NORTHERN TERRITORY

WEED RISK MANAGEMENT SYSTEM

USER GUIDE

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Department of **Environment, Parks and Water Security**

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Authors: Samantha Setterfield[1], Keith Ferdinands[1,2] , Natalie Rossiter-Rachor[1] &
Louis Elliott[2.].

[1] Charles Darwin University
[2] Weed Management Branch, NT Department of Environment and Natural Resources (now: Department of Environment, Parks and Water Security)

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Revision History

Version	Date	Notable changes	Reviewer
1.0	September 2015		
1.1	June 2016	• Additional point in WRA QA1. • Change WRA QB4 to include harmful effects on plants, additional comments also included.	M. Franklin WRTC
1.2	June 2017	• Add text to examples (pg. 13)	L. Elliott WRTC
1.3	October 2017	• Added special conditions on aquatic species for Potential Distribution section • Split tropical wetlands and floodplains into two separate habitat types for question C2	L. Elliott WRTC
1.4	May 2022	• Answers on WRA Q5b edited for clarity.	M. Franklin WRTC
1.5	December 2022	• Edited special conditions on aquatic species for Potential Distribution section, now includes species restricted to aquatic environments.	M. Franklin WRTC

Weed Management Branch contacts

For more information or advice in relation to the identification, management or monitoring of weeds in the Northern Territory, please contact the Weed Management Branch:

Phone: (08) 8999 4567
Email: weedinfo@nt.gov.au
Website: www.nt.gov.au/weeds
The NT Herbarium can also provide plant identification advice
Phone: (08) 8999 4516

Rangelands Division
Department of Environment, Parks and Water Security
PO Box 496
Palmerston NT 0831

EXECUTIVE SUMMARY

- Decisions on weed management have historically been frequently based on perceptions or emotions which is not necessarily a sound basis for determining long-term strategic priorities.
- In line with other jurisdictions in Australia, a risk-based, repeatable tool to help make decisions about individual species has been developed called the Northern Territory Weed Risk Management System (NTWRMS). The system is based on the National Post-Border WRM Protocol.
- The objective of this document is to provide technical guidance on how to use the NTWRMS - including a description of the background and process, and how to complete the questions and interpret the results.
- The system consists of two components: ‘weed risk’ and ‘feasibility of control’. Each component is scored between 0 and 1000 allowing different species to be ranked. Scores can be converted to bands ‘low’, ‘medium’, ‘high’ and ‘very high’.
- The weed risk component has sections on: invasiveness (biology and spread); impacts (economic, environmental and social); and potential distribution (amount of the environment it can invade).
- The feasibility of control component has sections on: cost of control (difficulty and resources required); current distribution (how much of the weed there is); and persistence (how long control required for).
- Evidence relevant to the questions in each section is compiled by a desk-top researcher using published literature and expert opinion.
- Final scores are determined by consensus based on deliberations by an expert Technical Committee.
- Final scores for weed risk and feasibility of control can be used to derive general guidance on appropriate regional, strategic weed management actions and inform general policy and planning advice for the species.

CONTENTS

DEFINITIONS

Alien plant	Plant not native to a given biogeographic area.
Allelopathy	Production of chemicals by a plant which inhibit the growth, survival and/or reproduction of neighbouring plants.
Climatch	A climate matching model that predicts the potential range of a species by matching climate data from weather stations where the species occurs, to climate data from weather stations in other selected regions (data.daff.gov.au:8080/Climatch/climatch.jsp).
Control costs	Section A of the feasibility of control component (out of 10). Considers the costs of detection, on-ground control and enforcement/education needs.
Current distribution	Section B of the feasibility of control component (out of 10). How widespread the weed is at the time of assessment.
Determination	Answer for a question for an assessment of weed risk or feasibility of control agreed on by the NTWRMS Technical Committee.
Feasibility of control	Second of two components of the NTWRMS (out of 1000). The comparative ease or practicality of controlling a weed species in a given weed management region.
Impacts	Section B of the weed risk component (out of 10). The economic, environmental, and social effects the plant would have assuming establishment.
Intact vegetation	Native vegetation that has not been seriously degraded by human activity during the immediately preceding period of 20 years; or if the only serious degradation of the vegetation by human activity during that period has been caused by fire (definition derived from *South Australian Native Vegetation Act 1991*).
Invasiveness	Section A of the weed risk component (out of 10). A weed's ability to establish, disperse and spread.
Introduced plant	A plant that has been deliberately introduced from outside its native range.
Invasive plant	A plant that is able to invade new areas by reproducing and establishing new populations, and which has significant negative economic, environmental and/or social/cultural impacts.
Naturalised plant	An alien or introduced plant that maintains a population by recruitment from seed or vegetative propagules capable of independent growth, without the need for direct human intervention (Pysek, *et al.* 2004).
NTWRMS	Northern Territory Weed Risk Management System.

Persistence	Section C of the feasibility of control component (out of 10). Expected duration of control works.
Population	A group of individual plants of the same species growing in the same locale.
Potential distribution	Section C of the weed risk component (out of 10). The amount of the Northern Territory environment broadly suitable for the growth of the plant without deliberate human assistance.
Propagules	Seeds, spores or vegetative parts capable of generating new individual plants separate from its parent.
Technical Committee	The group of representative expert stakeholders which makes determinations for the questions for weed risk and feasibility of control assessments.
Transformer	Plant that can change the character, condition, form or nature of vegetation over substantial areas.
Viable seed	Seed that is able to germinate.
Weed	Plant growing where it is not wanted which has some detectable economic and/or environmental impact.
Weed Management Region	Administrative region within the Northern Territory relating to weed management. There are four regions administered from Darwin, Katherine, Tennant Creek and Alice Springs (see Appendix A).
Weed Management Matrix	Matrix providing general guidance on appropriate regional, strategic weed management actions based on a comparison of weed risk and feasibility of control.
Weed risk	The first of two components of the NTWRMS (out of 1000). Relative risk of a weed having significant negative economic, environmental and/or social/cultural impacts.

BACKGROUND

What is the Northern Territory Weed Risk Management System?

The Northern Territory Weed Risk Management System (NTWRMS) provides an evidence-based, standard, agreed and transparent process for making decisions about the introduction, declaration and prioritisation of potential weed or current weed species in the Northern Territory.

It assesses weed risk on a Territory-wide scale, and feasibility of control by each of the four weed management regions in the Territory. The NTWRMS balances the economic benefits to be gained from using exotic species versus the potential detrimental impacts and costs imposed on the economy, environment, society and culture.

Specifically the NTWRMS has been designed as a decision support tool for:

- deciding which plants should be approved or not approved for release in the Territory;
- prioritising weeds for the allocation of limited management resources;
- determining the appropriate legislative status for undeclared naturalised plants;
- reviewing the legislative status of currently declared weeds; and
- reviewing existing Northern Territory weed management legislation.

In the Territory, the majority of the vegetation is relatively intact and most beneficial land uses rely on an intact/functioning landscape (Department of the Environment and Heritage 2003,Dore*, et al.* 1999). Major land uses include pastoralism, conservation management, defence and mining; and indigenous cultural interests prevail across the whole landscape regardless of land tenure. Some weeds threaten the intact nature of the landscape by substantially transforming the structure and function of vegetation. As such, weeds have the potential to have significant negative environmental, cultural, social and economic impacts.

Weed risk management systems in some Australian jurisdictions evaluate specific land uses separately – e.g. agricultural versus pastoral land. However, while there are varied land uses in the Territory, the majority of the landscape is largely intact and is managed in a relatively unmodified state. Also, weed risk is assessed at a Territory-wide scale. For these reasons, the NTWRMS evaluates the impact of weeds on intact native vegetation as the default context.

Why do we need a Weed Risk Management System?

Resources are always limited and people, including experts, have different opinions about how to rank weeds in importance. It is therefore important to have some method to assess which species are the most important, and how best to invest the resources that we do have. Weed Risk Management systems fill this need.

There are a number of WRM systems in use in Australia. They all comply with The Australian and New Zealand Standard — the National Post-Border Weed Risk Management Protocol. Not only is this protocol best practice in Australia and New Zealand, it has been adopted by the Food and Agricultural Organisation of the United Nations and is being implemented throughout Central and South America, South-east and Central Asia, Northern Africa and the Mediterranean region (Johnson 2009).

How is the NTWRMS different from other systems in use in Australia?

A key difference between the NTWRMS and other systems in use in Australia is that in the Northern Territory, assessments are done by consensus by a Technical Committee with broad stakeholder representation. Evidence is prepared and presented to the Committee which then debates and determines the outcome. This can be especially important in weed management, because different people can have divergent opinions regarding the priority, severity or importance of different weed species.

Brief history of the development of the NTWRMS

The NTWRMS was developed collaboratively by the Department of Land Resource Management; the Department of Primary Industries and Fisheries; Charles Darwin University and other stakeholder groups.

Initial discussions with a range of expert stakeholders began in 2004, outlining the need for a weed risk management system in the Territory, and comparing systems already in use in other parts of Australia (Setterfield*, et al.* 2010). Other Australian jurisdictions had already invested in weed risk management systems and for consistency and efficiency, the most relevant and useful aspects of these systems were used. Most of the NTWRMS is derived from the South Australian system (Virtue 2005,Virtue 2010), and complies with the National Post-border Weed Risk Assessment Protocols (Standards Australia*, et al.* 2006). The benefit-cost component of the NTWRMS is derived from the Queensland WRM system (Walton 2002). All components have been modified/improved to suit the environmental conditions and weed management needs of the Territory (NTG 2004).

At the initial meeting in 2004, the purposes of developing an NTWRMS were identified as including to:

- Provide an objective tool to help respond to weed issues
- Assist with any review of the declared weed list
- Prioritise use of scarce resources
- Help resolve conflict

In 2005, a steering committee met to continue discussions regarding which parts of other states models would be most suitable for the Territory. In 2006, a Reference Group was established to continue to oversee the development of the system, including the use of funding from the National Heritage Trust. The Reference Group existed for two years (2006-2008) during which time the system was established.

In 2006, a Technical Committee was established to test the system and to undertake weed risk assessments.

Technical Committee

The role of the Technical Committee is to evaluate evidence presented and make determinations for weed risk and feasibility of control assessments and reassessments. In addition, the committee has played a role in the testing and development of the NTWRMS, and is a forum for discussion regarding any issues or considerations regarding weed risk.

In particular, the Technical Committee has played a vital role in establishing an agreed process to evaluate the weed risk of contentious or 'conflict' species – usually species which have both economic use and are weeds of other sectors, e.g. gamba grass, lantana. It provides an forum with high level of cross-sectoral expertise to consider emerging issues such as proposed biofuel or other novel crop species.

The Technical Committee's membership has been made up from a range of experts, mostly from different Government agencies, including DLRM Weed Management Branch; NT Department of Primary Industries and Fisheries; DENR Flora and Fauna Division and the Australian Quarantine and Inspection Service. Membership has changed over time according to circumstances, but has always ensured effective representation across three broadly defined sectors: primary industry, environmental protection and weed management.

The Technical Committee met regularly (typically 3-5 times/year) between 2005 and 2011. During this time, it developed and tested the system, and completed a prioritised list of 97 assessments. Since 2011, few new assessments have been conducted and the committee now meets on an as needs basis.

Weed risk assessment process

There are five broad stages in the assessment process:

1. species selection;
2. compilation of information;
3. determination;
4. results;
5. re-evaluation.

Species selection

There are several factors relevant to species selection. The steering committee identified that it was important to select:

- a mix of high and low risk species to test the system;
- species from a range of environments in the Northern Territory;
- declared species present in the Northern Territory; and
- contentious or new weed species which appear to pose a serious threat.

From the list of possible candidates, the Technical Committee prioritises species for assessment. Reassessment of species is done in response to new information becoming available which has the potential to change the result of an existing assessment.

Note that some assessments cover more than one species where the species behave in a functionally similar manner from a weed management perspective – e.g. the water mimosa assessment covers both *Neptunia plena* and *N. oleraceae*; the rats tail grass assessment covers four species of introduced *Sporobolus*.

Compilation of information

For each species assessment, evidence relating to each question is compiled by a Weed Management Officer or researcher to be presented to the Technical Committee for evaluation. The evidence is entered into the NTWRMS database.

There are usually a range of sources available. Highest preference is given to primary sources and to peer-reviewed scientific literature. The next preference is given to 'grey' literature, i.e. non-peer reviewed reports and websites. If neither peer-reviewed nor 'grey' literature is available, then expert opinion or personal communication is sought.

In some cases, local knowledge or expert opinion will contradict published material, but it may be more reliable if it is based on direct observation of the behaviour of the species in the Northern Territory. This is particularly important for species that exhibit behaviour that is not well documented or may be different in the Northern Territory compared to elsewhere (e.g. cabomba reproduction, neem invasiveness).

Determination

Based on the evidence presented, the Technical Committee makes a determination for each of the questions in the assessment. Occasionally, different sources contradict each other. In this case, the Technical Committee makes a determination based on the reliability or relevance of the material presented.

Using a group with a range of stakeholder perspectives to answer the questions is an ideal way to eliminate individual subjectivity. The determinations are the result of group consensus.

Results

The results for each determination are entered into the NTWRMS database which calculates a score for each section, an overall score for weed risk or feasibility of control, and a band.

Using the weed risk and feasibility of control results, the species may be assigned a position in the Weed Management Matrix which provides general guidance on appropriate regional, strategic weed management actions.

A weed risk assessment technical report is able to be exported from the database which includes

- The evidence and source considered by the Technical Committee for each question;
- The determination made by the Technical Committee for each question;
- A reference list of sources used to compile the evidence for the assessment.

For priority species, a more comprehensive weed risk assessment technical reports with additional summary material are compiled and available at www.lrm.nt.gov.au/weeds/risk.

Requests for weed risk assessment technical reports for other species, or for further information regarding individual weed risk assessments can be made by email at weedinfo@nt.gov.au.

Re-evaluation

If new evidence becomes available which has the potential to change the results of an assessment, then it may require reassessment by the Technical Committee. However, if the new evidence would not affect any existing determinations, the evidence may simply be incorporated into the NTWRMS database without the need for consideration by the Technical Committee. As such, species are reassessed on an as needs basis only.

SPECIES ASSESSMENT

Assessment structure

The ‘Weed Risk’ and ‘Feasibility of Control’ components are each divided into three sections.

For weed risk, the sections are:

- Invasiveness
- Impacts
- Potential distribution

For ‘Feasibility of Control’, the sections are:

- Control costs
- Current distribution
- Persistence

Guide to answering questions

The following points should be used to guide the answering of questions as a part of the assessment process:

- Scores are based on reliable scientific or expert information. In the absence of published evidence or expert opinion, evidence from closely related species can be used.

- All the evidence used to answer the question needs to be documented as part of the risk assessment process.

- All questions should be answered. If there is no relevant evidence available for that question including relevant knowledge from the Technical Committee, choose the ‘don't know’ option. ‘Don't know’ is given an average of the highest and lowest scores in order to avoid bias and minimise error. However, results for species which have one or more questions answered as ‘don't know’ should be interpreted very cautiously. It may be necessary to seek opinions from others (e.g. landholders, advisers, other states) or conduct further research on the species before a reliable assessment can be conducted.

Interpreting the scores

Simply ranking species by their weed risk scores may be useful when prioritising known weed species as the values are comparable between species. This can be used for the prioritisation of limited time, money and other resources for weed management. The scores may be used as a first pass when assessing species for permitted use, weed status declaration, or early management actions. However, more complex economic, social and political considerations may be necessary before any decision is made.

Scoring

- Each section is given a corrected score from 0-10.
- Weed risk and feasibility of control are calculated by multiplying the scores from each of the three sections together.
- Weed risk and feasibility of control are given a score from 0-1000.

Calculating the corrected section score (0-10)

- To calculate the corrected score from 0-10.
- Each section is made up of a number of questions.
- To calculate the total score for the section,
  - add up the scores for all of the questions for that section;
  - note that sections have different maximum scores;
  - in order to make the sections comparable and of equal weight, divide the total score by the maximum score;
  - multiply by 10;
  - this results in a corrected score from 0-10;
  - corrected scores are rounded to one decimal place.

For example, the 'Impacts' section is scored out of a maximum of 19 points. If a species scored 12 out of 19, then divide 12 by 19 and multiply by 10 (12/19 = 0.632, 0.632 x 10 = 6.32). The result is then rounded to one decimal place. The corrected score would be 6.3 out of 10.

Calculating the component score (0-1000)

For each component, 'Weed Risk' and 'Feasibility of Control', the score is calculated by multiplying together the three corrected section scores, each ranging from 0-10.

- Maximum score = 10 x 10 x 10 = 1000.
- Therefore, the total score ranges from 0-1000.

Why multiply the section scores?

- Multiplying gives a greater spread in the scores than adding (i.e. range from 0-1000 compared to 0-30).
- Multiplying is logical, as it recognises the interactions between sections. Consequently, in order to get a high score a species needs to score reasonably high in all three sections. If a species scores low in one section, then the final score will likely be low. For example, to receive a very high score in weed risk, a species must exhibit high impact, colonise a wide range of environments, and be able to spread effectively.

Bands

It is easier in most situations to interpret the weed risk and feasibility of control results as a band - e.g. ‘low’, ‘medium’, ‘high’, ‘very high’.

Reporting the result as a band allows people to quickly evaluate what a score means in words rather than interpreting a number from 0-1000. Note that the bands are still relative measures. Therefore a species which scores ‘low’ risk may still be a weed with negative economic, environmental and/or social impacts. However, it is lower in relative risk compared to a species which scores ‘medium’, ‘high’ or ‘very high’.

In addition, the band results are used to position species in the Weed Management Matrix which provides general guidance on appropriate regional, strategic weed management actions.

How are the bands calculated

Bands for the components of weed risk and feasibility of control are calculated by the following procedure:

1. Calculate the result of every possible unique combination of answering all the questions. For example for weed risk, question A1 has 5 options, question A2(a) has 4 options, question A2(b) has 4 options . . . etc. The total unique combinations = 5 x 4 x 4 x . . . etc.

2. Sort all of the above results in order from lowest to highest (0-1000). Note that there are many ways of scoring 0 and there is only one way of scoring 1000.

3. Take the bottom 25% of the results and group them in the band ‘low’.

4. Take next highest 25% of the results (26-50%) and group them in the band ‘medium’.

5. Take next highest 25% of the results (51-75%) and group them in the band ‘high’

6. Take the final 25% of the results (76-100%) and group them in the band ‘very high’.

7. Determine the cut-off scores which define the bands, and use them to allocate bands to the species assessments.

Frequency Band	Component band
75 - 100% (top 25% of possible scores)	Very High
50 - 75%	High
25 - 50%	Medium
0 - 25% (bottom 25% of possible scores)	Low

WEED RISK

This component considers the relative risk of a weed having significant negative economic, environmental and/or social/cultural impacts. Weed risk is assessed for the whole of the Northern Territory.

The weed risk component is divided into three sections:

A) Invasiveness	A weed's ability to establish, disperse and spread.
B) Impacts	The economic, environmental, and social effects the plant would have assuming establishment.
C) Potential distribution	The amount of the Northern Territory environment broadly suitable for the growth of the plant without deliberate human assistance.

Each section is scored out of 10. Scores for the three sections are multiplied together to give a weed risk score between 0 and 1000. The higher the score, the greater the likelihood of the plant being a significant weed.

A) INVASIVENESS

This section evaluates the ability of the plant to reproduce, disperse and colonise native vegetation. In other words, the plant's ability to spread. It considers both natural and human-assisted means of dispersal.

A1. What is the ability of the plant to establish amongst intact native environments?		**SCORE**
☐ **very high**	'Seedlings' can establish within relatively intact vegetation. For aquatic plants, consider if they establish in undisturbed open water or require a reduction in water quality.	3
☐ **high**	'Seedlings' establish within slightly disturbed vegetation, defined as vegetation structure intact, disturbance affecting individual species (Keighery 1994).	2
☐ **medium**	'Seedlings' mainly establish when there has been moderate disturbance to existing vegetation which significantly alters the vegetation structure and substantially reduces competition from other plant species. This could include intensive grazing, mowing, raking, clearing of trees, floods, droughts or in some cases fire. The native vegetation retains basic structure or ability to regenerate it (Keighery 1994).	1
☐ **low**	'Seedlings' mainly need bare ground to establish; basic vegetation structure is severely impacted by disturbance, some or no scope for regeneration but not to a state approaching good condition without intensive management (Keighery 1994). This state may occur after major disturbance from cultivation, overgrazing, hot fires, mechanical grading, long-term flooding or long droughts.	0
☐ **don't know**		1.5

Comments

The ability to establish even in intact vegetation is a feature of many of the worst invaders. Plants that are able to invade intact native vegetation, where a dense vegetative cover is maintained are assumed to have greater weed potential. Some plants that have a low ability to establish in intact vegetation, and mainly establish after significant disturbance, such as fire, cultivation, drought or over-grazing (National Post-border Weed Risk Management Protocol, 2006).

Features which can help a plant establish amongst existing plants include:

- the ability to germinate under the canopy of other plants;
- large seeds or vegetative propagules (e.g. bulbs, root fragments, tubers, stolons) which provide more reserves to help the weed establish in competition with other plants;
- the ability to tolerate or avoid competitive stresses (e.g. by rapid root growth, nitrogen fixation or rapid vertical shoot growth).

Note that aquatic plants that occur in open water need to be considered differently to terrestrial or wetland plant species. For this group, consider whether the species can establish in undisturbed open water (e.g. pristine or high quality), or whether it requires a reduction in water quality.

Further assumptions

- Assume no weed control practices.
- 'Vegetation' implies native vegetation.
- 'Seedlings' includes growth from dispersed vegetative propagules (e.g. broken fragments of stems or roots) and spores, in addition to seeds.
- 'Seedlings' generally does not include new vegetative growth directly attached to the parent plant (e.g. by stolons, rhizomes or lateral roots). Vegetative growth is accounted for in question 2(c).

A2. What is the reproductive ability of the plant?						Total (a+b+c)	SCORE
(a) Time to seeding		**(b) Annual production of viable seed /m^2 or /plant**		**(c) Vegetative reproduction**			
☐ **1 year or less**	2	☐ **high**	2	☐ **frequent**	2	5 - 6	3
☐ **2-3 years**	1	☐ **low**	1	☐ **infrequent**	1	3 - 4	2
☐ **>3 years/never**	0	☐ **none**	0	☐ **none**	0	1 - 2	1
☐ **don't know**	1	☐ **don't know**	1	☐ **don't know**	1	0	0

Comments

Reproductive ability considers how well the plant can reproduce to rapidly build up its numbers at a site and to spread to other sites. If a plant never gets to reproduce then it will score 0.

Three factors are considered in scoring the reproductive ability of the plant:

(a) Time to seeding is the time from establishment from seed or vegetative propagules to production of viable seed.

(b) Annual production of seed is the average number of viable seeds produced per m^2 beneath the plant's canopy per year. For trees, consider production of viable seed per plant instead. For the calculation, account for the frequency of seeding events (e.g. biannual, annual or biennial). High would be more than 1000 viable seeds per m^2 or per individual plant per year. Low would be 0 - 1000 viable seeds per m^2 or per individual plant per year.

(c) Consider vegetative reproduction as the potential for 'new plants' to be produced by such means as bulbs, bulbils, corms, tubers, rhizomes, stolons, root suckers, root fragments and shoot fragments.

Further assumptions

For the purpose of part (c), 'new plants' are defined as shoots with their own root system. There may still be some connection to the parent plant.

A3. Do propagules of the plant have properties that allow them to be dispersed long-distance by natural means?								Total (a+b+c+d)	SCORE
(a) Flying animals (birds, bats)		**(b) Other wild animals**		**(c) Water**		**(d) Wind**		3 - 4	3
☐ **yes**	1	☐ **yes**	1	☐ **yes**	1	☐ **yes**	1	1.5 - 2.5	2
☐ **no**	0	☐ **no**	0	☐ **no**	0	☐ **no**	0	0.5 - 1	1
☐ **don't know**	0.5	☐ **don't know**	0.5	☐ **don't know**	0.5	☐ **don't know**	0.5	0	0

Comments

This question considers how well the plant can spread its propagules by natural means to start new weed outbreaks away from the original outbreak (generally more than 1 km). Plants which have multiple modes of dispersal, or have propagules that are regularly moved long distances from parent plants, are given greater significance as potential weeds, as they tend to spread faster. Consider if a plant has specific adaptations for long-distance dispersal from any of the features described below.

a) Flying animals (birds, bats)

Features favouring long-distance dispersal by flying animals are:

- whole fruits are eaten, and viable seeds are then defecated or regurgitated;
- propagules have hooks, barbs or sticky substances that attach to feathers, hairs or skin;
- very small seeds which can lodge within feathers, hairs or feet;
- seeds have an aril or coating which is attractive to birds or animals leaving viable seed discarded; and
- vegetative components which may be picked up and carried by birds (e.g. eating grass).

Examples of plant species commonly dispersed long-distance by birds include neem, brazilian pepper, camphor laurel and olives.

b) Other wild animals.

Dispersal can occur by other wild animals (i.e. ground animals such as kangaroos, emus, feral camels) via internal transport through the gut, and by external transport on fur or feet. Features favouring long-distance dispersal by other wild animals are:

- whole fruits which are eaten, and viable seeds which are then defecated or regurgitated;

- propagules which have hooks, barbs or sticky substances that attach to feathers, hairs or skin;
- very small seeds which can lodge within feathers, hairs or feet;
- seeds with an aril or coating which is attractive to birds or animals leaving viable seed discarded;
- propagules which are likely to be picked up and carried by animals (e.g. buffalo eating grass).

c) Water

Seeds of most species can be dispersed short distances by water runoff after heavy rainfall events. However, aquatic, coastal and riparian species may be pre-adapted for long-distance water dispersal.

Features favouring long-distance water dispersal are:

- propagules which float;
- the species is located in or near to moving water;
- frequent floods.

Examples of plant species commonly dispersed long-distance by water include mimosa, para grass, rubber vine, willows, and floating aquatics like cabomba.

d) Wind

Research has shown that the majority of wind-dispersed propagules land within close proximity to the parent plant. Dispersal beyond 1 km is not common. Examples of plant species dispersed long-distance by wind include siam weed, rubber bush, rubber vine, parthenium and serrated tussock.

Long-distance wind dispersal is more likely to be occasional or common for:

- tall trees with light seeds;
- plants with light seeds with wings, plumes or hairs;
- plants with propagules which can snap off after fruiting and roll across sparsely-vegetated ground.

Further assumptions

None.

A4. How likely is long-distance dispersal by human-assisted means?								Total (a+b+c+d)	SCORE
(a) Deliberate spread by people		(b) Accidentally by people and vehicles		(c) Contaminated produce		(d) Domestic/ farm animals			
☐ Common	2	☐ Common	2	☐ Common	2	☐ Common	2	6 - 8	3
☐ Occasional	1	☐ Occasional	1	☐ Occasional	1	☐ Occasional	1	3 - 5	2
☐ Unlikely	0	☐ Unlikely	0	☐ Unlikely	0	☐ Unlikely	0	1 - 2	1
☐ Don't know	1	☐ Don't know	1	☐ Don't know	1	☐ Don't know	1	0	0

Comments

This question considers how well the plant can spread its propagules by human-assisted means to start new weed outbreaks away from the original outbreak (generally more than 1 km). Plants which have more means of dispersal tend to spread faster. Consider if a plant is adapted for long-distance dispersal by any of the following means, and how regularly these means of dispersal are likely to occur.

a) Deliberate spread by people

- Include plants which are used in agriculture, forestry, horticulture, amenity, windbreaks and/or soil protection.
- Species which are (or could be) widely planted have greater potential to disperse due to many introduction points, because these plantings provide multiple sources for new infestations.
- Note that a weed may be legally restricted from sale, but may be still actively propagated and planted.
- Examples of plant species with weedy tendencies that have historically been commonly planted include: alligator weed, cabomba, bellyache bush, gamba grass, parkinsonia, water hyacinth and neem.

b) Accidentally by people and vehicles

- Features favouring accidental dispersal by people and vehicles are:
  - growth in heavily trafficked areas that facilitates transport by footwear, clothing or vehicles (including farm machinery and boats);
  - propagules that have hooks, barbs, or sticky substances to attach to objects;
  - very small propagules which can lodge in cracks in footwear, clothing or vehicles.
- Examples of plant species commonly dispersed long-distance by accidental human transport include: devil's claw, caltrop, mission grass, mexican poppy, hyptis, rubberbush, and salvinia.
- Garden refuse which is deliberately dumped, without the knowledge that this could cause spread is included as 'accidental'.

c) Contaminated produce

- Weed propagules can be dispersed via farm, mining and landscaping products such as crop seed, pasture seed, hay, grain, soil, gravel, fertilisers, manures, and/or mulch.
- Include the by-products or waste of industries such as stock feed manufacturers, tanneries etc.
- Examples of plant species commonly dispersed long-distance as a produce contaminant include: hyptis, mission grass, mexican poppy, parthenium.

d) Domestic/farm animals

- Features favouring dispersal by domestic and farm animals include:
  - whole fruits containing viable seeds that are eaten then defecated or regurgitated;
  - propagules with hooks, barbs or sticky substances that attach to feathers, hairs or skin;
  - very small seeds which can lodge within feathers, hairs or feet;
  - plant growing in or near pasture, paddocks, stables, cattle yards, watering holes, homesteads, tracks or roads.
- Examples of plant species commonly dispersed long-distance by domestic/farm animals include: mimosa, parkinsonia, hyptis, noogoora burr and prickly acacia.

Further assumptions

None.

B) IMPACTS

This section considers the potential environmental, social and economic impacts the plant could have on the land use, assuming the plant has invaded the landscape. Weeds which have the highest impact are capable of transforming environmental processes. Processes that may be significantly changed by high weed densities include fire regimes (fire frequency and intensity), levels of nitrogen fixation, water supply and use, soil sedimentation, erosion and salt accumulation.

Consider only negative impacts in this section as any benefits will be addressed separately.

B1. What is the plant's competitive potential?		**SCORE**
☐ **High**	Major impacts on native plant spp. richness and/or abundance.	3
☐ **Medium**	Moderate impact on native plant spp. richness and/or abundance.	2
☐ **Low**	Minor impact on native plant spp. richness and/or abundance.	1
☐ **None**	No impact on native plant spp. richness and/or abundance.	0
☐ **Don't know**		1.5

Comments

A weed will reduce the growth of other plants by competing for sunlight, water and nutrients, or by physically preventing germination or establishment. Note that a reduction in native plants may subsequently cause reductions in the abundance of wild animals (vertebrates and invertebrates) dependent on these plants.

A plant may reduce the establishment and/or biomass of other vegetation by:

- preventing germination by dense shading, or by forming a physical barrier such as a dense litter layer or mat of roots;
- killing or stunting seedlings by denying them access to soil moisture, sunlight and nutrients;
- producing allelopathic chemicals which reduce or prevent germination or growth of other plants.

Further assumptions

Greatest significance is given to transformer species, i.e. plants that change the character, condition, form or nature of vegetation over substantial areas. Plants that can form dense infestations that displace whole areas of vegetation are assumed to have greater weed potential.

B2. What is the plant's potential to modify the existing fire behaviour and alter the fire regime?		SCORE
☐ **Significant potential**	The plant has fuel properties that are substantially outside the normal range, and has the potential to substantially modify the fire regime.	4
☐ **Some potential**	The plant has fuel properties that are slightly outside the normal range, and may alter fire behaviour.	2
☐ **No potential**	The plant has fuel properties within the normal range and is unlikely to alter fire behaviour.	0
☐ **Don't know**		2

Comments

Consider the plant's ability to modify fuel properties and fire behaviour in Northern Territory landscapes. Invaders that alter fire regimes are widely recognised as some of the most important system-altering species worldwide (D'Antonio 2000,D'Antonio and Vitousek 1992,Vitousek 1990). Invaders that change fuel properties outside the natural range can also change fire behaviour and regime, which can result in localised extirpation of species that cannot persist under the new regime.

The most common and well-documented change to fire regimes caused by alien plants has been through increases in fuel load and flammability resulting in more frequent and/or more intense fires. Other documented changes include alterations to fuel continuity and changes to the packing ratio. A summary of the ways that invaders can alter fuel properties and consequently fire regime is presented in Table 1.

Further assumptions

None.

Table 1. Fuel properties and examples of changes to these due to invaders (summarised from Brooks, *et al.* 2004)

Fuel Property	Definition	Fire regime properties changed	Examples (1. Increase; 2. Decrease)
Fuel flammability	Ability of a material to ignite and burn readily. Can increase (e.g. due to volatiles) or decrease (e.g. due to minerals)	Fire frequency and intensity, or window of fire activity	1. Eucalypt spp. in North America; 2. Prickly Pear spp. (*Opuntia* spp.) in Europe
Fuel load	Amount of available and potentially combustible material. Can increase or decrease	Fire intensity	1. Gamba grass (*Andropogon gayanus)* in north Australia; 2. Cheat grasses (*Bromus* spp.) in north America
Horizontal continuity	Horizontal arrangement of fuel	Fire frequency and extent	1. Cheat grasses (*Bromus* spp.) in north America; 2. Mimosa (*Mimosa pigra*) in Australia
Vertical continuity	Vertical arrangement of fuel	Fire type (surface to crown)	1. Rubbervine (*Cryptostegia grandiflora*) in north Australia; 2. Wild oats (*Avena* spp.) in north America
Packing ratio	Amount of fuel per unit volume of space (affects rate of combustion, which is maximised at a particular ratio of fuel to oxygen)	Fire frequency and intensity, or window of fire activity	1. Cheat grass (*Bromus tectorum*) in north Australia; 2. Golden wreath wattle (*Acacia saligna*) in Africa

B3. What is the plant's potential to restrict the physical movement of people, animals, vehicles, machinery and/or water?		SCORE
☐ **High**	Major impediment to access. Infestations are almost always impenetrable, cause a major obstruction, completely preventing the physical movement of people, animals, vehicles, machinery and/or water.	3
☐ **Medium**	Access with difficulty. Infestations are sometimes impenetrable, cause a moderate obstruction, restricting or significantly slowing the physical movement of people, animals, vehicles, machinery and/or water.	2
☐ **Low**	Infestations are never impenetrable, but cause a minor obstruction and slightly impair or slow the physical movement of people, animals, vehicles, machinery and/or water.	1
☐ **None**	The plant has no effect on physical movement.	0
☐ **Don't know**		1.5

Comments

People move through the Territory environment for a range of reasons (e.g. hunting, cultural, economic use, social) and restricting movement is an important impact caused by some weeds. This question looks at the degree to which a dense infestation of the plant physically restricts movement. Weeds may restrict movement by being tall, thorny, tangled and/or dense. For this question, ignore any deliberate restrictions on movement aimed solely at limiting the spread of weed propagules.

Examples of weeds limiting movement include:

- impeding movement of people on foot by physical barrier or discomfort;
- blocking or slowing access of cars, motorcycles, ATVs, machinery etc. by physical barrier, tangling or tyre puncture;
- interference with boat access and/or maneuverability;
- blocking or slowing of water flow;
- preventing stock access to pasture and/or water by physical barrier or discomfort;
- preventing animal access to nesting sites by physical barrier or discomfort.

Further assumptions

None.

B4. What is the plant's potential to negatively affect the health of animals and/or people?		SCORE
☐ **High**	The plant could cause death and/or severe illness in people, animals, and/or plants. This is due to the plant being highly toxic, having large spines, or burrs, causing severe allergies, creating an increased incineration risk due to wildfire, being a vector for disease, or parasitising another species.	3
☐ **Medium**	The plant occasionally causes significant physical injuries and/or illness in people, animals or plants. This is due to the plant being mildly toxic, having spines or burrs, causing allergies, causing significant respiratory health problems, being a vector for disease, or parasitising another species.	2
☐ **Low**	The plant can cause slight physical injuries or mild illness in people, animals, and/or plants, but leaves no long lasting effects.	1
☐ **None**	The plant does not affect the health of people, animals or plants.	0
☐ **Don't know**		1.5

Comments

Consider how the plant affects the health of animals and people.

- To what extent is the plant toxic, injurious (e.g. burrs or spines)?
- Does it cause allergies or respiratory problems?
- Impact through physical injuries and/or illness in people, animals and/or plants referred to in this question does not include methods such as habitat transformation, allelopathy, or competition. It specifically refers to direct health impacts on individual species through methods such as intoxication, physical damage through spines or burrs, allergens, providing increased fire risk, acting as a vector for disease or through parasitism.

Note that if a plant is toxic but not palatable then it may not actually be grazed. Ignore any starvation effects from reduced growth of pasture or reduced access to pasture, as these have been covered in other questions.

Note that the ability of a plant to alter fire regimes (Question B2) can produce both direct and indirect effects, and both of these should be considered when answering this question. Direct effects are related to the increased risk of incineration due to altered fire intensity and/or behaviour (e.g. eucalypts in South Africa). Indirect effects are related to the increased impact on the health of people with asthma, other chronic respiratory disease, or cardiovascular disease due to increased smoke and particulate matter (Bowman and Johnston 2005,Johnston*, et al.* 2002).

Further assumptions

None.

B5. Does the plant potentially have negative effects on natural and cultural values?						Total (a+b+c)	SCORE
(a) Reducing habitat quality for native animals?		(b) Threatened species or communities		(c) Sites of natural or cultural significance			
☐ High	2	☐ more than one	2	☐ more than one	2	4 - 6	3
☐ Medium	1	☐ One	1	☐ One	1	2 - 3	2
☐ No	0	☐ None identified	0	☐ None identified	0	1	1
☐ Don't know	1	☐ Don't know	1	☐ Don't know	1	0	0

Comments

Question B5(a) looks at whether the plant has detrimental effects on the quality and function of the vegetation as habitat for native animals. Weeds that substantially transform the original vegetation – e.g. woody weed invasion of grassland are likely to have a substantial impact on habitat quality.

Question B5(b) considers probable impacts upon native plant or animal species (and/or ecological communities) that are listed as threatened (that is, critically endangered, endangered or vulnerable) under either national or Territory legislation.

Question B5(c) considers the probable impacts upon geographic sites that are recognised as of natural and cultural significance. Such sites include wetlands of international significance ('Ramsar' sites) and national significance, and areas of exceptional concentrations of species richness or endemism, major aggregations or key breeding sites, key habitats for bush tucker plants, hunting grounds and ceremonial sites. Sites of international and national significance for biodiversity values in the Northern Territory are listed in Harrison*, et al.* (2009).

Further assumptions

Question B5(c). Probable impacts refer specifically to the values that define the significance of the site.

B6. Is the plant *presumed* to have negative effects on environmental health?						**Total (a+b+c)**	**SCORE**
(a) Soil chemistry/stability		**(b) Water quality**		**(c) Hydrology**			
☐ **Yes**	1	☐ **Yes**	1	☐ **Yes**	1	2.5 - 3	3
☐ **No**	0	☐ **No**	0	☐ **No**	0	1.5 - 2	2
☐ **Don't know**	0.5	☐ **Don't know**	0.5	☐ **Don't know**	0.5	1	1

Comments

Question B6 considers whether the plant has detrimental effects on the quality and functioning of the environment.

(a) Does the plant increase soil erosion or alter soil chemistry?

(b) Does the plant increase siltation or contaminate waterways?

(c) Does the plant substantially raise or lower the soil water table compared to other plants present?

Further assumptions

If the species is well studied, but there is nothing in the literature that refers to an effect on environmental health, then answer 'no' to the relevant question above.

C) POTENTIAL DISTRIBUTION

This section considers what proportion of the broad environment of the Northern Territory is suitable for the plant. 'Suitable' is defined as those areas or vegetation types where the species can persist in the densities you assumed in scoring Impacts (Section B).

Special notes on aquatic species

The Technical Committee considered that the climate-based potential distribution models (including *Climatch*) are much less useful for the weed risk assessment of aquatic plants. This is because many aquatic species are effectively limited by the presence of available water, rather than directly by climate variables (DENR 2017).

Given the above limitation, to calculate the Potential Distribution section for aquatic plants, an additional step has been added to question C1. C1a asks if the species is "restricted to aquatic environments", and if the answer is yes, then C1b (the *Climatch* score) is to be disregarded. In cases where C1b is disregarded, the score for this section is calculated by adding the scores from C2 and C3, dividing by 9 (the maximum score) and multiplying by 10.

Example. Sagittaria (*Sagittaria platyphylla*) is considered to be "restricted to aquatic environments". It scores 4 for question C2, and 2 for question C3. This is a total of 6 out of maximum of 9. The corrected score = 10 x (6 / 9) = 6.67.

A broad definition of "restricted to aquatic environments" for the purposes of this question is a plant that is only able to live and grow permanently either in the water, or immediately adjacent to a permanent body of fresh water. Many plants are adapted to growing in seasonally flooded or waterlogged habitats and may be better described as terrestrial or semi-aquatic (e.g. *Melaleuca, Mimosa*, *Parkinsonia*); for these species all three questions will be addressed. The Technical Committee may choose to determine whether a species is considered to be "restricted to aquatic environments" for the purposes of this question.

Comments

Climatch (and its predecessor, *Climate*) is the default potential distribution modelling software used by the NTWRMS. *Climatch* is a climate matching model that allows the prediction of the potential range of a species by matching climate data from weather stations where the species occurs, to climate data from weather stations in other selected regions.

A web-based version of the Climatch software is available at: <http://data.daff.gov.au:8080/Climatch/climatch.jsp> (ABARES 2008).

There are three parts for this section,

1) run the *Climatch* modelling software, and assign a score based on the area of suitability;
2) calculate the number of habitats that the plant may inhabit within its climatically suitable zone;
3) determine the extent to which the plant is likely to invade its preferred habitat.

C1a. Is the species restricted to aquatic environments?	OUTCOME
☐ **Yes**	Disregard C1b and calculate total for section C out of 9.
☐ **No**	Include C1b and calculate total for section C out of 19.

C1b. What is the *Climatch* suitability score (which indicates the proportion of the NT environment that is suitable for the plant)?
To determine the Climatch suitability score for a plant in the Northern Territory: • Model the potential distribution of the species using Climatch software (or equivalent). • The Climatch model outputs a grid of cells for the whole of Australia. Each cell contains a value between 0 and 7. These cell values correspond to Climatch suitability scores which range from 1-10 (see Appendix B). • The Weed Risk Technical Committee assesses the potential distribution model with a default threshold Climatch suitability score of 7. If the model is a reasonable fit, then the threshold and the model is accepted. The Technical Committee may choose a different threshold value for a better fit. • Calculate the proportion of cells in the Northern Territory that are at or above this threshold (e.g. 0.63636). • Multiply by 10 and round to 1 decimal place. • Final score ranges from 0-10.

Comments

Do not include question C1b for plants which are restricted to aquatic environments.

Further assumptions

In scoring this section, consider only where the plant will grow at the density you assumed in scoring Impacts (Section B). That is, if you assumed a high density in scoring Impacts then ignore areas where the weed would only persist at a low density when determining potential distribution.

C2. How many broad habitat types in the NT will the plant potentially naturalise in (up to 5)?	SCORE
☐ Five or more	5
☐ Four	4
☐ Three	3
☐ Two	2
☐ One	1
☐ Don't know	2.5

Comments

There are fifteen broad habitat types in the model. They are:

- Tropical wetlands
- Tropical floodplains
- Tropical riparian
- Tropical open forests, savanna woodlands
- Rainforests
- Mangroves, beaches
- Sandstone heathlands
- Mitchell grasslands
- Spinifex grasslands
- Arid and semi-arid woodlands
- Arid and semi-arid shrublands
- Arid riparian
- Arid and semi-arid wetlands
- Permanent water bodies

Further assumptions

In scoring this section, consider only where the plant will grow at the density you assumed in scoring Impacts (Section B). That is, if you assumed a high density in scoring Impacts then ignore areas where the weed would only persist at a low density when determining potential distribution.

C3. What is the potential of the plant to occur throughout its favoured habitat in the NT (as identified in question 2)?		SCORE
☐ **Most**	Could occur throughout most of the habitat	4
☐ **Some**	Could occur throughout some of the habitat	2
☐ **Incidental**	Could occur incidentally throughout the habitat	1
☐ **None**	No potential	0
☐ **Don't know**		2

Comments

Determine the extent to which the plant is likely to invade its favoured habitat.

Further assumptions

None.

FEASIBILITY OF CONTROL

This component considers the comparative ease or feasibility being able to control a weed species.

Feasibility of control is assessed by weed management region – i.e. Darwin, Katherine, Tennant Creek, Alice Springs. See Appendix A for a map of the weed management regions.

The feasibility of control component is divided into three sections:

Control costs	Costs of weed detection, on-ground control and enforcement/education needs.
Current distribution	How widespread the weed is at the time of assessment.
Persistence	The expected duration of control works.

Each section is scored out of 10. Scores for the three sections are multiplied together to give a weed risk score between 0 and 1000. The higher the score, the greater the feasibility of control.

Comments

- Assess feasibility of control for the habitat(s) at risk identified in the weed risk component. This allows comparison with the weed risk result in order to set control priorities, and to identify an appropriate management and policy response.
- Higher scores indicate higher feasibility of control i.e. higher likelihood of management success.
- Consider all known populations of the plant being assessed within the region being assessed unless otherwise instructed by the specific questions guidelines.

A) CONTROL COSTS

Four significant cost factors associated with coordinated weed control programs are searching for the weed, accessing infestations, treating infestations, and achieving landholder commitment.

This section evaluates:

- How detectable is the weed?
- How accessible are infestations?
- How expensive is the weed to control?
- What is the community perception of the weed?

A1. How detectable is the weed?						Total (a+b+c)	SCORE
(a) Distinguishing features		**(b) Active growth period**		**(c) Height at maturity**			
☐ **Always distinct**	2	☐ **>8 months**	2	☐ **>2 m**	2	5 - 6	3
☐ **Sometimes distinct**	1	☐ **4 - 8 months**	1	☐ **0.5 - 2 m**	1	3 - 4	2
☐ **Non-descript**	0	☐ **<4 months**	0	☐ **<0.5 m**	0	1 - 2	1
☐ **Don't know**	1	☐ **Don't know**	1	☐ **Don't know**	1	0	0

Comments

Question A1 evaluates the cost of finding new infestations of the weed. Weed detectability is an important factor for both survey and control.

(a) Distinguishing features considers how conspicuous the weed is amongst native vegetation. For example, the shape and foliage of a pine tree is quite obvious amongst most native vegetation. Distinguishing features may include:

- the growth habit (for example upright, spreading, prostrate);
- the architecture of the plant;
- colour and shape of the flowers, fruits and leaves;
- unique features such as unusual seed pods, bark, perfume of flowers, smell of the leaves when crushed.

(b) Active growth period considers the length of time that the plant is actively growing (with visible shoots) throughout the year. Annuals and some perennials (e.g. noogoora burr, annual mission grass) have shoots present only for a limited part of the year, and can therefore only be controlled during this time.

(a) Height at maturity is important as it has a bearing on being able to locate new infestations of a weed. Taller plants can be spotted from greater distances.

Further assumptions

None.

A2. What is general accessibility of infestations at the optimum treatment time?		SCORE
☐ **High**	All infestation sites readily accessible via conventional methods	2
☐ **Medium**	Most infestation sites are readily accessible at most times of the year, or may require some additional equipment (e.g. quad bike)	1
☐ **Low**	Most infestation sites difficult to access via conventional methods and always require specialist equipment (e.g. helicopter, boat)	0
☐ **Don't know**		1

Comments

The general accessibility of weed infestations impacts both the cost of doing surveys to find the weed, and the cost of weed control. The following factors may apply,

- Sites may be difficult to traverse due to slope, rockiness, dense vegetation and/or surface water. This will slow down searching and control activities.
- There may be seasonal differences in accessibility (e.g. wet season water logging), so the response to this question should be in terms of the optimal time for search and control for the plant.

Further assumptions

Conventional methods of access include use of 4WD vehicles. Sites which are more difficult to access may require quad bikes. Difficult to access sites may require the use of a helicopter or boat.

A3. How expensive is control of the weed in the first year of targeted control, for an infestation that has reached maximum weed density?						**Total (a+b+c)**	**SCORE**
(a) Chemical cost – how much chemical will you use?		**(b) Labour cost – how many person hours will it take you to control?**		**(c) Equipment cost – what equipment are you going to use?**			
☐ **Very low** (few plants/ restricted distribution)	4	☐ **Very low** (few plants/ restricted distribution)	4	☐ **Very low** (physical control or very restricted distribution)	3	9 - 11	4
☐ **Low** (<$100/ha)	3	☐ **Low** (<$100/ha)	3	☐ **Low** (spray pack)	2	7 - 8	3
☐ **Medium** ($100 - 250/ha)	2	☐ **Medium** ($100 - 250/ha)	2	☐ **Medium** (slasher/tractor, quad bike/4WD, quick spray)	1	5 - 6	2
☐ **High** ($250 - 500/ha)	1	☐ **High** ($250 - 500/ha)	1	☐ **High** (helicopter, boat, earthmoving equipment, bulldozers)	0	3 - 4	1
☐ **Very high** (>$500/ha)	0	☐ **Very high** (>$500/ha)	0	☐ **Don't know**	1.5	0 - 2	0
☐ **Don't know**	2	☐ **Don't know**	2				

Comments

Assign to very low if a plant has very restricted distribution, e.g. few plants which result in very low chemical, labour and/or equipment costs.

Further assumptions

- Assume that you are already at the location of the weed infestation (no travel time required) and that there is good access to water nearby (no lengthy travel time to fill up for herbicide requiring dilution with water).
- Assume the use of techniques which maximise efficacy and minimise off-target damage. Herbicides are usually the main means by which weeds are controlled. Physical and mechanical control methods may include cutting/slashing, cultivation, or extraction.
- Do not consider capital costs for purchasing equipment.

A4. What is the general community perception of this weed within the region?		SCORE
☐ **High**	The weed is well known and has major impacts on the land use quality of a range of stakeholders; therefore landholders are likely to be highly motivated to control the weed on their land.	2
☐ **Medium**	The weed does have impacts on the land use quality of some stakeholders, and the level of motivation is likely to vary considerably between groups. This could include conflict weeds.	1
☐ **Low**	The weed is not seen as impacting on land use quality and is therefore likely to be a low priority and not controlled as a priority.	0
☐ **Don't know**		1

Comments

Aside from the 'on-ground' costs of search and control, a coordinated weed control program will have overarching costs of extension/education, enforcement, project management and administration. These activities will be affected by the community perception of the weed and the perceived benefit that weed control will have on their land use.

Some weeds will be perceived differently by different sectors of the community and are seen as conflict weeds. Examples of conflict weeds include pasture species, biodiesel species and ornamentals.

Further assumptions

None.

B) CURRENT DISTRIBUTION

This section considers how widespread the species is within the area to be managed (the weed management region). It considers the size of the area(s) affected as well as the overall pattern of infestations.

B1. What is the current pattern of the species' distribution across the weed management region?		**SCORE**
☐ Restricted	The species occurs as discrete and isolated populations across the region.	10
☐ Scattered	The species occurs as mainly *small* infestations across the region.	5
☐ Widespread	The species occurs as many *small* infestations or some *large* infestations across the region. Overall population density across the region is medium to high.	1
☐ Don't know		5

Comments

The aim of control is to prevent weed spread within a susceptible area or to other areas which are susceptible to infestation. The greater the area of potential distribution that is already occupied, then the less feasible is control. A species which is widespread will be more difficult to contain than one which is restricted to smaller areas or patches. The former will have more landholders potentially exposed to spread of the weed.

The intent of the category 'restricted' is to delineate species where eradication may be a feasible option.

Further assumptions

Both cultivated and naturalised populations of the species are considered. However, cultivated populations are considered to be 'discrete and isolated' and fall under the definition of 'restricted'.

C) PERSISTENCE

This section considers how long it takes to eradicate a population of the weed in a controlled area. It considers the efficacy of targeted control treatments, time to reproductive age, seed bank longevity and the likelihood of ongoing dispersal from outside the controlled area.

C1. How long will it take to reach the maintenance period?		SCORE
☐ **High**	1-2 years to reach the maintenance period	2
☐ **Medium**	2-5 years to reach the maintenance period	1
☐ **Low**	More than 5 years to reach the maintenance period	0
☐ **Don't know**		1.5

Comments

- The maintenance period is defined as the period after which there is no longer any reproduction from the original infestation being controlled.
- During the maintenance period, there may be recruitment from outside the original infestation which requires control.
- In theory, maintenance continues forever.

Further assumptions

Assume that no re-infestation is occurring and that the weed infestation is at maximum density.

C2. What is the minimum time period for reproduction of sexual or vegetative propagules?		SCORE
☐ **>2 years**	Minimum generation time >24 months.	3
☐ **<2 years**	Minimum generation time 12-24 months.	2
☐ **<1 year**	Minimum generation time 6-12 months.	1
☐ **<1 growing season**	Minimum generation time 0-6 months	0
☐ **don't know**		1.5

Comments

- The shorter the time period to reproduction, the greater the frequency of control treatments required, and the greater the chance of plants being missed prior to reproducing.
- Aquatic plants such as salvinia can have rapid vegetative reproduction (<1 growing season).

Further assumptions

None.

C3. What is the maximum longevity of sexual or vegetative propagules?		SCORE
☐ **<2 years**	Sexual or vegetative propagules remain dormant for less than 2 years.	2
☐ **2-5 years**	Sexual or vegetative propagules can remain dormant for 2-5 years.	1
☐ **>5 years**	Sexual or vegetative propagules can remain dormant for at least 5 years.	0
☐ **Don't know**		1

Comments

Soil seed bank longevity is the primary determinant of how long an infestation must be treated to achieve eradication.

Further assumptions

None.

C4. What is the threat of reinfestation from outside the management region?				**Total (a+b)**	**SCORE**
(a) Long-distance dispersal by natural means		***(b) Long-distance dispersal by human means***		6	*6*
☐ **Rare**	3	☐ **Rare**	3	5	5
☐ **Occasional**	2	☐ **Occasional**	2	4	4
☐ **Frequent**	1	☐ **Frequent**	1	3	3
☐ **Don't know**	1.5	☐ **Don't know**	1.5	2	2

Comments

To answer this question, consider the determinations already made for the following questions from the invasiveness section of the weed risk component:

- A3. Do propagules of the plant have properties that allow them to be dispersed long-distance by natural means?
- A4. How likely is long-distance dispersal by human means?

Further assumptions

None.

DETERMINING PRIORITIES

By comparing weed risk with feasibility of control, a species can be positioned within the Weed Management Matrix (see next page).

This matrix gives general guidance on appropriate regional, strategic weed management actions for species with particular weed risk and feasibility of control profiles. Different weed species will appear in different positions in the matrix, based on their weed risk and feasibility of control scores.

For each cell in the matrix, a number of general management recommendations are listed. A description of relevant actions for each management recommendation is also provided.

Note that the general management recommendations are intended as suggestions only. Any management recommendation made using the NTWRMS results will necessarily need to be tailored to a species using the information compiled as part of the assessment process. For some species, additional information may be required before a management recommendation can be made – e.g. where current distribution mapping is poor or incomplete, or where a benefit-cost analysis is required.

Note that some weed species are declared under the Northern Territory *Weeds Management Act* and are subject to legislation, including requirements for:

- Class A – eradication;
- Class B – prevention of growth and spread; and
- Class C – prevention of introduction into the Territory.

It is illegal to cultivate, trade or transport any declared species without a permit.

In addition, some high priority declared species are subject to legislated Statutory Weed Management Plans. For further information on legislative requirements for declared species in the Northern Territory visit www.lrm.nt.gov.au/weeds/legislation.

Weed Management Matrix

WEED RISK		FEASIBILITY OF CONTROL		
		Very High	**High**	**Low - Medium**
	Very High	Prevent entry Regional eradication Protect priority sites	Prevent entry Contain regional spread Protect priority sites	Targeted control (including biocontrol) Protect priority sites
	High	Prevent entry Contain regional spread	Protect priority sites	Targeted control
	Medium	Targeted control Monitor Protect priority sites	Targeted control Improve general weed management	Improve general weed management
	Low	Monitor	Assist interested parties	Assist interested parties

General Management Actions

REGIONAL ERADICATION
Aim: to remove the weed species from the region

- Detailed surveillance and mapping to locate all infestations.
- Destruction of all infestations including seed banks.
- Prevention of entry to region, and movement and sale within region.
- Species must not be grown and all cultivated plants to be removed.
- Monitor progress towards eradication.

CONTAIN SPREAD
Aim: to prevent the ongoing spread of the weed species in the NT

- Surveillance and mapping to locate all infested properties.
- Control of all infestations, aiming for a significant reduction in weed density.
- Prevention of entry to region, and movement and sale within region.
- Must not allow to spread from cultivated plants (if grown).
- Monitor change in current distribution.

PROTECT PRIORITY SITES
Aim: to prevent spread of the weed species to key sites/assets of high economic, environmental and/or social value

- Weed may be of limited current distribution but only threatens limited industries/habitats (lower weed risk). Or the weed may be more widespread but is yet to invade/impact upon many key sub-regional industries/habitats (higher weed risk).
- Surveillance and mapping to locate all infested sub-regions.
- Identification of key sites/assets in the region.
- Control of infestations in close proximity to key sites/assets, aiming for a significant reduction in weed density to below a threshold of impact.
- Limits on movement and sale of species within region.
- Must not allow to spread from cultivated plants (if grown) in close proximity to key sites/assets.
- Monitor change in current distribution within and in close proximity to key sites/assets.

TARGETED CONTROL

Aims to reduce the overall economic, environmental and/or social impacts of the weed species through targeted management

- Research and develop Integrated Weed Management (IWM) packages for the species, including herbicides and biological control where feasible.
- Promote IWM packages to landholders.
- Monitor decrease in weed impacts with improved management.
- Identify key sites/assets in the region and ensure adequate resourcing to manage the weed species.

IMPROVE GENERAL WEED MANAGEMENT

Aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general weed management

- Promote general IWM principles to landholders including: the range of control techniques; maintaining competitive vegetation/crops/pastures; hygiene and property management plans.
- Identify key sites/assets in the region and ensure adequate resourcing to manage these to maintain their values.
- Broaden focus beyond weeds to all threatening processes.

MONITOR

Aims to detect any significant changes in the species' weed risk

- Monitor the spread of the species and review any perceived changes in weediness.

ASSIST INTERESTED PARTIES

Aims to assist interested parties

- The weed species is perceived to be of insufficient risk to warrant any NTG investment in strategic management actions in the NT, but the NTG will assist or provide advice to any interested parties who wish to control the species.

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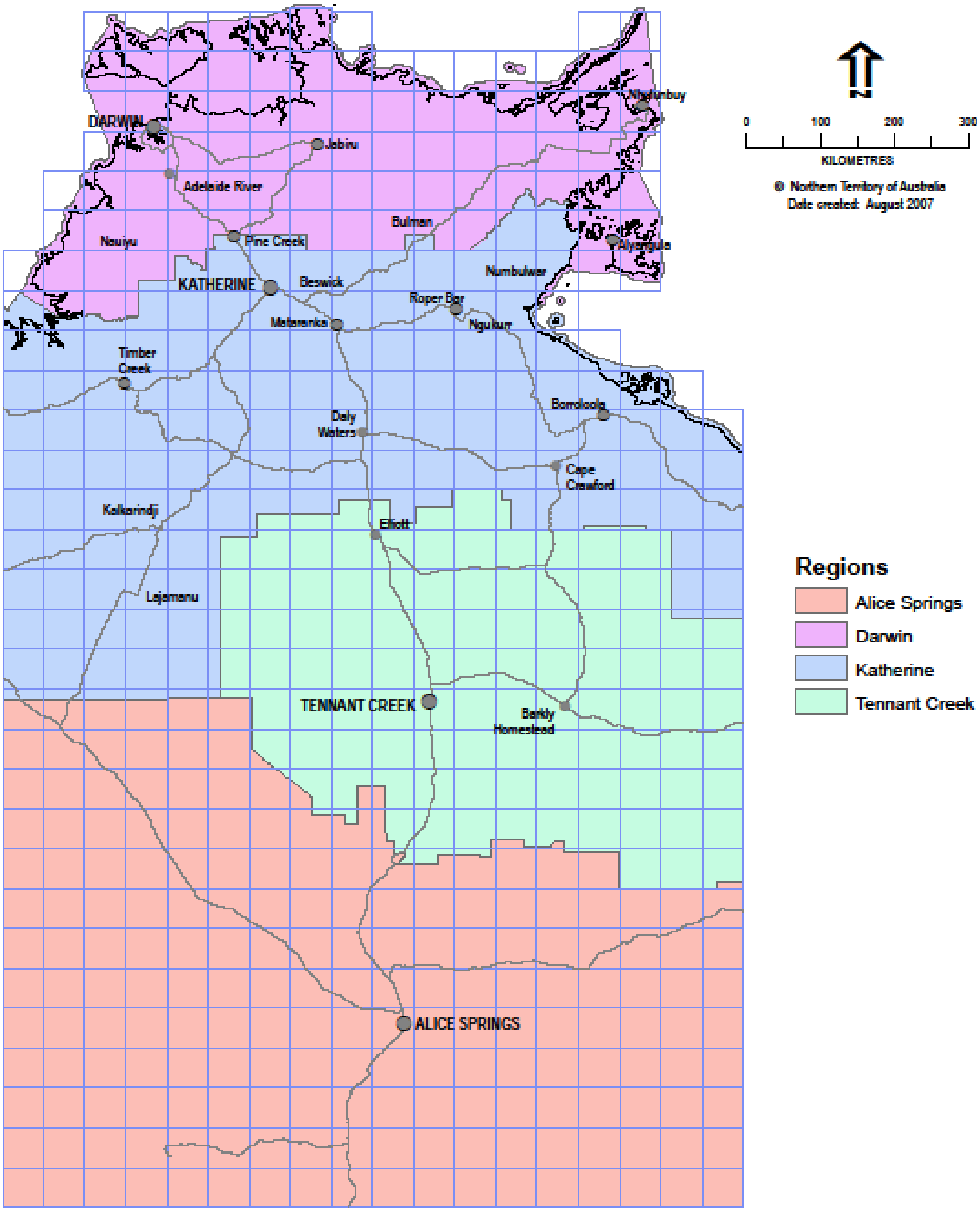
APPENDIX A

Northern Territory Weed Management Regions



APPENDIX B

Climatch cell values and Climatch suitability scores

Cell value	*Climatch* suitability score
0	= 1-3
1	= 4
2	= 5
3	= 6
4	= 7
5	= 8
6	= 9
7	= 10