Australian Government
Department of the Environment, Water, Heritage and the Arts

Background Paper to EPBC Act Policy Statement 3.11 – Nationally Threatened Species and Ecological Communities

Significant Impact Guidelines for the Critically Endangered Spiny Rice-flower (*Pimelea spinescens* subsp. *spinescens*)

Department of the Environment, Water, Heritage and the Arts

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Introduction

This paper provides background to *EPBC Act Policy Statement 3.11 – Significant Impact Guidelines for the Spiny Rice-flower* (Pimelea spinescens *subsp.* spinescens*),* hereafter referred to as the policy statement. This background paper provides the biological and ecological context behind the habitat areas, significant impact thresholds, and mitigation measures defined for the spiny rice-flower in the policy statement. The information provided in this paper has been prepared based on the best available scientific information. Increases in knowledge will be accounted for in future policy revisions.

The information in this background paper refers only to the subspecies *Pimelea spinescens* subsp. *spinescens*, referred to as the spiny rice-flower, the Plains Rice-flower, or the Prickly Pimelea. The spiny rice-flower closely resembles the subspecies *Pimelea spinescens* subsp. *pubiflora*, known commonly as the Wimmera Rice-flower. The Wimmera Rice-flower is listed as Extinct under the EPBC Act, although it has recently been rediscovered in the Wimmera area of Victoria (DSE 2003).

Conservation status

The spiny rice-flower is listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The subspecies is also listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*.

About the spiny rice-flower

Description

The spiny rice-flower is a grassland subshrub growing up to 30 cm in height, and bearing small yellow flowers from April to August (Entwisle 1996, Carter & Walsh 2006). Anecdotal evidence suggests plants from the northern populations have a different growth form from the Basalt Plains populations, with northern plants being larger and generally more robust than southern plants, which are more prostrate. This is possibly due to the increased rainfall and higher levels of competition from other plants such as *Themeda triandra* in southern Victoria.

Distribution and abundance

The subspecies is confined to, and dependant on, lowland grassland, grassy woodland and open shrublands from south-western to north-central Victoria (DSE 2003, Brennan & Herwerth 2005, Barnes et al. 2006, Carter & Walsh 2006). Recent survey effort suggests approximately 55,000 plants occur at 184 sites. However, the majority of sites support very small populations, with almost 70 per cent having less than 500 individuals. This situation is particularly severe in the area around Melbourne (Port Phillip region) where about 3,330 plants occur at 87 sites. Continued habitat loss coupled with very low levels of recruitment mean that overall the population numbers are declining (Carter & Walsh 2006).

Table 1: Estimated population numbers of spiny rice-flower from 184 known sites (DSE pers. comm. 2008)

Populations of 1 to 10 individuals	45
Populations of 11 to 50 individuals	41
Populations of 51 to 100 individuals	11
Populations of 101 to 500 individuals	31
Populations of 501 to 1 000 individuals	5
Populations of >1 000 individuals	9
Unknown population size	42

Populations and subpopulations are often geographically isolated, meaning gene flow is greatly restricted. This fragmentation of populations, along with lack of fire, weed invasion, habitat degradation, and browsing by herbivores, is thought to have contributed to low seed set and reduced recruitment (Foreman 2005).

A map has been produced to accompany this background paper. Map 1 shows the known and predicted distribution of the spiny rice-flower in Victoria. The known distribution will be progressively mapped as more information becomes available.

Habitat

The spiny rice-flower is endemic to Victoria, where it occurs in the central and western parts of the State (Walsh & Entwisle 1996), in the Victorian Volcanic Plain, Victorian Midlands and Riverina IBRA Bioregions (DSE 2005). In south-western Victoria it is occurs on basalt-derived soils, usually comprising black or grey clays (Walsh & Entwisle 1996). In north-central Victoria the spiny rice-flower occurs on sedimentary soils. Topography at occupied sites is generally flat but populations may occur on slight rises or in seasonally wet depressions. The vegetation at sites often contains exotic graminioids such as *Romulea rosea, R. minutiflora, and Phalaris aquatica.* Native species present include, but are not limited to, *Themeda triandra*, with *Austrostipa* spp. or *Austrodanthonia* spp. co-dominant*, Acaena echinata*, *Calocephalus citreus*, *Chrysocephalum apiculatum*, *Eryngium ovinum*, *Plantago varia*, and *Velleia paradoxa* (Foreman 2005).

The spiny rice-flower is mostly found within the ecological community ‘Natural Temperate Grassland of the Victorian Volcanic Plain’, a critically endangered ecological community listed under the EPBC Act (see *EPBC Act Policy Statement 3.8*) and associated with a Victorian Ecological Vegetation Class (EVC) known as Plains Grassland (EVC 132). The subspecies is also found in several other Victorian EVCs: Plains Grassy Woodland (EVC 55), Plains Woodland (EVC 803), and Plains Grassland/Grassy Woodland Mosaic (EVC 897).

Reproduction

Spiny rice-flower plants are mostly dioecious, meaning that an individual plants generally produce either male or female flowers (DSE 2003). Some plants however, are hermaphroditic, having both male and female flowers (e.g. at the Western Treatment Plant, S. Cropper, *pers. comm.*). Therefore, the maximum effective breeding number relative to the total population is about half, or just less than half, that of a fully monoecious species (male and female flowers on the same plant). While detailed research has not been undertaken, the sex ratio is thought to be roughly equal. Some populations however, may be dominated by one sex either across the whole population or in patches. Sexing of plants during surveys can provide insight into the sex ratio of the population and may be especially important when assessing the consequences of the loss of all or part of a population. The age structure of many populations is also unknown. Stochastic events, and the destruction of even small numbers of plants in smaller populations, may disproportionably remove either sex or age classes essential to the survival of a population.

As a largely dioecious species the spiny rice-flower is an obligate outcrosser, relying partially or wholly on invertebrates to achieve pollination. No specific insect pollinators are known, although a “small hairy beetle” (Cropper 2004) and the common grass-blue butterfly (*Zizina labradus labradus*) have been identified as potential pollinators (Deanna Marshall pers. comm. in Foreman 2005). Low seed germination may be related to the absence of suitable pollinators.

Plants are thought to be slow growing and may live as long as 30-50 years (Cropper 2009, *pers. comm*.), or possibly up to 100 years (Mueck 2000). Most populations consist of relatively mature individuals and there is limited recruitment in the majority of populations (J. Morgan & N. Walsh pers. comm., cited in Mueck 2000). DSE (2003) state that due to the lack of seed germination and recruitment, the number of individuals at most sites is declining over time. The slow recruitment of the subspecies limits its capacity for natural establishment at suitable grassland sites and its ability to recolonise former sites.

As is typical of a grassland species, successful recruitment may be associated with appropriate burning regimes (DSE 2003). It is thought that relatively frequent burning combined with good seasonal rainfall probably provides recruitment opportunities for the spiny rice-flower (Carter & Walsh 2006), although immature plants have been recorded in a small number of populations in the absence of fire (Foreman 2005).

Known subpopulations are often geographically isolated meaning gene flow between populations is restricted. Whilst the subspecies has been found at approximately 184 sites, the dioecious nature of the subspecies (plants are either male or female) and the paucity of representation in the reserve system cumulate to threaten protection of the spiny rice-flower over the long-term.

Key threats and recovery priorities

Habitat loss, degradation and fragmentation

The grassland habitats of the subspecies have been extensively cleared or modified for agriculture, urban and industrial developments. Today the majority of remaining grassland patches are small or narrow, linear areas such as roadside and rail verges (Carter & Walsh 2006; DSE 2003). The small size of many sites, and surrounding land uses, leave these grasslands and the spiny rice-flower further exposed to a range of impacts, such as habitat degradation. Only eight spiny rice-flower populations are known to occur in conservation reserves.

Changing land use

Many populations occur on land potentially subject to changing land use, such as from grazing to cropping, or from farming to industrial and residential uses, which can impact on spiny rice-flower populations.

Weed invasion

Invasion and spread of perennial introduced grasses, such as *Phalaris aquatica* and *Nassella* species threaten almost all populations of spiny rice-flower. The risk is greatest in small, heavily disturbed sites where populations are likely to be lost without active weed and biomass management.

Road and rail maintenance

Populations occurring along roadsides and rail reserves are at risk from maintenance works such as slashing, grading, clearing, widening and soil compaction by vehicle movement.

Grazing

Populations of spiny rice-flower on private land, road and rail reserves and on travelling stock routes are threatened by grazing by domestic stock. At very low intensities grazing may be of use to the conservation of the spiny rice-flower by maintaining an open habitat structure and by reducing competition from weeds, but at even moderate intensities can cause destruction of plants and habitat. Feral herbivores, including rabbits and hares, may also effect recruitment.

Inappropriate fire regimes

Like most grassland species, the spiny rice-flower has evolved to cope, and possibly even benefit, from fire. However, when natural fire regimes are stifled or intensified, slow-growing native plants like the spiny rice-flower are eventually crowded out by more vigorous native grasses and weeds.

Recovery objectives

A National Recovery Plan for the spiny rice-flower (Carter & Walsh 2006) has been adopted under the EPBC Act. The overall recovery plan objective is:

“To minimise the probability of extinction of the spiny rice-flower and to increase the probability of important populations being self-sustaining in the long-term.” (Carter & Walsh 2006)

Specific objectives of the recovery plan include the following:

- acquire accurate information for conservation status assessments
- identify habitat that is critical, common or potential
- ensure that all populations and their habitat are protected and managed appropriately
- manage threats to populations
- identify key biological functions
- determine the growth rates and viability of populations, and
- build community support for conservation.

Significant impact assessment

The potential for a significant impact on a listed threatened species will depend on:

- the intensity, duration, magnitude and geographic extent of the impact
- the sensitivity, value and quality of the environment on and around the site
- the cumulative effect of on-site, off-site, direct and indirect impacts, and
- the presence of this and other matters of national environmental significance.

Having considered the threats to the spiny rice-flower and its habitat in Australia, and in consultation with species experts, the Department of the Environment, Water, Heritage and the Arts is of the view that the following actions may constitute a significant impact on the subspecies. Where there is a possibility of a significant impact on a matter of national environmental significance, a referral under the EPBC Act should be considered.

Significant impact thresholds

Ecological element affected	Impact threshold	Comment
Contiguous habitat area • Contiguous habitat is a similar and connected area that supports a population of the subspecies.	Any fragmentation of a population.	Connectivity is particularly important for maintaining and supporting gene flow, given the limited dispersal ability of this subspecies.
Population viability (medium to long-term) • A ‘population’ of spiny rice-flower refers to a collection of individual plants occurring close together but separated geographically from	Population loss >5 individuals.	Given that recruitment (through germination of seeds) appears to be very limited, the loss of even small numbers of plants from a current population could have a significant.

other such collections. Land use and management practices may limit the geographic extent of populations.		
Populations at or near the edge of the range	Any loss of individuals from any population which occurs on the edge of the spiny rice-flower's current known distribution	The range of the spiny rice-flower has been greatly reduced, and populations at the edges of the current distribution may be particularly important.

Note: The elements and thresholds in the table above give guidance to the level of impact that is likely to be significant for the subspecies at a site. They are not intended to be exhaustive or prescriptive, but rather to highlight the need to maintain the ecological function of the habitat area.

The thresholds outlined above were developed in consultation with experts to provide guidance in determining the likely significance of impacts on the spiny rice-flower. However, decisions on significance will always need to be made on a case by case basis with consideration for the context of the action.

The significant impact thresholds take into account the highly fragmented nature of much of the spiny rice-flower's habitat, the small size of populations and the very low levels of recruitment. The loss of even small numbers of individuals and/or further fragmentation of habitat could constitute a significant impact on the subspecies.

<u>Population loss includes, but is not limited to:</u>

- clearing and removal of habitat containing spiny rice-flower plants, through ripping, cropping, ploughing, rock removal etc.
- the use of herbicide directly on plants
- application of chemicals (such as herbicides) which are harmful to the spiny rice-flower or its habitat, including spray drift from adjacent land management activities
- introduction of exotic weeds to a grassland or the ground layer of an open grassy woodland, e.g. by vehicular movements through the area as part of construction works where the grass cuttings and seed heads are not removed and/or the vehicle is not appropriately cleaned
- soil disturbances and earthworks related to construction and road/rail maintenance activities which may physically impact the plant and its taproot
- alteration of drainage and/or fire regimes, and
- introducing or intensifying edge effects (e.g. actions that result in spiny rice-flower individuals occurring close to the edge of suitable habitat, which may cause the population to decline).

Habitat fragmentation

The term fragmentation is used to describe changes that occur when blocks of vegetation are incompletely cleared leaving multiple smaller blocks that are separated. A significant impact may occur if the proposed action will result in the fragmentation of habitat that supports spiny rice-flower populations or suitable habitat adjacent to a population of spiny rice-flower that could provide opportunities for expansion of the subspecies. Fragmentation may also include any development or changes that introduce a physical barrier to plant dispersal within contiguous areas of spiny rice-flower habitat. Physical barriers include solid fences, transport corridors and walking tracks, and easements.

Populations at or near the edge of the range

“Populations at or near the edge of the range” includes populations that represent the outermost records of the subspecies’ known distribution. This also includes any new populations located in future surveys which fall outside the present mapped range of the subspecies.

Mitigation measures

Mitigation activities are generally undertaken on the site of the development to avoid or reduce impacts. Ideally, mitigation measures should be incorporated into the design of a development so that significant impacts are unlikely to occur.

Care should be taken to ensure that any mitigation and/or management actions implemented for the spiny rice-flower do not have a negative impact on other matters of NES present at a site. The mitigation and management proposed at a site needs to take into account the needs of all matters of NES in a project area.

The following measures may assist in minimising impacts on the spiny rice-flower. Avoidance measures should be considered the priority, followed by measures to reduce the level of impact. In many cases, a combination of mitigation measures may give the highest benefit.

Avoid impacts

- Retain habitat patches known or likely to contain the spiny rice-flower, and manage for the subspecies (see “Managing habitat” below).
  - Protect reserved habitat into perpetuity, with consideration given to the surrounding land-use and long-term viability of the proposed reserve (e.g. a proposed reserve surrounded by infrastructure with no adjoining grassland to provide the subspecies with an opportunity to expand is not ideal, and will be difficult to manage).
  - Management arrangements should be funded for a *minimum* of 10 years and managed by suitable conservation agencies, such as Parks Victoria. The proposed land manager must have the opportunity to comment on land issues and costs of management prior to transfer of land and commencement of any action.
- Re-site roads or easements so as to avoid habitat disturbance.
- Avoid soil disturbance (e.g. from vehicles), particularly at or near the root-zone, or on wet soil.

- Avoid broad-scale herbicide use (see ‘Managing habitat’ below).
- Avoid grazing on and around spiny rice-flower populations, particularly prior to and during the flowering period (April-August)

Minimise impacts

- Develop an environmental management plan that addresses the threats on site and draws together measures to address them. E.g. experimental and adaptive management (trying different things in different places and times, while closely monitoring the results) for the benefit of the population.
- Maintain hygiene on maintenance and construction vehicles and machinery passing through spiny rice-flower habitat, to ensure that weeds are not spread.
- Avoid landscaping that would introduce weeds or non-Indigenous plants into site.
- Fence populations to minimise risk of accidental damage or destruction of plants (e.g. from construction activities, recreational users, pest animals, rubbish dumping or unauthorised vehicle movement through an area). See Long & Robley (2004) for appropriate fence design.
- Erect appropriate signage to inform construction workers and the general public of the conservation significance of the site.

Manage habitat

- Implement a biomass management program:
    - Develop and implement a fire management plan of cool, quick mid-Autumn fires. Summer fires, when spiny rice-flower is not actively growing may also be appropriate.
- Control and reduce weeds in the area, taking care to avoid drift of herbicides onto native vegetation. e.g. through carefully applied and targeted spot-spraying or ‘wiping’.
- Improve degraded areas of habitat on the project site, and manage for the spiny rice-flower. Revegetated areas should be established prior to the removal of occupied habitat. Note however, that revegetation can be both intensive and expensive.
- Fence habitat on at least three sides to limit use as a thoroughfare, and erect interpretive/educational signage to highlight conservation significance.
- Use sealed roads and footpaths outside the reserve boundary to limit the spread of weeds and help control fire.
- Control vertebrate pests, e.g. rabbits and hares:
    - Where pest animals are a threat, monitoring for these animals should be undertaken at an appropriate time and a suitably qualified pest control contractor should be engaged to assess the level of infestation and provide advice on the best course of action (Mueck et al. 1998). Follow up eradication works (of pest species such as European Rabbit and hares where necessary: DNRE 2002), and fence repairs should be undertaken as soon as possible by any land manager responsible for a population of spiny rice-flower (Kern 2006).

Reserve management

Long term management of spiny rice-flower sites needs to take into consideration weed management, appropriate biomass management, control of grazing and potentially hydrological regimes.

Weed Control

The improvement of disturbed grassland areas should focus on the removal of problem weeds (such as such as Serrated Tussock *Nassella tricotoma*, canary grass *Phalaris aquatica* and chilean needle grass *Nassella neesiana*) and replanting with locally collected native grasses, particularly kangaroo grass (*Themeda triandra.)* spear grasses (*Austrostipa* spp.) and Wallaby-grasses *Austrodanthonia* spp.

Herbicides, particularly glyphosate, are the most commonly used method to control exotic weeds within native grasslands. The spiny rice-flower is sensitive to herbicides, although the concentrations at which different herbicides cause damage to plants is not fully known (DSE 2003). The use of herbicides as part of a weed control program at a spiny rice-flower site should be undertaken by a qualified operator with experience in native species rehabilitation in the local area (Mueck et al. 1998). Intensive use (i.e. boom spraying) of herbicides at a spiny rice-flower site could have a significant impact on the spiny rice-flower.

In the long term, weed management should include regular follow up actions to prevent the reestablishment of aggressive weeds. A key component of many weed management strategies should be the elimination of adult, seed-producing weed plants and the continual follow-up elimination of emerging weed seedlings. This process, if maintained consistently for a number of years, will eventually result in the exhaustion of the soil-stored seed from the weed species and should result in the complete elimination of the species from the site (Kern 2006).

In designing conservation reserves to protect the spiny rice-flower, sealed roads and footpaths should be utilised as reserve barriers where practical, to limit the potential spread of weeds (Kern 2006), and increase the ability to use fire as a management tool. Reserves should not be bounded by residential or industrial fences or buildings as these limit the ability to burn sites effectively.

The Cooperative Research Centre (CRC) for Weed Management has created information sheets for problems weeds such as Serrated Tussock and chilean needle grass. These, and other resources for weed management, are available on the CRC website: http://www.weeds.crc.org.au.

Biomass Reduction

Grassland communities require regular biomass reduction to maintain the structure and species diversity of the habitat. Historically, natural burning regimes and low intensity grazing from native herbivores has been used as a means of biomass reduction. In the absence of biomass reduction, the dominant perennial tussock grasses tend to out-compete and suppress the less competitive smaller plants, such as the spiny rice-flower. Successive years without appropriate biomass reduction will result in loss of many herb species and senescence and death of kangaroo grass tussocks (Lunt &

Morgan 1999 cited in DSE 2003). Open spaces may then be colonised by opportunistic weed species (DSE 2003).

For the spiny rice-flower, the recommended method for biomass reduction is ecological burning. In addition to promoting a healthy grassland ecosystem, burning is believed to stimulate spiny rice-flower recruitment (DSE 2003). While grazing regimes can also act as a biomass control, they are not considered widely appropriate for managing spiny rice-flower habitat due to the impacts on habitat structure, nutrient input and disturbance to seedlings.

The best time of the year to conduct biomass reduction burn is in mid-Autumn. However, summer fires may also benefit spiny rice-flower as it will not be actively growing during this period (Mueck et al. 1998) and burning may result in the proliferation of native kangaroo grass. Burning at any time of the year is preferable to an extended period (greater than three years) of no burning at all (Kern 2006).

Fire should not be used in isolation from other management actions. A key consideration prior to the planning of any biomass reduction burns is the ability to adequately resource follow-up weed management. Fire stimulates the soil stored seed of many grassy weed species and can result in a boom in germination thus necessitating post-burn weed control works, particularly for aggressive weeds such as chilean needle grass (Mueck et al. 1998, Kern 2006). Any proposed ecological burning should be undertaken in consultation with DSE and the local Country Fire Authority (CFA).

<u>Shade</u>

It is preferable that project design does not result in the significant shading of a spiny rice-flower population and the grassland patch on which it occurs (Kern 2006). This may affect the process of photosynthesis of spiny rice-flower plants and native grass species.

<u>Education</u>

Education can assist in limiting negative interactions between people and spiny rice-flower. The proposed programme should include measures to inform people (including those associated with development proposals during surveying, construction and operation) of how their behaviour may impact on the spiny rice-flower and/or other listed species e.g. a site induction for personnel engaged on construction projects. In residential developments, some consideration should be given to the development of education programmes aimed at the public (without increasing impacts on the spiny rice-flower). Education of residents can assist in reducing the impact of residential developments (e.g. by educating people on the detrimental effects of fertiliser run-off, and providing them with alternative management options).

Translocation

Translocation does not reduce the impact of an action. Translocation of the spiny rice-flower is not considered to mitigate the impact of an action, as it is unlikely to result in a positive conservation outcome for the subspecies. While spiny rice-flower plants have been translocated previously, and lived for many years post the translocation exercise, no reproduction has occurred in association with translocated plants. As such no translocations have been successful to date (S. Mueck pers. comm. 2008).

In limited circumstances, where very small numbers of individuals of a subspecies are proposed for translocation and the proposal is consistent with best practise, then translocation may be considered as compensation, in addition to appropriate mitigating measures. Any translocation experiment of the subspecies should be undertaken in accordance with a fully-funded monitoring and adaptive management strategy with clearly stated criteria for identifying success.

Best practice guidelines for salvage translocation are currently in preparation (Steve Mueck, on behalf of the *Pimelea spinescens* Recovery Team). Any salvage translocation plan should adhere to the recommendations of the Recovery Team, and include:

- realistic management funds for translocated plants for a minimum of ten years, and
- monitoring reports prepared at designated intervals (yearly/biannually) and provided to the Department of the Environment, Water, Heritage and the Arts and to the Spiny Rice-flower Recovery Team.

In general, any translocated plants and newly sown grasses should be given sufficient time to establish before any burning of a site is undertaken. For spiny rice-flower sites, burns should be conducted prior to translocation so that any seedlings can be located. If the root system has been damaged during translocation, a recently translocated plant may not be able to recover from immediate burning, if at all. Similarly, where revegetation works are involved, young or recently sewn perennial grasses without well established root systems can be seriously damaged by fire (Ward 1995).

<u>Cuttings</u>

The spiny rice-flower can been propagated from cuttings. However, cuttings are not considered to grow the robust root systems of seedlings, and are clonal, therefore not contributing to increased genetic diversity of populations. Care also needs to be taken to ensure that cuttings are planted during appropriate weather conditions (i.e. after rain and not during a severe drought).

<u>Seed collection</u>

Plants grown from seed have shown more resilience and strength than cuttings, and also have increased genetic diversity. Seed collection protocols are being developed by the *Pimelea spinescens* Recovery Team to guide the collection of seed from spiny rice-flower plants. Persons wanting to collect seed from spiny-rice flower plants should consult the Recovery Team for best practice guidance. Note however, that additional approvals and permits will be required to collect seed from native plants. Permit information is available from the Victorian Department of Sustainability and Environment.

Survey guidelines

The spiny rice-flower can be difficult to find when it is not in flower, and is easily overlooked in general vegetation surveys. The spiny rice-flower has been newly discovered in areas where less than a year earlier a survey had not identified its presence. This could be due either to the inappropriateness of the original survey, or a change in land use which masked the presence of the subspecies (e.g. grazing may limit the height of established plants). People experienced with the subspecies will have a better chance in detecting the spiny rice-flower at a site, as well as assessing the population sex ratio. Therefore, transect surveys are best undertaken when the plant is in flower between April and August (DSE 2003) by, or under direction of, people with experience in recognising the subspecies.

Survey effort is also a consideration. Many sites have been resurveyed after initial findings of spiny rice-flower, with many more individuals being found. Multiple surveys may need to be conducted for sites in the range of the spiny rice-flower.

Surveys for spiny rice-flower should be conducted at any location containing habitat likely to support the subspecies. Habitat likely to support the spiny rice-flower includes all areas which have, or once had, native grasslands (including derived grasslands), grassy woodlands and open shrublands on basalt-derived soils. The EPBC Act Protected Matters Search Tool can assist in determining if a location is within the historical range of the subspecies.

Habitat quality should not be used as a proxy for the likelihood of finding spiny rice-flower as individuals have been found in extremely degraded grasslands, and sometimes not found in high quality, seemingly suitable habitat. However, habitat disturbance and historic land use, such as a history of ploughing, can be indicators of the likelihood of finding the subspecies and should be included in all reports on survey effort for the spiny rice-flower. In addition to undertaking surveys for the spiny rice-flower, the following habitat characteristics should be assessed. Assessment of the habitat on the site may provide further indication of the likely presence (or absence) of the subspecies at a site:

- other vegetation (native and exotic)
- habitat quality (note: habitat quality is not indicative of the likely presence/absence of the subspecies)
- site history and time since last management event (e.g. grazing, cropping, biomass management, fertiliser/pesticide/herbicide use, fire), including current management regime
- proximity to other known populations, including on adjacent sites, and
- presence of similar habitat connecting the site to occupied areas or other areas of grassland or grassy woodland.

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