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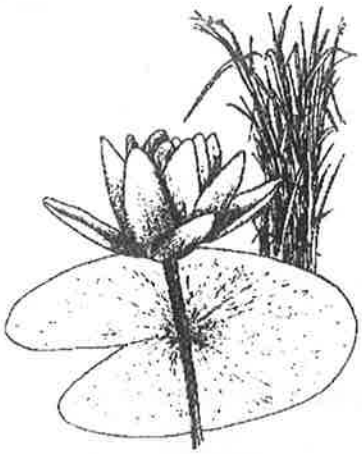

Association of Societies for Growing Australian Plants Inc.

AUSTRALIAN WATER PLANTS
Study Group

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Newsletter No. 3
February 2002

Welcome to all members:

Sorry about the delay in finalizing this newsletter, but a lack of information and letters from members did not help – enough complaining lets get on with it!

The ASGAP Biennial Conference and Seminar saw a notice board with a number of colour photographs of Australian water plants on display for all conference goers to see and contemplate.

At this conference discussions were held with a number of our members and a position established regarding the area of interest of this group;

> **"The Australian Water Plants Study Group is to concentrate on HERBACEOUS AQUATIC and SEMI-AQUATIC PLANT COMMUNITIES."**

Now that the area of interest has been established we can concentrate on the plants found within these communities.

Remember always please - we are all learning and none of us (most probably) know all the aquatic and semi-aquatic herbaceous species from the whole of Australia.

Articles of general interest as well as more specific species or community orientated ones will always be appreciated.

This newsletter sees the inclusion of the following:

A key to the Australian Waterlily subgenus Anecphya

Membership Happenings

Notes from all over

Notes on *Baumea rubiginosa*

and

Current membership listing.

I would like to wish all members (including a number of new members) a Happy, even if belated, New Year.

Ian Waldron

MEMBERSHIP HAPPENINGS

This Section is devoted to reporting events occurring within the membership of the study group.

If you know of any special happening to one of the study group members please let me know so it can be passed on to the members at large.

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Recently one of our members – Irene Champion , Honorary Secretary Mackay Branch SGAP (Qld Region) Inc., was awarded Honorary Life Membership of SGAP (Qld Region) Inc. for her services to the society.

The award came as a complete surprise to Irene. Although conferred by Qld Region in December 2001, the award was not revealed to Irene until the actual presentation at the Mackay Botanic Gardens Steering Committee meeting on 25 January 2002. At this meeting a very surprised Irene was presented with the citation and Life Membership Medallion by the Mayor of Mackay, Councillor Julie Boyd.

The members of Mackay Branch of the society were present as well as media coverage for the event (especially organized).

A copy of Irene's citation follows:

Society for Growing Australian Plants
Queensland Region

LIFE MEMBERSHIP
Irene Champion

The Mayor of Mackay Cr. Julie Boyd presented the citation for Life Membership of Society for Growing Australian Plants to local identity Irene Champion.

The presentation was done in association with the SGAP Queensland Region President, Lawrie Smith who is the landscape architect responsible for the planning of the new Regional Botanic Gardens in Mackay.

The Award
Irene is one of the few among the thousands of SGAP members nationally, throughout Queensland and in Mackay to be honoured by Life Membership. This award is made to acknowledge only those who have made a significant and distinguished contribution to the research, preservation and introduction of Australian native flora to horticulture and landscape.

The SGAP in Mackay
Irene joined the SGAP in early 1976 and she says, "the Society changed my life". She was a founding member of the Mackay branch in 1978 and has continued as an executive office ever since. Irene has been involved with the production of books, brochures and photographic displays by the Society - "Gardening with Australian Plants" and "100 trees for Mackay" being two informative ready references for local gardeners.

Irene - the quiet achiever
Irene is a caring wife, mother and grandmother and a quiet contributor in a number of community areas and initiatives. She is one of those busy people who are quiet achievers with the ability to fit 36 hours into every day and still keep smiling. She is a walking encyclopaedia of botanic knowledge, specifically of local native plants from the Whitsunday's to Eungella and far beyond. Irene has collected most of them and trailed them in her own garden at Slade Point but she has probably given more knowledge and plants away than she has grown.

Irene is respected at all levels of the community where her specialised knowledge and expertise is freely shared, whether it be for National Parks and Wildlife; Department of Natural Resources; the Queensland Herbarium; James Cook University; Mackay City Council or for the members of the Mackay SGAP, friends and neighbours.

Collecting and identifying specimens for the Queensland Herbarium has been a continuing passion and has taken Irene to almost every forested valley and ridge top in the region. Closer to home, the Slade Point Dune and wetland system has been of specific interest and Irene has been involved in many ways to see the area preserved, rehabilitated and interpreted.

Mackay Regional Botanic Gardens
Perhaps Irene's most significant contribution for Mackay has been her untiring efforts since the late 1980's to promote, with members of the SGAP, the establishment and development of a Botanic Gardens in the city to enable the general public to see and appreciate at first hand the beauties of the regional flora and their use in gardens. She has been singularly successful in this endeavour and is closely associated with the planners of the Gardens through appointment to the Council Steering Committee. Construction of the first phase of the development of the Gardens is about to commence and Irene is busier than ever collecting seeds and propagating plants as well as advising the landscape architects on botanic associations and species.

There are few people who can match this quiet achievers enthusiasm and love of our unique native flora. It is therefore very appropriate to make Irene a life Member of the Society for Growing Australian Plants – after all it is one way to ensure that Irene keeps up the good work – for years to come.

Congratulations!

Lawrence Smith
Queensland Region President
Society for Growing Australian Plants
and
Managing Director
LANDPLAN
Landscape Architects

KEY TO THE AUSTRALIAN WATERLILY SUBGENUS ANECPHYA

Supplied by Barre Hellquist, partially based on Jacobs and Porter, in press.

The key below is for all native Australian species in the subgenus Anecphya. This does not include *Nymphaea nouchali*, the small blue species from north coastal Queensland and *N. pubescens*, the white night bloomer from northern Australia.

Hellquist C.B., Jacobs S.W.L. and Porter C.L.

1. Petals continuous with stamens by a noticeable space; leaf margins entire, sinuate, or dentate; seeds 1-2mm long X 0.5-1.5mm wide; flowers fragrant

    2. Filaments to 25mm long, sepals to 11.5cm long; flowers blue, mauve, white, rarely pink. Northern tropics of Western Australia, Northern Territory, Queensland and New Guinea

    .....***Nymphaea violacea***

    2. Filaments to 18mm long, sepals to 7cm long; flowers white.

        3. Anthers to 8.5mm long, fruit to 2.5cm diam; seeds 1.75-2.5mm long X 1-1.5mm wide; sepals usually with purple flecks. Mostly permanent water on the northern tip of the Cape York Peninsular and New Guinea

        .....***Nymphaea elleniae***

        3. Anthers to 5.5mm long; fruit to 4.5cm diam.; seeds 1mm diam.; sepals lacking purple flecks. Ephemeral waters of northern Northern Territory and northern Western Australia

        .....***Nymphaea hastifolia***

1. Petals separated from stamens by a noticeable space; leaf margins toothed, rarely sinuate; seeds 4mm long X 2.5-4mm wide; flowers lacking odor

    4. Anthers to 5mm long; sepal length to 6.5cm; petal number to 22, acute tipped, Northern Territory, northern Queensland and New Guinea

    .....***Nympahaea macrosperma***

    4. Anthers to 15mm long; sepal length to 12cm; petal number to 34, obtuse tipped.

    5. Leaf tooth length to 5mm; sepals to 12cm; filaments to 32mm long.

6. Anthers to 11mm long; carpels 12-18; flower colour blue, white, rarely pink, colour fading with age; upper leaf surface of dried plants smooth, lacking punctae or small depressions. Tropical or subtropical regions from vicinity of Townsville, Qld. West to east central Northern Territory and south to northeast New South Wales

.....***Nymphaea gigantea***

6. Anthers to 15mm long; carpels 9-20; flower colour mainly white with outer petals blue, occasionally all white or blue, rarely changing to pink, often not fading with age; upper leaf surface of dried plants with obvious punctae or small depressions on most plants.

7. Stamens to 400; sepals to 10.5cm long; petals white with outer rows blue or all blue not fading with age; seeds pubescent; leaf tooth length to 4.5mm long. Tropical northern Queensland mainly Cape York Penninsular west to Northern Territory (uncommon), and northern Western Australia.

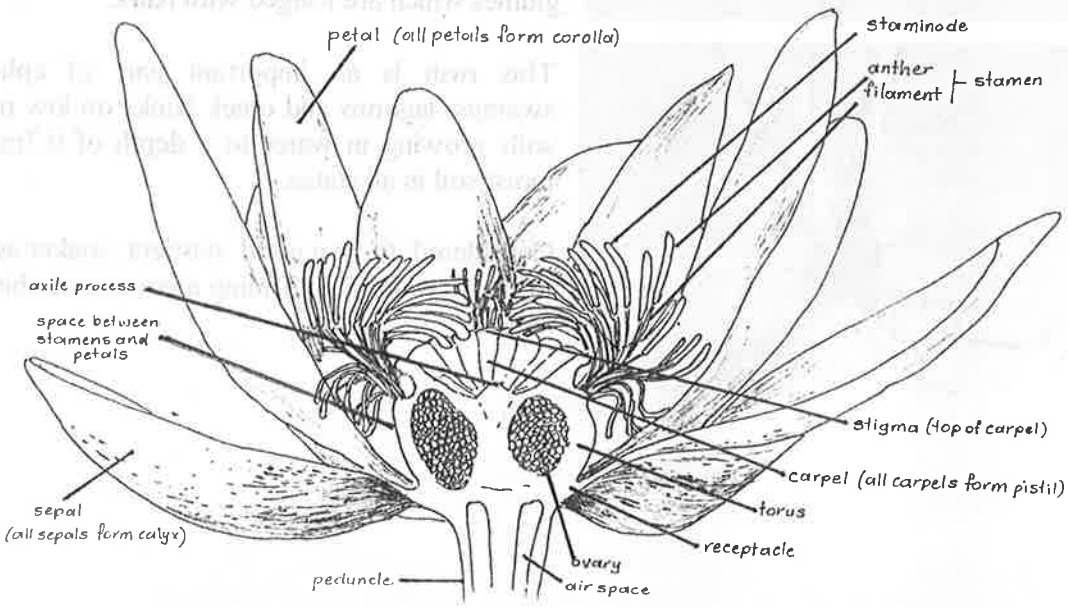
.....***Nymphaea immutabilis*** subsp ***immutabilis***

7. Stamens to 200; sepals to 12.5cm lng; petals blue, white at base, fading slightly with age; seeds glabrous; leaf tooth length to 3mm long. Local in the Kimberley region of Western Australia.

.....***Nymphaea immutabilis*** subsp. ***kimberleyensis***

5. Leaf tooth length to 2mm; sepals to 8cm lonh; filaments to 14mm long. Flowers white with blue outer petals aging to pink and eventually red when in fruit. Plants confined to central Cape York Penninsular.

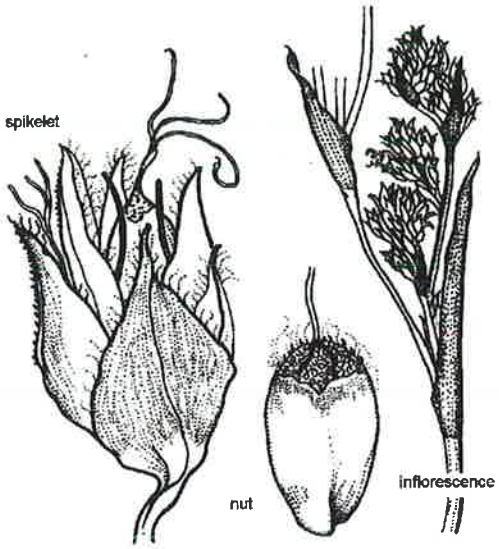
.....***Nymphaea atrans***



Baunea rubiginosa

SOFT TWIGRUSH

Family: Cyperaceae



A native rhizomatous perennial to 1m tall with basal leaves to 1m long, stem-like, compressed, with distinct leaf blades.

The inflorescence is an interrupted arrangement of brown or reddish-brown dense subglobular clusters of spikelets.

The flowers usually have 2, or more, usually 3, glumes which are fringed with hairs.

This rush is an important part of ephemeral swamps, lagoons and creek banks on low nutrient soils growing in water to a depth of 0.7m or on moist soil in all states.

Considered to be a good nutrient soaker acting to purify water and forming a good water bird habitat.

NOTES FROM ALL OVER

It would seem that Water Plants are finally receiving some recognition in Australian Plant Society circles. Newcastle NSW District Group APS has scheduled their March meeting under the title ***"Ponds and Water Plants"***

6th March 2002 Meeting

Michael, and Nola Fenech from Wallis Creek Pottery and Watergardens

Ponds and water plants

Michael and Nola Fenech own Wallis creek Pottery and Watergardens, which has an extensive array of native and exotic water plants. The Fenechs have been collecting and growing waterplants for over fifteen years. Initially being interested in Lilies, the Fenechs have discovered other water and bog plants, including a huge range of natives. Nola has an Advanced Certificate in Horticulture. With all this knowledge Michael and Nola have plenty of information on how to make ponds and what plants to put in, and around them. Since every garden should have a pond, this talk should be of interest to everybody.

The following information came to my notice in an E-mail from Dave in Northern Territory via the International Waterlily and Water Gardening Society E-mail list.

The Northern Territory Government has deemed all "Aquatic Life" of the plant persuasion that is not local native to be not allowed as an import into the Northern Territory or cultivated for sale or sold in nurseries unless it satisfies some difficult to fulfill criteria. The weed scientists think that all the water plants may become serious weeds choking up local waterways.

None of the Nurseries and plant growers can get any non native lilies unless they pass the following criteria.

> 'They have known parentage traced back to real species. They and their parents pass the Weed Risk Assessment criteria set down by the Australian Government.'

So even if they are already in Australia and the Northern Territory from years gone by they can't be cultivated or sold in the Northern Territory unless they pass all the tests.

The Australian weed risk assessment criteria can be viewed at:
http://www.affa.gov.au/docs/market_access/biosecurity/plant/wrmanu.html

A copy of this information is attached for convenience.

AGRICULTURE, FISHERIES AND FORESTRY - AUSTRALIA

MARKET ACCESS & BIOSECURITY

The Weed Risk Assessment system

The Weed Risk Assessment (WRA) system is a question-based scoring method. Using the WRA involves answering up to 49 questions on the new species to be imported. The questions include information of the plants; climatic preferences, biological attributes, reproductive and dispersal method. The WRA uses the responses to the questions to generate a numerical score. The score is used to determine an outcome: *accept*, *reject* or *further evaluate* for the species. The WRA also makes a prediction as to whether a species may be a weed of agriculture or the environment.

How to answer the WRA system's questions

An image of the WRA system is presented Form A - Weed Risk Assessment question sheet (gif - 204 Kb)- this image can be printed. The scoring sheet for the WRA system is also available Form B - Weed Risk Assessment scoring sheet (gif - 19Kb)

As you can see the answers to most of the questions in the system is yes (y), no (n) or don't know (leave blank). A few questions require a number as a responce.

How the WRA system generates a score

A typical score for a question is: *Yes* =1 point , *No* = -1 or 0 and *Don't Know* = 0

The climate and weed elsewhere questions differ from the typical scoring system in that they generate a score using a weighting system. The score given for Question 2.01 and 2.02 is used to weight the scores for `yes' answers in the weed elsewhere questions (3.01 to 3.05). The quality of climate data greatly affects the climate match. A good climate match increases the probability that a species will behave the same way in Australia as it does overseas. The weediness score increases if the information used to produce the climate match is not comprehensive, due to the greater uncertainty introduced by this data.

Two other questions do not fit into the standard scoring system. A score of `no' for Question 3.01, whether a plant has naturalised overseas, is modified by the score to Question 2.05, its history of repeated export. Species with repeated introductions outside of their native range that have not established are a lower risk. Question 6.07, the minimum generative time, requires the input of a numerical score. This generative time is standardised by the use of a correlation factor (1 year scores 1, 2-3 years' scores 0, greater than or equal to 4 years' scores -1).

The system compares the total score for a species to the critical values to determine the recommendation for the species. The threshold values for the system are, if the plant scores: less than 1, accept the plant for import, greater than 6, reject the importation of the plant and from 1 to 6, further evaluation the plant.

The threshold values are the product of the assessment of over 370 species. This species used for the calibration of the system ranged from severe agricultural and environmental weeds to benign and beneficial plants.

The system tallies the number of questions answered in each section. The WRA system allows for knowledge gaps, while still requiring responses to a minimum number of questions in each of its three different categories. The minimum number of questions for each section is: 2 for section A, 2 for section B and 6 for Section C.

The WRA system has some capacity to suggest the type of ecosystems likely to be affected by the plant assessed. The system indicates if the plant is more likely to be a specific weed of agriculture or the general environment, once it has assessed the plants potential to become a weed in Australia. A species may be assessed to be a weed of both categories. The partitioning helps to identify areas most at risk from the characters assessed for the species.

Do I need a computer?

The WRA system was developed to allow an assessment to be made without a computer (Form A). Form B sets out the method for manual calculation of the final score.

What computer software do I require to run the WRA system?

The WRA system is designed to run on Microsoft Excel version 5.x. It may be run on either a Windows or Macintosh computer. The system is also in the process of being adapted to run under Access 2.0 and 7.0.

If you would like a copy of the WRA Excel program contact Plant Biosecurity.

Using the WRA Excel spreadsheet

The WRA Excel spreadsheet consists of two worksheets. The risk assessment (RA) worksheet is the species assessment questionnaire (Form A). This worksheet can be filled out manually or by using the run command. The WRA worksheet is dynamically linked to the second worksheet, the Species sheet. This Species worksheet is the data worksheet for the system. All species assessed under the system are stored in this worksheet. New species added to the RA worksheet are listed at the bottom of the Species list.

Risk Assessment (RA) Sheet Buttons

Run - Runs the dialogue driven risk assessment. Alternatively, manual entry is possible.
Get - This button has two functions. It brings the responses for a specified species from the Species sheet to the RA sheet. Also new species can be added to the list by selecting `new' in the pop-up box. The system will you to type the genus and species, common name and author into a pop-up box.

Store - Transfers the current responses in the RA sheet to the Species sheet. Note that this does not save results to disk (see save).
Species - Switches to the Species worksheet.
Save - Saves the current state of the system to disk.
Help - Provides information on the operation of the system, including discussion of the questions and information on button functions.
Print Report - Creates a one page report of the risk assessment, Form A. Prints this report on the currently selected printer.

Species Sheet Buttons

Get - Allows you to find a species or add a new one to the list. It is possible to enter and modify responses directly on the species sheet but the scores will not be updated. To update the score, the species will need to be moved to the RA sheet using the RA sheet *Get* button and then restored to the species sheet using the RA *Store* button.
Delete - Delete a species from the sheet.
Sort - Sorts the species sheet alphabetically by botanical name.
RA - Switches to the RA worksheet.
Save - Saves the current state of the system to disk.
Help - Provides information on the operation of the system.

How should I interpret the questions in the WRA system?

The Weed Risk Assessment system consists of 49 questions.

A description of each question has been developed.
Users of the WRA should try to follow these descriptions so that all users of the system answer the questions consistently.

History/Biogeography

1 Domestication / cultivation

1.01 ***Is the species highly domesticated? If answer is `no" go to Question 2.01***
The taxon must have been cultivated and subjected to substantial human selection for at least 20 generations. Domestication generally reduces the weediness of a species by breeding out noxious characteristics.

1.02 ***Has the species become naturalised where grown?***
Is a domesticated plant, which has introduced from another region, growing, reproducing and maintaining itself in the area in which it is growing. A `yes' answer to question 1.01 will be modified by the response to this question.

1.03 ***Does the species have weedy races?***
Only answer this question if the species you are assessing is a sub-species, cultivar or registered variety of a domesticated species. If the taxon is a less weedy subspecies, variety or cultivar, then there must be good evidence that it does not retain the capacity to revert to a weedy form. A `yes' answer to question 1.01 will be modified by the response to this question.

2 Climate and distribution

2.01 ***Species suited to Australian climates (0-low; 1-intermediate; 2-high)***
This question applies to any one Australian climate type, or more than one. Ideally, base the climate matching on an approved computer prediction system such as CLIMEX , BIOCLIM or Climate. If no computer analysis is carried out then assign the maximum score (2).

2.02 ***Quality of climate match data (0-low; 1-intermediate; 2-high)***
The score for this question is an indication of the quality of the data used to generate the climate analysis. Reliable specific data scores 2, general climate references scores 1, broad climate or distribution data scores 0. If a computer analysis was not carried out assign the maximum score of 2.

2.03 ***Broad climate suitability (environmental versatility)***
Score `yes' for this question if the species is found to grow in a broad range of climate types. Output from the climate matching program may be used for this question. Otherwise base the response on the natural occurrence of the species in 3 or more distinct climate categories. Use the map of climatic regions provided or one available in a comprehensive atlas.

2.04 ***Native or naturalised in regions with extended dry periods***
The species is able to grow in areas with rainfall in the driest quarter less than 25 mm. Plants from this group may potentially grow and survive in arid Australian conditions.

2.05 ***Does the species have a history of repeated introductions outside its natural range?***
This history should be well documented. A potential weed must have opportunities to show its potential. A score for Question 2.05 will modify the score for a `no' answer to Question 3.01. Species with repeated introductions that have not established are a lower risk.

3 Weed Elsewhere

3.01 ***Naturalised beyond native range***
A naturalised species will be cited in floras of localities which are clearly outside of the native range. If the native range is uncertain and the known extent of the naturally growing plants is within the area of uncertainty then the answer is `don't know.'

3.02 ***Garden/amenity/disturbance weed***
The plant is generally an intrusive weed of gardens, parklands, roadsides, quarries, etc. This question carries less weight than 3.03 or 3.04. If a plant is listed as a weed in relevant references but the type of weed is uncertain or it is a minor weed - score `yes' for 3.02.

3.03 ***Weed of agriculture/horticulture/forestry***
The plant is generally a weed of agriculture/horticulture/forestry and causes productivity losses and/or costs due to control. This question carries more weight than 3.02. If a plant is listed as a weed in relevant references but the type of weed is uncertain or it is a minor weed - score `yes' for 3.02.

Environmental weed

3.04 The plant is documented to alter the structure or normal activity of a natural ecosystem. This question carries more weight than 3.02. If a plant is listed as a weed in relevant references but the type of weed is uncertain or it is a minor weed - score `yes' for 3.02.

3.05 ***Congeneric weed***
Documented evidence that one or more species, with similar biology, within the genus of the species being evaluated are weeds.

Biology/Ecology

4 **Undesirable traits**

4.01 ***Produces spines, thorns or burrs***
The plant possesses a structure on the plant known to cause fouling, discomfort or pain to animals or man. If the taxon is a thornless subspecies, variety or cultivar, then there must be good evidence that it does not retain the capacity to revert to a thorny form.

4.02 ***Allelopathic***
The plant is well documented as a potential suppressor of the growth of other species by chemical (eg. hormonal) means. Such evidence is rare throughout the whole plant kingdom.

4.03 ***Parasitic***
The parasite must have a detrimental effect on the host and the potential hosts must be present in Australia. This question includes wholly and semi-parasitic plants. Such plants are rare.

4.04 ***Unpalatable to grazing animals***
Consider the plant with respect to where the plant has the potential to grow and if the herbivores present could keep it under control. This trait may be found at any stage during the lifecycle of the plant and/or over periods of the growing season.

4.05 ***Toxic to animals***
There must be a reasonable likelihood that the toxic agent will reach the animal, by grazing or contact. Some species are mildly toxic but very palatable and could cause problems if heavily grazed.

4.06 ***Host for recognised pests and pathogens***
The main concerns are plants that are hosts of toxic pathogens and alternate or alternative hosts of crop pests and diseases. Where suitable alternative or alternate hosts are already widespread in cropping or natural systems the answer should be `no' unless the species will affect the current control strategies for the pathogen or pest. Apply a reasonable level of specificity; a pathogen of an entire family, such as takeall, should not be the basis for answering `yes' for an individual species.

4.07 ***Causes allergies or is otherwise toxic to humans***
This condition must be well documented and likely to occur under normal circumstances. For example by physical contact or inhalation of pollen from the species.

4.08 ***Creates a fire hazard in natural ecosystems***
This question applies to species that have a documented growth habit that leads to the rapid accumulation of fuel for fires when growing in natural or unmanaged ecosystems.

4.09 ***Is a shade tolerant plant at some stage of its life cycle***
Shade tolerance can enhance the invasive potential of a species.

4.10 ***Grows on infertile soils***
Australian soils are generally very infertile. Species that tolerate low nutrient levels could potentially grow well here. Legumes, tolerant of low soil phosphorus, are a particular concern since they would also modify the soil environment.

4.11 ***Climbing or smothering growth habit***
This trait includes fast growing vines and ivy's that cover and kill or suppress the growth of the supporting vegetation. Plants that rapidly produce large rosettes could also score for this question.

4.12 ***Forms dense thickets***
The thickets produced should obstruct passage or access, or exclude other species. Woody perennials are the most likely candidates, but this question may include densely growing grasses.

5 **Plant type**

Aquatic

5.01 The question includes any plants normally found growing on rivers, lakes and ponds. These species have the potential to choke waterways and starve the system of light, oxygen and nutrients. Consequently, the score is high (5).

5.02 ***Grass***
A large proportion of the grass family (Poaceae/Gramineae) are weeds in some context. As with congeneric weed species, there is a high probability that a species from this family will be a weed.

5.03 ***Nitrogen fixing woody plant***
A large proportion of woody legumes (Family Leguminosae/Fabaceae) are weeds, particularly of conservation areas. As with congeneric weed species, there is a high probability that a species from this family will be a weed.

5.04 ***Geophyte***
Perennial plants with tubers, corms or bulbs. This question is specifically to deal with plants that have specialised organs and should not include plants merely with rhizomes/stolons (see 6.06). Plants from this group can be particularly difficult to eradicate from a site.

6 Reproduction

6.01 ***Evidence of substantial reproductive failure in native habitat***
Predators and other factors present (eg. disease) in the native habitat can cause substantial reductions in reproductive capacity. The reproductive output of a species may greatly increase when the plant grows in areas without these factors.

6.02 ***Produces viable seed***
If the taxon is a subspecies, variety or cultivar, it must be indisputably sterile. The male plants of a dioecious species are regarded as seed producers.

6.03 ***Hybridises naturally***
A `yes' answer for this question requires documented evidence of interspecific hybrids occurring, without assistance, under natural conditions.

6.04 ***Self-fertilisation***
Species capable of self seeding, can spread from seed produced by an isolated plant.

6.05 ***Requires specialist pollinators***
The invasive potential of the plant is reduced if the species requires specialist pollinating agents that are not present or rare in Australia.

6.06 ***Reproduction by vegetative propagation***
The plant must be capable of increasing its numbers by vegetative means. This may include reproduction by: rhizomes, stolons or root fragments, suckers or division.

6.07 ***Minimum generative time (years)***
This is the time from germination to production of viable seed, or the time taken for a vegetatively reproduced plant to duplicate itself. The shorter the timespan, the more weedy a plant is likely to be. The score for this trait uses the correlation factor (1 year score 1, 2-3 years score 0, greater than or equal to 4 years score -1).

7 Dispersal mechanisms

7.01 ***Propagules likely to be dispersed unintentionally***
Propagules (any structure, sexual or asexual, which serves as a means of reproduction), unintentionally dispersed resulting from human activity. An example is plants growing in heavily trafficked areas such as farm paddocks or roadsides.

7.02 ***Propagules dispersed intentionally by people***
The plant has properties that make it attractive or desirable, such as an edible fruit, an ornamental or curiosity. The species is readily collected as a cutting or seed. This group includes most horticultural plants.

7.03 ***Propagules likely to disperse as contaminants of produce***
Produce is the economic output from any agricultural, forestry or horticultural activity. An example is grain shipments that contain seeds of weed species.

7.04 ***Propagules adapted to wind dispersal***
Documented evidence that wind significantly increases the dispersal range of the propagule. An example is an achene with a pappus. This group includes tumbling plants and plants with seeds contained within an explosive capsule or pod.

7.05	***Propagules buoyant*** This question includes any structure containing the propagule that typically becomes detached from the plant and is buoyant. An example is a pod of a legume. This is a limited method of distribution of land plants.
7.06	***Propagules bird dispersed*** Any propagule that may be transported and/or consumed by birds, and will grow after defecation. An example is small red berries with indigestible seeds.
7.07	***Propagules dispersed by other animals (externally)*** The plant has adaptations, such as burrs, and/or grows in situations that make it likely that propagules become temporarily attached to the animal. This can include the spread of plants parts on clothing. This dispersal group includes seeds with an oily or fat-rich outgrowth that aids in ant seed dispersal.
7.08	***Propagules dispersed by other animals (internally)*** The propagules are eaten by animals, dispersed and will grow after defecation.
8	**Persistence attributes**
8.01	***Prolific seed production*** The level of seed production must be met under natural conditions and applies only to viable seed. For grasses and annual species this rate should be (>5000-10000/m^2/yr), for woody annual a rate of (>500/m^2/yr) would be considered high. Specific data on this attribute may be unavailable, however, an estimate can be made from the seed/plant and the average size of the plant.
8.02	***Evidence that a persistent propagule bank is formed (>1 yr)*** Greater than 1% of the seed should remain viable after more than one year in the soil. This bank may include both canopy and soil seed banks. Long seed viability increases a plants invasive potential.
8.03	***Well controlled by herbicides*** Documented evidence is required for good chemical control of the plant. This control must be acceptable in the situations in which it is likely to be found. The chemical management should be safe for other desirable plants that are likely to be present. This information will be poorly documented for most non-agricultural plants.
8.04	***Tolerates or benefits from mutilation, cultivation or fire*** Plants that tolerate or benefit from such disturbance may out-compete other species. This question does not apply to seed banks.
8.05	***Effective natural enemies present in Australia*** A known, effective, natural enemy of the plant may or may not be present in Australia. The answer is 'don't know' unless a specific enemy/enemies are known.

Assessments may be entered manually into Form A and the final score calculated by reference to Form B.

Acknowledgements

The Weed Risk Assessment system was developed by Dr Paul Pheloung during his employment in Western Australian Department of Agriculture.

Input from a wide range of contributors has been instrumental in the finalisation of the WRA system. During the calibration phase input, including assessments using the system and comments on the system, was received from scientists from 13 organisations from both Australia and New Zealand. After the system was endorsed by the Australian Weeds Committee it was released to stakeholders of the Australian Quarantine and Inspection Service (AQIS) and the Australian Nature Conservation Agency (now a group within Environment Australia), the two Commonwealth agencies with an interest in the regulation of imported plants for comment. Comments from both groups were used to increase the effectiveness and clarify the questions used in this system, this contribution is greatly acknowledged.

Form A - Weed Risk Assessment question sheet

Form B - Weed Risk Assessment scoring sheet

Form A Weed Risk Assessment question sheet

Answer yes (y) or no (n), or don't know (leave blank), unless otherwise indicated

		Botanical name: Common name: Family name	Outcome: Score: Your name:	
			History/Biogeography	
A	1	*Domestication/ cultivation*	1.01 Is the species highly domesticated? If answer is 'no' got to question 2.01	
C			1.02 Has the species become naturalised where grown?	
C			1.03 Does the species have weedy races?	
	2	*Climate and Distribution*	2.01 Species suited to Australian climates (0-low; 1-intermediate; 2-high)	2
			2.02 Quality of climate match data (0-low; 1-intermediate; 2-high)	2
C			2.03 Broad climate suitability (environmental versatility)	
C			2.04 Native or naturalised in regions with extended dry periods	
			2.05 Does the species have a history of repeated introductions outside its natural range?	
C	3	*Weed elsewhere*	3.01 Naturalised beyond native range	
E			3.02 Garden/amenity/disturbance weed	
A			3.03 Weed of agriculture/horticulture/forestry	
E			3.04 Environmental weed	
			3.05 Congeneric weed	
			Biology/Ecology	
A	4	*Undesirable traits*	4.01 Produces spines, thorns or burrs	
C			4.02 Allelopathic	
C			4.03 Parasitic	
A			4.04 Unpalatable to grazing animals	
C			4.05 Toxic to animals	
C			4.06 Host for recognised pests and pathogens	
C			4.07 Causes allergies or is otherwise toxic to humans	
E			4.08 Creates a fire hazard in natural ecosystems	
E			4.09 Is a shade tolerant plant at some stage of its life cycle	
E			4.10 Grows on infertile soils	
E			4.11 Climbing or smothering growth habit	
E			4.12 Forms dense thickets	
E	5	*Plant type*	5.01 Aquatic	
C			5.02 Grass	
F			5.03 Nitrogen fixing woody plant	
C			5.04 Geophyte	
C	6	*Reproduction*	6.01 Evidence of substantial reproductive failure in native habitat	
C			6.02 Produces viable seed.	
C			6.03 Hybridises naturally	
C			6.04 Self-fertilisation	
C			6.05 Requires specialist pollinators	
C			6.06 Reproduction by vegetative propagation	
C			6.07 Minimum generative time (years)	1
A	7	*Dispersal mechanisms*	7.01 Propagules likely to be dispersed unintentionally	
C			7.02 Propagules dispersed intentionally by people	
A			7.03 Propagules likely to disperse as a produce contaminant	
C			7.04 Propagules adapted to wind dispersal	
E			7.05 Propagules buoyant	
E			7.06 Propagules bird dispersed	
C			7.07 Propagules dispersed by other animals (externally)	
C			7.08 Propagules dispersed by other animals (internally)	
C	8	*Persistence attributes*	8.01 Prolific seed production (>5000/m2/yr)	
A			8.02 Evidence that a persistent propagule bank is formed (>1 yr)	
A			8.03 Well controlled by herbicides	
C			8.04 Tolerates or benefits from mutilation, cultivation or fire	
E			8.05 Effective natural enemies present in Australia	

Form B. Weed Risk Assessment Scoring Sheet

	a	b	c	d	e
Section	Question	Response [1]	Score [2]	*N* score	*Y* score
A C	1.01			0	-3
C	1.02			-1	1
C	1.03			-1	1
	2.01		The response for these questions is 2 unless a climate analysis is done		
	2.02				
C	2.03			0	1
C	2.04			0	1
	2.05				
C	3.01			Refer to lookup table	
E	3.02				
A	3.03				
E	3.04				
C	3.05				
B C	4.01			0	1
C	4.02			0	1
C	4.03			0	1
A	4.04			-1	1
C	4.05			0	1
C	4.06			0	1
C	4.07			0	1
E	4.08			0	1
E	4.09			0	1
E	4.10			0	1
E	4.11			0	1
C	4.12			0	1
C E	5.01			0	5
C	5.02			0	1
E	5.03			0	1
C	5.04			0	1
C	6.01			0	1
C	6.02			-1	1
A	6.03			-1	1
C	6.04			-1	1
C	6.05			0	-1
A	6.06			-1	1
C	6.07				
A	7.01			-1	1
C	7.02			-1	1
A	7.03			-1	1
C	7.04			-1	1
E	7.05			-1	1
E	7.06			-1	1
C	7.07			-1	1
C	7.08			-1	1
C	8.01			-1	1
C	8.02			-1	1
A	8.03			1	-1
A	8.04			-1	1
C	8.05			1	-1
	Total score [3]				
	Outcome [4]				
	Agricultural score [5]				
	Environmental [6]				

Lookup table for section 3.										
Locate value of inputs and lookup output for each question										
	Yes to questions 3.01 - 3.05									**default**
Inputs	2.01	0	0	0	1	1	1	2	2	**2**
	2.02	0	1	2	0	1	2	0	1	**2**
Results	3.01	2	1	1	2	2	1	2	2	**2**
	3.02	2	1	1	2	2	1	2	2	**2**
	3.03	3	2	1	4	3	2	4	4	**4**
	3.04	3	2	1	4	3	2	4	4	**4**
	3.05	2	1	1	2	2	1	2	2	**2**
	No to questions 3.01 - 3.05									
Input	2.05	?	N	Y						
Results	3.01	-1	0	-2						
	3.02-3.05	0	0	0						

Procedure

1. Record appropriate responses in column b.
2. Look up score in columns d & e and record result in column c.
3. Calculate total score.
4. Lookup and record recommendation.
5. Verify that minimum number of questions from each section are answered.
6. Compute Agricultural (A&C) and Environmental (E&C) scores: if either score is less than 1, the outcome pertains to the other sector.

Lookup table for 6.07			
years	1	2	4
score	1	0	-1

Score	Outcome
< 1	Accept
1-6	Evaluate
> 6	Reject

Section	Minimum # questions [5]
A	2
B	2
C	6
Total	10

BOOK REVIEW

"Wetland Plants of Queensland – A field Guide"

KM Stephens & RM Dowling

Published by CSIRO Publishing 2002 ISBN 064306674-8

A relatively small, soft-covered work containing photographs by Ralph Dowling (and one by Selwyn Everist) and location maps of some 90 commonly encountered species of waterplants from throughout Queensland, this publication has been long awaited and is appreciated

Each species described, and some naturalized exotics which are commonly encountered are included, has the description divided into a number of headings; Habit, Distribution, leaves, Flowers, Flowering period, Fruit and Notes. The Family of each plant is listed along with the Genera and Species and common name where one is in use. All exotic species are indicated by use of an asterisk. Plants described are arranged alphabetically within families with the families also arranged alphabetically from Alismataceae to Typhaceae.

All photographs contained within the work are full colour, although of limited size and occasionally very indistinct, and generally provide an indication of the covered species in their growing environment. A few of the species covered have additional insert photographs showing more detail of the flower or fruiting body of the species. Each species covered also has a location map of Queensland with the general location of known populations indicated.

One omission which I thought would have been very useful is the inclusion of line drawings, particularly where very similar species are described. Adequate space is available.

Plants which fall into the category of Declared Plants under the *Rural Lands Protection Act (1985 – 1990) (Qld)* are indicated as such in the text. Reference is made to the *Nature Conservation Act (1992) (Qld)* and its associated *Nature Conservation (Wildlife) Regulations (1994)* in relation to Rare and Threatened Plants and the landholder is referred to the Environmental Protection Agency for advice on dealing with these species.

The Introduction to the publication provides the scope of the work and refers the reader interested in obtaining more information to the provided keys to Queensland species.

> "...keys to the currently known wetland species of Queensland (except for sedges) have been included in the second half of the book. The illustrated and described plants are indicated in these keys together with a page reference. A key to the sedges has not been included as a suitable key to identifying the species of this large specialized group already exists (Sharpe 1986)...."

These keys are divided into one for Families and then into individual Genera and for those without a good botanical knowledge, reference to the glossary is necessary.

The Glossary of Botanical Terms is quite adequate and does include some line drawings, although a number of additional drawings would have been beneficial.

Unfortunately this long-awaited publication has not quite lived up to expectations. It is however the first publication dealing exclusively with the waterplants of Queensland and will find an important place with many.

Available directly from CSIRO Publishing, Australian Information Services bookshops, as well as many other commercial outlets at a recommended retail price of $39.95 this is one to keep an eye open for and make your own judgment.