Approved Recovery Plan

Flame Spider-flower (*Grevillea kennedyana*) Recovery Plan

May 2000

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

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NSW National Parks and Wildlife Service Recovery Planning Program

Flame Spider Flower (*Grevillea kennedyana*)

Recovery Plan

Prepared in accordance with the New South Wales *Threatened Species Conservation Act* 1995

May 2000

Acknowledgments

This plan was originally prepared by Michele Cooper and Matt White, NSW National Parks and Wildlife Service, Western Directorate. Amendments were made to the draft and approved plans by Carolyn Raine and Robyn Molsher, respectively, from the NSW National Parks and Wildlife Service, Western Directorate.

Much of the information contained in this plan is based on information collated by Ann Duncan under contract to NPWS. Invaluable advice, observation and comment towards the development of this plan was provided by Bob Mackinson, Australian National Herbarium, Glen Fensom, Mt. Annan Botanic Gardens, Joe McAuliffe, Australian National Botanic Gardens, Anne Kerle, Jo Smith and the following NPWS officers Rita Enke, Bronwyn Johnston, Kim Piddington, Simon Allender, Douglas Beckers, Dani Ayers, Col Dollary and Andrew McDougal (Qld Dept. of Env.).

Thanks also to the neighbours of Sturt National Park, who continue to assist in the conservation of *Grevillea kennedyana*.

Foreword

The conservation of threatened species, populations and ecological communities is crucial for the maintenance of this State's unique biodiversity. In NSW, the *Threatened Species Conservation Act* 1995 (TSC Act) provides the framework to conserve and recover threatened species, populations and ecological communities through the preparation and implementation of recovery plans.

The preparation and implementation of recovery plans is identified by both the National Strategy for the Conservation of Australia's Biological Diversity and the approved NSW Biodiversity Strategy as a key strategy for the conservation of threatened flora, fauna and invertebrates. The object of a recovery plan is to document the research and management actions required to promote the recovery of a threatened species, population or ecological community and to ensure its ongoing viability in nature.

This plan describes our current understanding of the Flame Spider-flower, documents the research and management actions undertaken to date and identifies the actions required and parties responsible to ensure ongoing viability of the species in the wild.

NSW National Parks and Wildlife Service has prepared the Flame Spider-flower Recovery Plan with the assistance of a number of people. I thank these people for their efforts to date and look forward to their continued contribution to the recovery of the species.

BOB DEBUS MP
Minister for the Environment

Executive Summary

Introduction

Legislative context

The *Threatened Species Conservation Act* 1995 (TSC Act) is NSW's most comprehensive attempt at establishing a legislative framework to protect and encourage the recovery of threatened species, populations and communities. Under the TSC Act, the Director-General of the National Parks and Wildlife Service has certain responsibilities including the preparation of recovery plans for threatened species, populations and ecological communities. This Recovery Plan has been prepared in accordance with the provisions of the TSC Act.

Preparation of plan

This approved Recovery Plan has been prepared with the assistance of interested parties with relevant expertise. Components within the plan do not necessarily represent the views nor the official positions of all the individuals or agencies consulted. The information in this Recovery Plan was accurate to the best of the NPWS' knowledge on the date that it was approved.

Current species status

Grevillea kennedyana (Flame Spider-flower) is a shrub of restricted distribution occurring naturally in the extreme north-west of New South Wales and adjacent areas of Queensland. At present, *G. kennedyana* is known from six separate geographic locations. The total number of individual plants is currently thought to exceed 13,000, most of which occur within Sturt National Park, NSW.

The species is listed as 'vulnerable' under Schedule 1 part 2 of the Commonwealth *Endangered Species Act Protection* 1992 and listed as 'vulnerable' under Schedule 2 of the NSW *Threatened Species Conservation Act* 1995.

Known populations are thought to be threatened by lack of recruitment and total browsing pressure. One previously recorded population is thought to have become extinct as a consequence of browsing pressure (Enke and Mills 1997).

Recovery objectives

The long-term objective of this recovery plan is the conservation of the species in the wild in the long term. In the medium term (next 10 years) the objective is for the conservation status of *G. kennedyana* to be downgraded from 'Vulnerable' to 'Conservation dependant' or 'Rare' (IUCN criteria).

Specific objectives of the *G. kennedyana* recovery plan are to:

1. regularly monitor and protect all known populations across the species range in New South Wales;

2. identify and manage threats to the species' survival and recruitment; and

3. improve the management of any identified threats by involving the community in the conservation of the species and through liaison with relevant landholders/managers.

Recovery criteria

Recovery criteria for *G. kennedyana* are that:

1. any trend or pattern of continuing decline in known wild populations is prevented where possible;

2. the impacts of browsing and grazing animals on wild populations are understood; and

3. relevant landholders/managers and interested stakeholders are aware of the species and its conservation through their involvement in recovery actions and the regular dissemination of information.

Recovery actions

Recovery actions for *G. kennedyana* will be directed towards:

1. the regular monitoring of wild populations;

2. identifying, anticipating and managing potential threats to known populations, in particular the impacts of browsing and grazing animals; and

3. establishing links with landholders/managers and stakeholders and seeking their ongoing involvement in recovery actions.

BRIAN GILLIGAN
Director-General

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1 Current Conservation Status

Grevillea kennedyana (Flame Spider-flower) is a shrub of restricted distribution occurring naturally in the extreme north-west of New South Wales and adjacent areas of Queensland. At present *Grevillea kennedyana* is known from six separate locations. The total number of plants is estimated to exceed 13,000, most of which occur within Sturt National Park.

The species is listed as 'vulnerable' under Schedule 2 of the NSW *Threatened Species Conservation Act* 1995. It is also listed nationally as 'vulnerable' under Schedule 1 part 2 of the Commonwealth *Endangered Species Protection Act* 1992. In addition, the species has recently been added to Schedule 3 ('vulnerable taxas') of Queensland's *Nature Conservation Act* 1992.

The current conservation status of *G. kennedyana*, as defined by ROTAP (Rare or Threatened Australian Plants), is 2VCa (Briggs and Leigh 1996). This classification denotes that the species is 'vulnerable' (i.e. not presently endangered but at risk of disappearing from its habitat within 20-50 years) with a known geographic range of less than 100 km and is considered to be adequately reserved.

While the distribution of the species is highly restricted and populations are somewhat fragmented, no direct threats to extant populations or individuals have been documented. Absolute numbers of individuals and the area of occupancy appear to be stable since detailed survey of the species was initiated in 1992. Whilst recent surveys have located several new populations (Enke and Mills 1997, Johnston and Dollary 1998), the continued lack of knowledge of the species' biology is of concern in the event that active management is deemed necessary for its *in situ* and *ex situ* conservation (Cropper 1993). The conservation status of the species is to be reviewed following the implementation of the actions outlined in this plan.

2 Description

2.1 General description

Grevillea kennedyana F. Muell. (Family Proteaceae) is an erect, multi-branched shrub, typically 1 to 1.5 m in height (occasional individuals reaching 2 m) with silver-grey foliage. The leaves are linear or rarely narrow lanceolate, rigid, pungent (sharply pointed) and are 5-33 mm long. Leaf margins are entire and revolute, partially concealing the lower surface. Inflorescences (clusters of individual flowers) are erect, 2.5-3.5 cm long. The flowers are a conspicuous rich red colour and are 14-21 mm long (Figure 1).

photo M.Cooper (1996)

Figure 1. ***Grevillea kennedyana*** **inflorescence**

The fruit is a glabrous obovoid-ellipsoidal follicle, 12-17 mm long and tapered to a style base (Figure 2). The seed is 7.5-10.5 mm long, 2.7-3.1 mm wide, linear to narrowly ellipsoidal with a short, apical wing. Flowering occurs late winter-spring, and can be sporadic under drought conditions. For a complete botanical description refer to McGillivray and Makinson (1993) or Olde and Mariott (1995).

2.2 Taxonomy

This species does not appear closely related to any other Australian *Grevillea* species (B. Makinson pers. comm.). Based on morphological features *G. kennedyana* has apparent phylogenetic affinities with other *Grevillea* species of temperate arid and semi-arid south western Australia, including *G. acuaria, G. sparsiflora, G. oligantha, G. decipiens* - all Western Australia taxa, and *G. pauciflora* which occurs in both South Australia and Western Australia (B. Makinson pers. comm.). The highly disjunct distribution of these related *Grevillea* species is of particular biogeographic interest. *G. kennedyana* is potentially a relict species being poorly adapted to deep sandy soils and 'stranded' on isolated rocky uplands by successive contractions and expansions of the arid interior of the continent.

Photo D Ayers (1996)

Figure 2. Immature *Grevillea kennedyana* fruit consisting of a small capsule opening in two valves.

3 Distribution

Until 1977 no precise information on the exact distribution of *G. kennedyana* was available. It was first collected in 1886 by W. Baeuerlen at Olive Downs in the Grey Range. This material became the 'type' specimen on which the species' formal description was based by Mueller in 1888. Subsequent collections were made from Yandama Station in 1910 and 1960 and on Mount Woods in 1969 (McGillivray and Makinson 1993). In 1977, two additional locations were recorded for the species on Olive Downs Station and also Onepah Station by W.E. Mulham.

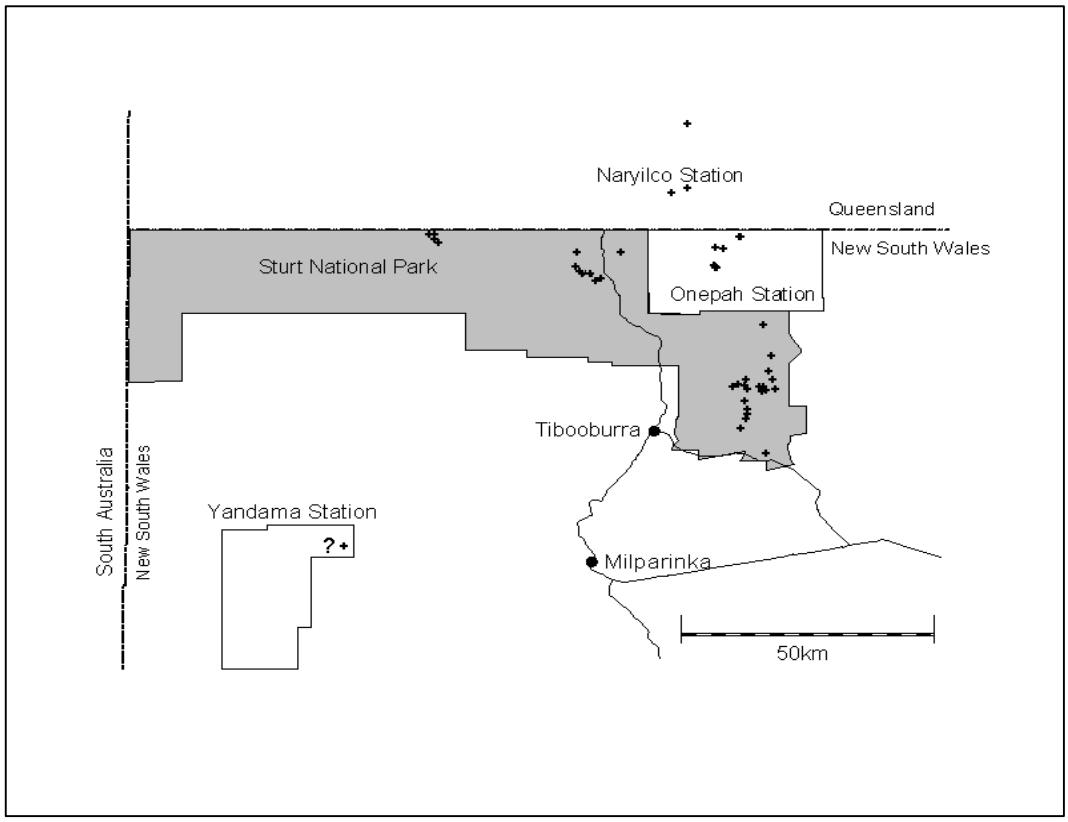

Figure 3. Distribution of *Grevillea kennedyana* (denoted by small crosses) in north-western New South Wales and south-western Queensland. Vague records from "Yandama Station" which have not been relocated are denoted by "?".

G. kennedyana has now been recorded from four general locations in the far north-west of New South Wales (Olive Downs escarpment, McDonalds Peak, Mt Wood Hills and Onepah Station) and two in south-west Queensland (Naryilco Station). All the populations are located at the southern end of the Grey Range and associated outlying hills and scarps. The linear geographic range of the species is less than 100 km (Figure 3 and Table 1).

At each of these localities, the arrangement of individuals in the landscape is highly fragmented and discontinuous. Each location comprises several populations or relatively discrete 'clumps'. The abundance of individuals varies considerably within the populations, from scattered shrubs spaced 100-200 m apart, up to concentrations of 3 plants/10 m² (Duncan 1992a). The most recent estimate of the total population is 13,000+ (Table 1) (Enke and Mills 1997, B. Johnston pers. comm.). Large proportions of these individuals occur within Sturt National Park (Table 1). Population estimates attempted to take into account 'clumps' formed by connecting horizontal roots and 'clumps' formed by seedling establishment, however, the group was often treated as an individual (Duncan 1992a and b).

Therefore, total population numbers are probably underestimates and so the data was presented as the minimum number.

The populations previously recorded from 'Yandama Station' in 1910 and 1960 have not been relocated despite exhaustive searches in 1992 and 1997 (Duncan 1992b, Enke and Mills 1997). Imprecise location descriptions such as the names of large pastoral leases, the size and extent of which can change over the years, make it difficult to verify the possible local extinction at Yandama.

Table 1: *Grevillea kennedyana* population census figures.
Source - Duncan 1992a and Enke and Mills 1997

Locality	**Minimum number**	**Numbers of individuals in localised groups**
Mount Wood*	2300	30-400
Mount Wood Hills Unnamed Area (east of Mount Wood)*	770	1-200
Mount Wood Hills (north of Mount Wood Gorge)*	1700	1-250
Mount Wood Hills (SE of Mt. Wood Peak)*	160	
McDonalds Peak*	1500	1-100
West of McDonalds Peak*	90	
Olive Downs Escarpment*	2900	47-400
Onepah	460	10-300
Three Sisters Hills	1650	
Naryilco - Grey Range (Qld)	2000	
Total	**13530**	

* Denotes populations within Sturt National Park

3.1 Tenure

It is estimated that 70% of the recorded number of individuals are located within Sturt National Park. These plants are found in 4 geographically discrete areas. Sturt National Park is protected under the *National Parks and Wildlife Act* 1974. Remaining individuals, comprising 3 to 4 populations, are on leasehold land in NSW and Queensland.

The populations in New South Wales are located in the 'Unincorporated Area', which is administered by the Western Lands Commissioner, Department of Land and Water Conservation.

4 Ecology

4.1 Life history

There is limited information on the biology and ecology of *G. kennedyana*. It is not known how long individual plants live. However, a relatively long life is a commonly observed adaptation in arid zone perennial plants as a response to the infrequent germination opportunities provided by limited rainfall.

G. kennedyana is capable of recruitment via rhizomes (modified subterranean shoots). Investigations of clumps of plants at Onepah Station found that individual shrubs were connected by rhizomes. It is likely that many apparent individuals are clones (ramets of a limited number of genets). In addition, Duncan (1992b) observed that the species has the ability to resprout from adventitious buds at the base of stems. A wildfire partially burnt the Naryilco population in 1975. When observed in 1992 these plants had resprouted (Duncan 1992b).

Flowering appears to be induced by cool season rainfall and has been observed throughout winter and spring (unpublished data NSW NPWS). Preliminary observations suggest that substantial flowering episodes occur 2-4 months after a significant rainfall event. Threshold levels of effective rainfall are unknown. Flowering is irregular in dry seasons (Duncan 1992b). *G. kennedyana*, like most *Grevillea* species, does not appear to retain the fruit in the canopy after fruit set. Fruit probably matures 6-8 weeks after fertilisation and seed would be dispersed shortly afterwards. Mechanisms for seed dispersal are unknown, however, dispersal over short distances may be aided by the wings on seeds. Establishment of seedlings has not been observed in the wild. Little is known about seed dormancy in *G. kennedyana* but several other *Grevillea* species exhibit dormancy, possibly up to three or four years (B. Makinson pers. comm.). Recruitment via seed and subsequent establishment (as with other arid zone perennials) may be 'event driven'. Germination and growth may be reliant on exceptional rainfall events in the appropriate season or above average rainfall over successive years.

5 Habitat

Grevillea kennedyana is found on rocky sites, typically the colluvial slopes of mesas and jump-ups, and occasionally in dry rocky watercourses (Figure 4). These habitats consist of the weathered moderately coarse fragments of silcrete duricrust overlying brown, loamy lithosols (Geological Survey of New South Wales 1967). The species appears absent from the upper, less stony slopes and the gently undulating plains which fringe the ranges. Denser concentrations of plants occur on lower slopes where the colluvium is deeper and water retention is comparatively good.

photo M. Cooper (1996)

Figure 4. Habitat of *Grevillea kennedyana* at Three Sisters Hills 'Onepah' Station. Note plants scattered in loose groups across both the rocky upper slopes (centre background) and the lower colluvial slopes (foreground).

Altitude range of *G. kennedyana* is from 140 m at Mount Wood to 200 m at Olive Downs. Slopes range from almost level (about 10º) to steep (about 75º) while aspect varies through 360º.

The climate across the species range is arid and rainfall is extremely variable and unreliable (Figure 5). Extended dry periods without effective rainfall are common.

G. kennedyana is associated with low, sparse arid shrublands dominated by Rock Fuchsia (*Eremophila freelingii*), Dead Finish (*Acacia tetragonophylla*) and Spiny Fan Flower (*Scaevola spinescens*). *G. kennedyana* is typically in the tallest stratum. The plant community or communities that are associated with *G. kennedyana* have not been adequately described.

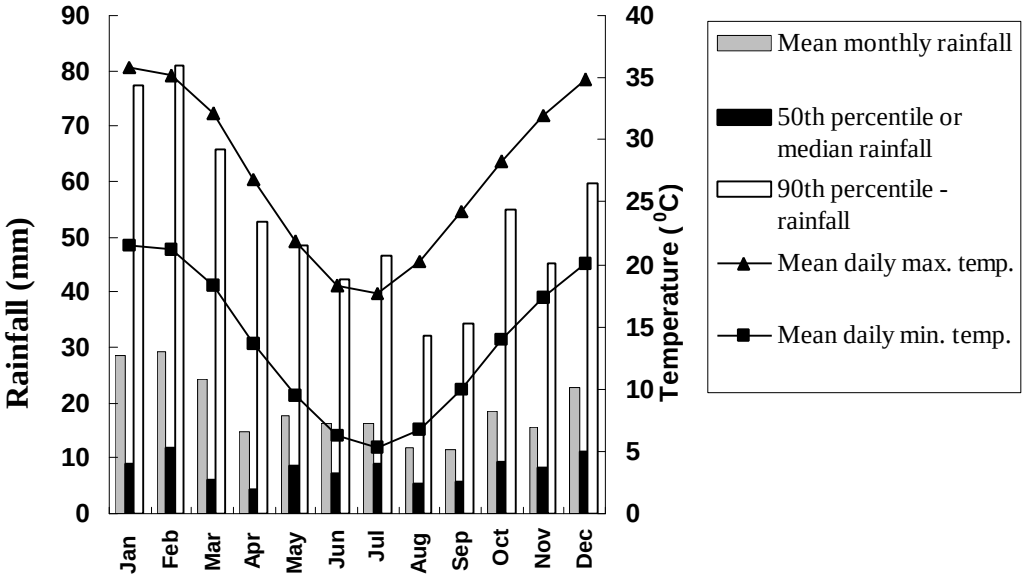

Figure 5. Mean monthly rainfall and temperature for Tibooburra based on records collected between 1886 and 1998 (source Bureau of Meteorology). Note the highly variable nature of rainfall in the Tibooburra area (indicated by the marked differences between the 50th and 90th percentile figures) which is typical of the Australian arid zone.

6 Relevant Legislation

6.1 *Threatened Species Conservation Act* 1995

G. kennedyana is listed on Schedule 2 of the *Threatened Species Conservation Act* 1995 (TSC Act) as a 'Vulnerable' species. It is an offence to harm, pick or damage the habitat of a threatened species unless the damage is the result of activities which have been licensed under section 91 of the TSC Act, or have otherwise gained approval under the *Environmental Planning and Assessment Act* 1979.

6.2 Commonwealth *Endangered Species Protection Act* 1992

G. kennedyana is listed as 'Vulnerable' under part 2 Schedule 1 of the Commonwealth *Endangered Species Protection Act* 1992 (ESP Act). The ESP Act protects threatened species in Commonwealth areas and regulates the activities of Commonwealth agencies.

6.3 *National Parks and Wildlife Act* 1974

Approximately 70% of the known population of *Grevillea kennedyana* occurs in Sturt National Park, an area gazetted under the *National Parks and Wildlife Act* 1974 (NPWS Act), and in the care and management of the New South Wales National Parks and Wildlife Service. *G. kennedyana* is protected where it occurs in Sturt National Park.

6.4 *Environmental Planning and Assessment Act* 1979

Land use and development on leasehold land in NSW is subject to evaluation in accordance with the *Environmental Planning and Assessment Act* 1979 (EP&A Act). Threatened species are to be taken into account by consent authorities when they are considering development applications under Part 4, or the carrying out, or applications for approval for the carrying out, of activities under Part 5, of the Act. Under the *Western Lands Act* 1901 the Department of Land and Water Conservation is the consent authority which invokes the *Environmental Planning & Assessment Act* 1979. Recovery Plans are one of the matters which should be taken into account by consent authorities as identified under the department of Urban Affairs and Planning's "Guide to Section 79C" guidelines. Recovery plans must also be taken into account by determining authorities under s112A of the EP&A Act.

6.5 *Native Vegetation Conservation Act* 1998

The clearing of native vegetation in NSW is subject to consent from the Department of Land and Water Conservation in accordance with the *Native Vegetation Conservation Act* 1998. The Act is integrated with the *Environmental Planning and Assessment Act* 1979, and requires that threatened species are taken into account by consent and determining authorities when considering clearing applications under Part 4 of the EP&A Act.

7 Management Issues

7.1 Threats and possible reasons for decline

Grevillea kennedyana is not threatened by overt habitat destruction. The arid climate and shallow soils which typify the habitat of *G. kennedyana* are unsuitable for intensive agricultural activities. However, subtle habitat degradation, through changes to pre-European fire regimes and browsing by herbivores, may have adversely affected the species.

7.1.1 Fire

While it is likely that pre- European fire intensities and frequencies have been altered in the last 100-150 years following the decline of Aboriginal burning practices and the introduction of stock and artificial watering points, the nature and consequences

of these changes for *G. kennedyana* are unknown. Fire is not required to trigger the release of seed (B. Mackinson pers. comm.) but may be implicated in the breaking of seed dormancy.

7.1.2 Grazing

It is likely that *G. kennedyana* can withstand browsing pressure. Plants respond well to heavy pruning in cultivation (G. Fensom pers. comm.) and much of the range of the species has been subject to prolonged and intensive grazing and browsing pressures by domestic stock, rabbits and macropods in the 1890's and the first half of this 20th century. However, grazing/browsing may be implicated in the in the lack of observed seedling recruitment.

Early records of the species from Yandama station have not been relocated despite searches across suitable habitat in the area. Browsing has been postulated as a potential cause of the apparent loss of this population (Enke and Mills 1997). However, the exact location of these plants was never recorded and browsing has not been directly linked to their assumed demise.

7.2 Social and economic consequences

The habitat of *G. kennedyana* is remote, arid and rocky. Changes to existing land uses, principally nature conservation and extensive beef production, are not anticipated. Approximately 70% of the area occupied by *G. kennedyana* is publicly owned and managed for nature conservation. The balance in western NSW is leasehold land. The possible detrimental impacts of grazing on the species are unsubstantiated at this stage and as such, this plan does not propose to regulate or modify grazing practices on leasehold land. However, the impacts of grazing on *G. kennedyana* will be monitored throughout the life of this current plan.

Any adverse social and economic consequences resulting from the implementation of this plan are either unknown or insignificant. The direct costs of achieving the objectives of this Recovery Plan will be borne by Government.

7.2.1 Social considerations

G. kennedyana provides aesthetic appeal for those who visit the Park. For the broader community, exposure to interpretive materials relating to *G. kennedyana* and its habitat has the potential to increase the awareness of threatened plant species and the management of threatened species generally.

7.2.2 Scientific and taxonomic value

The events and processes which have resulted in the current distribution and relative "rarity" of *Grevillea kennedyana* remain unknown. Investigations into the genetic diversity inherent within and between remaining populations and related taxa may contribute to a better understanding of speciation processes. Investigations into the

biology of the species will further our knowledge of breeding systems and plant adaptations to arid environments.

8 Previous Actions Undertaken

8.1 Survey and recovery actions

A survey of all known populations and areas of suitable habitat was conducted in 1992 and ecological notes were collated by Duncan (1992b). Subsequently, a Recovery Plan was prepared for the then Australian National Parks and Wildlife Service (Duncan 1992a).

Further survey and census of potential habitat was carried out in NSW and Queensland during 1997 and 1998 and additional populations have been located in Queensland (Enke and Mills 1997, Johnston and Dollary 1998). This work was sponsored by the NSW National Parks and Wildlife Service.

Although approximately 70% of known individuals occur within Sturt National Park, no conservation actions have been undertaken to protect the species in the Park. Subsequent to the parks gazettal, grazing of domestic stock has been withdrawn and some feral animal control has been undertaken.

Neither of the populations on Onepah (NSW) or Naryilco (Qld) are currently managed for conservation. Stock, mainly cattle, are free to roam through these populations.

A pamphlet was produced in 1996 to promote community awareness and establish regular contact with key park neighbours.

8.2 Current *ex-situ* programs

Propagative material was collected in 1980, 1989 and 1992 from various populations. The species is growing in cultivation at the Australian National Botanic Gardens (Canberra) and at Mount Annan annex, Royal Botanic Gardens (Sydney). Several clonal lines are now maintained in perpetuity via grafts and cuttings.

Mount Annan maintains clones from four separate locations (Olive Downs, McDonnell Peak, Mt Woods and the gorge below Mt Wood). Some material is maintained in tissue culture and *G. kennedyana* has been successfully grafted onto *Grevillea robusta*.

The Australian National Botanic Gardens (Canberra) maintains a single clone from Olive Downs Jump-up. Vegetative material is maintained by grafting onto *Hakea salicifolia* and *Grevillea poorinda* 'Royal Mantle' and is also grown on from cuttings.

9 Species Ability to Recover

It is likely that *G. kennedyana* is restricted and rare as a result of largely 'natural' ecological and evolutionary processes. Known populations of the species appear to be stable over the last six years of field monitoring, without conservation management. Currently there is no evidence to suggest that the species is in significant decline and no threatening processes have been documented. In addition, the discontinuous and disjunct nature of the species' distribution renders it less susceptible to unforeseen localised catastrophe.

Given that the species has persisted despite sustained intensive grazing and the cessation of prehistoric fire regimes and most of the population is within Sturt National Park, the prognosis for remaining wild populations in the medium to long term (the next 50 to 100 years) would appear to be reasonable. However, the lack of observed recruitment is of concern for the long-term survival of the species and needs to be monitored.

10 Recovery Objectives and Performance Criteria

10.1 Objectives of the Recovery Plan

The long-term objective of this recovery plan is the conservation of the species in the wild in the long term. In the medium term (next 10 years) the objective is for the conservation status of *G. kennedyana* to be downgraded from 'Vulnerable' to 'Conservation dependant' or 'Rare' (IUCN criteria).

Specific objectives of the *G. kennedyana* recovery plan are to:

1. monitor and protect all known populations;

2. identify and manage threats to the species' survival and recruitment; and

3. improve the management of any identified threats by involving the community in the conservation of the species and through liaison with relevant landholders/managers.

10.2 Recovery performance criteria

Recovery criteria for *G. kennedyana* are that:

1. any trend or pattern of continuing decline in known wild populations is prevented where possible;

2. impacts of browsing and grazing animals on wild populations are understood; and

3. relevant landholders/managers and interested stakeholders are aware of the species and its conservation through their involvement in recovery actions and the regular dissemination of information.

11 Recovery Actions

11.1 Action 1 - Monitoring of wild populations and evaluation of browsing impacts

Monitor the distribution, abundance and overall health of *G. kennedyana* in the wild. Edges of range are to be relocated every three years to examine possible range contraction.

In addition, establish exclosures within each metapopulation (ie Olive Downs escarpment, McDonalds Peak, Mount Wood Hills and Onepah Station) to investigate the relative impacts of various browsing animals (including cattle, macropods, goats and rabbits) on the survival and recruitment of *G. kennedyana*. The monitoring program will involve all *G. kennedyana* individuals within the exclosures being tagged and measured, photopoints being established and the floristic and physical characteristics of each exclosure documented. A random sample of tagged *G. kennedyana* plants within each exclosure will then be identified for ongoing monitoring and mortality and recruitment within the exclosures recorded.

Outcome:
Contraction in range and overall health of the population will be monitored. In addition, monitoring within the exclosures will provide information on the life cycle and reproductive capacity of *G. kennedyana* and impacts of browsing animals on the survival and regeneration of the species.

Action 1	**2000/2001**	**2001/2002**	**2002/2003**	**2003/2004**	**2004/2005**
Monitoring wild population	$7000			$7000	
Monitoring exclosures	$4000	$500	$500	$500	$500
Total					**$20,000**

Agency responsible for implementation
New South Wales National Parks and Wildlife Service.

Funding source
New South Wales National Parks and Wildlife Service.

11.2 Action 2 - Germination requirements

Undertake research to determine the viability and germination requirements of *G. kennedyana* seeds. Collect seed from across the extant distribution of the species. Conduct greenhouse germination trials using smoked water, and various temperature and watering regimes. The results of this research will be used to evaluate the best conditions for germination of this species in the wild.

Outcome:
Improved understanding of aspects of the species' ecology that are critical to its ongoing conservation in the wild.

Action 2	**2000/2001**	**2001/2002**	**2002/2003**	**2003/2004**	**2004/2005**
Germination requirements		$4500			
Total					**$4500**

Agency responsible for implementation
New South Wales National Parks and Wildlife Service

Funding source
New South Wales National Parks and Wildlife Service.

11.3 Action 3 - Community liaison and awareness

Maintain regular personal representations to relevant land managers and lessees.

Outcome:

Community appreciation and support for the conservation and protection of *Grevillea kennedyana*.

Agency responsible for implementation

New South Wales National Parks and Wildlife Service

12 Alternative Management Strategies

This section considers a series of options for the recovery of *G. kennedyana*.

12.1 Option 1. No management action taken

As the species is not in immediate danger of extinction and the majority of individuals and populations are protected in Sturt National Park, perhaps there is no requirement for any 'recovery' actions for *Grevillea kennedyana*.

This alternative approach is not considered appropriate as threats to the species may be operating over extended periods of time. Without quantitative information on recruitment and mortality, populations may decline imperceptibly.

12.2 Option 2. Research on fire response

It has been postulated that altered fire regimes may have impaired the ability of *G. kennedyana* to reproduce and colonise suitable habitat (Duncan 1992a).

Research into the response of *Grevillea kennedyana* to fire is not considered appropriate at this time. Notwithstanding the possible loss of individuals as a consequence of the application of fire, conducting burning trials on existing wild populations would be difficult given the general lack of fuels which typifies the habitat of the species. Fuel would only be available after exceptionally wet years at a time when fire control may be problematic. Indications as to the role of fire in the germination and growth of seedlings may emerge from the proposed germination studies (using smoke or smoked water). If smoke or fire is implicated in the breaking of seed dormancy or the promotion of vegetative spread, the deliberate and controlled application of fire to selected groups of plants should be considered when the plan is under review 5 years hence.

12.3 Option 3. Other research

Determining the genetic variability within and between populations would provide insights into the gross number of clones that make up the population, and by inference, the nature of reproduction.

This option will not be pursued as the outcomes, while potentially very interesting, are not anticipated to significantly modify the management of the remaining populations. The NSW National Parks Service will encourage and provide assistance to Universities or other organisations wishing to pursue research of this nature.

13 Community involvement

At this stage only two property owners are involved with the recovery of *Grevillea kennedyana* (Onepah, New South Wales and Naryilco, Queensland).

During the writing of this recovery plan, contact was maintained with landholders. A colour brochure was produced and sent to all properties concerned (Onepah, Yandama, Naryilco). Landholders were very receptive to the conservation of the species on their properties. Relevant lessees will be kept informed of the recovery process through regular personal representations and correspondence.

14 Implementation

The following table allocates responsibility for the implementation of recovery actions specified in this plan to relevant government agencies for the period 2000-2005.

Table 2: Implementation and costing table for all Recovery Plan actions

Section	Description	Responsibility for implementation	Time frame	Priority	Cost
11.1	Monitoring- wild population	NPWS	Ongoing	High	$6000
11.1	Monitoring- exclosures	NPWS	every 3 years	High	$14000
11.2	Germination research	NPWS	2001/2002	Medium	$4500
11.3	Community liaison	NPWS	Ongoing	High	nil
				Total	**$24500**

14.1 Review date

This recovery plan and the conservation status of the species will be reviewed within five years of the date of publication.

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