National recovery plan for the Julia Creek dunnart (*Sminthopsis douglasi*)

Australian Government

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Prepared by: Department of Environment and Resource Management

Copies may be obtained from the:
Executive Director
Sustainable Communities
Department of Environment and Resource Management
PO Box 15155
City East Qld 4002

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Executive Summary

Species

The Julia Creek dunnart *Sminthopsis douglasi* is a small, carnivorous marsupial belonging to the family Dasyuridae. There are 19 species of dunnarts in Australia with two of those species extending into Papua New Guinea. Only *S. douglasi* is confined to Queensland.

Current species status

Sminthopsis douglasi is listed as 'Endangered' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the Queensland *Nature Conservation Act 1992.*

Habitat and distribution summary

Sminthopsis douglasi is restricted to the Mitchell grass downs country of north-west Queensland. The region is characterised by predominantly grass-covered cracking clay soils of two types (ashy and stony). *Sminthopsis douglasi* is found on both soil types sheltering in cracks when the soil is dry and ground cover is sparse, and in vegetation when the cracks close up after rain. Prior to 1992 *S*. *douglasi* was known only from four specimens collected in a limited area between Richmond and Julia Creek in north-west Queensland. Surveys conducted since, indicate a wider distribution within both the Mitchell Grass Downs and Desert Uplands Bioregions, although occurrences of *S. douglasi* were patchy and abundances low.

Threats summary

Threats for this species have been summarised as 'not known although factors including introduced predators (especially cats) and current land use (sheep and cattle) may be implicated' (Maxwell *et al.* 1996). More recent studies have improved understanding of the known and potential threats to this species. Introduced predators (feral cats), woody weeds (prickly acacia) and land use (grazing) represent the key threats, while potential threatening processes include fire, climatic factors and small population size.

Recovery objective

To secure and enhance the species status in the wild through an on-ground conservation management program that targets known threats and an integrated program of investigations to improve knowledge and inform management decisions.

Summary of actions

The key actions required to promote the recovery of *S. douglasi* populations include:

- conduct surveys to clarify the extent of the species distribution;
- negotiate voluntary conservation agreements/management agreements for key *S. douglasi* sites and encourage landholders to protect and manage such sites;
- integrate *S. douglasi* habitat into local government Stock Route Network Management Plans;
- continue and expand implementation of pest animal and plant control programs (e.g. cats, prickly acacia), and *S. douglasi* population monitoring programs;
- investigate interactions between predators, water sources and grazing management;
- investigate interactions between *S. douglasi* and sympatric species of small mammals;
- conduct media campaigns and continue to produce/distribute educational material; and

- establish a recovery team with representatives from key stakeholder groups and develop consultative protocol for Traditional Owner engagement.
- The total estimated cost of implementing recovery action is $510,000.

1. General information

Conservation status

The Julia Creek dunnart *Sminthopsis douglasi* is listed as 'Endangered' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the Queensland *Nature Conservation Act 1992.*

International obligations

The actions stated in this recovery plan are consistent with Australia's international obligations for threatened species.

Affected interests

Implementation of the recovery plan for *Sminthopsis douglasi* may affect and/or require involvement from the stakeholders listed below.

- Department of Environment and Resource Management (DERM)
- Southern Gulf Catchments NRM (SGC)
- Desert Channels Queensland NRM (DCQ)
- Local Government Councils (McKinlay, Winton, Richmond, Flinders, Longreach, Barcaldine)
- Landcare groups e.g. McKinlay Shire Landcare
- Indigenous groups
- Independent researchers
- Universities e.g. James Cook University (JCU), University of Queensland (UQ)
- CSIRO Tropical Savannas Cooperative Research Centre
- QLD Department of Employment, Economic Development and Innovation (DEEDI – Toorak Research Station)
- QLD Department of Transport and Main Roads
- National Prickle Bush Management Group (NPBMG)
- Australian Plague Locust Commission (APLC – DAFF)
- Non-Government Conservation Organisations e.g. World Wide Fund for Nature (WWF - Threatened Species Network)
- Mining companies
- Private landholders
- Community representatives

Consultation with Indigenous people

Consultation with Indigenous people has been undertaken with advice from, and through, the NRM Indigenous Land Management Facilitators (ILMF) for Northern and Southern Queensland and the Aboriginal Land Management Facilitators (ALMF) for Southern Gulf Catchments (SGC) and Desert Channels Queensland (DCQ) NRM regional groups. The ALMF's were provided with the discussion paper and draft recovery plan for comment and for dissemination to representatives of local Indigenous groups and traditional owners.

The distribution of the Julia Creek dunnart occurs over the Traditional Owner groups of the Ngawun/Mbara and Yirendali people. Implementation of the plan must take into account the Indigenous value, right and interest concerning the Julia Creek dunnart. Recommendations on engaging Traditional Owners in implementation are specified under Actions 6.1 and 6.2.

Benefits to other species or communities

Implementation of the recovery plan for *S. douglasi* will assist with the ongoing protection of remnant vegetation in the Mitchell Grass Downs (MGD) Bioregion and the promotion of improved land management practices in these areas to enhance conservation values. This is likely to assist with the protection of habitat occupied by other associated threatened flora and fauna species, thereby benefiting species such as the 'Vulnerable' plains wanderer *Pedionomus torquatus,* 'Rare' kultarr *Antechinomys laniger*, 'Rare' *Ctenotus schevilli* and the 'Rare' Collet's snake *Pseudechis colletti*.

Social and economic impacts

It is unlikely that implementation of this recovery plan will have any adverse social or economic impacts. Implementation of management actions necessary for the maintenance of *S. douglasi* populations and remnant vegetation in the MGD bioregion (e.g. weed control, sustainable grazing management) is likely to benefit graziers. Promotion of *S. douglasi* as a regional icon for tourism and conservation in McKinlay Shire is likely to benefit Julia Creek and surrounding regional areas (e.g. Winton and Richmond Shires).

2. Biological information

Species description

The Julia Creek dunnart *Sminthopsis douglasi* was described in 1979 by Archer from four museum specimens lodged between 1911 and 1972. It was presumed extinct by the early 1980's until it was 'rediscovered' by Woolley in 1990 from owl pellets and cat remains and in 1991 and 1992 live specimens were caught (McAlpine and Howes 2005). It belongs to the subfamily Sminthopsinae (dunnarts and kultarr) of the family Dasyuridae which contains most of the Australian carnivorous marsupials. There are 19 species of dunnarts in Australia with two of those species extending into Papua New Guinea. Only *S. douglasi* is confined to Queensland.

This species is the largest member of its genus and is brown, speckled with grey above and buffy white below. It is morphologically similar to the red-cheeked dunnart *S. virginiae* and has a prominent facial stripe like the stripe-faced dunnart *S. macroura* but is distinguished by dark hairs in rings around the eyes and on the outer mesial edge of the ears (Woolley 1995). It has rufous hairs on the cheeks and at the base of the ears and dark hairs towards the tip of its long tapering tail that is fattened at the base and slightly shorter than the head and body (Woolley 1995).

Life history and ecology

Sminthopsis douglasi is nocturnal, sheltering during the day in the cavities in cracking clay soils and in vegetation. It is a carnivorous species that feeds on arthropods such as crickets, cockroaches, silverfish and slaters, as well as arachnids and small reptiles (Mifsud 2001b). Native predators such as barn owls *Tyto alba* consume dunnarts although they are not a readily available food item (Woolley 1998). The species appears to be highly mobile, although it occupies stable home ranges that range from 0.25ha to 7.125ha in size (Mifsud 1999).

With a lifespan of two to three years, *Sminthopsis* species are generally short lived (Pollock *et al.* 2006). *Sminthopsis douglasi* is polyoestrous (undergoes oestrus more than once each year) and individuals appear to raise young in at least two seasons (Bjursell 2005). Females have eight teats and are capable of rearing that number of young in one litter. In captivity, female offspring reach sexual maturity between 17-27 weeks and males between 28-31 weeks, with females always maturing prior to males of the same litter.

Trapping surveys at the property 'Proa' revealed that females may produce two litters over a highly seasonal and extended breeding season (spring and summer; Mifsud 1999). This life history trait is typical of small species inhabiting semi-arid and arid environments where food supply is unpredictable. By producing two litters an individual spreads its reproductive effort to ensure that one or both litters benefit from unpredictable rainfall events and subsequent increases in food availability (Mifsud 1999). Climatic conditions may also influence abundance patterns in *S. douglasi,* as seasonal increases at Proa were possibly due to above average rainfall and subsequent ground cover growth which may have enhanced juvenile survival rates by providing shelter from predators (Mifsud 1999).

Distribution

Sminthopsis douglasi is restricted to the Mitchell grass downs country of north-west Queensland. Prior to 1992, the species was known only from four specimens collected from three properties in a limited area between Richmond and Julia Creek (Woolley 1992a). Surveys conducted during the 1990's extended the species geographic range considerably, in both north-south (to over 200km) and east-west directions around the original known range, and the number of known localities increased from three to 11 using indirect survey methods (Woolley 1992, 1998). This distribution closely matched that predicted by BIOCLIM analysis despite there being other areas of apparently suitable habitat to the south and south-east in Queensland, and to the west on the Barkly Tableland, Northern Territory (Woolley 1997). Julia Creek dunnarts captured at Winton town common also significantly extended the known range of the species (Mifsud 2001b).

Kutt (2003) conducted fauna surveys and predator gut collections throughout the MGD and Desert Uplands (DEU) bioregions between 1997 and 2000. These surveys indicated a wider distribution for *S. douglasi* within these areas. For example, the most eastern record for *S. douglasi* was made from Moorrinya NP, a further 200km from localities previously published by Woolley in 1992. A collection from predator gut contents at Dunblane near Barcaldine was 300km south-east of records in Woolley (1992b), although an intact specimen would be required to confirm this possible southern range extension (Kutt 2003). From these surveys, Kutt (2003) proposed that *S. douglasi* may once have been more widespread and current patterns of rarity are possibly the result of more recent impacts. These include feral predators, pastoralism and changes in land management, combined with naturally low abundances (Kutt 2003).

Sminthopsis douglasi (live specimens and remains) has been recorded from 25 locations across the MGD and adjacent, DEU bioregion (Figure 1). Although recent locality records extended the species range, the occurrence of Julia Creek dunnarts remains patchy and abundances low (Kutt 2003).

Habitat

The Mitchell grass downs are characterised by predominantly grass-covered cracking clay soils of two types (ashy and stony). Following the summer rain there is typically a new growth of grasses and forbs, and the ground swells and then cracks as the soil dries out. *Sminthopsis douglasi* may shelter in cracks in the ground when the soil is dry and ground cover is sparse, and in vegetation when the cracks and holes close up after rain and the vegetation sprouts (Woolley 1998).

Habitat selection appears to be based on edaphic features such as soil crack and hole density as this is a more reliable and predictable source of shelter than vegetation cover (Mifsud 1999). Although *S. douglasi* has been recorded on both ashy and stony soil types, in areas of sparse and dense ground cover, and where no soil cracks or holes remained, the species has been located more frequently in habitats on ashy soils exhibiting high crack and hole densities, and in areas of dense vegetation cover (Mifsud 1999).

Habitat critical to the survival of the species

The habitat requirements of *S. douglasi* ensure that it remains an obligate in Mitchell grass (*Astrebla* spp.) tussock grasslands which grow in areas of dominant summer rainfall. These grasslands are described as treeless or lightly timbered and occur on rolling plains (Downs) on deep cracking clay soils (Wilson 1999). They are the dominant feature of the MGD bioregion, covering approximately 23 million hectares or 13.8 percent of Queensland (Wilson 1999).

The core areas of habitat necessary for the survival of *S. douglasi* were predicted and mapped by McAlpine and Howes (2005, Smith *et al*. 2006) using a Bayesian Belief Network model and a sample area of Mitchell grassland containing confirmed *S. douglasi* sightings[1]. These analyses used land tenure, soil type, seasonal variability, prickly acacia *Acacia nilotica* densities and livestock movements as the key variables affecting habitat suitability. Experts clarified and defined a range of values for ground cover abundance, soil cracks and grazing pressure that were used to define suitable habitat. Due to the relationship between habitat suitability and land tenure, protected areas (e.g. Bladensburg National Park) and Toorak Research Station were predicted as having the greatest probability of high habitat suitability, while stock routes and wide road reserves were predicted to have medium-high habitat suitability in wet season scenarios (McAlpine and Howes 2005). In these areas, grazing pressure is low or absent (e.g. in national parks where fencing has not been breached by stray cattle) and the density of prickly acacia and stock watering points is low.

In light of the outcomes of the habitat modelling work, continued protection of suitable habitat in protected areas such as Bladensburg NP will be important for ensuring the survival of *S. douglasi* in the wild. As few protected areas occur in the study area used by McAlpine and Howes (2005), maintaining/restoring habitat on freehold/leasehold land where clay soils exist and grazing pressure and prickly acacia densities are low, is critical for the conservation of *S. douglasi*. These actions will assist in maintaining: (i) soil cracks and holes which provide refuge from excessive temperatures, fire and predators in dry seasons; and (ii) abundant vegetation cover which assists in predator avoidance in wet seasons (Mifsud 1999). These habitat features form an essential component of the species habitat preferences and are necessary for its survival (McAlpine and Howes 2005).

Important populations

Sminthopsis douglasi is confined to a limited region of north-west Queensland where its distribution is fragmented and populations are small. To ensure the long-term persistence of this species in the wild, conserving all known populations is important. Maintaining areas which support suitable habitat and trappable populations holds the greatest potential for conserving wild populations of *S. douglasi*. Such areas are listed below as are other important populations:

Protected areas (Bladensburg NP and Moorrinya NP): Specific management actions relevant to the protection of *S. douglasi* are more easily implemented in reserves and have been incorporated into the management plans/strategies for these parks. Trapping surveys in 2000 and 2001 indicated that population numbers on Bladensburg NP were reasonably healthy and high (Mifsud 2000, 2001a). With appropriate management (i.e. maintenance of suitable habitat and introduced predator control) numbers should remain this way (Mifsud 2001a). Implementation of Action 1.1 and 4.1 will assist in clarifying the status of this population and ensure that habitat for this species is managed appropriately on the park. *S. douglasi* has been found in only a very small area in Moorrinya NP and whilst densities appear to be lower than that on Bladensburg NP, this population is also significant and similar management regimes should be investigated.

[1] Sample area consisted of a triangle encompassing the region between Julia Creek (20.66 S, 141.74 E), Richmond (20.73 S, 143.14 E), east to Hughenden (20.87 S, 144.24 E) and south to Winton (22.40 S, 143.04 E) (McAlpine and Howes 2005).

Toorak Research Station: Arrangements for collaborative management of known *S. douglasi* sites with respect to feral animals, weeds, fire and grazing were initially established at Toorak Research Station (Memorandum of Understanding was negotiated with DEEDI) in 2001. These arrangements have since lapsed and priority should be given to the re-negotiation of long-term arrangements. Due to its role as a livestock research station, Toorak is subject only to low-moderate grazing pressure and could more readily accommodate a conservation management regime compared with a commercial grazing property.

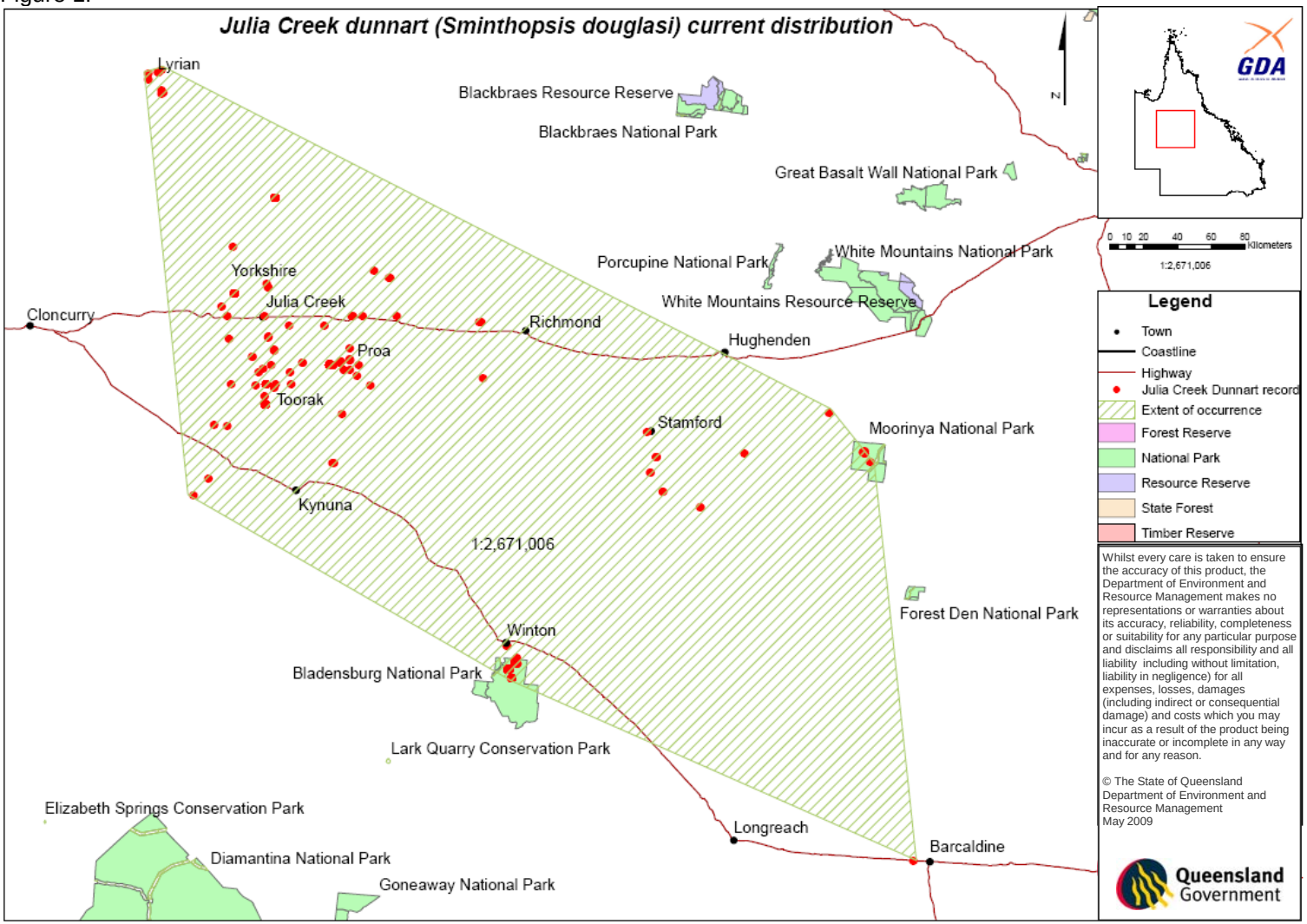
Julia Creek aerodrome: Preliminary field surveys in 2005 located one live *S. douglasi* specimen in Mitchell Grass habitat adjacent to the Julia Creek aerodrome. As the 250ha area of Mitchell grassland surrounding the aerodrome is relatively undisturbed, preliminary negotiations have been held with McKinlay Shire Council in regards to potential gazettal of the site as a nature refuge. To assist with the protection of *S. douglasi* at this site, installation of vermin proof fencing encompassing the entire aerodrome was completed in January 2008 (Vollmer *pers. comm.* March 2008) and fencing to exclude the airport apron was intended to be completed by August 2008 (Vollmer *pers. comm.* June 2008).

In June 2007, 20 captive-bred individuals were reintroduced to the aerodrome as a pilot reintroduction program. Trapping has since been conducted on two separate occasions (August 2007 and April 2008), however none of the released animals have been recaptured to date (Lundie-Jenkins 2008).

Seasonal climatic conditions

Unpredictable events such as heavy, prolonged rainfall which can cause severe flooding, could have the potential to cause high mortality of juvenile *S. douglasi* if such an event occurs when young are not sufficiently mobile to escape rising floodwaters and similarly, females carrying pouch young may be at risk form drowning because of the increased weight being carried, preventing them from swimming or climbing onto vegetation (Mifsud 1999). Findings from a study on *S. douglasi* ecology indicated that the species prefers habitat with high densities of soil cracks and holes and dense ground cover. As the latter is dependent on seasonal and unpredictable rainfall events, it is not a reliable source of shelter and in the absence of ground cover individuals may be more susceptible to predation when alternative refuge sites (e.g. soil cracks) are unavailable. As with inappropriate fire regimes, severe drought will also reduce vegetation cover and further expose animals to predators. In times of drought, predator impacts are exacerbated by current grazing practices (Malone *pers comm.* 2007).

Figure 1.


Julia Creek dunnart (Sminthopsis douglasi) current distribution
Lyrian
Blackbraes Resource Reserve
Blackbraes National Park
Great Basalt Wall National Park
Porcupine National Park
White Mountains National Park
White Mountains Resource Reserve
Yorkshire
Julia Creek
Cloncurry
Richmond
Hughenden
Proa
Toorak
Stamford
Moorinya National Park
Kynuna
1:2,671,006
Forest Den National Park
Winton
Bladensburg National Park
Lark Quarry Conservation Park
Elizabeth Springs Conservation Park
Diamantina National Park
Goneaway National Park
Longreach
Barcaldine
N
GDA
0 10 20 40 60 80
kilometers
1:2,671,006
Legend
Town
Coastline
Highway
Julia Creek Dunnart record
Extent of occurrence
Forest Reserve
National Park
Resource Reserve
State Forest
Timber Reserve
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3. Threats

Biology and ecology relevant to threats

McAlpine and Howes (2005) suggest that the confinement of *S. douglasi* to a region of extensive grazing, introduced predator presence and the medium size of this mammal contributes to its apparent risk of decline. For example, adult weight ranges in *S. douglasi* are 40-60g for females and 50-70g for males (Woolley 1995) which falls within the Critical Weight Range (35g and 5500g) for terrestrial species in Australia (Burbridge and McKenzie 1989). Species that inhabit arid and semi-arid environments and fall within the critical weight range (CWR), such as *S. douglasi,* have experienced the highest rate of extinction and decline in Australia (Burbridge and McKenzie 1989).

As a habitat specialist, *S. douglasi* has strong environmental associations with and is entirely restricted to the Mitchell grasslands. Whilst these grasslands cover an extensive region in north-west Queensland, most support extensive grazing and tenure is primarily freehold/leasehold. As such, areas of habitat suitability for *S. douglasi* (i.e. areas with low grazing pressure, limited predators and low prickly acacia and water point density), as found in reserved areas, are relatively limited (Wilson 1999, McAlpine and Howes 2005). Within its habitat, *S. douglasi* is dependent on extensive cracks in dry clay soils and vegetation cover for shelter in dry and wet seasons, respectively. Loss or disturbance of these refuge sites by natural or human induced processes will increase the species susceptibility to introduced and native predators, fire and extreme climatic events.

Abundance patterns in *S. douglasi* may also be adversely affected by seasonal climatic factors and ecological interactions with sympatric species.

Identification of threats

The reasons for the low abundance of this species were summarised in the previous recovery plan as 'not known but factors including introduced predators (especially cats) and current land use (sheep and cattle) may be implicated' (Maxwell *et al.* 1996). More recent studies have improved understanding of the known (K) and potential (P) threats impacting on this species and these are discussed below (Woolley 2000; Mifsud 1999, 2001b; Kutt 2003; McAlpine and Howes 2005).

Introduced predators (K): An investigation of the stomach contents of feral cats revealed that they were a significant predator of *S. douglasi* and that predation can be locally high. It has been suggested that feral cats were responsible for the disappearance of *S. douglasi* on the Lyrian property where they were once readily trapped (Woolley 1998). Trapping surveys by Mifsud (1999) found that capture frequencies for *S. douglasi* at Proa increased only after predator numbers were reduced. Examination of the stomach contents of cats and foxes collected by shooting and trapping on Toorak Research Station revealed that foxes also prey on *S. douglasi* (Woolley 2000). Although considered less of a threat, foxes are common throughout the range of *S. douglasi* and their opportunistic predatory behaviour suggests they cannot be disregarded as a potentially significant predator (Mifsud 1999). Continuation of targeted control programs will be necessary for protecting *S. douglasi* and other associated small mammals (e.g. long-tailed planigale *Planigale ingrami*, stripe-faced dunnart *Sminthopsis macroura*) and reptiles that feature prominently in the diet of these introduced predators.

Interactions between sympatric species and introduced predators may cause declines in *S. douglasi,* particularly in the absence of effective predator control programs. Following investigation of the ecology of *S. douglasi,* it was proposed that abundance patterns in *S. douglasi* may be driven by the population dynamics of sympatric species and predator-prey interactions (Mifsud 1999). For example, populations of eruptive, co-existing rodent species such as *Rattus villosissimus* may increase rapidly under favourable conditions. In response to

increasing prey availability, introduced predator (feral cats) abundances rise but avoid declines when prey populations are depleted through prey switching. As introduced predators such as feral cats, are not dependent on a single species for survival, they have the capacity to switch to, and cause declines in, alternative species such as *S. douglasi.*

Weed invasion (K): A major threat to biodiversity in the MGD bioregion is the widespread occurrence of environmental weeds such as prickly acacia *Acacia nilotica*, mesquite *Prosopis* spp and parkinsonia *Parkinsonia aculeata* (Wilson 1999). Prickly acacia was introduced to Queensland from Pakistan in the late 1890s to provide shade and fodder for livestock. It was declared a noxious weed in 1957 under the *Rural Lands Protection Act 1985* and seven million hectares of the Mitchell grass downs are now infested (DNRW 2006). Increased tree density of prickly acacia eliminates much of the ground vegetation as little grows under the canopy and the tree out-competes pasture for water. In addition, the extensive root system inhibits the cracking ability of clay soils (McAlpine and Howes 2005). Gradual changes in the botanical composition of pastures may also occur as perennial grasses are replaced by short-lived, less stable annual plants (Milson 1995). An increase of woody trees (prickly acacia) in the MGD bioregion has in turn provided barn owls with more roosting sites thereby intensifying their predatory abilities in a given area (Malone *pers comm.* 2007). Anecdotal information also suggests that prickly acacia infestations may exacerbate predator threats by providing refuge sites for feral animals (Woolley and Mifsud 2000, March *pers comm.* 2007).

Prickly acacia is therefore a threat to *S. douglasi* inhabiting these tussock grasslands in the MGD bioregion. Biological controls for this weed are now being investigated by the Department of Employment, Economic Development and Innovation (DEEDI).

Land use (grazing) (K): Mitchell grasses are considered to be relatively resilient to grazing as demonstrated at the property 'Proa' which is used for sheep and cattle grazing. An exclusion experiment showed that sheep had no apparent effect on the vegetation and soil characteristics, but this may reflect the modest stocking rate of sheep on this property. Orr (1975, 1978) found that the survival and productivity of individual Mitchell grass tussocks was greatest under low-moderate grazing regimes. Sustained overgrazing was found to be detrimental, as plant regeneration is suppressed and ground cover is subsequently reduced, and community composition is altered (QPWS 2000).

Trampling by hoofed stock within habitat occupied by *S. douglasi* and areas of potential habitat (e.g. stock routes) may be detrimental as soil compaction reduces cracking ability. Removal of vegetation by grazing stock in times of drought exposes and dries soil leading to crack filling, a process accelerated by hoofed stock movements (Malone *pers comm.* 2007). Disturbance to the upper soil surface and subsequent closure of cracks was observed at Proa (Mifsud 1999). Whilst trapping of live specimens in both ungrazed (Moorrinya NP) and actively grazed (Ashton Station) habitats indicates that this species can persist at sites with hoofed stock, it is probable that high levels of grazing and trampling negatively impact habitat suitability.

Fire (P): An experimental burn was conducted at Bladensburg NP in 2001 to examine the response of dunnarts to burning of Mitchell grass habitat. The trial indicated that *S. douglasi* can survive the direct effects of fire by retreating into soil cracks, however it emphasised the importance of ground cover in providing protection from predators as higher rates of predation by native predators (primarily barn owls) were experienced due to removal of vegetation (Mifsud 2001b).

As individuals are unlikely to shift their home ranges following fire, the impact of fire will depend on the timing and severity of the burn and the amount of remaining ground cover (Mifsud 2001b). Late dry season burns are likely to be more severe as dry matter curing rates are high (Mifsud 1999). Early season burns are recommended for some areas supporting *S. douglasi* habitat (e.g. Moorrinya NP) when grass is fairly green and soil retains moisture hence creating

fires of low intensity burns and patchily burnt habitat (QPWS 2004). Burns early in the dry season can however be detrimental for ground-dwelling biota such as *S. douglasi* which may perish if fires occur before the soil has fractured and when refuge sites are limited (Mifsud 2001b; Malone *pers comm.* 2007). Management regimes proposed for Mitchell grassland communities at Moorrinya NP involve: (i) regular fires and mosaic burning (sections are burnt every 4-8 years) to assist with grass regeneration and maintenance of grassland structure; and (ii) habitat assessments to ensure the continued presence of *S. douglasi* (QPWS 2004).

Small population size (P): Most survey records for *S. douglasi* suggest it occurs in small dispersed populations. Monitoring of the *S. douglasi* population at Bladensburg NP also indicates that local abundance can fluctuate significantly in relation to seasonal conditions (Mifsud 2001a). These characteristics may pose problems for *S. douglasi* as small populations are generally more vulnerable to stochastic events and therefore demographic instability (Frankham *et al.* 2003). In addition, inbreeding and loss of genetic diversity are inevitable in small populations. These processes can reduce reproductive fitness (i.e. ability to reproduce and survive) and the capacity to adapt to environmental change (Frankham *et al.* 2003). The population genetic structure of *S. douglasi* is not known.

Areas and populations under threat

The majority of the known threats to *S. douglasi* operate at the landscape scale and hence have potential to impact on all populations. The relative significance of these threats is likely to be mitigated by factors including habitat condition and management regimes. Populations of *S. douglasi* on freehold or leasehold land are subject to a range of threats including grazing pressure, fire and introduced predators as management of these areas is generally focussed on primary production. In contrast, populations on protected areas, including Bladensburg NP and Moorrinya NP, are considered to be exposed to a lower level of threats. This is primarily because in these areas grazing is excluded and control programs for introduced predators and weed infestations (prickly acacia) are incorporated into protected area management plans (McAlpine and Howes 2005). Similarly, threats associated with domestic stock and prickly acacia infestations are considered to be less at Toorak Research Station (as grazing pressure is low and weed eradication programs have been implemented) or the Julia Creek aerodrome which is a relatively intact remnant of Mitchell Grass habitat.

4. Evaluation of previous recovery plan

The present recovery plan is an updated plan based on a review of the Recovery plan for the Julia Creek Dunnart (*Sminthopsis douglasi*) 2000-2004. The outcomes of the previous recovery plan are summarised below.

1. Negotiate voluntary conservation agreements for future conservation and management of known dunnart populations.

Action 1.1: *Develop and assist in the implementation of management agreements in relation to known dunnart populations, starting with populations on Toorak Research Station and Proa.*

Agreements were negotiated with landholders in relation to monitoring and conservation management for areas of habitat supporting *S. douglasi* populations on the Yorkshire Downs, Toorak Research Station, Stamford and Woodsbury Stock Reserves. Due to differences in the circumstances of these various properties, these agreements were individually tailored and binding to current landholders only. To ensure the conservation and recovery of known populations, negotiations have also commenced with landholders neighbouring several known *S. douglasi* sites. This will assist in securing both access and the implementation of

appropriate management of such sites and potential for future habitat surveys and for developing collaborative management agreements to address weed/pest animal threats.

Action 1.2: *Negotiation of voluntary conservation agreements for other key sites.*

At the time of writing, four covenants/conservation agreements had been finalised or were under negotiation. To date these agreements have been entirely voluntary and not permanently attached to title. McKinlay Shire Council has been instrumental in progressing a Nature Refuge proposal for the Julia Creek Aerodrome aiming to have the proposal submitted for NatureAssist Round 3 (Vollmer *pers. comm*. June 2008).

2. Identify and protect areas of critical habitat for the Julia Creek dunnart.

Action 2.1: *Surveys to identify critical habitat and clarify species distribution and status.*

To locate core areas of habitat critical for the survival of *S. douglasi*, a survey program was conducted in the MGD bioregion. This involved:

- mapping - satellite imagery, regional ecosystem and tenure maps were used to identify significant areas of potentially suitable habitat;
- survey trapping - was implemented at Bladensburg NP, Moorrinya NP, Lochern NP, Toorak Research Station, Yorkshire Downs, Winton Town Common, Westbourne[2];
- preliminary habitat assessments - were conducted at three camp and water reserves (Od9, Wm43, Ae99); and
- consultation - government and non-government agencies were consulted to identify potential habitat and additional populations on private and unallocated crown land.

Core sites supporting *S. douglasi* populations were identified at Bladensburg NP, Moorrinya NP[3], Toorak Research Station and Proa/Yorkshire Downs. Agreements were negotiated with the respective land managers of the latter two sites to provide for future access and to ensure site protection and implementation of threat abatement plans.

Action 2.2: *Spatial mapping and analysis of habitat associations using GIS/satellite imagery.*

The University of Queensland's Centre for Remote Sensing and Spatial Information conducted a project to identify and map areas of habitat critical for the survival of *S. douglasi*. This involved several stages including: identification of key variables that contribute to the establishment of suitable habitat; development of a Bayesian Belief Network (BBN) model of habitat suitability; and production of a probability map illustrating *S. douglasi* presence across the study area. Study findings will guide future fauna surveys in targeted areas and allow for a more comprehensive assessment of the species status.

Prior to the models and maps being used to direct survey and conservation efforts, a series of preliminary fauna surveys were conducted to test and validate the spatial models. The overall accuracy of the model was limited in some instances by the availability of sufficient data, for example prickly acacia mapping was outdated and field data for *S. douglasi* locations was sparse. However, the BBN model successfully predicted locations known to support *S. douglasi* populations as having relatively high habitat suitability (e.g. Bladensburg and Moorrinya NP, Toorak Research Station, small reserves in Julia Creek, Richmond and Hughenden districts). As more current information comes to hand adjustments can easily be made to strengthen the

[2] Trapping surveys conducted at the following sites failed to locate *S. douglasi*: (i) Lyrian property - survey trapping in 1995 failed to locate *S. douglasi* despite the species being recorded here by Woolley (1992) in 1992 and 1994 (Mifsud 1999); and (ii) Western Mitchell Grass Downs area (Northern Territory) – intensive surveys conducted in this area (Barkly Tableland, Georgina Limestone sub-regions) failed to record *S. douglasi* (Kutt 2003).

[3] Since the gazettal of Moorrinya National Park in 1996, James Cook University conducted a series of short annual surveys, however *S. douglasi* records were only made after five years of surveys (see Kutt 2003).

model and its outputs. A final report for this project was submitted to DERM in 2006, and the results have been published (Smith *et al*. 2006).

3. Identify and implement on-ground management of key threats and develop effective management prescriptions for known dunnart populations.

Action 3.1: *Implement predator control programs to protect dunnart populations on Toorak Research Station and Proa.*

To address predation by feral cats and foxes, regular baiting and intermittent shooting programs have been implemented at Bladensburg NP and Moorrinya NP. A pilot baiting program was implemented on Toorak Research Station in May 1999. Currently only baiting for dogs continues as a component of the Blueprint for the Bush program funding received for baiting of dogs over a five year period for the entire McKinlay Shire, which is currently in its second year (*pers. comm.* P. Olsson 2008). General pest animal and weed control activities are being undertaken at a range of other sites known to support *S. douglasi* populations. McKinlay Shire Council received funding through the Southern Gulf Catchments NRM body for the 2007-2008 financial year to monitor and control for predators in the Julia Creek Aerodrome. This has involved predator (feral cats and foxes) footprint monitoring, one session of baiting and ongoing trapping for stomach content analysis (Vollmer *pers. comm*. June 2008). Landholders have been consulted to progress implementation of baiting programs on Yorkshire Downs and Stamford and Woodsbury Reserves.

Action 3.2 *Implement management plans and conduct monitoring of dunnart populations revealed during surveys detailed in Action 2.1.*

Trappable populations of *S. douglasi* were recorded from Bladensburg NP and Moorrinya NP, although the species extent at these sites is not known and must be confirmed by further trapping surveys. Management plans have been prepared for both national parks and include actions relevant to the conservation of *S. douglasi* habitat and populations.

Management actions addressing feral animal and weed threats and fire and grazing management have been incorporated into the Memorandum of Understanding negotiated for Toorak Research Station and the grazing lease arrangements negotiated for Yorkshire Downs and Stamford and Woodsbury Reserves. Weed control has been undertaken at Bladensburg NP and to varying degrees at all sites containing known *S. douglasi* populations. Prickly acacia has been targeted in these programs.

Monitoring of *S. douglasi* and feral animal populations, vegetation condition and weed infestations were implemented to various extents at four core sites (Toorak Research Station, Proa/Yorkshire Downs, Moorrinya NP and Stamford and Woodsbury Reserves). Monitoring is currently conducted on an intermittent basis in conjunction with other activities.

4. Education and extension to rural landholders.

Action 4.1: *Education and extension to rural landholders.*

Actions undertaken to promote awareness among landholders of the nature conservation values of the MGD bioregion and options for conserving threatened species/habitat included: mobile poster displays developed and presented at field days held at Bladensburg NP and Toorak Research Station involving government/non-government agencies, landholders and the community; and 5000 brochures (“What is a Julia Creek Dunnart”) describing the species, its status, distribution, ecology, threats and conservation needs were produced and distributed to tourism information centres and schools.

Action 4.2: *Media and sponsorship campaigns.*

The following actions have been undertaken to promote the species:

- the production and sale of *S. douglasi* memorabilia (post cards, coffee mugs, t-shirts);
- radio and newspaper stories to promote the discovery of *S. douglasi* at Bladensburg NP and the DERM captive breeding program;
- the inaugural Julia Creek Dunnart Bush Festival was held in 2005 and included displays of live animals from DFWP and educational materials and presentations about the species. The festival was held again in 2006 and it is intended to be held every two years on an ongoing basis; and
- installation of a permanent habitat-based threatened species display in 2002, which provides information about the recovery program for *S. douglasi*.

Whilst individual approaches to a number of potential commercial sponsors were made during the life of the recovery plan, no formal campaign to attract sponsorship support for the *S. douglasi* recovery program was implemented.

Action 4.3: *Facilitate landholder access to funding and resources to assist in protection and management of key sites for the Julia Creek dunnart.*

During the life of the previous recovery plan, landholders were provided information in relation to a range of funding programs including Envirofund, Threatened Species Network Community Grants and the Greening Australia – Advancing on Ground Nature Conservation in the Southern Gulf Region. Support was provided in relation to the preparation and submission of several applications under these programs. In the future, where nature refuges have been established, non-monetary resources and funding may be available to landholders through the DERM NatureAssist program[4] and applied for through Commonwealth programs such as Caring for Our Country and regional NRM bodies.

5. Investigations to guide future management of the Julia Creek dunnart.

Action 5.1*: Investigations to determine the ecology and habitat requirements of the dunnart and determine abundance and population dynamics at known sites.*

To identify factors that may be limiting the distribution and abundance of *S. douglasi*, a post-graduate study was conducted by Mifsud (1999). Aspects of the species ecology, including its habitat, population size, movements, reproduction, life history and the impact of introduced predators, were investigated. The significance of predators for the species conservation and the factors that influence habitat preferences were identified. The findings from this study are discussed in Sections 2 and 3.

Action 5.2: *Investigation of the impact of introduced predators and competitors in areas where the dunnart is known to occur.*

The influence of habitat features such as ground cover, soil structure, seasonal conditions and alternate prey availability on threats posed by native and introduced predators, were also assessed by Mifsud (1999). Research findings indicated that abundance patterns in *S. douglasi* and its susceptibility to introduced predators may be influenced by: the population dynamics of sympatric species; soil structure and the density of cracks and holes; and wildfires and

[4] An NHT funded project was implemented at Eddington Station (*S. douglasi* was recorded in owl pellets collected at this site by Woolley 1995). This project aimed to control the spread of prickly acacia infestations by fencing parts of Eastern Creek to control livestock movements and prevent stock from feeding on and transporting prickly acacia across the MGD bioregion (Malone *pers comm.* 2007).

seasonal conditions which influence the abundance and growth of ground cover. The findings from this study are discussed in Section 3.

It is suspected that other factors such as the distribution and abundance of feral cats, ground cover trends (as mediated by grazing management) and water point distribution may interact and influence predator impacts on *S. douglasi*. The significance of these factors for the species conservation is unknown and could be clarified through further research and results applied to guide management.

Action 5.3: *Investigate the life history of the dunnart and reproduction in the wild.*

The basic features of *S. douglasi* reproductive biology have been established in both captive and field populations (Mifsud 1999, Woolley 1997, Woolley *pers comm.* 2007). A large body of work on *S. douglasi* has been conducted at La Trobe University by PA Woolley together with a number of collaborators as well as students working under her supervision. Research undertaken has investigated aspects of the species reproductive biology, growth and development of pouch young, maternal behaviour, diet and digestive strategy, cranial and dental abnormalities of captive animals and ecology (Woolley *pers comm.* 2007). Additional studies on *S. douglasi* physiology, ventilation, metabolism and torpor have also been conducted at La Trobe University (see Appendix 1).

Using captive animals, additional studies on *S. douglasi* life history and reproductive biology have been undertaken at the DERM facility, David Fleay Wildlife Park (DFWP). These projects have been conducted to examine trends in growth and development and oestrous cycle activity, pregnancy and lactation. Completed projects from this institution are listed below and have focused on identifying methods for oestrus detection which do not involve the intensive technique of urogenital cytology (see Appendix 1).

Action 5.4: *Investigate interactions between S. douglasi and sympatric species of small mammals (Planigale ingrami, S. macroura, S. crassicaudata, Rattus villosissimus and Leggadina forresti).*

This action was rated as a low priority for the *S. douglasi* recovery program and was not implemented during the life of the previous recovery plan. Patterns of breeding in wild populations of *S. douglasi, S. macroura* and *Planigale ingrami* have been investigated by La Trobe University but the results are yet to be published.

6. Continuation of captive populations at La Trobe University, DFWP and other appropriate institutions.

Action 6.1: *Continuation of captive breeding at La Trobe University and development of a captive management plan for captive populations at La Trobe University and DFWP.*

Captive breeding at La Trobe University ceased in 1999 and captive animals from this institution were transferred to DFWP where all captive stock of *S. douglasi* are now held.

To date, the captive population at DFWP has been used to investigate aspects of the species biology, for public education and a pilot monitored reintroduction program. Whilst there was no specific action in the previous recovery plan associated with reintroduction, it was identified as a potential management strategy for the species.

In June 2007, 20 captive-bred sub-adult dunnarts were released into suitable habitat at the Julia Creek aerodrome for a pilot reintroduction program. Eight of the 20 released animals were fitted with radio collars with monitoring planned to determine survival, diurnal shelter selection and patterns of movement and dispersal. However, two of these radio collars were damaged during transportation of the dunnarts to the reintroduction site which negatively impacted the effective range of these units with only survival and nocturnal movements able to be monitored (Lundie-Jenkins 2008). Another issue with use of the radio collars was interference from the

non-directional beacon (NDB) operating at the Julia Creek Airport, which significantly impacted the ability to accurately locate several of the transmitters. As a result of these two issues, only five of the eight radio-transmitters fitted to dunnarts could be relocated in the week following release, however tracking that did occur revealed evidence of foraging, burrow creation and movements for the three days immediately post release. Detailed analysis will be undertaken for the final report on this pilot reintroduction. Since the release of Julia Creek dunnarts to the aerodrome, trapping has been conducted on two separate occasions at this site (August 2007 and April 2008) however none of the released animals have been recaptured to date (Lundie-Jenkins 2008).

Action 6.2: *Establish additional captive populations at appropriate institutions.*

Establishing and maintaining captive breeding programs has been too costly for some institutions and additional populations have not been established in captivity. With the cessation of the captive breeding programs at La Trobe University and Pearcedale Conservation Park, only one *S. douglasi* population is now managed in captivity at DFWP. DERM will be finalising research on the *ex situ* population and future recovery efforts will focus on securing populations *in situ* through: the continuation of existing and/or implementation of additional management programs targeting known threats; and by conducting investigations to inform and support the recovery planning process.

7. Continue maintenance of the recovery team.

A recovery team was not formally established during the life of the previous recovery plan. Approaches were however made to a number of organisations and stakeholder meetings were held in July 2005 to discuss: future directions for the recovery program; to progress the development of a formal recovery team/steering committee; and to identify roles/responsibilities for recovery plan implementation. A further meeting occurred in April 2008 at Julia Creek with various stakeholders to discuss recovery planning.

5. New Recovery objectives, Performance criteria and Actions

Overall objective

To secure and enhance the status of *S. douglasi* in the wild through an on-ground conservation management program that targets known threats and an integrated program of investigations during the life of this plan.

Specific objective 1: To verify the distribution of *S. douglasi* and ensure 'essential habitat' for this species is considered in planning processes.

Action 1.1: Conduct surveys to verify S. douglasi presence/absence in areas of suitable habitat and to clarify the extent of the species distribution.

Performance criterion: Surveys to verify the species distribution completed within two years

Rationale: *S. douglasi* remains have been detected in owl pellets from 28 localities (in prep. Woolley 2008) and in stomach contents of feral cats from several sites within the MGD bioregion (Woolley 1998). It is highly probable that other extant populations exist. McAlpine and Howes (2005) Bayesian Belief Network Model identified areas of high conservation value with respect to *S. douglasi* populations, predicting protected areas to have the greatest probability of high habitat suitability and stock routes a medium-high level, and targeted field surveys are now required to verify the species presence/absence in areas of suitable habitat. As protected areas are considered to have lower levels of threats than freehold/leasehold land and these areas are relatively limited in the MGD bioregion and specific management actions

relevant to the protection of *S. douglasi* are more easily implemented in such areas (via management plans / strategies), it may be valuable to initially target surveys for *S. douglasi* in protected areas with suitable habitat, such as Forest Den NP and Combo Conservation Parks 1 and 2. Results from McAlpine and Howes (2005) habitat suitability modelling and mapping exercise, previous BIOCLIM analysis and expert knowledge will be used to help guide future surveys. This will assist in verifying the extent of the species distribution and securing the protection of key habitat areas and populations.

Contact is recommended with relevant landholders in the MGD and DEU bioregions seeking information on the occurrence of *S. douglasi* and permission to conduct inspections. An ongoing extension and public education program (Action 2.2, 6.2) will support this action by encouraging sighting reports and promoting the 'off-park collaborative conservation' focus of the recovery program.

Agencies conducting relevant environmental research/monitoring in the MGD and adjacent bioregions could assist with this survey/ground truthing effort by alerting DERM of sightings by providing this information to the DERM's WildNet Team at WildNet@derm.qld.gov.au (e.g. APLC surveys of sympatric dunnart species; Local Council biodiversity identification programs along stock routes). Discovery of additional populations would improve the species status and management options could then be explored to ensure their protection (Action 2.1).

Potential contributors: DERM, Department of Transport and Main Roads, APLC, regional councils (Stock Route Supervisors), land holders/managers, mining companies, Universities, NRM groups (SGC, DCQ), Traditional Owners.

Action 1.2: Apply data from habitat modelling exercises to map 'essential habitat' for incorporation into Biodiversity Planning Assessments.

Performance criterion: Habitat essential for the survival of *S. douglasi* is mapped.

Rationale: Information captured in habitat modelling studies would be used in conjunction with field survey results and spatial data representing *S. douglasi* populations to map 'essential habitat' for this species. This would assist in obtaining protection for habitat that is essential for the species survival as these key areas could be formally identified and considered in planning decision-making processes.

This exercise would be based on the Biodiversity Assessment and Mapping Methodology (BAMM), which is used by DERM to generate habitat suitability maps for Biodiversity Planning Assessments (BPAs). BPAs are used by Government Agencies to advise on a range of planning decision-making processes such as identifying off-reserve conservation priorities. Essential habitat layers for threatened species are supplied to and used by DERM for assessing clearing applications under the Queensland *Vegetation Management Act 1999*.

Potential contributors: DERM, regional councils, NRM groups (SGC, DCQ), landholders/managers.

Specific objective 2: To secure protection of suitable habitat and populations on non-reserved lands.

Action 2.1 Negotiate voluntary conservation agreements/management agreements for key sites to secure protection of known populations and suitable habitat.

Performance criterion: Voluntary conservation agreements for known *S. douglasi* sites are negotiated and executed in the next five years.

***Rationale*:** As securing and maintaining existing wild *S. douglasi* populations is fundamental for the species recovery program, it is essential to develop and implement management plans which mitigate the known threats to this species. Since many known *S. douglasi* populations

occur on non-reserved lands, the development of formal conservation agreements will assist with implementing threat abatement and securing habitat for this species on such lands.

The MGD bioregion of western Queensland supports a number of extensive land uses including pastoralism and mining. Negotiating voluntary conservation agreements with landholders will be an important step in securing and managing key areas of *S. douglasi* habitat. Negotiations may lead to the establishment of Land for Wildlife, Natural Resource Management, or more formal nature refuge agreements. Property management planning (PMP), a process which promotes sustainable natural resource management may also assist with protecting *S. douglasi* populations and habitat. The DEEDI *Futureprofit* workshop program offers training to landholders via a series of integrated workshops covering a range of PMP components (e.g. land, water and biodiversity planning and management). Resultant property management plans assist landholders in managing their properties sustainably and profitably, and documenting actions that demonstrate a duty of care to the environment.

Developing and implementing management agreements for sites supporting trappable *S. douglasi* populations and intact habitat (e.g. Julia Creek aerodrome reserve) is a priority. Incentive and grant programs exist to assist landholders with implementing management programs (see Action 2.2).

***Potential contributors*:** DERM, DEEDI, regional councils, land holders/managers, NRM Groups (SGC, DCQ), Landcare groups, Traditional Owners.

Action 2.2: Encourage landholders to protect and manage key sites for S. douglasi.

Performance criterion: Agreements defining arrangements for managing known *S. douglasi* sites (in relation to feral animals, weeds, fire and grazing) are negotiated.

***Rationale*:** There are a number of schemes which support nature conservation activities on private land including devolved grant schemes and volunteer support initiatives. Funding and resources could be made available to landholders through the DERM NatureAssist program, an incentives scheme designed to encourage and assist management of nature refuges through a competitive tender process. Other relevant schemes include those provided by the Australian Government (Caring for our Country), Greening Australia (Advancing On-ground Nature Conservation in the MGD bioregion) and WWF (Threatened Species Network). The network of government and non-government nature conservation extension staff in the region could facilitate landholder access to these schemes and the development of applications for support.

Non-monetary resources to assist landholders in protecting and managing key sites for *S. douglasi* will continue to be delivered via direct liaison, field days and production of information kits. This will assist with promoting nature conservation and threatened species conservation initiatives within the context of sustainable production.

Potential contributors: NRM groups (DCQ, SGC), DERM, Department of Transport and Main Roads, regional councils, land holders/managers, Landcare groups, Traditional Owners.

Action 2.3: Areas of known/potential S. douglasi habitat relevant to Stock Routes are integrated in local government Stock Route Network Management (SRNM) Plans.

Performance criterion: Where known/potential *S. douglasi* habitat occurs along stock routes, provisions are made for the management of these areas in local government SRNM Plans to minimise impacts and conserve *S. douglasi* habitat.

***Rationale*:** Management of the Queensland Stock Route Network (SRN) is shared between local government and DERM. Under the *Land Protection (Pest and Stock Route Management) Act 2002*, 24 local governments (including Flinders, McKinlay, Richmond and Winton) are

required to have stock route network management plans to guide the daily management of these areas and to ensure that the impacts from, and to, travelling stock and other stock route activities on the resources, users and values of the SRN are minimised.

McAlpine and Howes (2005) predicted medium-high habitat suitability for stock routes and wide road reserves in wet season scenarios. Identification of biodiversity along stock routes by local government Stock Route Supervisors will assist in ground-truthing these predictions (see Action 1.1). Stock Route Supervisors could also be provided with information on *S. douglasi* (e.g. description, habitat, distribution) and other priority species to assist with identification. Where sightings are made and areas of known/potential habitat detected along stock routes, this could be acknowledged in SRNM Plan reviews. Management requirements aimed at conserving *S. douglasi* habitat could then be incorporated into revised SRNM Plans to minimise livestock impacts in such areas. Such provisions may involve: investigating alternative routes and locations for stock water points/reserves; monitoring of significant areas by SRN supervisors; maintaining/implementing pest animal and plant control programs; fencing and mapping of significant areas of Mitchell Grass habitat; and notifying stock route users/managers of such areas (e.g. via maps made available for public reference). The project 'Enhancing Biodiversity Hotspots along Western Queensland Stock Routes' may assist to identify *S. douglasi* habitat on stock routes, as the project will overlay records of priority species (as identified by the 'Back on Track species prioritisation framework') including *S. douglasi*, and identify sites of multi-species overlap to focus guidelines for best management practice for these key sites within the SRN.

Potential contributors: Regional councils (Stock Route Supervisors for Flinders, McKinlay, Richmond and Winton Shire Councils), DERM (Stock Route Management Team).

Specific objective 3: To reduce the impact of threatening processes on *S. douglasi* populations by maintaining and/or implementing effective threat abatement programs.

Action 3.1: Continue and expand implementation of predator control programs to protect known S. douglasi populations and trial/implement alternative control strategies.

Performance criterion: Predator control programs maintained at existing *S. douglasi* sites and implemented at other key sites when located.

***Rationale*:** Ecological research on this species identified predation, principally by feral cats, as a key process threatening *S. douglasi* populations (Mifsud 1999). Implementation of effective, targeted control programs in the vicinity of known populations is therefore critical for the species recovery. As several populations exist at sites on pastoral properties and research stations, baiting programs that reduce the potential for bait uptake by livestock, working dogs and native wildlife will be maintained. Existing predator control programs coordinated by DERM and McKinlay Shire Council at several *S. douglasi* sites (e.g. Bladensburg NP, Moorrinya NP, Julia Creek aerodrome) will be maintained.

Refinement of existing control methods may be required as research findings suggested that feral cats are less susceptible to baiting as baits laced with 1080 poison are rarely taken (Mifsud 1999). Observations of feral cats taking meat baits during colder months suggests however that baiting would be most effective if applied between June and August and if used in conjunction with shooting (Mifsud 1999; Woolley 2000). Baiting with 1080 has been effective in controlling foxes and would be continued.

McKinlay Shire Council has excluded feral cats from the Julia Creek Aerodome Enclosure, where a number of *S. douglasi* individuals have been released. A feral cat bounty is also being trialled in the Shire to reduce the number of feral cats in known *S. douglasi* habitat close to Julia Creek township (Young *pers. comm.* 2009). Pro-active control measures should continue in the McKinlay Shire and expand to include other regional councils where *S. douglasi* occurs.

Potential contributors: DERM, DEEDI, regional councils, land holders/managers, Traditional Owners.

Action 3.2: Maintain existing weed control programs and implement at other sites to restore / maintain suitable S. douglasi habitat.

Performance criterion: Weed control programs maintained at known *S. douglasi* sites.

Rationale: Prickly acacia is a weed of national significance and landholders are required by law to control and where possible eradicate this species. Widespread infestations of this and other weeds of national significance such as mesquite and parkinsonia throughout north-west and central-west Queensland, pose a key threat to biodiversity as natural grassland is transformed into thorny scrub and woodland (DNRW 2006). Results from McAlpine and Howes (2005) habitat modelling study indicated that aside from dominant soil type, prickly acacia density and land tenure were the most influential variables on habitat suitability. Hence, maintaining areas with low prickly acacia density on clay soils is crucial for the continued existence of *S. douglasi* (McAlpine and Howes 2005).

Control programs are currently based on the strategic location of infestations relative to the core prickly acacia area. Areas of known *S. douglasi* habitat and adjacent sites could therefore be included within the funding criteria, or such criteria amended to reflect this (March *pers comm.* 2007). To maintain and/or restore known/potential *S. douglasi* habitat, existing control programs at known sites (e.g. Bladensburg NP, Moorrinya NP) will continue. Similar programs will be implemented in the vicinity of other populations as they are located. Vegetation/weed management extension staff from local government and State weed management agencies are available to advise on appropriate control strategies.

Potential contributors: DERM, DEEDI, Department of Transport and Main Roads, NRM groups (SGC, DCQ), regional councils, land holders/mangers, NPBMG, Traditional Owners.

Action 3.3: Liaise with landholders to encourage implementation of sustainable land practices to assist with maintaining/restoring* known and potential *S. douglasi habitat.

Performance criterion: Management agreements relating to sustainable land practices (e.g. grazing regimes) are negotiated and implemented at *S. douglasi* sites in the next five years.

Rationale: Overgrazing and trampling by hoofed stock in Mitchell grasslands can degrade habitat, and in areas occupied by *S. douglasi,* threaten the persistence of populations. Where low stocking rates have however been practiced (e.g. Proa, Toorak Research Station), grazing did not appear to accelerate ground cover reduction rates in comparison with ungrazed areas (Mifsud 1999). McAlpine and Howes (2005) predicted that areas of high habitat suitability for *S. douglasi* existed in areas where domestic stock were excluded (e.g. Bladensburg NP) or grazing pressure was low (50-70% ground cover remains) such as at Toorak Research Station[5]. They advised that maintaining areas of low grazing pressure on clay soils was necessary for the species conservation and recovery in the wild.

Hay making (i.e. removal of stubble or vegetative material left behind in a paddock following crop harvesting) may also adversely affect *S. douglasi* habitat (Woolley *pers comm.* 2007). As this practice can result in soil nutrient loss, reduced ground cover and increased soil compaction, alternatives options could be considered (visit the DNRW Stubble Management website for management advice).

Current natural resource management stewardship programs being developed by the Commonwealth and several NRM regional groups and the State Rural Leasehold Land Strategy developed by the Department of Environment and Resource Management may also

[5] A 'safe' grazing practice states that ground cover should not be reduced below 30 percent (Orr 1975).

provide a basis for establishing and funding agreements to sustainably manage habitat for *S. douglasi*.

Potential contributors: DERM, DEEDI, land holders/managers, Landcare groups, Traditional Owners.

Specific objective 4: To increase knowledge of *S. douglasi* population dynamics, threats and ecology and use acquired information to guide future management.

Action 4.1: Continue monitoring S. douglasi populations and implement monitoring programs at other significant sites to track abundance patterns.

Performance criterion: Monitoring programs maintained at known *S. douglasi* sites and conducted at least biannually.

***Rationale*:** Monitoring programs are essential for tracking *S. douglasi* population abundance patterns, and for assessing the efficacy of threat abatement actions. Ongoing monitoring of *S. douglasi* populations will ensure that habitat supporting this species is properly managed.

Biannual monitoring programs at Bladensburg NP, Moorrinya NP, Proa/Yorkshire Downs, Toorak Research Station, Julia Creek aerodrome, Winton Town Common and Stamford and Woodsberry Reserves is recommended. If additional trappable populations are located, monitoring programs could be established at these sites to determine efficacy of threat abatement programs if they are undertaken. To promote community ownership of the program, community participation will be encouraged.

***Potential contributors*:** DERM, DEEDI, NRM groups (SGC, DCQ), regional councils (McKinlay Shire), land holders/managers, Traditional Owners.

Action 4.2: Conduct a review of sites being used for S. douglasi monitoring programs.

Performance criterion: A review of the existing *S. douglasi* monitoring program is conducted within two years.

***Rationale*:** Monitoring of *S. douglasi* populations has been conducted over a number of years at Toorak Research Station, Bladensburg NP, Proa/Yorkshire Downs and Moorrinya NP. The consistency and frequency of this monitoring has varied considerably due to changes in staffing and funding available to the program. With the discovery of additional *S. douglasi* locations in recent years and indications of large fluctuations in the size of known populations overtime (e.g. Bladensburg NP; Mifsud 1999), a review of existing monitoring sites/new locations is required to assess site suitability for monitoring and to clarify the number of monitoring sites required.

***Potential contributors*:** DERM, NRM groups (SGC, DCQ), research institutions.

Action 4.3: Investigate interactions between introduced predators, artificial water sources and grazing management and their significance for S. douglasi conservation.

Performance criterion: Interactions between listed subjects are documented and ameliorative management prescriptions developed within five years (if necessary).

Rationale: While it is clear that introduced predators, particularly feral cats, pose a direct threat to *S. douglasi* populations, the manner in which this impact may be influenced by other factors such as grazing management and artificial water sources is not known. For example, it is suspected that over-grazing by cattle in grassland habitats may secondarily increase the impact of introduced predators on *S. douglasi* as predation is enhanced by loss of ground cover. Increased grazing around artificial water sources by macropods and livestock also denudes groundcover, thereby degrading *S.douglasi* habitat (Clague *pers comm.* 2007).

Although feral cats can persist in the absence of free water, their numbers appear to be higher around artificial water points suggesting that these features influence predator abundance patterns. Research by McRae (2004) suggests a clear linkage between the density of artificial watering points and the persistence of bilby populations in western Queensland. Further work is needed to clarify whether these factors also influence the persistence of *S. douglasi* populations. This research will support the recovery planning process for *S. douglasi* by informing management and assisting with the development of targeted control programs addressing predator impacts on known populations.

The Grazing Land Management (GLM) program currently coordinated and delivered by DEEDI, should also be considered in this study as this scheme assists landholders with developing grazing management strategies to increase profit and sustainability.

Potential contributors: James Cook University, CSIRO Tropical Savannas Cooperative Research Centre, NRM groups (SGC, DCQ), DERM, DEEDI, land holders/managers.

Action 4.4: Investigate interactions between S. douglasi and sympatric species of small mammals including Planigale ingrami, S. macroura, S. crassicaudata, Rattus villosissimus and Leggadina forresti.

Performance criterion: Ecological interactions between *S. douglasi* and sympatric species and implications for conservation are documented and disseminated to relevant stakeholders.

Rationale: *Sminthopsis douglasi* occurs sympatrically with a number of other small native mammals including the long-tailed planigale *Planigale ingrami*, stripe-faced dunnart *S. macroura*, fat-tailed dunnart *S. crassicaudata*, long-haired rat *Rattus villosissimus* and Forrest's mouse *Leggadina forresti*. The relative abundance of these species is known to differ between sites and to fluctuate under different seasonal and environmental conditions. The differing responses by each species suggest different strategies are being pursued by each species and/or that there may be competitive exclusion occurring at particular densities. Understanding these interactions and establishing whether they are a product of natural ecological processes, land management practices and/or introduced predators, will enhance our capacity to effectively design management to recover and protect dunnart populations.

Field observations also suggest strong associations between the distribution of *S. douglasi* and that of two native reptiles (Collet's snake *Pseudechis colletti*, Soil dragon *Pogona henrylawsoni*; Malone *pers comm.* 2007). As detection of these species at sites may be a good indicator of *S. douglasi* presence, this apparent shared distribution could be investigated further as part of this ecological study.

Potential contributors: Research institutions such as universities and CSIRO.

Specific objective 5: Promote awareness of *S. douglasi* and obtain support for the recovery program.

Action 5.1: Conduct media campaigns to raise the profile of S. douglasi and obtain support for the recovery program.

Performance criterion: Media campaigns conducted annually to raise the species profile.

Rationale: The recovery plan described here is expensive in terms of both staff and resources and the support of the public is essential if populations of *S. douglasi* are to be conserved in the wild. DERM in co-operation with other relevant organisations including McKinlay Shire Council, Greening Australia, WPSQ and WWF will develop and coordinate a campaign to raise the profile of *S. douglasi* in the broader community and attract sponsorship support for the recovery program.

The biannual Julia Creek Dunnart Bush Festival provides one forum for coordinated media and education programs to both raise the profile of the program and to attract additional support.

Potential contributors: DERM, partner organisations, Traditional Owners.

Action 5.2: Continue production and dissemination of educational material.

Performance criterion: Interpretive material is developed and disseminated to landholders, the community and tourists.

Rationale: Production and dissemination of educational material on *S. douglasi*, by regional Tourist Information Centres, DERM, and via field days and festivals has successfully raised the profile of this species within the local and broader community. These activities have encouraged members of the local community to become engaged in the recovery process and will be continued. McKinlay Shire Council will proceed with the production and dissemination of educational/promotional material to promote *S. douglasi* to the local and tourist communities. Establishment of the proposed Julia Creek Interpretive Centre by McKinlay Shire Council will further assist in raising the profile of *S. douglasi* and other significant species and ecological communities in western Queensland.

Potential contributors: DERM, regional councils, NRM groups (SGC, DCQ), Traditional Owners.

Specific objective 6: Establish a recovery team to manage the recovery program.

Action 6.1: Establish a recovery team with representatives from key stakeholder groups and develop an implementation plan.

Performance criterion: The Julia Creek dunnart Recovery Team is established and develops an implementation plan and continues to meet at least annually.

Rationale: The recovery team may contain representatives from each of the State government and non-government agencies relevant to issues pertaining to the objectives of the recovery program and will have Indigenous representation to enable negotiation and consultation with relevant Aboriginal communities to facilitate Traditional Owner participation in implementation of the plan. Members with particular expertise (e.g. researchers, private consultants), land managers and institutions conducting relevant environmental research (e.g. APLC research on sympatric Sminthopsis species) will also be drawn from other areas and/or informed of team meetings and outcomes. Venues will be chosen to minimise travel expenses.

To ensure effective management of the recovery program, a priority of the recovery team will be the development and implementation of a schedule outlining timeframes and responsibilities.

Potential contributors: All relevant stakeholders, Traditional Owners.

Action 6.2: Establish a consultative protocol to engage Traditional Owner communities in recovery plan implementation.

Performance criterion: Consultative protocol established by Indigenous representative/s on Julia Creek dunnart recovery team.

Rationale: Establishing a consultative protocol by the Indigenous representative/s on the recovery team will allow for and direct the future engagement of traditional owner communities in the implementation of the recovery plan. These protocols are to facilitate Traditional Owner participation in recovery actions as well as the use and application of traditional ecological

knowledge relating to the species, for example, through traditional knowledge recording projects. The Murri Network is suggested as a first point of contact for working to establish these protocols.

Potential contributors: Traditional owners.

Summary Table

Table 1: Summary of objectives, performance criteria, recovery actions and potential contributors. Priority ratings for each recovery action: **1** = high priority; **2** = medium priority; **3** = low priority.

Objectives	Performance criteria	Actions	Potential Contributors	Priority
1. To verify the distribution of *S. douglasi* and ensure 'essential habitat' for this species is considered in planning processes	1.1: Surveys to verify the species distribution completed within two years	1.1: Conduct surveys to verify *S. douglasi* presence/absence in areas of suitable habitat and to clarify the extent of the species distribution	DERM, Department of Transport and Main Roads, APLC, land holders/managers, mining companies, Traditional	1
	1.2: Habitat identified in modelling exercises as essential for the survival of *S. douglasi* is mapped	1..2: Apply data from habitat modelling exercises to map 'essential habitat' for incorporation into Biodiversity Planning Assessments (BPA)	DERM, regional councils, NRM (SGC, DCQ), landholders/managers	3
2. To secure protection of suitable habitat and populations on non-reserved lands	2.1: Voluntary conservation agreements for known *S. douglasi* sites are negotiated and executed in the next five years	2.1 Negotiate voluntary conservation agreements/management agreements for key sites to secure protection of known populations and suitable habitat	DERM, regional councils, land holders/managers, NRM groups, Landcare groups, Traditional Owners	1
	2.2: Agreements defining arrangements for managing known *S. douglasi* sites (in relation to feral animals, weeds, fire and grazing) are negotiated	2.2: Encourage landholders to protect and manage key sites for *S. douglasi*	DERM, Department of Transport and Main Roads, regional councils, NRM (SGC, DCQ), landholders/managers, Landcare groups, Traditional Owners	1
	2.3: Where known/potential *S. douglasi* habitat occurs along stock routes, provisions are made for the protection of these areas in Local Government SRNM Plans	2.3: Areas of known/potential *S. douglasi* habitat relevant to Stock Routes are integrated in the development and implementation of Local Government Stock Route Network Management (SRNM) Plans	Regional councils (Stock Route Supervisors), DERM (Stock Route Management Team)	2
3. To reduce the impact of threatening processes on *S. douglasi* populations by maintaining and/or implementing effective threat abatement programs	3.1: Predator control programs maintained at existing *S. douglasi* sites and implemented at other key sites when located	3.1: Continue and expand implementation of predator control programs to protect known *S. douglasi* populations and trial/implement alternative control strategies	DERM, DEEDI, regional councils, land holders/managers, Traditional Owners	1
	3.2: Weed control programs maintained at known *S. douglasi* sites	3.2: Maintain existing weed control programs and implement at other sites to restore / maintain suitable *S. douglasi* habitat	DERM, DEEDI, Department of Transport and Main Roads, regional councils, land holders/mangers, Traditional	1
	3.3: Management agreements relating to sustainable land practices (e.g. grazing regimes) are negotiated and implemented at *S. douglasi* sites in the next five years	3.3: Liaise with landholders to encourage implementation of sustainable land practices to assist with maintaining/restoring known and potential *S. douglasi* habitat.	DERM, DEEDI, land holders/managers, Landcare groups, Traditional Owners	2

Objectives	Performance criteria	Actions	Potential Contributors	Priority
4. To increase knowledge of *S. douglasi* population dynamics, threats and ecology and use acquired information to guide future management	4.1: Monitoring programs maintained at known *S. douglasi* sites and conducted at least biannually	4.1: Continue monitoring *S. douglasi* populations and implement monitoring programs at other significant sites to track abundance patterns.	DERM, DEEDI, NRM (SGC, DCQ), land holders/managers, Traditional Owners	2
	4.2: A review of the existing *S. douglasi* monitoring program is conducted within two years	4.2: Conduct a review of sites being used for *S. douglasi* monitoring programs.	DERM	1
	4.3: Interactions between listed subjects are documented and ameliorative management prescriptions developed within five years (if necessary)	4.3: Investigate interactions between introduced predators, artificial water sources and grazing management and their significance for *S. douglasi* conservation.	JCU, CSIRO Tropical Savannas Cooperative Research Centre, NRM (SGC, DCQ), land holders/managers	2
	4.4: Ecological interactions between *S. douglasi* and sympatric species and implications for conservation are documented and disseminated to relevant stakeholders	4.4: Investigate interactions between *S. douglasi* and sympatric species of small mammals including *Planigale ingrami, S. macroura, S. crassicaudata, Rattus villosissimus* and *Leggadina forresti*	Research institution	3
5. Promote awareness of *S. douglasi* and obtain support for the recovery program	5.1: Media campaigns conducted annually to raise the profile of *S. douglasi*	5.1: Conduct media campaigns to raise the profile of *S. douglasi* and obtain support for the recovery program	DERM, partner organisations, Traditional Owners	2
	5.2: Interpretive material is developed and disseminated to landholders, the community and tourists	5.2: Continue production and dissemination of educational material	DERM, McKinlay Shire Council, Traditional Owners	2
6. Establish a recovery team to manage the recovery program	6.1: The Julia Creek dunnart Recovery Team is established within the first year and continues to meet at least annually	6.1: Establish a recovery team with representatives from key stakeholder groups and develop an implementation plan	DERM, relevant stakeholders, Traditional Owners	2
	6.2: Consultative protocol established by Indigenous representative/s on Julia Creek dunnart recovery team	6.2 Establish a consultative protocol to engage Traditional Owner communities in recovery plan implementation	Traditional Owners	2

Priority ratings for each recovery action: **1** = high priority; **2** = medium priority; **3** = low priority

6. Management practices

The management practices prescribed below are based on current understanding of threats impacting on Julia Creek dunnart populations and existing conservation measures known to be effective in addressing these. These practices are necessary for the protection of *S. douglasi* habitat and therefore, the long-term persistence of this species in the wild.

- maintain a coordinated predator control (targeting feral cats) that involves relevant State and Local government agencies and regional NRM bodies, that focuses on identified important populations (see Section 2);
- restore/maintain Mitchell grass communities in north-west Queensland by maintaining and/or implementing control programs to address the impacts of environmental weeds, particularly prickly acacia. For further information contact the National Prickly Acacia Coordinator;
- continue to secure the long-term protection of suitable habitat and populations by negotiating voluntary conservation agreements for relevant sites and establishing management plans that favour the persistence of viable populations in the wild; and
- maintain suitable stocking rates on non-reserved lands with known *S. douglasi* populations to ensure that grazing pressure is low (50-70 percent of ground cover remains during grazing; McAlpine and Howes 2005) and Mitchell grassland habitat is conserved.

7. Costs of recovery

Table 2: Estimated costs of recovery ($ per annum).

Action description	Year 1	Year 2	Year 3	Year 4	Year 5	**Total**
Action 1.1: Conduct surveys to clarify the extent of the species distribution	25, 000	25, 000	-	-	-	**50, 000**
Action 1.2: Apply data from habitat modelling exercises to map 'essential habitat' for incorporation into BPA's	-	-	15, 000	15, 000	-	**30, 000**
Action 2.1: Negotiate voluntary conservation agreements/management agreements	25, 000	20, 000	15, 000	5, 000	3, 000	**68, 000**
Action 2.2: Encourage landholders to protect and manage key sites for *S. douglasi*	15, 000	10, 000	10, 000	10, 000	5, 000	**50, 000**
Action 2.3: *S. douglasi* habitat integrated in Local Government SRNM Plans	10, 000	10, 000	5, 000	5, 000	3, 000	**33, 000**
Action 3.1: Continue and expand implementation of predator control programs	5, 000	5, 000	5, 000	5, 000	5, 000	**25, 000**
Action 3.2: Maintain existing weed control programs and implement at other sites	5, 000	5, 000	5, 000	5, 000	5, 000	**25, 000**
Action 3.3: Liaise with landholders to encourage sustainable land practices	10, 000	10, 000	5, 000	5, 000	5, 000	**35, 000**
Action 4.1: Continue monitoring *S. douglasi* populations	10, 000	-	10, 000	-	10, 000	**30, 000**
Action 4.2: Conduct a review of sites being used for *S. douglasi* monitoring programs	20, 000	-	-	-	-	**20, 000**

Action description	Year 1	Year 2	Year 3	Year 4	Year 5	**Total**
Action 4.3: Investigate interactions between predators, artificial water sources and grazing	10, 000	10, 000	10, 000	10, 000	5, 000	**45, 000**
Action 4.4: Investigate interactions between *S. douglasi* and sympatric species	-	-	10, 000	10, 000	10, 000	**30, 000**
Action 5.1: Conduct media campaigns to raise the species profile and obtain support	10, 000	5, 000	5, 000	5, 000	5, 000	**30, 000**
Action 5.2: Continue production and dissemination of educational material	3, 000	3, 000	3, 000	3, 000	3, 000	**15,000**
Action 6.1: Establish a recovery team with representatives from key stakeholder groups	10, 000	5, 000	5, 000	2, 000	2, 000	**24, 000**
Total ($)	**158, 000**	**108, 000**	**103, 000**	**80, 000**	**61, 000**	**510, 000**

8.0 Evaluation of recovery plan

The recovery plan will be reviewed and evaluated by the Julia Creek Dunnart Recovery Team on an annual basis. This will enable the team to assess the success of recovery action implementation against the prescribed performance criteria. A review of the recovery plan will be conducted five years after implementation and in accordance with the Australian Government Department of the Environment, Water, Heritage and the Arts guidelines.

Acknowledgements

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