (AQIS) has new policies that include weed risk assessments and prohibition of entry

of weedy plants. According to Walton (2001) the adoption of these new procedures by AQIS has considerably improved the screening process for importation of plant species. Control and regulation of invasive aquatics will continue to be difficult. Finally, the compilation of this list of invasive plants is seen as a small step in assisting weed management in south-east Queensland.

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Appendix. List of invasive naturalized plants in south-east Queensland compiled by George N. Batianoff and Don W. Butler, Queensland Herbarium, Environmental Protection Agency, August 2001.

Rank	Family	Scientific and common names	Sub-region	Recd No.	Score	Life form and source
1	Verbenaceae	*Lantana camara* var. *camara* (lantana)	10	455	5	S/O
2	Asteraceae	*Baccharis halimifolia* (groundsel bush)	10	168	4.8	S/O
3	Crassulaceae	*Bryophyllum delagoense* (mother of millions)	8	38	4.9	H/O
4	Bignoniaceae	*Macfadyena unguis-cati* (cat's claw creeper)	5	36	4.9	V/O
5	Basellaceae	*Anredera cordifolia* (madeira vine)	8	16	4.9	V/O
6	Asparagaceae	*Asparagus africanus* (ornamental asparagus, asparagus fern)	7	26	4.9	V/O
7	Ulmaceae	*Celtis sinensis* (Chinese celtis)	8	19	4.9	T/O
8	Lauraceae	*Cinnamomum camphora* (camphor laurel)	7	25	4.8	T/O
9	Anacardiaceae	*Schinus terebinthifolius* (broad-leaf pepper tree)	6	49	4.8	T/O
10	Salviniaceae	*Salvinia molesta* (salvinia)	8	57	4.9	Ha/F
11	Cabombaceae	*Cabomba caroliniana* (cabomba, fanwort)	4	12	4.9	Ha/F
12	Asteraceae	*Chrysanthemoides monilifera* subsp. *rotundata* (bitou bush)	3	23	4.9	S/OA
13	Pontederiaceae	*Eichhornia crassipes* (water hyacinth)	4	8	4.9	Ha/OF
14	Acanthaceae	*Hygrophila costata* (Glush weed)	3	7	5	Ha/F
15	Oleaceae	*Ligustrum lucidum* (tree privet)	5	9	4.8	T/O
16	Asteraceae	*Sphagneticola trilobata* (Singapore daisy)	6	34	4.6	H/O
17	Asteraceae	*Ageratina adenophora* (crofton weed)	6	38	4.6	H/O
18	Verbenaceae	*Lantana montevidensis* (creeping lantana)	8	62	4.8	S/O
19	Fabaceae	*Neonotonia wightii* (glycine)	5	16	4.7	H/A
20	Poaceae	*Panicum maximum* (green panic and guinea grass)	8	78	4.6	H/A
21	Oleaceae	*Ligustrum sinense* (Chinese privet)	4	11	4.6	T/O
22	Ochnaceae	*Ochna serrulata* (ochna)	7	33	4.5	S/O
23	Asparagaceae	*Asparagus aethiopicus* cv. Sprengeri (asparagus ground fern)	5	35	4.5	H/O
24	Poaceae	*Sporobolus pyramidalis* and *S. natalensis* (giant rat's tail grasses)	8	72	4.8	H/U?
25	Asteraceae	*Ageratina riparia* (mistflower)	5	38	4.6	H/O
26	Asclepiadaceae	*Araujia sericifera* (mothvine)	9	38	4.4	V/O
27	Crassulaceae	*Bryophyllum daigremontianum* × *B. delagoense* (hybrid mother-of-millions)	6	15	4.5	H/O
28	Convolvulaceae	*Ipomoea cairica* (mile-a-minute)	7	56	4.4	V/O
29	Sapindaceae	*Cardiospermum grandiflorum* (balloon vine)	7	31	4.4	V/O
30	Asclepiadaceae	*Cryptostegia grandiflora* (rubber vine)	6	19	4.4	V/O
31	Phytolaccaceae	*Rivina humilis* (baby pepper)	8	61	4.3	H/O
32	Poaceae	*Sporobolus africanus* (Parramatta grass)	8	48	4.5	H/U
33	Poaceae	*Sporobolus fertilis* (giant Parramatta grass)	9	27	4.5	H/U
34	Poaceae	*Eragrostis curvula* (African lovegrass)	7	29	4.3	H/U
35	Asteraceae	*Gymnocoronis spilanthoides* (Senegal tea)	3	4	4.7	Ha/F
36	Amaranthaceae	*Alternanthera philoxeroides* (alligator weed)	1?	3	5	Ha/U
37	Passifloraceae	*Passiflora suberosa* (cork passionflower)	8	166	4.2	V/O
38	Poaceae	*Melinis minutiflora* (molasses grass)	5	17	4.5	H/A
39	Aristolochiaceae	*Aristolochia elegans* (Dutchman's pipe)	8	30	4.3	V/O
40	Convolvulaceae	*Ipomoea indica* (blue morning glory)	5	24	4.3	V/O
41	Mimosaceae	*Leucaena leucocephala* (leucaena)	6	14	4.3	ST/A
42	Poaceae	*Brachiaria mutica* (para grass)	6	18	4.4	Ha/A
43	Hydrocharitaceae	*Egeria densa* (egeria waterweed)	2	7	4.4	Ha/F
44	Pinaceae	*Pinus elliottii* (slash pine)	4	22	4.3	T/A
45	Caesalpiniaceae	*Senna pendula* var. *glabrata* (Easter cassia)	7	33	4.2	ST/O
46	Poaceae	*Chloris gayana* (Rhodes grass)	9	55	4.3	H/A
47	Crassulaceae	*Bryophyllum pinnatum* (resurrection plant)	6	17	4.2	H/O
48	Asteraceae	*Parthenium hysterophorus* (parthenium weed)	6	14	4.2	H/U
49	Caprifoliaceae	*Lonicera japonica* (Japanese honeysuckle)	3	6	4.3	V/O
50	Acanthaceae	*Thunbergia alata* (black eyed susan)	5	22	4.2	H/O
51	Fabaceae	*Macroptilium atropurpureum* (siratro)	8	39	4.2	V/A
52	Rosaceae	*Rubus ellipticus* (yellowberry)	4	26	4.1	S/O
53	Colchicaceae	*Gloriosa superba* (glory lily)	3	26	4.1	V/O
54	Verbenaceae	*Phyla canescens* (lippia, Condamine couch)	3	4	4.2	Ha/O
55	Solanaceae	*Solanum seaforthianum* (Brazilian nightshade)	8	78	4	V/O
56	Araceae	*Pistia stratiotes* (water lettuce)	3	8	4.1	Ha/OF
57	Asparagaceae	*Asparagus plumosus* (asparagus fern)	4	8	4.1	V/O
58	Commelinaceae	*Tradescantia fluminensis* (Qld use *T. albiflora*) (wandering jew)	5	9	4.1	H/O
59	Solanaceae	*Cestrum parqui* (green cestrum)	6	36	3.9	S/O
60	Caesalpiniaceae	*Senna septemtrionalis* (arsenic bush, was *S. floribunda*)	6	25	4	S/O
61	Solanaceae	*Solanum mauritianum* (wild tobacco tree)	8	30	4	S/O

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Rank	Family	Scientific and common names	Sub-region	Recd No.	Score	Life form and source
62	Apocynaceae	*Catharanthus roseus* (pink periwinkle)	5	22	4	S/O
63	Passifloraceae	*Passiflora subpeltata* (white passion flower)	10	60	3.9	V/O
64	Fabaceae	*Desmodium uncinatum* (silverleaf desmodium)	5	14	4	H/A
65	Poaceae	*Melinis repens* (red Natal grass)	10	134	4.1	H/A
66	Nymphaeaceae	*Nymphaea caerulea* subsp. *zanzibarensis* (blue lotus)	4	17	4	Ha/OF
67	Onagraceae	*Oenothera drummondii* subsp. *drummondii* (beach evening primrose)	3	17	4	H/O
68	Tiliaceae	*Triumfetta rhomboidea* (Chinese burr)	7	44	4	H/U
69	Haloragaceae	*Myriophyllum aquaticum* (parrot's feather)	3	15	4	Ha/F
70	Passifloraceae	*Passiflora foetida* (stinking passion flower)	7	50	3.9	V/O
71	Asteraceae	*Verbesina encelioides* (crownbeard)	7	34	4	H/U
72	Poaceae	*Paspalum mandiocanum*	3	6	4	H/A
73	Poaceae	*Paspalum dilatatum* (paspalum grass)	10	30	3.9	H/A
74	Ruppiaceae	*Ruppia maritima* (sea tassel)	2	8	4	Ha/F
75	Arecaceae	*Syagrus romanzoffiana* (queen palm)	4?	10	3.9	T/O
76	Poaceae	*Hymenachne amplexicaulis* cv. Olive (hymenachne)	1?	1	4	Ha/A
77	Asteraceae	*Senecio tamoides* (Canary creeper)	3	8	4	V/O
78	Poaceae	*Cenchrus ciliaris* (buffel grass)	4	15	4.1	H/A
79	Acanthaceae	*Thunbergia grandiflora* (thunbergia, blue thunbergia)	2	3	5?	V/O
80	Cactaceae	*Opuntia tomentosa* (velvet tree pear)	8	46	3.9	S/O
81	Euphorbiaceae	*Ricinus communis* (castor oil plant)	7	20	3.9	S/O
82	Asteraceae	*Senecio madagascariensis* (fire weed)	6	28	3.8	H/U
83	Cyperaceae	*Cyperus involucratus* (African sedge)	6	15	3.8	Ha/OF
84	Asteraceae	*Tithonia diversifolia* (Mexican sunflower)	5	11	3.9	H/O
85	Poaceae	*Setaria sphacelata* (South African pigeon grass)	9	41	3.8	H/A
86	Asclepiadaceae	*Gomphocarpus physocarpus* (balloon cotton bush)	10	132	3.7	S/OU
87	Poaceae	*Digitaria didactyla* (Queensland blue couch)	9	70	3.7	H/A
88	Caesalpiniaceae	*Gleditsia triacanthos* (honey locust)	7	12	3.8	T/O
89	Poaceae	*Paspalum notatum* (bahia grass)	4	10	3.8	H/A
90	Cactaceae	*Opuntia monacantha* (drooping tree pear, syn. *O. vulgaris*)	2	3	4	S/O
91	Poaceae	*Paspalum conjugatum* (paspalum grass)	7	38	3.8	H/A
92	Malpighiaceae	*Hiptage benghalensis* (hiptage)	3	5	4	S,V/O
93	Solanaceae	*Solanum torvum* (devil's fig)	6	39	3.9	S/O
94	Caesalpiniaceae	*Caesalpinia decapetala* (thorny poinciana)	4	20	3.9	S,V/O
95	Poaceae	*Pennisetum alopecuroides* (swamp foxtail)	7	29	3.8	H/O
96	Verbenaceae	*Duranta erecta* (duranta)	6	14	3.6	ST/O
97	Brassicaceae	*Rorippa nasturtium-aquaticum* (syn. *Nasturtium officinale*) (watercress)	7	19	3.7	Ha/FU
98	Polygonaceae	*Acetosa sagittata* (rambling dock)	4	18	3.7	V/U
99	Poaceae	*Cynodon dactylon* (couch, Bahama grass introduced cultivars)	10	45	3.6	H/OA
100	Bignoniaceae	*Tecoma stans* (yellow bells)	4	16	3.6	ST/O
101	Rosaceae	*Rhaphiolepis indica* (Indian hawthorn)	3	10	3.5	ST/O
102	Mimosaceae	*Mimosa pudica* (common sensitive plant)	4	12	3.7	S/A
103	Commelinaceae	*Callisia fragrans* (purple succulent)	3	9	3.9	H/O
104	Scrophulariaceae	*Paulownia tomentosa* (paulownia)	3	5	4	T/AO
105	Commelinaceae	*Tradescantia zebrina* (zebrina)	3	12	3.7	H/O
106	Acanthaceae	*Ruellia malacosperma* (ruellia)	5	16	3.8	H/O
107	Poaceae	*Pennisetum clandestinum* (kikuyu grass)	4	12	3.8	H/A
108	Liliaceae	*Lilium formosanum* (Taiwan lily)	5	10	3.8	H/O
109	Asteraceae	*Sigesbeckia orientalis* (Indian weed)	10	148	3.6	H/U
110	Asteraceae	*Bidens pilosa* (cobbler's pegs)	10	110	3.5	H/U
111	Cactaceae	*Opuntia stricta* (common prickly pear)	7	67	3.6	S/O
112	Poaceae	*Eleusine indica* (crowsfoot grass)	8	55	3.5	H/A
113	Poaceae	*Axonopus compressus* (broad leaved carpet grass)	5	23	3.6	H/AO
114	Lamiaceae	*Salvia coccinea* (red salvia)	9	46	4	H/O
115	Asteraceae	*Ageratum houstonianum* (blue billygoat weed)	8	81	3.8	H/UO
116	Myrtaceae	*Psidium guajava* and *P. guineense* (yellow guava and West Indes guava)	4	7	3.7	ST/AO
117	Rosaceae	*Rubus bellobatus* (kittatinny blackberry)	5	22	3.5	S/O
118	Myrtaceae	*Eugenia uniflora* (Brazilian cherry)	4	19	3.5	ST/O
119	Oleaceae	*Olea europaea* (olive)	2	6	4?	T/A
120	Poaceae	*Brachiaria decumbens* (signal grass)	4	14	3.5	H/A
121	Fabaceae	*Stylosanthes scabra* (shrubby stylo)	4	4	4.3?	H/A
122	Commelinaceae	*Commelina benghalensis* (hairy wandering jew)	4	7	3.5	H/O
123	Poaceae	*Pennisetum purpureum* (elephant grass)	2	9	3.5	H/O

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Rank	Family	Scientific and common names	Sub-region	Recd No.	Score	Life form and source
124	Zingiberaceae	*Hedychium coronarium* (wild ginger)	2	2	3.5	H/O
125	Phytolaccaceae	*Phytolacca octandra* (inkweed)	10	50	3.4	H/O
126	Asclepiadaceae	*Asclepias curassavica* (red cotton bush)	9	43	3.4	S/O
127	Solanaceae	*Lycium ferocissimum* (African boxthorn)	1?	5	4.4?	S/O
128	Mimosaceae	*Prosopis pallida* (algaroba)	2	2	4	ST/O
129	Juncaceae	*Juncus articulatus* (jointed rush)	1	2	4	Ha/FO
130	Cactaceae	*Opuntia aurantiaca* (tiger pear)	1	2	4	S/O
131	Poaceae	*Arundo donax* (giant reed)	1	4	3.8	H/O
132	Cactaceae	*Opuntia imbricata* (rope pear)	1	1	4	H/O
133	Bignoniaceae	*Pyrostegia venusta* (flame vine)	1	1	4	V/O
134	Poaceae	*Cortaderia selloana* (pampas grass)	2	1	3.7	H/O
135	Solanaceae	*Solanum hispidum* (giant devil's fig)	5	23	3.6	S/O
136	Agavaceae	*Furcraea foetida* (Cuban hemp)	3	4	4.3?	S/OA
137	Agavaceae	*Furcraea selloa* (hemp)	1	2	4?	S/OA
138	Agavaceae	*Agave americana* (century plant)	4	9	3.7	S/OA
139	Rutaceae	*Murraya paniculata* cv. Exotica (murraya)	6	26	3.6	S/O
140	Rosaceae	*Rubus discolor* (*R. fruticosus* complex, a blakberry)	4	10	3.7	S/OA
141	Brassicaceae	*Cakile edentula* (American sea rocket)	4	24	3.7	H/U
142	Balsaminaceae	*Impatiens walleriana* (balsam)	2	6	3.7	H/O
143	Agavaceae	*Agave sisalana* (sisal)	2	4	3.7	S/OA
144	Agavaceae	*Agave vivipara* var. *vivipara* (sisal)	2	3	3.7	S/OA
145	Rosaceae	*Prunus munsoniana* (wild goose plum)	7	31	3.7	ST/A
146	Poaceae	*Echinochloa crus-galli* (barnyard grass)	6	34	3.7	H/A
147	Asteraceae	*Solidago canadensis* var. *scabra* (Canadian goldenrod)	7	15	4?	H/O
148	Fabaceae	*Pueraria lobata* (kudzu)	3	4	3.8	V,S/O
149	Alismataceae	*Sagittaria graminea* var. *platyphylla* (sagittaria arrowhead)	3	7	3.5	Ha/FO
150	Nymphaeaceae	*Nymphaea mexicana* (yellow waterlily)	2	4	3.7	Ha/OF
151	Poaceae	*Phyllostachys aurea* (fishpole bamboo)	1	2	3.7	S/O
152	Euphorbiaceae	*Jatropha gossypiifolia* (cotton-leaf physic nut, bellyache bush)	1	1	3.7	S/O
153	Malvaceae	*Sida rhombifolia* (Paddy's lucerne)	9	69	3.6	S/U
154	Poaceae	*Themeda quadrivalvis* (grader grass)	8	25	3.6	H/A
155	Poaceae	*Andropogon virginicus* (whisky grass)	6	14	3.6	H/A
156	Bignoniaceae	*Jacaranda mimosifolia* (jacaranda)	4	12	3.4	T/O
157	Acanthaceae	*Justicia betonica* (squirreltail)	2	4	4	S/O
158	Mimosaceae	*Acacia boliviana* (Bolivian wattle)	1	1	4	T/O
159	Simaroubaceae	*Ailanthus altissima* (tree of heaven)	1?	3	3.5	T/O
160	Poaceae	*Echinochloa colona* (awnless barnyard grass)	9	44	3.3	H/A
161	Cyperaceae	*Cyperus brevifolius* (Mullumbimby couch)	8	53	3.4	H/O
162	Moraceae	*Morus alba* (white mulberry)	3	10	3.4	T/O
163	Arecaceae	*Colocasia esculenta* (taro)	3	4	3.4	H/AO
164	Cannaceae	*Canna indica* (canna lily)	3	9	3.3	H/O
165	Buddlejaceae	*Buddleja madagascariensis* (buddleja)	5	6	3.4	S,V/O
166	Bignoniaceae	*Tecoma capensis* (Cape honeysuckle)	3	8	4	ST/O
167	Cactaceae	*Harrisia martinii* (harrisia cactus)	2?	4	4	S/O
168	Acanthaceae	*Thunbergia laurifolia* (laurel clock vine)	1	1	4	V/O
169	Fabaceae	*Erythrina crista-galli* (cockspur coral tree)	2?	4	3.5	T/O
170	Sapindaceae	*Koelreuteria elegans* (Chinese rain tree)	1?	1	3.6?	T/O
171	Zingiberaceae	*Hedychium gardnerianum* (ginger lily)	1?	3	3.6	H/O
172	Acanthaceae	*Hypoestes phyllostachya* (polka-dot plant	3	5	3.5	H/O
173	Caprifoliaceae	*Sambucus canadensis* (American elder)	3	7	3.4	ST/O
174	Asteraceae	*Conyza sumatrensis* (tall fleabane)	9	45	3.3	H/U
175	Fabaceae	*Tipuana tipu* (tipuana)	2	5	3.4	T/O
176	Asteraceae	*Tagetes minuta* (stinking roger)	8	32	3.3	H/U
177	Caesalpiniaceae	*Chamaecrista rotundifolia* (round-leaf cassia)	6	14	3.3	ST/A
178	Poaceae	*Cenchrus echinatus* (Mossman river grass)	8	43	3.3	H/A
179	Asteraceae	*Conyza canadensis* (Canadian fleabane)	10	55	3.3	H/U
180	Euphorbiaceae	*Euphorbia cyathophora* (painted spuge)	8	20	3.3	H/O
181	Poaceae	*Setaria palmifolia* (palm leaf setaria)	5	13	3.3	H/O
182	Euphorbiaceae	*Euphorbia heterophylla* (milk weed)	5	12	3.4	H/O?
183	Fabaceae	*Desmodium intortum* (greenleaf desmodium)	4	11	3.3	H/A
184	Poaceae	*Pennisetum setaceum* (fountain grass)	3	11	3.3	H/O
185	Asteraceae	*Conyza bonariensis* (flax-leaf fleabane)	7	38	3.3	H/U
186	Solanaceae	*Solanum erianthum* (a tobacco bush)	7	19	3.2	S/O
187	Poaceae	*Stenotaphrum secundatum* (buffalo grass)	3	23	3.2	H/AO

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Rank	Family	Scientific and common names	Sub-region	Recd No.	Score	Life form and source
188	Apocynaceae	*Cascabela thevetia* (syn. *Thevetia peruviana*) (yellow oleander)	5	9	3.1	ST / O
189	Rubiaceae	*Coffea arabica* (coffee)	3	7	3.2	ST / A
190	Bignoniaceae	*Spathodea campanulata* (African tulip tree)	1?	1	3.4	T / O
191	Fabaceae	*Macrotyloma axillare* (perennial horse gram)	4	12	3.1	V,H / A
192	Iridaceae	*Watsonia meriana var. bulbillifera* (bulbil watsonia)	2	3	3.1	H / O
193	Passifloraceae	*Passiflora edulis* (passion fruit)	6	12	3.2	V / AO
194	Asteraceae	*Zinnia peruviana* (wild zinnia)	6	33	3.1	H / O
195	Dracaenaceae	*Sansevieria trifasciata* (sansevieria)	2?	7	3.1	H / O
196	Poaceae	*Digitaria eriantha* (pangola grass)	5	20	3.1	H / A
197	Rosaceae	*Eriobotrya japonica* (loquat)	3	5	3.1	T / O
198	Cactaceae	*Acanthocereus tetragonus* (sword pear)	1	1	3.3	S / O
199	Mimosaceae	*Acacia nilotica* subsp. *indica* (prickly acacia)	3	3	4.4?	T / A
200	Mimosaceae	*Acacia farnesiana* (mimosa bush)	6	15	3.1	T / A

Explanatory notes

Sub-region Number of the ten sub-regions of the south-east Queensland bioregion (Young and Dillewaard 1999) within which species recorded (Queensland Herbarium data).

Recd No. Total number of records for species within study area, Queensland Herbarium CORVEG and HERBRECS data.

Scores Based on panel data of invasiveness, 5 (highest) to 3 (moderate). ? indicate doubtful scores.

Life forms T – tree (woody plant >5 m), ST – small tree (2-5 m), S – shrub (woody <2 m), H – herb (grasses and forbs), Ha – aquatic herbs.

Source A – agriculture, O – ornamental and landscaping, F – fish aquarium, U – unintentional introduction and / or contaminant.