Environmental weed census and prioritisation, Swan NRM Region
July 2008

Karen Bettink and Greg Keighery
Swan Catchment Council (SCC) and Department of Environment and Conservation (DEC)

1. Purpose of the assessment

The Environmental Weed Strategy of Western Australia (1999) provided a basic ranking of weeds on a state-wide basis, however, there was no spatial reference to Natural Resource Management (NRM) regions or lesser State-wide jurisdictions. One of the key outcomes of the current Swan Weed Project is to provide a regional specific assessment of environmental weeds. With large numbers of environmental weeds (in excess of 900 taxa), this regional assessment is necessary to identify the most threatening species, in order to prioritise works programs and effectively allocate resources.

The assessment is targeted at the Swan NRM Region but the process can be applied to other regions and can be used on a variety of scales. The type of information covered in the assessment is designed to align with National and State protocols for collecting data on invasive species. It is also designed to be comprehensive and practical, thus the file contains a considerable number of fields. Several of these fields may not be necessary, or could be amalgamated into one field if a similar but basic assessment is to be carried out by other regional groups. For example, the fields for National and State classification, other NRM priority weeds and Interim Biogeographic Regionalisation of Australia (IBRA) significant weeds could be combined into a single 'other ratings/appearance on other lists' field.

The assessment provides a baseline and valuable tool for longer term environmental weed management in the region. Whether kept as an excel file or database such as Microsoft Access, lists such as this should replace the *The Environmental Weed Strategy of Western Australia* for use in the region, as it can be:
- updated
- added to
- filtered or sorted and used as a search tool. For example, to find all emerging, perennial grasses with high ecological impacts
- linked to Max (WA Census database)
- linked to distributional information
- linked to biological information
- used for statistics
- used as a monitoring tool, to assess changes in weed numbers, trends etc.

2. Features

There are three main features of the assessment – the first is the census of all known or recorded environmental weeds in the region. For the purpose of the list, 'environmental weeds' are those occurring and reproducing (naturalised) in reasonably intact bushland (Keighery and Longman 2004). This section includes general information on each taxa under headings of:
- family
- name identification and code
- scientific name
- common name
- name currency

- occurrence in IBRA Region
- habitat.

The second part of the assessment involves the addition of information which enables prioritisation of the listed weeds. The prioritisation process centres around ratings of ecological impact, invasiveness, current and potential distribution in the region and recognised importance (existing classifications or its recognised weed potential elsewhere).

A field for 'Relative Importance – Swan Priority Rating' lists the rating given to each species, on a scale of 'very high', 'high', 'medium', 'low', 'unknown' and 'further assessment required'. Full descriptions of the fields are provided in the Swan NRM Environmental Weed List Legend (Appendix 1) and the methodology applied in developing priorities is outlined below.

A third feature of the assessment is the section included at the end of the spreadsheet on management. This section aims to take information on the highest priority species to the next level by outlining management aims.

3.1 Methodology - weed census

DEC Research Scientist Greg Keighery developed the original weed census list. A number of sources were used, including current literature, databases, observations and previous lists. Sources of information included:

- formal literature
    - previous lists (see below)
    - checklists
    - survey lists
    - revisions
    - floras
    - management plans
- informal literature
    - consultants reports
    - personal communications
    - friends newsletters
    - online resources
- Florabase
- Australian Virtual Herbarium
- personal observations/data.

Previous lists for the Swan Region and State are listed in Appendix 2.

A workshop was held in March 2007 to add any species not present in this list and consult stakeholders on the prioritisation process and types of information included to make the assessment comprehensive and useful for land managers. Several new species and fields were added, including a field for plants which, although native to Western Australian, may be weeds outside their native range. This was in response to a concern that some bush regenerators and landscapers may choose species inappropriate to the region, which have the potential to become problematic weeds.

3.2 Methodology – weed prioritisation

Greg Keighery's original prioritisation, completed in February 2007, was used as the basis to refine and add data and data fields. A 'Relative Importance – Swan Priority Rating' was completed for each species, based on values given to its ecological impact, invasiveness,

current and potential distribution in the region and recognised importance (existing classifications or its recognised weed potential elsewhere).

Data fields used to determine the relative priority ratings are grouped under main headings of:
- distribution and abundance
- ecological impacts
- invasiveness
- trends. Including their status as emerging or established
- classifications, other listings and ratings.

Descriptions and references for all fields are given in the field list legend (Appendix 1).

With sufficient information entered into the fields, ratings could then be developed. Species with high ecological impacts, high-to-extensive potential distribution and moderate-to-rapid rates of spread were ranked with a high to very high management priority. From there, knowledge of key weed experts in the regional, State, National and other listings were used to further prioritise the listings. From the Swan Region priority ratings, a set of the 30 highest priority weeds, made up of 25 terrestrial and five aquatic weeds, were identified (Table 1, overleaf). It is important to note that State, National or other listings do not automatically equate with a species being one of the highest priorities for the region.

Other combinations of ratings resulted in a lower priority rating. For example, species which may be widespread with high rates of spread but lower ecological impact (medium rating), such as those occurring in disturbed sites, were given an overall lower rating of ‘medium’.

4. Further work

Weed assessment is only the first step in strategically managing the threat of environmental weeds in the Swan NRM Region.

Additional information has been included for species rated ‘very high priority’ (and some of the high priority species). However, there are many more species requiring further investigation and a considerable number of species where there is limited information. It is also recommended that a formal weed risk assessment be completed starting with all species rated very high priority. This work will need to be undertaken in a future project, preferably once a formal WA Weed Risk Assessment (WRA) protocol has been developed.

As yet, there has not been a thorough biodiversity asset prioritisation undertaken in the region. Therefore the high biodiversity assets that need to be protected from the priority weeds identified in this project are yet to be determined. The biodiversity asset prioritisation should be an urgent endeavor for the region.

Table 1: Draft list of the 30 highest priority weeds in the Swan NRM Region identified in the assessment.

Scientific name	Common name	Appears on other lists
Acacia spp. (incl. *longifolia, pycnantha, dealbata*)		
Asparagus asparagoides	Bridal creeper	WONS, P1 (whole state)
Carduus pycnocephalus	Slender thistle	
Cenchrus ciliaris	Buffel grass	
Chrysanthemoides monilifera subsp. *monilifera*	Boneseed	WONS, P1 (whole state)
Colocasia esculenta	Taro	
Cortaderia selloana	Pampas grass	
Cynodon dactylon	Couch	
Ehrharta calycina	Perennial veldt grass	
Euphorbia terracina	Geraldton carnation weed	
Ferraria crispa	Black flag	
Freesia alba x leichtlinii	Freesia	
Gladiolus undulatus	Wavy gladiolus	
Hydrocotyle ranunculoides	Robust pennywort	WONS nominated, P1,P2 (whole state)
Hyparrhenia hirta	Tambookie grass	
Isolepis hystrix	Club rush	
Juncus acutus	Sharp rush	
Lachenalia reflexa	Yellow soldier	ALERT
Leptospermum laevigatum	Victorian tea tree	
Moraea flaccida	One-leaf cape tulip	P1 (whole state), P4 (select shires)
Myriophyllum aquaticum	Parrots feather	WONS, P1,P2 (whole state)
Retama raetam	White weeping broom	ALERT
Rubus spp.	Blackberry	WONS, P1, P2 (whole state)
Salvinia molesta	Salvinia	WONS, P1, P2
Schinus terebinthifolius	Brazilian pepper	WONS nominated
Sparaxis bulbifera	Sparaxis	
Tribolium uniolae	Haas grass, Tribolium	
Typha orientalis	Typha, bulrush	
Watsonia meriana var. bulbillifera	Bulbil watsonia	WONS nominated
Zantedeschia aethiopica	Arum lily	WONS nominated, P1, P4 (whole state)

5. References

Department of Agriculture and Food Western Australia (2007) *Declared Plants listed in the Agriculture and Related Resources Protection Act 1976* South Perth as at 6 December 2007.

Department of Conservation and Land Management (1999) *Environmental Weed Strategy for Western Australia*, Appendix 3: List of Environmental Weed Species of Actual and Potential Significance in WA, Como.

Keighery, G. and Longman, V. (2004) The naturalized vascular plants of Western Australia 1: Checklist, environmental weeds and distribution in IBRA regions, *Plant Protection Quarterly* Vol 19(1).

Thorp, J R, & Lynch, R (2000) *The Determination of Weeds of National Significance.* National Weeds Strategy Executive Committee, Launceston.

Appendix 1: Descriptions and references for all fields in the Swan NRM Environmental Weed List.

FIELD	DESCRIPTION	CODE	
FAMILY	Plant family		
NAME_ID	Max name identification number		
SPECIES_CODE	Max name identification alpha code		
Wd	Weed species	*	weed
Plant name	Scientific name		
Common name	Common or vernacular names, taken from Keighery et al [2] and Max [3]		
Life form	Based on description from WA Census (Florabase), described as herb (aquatic, perennial or annual), geophyte (perennial or annually renewed), shrub, tree, grass (annual or perennial)	herb aq herb a herb p herb shrub p geophyte ar geophyte grass p grass a grass tree	perennial, annual or biennial herb aquatic herb annual herb perennial herb shrub perennial geophyte annually renewed geophyte perennial or annual grass perennial grass annual grass tree
CURR	Name currency according to WA Census June 2008	Y N	current not current
SCC	Swan Catchment Council – present in region	Y	presence
ENV	Environmental weed, i.e. occurring and reproducing (naturalised) in reasonably intact bushland[1]	Y	presence
Aq	Aquatic habitat	Y	presence
Dp	Dampland habitat	Y	presence
Terr	Terrestrial habitat	Y	presence
Hy	Capacity to hybridise with native species	Y	capable of hybridising
WA	Western Australian native	Y	yes
Notes	General information, can include biology, dispersal methods, distribution in WA		
SCP	Occurs in the Swan Coastal Plain IBRA region	Y	presence
JF	Occurs in the Jarrah Forest IBRA region	Y	presence
Swan location/s	General locations and distribution in Swan NRM Region		
Distribution - potential	Area of potential habitat in the region that could be occupied	L M H E U	limited (localised) moderate high extensive (widespread) unknown
Distribution - current	Area of potential habitat in the Region currently occupied	L M H E U	limited (localised) moderate high extensive (widespread) unknown

FIELD	DESCRIPTION	CODE	
Abundance	Density class across one or more IBRA regions in the Swan NRM Region[4]	occasional common abundant	light (<10 populations or 1-10% of IBRA region) medium (>10 populations or 11-50% of IBRA region) heavy (>100 populations or 51-100% of IBRA region)
Ecological impact	Ecological impact of species in the region, from low impact (causes minimal disruption to ecological processes or loss of biodiversity) to high (causes acute disruption of ecological processes, dominate and/or significantly alter vegetation structure)	L M H U	low impact species medium impact species high impact species unknown
Impact attributes	List of known ecological impact attributes, based on Platt *et al* (2005)[5]	1 2 3 4 5 6 7 8 9 10	changed fire regime changed nutrient conditions changed hydrological patterns changed soil erosion patterns changed geomorphological processes changed biomass distribution changed light distribution loss of biodiversity substantially reduces regeneration opportunities of native plants allelopathic effects
Invasiveness	Rate of dispersal and/or establishment in native vegetation	S M R U	slow moderate rapid unknown
General trend	General trend in distribution and abundance across the region	decreasing increasing stable unknown	
Status	Define whether the species is outside the region, considered emerging (density class of occasional), established (density class of common or abundant) or unknown	outside emerging established unknown	occurs outside the region but known from WA density class of occasional (see above) density class of common or abundant (see above) current status in doubt or unknown
Classification - National	Any current national classification or listing, including current listing as a WONS species or WONS ranking (21-70)[8] or species identified nationally as a potential or established environmental weed[9]	WONS WONS no. other	Weed of National Significance (1-20) nomination and ranking as a WONS (21-70) nationally recognised environmental weed

FIELD	DESCRIPTION	CODE
Classification - State	State declared plants, listed under the *Agriculture and Related Resources Protection Act 1976*, Agriculture Protection Board, as at December 2007[7]	P1 see Act for definition P2 see Act for definition P3 see Act for definition P4 see Act for definition
EWSWA rating	Risk rating according to the Environmental Weed Strategy of Western Australia and the three criteria of invasiveness, distribution and environmental impacts[6]	species scoring 0 of the 3 criteria Low species scoring 1 of the 3 criteria Mild Moderate species scoring 2 of the 3 criteria High TBA species scoring 3 of the 3 criteria species not rated
Weed elsewhere in Australia	Known occurrence as a weed naturalised in any other area of Australia, sources including Australia's Virtual Herbarium	yes/no
Number of NRM regions identified as a priority	Plant species listed as priority environmental weed in NRM regions across Australia 2006[10]	no. of regions
IBRA significant weed	Species listed by Keighery (2006) as most significant weeds for each IBRA region[11]	yes/no
Relative importance – ranking score	Numerical score, to be determined by sum of weighted value given to each field[12]	to be determined
Relative importance - Swan priority rating	The risk each species poses to environmental assets in the region, based on invasiveness, ecological impact, current and potential distribution, and thus priority for management	VH very high priority H high priority M medium priority L low priority U unknown FAR further assessment required
Management strategy	Outline basic strategy for management, from eradication, control and containment to asset-based protection	
Extent of active management	List broad recent and current management activities	
Recommendations	List broad recommendations for management	

[1] Keighery, G. and Longman, V. (2004) The naturalized vascular plants of Western Australia 1: Checklist, environmental weeds and distribution in IBRA regions *Plant Protection Quarterly*, Vol 19(1) 2004.

[2] Keighery. G. and Keighery, B., pers comm

[3] Department of Conservation and Land Management (Simon Woodman & Paul Gioia) 1997-2005 Max 3.1.4.218

[4] McNaught, I., Thackway, R., Brown, L. and Parsons, M. (2008) *A Field Manual for Surveying and Mapping Nationally Significant Weeds*, 2nd Edition, Bureau of Rural Sciences, Canberra.

[5] Platt, S., Adair, R., White, M. and Sinclair, S. (2005) Regional priority-setting for weed management on public land in Victoria, *Paper: Second Victorian Weed Conference-Smart weed control, managing for success*. Department of Sustainability and the Environment and the Department of Primary Industries, Melbourne.

[6] Department of Conservation and Land Management (1999) Environmental Weed Strategy for Western Australia, Environmental Protection Branch, Bentley.

[7] Department of Agriculture and Food Western Australia (2007) *Declared Plants, Agriculture and Related Resources Protection Act, 1976*, Agriculture Protection Board, South Perth.

[8] Thorp, J R, & Lynch, R (2000) *The Determination of Weeds of National Significance.* National Weeds Strategy Executive Committee, Launceston.

[9] Csurches, S. & Edwards, R. (1998) *Potential Environmental Weeds in Australia*, Queensland Department of Natural Resources, Queensland.

[10] Cooperative Research Centre for Australian Weed Management (2006) *Environmental weeds of regional Australia: Plant species listed as priority environmental weeds in Natural Resource Management Regions, March-May 2006,* Canberra.

[11] Keighery, G. (2005) *Most significant weeds across Western Australia*, extract for the two IBRA regions (Swan Coastal Plain, Jarrah Forest), unpublished.

Department of Environment and Conservation (2008) *Florabase: The Western Australian Flora*, Western Australian Herbarium, http://www.florabase.dec.wa.gov.au/

Appendix 2: Previous lists drawn upon to develop the weed census for the Swan NRM Region.

Gardner, C. A. (1924/25) *List of the naturalised plants of extra- tropical Western Australia*. Journal of the Royal Society of Western Australia. - Vol. 11. (237 Weeds).

Gardner, C.A. (1930) Enumeratio Plantarum Australe Occidentale (all of WA).

Green, J. W. (1981) *Census of the vascular plants of Western Australia.*

Green, J. W. (1985) *Census of the vascular plants of Western Australia,* 2nd Edition.

Hussey, P., Keighery, G.J., Cousens, R., Dodd. J. and S. Lloyd (1997) *Western Weeds (A Guide to the Weedy Plants of Western Australia)* Plant Protection Society of Western Australia.

Keighery, G.J. (1992). Environmental Weeds of Western Australia Kowari 2 180-188.

Keighery, G.J. (1995). How Many Weeds? in Invasive Weeds and Regenerating Ecosystems in Western Australia, Ed. G. Burke, Murdoch University, pp.8-12, and 71-101.

Keighery, G.J. (1999). *A checklist of the naturalised vascular plants of Western Australia (including distribution in IBRA regions and garden escapes).* Department of Conservation and Land Management, 31 p.

Keighery, G.J. and Longman, V. (2004). The naturalised vascular plants of Western Australia 1: Checklist, Environmental Weeds and Distribution in IBRA regions. Plant Protection Quarterly 19: 12-32.